

Inventory of Important Biological Resources for the Upper Yellowstone River Watershed

Prepared for the
Environmental Protection Agency

Project prepared by:
Montana Natural Heritage Program
Additional scientific and technical advice provided by:
Wyoming Natural Diversity Database

June 2001



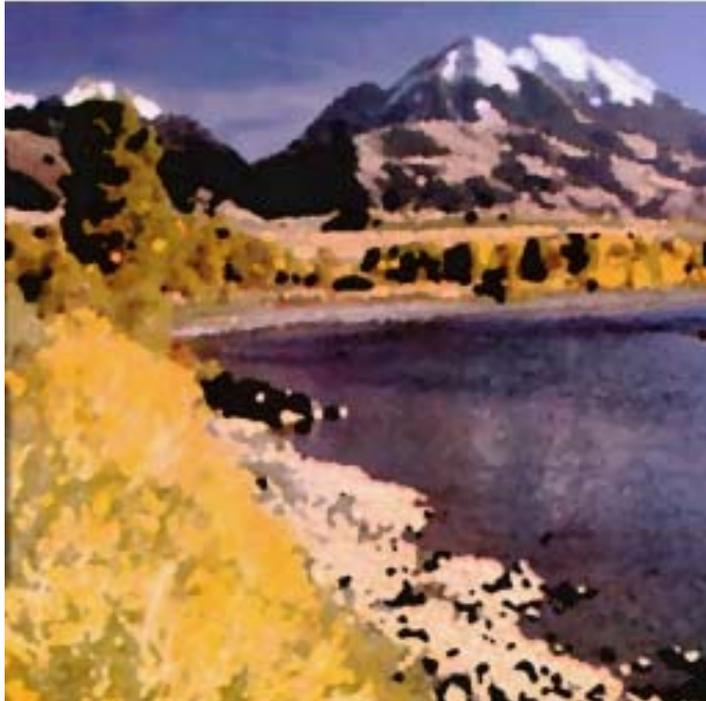
Inventory of Important Biological Resources for the Upper Yellowstone River Watershed

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Emigrant Peak, Yellowstone River
watercolor by Jim Dushin

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Executive Summary

The purpose of this project was to assemble and improve the quality and accessibility of basic information about key biological resources in the Upper Yellowstone Watershed. The watershed was defined as the headwaters of the Yellowstone River extending downstream to the junction of the Yellowstone River with the Big Horn River in Yellowstone County, Montana. The Clark's Fork drainage and the headwaters of the Yellowstone River extend into Wyoming.

From the Montana and Wyoming natural heritage databases, we assembled a consolidated dataset of occurrence records for plant and animal species of concern and high quality natural communities in the watershed. All of the species and natural communities identified in this report, both familiar and obscure, contribute to the biological diversity and significance of the Upper Yellowstone watershed. Some have declined greatly and/or are in recovery. Some are unique to the watershed or the immediate vicinity, others are associated with distinctive habitats that are rare or restricted in distribution; all are potentially at risk from habitat modification and human disturbances. Timely knowledge about where these species and communities occur can provide opportunities for governments and citizens to make informed decisions about the future of the Upper Yellowstone watershed.

The species and community records assembled from the natural heritage programs were used to identify 79 sites of biological importance. These sites support imperiled or rare plants and animals, valuable wetland ecosystems or high quality natural communities, often of relatively restricted or declining types. The sites are concentrated on public lands managed by the National Park Service, Bureau of Land Management and the US Forest Service. In Wyoming, these sites lie entirely on public land. In Montana, most of the sites have a core area on federal or state land but may also include private property; a few sites are largely on private property.

For each site identified, we completed a site description that highlights its biological resource values. An ArcExplorer project on CD-ROM, presents the assembled species, including commu-

nity and site information in a series of GIS maps and associated data tables. This will provide planners and managers with desktop access to information on species of concern and high quality natural communities by watershed and at identified significant sites. The information can be used to help determine if planned activities might impact species of concern or sensitive ecological areas. When more precise or comprehensive information is needed, planners can contact the state heritage programs.

This project highlighted the absence of biological inventory data for many areas in the watershed, and the absence of information for any given area cannot be interpreted to indicate the absence of important species or communities. Nor can this dataset substitute for on-site surveys, which may be required for environmental assessments. Further biological inventory work focusing on the Great Plains and other "data gaps," will be essential to provide reliable data for planning and resource management. High priorities for survey include prairie fishes (some of which are federally listed or candidates), riparian corridors and wetlands, woody draws, and major intact grasslands – especially in the Northern Glaciated Plains (north of the Missouri River in northeastern Montana).

This project also highlighted the need for heritage programs to provide more direct support and assistance to local governments and planners. This should involve clearly identifying the specific needs of local planners, and developing data formats and interactive, web-based tools that facilitate data access and analysis. Also, to address the increasing need for natural heritage data that spans state boundaries, we strongly recommend the development of a unified multi-state dataset, in partnership with the Association for Biodiversity Information (ABI), which represents the natural heritage network. Several heritage programs in the Rocky Mountain region have also partnered to begin developing direct web-access to integrated heritage data through a flexible, distributed database model. We urge EPA and other partners to work with and assist the heritage network in achieving these goals of expanded and more efficient data access, rather than assembling data on a watershed by watershed basis.

Acknowledgements

This project was funded with the generous support of the United States Environmental Protection Agency (EPA) Region VIII Ecosystem Protection Grant and Regional Geographic Initiative to The Nature Conservancy's Western Regional Office, the Montana Natural Heritage Program and the Wyoming Natural Diversity Database. These grants provided support to improve the quality and quantity of important biological information in the Upper Yellowstone Watershed. The contents of this document do not necessarily reflect the views and policies of the EPA, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. We extend special thanks to Tom Johnson of EPA for his patient support throughout the duration of this project and to Joyce K. Brame, EPA Grants Specialist.

The Montana Natural Heritage Program produced this report. Data records presented in this report represent contributions from many individuals who have worked in the watershed over the last century and deserve a special thanks and recognition. For this project, several individuals added new or updated species and community occurrence information in the watershed; these people include Marc Jones, Peter Lesica, and Jack Greenlee. The credibility of heritage data is founded on a strong science staff. Thanks to botanists Bonnie Heidel

and Walt Fertig, zoologists Paul Hendricks and Gary Beauvais and ecologists Marc Jones and George Jones for their contribution to this project. This project received substantial support from heritage staff: Pete Feigley helped develop the first iteration of heritage sites in Montana. Cedron Jones migrated the mapped information into a Geographic Information System (GIS), making the delivery of this information possible. Joy Lewis helped with editing and publishing. Martin Miller processed the element occurrence and site basic records. Terrie Kenney helped with data entry and storage, file organization and report formatting. Laura Welp and Rebekah Smith provided element occurrence and site basic records from the Wyoming Natural Diversity Database.

Thank you to Katrina Scheuerman, (NRIS) for her help in formatting and production and to Jim Dushin for his original watercolor of Emigrant Peak, Yellowstone River. A huge thank you to Melony Bruhn, MTNHP contract and grants administrator for the terrific job keeping the project financial and accounting records. Melony has demonstrated patience and fortitude beyond the call of duty.

We are also grateful for the kindness of landowners and state land lessee who gave us permission to access private property or to gain access to state lands in the watershed.

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Introduction

The Upper Yellowstone Watershed is part of the largest, relatively intact temperate zone ecosystems on the planet, the Greater Yellowstone Ecosystem. The watershed supports significant biological resources, including over 200 plant and animal species of conservation concern, forest carnivores, and key home and winter range for large mammals like elk (*Cervus elaphus*), and bison (*Bos bison*). The Yellowstone River is one of the longest free-flowing rivers remaining in the United States. This area represents one of the last large wild landscapes where natural ecological processes and disturbances of large magnitude are allowed to operate with minimum human manipulation (Little 1990).

The outstanding natural beauty of this area, its blue-ribbon trout streams and diverse recreational opportunities have attracted a great deal of recreational and residential development. Already the natural values that make the Upper Yellowstone so attractive are being affected by activities such as subdivision on agricultural lands, overuse of water resources, and alteration of important natural habitats by noxious weeds, exotic species, recreation, and mining. The goal of this project was to improve the quality

and accessibility of biological resource information on the Upper Yellowstone Watershed, which is essential to effective planning and decision-making. Natural Heritage programs are the best source of accurate and reliable information on significant biological resources, and projects such as this provide an excellent opportunity for heritage staff to deliver information on areas of particular importance. In the course of this project, however, we encountered several issues that need to be addressed through future efforts.

The purpose of this project was to assemble basic information about key biological resources from the Wyoming Natural Diversity Database and Montana Natural Heritage Program, to improve the quality and accessibility of this information and to make this information readily accessible to planners and decision-makers. With financial support from the Environmental Protection Agency, the Wyoming and Montana heritage programs reviewed and upgraded their data on the region, and added new records for federally listed and candidate species, state species of concern¹, and significant natural communities. Based on this information, biologically important sites are highlighted and described. These sites support species of concern, and rare or high quality wetlands and other natural communities.



Stillwater River Watershed, Stillwater County, MT

¹ Species of concern are plant or animal species or subspecies identified by heritage programs as rare, endemic, disjunct, or imperiled at the state or global level.

All of the species and natural communities identified in this report, both familiar and obscure, are important to the biological diversity and significance of the Upper Yellowstone watershed. Some have declined greatly and/or are in recovery, some are unique to the watershed or the immediate vicinity, others are associated with distinctive habitats that are rare or restricted in distribution; all are potentially at risk from habitat modification and human disturbances. Timely knowledge about where these species and communities occur can provide opportunities for governments and citizens to make informed decisions about the future of the Upper Yellowstone watershed.

The Upper Yellowstone Watershed

Physical Setting

For the purposes of this project, the Upper Yellowstone Watershed (Figure 1) was defined as the headwaters of the Yellowstone River and several major tributaries: the Shields, Stillwater, and Clark’s Fork of the Yellowstone River. It extends downstream to the junction of the Yellowstone River with the Big Horn River in Yellowstone County, Montana. The Clark’s Fork drainage and the headwaters of the Yellowstone River extend into Wyoming.

The Upper Yellowstone watershed has diverse physiography, climate, and vegetation. It includes portions of four Bailey ecoregion provinces (Figure 2.):

- Southern Rocky Mountains Province, represented by the Yellowstone Highlands Section (including the Yellowstone Volcanic Plateau, Beartooth Front, Beartooth Mountains, and the Absaroka/Gallatin Mountains Subsections);
- Middle Rocky Mountains Province, represented by the Belt Mountains Section (including the Crazy Mountains and Central Montana Broad Valleys Subsections);
- Great Plains-Palouse Province, represented by the Powder River Section (including the Montana High Plains and Foothills and Montana Sedimentary Plains Subsections);
- Intermountain Semi-Desert Province, represented Big Horn Basin and Big Horn Mountains Section including the Bighorn Intermontane Basin Subsection and by the Pryor Mountains (Nesser et al. 1997).

The climate of the watershed is largely continental and can be extremely variable. Strong seasonal differences are generated by interactions among air masses from the northern Pacific Ocean, the Gulf of Mexico, and the Arctic, with Gulf systems dominant in the spring and early summer and Arctic air dominant in the winter (Zelt et al. 1999). Climate ranges from cold and moist in the moun-

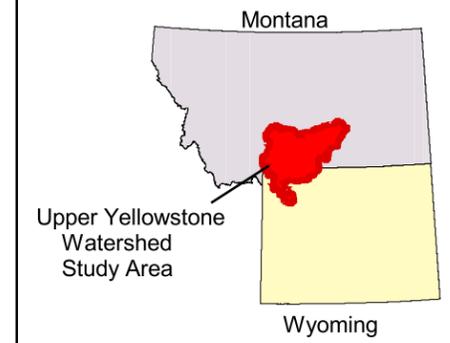
WATERSHED	HUC²	ACRES
Yellowstone Headwaters	10070001	1,657,554
Upper Yellowstone	10070002	1,892,153
Shields	10070003	549,896
Stillwater	10070005	682,777
Upper Yellowstone-Lake Basin	10070004	1,003,190
Clark’s Fork Yellowstone	10070006	1,777,238
Upper Yellowstone-Pompey’s Pillar	10070007	1,278,717
Pryor	10070008	393,449

² Hydrologic Unit Code

Upper Yellowstone Watershed

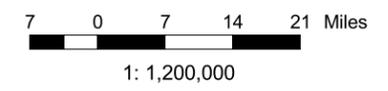
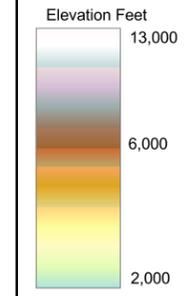


Study Area Vicinity Map



Legend

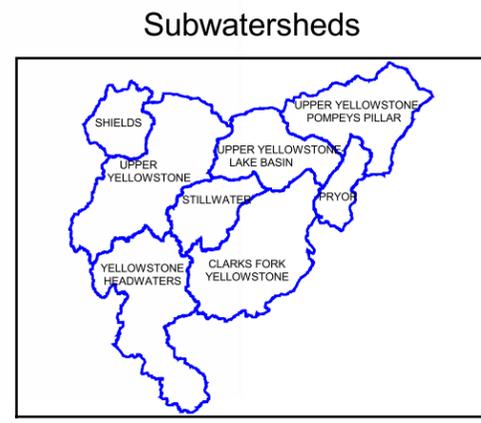
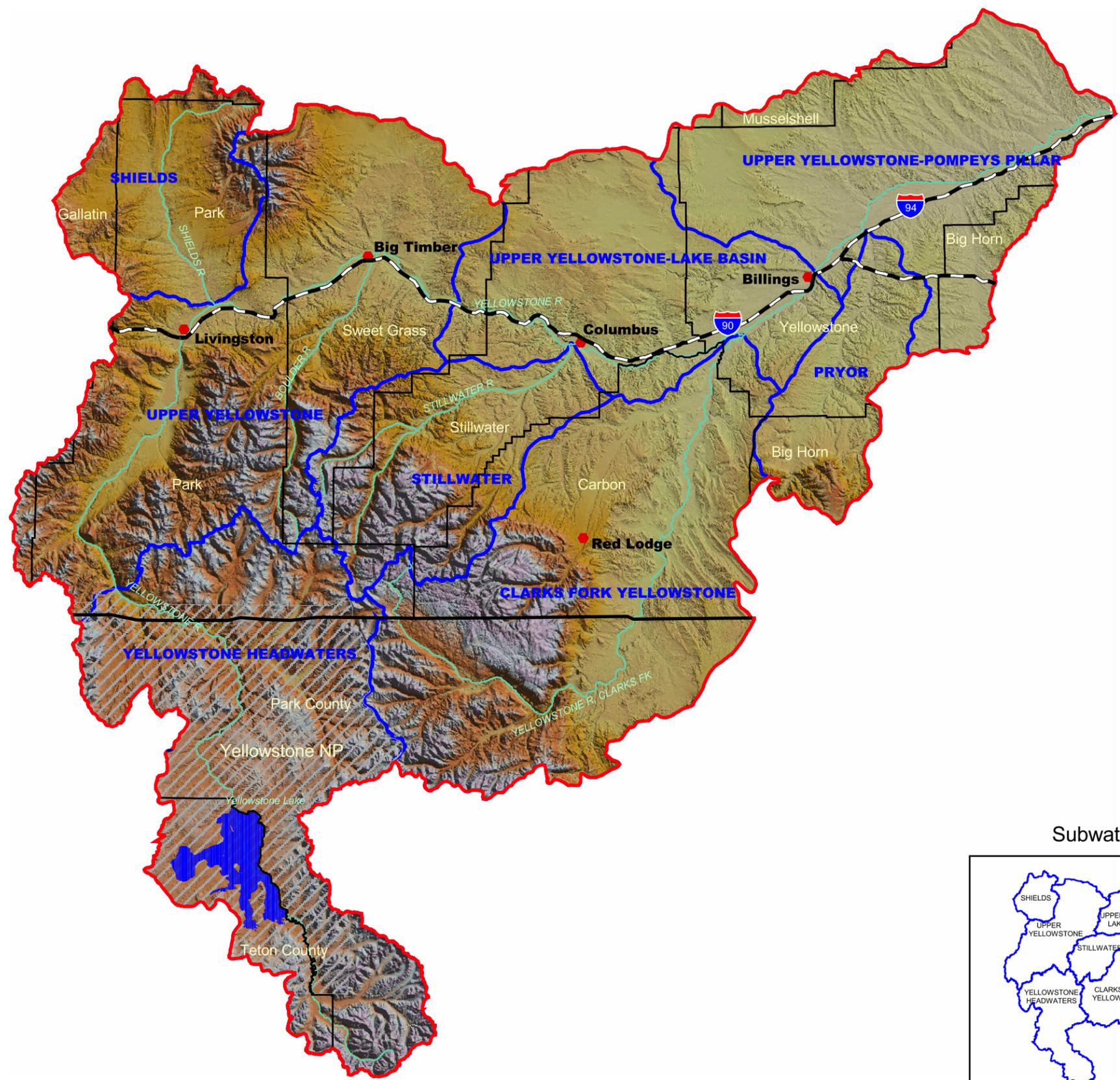
- Interstate
- State Boundary
- River
- Towns
- Upper Yellowstone Watershed
- Wyoming Counties
- Montana Counties
- Yellowstone Lake
- Yellowstone National Park
- Subwatersheds



Tt Tera Tech EM Inc.
 Power Plock Building, Suite 612
 6th & Last Chance Gulch
 Helena MT 59601
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Map 3/13/01.apr
 By John Peterson

Source:
 Montana Natural Heritage Program and
 the Wyoming Natural Diversity Database



tains too temperate and semiarid in the plains (Zelt et al. 1999). Average annual temperatures range from 34°F at Cooke City to 47°F at Billings (Western Regional Climate Center 2001). Precipitation varies from 40 to 110 inches per year in the Absaroka and Beartooth Mountains to 10 to 20 inches in the Great Plains, while the arid Bighorn Basin, in the rain shadow of the Beartooth Mountains, receives only 5 to 12 inches (Nesser et al. 1997). Elevations in the study area range from over 12,000 feet in the Beartooth Mountains to just over 3,000 feet at Billings in the Great Plains

The Yellowstone Highlands comprise the mountainous portion of the watershed, and include the Yellowstone Plateau, the Beartooth Range and the Absaroka Mountains. The Beartooth Mountains are a broad, fault-bound uplift of Precambrian crystalline rocks, gneiss, and schist (Zelt et al. 1999). The Beartooth Plateau consists of extensive alpine areas with many lakes. The Absaroka Range is a large Tertiary age volcanic field composed largely of andesite, dacite, and rhyolite that was laid down in volcanic flows and eruptions (Woods et al. 1999, Zelt et al. 1999). The Crazy Mountains, which lie north of the Yellowstone Highlands, consist of a core of Tertiary coarse-grained alkaline intrusive rock surrounded by a mantle of Quaternary drift and colluvium (Alt and Hyndman 1986, Woods et al. 1999). All these ranges were extensively glaciated and are very rugged. The extent and magnitude of Yellowstone's geothermal activity affirms that the geologic landscape in the Upper Yellowstone Watershed is dynamic and rapidly evolving.

The non-mountainous portions of the watershed — the Great Plains and Bighorn Basin — are primarily underlain with Cretaceous age sedimentary rocks, such as sandstone and shale, with localized deposits of volcanic debris, as in the Crazy Mountain Basin (Alt and Hyndman 1986). Unconsolidated Quaternary deposits, such as glacial outwash terraces and alluvium are common along stream courses.

Vegetation

Alpine tundra is extensive across the Beartooth Mountains. The high plateaus and many peaks support the largest extent of alpine tundra in Montana (Lesica 1993). Associated with the splendor of the alpine vegetation is the greatest variety and extent of cryopedogenic features observed anywhere in Wyoming or Montana, including solifluction terraces, sorted nets and stripes, sorted and unsorted polygons, and frost hummocks (Johnson and Billings 1961). The vegetation on the Line Creek Plateau is more similar to the high ranges of Wyoming, Utah, and Colorado than any other mountain range in Montana. Line Creek Plateau is a gently rolling alpine tundra landscape with extensive areas of moist snowbed vegetation. The plateau contains hundreds of glacial lakes and potholes although wetland features are rare (Lesica 1993).

Vegetation of these alpine environments is characterized by turf vegetation dominated by Ross' avens (*Geum rossii*), curly sedge (*Carex rupestris*), Bellardi bog sedge (*Kobresia myosauroides*) and blackroot sedge (*Carex elynoides*); cushion plant communities dominated by curly sedge, moss campion (*Silene acaulis*), dwarf clover (*Trifolium nanum*), and twinflower sandwort (*Minuartia obtusiloba*); and moist grasslands to wet meadows dominated by tufted hairgrass (*Deschampsia cespitosa*), alpine bluegrass (*Poa alpina*), and Parry's clover (*Trifolium parryi*). The transition from wet meadow to marsh and fen is characterized by the increasing presence of mountain sedge (*Carex scopulorum*).

Coniferous forests and woodlands dominate mountainous portions of the watershed. In high elevation subalpine forests, principle species are whitebark pine (*Pinus albicaulis*), subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), and lodgepole pine (*Pinus contorta*). Whitebark pine is found only in the upper sub-alpine zone and at highest elevations it alone dominates a woodland formation, while the

other species are important throughout the mountainous region. Low and mid elevation montane areas are dominated by Douglas fir (*Pseudotsuga menziesii*) and lodgepole pine. Ponderosa pine (*Pinus ponderosa*) represents the dominant forest and woodland type at lower treeline and on calcareous substrates limber pine (*Pinus flexilis*) and Rocky Mountain juniper (*Juniperus scopulorum*) fill this role.

Deciduous forests of aspen (*Populus tremuloides*) or cottonwood (*Populus balsamifera ssp. trichocarpa* or *P. deltoides* and *P. angustifolia*) are relatively uncommon but occur locally in the mid to low montane zone where adequate soil moisture is available. Aspen forms large stands on toe slope positions and subirrigated slopes, especially along the base of the Beartooth Front at Grove Creek (east slope) and west of Red Lodge (north slope). Seasonally flooded aspen stands are restricted to sites saturated by seepage from springs or from high stream flow such as below seeps on gentle slopes, wet draws and flats, and in depressions along stream bank terraces. Cottonwood stands occur primarily as a riverine or streamside forest. Recent inventory in the watershed for high quality cottonwood stands (such as those with a well-developed native red-osier dogwood (*Cornus sericea*) understory) or lacking exotic grass species concluded high quality condition is very rare (Jones 2001). In many cases, the native shrub component has been converted to an understory dominated by exotic pasture grasses or Russian olive (*Elaeagnus angustifolia*) or noxious weeds (Jones 2001).

Grasslands and shrublands dominate broad valleys and sedimentary plains. The primary exception is where ponderosa pine (*Pinus ponderosa*) woodlands are locally abundant on exposed sandstone ridges and benches. Grasslands are composed chiefly of Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*) and needle-and-thread (*Hesperostipa comata*) grasslands. These grassland types were once extensive across the

west (Palouse Prairie on the Columbia Plateau, extending east into the Rocky Mountains and south into the Great Basin), but have declined significantly in the last century. In the Upper Yellowstone Watershed, native grasslands have been lost to agriculture, conversion to ponderosa pine woodlands (from fire suppression) or introduced species such as Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), smooth brome (*Bromus inermis*) or cheat grass (*Bromus tectorum*).

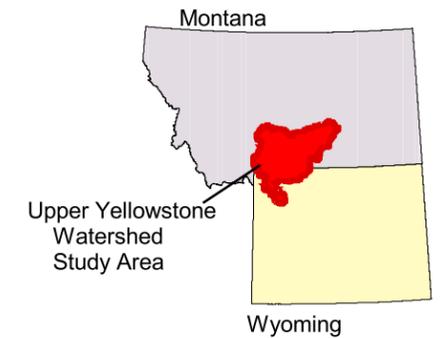
Sagebrush communities typically are found in upland sites such as flat to rolling plains, plateaus and hills, benches and terraces above valley floors, alluvial fans and footslopes, mountain parks and ridges, as well as well-drained alluvial bottomlands (ABI 2001). Mountain sagebrush (*Artemisia tridentata ssp. vaseyana*) is found with Idaho fescue, bluebunch wheatgrass, or western wheatgrass (*Pascopyrum smithii*). In the more arid Big Horn Basin, Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*) replaces mountain sagebrush as the dominant sagebrush species. Like the associated grasslands, sagebrush communities have declined from agricultural conversion, range “improvement” practices (Blaisdell et al. 1982, Tisdale and Hironaka 1981) and the introduction of exotic species (Blaisdell et al. 1982, Morgan et al. 1994).

The decline of sagebrush is especially so for basin big sagebrush (*Artemisia tridentata ssp. tridentata*). This sagebrush species grows on deep, fine- to medium-textured alluvial soils with some source of subirrigation during the summer season (ABI 2001); the same soils valued for agriculture. Communities dominated by this species are now relatively rare in the Upper Yellowstone Watershed. A few relic stands are found in the Upper Yellowstone Valley subsection. Black sagebrush / bluebunch wheatgrass shrublands (*Artemisia nova* / *Pseudoroegneria spicata*) grow on calcareous parent material. Good examples of this community are found on limestone substrates in the Big Horn Basin and Upper Yellowstone Valley subsection.

Upper Yellowstone Watershed



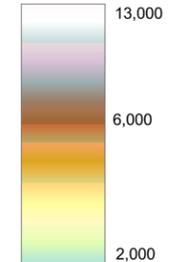
Ecological Sections of the Upper Yellowstone Watershed



Legend

- Interstate
- State Boundary
- Rivers
- Towns
- Upper Yellowstone Watershed
- Sections
- Subsections
- Yellowstone Lake
- Yellowstone National Park

Elevation Feet



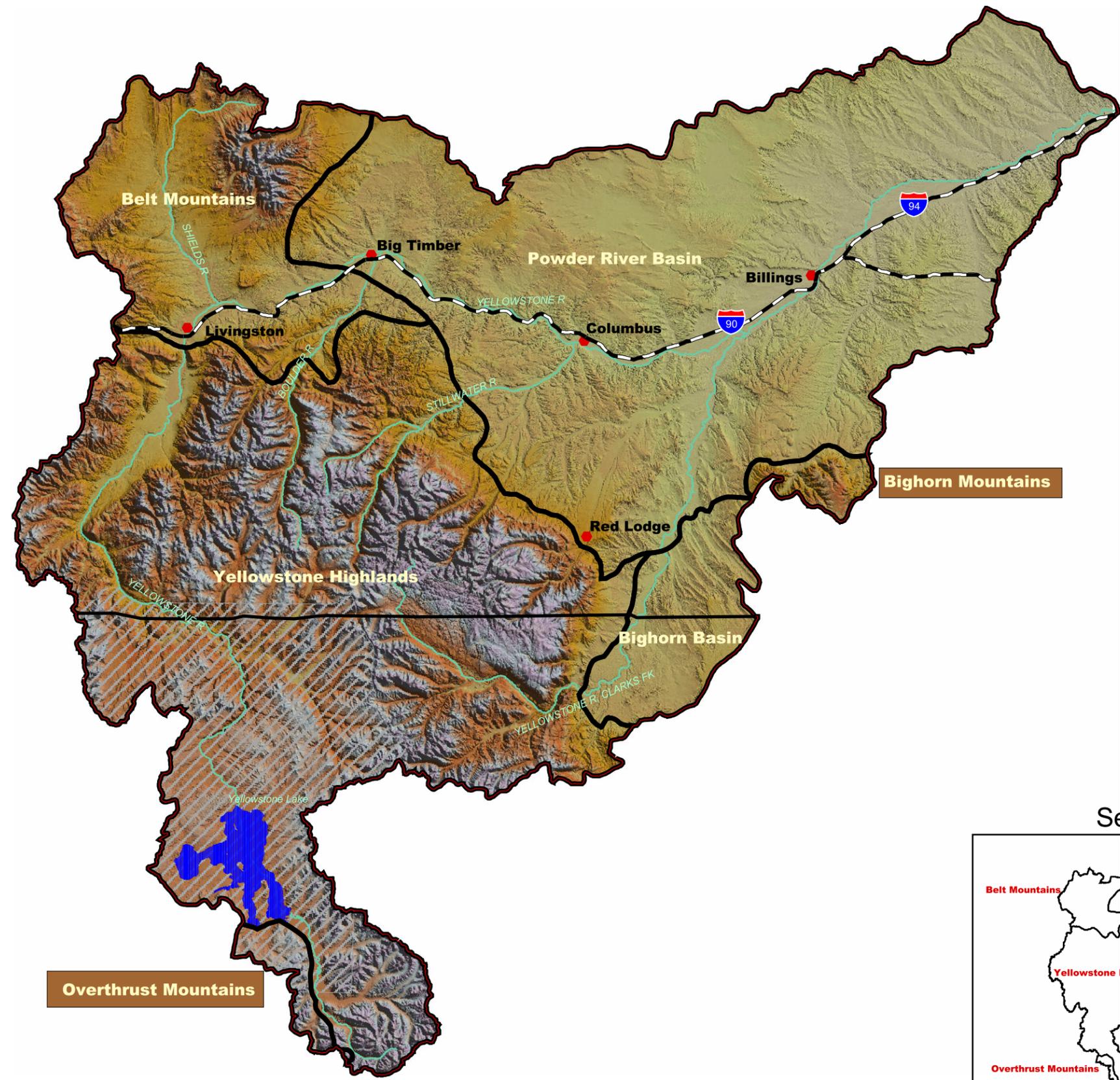
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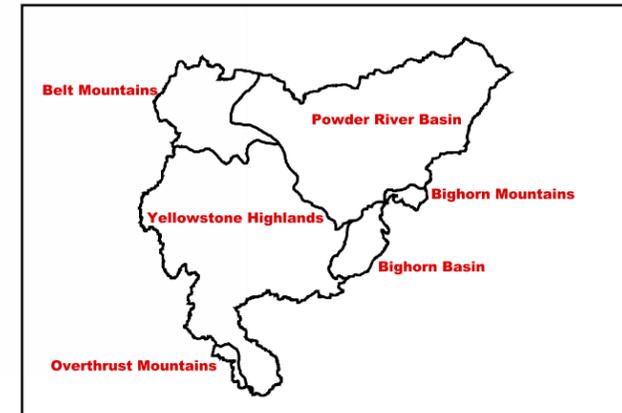
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Map 3/13/01.apr
By John Peterson

Source:
Montana Natural Heritage Program and
the Wyoming Natural Diversity Database



Sections



Overthrust Mountains

Bighorn Mountains

Wetlands described by Jones (2001) in the Upper Yellowstone Watershed include those formed by glacial processes in and near the mountains such as cirques, kettle ponds and glaciated valleys with well developed riverine floodplains and depressional wetlands associated with wind-eroded deflation basins (Woods et al. 1999, in Jones 2001). Willow shrublands are found on active floodplain zones of low and high gradient streams and rivers, around beaver ponds, in peatlands, and on the edge of marshes, potholes, and lakes. Several non-willow shrubland communities are also found in the watershed. Mountain alder (*Alnus incana*) and water birch (*Betula occidentalis*) are dominant in springs and seeps and along high gradient streams. Western snowberry (*Symphoricarpos occidentalis*), silver sagebrush (*Artemisia cana*), chokecherry (*Prunus virginiana*), and red-osier dogwood are common and locally dominant in riverine floodplains and terraces. Black greasewood (*Sarcobatus vermiculatus*) is a common dominant around alkali lakebeds (Jones 2001).

Native herbaceous emergent vegetation is common in a variety of settings, including peatlands, marshes, potholes, beaver ponds, wet meadows, lake edges, oxbows, and sloughs. Intact wet meadow communities are still relatively common at higher elevations, however many valley bottom wet meadows that once supported tufted hairgrass (*Deschampsia caespitosa*) and bluejoint reedgrass (*Calamagrostis canadensis*) communities are now dominated by exotics like redtop (*Agrostis scabra*), Kentucky bluegrass, smooth brome, common timothy, and reed canarygrass (*Phalaris arundinacea*). This conversion has also affected western wheatgrass communities on riparian floodplains and terraces (Jones 2001).

Fauna and Animal Species of Concern

The variety of landscapes within the Upper Yellowstone Watershed provides habitat for a diverse range of animal species, from terrestrial mollusks to wide-ranging carnivores. Many

people are aware of the abundance of the more easily observed and charismatic species such as elk, mule deer (*Odocoileus hemionus*), bighorn sheep (*Ovis canadensis*), and antelope (*Antilocapra americana*), however these species merely provide a more visible indication of the importance of the watershed to all animals inhabiting this landscape.

Most animal species that could have been found by Capt. Clark in the early 1800's are still found in this watershed. This is because most of the historical ecosystem process that resulted in this diversity functions today as it did then. Fire and flooding continue to influence the landscape and provide habitats for species adapted to these disturbances. These disturbances, especially flooding have been eliminated or reduced in most other landscapes. The population processes of immigration and emigration that influence population persistence function today for most species because the landscape is still relatively intact. Wide-ranging animals continue to move between populations and influence the population dynamics of local populations that might have been isolated in a more altered landscape. However, factors within the watershed and from the surrounding landscapes have resulted in some animal species needing special management concern. These species are presented in Appendix B.

A number of animal species of concern are associated with the coniferous forests, the predominant vegetation type in the watershed. The U.S. Fish and Wildlife Service in the Northern Rockies list the gray wolf (*Canis lupus*) as an endangered species and the wolves released into Yellowstone National Park are considered an experimental population until the recovery goals are met. The grizzly bear (*Ursus arctos horribilis*) and the North American lynx (*Lynx canadensis*) are listed as threatened species. Other mammal species associated with this habitat and considered species of concern by the Montana Natural Heritage Program, the Montana Department of Fish, Wildlife and Parks and the Wyoming Natural Diversity Database include the fisher and wolver-

ine. All of these species naturally occur at low densities or require large areas of habitat and garner concern because, although large, the Upper Yellowstone Watershed may still be too small to ensure viable populations of these species by itself. Bird species of concern such as the goshawk (*Accipiter gentiles*), black-backed woodpecker (*Picoides arcticus*) and white-winged crossbill (*Loxia leucoptera*) rely on the large size of the relatively intact landscape and the inherent ecological processes to maintain their populations within the watershed

The riverine system and associated riparian habitats in the Upper Yellowstone Watershed are also important to a variety of animal species of concern and supports an outstanding trout fishery. It is obviously vitally important for many fish, reptile and amphibians species. The Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) is probably the most notable species of concern in this habitat type. The sauger (*Stizostedion canadense*), a species that inhabits the lower portion of the watershed, is a recent addition to the species of special concern list because of population declines. Numerous other native fish still maintain healthy populations on the Yellowstone River and its tributaries because of the free flowing nature of the river. Reptiles of concern include the snapping turtle (*Chelydra serpentina*) and spiny softshell (*Trionyx spiniferus*). Both are directly tied to the riverine system in the lower portion of the river. Two



Male Harlequin Duck, photo by Doug Chadwick

amphibian species of concern, the Columbia spotted frog the Northern leopard frog, are associated with riverine or wetland habitats within the watershed.

Thirty-one percent of the 35 bird species of concern found within the watershed are associated with riparian or wetland habitats. The bald eagle (*Haliaeetus leucocephalus*), which nests in the riparian forests along the major waterways, is listed as a threatened species. Other species of concern include the harlequin duck (*Histrionicus histrionicus*), which breeds along relatively undisturbed mountainous streams in the upper reaches of the watershed and the redheaded woodpecker (*Melanerpes erythrocephalus*), which inhabits large cottonwood forests in the lower portion of the watershed. Most neotropical migrants, birds that winter in neotropical areas but migrate north to nest, also rely on the riparian habitat within the watershed. As a group, neotropical migrants have become of interest because of noted declines in a number of these species. Only one mammal species of concern, the river otter, can be said to depend on this habitat type.

Many grassland and shrubland species of concern inhabit the uplands of the Upper Yellowstone Watershed. The black-tailed prairie dog (*Cynomys ludovicianus*) is a candidate species for listing by the USFWS. The Upper Yellowstone Watershed also contains a high proportion of the population of free ranging bison (*Bos bison*). Free ranging bison are now constrained to Yellowstone National Park but formerly were the most abundant large ungulate on the plains in the watershed. The mountain plover (*Charadrius montanus*), which inhabits areas with very low grass cover, is a proposed threatened species. Another bird of recent concern associated with sagebrush habitats in the watershed is the greater sage grouse (*Centrocercus urophasianus*). Two reptile species associated with dry habitats are the milk snake (*Lampropeltis triangulum*) and western hognose

snake (*Heterodon nasicus*). Both are found in upland areas in the lower portion of the watershed.

Plant Species Of Concern

Wyoming and Montana Natural Heritage databases have records for 155 different plant species or subspecies of concern in the Upper Yellowstone Watershed (Appendix A). Thirty-four of these are believed to be globally imperiled (G1-G2 / T1-T2) or vulnerable (G3). Ranks are explained in Appendix C. Most of these are local or regional endemics, having most or a major portion of their total range in this watershed. The remaining species are considered imperiled or vulnerable at the state level in Wyoming or Montana (S1-S3) and include several disjunct species that have a limited distribution in the Rocky Mountains. All but 3 of the identified plant species of concern are vascular plants, the 3 exceptions

being mosses. This reflects, at least in part, greater effort and knowledge of vascular as compared to non-vascular plants.

Many of the plant species of concern in the Upper Yellowstone watershed are restricted to specialized, and often highly localized, habitats. Five of the seven globally imperiled plants (G/T1 & G/T2) occupy high-elevation (alpine and subalpine) habitats, primarily in the Wyoming portion of the Watershed; about half of their known occurrences lie within federal Wilderness Areas. Regionally endemic species whose worldwide distribution is restricted or nearly restricted to the Upper Yellowstone Watershed include the snow paintbrush (*Castilleja nivea*), fan-leaved fleabane (*Erigeron flabellifolius*), and tiny swamp saxifrage (*Saxifraga apetala*).

Wetland (palustrine and riparian) habitats also support a disproportionate number of the

Table 2. Plant species of global significance in the Upper Yellowstone Watershed

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	WY RANK	MT RANK	SIGNIFICANCE	WET-LAND	HIGH ELEVATION
<i>Abronia ammophila</i>	YELLOWSTONE SAND VERBENA	G1	S1		Near endemic	X	
<i>Draba pectinipila</i>	COMB-HAIR WHITLOW-GRASS	G1Q	S1		Local endemic		X
<i>Carex stenoptila</i>	SMALL-WINGED SEDGE	G2	S2	S2	Regional endemic		X
<i>Penstemon absarokensis</i>	ABSAROKA BEARDTONGUE	G2	S2		Near endemic		X
<i>Shoshonea pulvinata</i>	SHOSHONEA	G2G3	S2	S1	Regional endemic		
<i>Silene kingii</i>	KING'S CAMPION	G2G4Q	S2	SU			
<i>Castilleja nivea</i>	SNOW PAINTBRUSH	G3	S2	SU	Regional endemic		X
<i>Draba crassa</i>	THICK-LEAF WHITLOW-GRASS	G3	S2	S3	Regional endemic		X
<i>Draba globosa</i>	ROCKCRESS DRABA	G3	S2	S1	Regional endemic		X
<i>Erigeron flabellifolius</i>	FAN-LEAVED FLEABANE	G3	S2	S3	Regional endemic		
<i>Erigeron radicans</i>	TAPROOTED FLEABANE	G3	S1	S3	Disjunct		X

Table 2. Continued

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	WY RANK	MT RANK	SIGNIFICANCE	WET - LAND	HIGH ELEVATION
<i>Eriogonum brevicaule var canum</i>	RABBIT BUCKWHEAT	G3	S2	S3	Regional endemic	X	
<i>Heterotheca depressa</i>	TETON GOLDEN-ASTER	G3	S2	SU	Regional endemic	X	
<i>Rorippa calycina</i>	PERSISTENT SEPAL YELLOWCRESS	G3	S2S3	S1	Regional endemic	X	
<i>Thlaspi parviflorum</i>	SMALL-FLOWERED PENNYCRESS	G3	S3	S2		X	
<i>Castilleja crista-galli</i>	COCK'S-COMB PAINTBRUSH	G3?	S2	SU	Regional endemic		
<i>Pyrrocoma integrifolia</i>	ENTIRE-LEAF GOLDENWEED	G3?	S1	SU	Regional endemic	X	
<i>Carex nelsonii</i>	NELSON'S SEDGE	G3G4	S2	SU	Regional endemic	X	X
<i>Erigeron tweedyi</i>	TWEEDY FLEABANE	G3G4	S2	SR			
<i>Castilleja gracillima</i>	SLENDER INDIAN PAINTBRUSH	G3G4Q		S2	Regional endemic	X	
<i>Papaver kluanensis</i>	ALPINE POPPY	G3G4Q	S2	S1	Disjunct		X
<i>Draba porsildii var brevicula</i>	LITTLE SNOW DRABA	G3G4T1	S1		Local endemic		X
<i>Draba porsildii var porsildii</i>	PORSILD'S WHITLOW-GRASS	G3G4T3T4	S1	S1			
<i>Juncus tweedyi</i>	TWEEDY'S RUSH	G3Q	S2	SU	Regional endemic	X	
<i>Saxifraga apetala</i>	TINY SWAMP SAXIFRAGE	G3Q	S1	S2	Regional endemic	X	X
<i>Scirpus rollandii</i>	ROLLAND BULRUSH	G3Q	S1	S1	Disjunct	X	
<i>Arabis williamsii var williamsii</i>	WILLIAM'S ROCKCRESS	G3QT3Q	S3	SRF	Regional endemic	X	
<i>Ipomopsis spicata ssp robruthii</i>	KIRKPATRICK'S IPOMOPSIS	G4?T2	S2		Disjunct		
<i>Pyrrocoma carthamoides var subsquarrosom</i>	BEARTOOTH LARGE-FLOWERED GOLDENWEED	G4G5T2T3	S2	S2	Regional endemic		
<i>Haplopappus macronema var linearis</i>	NARROWLEAF GOLDENWEED	G4G5T3	S2	S3	Regional endemic		
<i>Townsendia condensata var anomala</i>	NORTH FORK EASTER DAISY	G4T2	S2	SRF	Near endemic		X
<i>Draba fladnizensis var pattersonii</i>	WHITE ARCTIC WHITLOW-GRASS	G4T2T3	S2	S1	Regional endemic		
<i>Eleocharis flavescens var thermalis</i>	WARM SPRINGS SPIKERUSH	G5T2T3Q	S2		Regional endemic	X	
<i>Draba paysonii var paysonii</i>	PAYSON'S DRABA	G5T3?	S2	S3	Regional Endemic		X

watershed's globally significant plants. The rarest is the Yellowstone sand verbena (*Abronia ammophila*), which grows only on the shores of Yellowstone Lake. Wetlands support many of the globally significant plants in this watershed. Important wetland species include Tweedy's rush (*Juncus tweedyi*) and Rolland's scirpus (*Scirpus rollandii*).

Several regional endemics also occur in the foothills and montane zones. Two of these are Shoshonea (*Shoshonea pulvinata*) and Beartooth large-flowered goldenweed (*Pyrrocoma carthamoides* var. *subsquarrosus*), both of which are now better documented in Montana as a result of this study with five element occurrences being updated. The balance of plant species of concern in the watershed occupy a variety of habitats. A good example is the warm springs spikerush (*Eleocharis flavescens* var. *thermalis*), a highly specialized plant that occurs only in geothermal areas of Yellowstone National Park.

More extensive information on habitat, elevation and distribution for all of these species is available on the worldwide web. Montana information is available at: <http://nris.state.mt.us/mtnhp/plants/index.html>. Wyoming information is available at: <http://www.uwyo.edu/wyndd>.

Cultural Characteristics & Land Use

Population in the watershed is sparse, in most areas averaging 2-6 persons per square mile. The exception is Yellowstone County, Montana, where Billings (Montana's largest city and the only one of over 15,000 in the watershed) accounts for an average population of nearly 50-persons/sq. mi. in the county. The region's population was relatively stable until the 1990's, but increased between the 1990 and 2000 census from 10-11% in Park Co. (MT) and Park Co. (WY) to 27% Stillwater Co. (MT) (U.S. Bureau of the Census, March 2000). Most of the growth is concentrated in the Billings area and in desirable recreational/resort areas, the

latter driven primarily by conversion of ranches to low-density residential use (Zelt et al. 1999). Population of the watershed's Montana counties is projected to increase by almost 50,000 persons (29%) by 2025.

Just over half of the Upper Yellowstone Watershed is in private ownership. Figure 3 shows the relationship of major land ownership types in the watershed. These proportions vary dramatically by sub-watershed; for instance, the Beartooth, Absaroka, and Crazy Mountains contain large blocks of public lands, mostly in the Gallatin and Shoshone National Forests and Yellowstone National Park. The lower (eastern) portion of the watershed is overwhelmingly in private ownership; BLM's holdings are primarily in the lower watershed and concentrated in the upper Clark's Fork River drainage, as are tribal lands on the Crow Reservation. State school trust lands, managed by the Department of Natural Resources and Conservation, are interspersed throughout the privately owned lands.

Land use varies dramatically between the lower and upper watershed and by elevation. In the non-forested eastern portion of the watershed and the intermountain valleys, grazing and, to a lesser extent, crop production (both dryland and irrigated) represent the major land uses by acreage. Although overstocking and concentration of stock along watercourses can impact habitat, grazing is among the lowest-impact land uses and is important to the health of grasslands. Habitat loss on rangelands is perhaps most serious where sagebrush has been cleared to increase forage. Invasive exotics, such as leafy spurge (*Euphorbia esula*), spotted knapweed (*Centaurea maculosa*) and cheat grass (*Bromus tectorum*), also pose a serious threat to both the economic and biological health of rangelands. Ranches with rangelands are increasingly being converted to low-density residential development, resulting in habitat loss and fragmentation. The bald eagle (*Haliaeetus leucocephalus*) is especially sensitive to watershed disturbances that diminish foraging, nesting and roosting sites near riparian areas. Land trusts

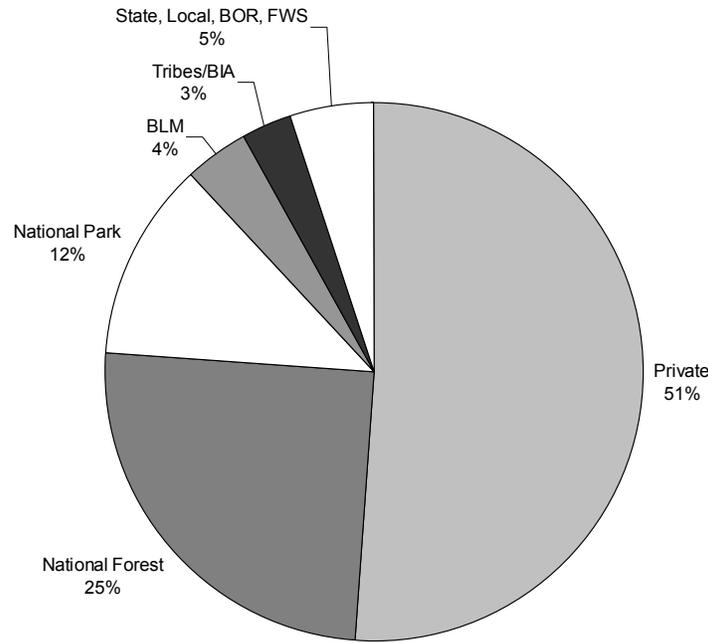


Figure 3. Land Ownership in the Upper Yellowstone Watershed

dedicated to open space have secured many agricultural easements in valley locations helping to prevent habitat fragmentation in the watershed.

Development and intensive human use is concentrated along rivers, with major impacts on habitat and species diversity. Riparian habitats support a diverse array of species, many of them dependent on riparian or wetland habitats for all or a portion of their habitat requirements. Riparian habitat, especially along the Yellowstone, has also been heavily impacted by bank hardening, which suppresses the flooding required for cottonwood regeneration. Riparian areas are also particularly susceptible to invasion by exotic weeds, especially those that rely on elevated moisture levels or that invade where soils is disturbed. Grazing animals tend to concentrate in riparian areas because of the highly productive forage, available water and shade. Recreation activities frequently take place in riparian settings. Grazing animals and humans can also accidentally spread weeds into riparian areas.

In the south and western-forested portions of the watershed, dominant land uses are recreation,

forestry, and mining. The principle human impact in forested zones has probably been fire suppression (Arno 2000). Major mining activity is concentrated at the Stillwater drainage. Stillwater Mining Company is the only U.S. producer of platinum and palladium, strategic precious metals with unique physical and chemical properties vital to modern society. Recreational impacts are concentrated in areas of higher tourism development (e.g., near Red Lodge, Gardiner and Livingston), but are also widely dispersed throughout mid and high-elevation areas, where there is extensive camping, fishing, and hiking use. These activities can damage fragile alpine vegetation in areas of heavy use.

Previous Biological Assessments

The headwaters of the Yellowstone River originate in Yellowstone National Park, established in 1872 by the United States Congress for its outstanding natural features. The Upper Yellowstone region has long been recognized for its exceptional ecological significance and this project is not the first to identify the importance or significance of certain areas, nor will it be the last. Since the

establishment of the park, people continue to share a vision of integrity for the greater Yellowstone. Here are a few examples:

In 1978, the General Assembly of the United Nations Educational, Scientific and Cultural Organization (UNESCO) approved inscription of Yellowstone National Park as a World Heritage Site. The following criteria for a world Heritage Site is taken from the UNESCO web page at (<http://www.unesco.org/whc/heritage.htm>). A world Heritage Site includes: “natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view; geological and physiographic formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation; natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.”

In 1990 the National Park Service designated a 20.5-mile reach of the Clark’s Fork Yellowstone River (Crandall Creek Bridge downstream to the Clarks Fork Canyon) as a Wild and Scenic River. Here the Clark’s Fork flows through a deep canyon; tumultuous waterfalls, whitewater cascades, deep pools, and rugged corridor lands are its unique characteristics. (<http://www.nps.gov/rivers/clarksfork.html>).

The Forest Service and Bureau of Land Management have also identified significant ecological sites in the Upper Yellowstone Watershed. The Forest Service has designated one and proposed four Research Natural Areas (RNA). Line Creek Plateau was recently established as an RNA (USDA FS 2001). The four proposed RNAs include East Fork Mill Creek (pRNA), Passage Creek (pRNA), Sliding Mountain (pRNA) and the Twin Lakes (pRNA) (<http://>

[rma.nris.state.mt.us.](http://rma.nris.state.mt.us/)) The Bureau of Land Management designated Meeteetse Spires an Area of Critical Environmental Concern in 1999 for the areas spectacular limestone cliffs, rare plants and scenic values.

The Nature Conservancy (TNC) began working in the Upper Yellowstone Watershed over two decades ago. The draft strategic plan for the Greater Yellowstone Bio-reserve Project (TNC, 1990) recognized the significance of the ‘Greater Yellowstone’ as more than the aggregation of rare species and communities, but as a region with intact (or nearly so) ecological processes. In 1991, TNC commissioned a report to identify landscape Conservation Priorities in the Greater Yellowstone Ecosystem (Noss 1991). Many priority landscapes were identified in the Upper Yellowstone Watershed, the Clark’s Fork, Line Creek and Upper Yellowstone megasites³ and Bald Ridge / Clark’s Fork, Broadwater River, Upper & Lower Deer Creeks, Meeteetse Spires, Swamp Lake, Clay Butte and Pryor Mountains microsities⁴. In 1996 the Montana Field Office selected the Pryor-Beartooth Site as one of seven in their statewide conservation plan (TNC, 1996a). This important area was further described in the Northern Bighorn Basin Site Conservation Plan (Lesica 1998).

In 1996, TNC began an ecoregional approach to conservation to “ensure the long-term survival of all viable native species and communities through the design and conservation of a portfolio of conservation sites (TNC 1996b). The Nature Conservancy chose the U.S. Forest Service ECOMAP framework as the ecoregion source in the United States (Bailey 1995; 1998) because of the scientific consistency and hierarchy of spatial scales provided by this framework. The Upper Yellowstone Watershed intersects four TNC planning ecoregions; the Northern Great Plains Steppe (TNC 1999), the Middle Rockies-Blue Mountains (TNC 2000a), the Wyoming Basin

³ A megasite is an area larger than 200,000 acres identified as a core reserve for biodiversity conservation purposes.

⁴ A microsite is an area less than 150,000 acres identified as a core reserve for biodiversity conservation purposes.

(TNC 2000b) and the Utah - Wyoming Mountains (Noss et al. 2001). Ecoregional planning teams use data from the Natural Heritage Programs to identify priority “conservation targets” for the portfolio. Unlike previous TNC planning efforts, today’s ecoregional plans systematically include common and widespread natural community and aquatic types as conservation targets to ensure long term viability of the full range of biological diversity.

Data Assembly

The first phase of this project involved assembling data on the significant biological resources of the watershed, including plant and animal species of concern as well natural features such as bird rookeries, wetlands and natural communities. The Montana Natural Heritage Program led this component of the project. Element occurrence data⁵ on plant and animal species of concern and natural plant communities⁶ comes from new inventory and secondary sources, including publications, museum/herbarium records, and biologists from the private sector, public agencies, and academia. We gathered new records from a combination of published and unpublished reports, field survey forms, agency personnel, and by knowledgeable people in public and private sector.

Field inventories were conducted to verify and ground truth, high priority species groups as well as natural communities to increase the quality and quantity of the existing heritage data set. A Rapid Ecological Assessment⁷ (REA) was used as a

reconnaissance procedure to quickly fill data gaps and assess an area’s importance and or significance. This effort focused particularly on the Montana Sedimentary Plains subsection (Nesser et al. 1997) where very little species or community information had been recorded. Special effort was also given to filling survey gaps and relocating historic records of globally significant species. All new occurrence data were assembled and fully integrated into the Natural Heritage Databases.

Heritage staff scientists use standardized and documented criteria (called element occurrence specifications) to evaluate, 1) whether an observation represents a valid species or community record (element occurrence), 2) the type of occurrence that the record represents (e.g., for a bird species, breeding site vs. migratory concentration area), and 3) the quality of the occurrence. Specifications have been documented at some level for the most highly visible animal species and for general plant and animal species groups. In addition, Jones (2001) developed specifications for ranking wetland communities in the watershed. Each occurrence record is mapped and digitized as a point or polygon feature, and is assigned a precision code to indicate the degree of locational accuracy. Spatial data is subject to quality control measures to ensure its accuracy.

As of February 2001, over 770 records of species of concern and outstanding natural communities were documented in the combined Montana and Wyoming natural heritage dataset for Upper Yellowstone Watershed. These records are for species *currently* tracked in heritage

⁵ An element occurrence is a location for a species or community tracked by the state heritage program. For plants, an occurrence is location of a plant population. In some instances, nearby but spatially separated clusters are considered subpopulations and are grouped as one occurrence. For animals with limited mobility, such as most invertebrates, amphibians, reptiles, small mammals, and most fish, an occurrence is a location record, assumed to represent a breeding population, based on a specimen collection or of a verified sighting. An occurrence for mobile or migratory animals, including most birds, large mammals and some fish is the habitat necessary to support a population of the species. This may be a breeding area (e.g. nesting territories, dens and leks) or a significant aggregation site (e.g. winter feeding areas, staging grounds or hibernacula).

⁶ An element occurrence of a community is a documented location for a vegetation type. The occurrence may occur as a small to large patch or within a matrix of other vegetation types. The community is a conceptual grouping of species into associations based on floristic composition, vegetation structure and environmental characteristics. All plant communities that occur naturally in Montana are tracked by the MTNHP. However element occurrences are created only for (1) community types that are uncommon or rare or (2) high-quality examples of more common types.

⁷ The Rapid Ecological Assessment is a quick survey method designed to gather natural community information for large landscape areas or smaller sites.

databases. These include 119 new records that were added during the course of this project (1997 to 2001), an increase of 15%. Forty-five percent of these represent important occurrences of natural communities. A concurrent wetland project (Jones 2001) generated many new records for wetland communities in Montana. The remainder of the new occurrence records, in order of volume, was for birds, amphibians, and vascular plants. In addition to these new records, 129 plant and animal records (17% of the original records) were verified and updated with recent observation dates, thus increasing the reliability of the data. Overall, 38% of the final dataset consists of records with observation dates since 1990, 53% with observations since 1980. The reliability of older records is dependent upon the original source of the data and the land use activities in the vicinity of the species occurrence. Records in areas of little ecological change and very low human impact, such as upper watersheds (esp. in wilderness areas) are more likely to persist over time.

Identification of Biologically Important Sites

Once the biological data were assembled for the Upper Yellowstone Watershed, we identified and recorded 79 *important* biological sites⁸ (Figure 4). These sites support rare plants or animals, valuable wetland ecosystems or have rare and or exemplary high quality natural communities. Appendix E is a description of the biological values present within each site, as well as information on current land use and management issues such as invasive weeds. Biologically important sites are concentrated on public lands managed by the National Park Service, Bureau of Land Management and the US Forest Service. In Wyoming, sites are entirely on public land. In Montana, most sites have a core area on federal or state land but may also include private property; a few sites are largely on private property. Though these sites are biologically important due to the species or communities that



Yellowstone River near Pompey's Pillar

⁸ A site is an area of ecological or biological significance that is recorded as a Site Basic Record in the state heritage databases. A site's importance is based upon an assemblage of plant, animal and or community element occurrences. Site boundaries are drawn to capture these features.

they represent, we are not proposing special designation or protection. Our intention is simply to highlight areas with valuable and often little known resources for the benefit of private and public land managers.

Very little low elevation area was captured in a site boundary due to land ownership patterns, e.g. private lands dominate in low elevation habitats and influence data gathering and analysis. This does not mean important biological resources are absent but rather a need exists for more complete inventory. This is particularly important in low elevation forests, shrub steppe, aspen and riparian areas as these places are at risk from continued development in the watershed.

We mapped sites as large as 700,000 acres and as small as 10 acres. Some of the sites are nested one within another, and some lie within areas of significance identified by previous studies. Small or “local” sites (e.g., wetland complexes) are mapped with more precise boundaries than larger “landscape-scale sites” such as Meeteetse Spires in the Clark Fork watershed. The Pryor Mountains-Line Creek Plateau is a very large “regional site” that encompasses the full environmental gradient from the alpine tundra of the Beartooth Mountains to the desert ecosystem of the Pryor Mountains and Big Horn Basin. Regional sites are more likely to support intact natural processes such as species movements and migrations, and natural fire regimes. Boundaries mapped for very large sites are only intended to serve as very general delineations. Selected sites and localities are discussed below.

Yellowstone River Corridor

This site includes the Yellowstone River corridor and a 1-kilometer buffer on either side. It crosses through three of the six ecological sections represented within the watershed, and has a highly diverse suite of aquatic, riverine, wetland and terrestrial habitats. The Yellowstone River is free of the major impoundments that have dramatically

altered the hydrologic regime of most rivers in the West. Flood events are instrumental in cottonwood establishment on floodplains. Cottonwood gallery forests and terraces provide habitat for nesting, wintering and migrating bald eagles (*Haliaeetus leucocephalus*) and rookery sites for blue heron.

The aquatic environment of the Upper Yellowstone Watershed includes both cold water and warm water habitats. Cold water environments in the upper watershed support Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*); downstream, warm water aquatic species include pallid sturgeon (*Scaphirhynchus albus*), paddlefish (*Polyodon spathula*), blue sucker (*Cycleptus elongatus*), the sicklefin chub (*Hybopsis meeki*) and sturgeon chub. Channel gravel and sand bars provide habitat for spiny softshell (*Trionyx spiniferus*) and in the past supported persistent-sepal yellowcress (*Rorippa calcyina*), which has not been relocated in recent years. Riparian communities support the rare beaked spikerush (*Eleocharis rostellata*) and Schweinitz flatsedge (*Cyperus schweinitzii*). A notable shorebird on this stretch of the Yellowstone is the interior least tern (*Sterna antillarum athalassos*). Two reptiles, the western hognose snake (*Heterodon nasicus*) and milk snake (*Lampropeltis triangulum*) have also been reported from the river corridor.

Wetlands

At the time of this report, 42 ecologically significant wetlands had been inventoried and described by Jones (2001). Wetlands were documented throughout the study area, but the majority of sites occurred in the Beartooth Front. These sites encompass a wide variety of wetland types, including riverine cottonwood gallery forests, beaver-influenced willow and sedge bottomlands, alkaline lakebeds, glacial potholes, and poor fens. The sites are relatively small, ranging from tens to a few hundred acres in size. Sites range in quality from pristine wetlands of statewide conservation

significance to highly impacted wetlands that still provide important wildlife habitat.

Of the 42 sites inventoried, 8 were judged to be of outstanding quality. These sites have intact hydrologic regimes, undisturbed uplands, and support high quality native plant communities. Sites include poor fens, beaver-influenced slope and riverine wetlands, and a lacustrine fringe wetland. The beaver-influenced wetlands are exceptionally diverse and support aquatic communities, sedge meadows, willow bottoms, stands of cottonwood and wet aspen, and climax riparian spruce forests. The poor fens, while not as structurally or floristically diverse, are regionally rare wetland types. Chrome Lake is especially interesting, as it is only the fourth patterned fen documented from the state (J. S. Shelly, pers. comm.). These sites support excellent examples of several G3 and more common wetland communities, including beaked sedge (*Carex utriculata*), Buxbaum's sedge (*Carex buxbaumii*), Booth's willow / bluejoint reedgrass (*Salix boothii* / *Calamagrostis canadensis*), planeleaf willow / water sedge (*Salix planifolia* / *Carex aquatilis*), and Engelmann spruce / bluejoint reedgrass (*Picea engelmannii* / *Calamagrostis canadensis*). These sites all occur on private and National Forest land in the Beartooth Front.

Yellowstone Highlands

Most of the regional and large landscape sites we identified are in the Yellowstone Highlands Section of the watershed, an area famous for having extant populations of wide-ranging forest carnivores. Sites in this section include such areas as the Beartooth Plateau, Absaroka Mountains, Lamar Valley and Yellowstone Lake. Land ownership is primarily public with a significant amount managed for conservation e.g. Yellowstone National Park or as designated Wilderness in the Beartooth – Absaroka Wilderness Area. The importance of this wild area to grizzly bears and the gray wolf cannot be overemphasized. These species have

been extirpated from nearly all of their historic range, yet they are still extant in the Yellowstone region (Clark et al. 1989). Extensive habitat, isolation from human activities and abundant forage and prey base make this area critical habitat for the recovery of the grizzly bear. The Upper Yellowstone watershed is also important habitat for lynx. Dense lodgepole pine forests are available for hunting snowshoe hares and higher elevation spruce-fir forests are available for denning. The higher elevation coniferous forest is also habitat for the wolverine. In addition, many headwater streams have genetically pure Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) populations (MRIS 2001). These fish have adapted to localized conditions in the past and contribute to the genetic variability that helps ensure long-term adaptation and survival into the future.

Many species of arctic plants have disjunct populations in the Beartooth Mountains; these include arctic cottongrass (*Eriophorum callitrix*), a characteristic forb of alpine wetlands and icegrass (*Phippsia algida*) and island purslane (*Koenigia islandica*), both of which form very open communities on sites with lingering snow. A rare alpine snowbed community, Littleleaf Pussytoes - Alpine Sagebrush Herbaceous Vegetation (*Antennaria microphylla* - *Artemisia scopulorum*), has been described from the eastern edge of the Absaroka Mountains in northwestern Wyoming. The current high rank (G1Q)⁹ is based on a very limited known range, only three stands have been documented on one alpine ridge of Carter Mountain in northeastern Wyoming. There is some uncertainty about the distinctness of this vegetation type and additional fieldwork is needed.

The Beartooth Front encompasses important aspen parklands. The Beartooth Front – Aspen Parkland site is located along the strongly tilted north slope foothills at the base of the Beartooth Plateau. Vegetation is a mosaic of grass and shrublands with both coniferous and deciduous

⁹ Rank definitions are in Appendix D.

forests. Small to large open park-like meadows of Idaho fescue – Richardson’s needlegrass (*Festuca idahoensis* - *Stipa richardsonii*) herbaceous vegetation are embedded in the forest vegetation. This particular grassland association occurs at scattered locations in the mountains of southwestern Montana and in Yellowstone National Park in northwestern Wyoming. Stands are local and infrequent because they are restricted to relatively uncommon topographic and edaphic conditions characterized by gentle terrain with deep, loamy and mesic soils. This grassland type can be easily degraded by off-highway vehicles, roads and grazing practices that lead to accelerated soil erosion and encroachment of alien increaser grasses.

A large part of this site lies in state school trust sections, which are leased for grazing and support active logging operations. Several noxious weeds have been recorded from state lands by Montana Division of Natural Resources and Conservation (DNRC) during range allotment allotments. These weeds Canada thistle (*Cirsium arvense*), knapweed (*Centaurea ssp.*) and leafy spurge (*Euphorbia esula*). Two introduced grasses, *Phleum pratense* and *Poa pratensis* are abundant in the meadow and aspen communities.

Aspen parklands contribute to the diverse composition and structure of vegetation on the Beartooth Front. The interspersed spatial pattern of aspen makes these habitats very important for some wildlife species (DeByle 1985). An undergrowth rich in forbs and grasses provides valuable habitat for small seed eating mammals such as voles, which are in turn an important prey base for owls and other predatory birds. Because aspen is susceptible to heart rot disease, the punky interiors of these trees are readily excavated by cavity nesters, such as woodpeckers. In mixed aspen-conifer forests, the aspen component is probably essential for some of the cavity nesting birds (DeByle 1985). Aspen is also a highly important browse species, with young suckers and buds favored by elk, deer, and moose (*Alces alces*).

Montana High Plains and Foothills and Sedimentary Plains

In the Montana Sedimentary Plains Subsection, Pine Ridge was highlighted for its intact natural landscape with an extensive representation of ponderosa pine / bluebunch wheatgrass woodlands (*Pinus ponderosa* / *Pseudoroegneria spicata*). This ponderosa pine woodland is found on sandstone ridge outcrops, benches and coulee slopes and is one of the drier ponderosa pine woodlands found in the northern Rocky Mountains, Inter-Mountains, and extreme northwestern Great Plains of the United States and Canada.

In the Montana High Plains and Foothills subsection, we identified Hailstone and Half-breed National Wildlife Refuges and Big Lake as important biological sites. These are large, shallow brackish lakes in the Lake Basin area of central Montana. The closed basin (a relatively uncommon geomorphological feature), coupled with soils weathered from a substrate high in clays and of low permeability, has created a condition promoting intermittent flooding, salt accumulation, and ponding of water. The large complex of wetlands and their abundance of sago pondweed (*Stuckenia pectinata*) are significant for spring waterfowl migration. The black-necked stilt (*Himantopus mexicanus*) is recorded from the lake area. The burrowing owl (*Athene cunicularia*) and black-tailed prairie dog (*Cynomys ludovicianus*) are located in the adjacent uplands. The core of these sites lie on FWS and State Lands.

Interactive Map Project

In addition to this report, we developed an ArcExplorer¹⁰ GIS project that displays, by subwatershed (HUC 11) and by site, all the database records assembled for species of concern and high quality natural communities. It illustrates important watersheds and areas of

¹⁰ ArcExplorerTM is a geographic data explorer developed by Environmental Systems Research Institute, Inc. (ERSI).

Upper Yellowstone Watershed



Sites



Upper Yellowstone Watershed Study Area

Legend

- Interstate
- State Boundary
- Towns
- Yellowstone Lake
- Local Point Sites
- Landscape Point Sites
- Upper Yellowstone Watershed
- Yellowstone National Park
- Wyoming Counties
- Montana Counties
- Local_sites
- Landscape_sites
- Regional_sites

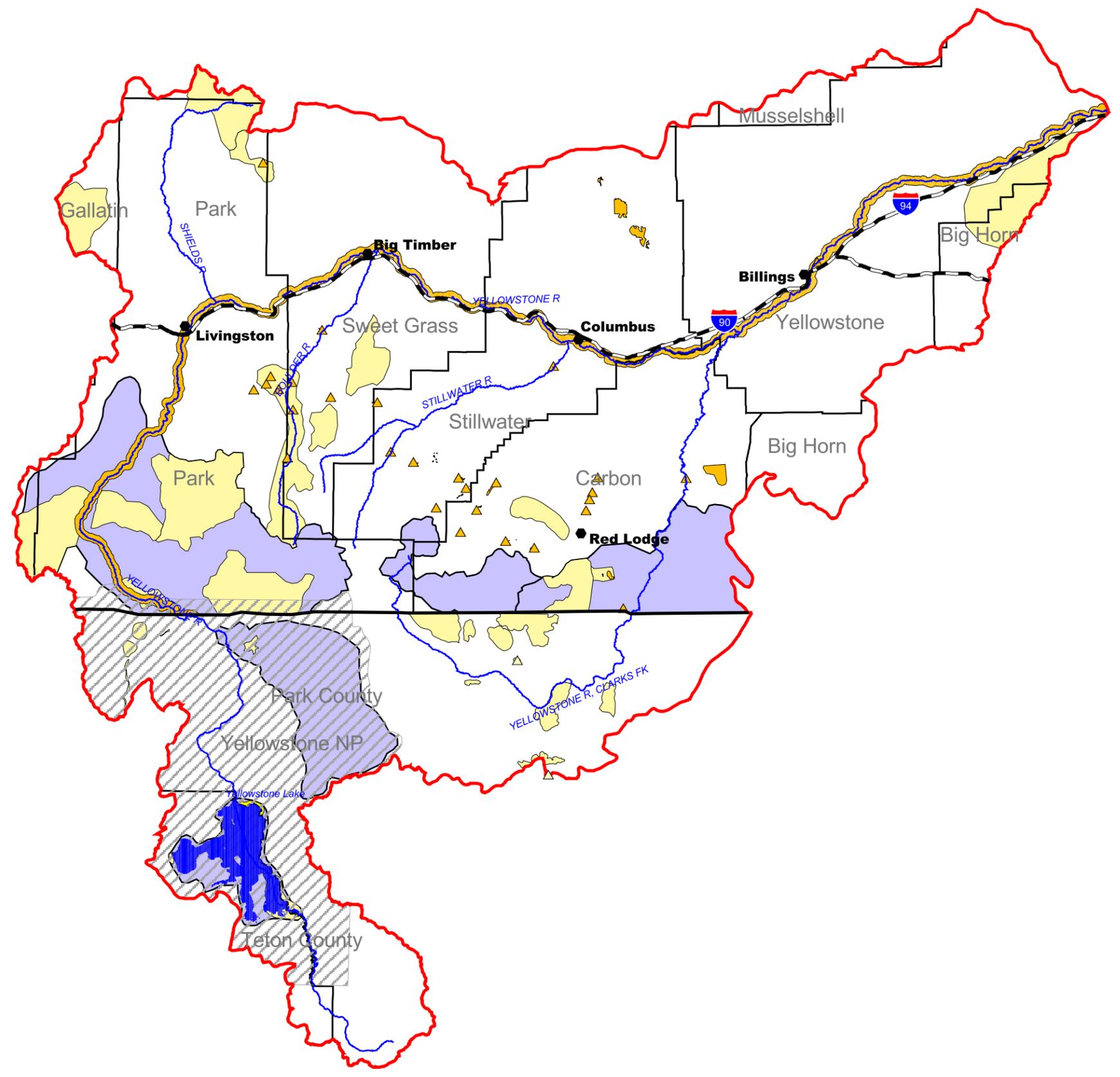


7 0 7 14 21 Miles
1: 1,200,000

Tt Tera Tech EM Inc.
Power Plock Building, Suite 612
6th & Last Chance Gulch
Helena MT 59601
(406)442-5588

Map 3/13/01.apr
By John Peterson

Source:
Montana Natural Heritage Program and
the Wyoming Natural Diversity Database



biological significance in a series of GIS maps and associated data tables, and is available on CD-ROM (with metadata). In consideration of the sensitive nature of some species of concern and for the concerns of private landowners on whose properties they may occur, exact locations have not been provided.

Planners, managers and other decision-makers can use the interactive format to query the ArcExplorer for high quality wetland, riparian, terrestrial communities and species of concern in any watershed or identified site in the Upper Yellowstone Watershed. The information can serve as a first step in identifying species of concern or sensitive ecological areas that might be affected by land development or management activities. When more precise or comprehensive information is needed for specific projects or planning initiatives, the state Heritage programs can be contacted for assistance (*see page i*).

Users should keep in mind that this information reflects only what is known about the watershed, and an absence of information for any given area does not mean that species of concern or sensitive areas do not exist there. Many parts of the watershed have not been inventoried, and this data set is not intended as a definitive information source or as a substitute for on-site surveys, which may be required for environmental assessments.

The Natural Heritage databases are being continuously updated with new information on species and communities. Data summarized in this report and on the CD-ROM ArcExplorer have a short shelf life; the data is accurate and current for approximately one year from publication. Beyond that, users should go to the MTNHP web page, where interactive search tools will soon be available to obtain current information on the Montana portion of the watershed. The Wyoming Natural

Diversity Database should be contacted directly for updates in that portion of the watershed. There are no plans to maintain an up-to-date dataset that combines data from Montana and Wyoming for the watershed. However the Association for Biodiversity Information¹¹ has begun developing a multi-jurisdictional heritage dataset for North America, with web-based access as a longer-term objective.

Project Assessment and Recommendations

The goal of this project was to improve the quality and accessibility of biological resource information on the Upper Yellowstone Watershed, which is essential to effective planning and decision-making. Natural Heritage programs are the best source of accurate and reliable information on significant biological resources, and projects such as this provide an excellent opportunity for heritage staff to deliver information on areas of particular importance. In the course of this project, however, we encountered several issues that need to be addressed through future efforts.

Spanning political boundaries

Increasingly, conservation planning is done at large scales, with a focus on ecological rather than politically-based planning units. This makes sense with respect to species and ecosystems, which don't follow political boundaries. However, it poses significant challenges for assembling Heritage data, because Heritage Programs operate at the state level. Although Heritage data is collected and managed using a standardized methodology (the great strength of the Heritage network), each program has variations in approach, database customizations, and different emphases in their data collection. This produces datasets that, while

¹¹ The Association for Biodiversity Information (ABI) is a non-profit organization dedicated to developing and providing information about the world's plants, animals, and ecological communities. ABI works in partnership with 85 independent Natural Heritage programs and Conservation Data Centers that gather scientific information on rare species and ecosystems in the United States, Latin America, and Canada (the Natural Heritage Network).

similar and complementary, don't "match up" precisely across political boundaries and require significant effort to synthesize, normalize, and effectively interpret.

For instance, the Wyoming Natural Diversity Database manages site records only on public lands, while the Montana Heritage Program sites covers both public and private lands. In addition, the Wyoming program tracks some species as rare that have not been considered rare in Montana (and thus not tracked), and vice-versa. Wyoming heritage biologists felt that most of the watershed in Wyoming had been adequately surveyed for biologically significant species and sites; this was clearly not the case for Montana. Reconciling these differences refines, enhances, and helps quality-control both datasets, but it also takes a good deal of time. As a result, it is not efficient to do this repeatedly on a small scale – e.g., watershed-by-watershed.

Heritage programs have for some time recognized the efficiency of creating a single "multi-jurisdictional" dataset, and collectively formed the Association for Biodiversity Information to begin the major challenge of assembling and maintaining a synthesized heritage dataset for North America, in partnership with the heritage network. In the future, we recommend that EPA and other partners work with ABI in support of that effort, rather than continue to invest in smaller-scale data assembly projects.

Filling data gaps

As noted previously, data gaps in the Upper Yellowstone watershed posed a serious challenge for this project. Datasets with major data gaps can be misleading to the user (seeming to imply absence of significance where data is lacking), and providing them as a "finished product" can actually mask the need for inventory work.

This project revealed a particular lack of biological survey data for the Montana Sedimentary Plains

subsection (Nesser et al., 1997). Historically, the Great Plains portion of the Yellowstone and Missouri watersheds have received far less attention in terms of biological inventory and conservation assessment. Interest in and need for that information is growing because of species like the prairie dog and sage grouse, as well as many less conspicuous but no less important species that are only beginning to emerge "on the radar screen". Because all these species are dependent on the large landscape ecosystems and processes of the Great Plains, good data on those species' status, distribution and ecology will be needed not only to address their needs, but to do it efficiently at an ecosystem level, rather than species by species.

Our Rapid Ecological Assessment ¹² (REA) procedure helped to provide a landscape-level overview of ecological integrity – e.g., confirming that ponderosa pine-dominated sandstone benches and plateaus of the Sedimentary Plains are relatively intact compared to the surrounding grasslands, which have been modified by agriculture. However, the REA does not provide enough detail to document, in the Heritage databases, specific features or sites of biological importance in the large landscape areas that are identified. The REA is most effective as a first step, to help prioritize areas for more detailed assessment and documentation, with follow-up survey during the following field season. Using the REA to "pre-select" inventory sites can also provide time to identify private landowners and seek permission for access to conduct inventory. Because we did not have time to contact landowners of REA-identified landscapes and then follow up with on-site inventory, our detailed surveys were largely confined to publicly-owned lands.

Further biological inventory work, focusing on the Great Plains and other "data gaps," will be critical to providing a reliable foundation for planning and resource management. Species and communities of particular significance for "gap-filling" include

¹² The Rapid Ecological Assessment is a field survey method designed to quickly gather natural community information for large landscape areas or smaller sites.

prairie fishes (some of which are federally listed or candidates), riparian corridors and wetlands, woody draws, and major intact grasslands – especially in the Northern Glaciated Plains (north of the Missouri River in northeastern Montana.

Local planning support

Finally, additional attention should be devoted to delivering biological information to planners and helping them use it effectively. While we hope that this project is a step in the right direction, we can identify two areas that would improve planners' ability to access and apply this information to decision-making. One is to provide more hands-on staff support to planners and planning efforts. Our efforts were spent primarily in-house on data assembly and analysis, but there is a real need and opportunity to work more directly with planners, resource managers and extension agents in applying heritage data. In doing so, we would also

learn more about their specific needs and how to make biological information more accessible and useful to them.

We also need to take advantage of new technologies to deliver and apply Heritage data. Although we took advantage of GIS capabilities for delivering and displaying spatial data, continuing to create stand-alone GIS projects for selected study areas is not the best strategy. It would be far more efficient and effective to develop real-time data access and interactive analysis tools that apply to a range of different geographic areas and questions. The Montana Natural Heritage Program has begun to explore these opportunities, working with ABI and other Heritage Programs in the Rocky Mountain region, and would like to expand our partnerships with federal and state agencies and others to create Web-enabled data delivery and analysis capabilities.

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Appendix A

Plants of Concern in the Upper Yellowstone Watershed

SCIENTIFIC NAME	COMMON NAME	US-ESA	GRANK	WY RANK	MT RANK
<i>Abronia ammophila</i>	YELLOWSTONE SAND VERBENA		G1	S1	
<i>Adoxa moschatellina</i>	MUSK-ROOT		G5	S1	S2
<i>Agoseris lackschewitzii</i>	PINK AGOSERIS		G4	S3	S3
<i>Agrostis oregonensis</i>	OREGON BENT GRASS		G4	S1	SR
<i>Amerorchis rotundifolia</i>	ROUND-LEAVED ORCHID		G5	S1	S2S3
<i>Androsace chamaejasme</i> <i>ssp carinata</i>	SWEET-FLOWERED ROCK JASMINE		G5T4	S1S2	
<i>Antennaria aromatica</i>	AROMATIC PUSSYTOES		G4	S2S3	S3S4
<i>Antennaria flagellaris</i>	STOLONIFEROUS		G5?	S1	
<i>Antennaria monocephala</i>	SINGLE-HEAD PUSSYTOES		G4G5	S1	SR
<i>Aquilegia formosa</i> var	CRIMSON COLUMBINE		G5T5	S1	S2
<i>Arabis williamsii</i> var	WILLIAM'S ROCKCRESS		G3QT3Q	S3	SRF
<i>Arctostaphylos rubra</i>	RED MANZANITA		G5	S1	
<i>Asclepias incarnata</i>	SWAMP MILKWEED		G5	S2	S1
<i>Aster scopulorum</i>	LAVA ASTER		G5	S1	SR
<i>Astragalus grayi</i>	GRAY'S MILKVETCH		G4?	S3	S2
<i>Atriplex truncata</i>	WEDGE-LEAVED		G5	S2	S1
<i>Botrychium virginianum</i>	RATTLESNAKE FERN		G5	S1	SR
<i>Camissonia andina</i>	OBSCURE EVENING-		G4	S2	S1
<i>Carex concinna</i>	BEAUTIFUL SEDGE		G4G5	S1	SR
<i>Carex cusickii</i>	CUSICK'S SEDGE		G5	S1	SR
<i>Carex diandra</i>	LESSER PANICLED SEDGE		G5	S2	SR
<i>Carex leptalea</i>	BRISTLY-STALK SEDGE		G5	S2	S3S4
<i>Carex limosa</i>	MUD SEDGE		G5	S2	SR
<i>Carex livida</i>	LIVID SEDGE		G5	S1	S3
<i>Carex microglochin</i>	FALSE UNCINIA SEDGE		G5?	S1	SU
<i>Carex misandra</i>	SHORT-LEAF SEDGE		G5	S1	S3
<i>Carex multcostata</i>	MANY-RIBBED SEDGE		G5		S1
<i>Carex nelsonii</i>	NELSON'S SEDGE		G3G4	S2	SU
<i>Carex norvegica</i> ssp <i>inserrulata</i>	TOOTHED SCANDINAVIAN SEDGE		G5T?Q	S2	S1
<i>Carex preslii</i>	PRESL SEDGE		G4	S1	SR
<i>Carex scirpoidea</i> var <i>scirpiformis</i>	CANADIAN SINGLE-SPIKE SEDE		G5T4Q	S1	
<i>Carex stenoptila</i>	SMALL-WINGED SEDGE		G2	S2	S2
<i>Carex tinctoria</i>	SLENDER SEDGE		G4G5		SU
<i>Castilleja crista-galli</i>	COCK'S-COMB		G3?	S2	SU
<i>Castilleja exilis</i>	ANNUAL INDIAN		G5	S2	S2
<i>Castilleja gracillima</i>	SLENDER INDIAN		G3G4Q		S2
<i>Castilleja nivea</i>	SNOW PAINTBRUSH		G3	S2	SU
<i>Cirsium canovirens</i>	GRAY-GREEN THISTLE		G4G5	SH	SR
<i>Cirsium foliosum</i>	LEAFY THISTLE		G5	S1	SR
<i>Cleome lutea</i>	YELLOW BEE PLANT		G5	S3	S1
<i>Crassula aquatica</i>	PYGMYWEED		G5	S1	SU
<i>Cryptogramma stelleri</i>	FRAGILE ROCKBRAKE		G5	S1	SR
<i>Cypripedium parviflorum</i>	SMALL YELLOW LADY'S- SLIPPER		G5		S3
<i>Dicranoweisia cirrata</i>	FINE ROLLED-LEAF MOSS		G4		S1
<i>Deschampsia</i>	ANNUAL HAIRGRASS		G5	S1	SR
<i>Draba borealis</i>	BOREAL DRABA		G4	S2	

SCIENTIFIC NAME	COMMON NAME	US-ESA	GRANK	WY RANK	MT RANK
<i>Draba crassa</i>	THICK-LEAF WHITLOW-GRASS		G3	S2	S3
<i>Draba densifolia</i>	DENSE-LEAF DRABA		G5	S2	S2
<i>Draba fladnizensis</i> var <i>pattersonii</i>	WHITE ARCTIC WHITLOW-GRASS		G4T2T3	S2	S1
<i>Draba glabella</i>	ROCK WHITLOW-GRASS		G4G5	S1	SR
<i>Draba globosa</i>	ROCKCRESS DRABA		G3	S2	S1
<i>Draba paysonii</i> var	PAYSON'S DRABA		G5T3?	S2	S3
<i>Draba pectinipila</i>	COMB-HAIR WHITLOW-GRASS		G1Q	S1	
<i>Draba porsildii</i> var	LITTLE SNOW DRABA		G3G4T1	S1	
<i>Draba porsildii</i> var <i>porsildii</i>	PORSILD'S WHITLOW-GRASS		G3G4T3T4	S1	S1
<i>Drosera anglica</i>	ENGLISH SUNDEW		G5	S2	S2
<i>Dryopteris expansa</i>	SPREADING WOODFERN		G5	S1	SR
<i>Eleocharis flavescens</i> var	WARM SPRINGS		G5T2T3Q	S2	
<i>Eleocharis rostellata</i>	BEAKED SPIKERUSH		G5	S2	S2
<i>Elodea longivaginata</i>	LONG SHEATH		G4G5		S2
<i>Epipactis gigantea</i>	GIANT HELLEBORINE		G4	S1	S2
<i>Equisetum fluviatile</i>	WATER HORSETAIL		G5	S1	S4
<i>Erigeron eatonii</i> ssp <i>eatonii</i>	EATON'S DAISY		G5T5	S3	S1
<i>Erigeron flabellifolius</i>	FAN-LEAVED FLEABANE		G3	S2	S3
<i>Erigeron formosissimus</i> var	BEAUTIFUL FLEABANE		G5T4	S2	S1
<i>Erigeron humilis</i>	LOW FLEABANE		G4	S2	S3
<i>Erigeron linearis</i>	LINEARLEAF FLEABANE		G5	S2	S1
<i>Erigeron radicans</i>	TAPROOTED FLEABANE		G3	S1	S3
<i>Erigeron tweedyi</i>	TWEEDY FLEABANE		G3G4	S2	SR
<i>Eriogonum brevicaulum</i> var	RABBIT BUCKWHEAT		G3	S2	S3
<i>Eriophorum callitrix</i> var	SHEATHED COTTON-		G5T?	S1	S1
<i>Eriophorum chamissonis</i>	RUSSET COTTON-GRASS		G5	S1	SR
<i>Eriophorum gracile</i>	SLENDER COTTON-GRASS		G5	S1	S2
<i>Eriophorum viridicarinatum</i>	GREEN KEELED COTTON-GRASS		G5	S1	S3
<i>Eritrichium howardii</i>	HOWARD FORGET-ME-NOT		G4	S1	SU
<i>Eupatorium maculatum</i>	JOE-PYE WEED		G5TU	S2	S2
<i>Festuca hallii</i>	HALL'S FESCUE		G4	S1	
<i>Gentianopsis simplex</i>	HIKER'S GENTIAN		G4	S1	S1
<i>Gnaphalium microcephalum</i> var <i>therma</i>	WHITE CUDWEED		G5T4Q	S1	
<i>Gratiola ebracteata</i>	BRACKETLESS HEDGE-HYSSOP		G4		S1
<i>Grayia spinosa</i>	SPINY HOPSAGE		G5	S3	S2
<i>Haplopappus macronema</i> var <i>linearis</i>	NARROWLEAF GOLDENWEED		G4G5T3	S2	S3
<i>Hemicarpha drummondii</i>	DRUMMOND'S		G4G5	S1	SH
<i>Heterotheca depressa</i>	TETON GOLDEN-ASTER		G3	S2	SU
<i>Horkelia fusca</i> var	PINE WOODS HORKELIA		G5T?	SH	
<i>Hutchinsia procumbens</i>	HUTCHINSIA		G5	S2	S1
<i>Ipomopsis spicata</i> ssp <i>robruthii</i>	KIRKPATRICK'S IPOMOPSIS		G4?T2	S2	

SCIENTIFIC NAME	COMMON NAME	US-ESA	GRANK	WY RANK	MT RANK
<i>Isoetes occidentalis</i>	WESTERN QUILLWORT		G4G5	S1	SR
<i>Juncus albescens</i>	THREE-FLOWERED RUSH		G5	S2	S2
<i>Juncus filiformis</i>	THREAD RUSH		G5	S1	SR
<i>Juncus triglumis</i>	THREE-FLOWERED RUSH		G5	S2	SU
<i>Juncus triglumis</i> var <i>triglumis</i>	THREE-FLOWER RUSH		G5T5	S1	
<i>Juncus tweedyi</i>	TWEEDY'S RUSH		G3Q	S2	SU
<i>Kobresia macrocarpa</i>	LARGE-FRUITED		G5		S1
<i>Kobresia schoenoides</i>	SIBERIAN KOBRESIA		G5	S1	S1
<i>Kobresia simpliciuscula</i>	SIMPLE KOBRESIA		G5	S1	S2
<i>Koenigia islandica</i>	ISLAND KOENIGIA		G4	S1	S1
<i>Luzula glabrata</i> var	SMOOTH WOOD-RUSH		G5T4	S1	
<i>Meesia triquetra</i>	LONG-STALKED SWAN		G5		S2
<i>Mentzelia pumila</i>	DWARF MENTZELIA		G4	S2S3	S2
	CILIOLATE-TOOTHED				
<i>Mimulus rubellus</i>	MONKEY-FLOWER		G5	S1	
<i>Muhlenbergia glomerata</i>	MARSH MUHLY		G5	S1	SR
	COMMON COLD-				
<i>Paludella squarrosa</i>	WETLAND MOSS		G3G5		S1
<i>Papaver kluanensis</i>	ALPINE POPPY		G3G4Q	S2	S1
<i>Parrya nudicaulis</i>	NAKED-STEMMED		G5	S2	
<i>Pedicularis oederi</i>	OEDER'S LOUSEWORT		G5	S1	S3
<i>Penstemon absarokensis</i>	ABSAROKA		G2	S2	
<i>Phippsia algida</i>	ICE GRASS		G5	S1	S2
<i>Polemonium micranthum</i>	ANNUAL POLEMONIUM		G5	SH	SR
<i>Polygonum douglasii</i> ssp	AUSTIN'S KNOT WEED		G5T4	S2	S2S3
<i>Potamogeton praelongus</i>	WHITE-STEM PONDWEED		G5	S1	SR
<i>Potentilla hyparctica</i>	LOW ARCTIC		G4G5	S1	S1
<i>Potentilla quinquefolia</i>	FIVE-LEAF CINQUEFOIL		G5T4		S2
<i>Potentilla uniflora</i>	ONE-FLOWERED		G5	S1	S1
<i>Primula egalikensis</i>	GREENLAND PRIMROSE		G4	S1	
<i>Primula incana</i>	MEALY PRIMROSE		G4G5	S2	S2
<i>Pyrrocoma carthamoides</i> var <i>subsquarrosus</i>	BEARTOOTH LARGE- FLOWERED		G4G5T2T3	S2	S2
<i>Pyrrocoma integrifolia</i>	ENTIRE-LEAF		G3?	S1	SU
<i>Ranunculus gelidus</i> (syn. <i>Ranunculus verecundus</i>)	ARCTIC BUTTERCUP		G4	S1	S1
<i>Ranunculus jovis</i>	JOVE'S BUTTERCUP		G4	S2	S2
<i>Ranunculus verecundus</i> (syn. <i>Ranunculus gelidus</i>)	TIMBERLINE BUTTERCUP		G5	S1	S2
	PERSISTENT SEPAL				
<i>Rorippa calycina</i>	YELLOWCRESS		G3	S2S3	S1
<i>Salix barrattiana</i>	BARRATT'S WILLOW		G5	S1	S1
<i>Salix candida</i>	HOARY WILLOW		G5	S2	S3S4
<i>Salix myrtillofolia</i> var	MYRTLELEAF WILLOW		G5T5	S1	
<i>Sanicula graveolens</i>	SIERRA SANICLE		G4	S1	SR
<i>Saxifraga apetala</i>	TINY SWAMP SAXIFRAGE		G3Q	S1	S2
<i>Saxifraga chrysantha</i>	GOLDEN SAXIFRAGE		G4	S1	SU

SCIENTIFIC NAME	COMMON NAME	US-ESA	GRANK	WY RANK	MT RANK
<i>Saxifraga hirculus</i>	YELLOW MARSH SAXIFRAGE		G5		S1
<i>Scirpus atrovinctus</i>	BLACK-GIRDLE BULRUSH		G5	S1	
<i>Scirpus rollandii</i>	ROLLAND BULRUSH		G3Q	S1	S1
<i>Scolochloa festucacea</i>	SPRANGLE-TOP		G5	S1	SR
<i>Sedum stenopetalum</i>	NARROW-PETAL		G4G5	S1	SR
<i>Selaginella selaginoides</i>	LOW SPIKE-MOSS		G5	S1	S2
<i>Selaginella watsonii</i>	WATSON'S SPIKE-MOSS		G4	S1	S3
<i>Senecio amplexans</i> var	CLASPING GROUNDSEL		G4T?	S3	S1
<i>Senecio eremophilus</i> var <i>eremophilus</i>	CUT-LEAVED GROUNDSEL		G5T5		S1
<i>Senecio indecorus</i>	PLAINS RAGWORT		G5	S1	SR
<i>Senecio megacephalus</i>	BIG-HEADED GROUNDSEL		G4?	SH	S3
<i>Shoshonea pulvinata</i>	SHOSHONEA		G2G3	S2	S1
<i>Silene kingii</i>	KING'S CAMPION		G2G4Q	S2	SU
<i>Solidago sparsiflora</i>	FEW-FLOWERED		G5?	S3	S1
<i>Sparganium minimum</i>	SMALL BUR-REED		G5	S1	SR
<i>Stellaria crassifolia</i>	FLESHY STITCHWORT		G5	S2	S1
<i>Stellaria crispa</i>	CRIMPED STITCHWORT		G5	S1	SR
<i>Stipa lettermanii</i>	LETTERMAN'S		G5	S3S4	S1
<i>Taraxacum eriophorum</i>	ROCKY MOUNTAIN DANDELION		G4	S2	S2
<i>Thlaspi parviflorum</i>	SMALL-FLOWERED PENNYCRESS		G3	S3	S2
<i>Townsendia condensata</i>	CUSHION TOWNSENDIA		G4	S2	S2
<i>Townsendia condensata</i> var <i>anomala</i>	NORTH FORK EASTER DAISY		G4T2	S2	SRF
<i>Townsendia leptotes</i>	COMMON EASTER-DAISY		G4	S1	SU
<i>Triteleia grandiflora</i>	LARGE-FLOWER		G4	S1	SR
<i>Utricularia minor</i>	LESSER BLADDERWORT		G5	S1S2	SR
<i>Vaccinium myrtilus</i> var	DWARF BILBERRY		G5T?	S1	
<i>Veratrum californicum</i>	CALIFORNIA FALSE-HELLEBORE		G5	S2	S1
<i>Viburnum edule</i>	SQUASHBERRY		G5	S1	SR

Appendix B.

Animals of Concern in the Upper Yellowstone Watershed

SCIENTIFIC NAME	COMMON NAME	US- ESA	G RANK	WY RANK	MT RANK
Amphibian					
<i>Bufo boreas</i> (N. Rocky Mt)	WESTERN BOREAL TOAD		G4T4	S2	S3S4
<i>Bufo cognatus</i>	GREAT PLAINS TOAD		G5	S3	S3S4
<i>Rana luteiventris</i>	COLUMBIA SPOTTED FROG		G4	S2S3	S4
<i>Rana pipiens</i>	NORTHERN LEOPARD FROG		G5	S3	S3S4
<i>Spea bombifrons</i>	PLAINS SPADEFOOT TOAD		G5		S3
Bird					
<i>Accipiter gentilis</i>	NORTHERN GOSHAWK		G5	S2S3B	S3S4
<i>Aegolius funereus</i>	BOREAL OWL		G5	S2	S4
<i>Amphispiza belli</i>	SAGE SPARROW		G5	S3B, SZN	S1B, SZN
<i>Athene cunicularia</i>	BURROWING OWL		G4	S3B, SZN	S3B, SZN
<i>Bartramia longicauda</i>	UPLAND SANDPIPER		G5	S3B, SZN	S4B, SZN
<i>Buteo regalis</i>	FERRUGINOUS HAWK		G4	S3B, S3N	S3B, SZN
<i>Calcarius mccownii</i>	MCCOWN'S LONGSPUR		G5	S3B, SZN	S4B, SZN
<i>Centrocercus urophasianus</i>	GREATERS SAGE-GROUSE		G4	S3	S4
<i>Charadrius montanus</i>	MOUNTAIN PLOVER	PT ¹	G2	S2B, SZN	S2B, SZN
<i>Chlidonias niger</i>	BLACK TERN		G4	S1B, SZN	S3B, SZN
<i>Coccyzus erythrophthalmus</i>	BLACK-BILLED CUCKOO		G5	S2B, SZN	S4B, SZN
<i>Cygnus buccinator</i>	TRUMPETER SWAN		G4	S1B	S2B, S2N
<i>Falco columbarius</i>	MERLIN		G5	S2B, SZN	S4
<i>Falco peregrinus</i>	PEREGRINE FALCON		G4	S1B, S3N	S1S2B, SZN
<i>Gavia immer</i>	COMMON LOON		G5	S2B, SZN	S2B, SZN
<i>Haliaeetus leucocephalus</i>	BALD EAGLE	LT ²	G4	S2B	S3B, S3N
<i>Histrionicus histrionicus</i>	HARLEQUIN DUCK		G4	S1B, SZ?N	S2B, SZN
<i>Larus californicus</i>	CALIFORNIA GULL		G5	S2?B, SZN	S5B, SZN
<i>Larus delawarensis</i>	RING-BILLED GULL		G5	S1B	S5B, SZN
<i>Leucosticte atrata</i>	BLACK ROSY-FINCH		G4	S3B, S3N	S3
<i>Loxia leucoptera</i>	WHITE-WINGED CROSSBILL		G5	S1B, S2N	S4
<i>Melanerpes erythrocephalus</i>	RED-HEADED WOODPECKER		G5	S3B, SZN	S3S4B, SZN
<i>Melanerpes lewis</i>	LEWIS' WOODPECKER		G5	S2B, SZN	S4B, SZN
<i>Numenius americanus</i>	LONG-BILLED CURLEW		G5	S3B, SZN	S4B, SZN
<i>Nycticorax nycticorax</i>	BLACK-CROWNED NIGHT - HERON		G5	S3B, SZN	S2S3
<i>Pandion haliaetus</i>	OSPREY		G5	S3B, SZN	S5B, SZN
<i>Pelecanus erythrorhynchos</i>	AMERICAN WHITE PELICAN		G3	S1B, SZN	S2B, SZN
<i>Phalaropus tricolor</i>	WILSON'S PHALAROPE		G5	S3B, S3N	S4B, SZN
<i>Picoides arcticus</i>	BLACK-BACKED WOODPECKER		G5	S2	S3
<i>Polioptila caerulea</i>	BLUE-GRAY GNATCATCHER		G5	S3?B, SZN	S1B, SZN
<i>Spizella breweri</i>	BREWER'S SPARROW		G5	S3B, SZN	S4B, SZN
<i>Sterna caspia</i>	CASPIAN TERN		G5	S1B, SZN	S2B, SZN
<i>Strix nebulosa</i>	GREAT GRAY OWL		G5	S2	S3
<i>Tyrannus vociferans</i>	CASSIN'S KINGBIRD		G5	S3B, SZN	S1S3
<i>Tyto alba</i>	BARN OWL		G5	S1B, SZ?N	S1B, S1N

SCIENTIFIC NAME	COMMON NAME	US-ESA	G RANK	WY RANK	MT RANK
Fish					
<i>Oncorhynchus clarki bouvieri</i>	YELLOWSTONE CUTTHROAT TROUT		G4T2	S2	S2
<i>Stizostedion canadense</i>	SAUGER		G5	S3S4	S2
Mammal					
<i>Antrozous pallidus</i>	PALLID BAT		G5	S1B, SZN	S1
<i>Bos bison</i>	BISON		G4	S2	S3?
<i>Canis lupus</i>	GRAY WOLF	LE ³	G4	S2	S1
<i>Corynorhinus townsendii</i>	TOWNSENDS BIG-EARED BAT		G4	S1B, SZN	S2S3
<i>Cynomys leucurus</i>	WHITE-TAILED PRAIRIE DOG		G4	S2S3	S1
<i>Cynomys ludovicianus</i>	BLACK-TAILED PRAIRIE DOG	C ⁴	G4	S2S3	S3S4
<i>Euderma maculatum</i>	SPOTTED BAT		G4	S1B, SZN	S1
<i>Gulo gulo luscus</i>	NORTH AMERICAN WOLVERINE		G4T4	S1	S2
<i>Lutra canadensis</i>	RIVER OTTER		G5	S3	S4
<i>Lynx canadensis</i>	NORTH AMERICAN LYNX	LT	G5	S1	S2
<i>Martes pennanti</i>	FISHER		G5	S1	S2
<i>Microtus richardsoni</i>	WATER VOLE		G5	S2S3	S4
<i>Myotis evotis</i>	LONG-EARED MYOTIS		G5	S1B, S1?N	S4
<i>Sorex nanus</i>	DWARF SHREW		G4	S2S3	S3
<i>Sorex preblei</i>	PREBLE'S SHREW		G4	S1S2	S3
<i>Tamias umbrinus</i>	UINTA CHIPMUNK		G5		S3?
<i>Ursus arctos horribilis</i>	GRIZZLY BEAR	LT	G4T3	S2	S1S2
Mollusk					
<i>Discus shimckii</i>	STRIATE DISC		G4		S1
<i>Oreohelix strigosa berryi</i>	BERRY'S MOUNTAIN SNAIL		G5T2		S1S2
Reptile					
<i>Charina bottae</i>	RUBBER BOA		G5	S2S3	S4
<i>Chelydra serpentina</i>	SNAPPING TURTLE		G5	S4	S3
<i>Heterodon nasicus</i>	WESTERN HOGNOSE SNAKE		G5	S4	S3
<i>Lampropeltis triangulum</i>	MILK SNAKE		G5	S2S3	S2
<i>Phrynosoma hernandesi</i>	SHORT HORNED LIZARD		G5	S4	S4
<i>Trionyx spiniferus</i>	SPINY SOFT SHELL		G5	S4	S3

- 1 = Proposed Threatened
2 = Listed Threatened
3 = Listed Endangered (in the Northern Rockies)
4 = Candidate

Appendix C.

Global and State Rank Guidelines

The term “species of special concern” includes taxa that are rare, endemic, disjunct, threatened or endangered throughout their range or in Montana, vulnerable to extirpation from Montana, or in need of further research. The term also encompasses species that have a special designation by organizations or land management agencies in Montana, including: Bureau of Land Management Special Status and Watch species; U.S. Forest Service Sensitive and Watch species; U.S. Fish and Wildlife Service Threatened, Endangered and Candidate species.

Taxa are evaluated and ranked by the Heritage Program on the basis of their global (range-wide) status, and their statewide status according to a standardized procedure used by all Natural Heritage Programs. These ranks are used to determine protection and data collection priorities, and are revised as new information becomes available.

For each level of distribution—global and state—species are assigned a numeric rank ranging from 1 (critically imperiled) to 5 (demonstrably secure). This reflects the species’ relative endangerment and is based primarily on the number of occurrences of that species globally or within the state. However, other information such as date of collection, degree of habitat threat, geographic distribution patterns and population size and trends is considered when assigning a rank, and the number of occurrences listed below are suggestions, not absolute criteria.

For example, Clustered lady’s slipper (*Cypripedium fasciculatum*) is ranked G4 S2. That is, globally the species is apparently secure, while in Montana it is imperiled because of rarity, or because of other factors making it demonstrably vulnerable to extirpation.

For ranks, substitute S (State) or G (Global) in these definitions

Rank	Definition
1	Critically Imperiled —Critically imperiled because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation. Typically 5 or fewer occurrences or very few remaining individuals (<1,000).
2	Imperiled —Imperiled because of rarity or because of some factor(s) making it very vulnerable to extirpation. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000).
3	Vulnerable —Vulnerable either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.
4	Apparently Secure —Uncommon but not rare, and usually widespread. Possible cause of long-term concern. Usually more than 100 occurrences and more than 10,000 individuals.
5	Secure —Common, widespread, and abundant. Essentially ineradicable under present conditions. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

****Qualifiers and Rank Ranges****

Qualifier	Definition
# #	Range Rank —A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the element. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
?	Unranked —rank not yet assessed.
#	A modifier to X or H; the species has been reintroduced but the population is not yet established.
*	G or S rank has been assigned and is under review. Contact the individual state Natural Heritage program for assigned rank.
HYB	Hybrid —Element not ranked because it represents an interspecific hybrid, not a species.
U	Unrankable —Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
E	Exotic —An established exotic; may be native in nearby regions (e.g., house finch or catalpa in eastern U.S.).
E#	Exotic Numeric —An established exotic that has been assigned a numeric rank to indicate its status, as defined for G1 or S1 through G5 or S5.
A	Accidental —Accidental or casual, in other words, infrequent and outside usual range. Includes species (usually birds or butterflies) recorded once or only a few times at a location. A few of these species may have bred on the one or two occasions they were recorded. Examples include European strays or western birds on the East Coast and vice-versa.
B	Breeding —Basic rank refers to the breeding population of the element.
C	Captive or Cultivated —Native element presently extant only in captivity or cultivation.
H	Possibly Extirpated (Historical) —Element occurred historically, and there is some expectation that it may be rediscovered. Its presence may not have been verified in the past 20 years. An element would become GH or SH without such a 20-year delay if the only known occurrences were destroyed or if it had been extensively and unsuccessfully looked for. Upon verification of an extant occurrence, GH or SH-ranked elements would typically receive a G1 or S1 rank. The GH or SH rank should be reserved for elements for which some effort has been made to relocate occurrences, rather than simply using this rank for all elements not known from verified extant occurrences.
N	Nonbreeding —Basic rank refers to the non-breeding population of the element.
P	Potential —Potential that element occurs but no extant or historic occurrences are accepted.
R	Reported —Element reported but without a basis for either accepting or rejecting the report, or the report not yet reviewed locally. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports.
T	Rank for subspecific taxon (subspecies, variety, or population); appended to the global rank for the full species, e.g. G4T3
X	Presumed Extirpated —Element is believed to be extirpated. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

CRITERIA USED FOR RANKING

The criteria for ranking are based on a set of quantitative and qualitative factors. These factors are listed below in order of their general importance:

- a. Number of Element Occurrences (EOs):
the estimated number of EOs throughout the Element's global range;
- b. Abundance:
the estimated global abundance of the Element (measured by number of individuals, or area, or stream length covered);
- c. Size of Range:
the estimated size of the Element's global range;
- d. Distribution trend:
the trend in the Element's distribution over its global range;
- e. Number of protected EOs:
the estimated number of adequately protected EOs throughout the Element's global range;
- f. Degree of threat:
the degree to which the Element is threatened globally;
- g. Fragility:
the fragility or susceptibility of the Element to intrusion;
- h. Other global considerations:
for example, the quality or condition of EOs that affect or may affect endangerment status; unexplained population fluctuations; reproductive strategies that are dependent on specific habitat; etc.

Appendix D.

Plant Associations in the Upper Yellowstone Watershed

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Abies lasiocarpa</i> - <i>Acer glabrum</i> Avalanche Chute Shrubland	G5	y			
<i>Abies lasiocarpa</i> - <i>Pinus albicaulis</i> / <i>Vaccinium scoparium</i> Woodland	G5?	y			y
<i>Abies lasiocarpa</i> / <i>Acer glabrum</i> Forest	G5				y
<i>Abies lasiocarpa</i> / <i>Actaea rubra</i> Forest	G4?	y			y
<i>Abies lasiocarpa</i> / <i>Alnus viridis</i> ssp. <i>sinuata</i> Forest	G4	y			y
<i>Abies lasiocarpa</i> / <i>Arnica cordifolia</i> Forest	G5				y
<i>Abies lasiocarpa</i> / <i>Arnica latifolia</i> Forest	G4	y			y
<i>Abies lasiocarpa</i> / <i>Calamagrostis canadensis</i> Forest	G5	y			y
<i>Abies lasiocarpa</i> / <i>Calamagrostis rubescens</i> Forest	G4G5	y			y
<i>Abies lasiocarpa</i> / <i>Carex geeyeri</i> Forest	G5				y
<i>Abies lasiocarpa</i> / <i>Clematis columbiana</i> var. <i>columbiana</i> Forest	G3?	y			y
<i>Abies lasiocarpa</i> / <i>Galium triflorum</i> Forest	G4	y			y
<i>Abies lasiocarpa</i> / <i>Juniperus communis</i> Woodland	G4G5	y			y
<i>Abies lasiocarpa</i> / <i>Ledum glandulosum</i> Forest	G4				y
<i>Abies lasiocarpa</i> / <i>Linnaea borealis</i> Forest	G5	y			y
<i>Abies lasiocarpa</i> / <i>Luzula glabrata</i> var. <i>hitchcockii</i> Forest	G5				y
<i>Abies lasiocarpa</i> / <i>Mahonia repens</i> Forest	G5				y
<i>Abies lasiocarpa</i> / <i>Pedicularis racemosa</i> Forest	G5				y
<i>Abies lasiocarpa</i> / <i>Ribes</i> (<i>montigenum</i> , <i>lacustre</i> , <i>inermis</i>) Forest	G5	y			y
<i>Abies lasiocarpa</i> / <i>Spiraea betulifolia</i> Forest	G4				y
<i>Abies lasiocarpa</i> / <i>Streptopus amplexifolius</i> Forest	G4	y			y
<i>Abies lasiocarpa</i> / <i>Symphoricarpos albus</i> Forest	G3	y			y
<i>Abies lasiocarpa</i> / <i>Thalictrum occidentale</i> Forest	G4				y
<i>Abies lasiocarpa</i> / <i>Vaccinium cespitosum</i> Forest	G5	y			y

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Abies lasiocarpa</i> / <i>Vaccinium membranaceum</i> Rocky Mountain Forest	G5	y			y
<i>Abies lasiocarpa</i> / <i>Vaccinium scoparium</i> Forest	G5	y			y
<i>Abies lasiocarpa</i> / <i>Xerophyllum tenax</i> Forest	G5	y			y
<i>Abies lasiocarpa</i> Krummholz Shrubland	G4	y			y
<i>Abies lasiocarpa</i> Scree Woodland	G5?	y			y
<i>Acer glabrum</i> Avalanche Chute Shrubland	G5				y
<i>Acer glabrum</i> Drainage Bottom Shrubland	G4?	y			
<i>Agrostis stolonifera</i> Herbaceous Vegetation	GM	y		y	y
<i>Alnus incana</i> / Mesic Forbs Shrubland	G3G4				y
<i>Alnus incana</i> / Mesic Graminoids Shrubland	G3				y
<i>Alnus incana</i> / <i>Ribes (inermis, hudsonianum, lacustre)</i> Shrubland	G3				y
<i>Alnus incana</i> Shrubland	G?Q	y			y
<i>Alnus viridis</i> ssp. <i>sinuata</i> Shrubland [Placeholder]	G?Q	y			
<i>Andropogon gerardii</i> - <i>Schizachyrium scoparium</i> Western Great Plains Herbaceous	G2?			y	
<i>Andropogon hallii</i> - <i>Calamovilfa longifolia</i> Herbaceous Vegetation	G4G5			y	
<i>Andropogon hallii</i> - <i>Carex inops</i> ssp. <i>heliophila</i> Herbaceous Vegetation	G3			y	
<i>Antennaria microphylla</i> - <i>Artemisia scopulorum</i> Herbaceous Vegetation	G1Q				y
<i>Artemisia arbuscula</i> - <i>Cercocarpus ledifolius</i> / <i>Pseudoroegneria spicata</i> - <i>Poa secunda</i>	G4Q			y	
<i>Artemisia arbuscula</i> / <i>Festuca idahoensis</i> Dwarf-shrub Herbaceous Vegetation	G5	y			y
<i>Artemisia arbuscula</i> / <i>Pseudoroegneria spicata</i> Dwarf-shrub Herbaceous Vegetation	G5				y
<i>Artemisia arbuscula</i> ssp. <i>longiloba</i> / <i>Festuca idahoensis</i> Dwarf-shrub Herbaceous	G3?	y			y
<i>Artemisia arbuscula</i> ssp. <i>thermopola</i> / <i>Festuca idahoensis</i> Dwarf-shrub Herbaceous	G2				y

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Artemisia cana</i> / <i>Festuca idahoensis</i> Shrub Herbaceous Vegetation	G3?	y			y
<i>Artemisia cana</i> / <i>Pascopyrum smithii</i> Shrubland	G4	y		y	y
<i>Artemisia cana</i> / <i>Stipa comata</i> Shrub Herbaceous Vegetation	G3			y	
<i>Artemisia cana</i> ssp. <i>cana</i> / <i>Calamovilfa longifolia</i> Shrub Herbaceous Vegetation	G3			y	
<i>Artemisia cana</i> ssp. <i>cana</i> / <i>Pascopyrum smithii</i> Shrub Herbaceous Vegetation	G3?			y	
<i>Artemisia cana</i> ssp. <i>viscidula</i> / <i>Festuca idahoensis</i> Shrubland	G3				y
<i>Artemisia longifolia</i> - <i>Oryzopsis hymenoides</i> Sparse Vegetation	G3?			y	
<i>Artemisia longifolia</i> Sparse Vegetation	G3			y	
<i>Artemisia nova</i> / <i>Pseudoroegneria spicata</i> Dwarf-shrubland	G4G5	y	y		y
<i>Artemisia nova</i> Dwarf-shrubland	G3G5				y
<i>Artemisia pedatifida</i> - <i>Atriplex gardneri</i> Dwarf-shrubland	G3?		y	y	
<i>Artemisia pedatifida</i> / <i>Pascopyrum smithii</i> Dwarf-shrubland	G3			y	
<i>Artemisia pedatifida</i> / <i>Pseudoroegneria spicata</i> Dwarf-shrub Herbaceous Vegetation	G3		y		
<i>Artemisia spinescens</i> Dwarf-shrubland	G3Q		y		
<i>Artemisia tridentata</i> - <i>Atriplex confertifolia</i> Shrubland	G4		y		
<i>Artemisia tridentata</i> / <i>Festuca campestris</i> Shrub Herbaceous Vegetation	G3Q	y			
<i>Artemisia tridentata</i> / <i>Festuca idahoensis</i> Shrub Herbaceous Vegetation	G4Q	y	y		
<i>Artemisia tridentata</i> ssp. <i>tridentata</i> / <i>Festuca idahoensis</i> Shrubland	G4?				y
<i>Artemisia tridentata</i> ssp. <i>tridentata</i> / <i>Leymus cinereus</i> Shrubland	G2	y	y		y
<i>Artemisia tridentata</i> ssp. <i>tridentata</i> / <i>Pascopyrum smithii</i> Shrubland	G3?	y		y(?)	
<i>Artemisia tridentata</i> ssp. <i>tridentata</i> / <i>Pseudoroegneria spicata</i> Shrub Herbaceous	G2G4	y	y	y	y
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> - <i>Symphoricarpos oreophilus</i> / <i>Festuca</i>	G4				y

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> / <i>Bromus carinatus</i> Shrubland	G4?				y
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> / <i>Festuca campestris</i> Shrub Herbaceous Vegetation	G?	y			
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> / <i>Festuca idahoensis</i> - <i>Elymus trachycaulus</i>	G?	y			
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> / <i>Festuca idahoensis</i> - <i>Geranium viscosissimum</i>	G?	y			
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> / <i>Festuca idahoensis</i> - <i>Pseudoroegneria spicata</i>	G?	y			
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> / <i>Festuca idahoensis</i> Shrub Herbaceous Vegetation	G5	y			y
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> / <i>Pascopyrum smithii</i> Shrubland	G3?	y			
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> / <i>Pseudoroegneria spicata</i> Shrubland	G5		y	y(?)	y
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> / <i>Festuca idahoensis</i> - <i>Stipa occidentalis</i> Shrubland	G?	y			y
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> - <i>Atriplex confertifolia</i> Shrubland	G3G5			y	
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / Mixed Grasses Shrub Herbaceous Vegetation	G5		y	y	
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Pascopyrum smithii</i> Shrubland	G4			y	
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Pseudoroegneria spicata</i> Shrub Herbaceous	G4	y	y	y	y
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Pseudoroegneria spicata</i> Shrubland	G5?	y	y	y	
<i>Atriplex confertifolia</i> / <i>Oryzopsis hymenoides</i> Shrubland	G3?		y		
<i>Atriplex confertifolia</i> / <i>Pseudoroegneria spicata</i> Shrubland	G3		y		
<i>Atriplex confertifolia</i> Wyoming Basins Shrubland	G5		y	y	
<i>Atriplex gardneri</i> - <i>Artemisia spinescens</i> Dwarf-shrubland	G2G3		y		
<i>Atriplex gardneri</i> / <i>Artemisia tridentata</i> Dwarf-shrubland	G3		y	y	
<i>Atriplex gardneri</i> / <i>Monolepis nuttalliana</i> Dwarf-shrubland	G3?		y		
<i>Atriplex gardneri</i> / <i>Oryzopsis hymenoides</i> Dwarf-shrubland	G3				y
<i>Atriplex gardneri</i> / <i>Pascopyrum smithii</i> Dwarf-shrubland	G3		y	y	

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Betula nana</i> / <i>Carex utriculata</i> Shrubland	G4?	y			y
<i>Betula occidentalis</i> - <i>Pentaphylloides floribunda</i> Shrubland	G2Q	y			
<i>Betula occidentalis</i> / <i>Cornus sericea</i> Shrubland	G3?				y
<i>Betula occidentalis</i> Shrubland	G3Q	y			y
<i>Bouteloua gracilis</i> - <i>Carex filifolia</i> Herbaceous Vegetation	G3?			y	
<i>Calamagrostis canadensis</i> - <i>Senecio triangularis</i> Herbaceous Vegetation	G3				y
<i>Calamagrostis canadensis</i> Western Herbaceous Vegetation	G4	y			y
<i>Calamovilfa longifolia</i> - <i>Carex inops</i> ssp. <i>heliophila</i> Herbaceous Vegetation	G3			y	
<i>Calamovilfa longifolia</i> - <i>Stipa comata</i> Herbaceous Vegetation	G3			y	
<i>Caltha leptosepala</i> Herbaceous Vegetation	G4				y
<i>Carex aquatilis</i> Herbaceous Vegetation	G5	y	y		y
<i>Carex buxbaumii</i> Herbaceous Vegetation	G3				y
<i>Carex duriuscula</i> Herbaceous Vegetation	GUQ				y
<i>Carex elynoides</i> - <i>Geum rossii</i> Herbaceous Vegetation	G4	y			y
<i>Carex elynoides</i> Herbaceous Vegetation	G4	y			y
<i>Carex lanuginosa</i> Herbaceous Vegetation	G5?	y			y
<i>Carex lasiocarpa</i> Herbaceous Vegetation	G4?	y			y
<i>Carex limosa</i> Herbaceous Vegetation	G3				y
<i>Carex microptera</i> Herbaceous Vegetation	G4				y
<i>Carex nebrascensis</i> Herbaceous Vegetation	G4	y	y	y	y
<i>Carex nigricans</i> Herbaceous Vegetation	G4	y			y
<i>Carex praeegracilis</i> - <i>Carex aquatilis</i> Herbaceous Vegetation	G3				y

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Carex rupestris</i> - <i>Geum rossii</i> Herbaceous Vegetation	G4				y
<i>Carex rupestris</i> - <i>Potentilla ovina</i> Herbaceous Vegetation	G4	y			y
<i>Carex scirpoidea</i> - <i>Geum rossii</i> Herbaceous Vegetation	G4	y			y
<i>Carex scirpoidea</i> - <i>Potentilla diversifolia</i> Herbaceous Vegetation	G3?				y
<i>Carex scopulorum</i> - <i>Calitha leptosepala</i> Herbaceous Vegetation	G4				y
<i>Carex scopulorum</i> Herbaceous Vegetation	G5	y			y
<i>Carex simulata</i> Herbaceous Vegetation	G4	y			y
<i>Carex utriculata</i> Herbaceous Vegetation	G5	y		y	y
<i>Cercocarpus ledifolius</i> / <i>Pseudoroegneria spicata</i> Shrubland	G4Q	y	y		y
<i>Cornus sericea</i> / <i>Galium triflorum</i> Shrubland	G3				y
<i>Cornus sericea</i> / <i>Heracleum maximum</i> Shrubland	G3				y
<i>Cornus sericea</i> Shrubland	G4Q	y			y
<i>Crataegus douglasii</i> - (<i>Crataegus chrysoarpa</i>) Shrubland	G2Q	y		y	
<i>Crataegus succulenta</i> Shrubland [Placeholder]	G3G4Q	y		y	y
<i>Danthonia unispicata</i> - <i>Poa secunda</i> Herbaceous Vegetation	G3		y		
<i>Deschampsia cespitosa</i> - <i>Aster foliaceus</i> Herbaceous Vegetation	G3Q				y
<i>Deschampsia cespitosa</i> - <i>Carex microptera</i> Herbaceous Vegetation	G2G3				y
<i>Deschampsia cespitosa</i> - <i>Carex</i> spp. Herbaceous Vegetation	G4Q	y			y
<i>Deschampsia cespitosa</i> - <i>Luzula multiflora</i> Herbaceous Vegetation	G3Q				y
<i>Deschampsia cespitosa</i> - <i>Potentilla diversifolia</i> Herbaceous Vegetation	G5	y			y
<i>Deschampsia cespitosa</i> Herbaceous Vegetation	G4	y		y	y
<i>Distichlis spicata</i> Herbaceous Vegetation	G5		y	y	

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Dryas octopetala</i> - <i>Carex rupestris</i> Dwarf-shrub Herbaceous Vegetation	G4	y			y
<i>Dryas octopetala</i> - <i>Polygonum viviparum</i> Dwarf-shrub Herbaceous Vegetation	G3?	y			y
<i>Elaeagnus commutata</i> / <i>Pascopyrum smithii</i> Shrubland	G3?			y	
<i>Eleocharis acicularis</i> Herbaceous Vegetation	G4?				y
<i>Eleocharis palustris</i> Herbaceous Vegetation	G5	y	y	y	y
<i>Eleocharis quinqueflora</i> Herbaceous Vegetation	G4	y			y
<i>Equisetum fluviatile</i> Herbaceous Vegetation	G4	y			y
<i>Festuca brachyphylla</i> - <i>Trisetum spicatum</i> Herbaceous Vegetation	G3?				y
<i>Festuca idahoensis</i> - <i>Carex filifolia</i> Herbaceous Vegetation	G3	y			y
<i>Festuca idahoensis</i> - <i>Carex inops</i> ssp. <i>heliophila</i> Herbaceous Vegetation	G3			y	
<i>Festuca idahoensis</i> - <i>Danthonia intermedia</i> Herbaceous Vegetation	G3?				y
<i>Festuca idahoensis</i> - <i>Deschampsia cespitosa</i> Herbaceous Vegetation	G3G4	y			y
<i>Festuca idahoensis</i> - <i>Elymus trachycaulus</i> Herbaceous Vegetation	G4	y			y
<i>Festuca idahoensis</i> - <i>Eriogonum heracleoides</i> Herbaceous Vegetation	G2				y
<i>Festuca idahoensis</i> - <i>Pascopyrum smithii</i> Herbaceous Vegetation	G4	y		y	y
<i>Festuca idahoensis</i> - <i>Potentilla diversifolia</i> Herbaceous Vegetation	G3	y			
<i>Festuca idahoensis</i> - <i>Pseudoroegneria spicata</i> Herbaceous Vegetation	G4				y
<i>Festuca idahoensis</i> - <i>Stipa richardsonii</i> Herbaceous Vegetation	G3	y			y
<i>Geum rossii</i> - <i>Minuartia obtusiloba</i> Herbaceous Vegetation	G3?	y			y
<i>Geum rossii</i> - <i>Polygonum bistortoides</i> Herbaceous Vegetation	G4G5		y		
<i>Geum rossii</i> - <i>Trifolium</i> spp. Herbaceous Vegetation	G3				y
<i>Glyceria borealis</i> Herbaceous Vegetation	G4	y		y	y

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Grayia spinosa</i> / <i>Oryzopsis hymenoides</i> Shrubland	G4		y		
<i>Hordeum jubatum</i> Herbaceous Vegetation	G4	y		y	
<i>Juncus balticus</i> Herbaceous Vegetation	G5	y	y	y	y
<i>Juncus drummondii</i> - <i>Antennaria lanata</i> Herbaceous Vegetation	G3?	y			y
<i>Juniperus horizontalis</i> / <i>Carex inops</i> ssp. <i>heliophila</i> Dwarf-shrubland	G4			y	
<i>Juniperus horizontalis</i> / <i>Schizachyrium scoparium</i> Dwarf-shrubland	G4			y	
<i>Juniperus osteosperma</i> / <i>Artemisia nova</i> Woodland	G5?		y		
<i>Juniperus osteosperma</i> / <i>Artemisia tridentata</i> Woodland	G5?		y		
<i>Juniperus osteosperma</i> / <i>Cercocarpus ledifolius</i> Woodland	G3?		y		y
<i>Juniperus osteosperma</i> / <i>Pseudoroegneria spicata</i> Woodland	G4		y		y
<i>Juniperus scopulorum</i> / <i>Artemisia nova</i> Woodland	G2?		y		
<i>Juniperus scopulorum</i> / <i>Artemisia tridentata</i> Woodland	G3Q	y			
<i>Juniperus scopulorum</i> / <i>Cercocarpus ledifolius</i> Woodland	G3?	y			
<i>Juniperus scopulorum</i> / <i>Cornus sericea</i> Woodland	G4	y			y
<i>Juniperus scopulorum</i> / <i>Pseudoroegneria spicata</i> Woodland	G4	y		y	y
<i>Krascheninnikovia lanata</i> / <i>Stipa comata</i> Dwarf-shrubland	G3			y	
<i>Leymus cinereus</i> Herbaceous Vegetation	G2G3Q	y			
<i>Lupinus</i> spp. - <i>Poa</i> spp. Herbaceous Vegetation	G1Q				y
<i>Mertensia ciliata</i> Herbaceous Vegetation	G3				y
<i>Nuphar lutea</i> ssp. <i>polysepala</i> Herbaceous Vegetation	G5				y
<i>Pascopyrum smithii</i> - <i>Bouteloua gracilis</i> - <i>Carex filifolia</i> Herbaceous Vegetation	G4			y	
<i>Pascopyrum smithii</i> - <i>Distichlis spicata</i> Herbaceous Vegetation	G4		y	y	

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Pascopyrum smithii</i> - <i>Eleocharis</i> spp. Herbaceous Vegetation	G1			y	
<i>Pascopyrum smithii</i> - <i>Hordeum jubatum</i> Herbaceous Vegetation	G4		y	y	
<i>Pascopyrum smithii</i> - <i>Nassella viridula</i> Herbaceous Vegetation	G3G4	y		y	
<i>Pascopyrum smithii</i> Herbaceous Vegetation	G3G5Q			y	y
<i>Pentaphylloides floribunda</i> / <i>Deschampsia cespitosa</i> Shrubland	G4	y			y
<i>Pentaphylloides floribunda</i> / <i>Festuca idahoensis</i> Shrub Herbaceous Vegetation	G4	y		y	y
<i>Phalaris arundinacea</i> Western Herbaceous Vegetation	G5	y		y	
<i>Phleum alpinum</i> - <i>Carex aquatilis</i> Herbaceous Vegetation	G3?				y
<i>Phleum alpinum</i> - <i>Carex microptera</i> Herbaceous Vegetation	G3?				y
<i>Phleum alpinum</i> - <i>Elymus trachycaulus</i> Herbaceous Vegetation	G3?				y
<i>Phlox pulvinata</i> - <i>Trifolium dasyphyllum</i> Herbaceous Vegetation	G3				y
<i>Phragmites australis</i> Western North America Temperate Semi-natural Herbaceous	G4	y		y	
<i>Picea (engelmannii X glauca, engelmannii)</i> / <i>Carex disperma</i> Forest	G2Q				y
<i>Picea (engelmannii X glauca, engelmannii)</i> / <i>Equisetum arvense</i> Forest	G4				y
<i>Picea (engelmannii X glauca, engelmannii)</i> / <i>Galium triflorum</i> Forest	G4	y			y
<i>Picea (engelmannii X glauca, engelmannii)</i> / <i>Juniperus communis</i> Forest	G2Q				y
<i>Picea (engelmannii X glauca, engelmannii)</i> / <i>Linnaea borealis</i> Forest	G4	y			y
<i>Picea (engelmannii X glauca, engelmannii)</i> / <i>Senecio streptanthifolius</i> Forest	G4	y			y
<i>Picea engelmannii</i> / <i>Arnica cordifolia</i> Forest	G3G4		y		y
<i>Picea engelmannii</i> / <i>Calamagrostis canadensis</i> Forest	G4	y			y
<i>Picea engelmannii</i> / <i>Caltha leptosepala</i> Forest	G3?				y
<i>Picea engelmannii</i> / <i>Carex disperma</i> Forest	G2				y

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Picea engelmannii</i> / <i>Cornus sericea</i> Woodland	G3				y
<i>Picea engelmannii</i> / <i>Equisetum arvense</i> Forest	G4	y			y
<i>Picea engelmannii</i> / <i>Galium triflorum</i> Forest	G4				y
<i>Picea engelmannii</i> / <i>Hypnum revolutum</i> Forest	G2		y		y
<i>Picea engelmannii</i> / <i>Juniperus communis</i> Forest	G3		y		y
<i>Picea engelmannii</i> / <i>Linnaea borealis</i> Forest	G3				y
<i>Picea engelmannii</i> / <i>Maianthemum stellatum</i> Forest	G4?	y			y
<i>Picea engelmannii</i> / <i>Physocarpus malvaceus</i> Forest	G3				y
<i>Picea engelmannii</i> / <i>Vaccinium scoparium</i> Forest	G3G5	y			y
<i>Pinus albicaulis</i> - <i>Abies lasiocarpa</i> Woodland [Placeholder]	G5?				y
<i>Pinus albicaulis</i> / <i>Carex geyeri</i> Woodland	G2G3	y			y
<i>Pinus albicaulis</i> / <i>Carex rossii</i> Forest	G3?				y
<i>Pinus albicaulis</i> / <i>Festuca idahoensis</i> Woodland	G4				y
<i>Pinus albicaulis</i> / <i>Juniperus communis</i> Woodland	G4?				y
<i>Pinus albicaulis</i> / <i>Vaccinium scoparium</i> Forest	G4	y			y
<i>Pinus albicaulis</i> Woodland [Placeholder]	G5?				y
<i>Pinus contorta</i> / <i>Arnica cordifolia</i> Forest	G4?	y			y
<i>Pinus contorta</i> / <i>Calamagrostis canadensis</i> Forest	G5	y			y
<i>Pinus contorta</i> / <i>Calamagrostis rubescens</i> Forest	G5	y			y
<i>Pinus contorta</i> / <i>Carex geyeri</i> Forest	G4?				y
<i>Pinus contorta</i> / <i>Juniperus communis</i> Woodland	G5	y	y		y
<i>Pinus contorta</i> / <i>Linnaea borealis</i> Forest	G5				y

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Pinus contorta</i> / <i>Purshia tridentata</i> Woodland	G3				y
<i>Pinus contorta</i> / <i>Shepherdia canadensis</i> Forest	G3G4				y
<i>Pinus contorta</i> / <i>Spiraea betulifolia</i> Forest	G3G4				y
<i>Pinus contorta</i> / <i>Thalictrum occidentale</i> Forest	G4Q				y
<i>Pinus contorta</i> / <i>Vaccinium cespitosum</i> Forest	G5	y			y
<i>Pinus contorta</i> / <i>Vaccinium membranaceum</i> Rocky Mountain Forest	G3G4	y			y
<i>Pinus contorta</i> / <i>Vaccinium scoparium</i> Forest	G5	y			y
<i>Pinus contorta</i> / <i>Xerophyllum tenax</i> Forest	G5				y
<i>Pinus contorta</i> / <i>Xerophyllum tenax</i> Forest	G5				y
<i>Pinus contorta</i> Scree Woodland	G5?	y			y
<i>Pinus flexilis</i> / <i>Festuca idahoensis</i> Woodland	G5		y		y
<i>Pinus flexilis</i> / <i>Festuca kingii</i> Woodland	G3				y
<i>Pinus flexilis</i> / <i>Juniperus communis</i> Woodland	G5	y	y		y
<i>Pinus flexilis</i> / <i>Juniperus osteosperma</i> Woodland	G3		y		
<i>Pinus flexilis</i> / <i>Pseudoroegneria spicata</i> Woodland	G4?	y			y
<i>Pinus ponderosa</i> / (<i>Andropogon gerardii</i> , <i>Schizachyrium scoparium</i>) Woodland	G2Q			y	
<i>Pinus ponderosa</i> / <i>Carex inops</i> ssp. <i>heliophila</i> Woodland	G3G4			y	
<i>Pinus ponderosa</i> / <i>Cornus sericea</i> Woodland	G3	y		y	
<i>Pinus ponderosa</i> / <i>Crataegus douglasii</i> Woodland	G1			y	

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Pinus ponderosa</i> / <i>Festuca idahoensis</i> Woodland	G4	y		y	
<i>Pinus ponderosa</i> / <i>Juniperus communis</i> Woodland	G4?			y	
<i>Pinus ponderosa</i> / <i>Juniperus horizontalis</i> Woodland	G3?	y		y	
<i>Pinus ponderosa</i> / <i>Juniperus scopulorum</i> Woodland	G4	y		y	
<i>Pinus ponderosa</i> / <i>Mahonia repens</i> Forest	G3Q	y		y	
<i>Pinus ponderosa</i> / <i>Pascopyrum smithii</i> Woodland	G3G4			y	
<i>Pinus ponderosa</i> / <i>Physocarpus monogynus</i> Forest	G3			y	
<i>Pinus ponderosa</i> / <i>Prunus virginiana</i> Forest	G3			y	
<i>Pinus ponderosa</i> / <i>Pseudoroegneria spicata</i> Woodland	G4			y	
<i>Pinus ponderosa</i> / <i>Purshia tridentata</i> Woodland	G3G5	y			
<i>Pinus ponderosa</i> / <i>Schizachyrium scoparium</i> Woodland	G3G4			y	
<i>Pinus ponderosa</i> / <i>Symphoricarpos albus</i> Forest	G4?	y			
<i>Pinus ponderosa</i> / <i>Symphoricarpos occidentalis</i> Forest	G3	y			
<i>Pinus ponderosa</i> Scree Woodland	G4	y			
<i>Poa palustris</i> Herbaceous Vegetation	GW	y		y	y
<i>Polygonum amphibium</i> Permanently Flooded Herbaceous Alliance	G5			y	
<i>Populus angustifolia</i> / <i>Betula occidentalis</i> Woodland	G3				y
<i>Populus angustifolia</i> / <i>Cornus sericea</i> Woodland	G4	y		y	y
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> / <i>Cornus sericea</i> Forest	G3?				y
<i>Populus deltoides</i> / <i>Cornus sericea</i> Forest	G3?	y	y	y	y
<i>Populus deltoides</i> / <i>Pascopyrum smithii</i> Woodland	G3?			y	
<i>Populus deltoides</i> / <i>Symphoricarpos occidentalis</i> Woodland	G2G3			y	
<i>Populus tremuloides</i> - <i>Pinus contorta</i> / <i>Carex geyeri</i> Forest	G3?				y

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Populus tremuloides</i> - <i>Pinus contorta</i> / <i>Symphoricarpos oreophilus</i> Forest	G3G4				y
<i>Populus tremuloides</i> - <i>Pseudotsuga menziesii</i> / <i>Amelanchier alnifolia</i> Forest	G3?				y
<i>Populus tremuloides</i> - <i>Pseudotsuga menziesii</i> / <i>Calamagrostis rubescens</i> Forest	G3?				y
<i>Populus tremuloides</i> - <i>Pseudotsuga menziesii</i> / <i>Symphoricarpos oreophilus</i> Forest	G3G4				y
<i>Populus tremuloides</i> / <i>Amelanchier alnifolia</i> - <i>Symphoricarpos oreophilus</i> / <i>Bromus</i>	G3G5				y
<i>Populus tremuloides</i> / <i>Amelanchier alnifolia</i> - <i>Symphoricarpos oreophilus</i> / <i>Calamagrostis</i>	G4				y
<i>Populus tremuloides</i> / <i>Amelanchier alnifolia</i> - <i>Symphoricarpos oreophilus</i> / Tall Forbs	G5				y
<i>Populus tremuloides</i> / <i>Amelanchier alnifolia</i> - <i>Symphoricarpos oreophilus</i> / <i>Thalictrum</i>	G5				y
<i>Populus tremuloides</i> / <i>Amelanchier alnifolia</i> / Tall Forbs Forest	G3G5				y
<i>Populus tremuloides</i> / <i>Amelanchier alnifolia</i> / <i>Thalictrum fendleri</i> Forest	G3G4				y
<i>Populus tremuloides</i> / <i>Calamagrostis canadensis</i> Forest	G3	y			y
<i>Populus tremuloides</i> / <i>Calamagrostis rubescens</i> Forest	G5?	y			y
<i>Populus tremuloides</i> / <i>Carex geyeri</i> Forest	G4				y
<i>Populus tremuloides</i> / <i>Cornus sericea</i> Forest	G4	y			
<i>Populus tremuloides</i> / <i>Equisetum arvense</i> Forest	G4				y
<i>Populus tremuloides</i> / <i>Heracleum sphondylium</i> Forest	G4Q	y			
<i>Populus tremuloides</i> / <i>Mahonia repens</i> Forest	G3			y	
<i>Populus tremuloides</i> / <i>Poa pratensis</i> Forest	S?	y			
<i>Populus tremuloides</i> / <i>Prunus virginiana</i> Forest	G3?Q				y
<i>Populus tremuloides</i> / <i>Salix scouleriana</i> Forest	G4				y
<i>Populus tremuloides</i> / <i>Shepherdia canadensis</i> Forest	G3G4				y
<i>Populus tremuloides</i> / <i>Symphoricarpos albus</i> Forest	G3?				y

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Populus tremuloides</i> / <i>Symphoricarpos oreophilus</i> / <i>Calamagrostis rubescens</i> Forest	G3G5				y
<i>Populus tremuloides</i> / <i>Symphoricarpos oreophilus</i> / Tall Forbs Forest	G3G5				y
<i>Populus tremuloides</i> / <i>Symphoricarpos oreophilus</i> / <i>Thalictrum fendleri</i> Forest	G5				y
<i>Populus tremuloides</i> / <i>Symphoricarpos oreophilus</i> Forest	G5				y
<i>Populus tremuloides</i> / Tall Forbs Forest	G5	y		y	y
<i>Populus tremuloides</i> / <i>Thalictrum fendleri</i> Forest	G5				y
<i>Populus tremuloides</i> / <i>Wyethia amplexicaulis</i> Forest	G3				y
<i>Prunus virginiana</i> - (<i>Prunus americana</i>) Shrubland	G4Q	y	y	y	
<i>Pseudoroegneria spicata</i> - <i>Bouteloua curtipendula</i> Herbaceous Vegetation	G3			y	
<i>Pseudoroegneria spicata</i> - <i>Bouteloua gracilis</i> Herbaceous Vegetation	G4	y			
<i>Pseudoroegneria spicata</i> - <i>Carex filifolia</i> Herbaceous Vegetation	G4		y	y	
<i>Pseudoroegneria spicata</i> - Cushion Plant Herbaceous Vegetation	G3?	y	y		y
<i>Pseudoroegneria spicata</i> - <i>Eriogonum brevicaulis</i> Sparse Vegetation	G3?		y		
<i>Pseudoroegneria spicata</i> - <i>Pascopyrum smithii</i> Herbaceous Vegetation	G4	y	y	y	y
<i>Pseudoroegneria spicata</i> - <i>Poa secunda</i> Herbaceous Vegetation	G4?	y	y	y	y
<i>Pseudoroegneria spicata</i> - <i>Stipa comata</i> Herbaceous Vegetation	G4	y		y	
<i>Pseudotsuga menziesii</i> - <i>Pinus flexilis</i> / <i>Festuca kingii</i> Woodland	G4Q				y
<i>Pseudotsuga menziesii</i> / <i>Acer glabrum</i> Forest	G4?				y
<i>Pseudotsuga menziesii</i> / <i>Arctostaphylos uva-ursi</i> Forest	G4	y			y
<i>Pseudotsuga menziesii</i> / <i>Arnica cordifolia</i> Forest	G4	y			y
<i>Pseudotsuga menziesii</i> / <i>Calamagrostis rubescens</i> Forest	G5	y			y
<i>Pseudotsuga menziesii</i> / <i>Carex geyeri</i> Forest	G4?	y			y

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Pseudotsuga menziesii</i> / <i>Festuca idahoensis</i> Woodland	G4				y
<i>Pseudotsuga menziesii</i> / <i>Festuca kingii</i> Woodland	G3G4				y
<i>Pseudotsuga menziesii</i> / <i>Juniperus communis</i> Forest	G4				y
<i>Pseudotsuga menziesii</i> / <i>Juniperus osteosperma</i> Forest	G2?		y		
<i>Pseudotsuga menziesii</i> / <i>Juniperus scopulorum</i> Woodland	G3	y	y		
<i>Pseudotsuga menziesii</i> / <i>Linnaea borealis</i> Forest	G4	y			y
<i>Pseudotsuga menziesii</i> / <i>Mahonia repens</i> Forest	G5	y			
<i>Pseudotsuga menziesii</i> / <i>Osmorhiza berteroi</i> Forest	G4G5				y
<i>Pseudotsuga menziesii</i> / <i>Physocarpus malvaceus</i> Forest	G5	y			y
<i>Pseudotsuga menziesii</i> / <i>Physocarpus monogynus</i> Forest	G4				y
<i>Pseudotsuga menziesii</i> / <i>Pseudoroegneria spicata</i> Woodland	G4	y			y
<i>Pseudotsuga menziesii</i> / <i>Spiraea betulifolia</i> Forest	G5	y			y
<i>Pseudotsuga menziesii</i> / <i>Symphoricarpos albus</i> Forest	G5				y
<i>Pseudotsuga menziesii</i> / <i>Symphoricarpos oreophilus</i> Forest	G5				y
<i>Pseudotsuga menziesii</i> / <i>Vaccinium cespitosum</i> Forest	G5	y			
<i>Pseudotsuga menziesii</i> / <i>Vaccinium membranaceum</i> Forest	G5?	y			y
<i>Pseudotsuga menziesii</i> Scree Woodland	G5	y			
<i>Purshia tridentata</i> / <i>Pseudoroegneria spicata</i> Shrub Herbaceous Vegetation	G3	y			
<i>Rhus trilobata</i> / <i>Carex filifolia</i> Shrub Herbaceous Vegetation	G3			y	
<i>Rhus trilobata</i> / <i>Festuca idahoensis</i> Shrub Herbaceous Vegetation	G2?			y	
<i>Rhus trilobata</i> / <i>Pseudoroegneria spicata</i> Shrub Herbaceous Vegetation	G4	y	y	y	
<i>Rhus trilobata</i> / <i>Schizachyrium scoparium</i> Shrub Herbaceous Vegetation	G3			y	

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Ribes lacustre</i> / <i>Mertensia ciliata</i> Shrubland	G2		y		
<i>Rosa woodsii</i> Shrubland	G5	y	y	y	y
<i>Salicornia rubra</i> Herbaceous Vegetation	G2G3			y	
<i>Salix</i> (<i>boothii</i> , <i>geyeriana</i>) / <i>Carex aquatilis</i> Shrubland	G3				y
<i>Salix</i> (<i>farriarum</i> , <i>planifolia</i>) / <i>Carex utriculata</i> Shrubland	G3				y
<i>Salix amygdaloides</i> Woodland	G3	y		y	
<i>Salix arctica</i> / <i>Polygonum bistortoides</i> Dwarf-shrubland	G2G3Q	y			y
<i>Salix bebbiana</i> Shrubland	G3?	y		y	
<i>Salix boothii</i> / <i>Calamagrostis canadensis</i> Shrubland	G3G4Q				y
<i>Salix boothii</i> / <i>Carex utriculata</i> Shrubland	G4	y			y
<i>Salix boothii</i> / <i>Equisetum arvense</i> Shrubland	G3				y
<i>Salix boothii</i> / <i>Maianthemum stellatum</i> Shrubland	G3Q				y
<i>Salix boothii</i> / Mesic Graminoids Shrubland	G3?	y			
<i>Salix brachycarpa</i> / Mesic Forbs Shrubland	G4				y
<i>Salix candida</i> / <i>Carex rostrata</i> Shrubland	G3	y			y
<i>Salix drummondiana</i> Shrubland [Placeholder]	G3Q				y
<i>Salix exigua</i> / <i>Equisetum arvense</i> Shrubland	G3				y
<i>Salix exigua</i> / Mesic Forbs Shrubland	G2?				y
<i>Salix exigua</i> Temporarily Flooded Shrubland	G5	y	y	y	y
<i>Salix geeyeriana</i> / <i>Calamagrostis canadensis</i> Shrubland	G5				y
<i>Salix geeyeriana</i> / <i>Carex utriculata</i> Shrubland	G5				y
<i>Salix geeyeriana</i> / Mesic Forbs Shrubland	G3				y

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Salix geyeriana</i> / Mesic Graminoids Shrubland	G2G3Q				y
<i>Salix geyeriana</i> / <i>Poa palustris</i> Shrubland	GW				y
<i>Salix glauca</i> Shrubland	G3?				y
<i>Salix lutea</i> / <i>Calamagrostis canadensis</i> Shrubland	G3?	y			y
<i>Salix lutea</i> / <i>Carex utriculata</i> Shrubland	G4	y			y
<i>Salix planifolia</i> / <i>Caltha leptosepala</i> Shrubland	G4				y
<i>Salix planifolia</i> / <i>Carex aquatilis</i> Shrubland	G5	y			y
<i>Salix planifolia</i> Shrubland	G4				y
<i>Salix reticulata</i> / <i>Caltha leptosepala</i> Dwarf-shrubland	G3				y
<i>Salix wolfii</i> / <i>Carex aquatilis</i> Shrubland	G4	y			y
<i>Salix wolfii</i> / <i>Deschampsia cespitosa</i> Shrubland	G3	y			
<i>Salix wolfii</i> / <i>Fragaria virginiana</i> Shrubland	G4?				y
<i>Salix wolfii</i> / Mesic Forbs Shrubland	G3				y
<i>Sarcobatus vermiculatus</i> / <i>Artemisia tridentata</i> Shrubland	G4		y	y	
<i>Sarcobatus vermiculatus</i> / <i>Atriplex gardneri</i> Shrubland	G4?		y		
<i>Sarcobatus vermiculatus</i> / <i>Leymus cinereus</i> Shrubland	G3			y	
<i>Sarcobatus vermiculatus</i> / <i>Pascopyrum smithii</i> - (<i>Elymus lanceolatus</i>) Shrub	G4	y	y	y	
<i>Sarcobatus vermiculatus</i> / <i>Pseudoroegneria spicata</i> Shrubland	G3		y	y	
<i>Sarcobatus vermiculatus</i> / <i>Sporobolus airoides</i> Sparse Vegetation	G3?			y	
<i>Schizachyrium scoparium</i> - <i>Bouteloua (curtipendula, gracilis)</i> - <i>Carex filifolia</i>	G3G4			y	
<i>Schizachyrium scoparium</i> - <i>Carex inops</i> ssp. <i>heliophila</i> Herbaceous Vegetation	G3			y	
<i>Schizachyrium scoparium</i> - <i>Muhlenbergia cuspidata</i> Herbaceous Vegetation	G3?	y		y	

PLANT ASSOCIATION NAME	GLOBAL RANK	Belt Mts (332D)	Bighorn Basin (331B)	Powder River Basin (331G)	Yellowstone Highlands (331A)
<i>Scirpus acutus</i> Herbaceous Vegetation	G5	y	y	y	y
<i>Scirpus maritimus</i> Herbaceous Vegetation	G4	y		y	
<i>Scirpus pungens</i> Herbaceous Vegetation	G3G4	y		y	
<i>Scirpus tabernaemontani</i> Temperate Herbaceous Vegetation	G5	y		y	
<i>Senecio triangularis</i> - <i>Mimulus guttatus</i> Herbaceous Vegetation	G3?				y
<i>Senecio triangularis</i> Herbaceous Vegetation	G5?	y			y
<i>Shepherdia argentea</i> Shrubland	G3G4			y	
<i>Silene acaulis</i> Herbaceous Vegetation	G5?	y			y
<i>Spartina pectinata</i> - <i>Carex</i> spp. Herbaceous Vegetation	G3?			y	
<i>Spartina pectinata</i> - <i>Scirpus pungens</i> Herbaceous Vegetation	G3Q			y	
<i>Spartina pectinata</i> Western Herbaceous Vegetation	G3?			y	
<i>Sporobolus cryptandrus</i> Shrub Herbaceous Vegetation	G2			y	
<i>Stipa comata</i> - <i>Bouteloua gracilis</i> - <i>Carex filifolia</i> Herbaceous Vegetation	G5			y	
<i>Stipa comata</i> - <i>Carex filifolia</i> Herbaceous Vegetation	G4			y	
<i>Stipa comata</i> - <i>Carex inops</i> ssp. <i>heliophila</i> Herbaceous Vegetation	G4			y	
<i>Symphoricarpos occidentalis</i> Shrubland	G4G5	y	y	y	
<i>Typha latifolia</i> Western Herbaceous Vegetation	G5	y		y	
<i>Yucca glauca</i> / <i>Calamovilfa longifolia</i> Shrub Herbaceous Vegetation	G4			y	

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Site Descriptions

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Bald Ridge

Directions

Northeast Absaroka Mountains, Bald Ridge, on east side of Clark's Fork Canyon, 5-6 air miles northeast of Dead Indian Pass, about 23.3 air miles northwest of Cody. From Cody, proceed north on Wyoming state highway 120 about 16 miles to state highway 296 (Chief Joseph Scenic Highway). Travel west on highway 296 about 11.2 miles to Forest Service Road 100. Proceed north on road 100 for about 6 miles. This road is an unimproved dirt two-track.

Description

Bald Ridge is located on the far eastern flank of the Absaroka Range in an area noteworthy for its remnant surfaces of calcareous bedrock (most of the other areas of the Absarokas were buried in volcanic deposits nearly 50 million years ago). The crest of Bald Ridge divides the site into distinctive vegetative regions. Open woodlands of limber pine with patches of bluebunch wheatgrass and Idaho fescue grasslands cover most of the area east of the divide. Thick forests of Engelmann spruce and Douglas-fir dominate the west side. The crest of the ridge itself is dominated by a rich variety of regionally endemic cushion plant species. Bald Ridge apparently burned in a fire in 1996, but a visit by Walt Fertig and Laura Welp in 1999 confirmed their continued presence there.

Key Environmental Factors

Substrate.

Climate

Based on state-wide maps provided by Martner (1986), the mean annual temperature of the Bald Ridge area is 30-40 degrees F. Winters are cold, with January mean daily low temperature of 6-8 degrees F and a mean daily high temperature of 32-34 degrees F. Summer high temperatures are also relatively low, with a July mean daily low temperature of 48-50 degrees and a mean daily high of 82-84 degrees. The region has 200-225 days annually with a minimum temperature under 32 degrees F. The frost-free period averages 75-100 days. Mean annual precipitation is 12-14 inches and mean annual snowfall is 40-60 inches.

Rarity

The site contains high-quality habitat for 3 plants designated Sensitive on US Forest Service Region 2: an A-ranked EO for *Shoshonea pulvinata* (G2G3) and B-ranked EOs for *Pyrrocoma carthamoides* var. *subsquarrosa* (T2T3) and *Festuca hallii* (G3G4/S1). Six other rare plants tracked by WYNND are also present at this site. *Androsace chamaejasme* ssp. *carinata* is a peripheral species, *Antennaria aromatica* is a disjunct

species, and *Eritrichium howardii* and *Castilleja cristagalli* are regional endemics. In addition, 4 plant species no longer tracked by WYNDD but still of interest (*Aquilegia jonesii*, *Castilleja nivea*, *Helictotrichon hookeri*, and *Kelseya uniflora*) and four community types represented at the site: *Elymus spicatus*-*Poa secunda* (blue-bunch wheatgrass-sandberg bluegrass); *Picea engelmannii* / *Hypnum revolutum* (Engelmann spruce / moss); *Pinus flexilis* / *Juniperus communis* (limber pine / common juniper); and *Pseudotsuga menziesii* / *Juniperus communis* (Douglas fir / common juniper).

Other Values

Very scenic; great views of Clark's Fork, Beartooth Plateau, northern Absarokas.

Information Needs

Monitoring information on rare plant and animal species of interest. Much of Bald Ridge burned in a fire in 1996, and re-survey is recommended to determine the current status of many elements. A visit in July 1999 showed little remaining evidence of fire in the lower grassland communities.

Basin Lakes

Directions

Basin Lakes is located in the Beartooth Mountains of south central Montana. From Red Lodge; travel 7.5 miles on Forest Service Route 71 to Forest Service Trail 35. Follow Forest Service Trail 35 southerly for about 2 miles to Basin Lakes.

Description

This collection of wetlands occurs in a lower subalpine basin in the Beartooth Mountains. These wetlands consist of small glacial depressions on and adjacent to several small creeks. Some of these depressions are supplied primarily with surface water from the creeks, while groundwater is the primary water source for the others. These depressions are small, ranging in size from 2 to 11 acres. The uplands are forests dominated by *Pinus contorta* (lodgepole pine) and *Pinus albicaulis* (whitebark pine) in the upper canopy and *Vaccinium scoparium* (grouse whortleberry) in the undergrowth. The wetter portions of the depressions in this complex are generally dominated by *Carex aquatilis* (water sedge), although in one instance *Nuphar lutea* (yellow pond-lily) dominates open water in the center of the wetland. Fens have developed in some of the small, shallow depressions. They are dominated by a *Salix planifolia* / *Carex aquatilis* (planeleaf willow / water sedge) community; most of the examples of this community have dense *Sphagnum* (mosses characteristic of poor fens and bogs) cover as well. In one instance,

Sphagnum appears to be invading small *Pinus contorta*-dominated islands within the fen. One depression is dominated by a *Carex limosa* (mud sedge) floating mat surrounded by a fringe of *Carex utriculata* (beaked sedge). A small stand of *Salix geyeriana* / *Carex utriculata* (Geyer's willow / beaked sedge) occurs along one of the streams.

Key Environmental Factors

Groundwater generated by meltwater from surrounding basin slopes is responsible for maintaining these wetlands.

Rarity

No rare plants or animals were observed. This site supports many high quality occurrences of common plant communities and one G3 plant association, *Carex limosa* (mud sedge) herbaceous vegetation.

Land Use

No human impacts were discovered within the wetlands in the course of inventory.

Exotics

No exotic species were found.

Uplands

This basin has experienced past mining activity; associated structures (cabins) and evidence of activities (timbering) remain.

Information Needs

None have been noted.

Management Needs

None have been noted.

Beartooth Front-Aspen Parkland

Directions

This site is located west of Red Lodge Montana along the foothills of the Beartooth Plateau in Carbon County. From Red Lodge, take Highway 78 north; turn west on the Luther road and travel 7/10 of a mile. Land owner permission to access state lands is required at this point. Turn left (south) on the western most-least improved road and travel 2-3 miles to the state section. Park and walk south.

Description

The Beartooth Front Aspen Parklands site spans the north slope foothills at the base of the Beartooth Plateau. The massive Beartooth uplift elevated Paleozoic sedimentary rocks above the precambrian igneous and metamorphic basement rocks over 50 million years ago.

Most of the uplifted sedimentary rock has been removed by erosion, but the greatly tilted sedimentary outcrops still form a broken ring around the northern and eastern perimeters of the Beartooth Mountains. The site is centered on the strongly tilted landform at Palisades and Sheep Mountain. The front is dissected by permanent and intermittent streams, nearly parallel south to north, separated by glacial and pre-glacial slopes, ridges and benchlands. Soils are derived from granitics but have significant limestone to encourage *Pinus flexilis* grasslands in places. Otherwise the vegetation is a mosaic of grass and shrublands with both coniferous and deciduous forests. *Pinus ponderosa*, *Pinus contorta*, *Pseudotsuga menziesii*, *Abies lasiocarpa* and *Picea engelmannii* occur on forested slopes. There are many, widely-scattered *Populus tremuloides* (aspen) stands positioned on gently sloping benches, toeslopes, hillslopes and riparian habitats. Forest ridgelines are interrupted by small to large open park-like meadows of *Festuca idahoensis* - *Stipa richardsonii*, these having lesser amounts of *Danthonia intermedia* and *Stipa viridula*. *Pseudoroegneria spicata* grasslands also occur in the shrub steppe with *Artemisia tridentata* ssp. *vaseyana*. Large grasslands occur along the lower hillslopes. Wet riparian areas are a matrix of *Salix bebbiana* shrublands, *Populus tremuloides* forests and *Carex* dominated wet communities.

Key Environmental Factors

The toe slope position of this site, northern aspect, and fractured sedimentary bedrock provide sheltered habitat for aspen. Springs are fed from ground water sources. Fire helps maintain the herbaceous grassland community ecotone, reduce fuels in forested areas and helps cleanse and restore aspen communities.

The site spans several hundred feet in elevation. This sharp topographic relief, and variety of substrates and moisture conditions fosters high habitat diversity, and brings subalpine communities in proximity to foothills vegetation.

Rarity

The extensive aspen parkland communities contribute to the diverse composition and structure of the vegetation. Aspen is the only upland deciduous forest cover in this site; the understory shrub layers are dominated by *Physocarpus malvaceus* or *Symphoricarpos albus*. The latter association is floristically rich. This diversity increases the number of insects, thus an increase in insectivorous birds such as fly catchers. Collectively these aspen stands contribute to wildlife habitat diversity and floristic diversity of the study area. Aspen are subject to disease and the rotted interior of aspen trees provide habitat for cavity nesters such as red-naped sapsuckers and hairy woodpeckers. Aspen shoots and

herbaceous forb understories provide nutritious forage for moose and elk; fescue and blue bunchgrass communities provide summer and winter forage for many species.

Other Values

Sheep Mountain is an important mule deer winter range and breeding habitat for both ruffed and sharptail grouse. The Palisades limestone escarpments are local landmarks, and in turn offer scenic overviews from the abrupt rim of the Beartooth Front.

Land Use

A large part of this site is state school sections; each of which is leased for grazing cattle. Cattle grazing occurs throughout with subsequent fencing and salting sites and probably some water developments. The forests are actively managed and the area is dissected with unmaintained roads. Many forest stands have been clear-cut and others are undergoing logging operations. An active landing was situated in a fescue meadow adjacent to a forest stand. A power utility line crosses the site.

The north side of the Palisades is bordered by the access road to the Red Lodge ski resort. There are no other adjoining public roads, or trails into the area except at the Palisades Campground at the eastern end. An aspen restoration plot is present on national forest in which aspen cover was regenerated within a forest cover of *Pinus contorta*.

Exotics

Several noxious weeds are reported from the state school land sections (*Cirsium arvense*, *Centaurea ssp.* and *Euphorbia esula*). Two introduced grasses, *Phleum pratense* and *Poa pratensis* are present and abundant in meadow and aspen communities. Annual bromes, *Bromus tectorum* (cheatgrass) probably also occurs.

Uplands

To the north, this site borders private ranches; most of the private adjacent natural grasslands have been converted (pasteurized and fortified) with introduced forage grasses and legumes.

There are private tracts and inholdings on all sides, and part of Sheep Mountain is privately owned; new buildings have been constructed at midslope and crest positions near the perimeter of state land.

Information Needs

Further documentation of aspen stand composition and condition is warranted, in concert with botany work and surveys for terrestrial mollusks. The aspen stands on glacial outwash flats may be particularly significant. We surveyed the foothills for regional endemic species

(*Shoshonea pulvinata* and *Haplopappus carthamoides ssp. subsquarrosus*) without success. There has been no survey of the localized spring and seep habitats for other Montana plant species of special concern known from the Beartooth Mountains such as *Adoxa moschatellina* and *Cypripedium parviflorum*, nor did we survey the upper elevation reaches for high elevation rare plants.

Management Needs

Noxious weed control and best management practices would improve the condition of this site.

Beartooth High-Elevation Plateaus

Directions

The Beartooth High-elevation Plateaus site is located at the crest of the Beartooth Mountains approximately 7.5 miles southwest of Red Lodge, MT and spans the Montana-Wyoming border. The site is accessed via Highway 212, which intersects the site 8.5 miles south of Red Lodge, in the vicinity of the confluence of Rock Creek with Lake Fork of Rock Creek. The site is also 6.5 miles east of Cooke City, accessed from Highway 212.

Description

This site is comprised of the alpine portions of the Beartooth, Froze-to-Death, Silver Run, Hellroaring, and Line Creek Plateaus. Line Creek Plateau is a gently rolling alpine tundra landscape with extensive areas of moist snowbed vegetation. The plateau contains hundreds of glacial lakes and potholes although wetland features are rare. Major species of the alpine plateau include *Festuca idahoensis* (Idaho fescue), *Carex scirpoidea* (single-spike sedge), *Carex elynoides* (kobresia-like sedge), *Deschampsia cespitosa* (tufted hairgrass), *Salix glauca* (glaucous willow), and *Geum rossii* (Ross' avens). Side slopes on the north and east sides of the plateau fall off steeply and are timbered by subalpine and montane coniferous forest within the *Pinus albicaulis* (whitebark pine), *Abies lasiocarpa* (subalpine fir), and *Pseudotsuga menziesii* (Douglas-fir) series of habitat types. Elevations range from 9020 ft. (2750 m) to 12611 ft. (3845 m). In Montana the substrate is derived from metamorphic (gneiss) rock. The vegetation on the Line Creek Plateau is more similar to the high ranges of Wyoming, Utah, and Colorado than any other mountain range in Montana. Average minimum temperatures in Cooke City range from 2.5 deg. F. to 38 deg. F.

Key Environmental Factors

High elevation, permanently frozen subsoil, substrate consisting of exposed basement rock (gneisses) and geographic isolation are factors contributing to the uniqueness of this area. The Line Creek Plateau is the eastern most and warmest alpine plateau in the range. As the prevailing winds are from the west, Line Creek

Plateau is leeward of the main portion of the Beartooth Range, and may be drier with a longer snow-free period than other plateaus in the Beartooths. Average annual precipitation at Cooke City is 26.2 inches, while average annual snowfall is 207 inches. Areas on the Beartooth Plateau may receive as much as 80 inches of annual precipitation. Growing season temperatures measured on the west edge of the Plateau in 1958 and 1959 averaged 47 degrees F (15 degrees C), with a high of 68 degrees F (20 degrees C), and a low of 24 degrees F (-4 degrees C).

Rarity

This site is an arctic refugia for several disjunct plants: *Draba porsildii* (porsild's draba), *Koenigia islandica* (island koenigia), *Salix barrattiana* (Barratt's willow), *Eriophorum callitrix* (sheathed cotton-grass), *Koebresia macrocarpa* (large-fruited kobresia) and *Phippsia algida* (ice grass) are arctic disjuncts known from this site. This site is valuable as important habitat for genetically pure *Oncorhynchus clarki bouvieri* (Yellowstone cutthroat trout), *Ursus arctos horribilis* (grizzly bear) and *Lynx canadensis* (Canada lynx). There is at least one endemic beetle and potentially many more undescribed insect species.

Other Values

This site has substantial year-round recreational and tourism values.

Exotics

Exotic salmonid fish species have been widely stocked in the numerous lakes and streams.

Information Needs

Additional surveys for animals, plants and plant communities of special concern are needed. Surveys are needed particularly in areas away from roads and trails to better define the occurrences and distributions of these elements.

Beartooth Kettle Lakes

Directions

The Beartooth Kettle Lakes lie high on the Beartooth Plateau of the Northern Absarokas in northwestern Wyoming, just east of Yellowstone National Park. The area is easily reached in summer via Highway 212 from the Clark's Fork Valley, over Beartooth Pass, and north to Red Lodge, MT.

Description

The Beartooth Kettle Lakes lie high on the Beartooth Plateau where exposed Precambrian granite has been eroded by glaciers and exposure. This unique area is the largest wetland complex at this altitude in this region of the Rocky Mountains. Each lake is ringed by vegetation,

with exposed granite and sometimes metamorphic rocks surrounding the lakes as the basic matrix. Subalpine forest and alpine meadows occur where there is available soil. The site focuses on the uniqueness of the kettle lakes and the associated flora and expected fauna.

Key Environmental Factors

Altitude, wetlands and related water quality, geology.

Climate

A continental, mountain climate prevails - cold winters with a goodly amount of snow, and warm summers with afternoon rainfall.

Rarity

Rank is based on the number of G5 species and the lack of ratings for most element occurrences.

Beaver Lodge

Directions

Beaver Lodge is located in the foothills and high plains of south central Montana. From Red Lodge, travel north on U.S. Highway 212 for approximately 5.5 miles. Turn east on a dirt road that is signed for Rock Creek fishing access. Follow this road for approximately 0.5 mile. After crossing Rock Creek, turn right at a T-intersection and travel south for approximately 1 mile. The access to Beaver Lodge Fishing Access is signed.

Description

Beaver Lodge is located in the floodplain of Rock Creek. In this reach, Rock Creek is braided with two or three primary channels. The site is composed primarily of mature cottonwood forest, with *Populus balsamifera sap. trichocarpa* / *Symphoricarpos occidentalis* (black cottonwood / western snowberry) occupying most of the floodplain at this site. This community has an open canopy of *Populus balsamifera sap. trichocarpa* with scattered *Picea engelmannii* (Engelmann spruce) saplings and an herbaceous layer dominated by the exotics *Poa pratensis* (Kentucky bluegrass) and *Bromus inermis* (smooth brome). *Symphoricarpos occidentalis* is widespread, but other shrubs, such as *Prunus virginiana* (chokecherry), *Betula occidentalis* (water birch), and *Rosa acicularis* (prickly rose), are poorly represented and confined to mesic swales. A *Populus balsamifera sap. trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) community occurs on a large island between channel braids. Although heavily browsed, the shrub layer is well developed and dominated by tall *Prunus virginiana*. *Poa pratensis* dominates the herbaceous layer.

This site also has mesic seeps and swales that intercept groundwater and support an *Alnus incana* / *Equisetum*

arvensis (mountain alder / field horsetail) community. Very small backwater sloughs along the active channels collect fine sediments and support small stands of *Typha latifolia* (broadleaf cattail), *Calamagrostis canadensis* (bluejoint reedgrass), and the exotic *Phalaris arundinacea* (reed canarygrass). Point and side gravel-cobble bars are common and are being colonized by herbaceous species, including many exotics.

Key Environmental Factors

Fluvial processes, such as seasonal flooding and high groundwater, and the associated channel migration and microtopography are the primary influences on vegetation structure and composition at this site. Browsing by wild ungulates (perhaps elk and moose) has altered the structure of the shrub layer in some cottonwood stands by suppressing and reducing the cover of palatable species, such as *Cornus sericea* (red-osier dogwood).

Rarity

No special status plant or animal species were observed. Two G3 communities in fair condition were documented: *Populus balsamifera* ssp. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) and *Alnus incana* / *Equisetum arvense* (mountain alder / field horsetail).

Other Values

Although there are several diversion ditches upstream of and within this reach, this section of Rock Creek appears to support important hydrologic functions, such as dynamic water storage and surface water - groundwater interactions. The floodplain is still accessed by surface and subsurface flooding regimes, and native vegetation appears to be highly connected and to occupy much of the floodplain.

Land Use

Beaver Lodge is a state fishing access site, and informal recreational trails occur throughout the site. There is also a small camping area.

Exotics

Weeds are abundant around the camping area and along trails. These include *Centaurea maculosa* (spotted knapweed), *Euphorbia esula* (leafy spurge), *Cynoglossum officinale* (hound's tongue), *Taraxacum officinale* (common dandelion), *Poa pratensis* (Kentucky bluegrass), *Leucanthemum vulgare* (ox-eye daisy), *Dactylis glomerata* (orchard grass), and *Phleum pratense* (common timothy).

Uplands

Native vegetation occupies the floodplain of Rock Creek along the active channels immediately up and downstream of the site. Land use adjacent to this riparian

corridor is predominately pasture and housing development.

Information Needs

What was the land use at this site before its acquisition by the Department of Fish, Wildlife & Parks?

Management Needs

Although this site would benefit from noxious weed management, the influx of river-borne weed propagules from the upstream watershed will make weed control efforts even more challenging.

Big Beaver

Directions

Big Beaver is located in the Beartooth Mountains of south central Montana. From McLeod proceed 16 miles south on State Route 298 to Forest Service Trail 117. Big Beaver is located 0.5 miles south on State Route 298.

Description

This wetland/riparian area, located in the active floodplain of the Boulder River, is a complex array of aquatic, emergent, shrub, and riparian communities. Some of the shrub and emergent communities lack well-defined boundaries and appear to intergrade depending mainly on the depth to the water table. The water source is primarily surface and groundwater from the Boulder River. *Castor canadensis* (beaver) activity has resulted in a series of dams that have ponded water in an old river slough adjacent to the main channel. The flooded beaver ponds have aquatic communities that support a variety of species such as *Potamogeton foliosus* (close-leaved pondweed), *Callitriche heterophylla* (different-leaved water starwort), *Ranunculus aquatilis* (water buttercup), *Hippuris vulgaris* (common mare's tail), *Sparganium* sp. (bur-reed), and *Nitella* sp. (an algal species). A small *Typha latifolia* (broadleaf cattail) community occurs at one end of the beaver pond, and *Carex utriculata* (beaked sedge) occurs along some of the slough margins. An exotic community of *Poa palustris* (fowl bluegrass) occurs on some sparsely vegetated silt deposits next to the beaver ponds.

The remaining portion of the site occurs on drier terrace deposits. A *Salix exigua* (sandbar willow) community occurs on a low terrace next to the river. This community has a diverse understory of forbs and graminoids, and later-successional willow species are beginning to dominate the overstory. An *Alnus incana* (mountain alder) community occurs at other low spots on the interior part of this terrace. Dominance in this community shifts at times from *Alnus incana* to *Salix exigua* or *Salix boothii* (Booth's willow). There is a small patch of *Populus balsamifera* ssp. *trichocarpa* / *Cornus sericea*

(black cottonwood / red osier dogwood) on the terrace as well. Most of this stand is fairly young and poorly developed. The dominant forested community, however, is a climax riparian community, *Picea engelmannii* / *Cornus sericea* (Engelmann spruce / red osier dogwood). There is some spruce blowdown in this community and the red-osier dogwood undergrowth is heavily browsed by ungulates (wild and/or domesticated).

Key Environmental Factors

The primary factors structuring this site's plant communities are beaver activity (primarily harvesting), high water tables, and seasonal flooding.

Rarity

No rare plants or animals were observed. Two high quality G3 plant associations were documented: *Populus balsamifera sap. trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) and *Picea engelmannii* / *Cornus sericea* (Engelmann spruce / red-osier dogwood).

Land Use

The presence of pasture grasses, weedy species, and severe browsing of *Cornus sericea* (red-osier dogwood) all point to past (and ongoing?) disturbance (grazing, browsing).

Exotics

Pasture grasses, such as *Phleum pratense* (common timothy), *Poa palustris* (fowl bluegrass), and *Poa pratensis* (Kentucky bluegrass), and other exotic increaser species, including *Trifolium pratense* (red clover), *Medicago lupulina* (black medic), and *Taraxacum officinale* (common dandelion), occur on dry to mesic terraces. More mesic to hydric conditions favor *Phalaris arundinacea* (reed canarygrass), *Leucanthemum vulgare* (oxeye-daisy), *Tanacetum vulgare* (common tansy), and *Cirsium vulgare* (bull thistle).

Uplands

A road exists along the eastern edge of the wetland, but it probably is no more confining of the channel than the talus slope that also borders this section of the wetland. Upstream, grazing and construction of homesites is occurring within the riparian corridor.

Information Needs

Is this a management allotment or is the heavy browsing on *Cornus sericea* (red-osier dogwood) all attributable to wild ungulates?

Management Needs

A weed management plan is needed to keep out *Euphorbia esula* (leafy spurge). This is a very aggressive

noxious weed and was noted along the trail to Green Mountain in the vicinity of Natural Bridge. *Phalaris arundinacea* (reed canarygrass) is also very aggressive and should be controlled.

Big Lake

Directions

Big Lake is north of the Yellowstone River in south central Montana. From Molt, 22 miles west of Billings on State Route 302, travel 10 miles northwesterly to Wheat Basin Road. Proceed approximately 1 mile southeasterly on Wheat Basin Road to Big Lake.

Description

This site is composed of a large, shallow lake basin. Big Lake has no outlet, and is the recipient of water from several intermittent creeks. During wet climatic periods (e.g., several years with above average precipitation), it fills with water. However, during drier periods, it dries up and leaves expansive, unvegetated, alkaline mud flats. *Agropyron cristatum* (crested wheatgrass) is common in the adjacent uplands. Big Lake, like the nearby Hailstone and Halfbreed Wildlife Refuges, has little in the way of emergent vegetation. Parts of the large saline mud flats are covered with a *Salicornia rubra* (red glasswort) community, but in general these flats are unvegetated. The next higher community along a topographic and moisture gradient is *Distichlis spicata* (saltgrass), which occurs on flat areas slightly above the mud flats on the edges of Big Lake. Slightly above the *Distichlis spicata* community is a *Schoenoplectus pungens* (threesquare) community. This community also occurs as a narrow band around some parts of the edge of Big Lake. A *Hordeum jubatum* (foxtail barley) community occurs in the driest position on the site, above the two previous communities. One of the inlet creeks has been impounded to form a small wetland that commonly has standing water for part of the year. The neighboring borrow pit (where fill material for the impoundment was taken from) also had standing water at the time of the site visit, with *Stuckenia pectinata* (sago pondweed) and the green alga *Chara* present.

Key Environmental Factors

Variation in landform, heavy-textured soils (and associated slow-drainage), and seasonal flooding of the basin setting structure this site's wetlands.

Rarity

No rare plants or animals were observed. A sizeable occurrence of *Salicornia rubra* (red glasswort), G2G3, was documented.

Other Values

Big Lake is an important migratory bird stopover and a breeding production site when it has water; it supports abundant *Stuckenia pectinata* (sago pondweed) in the aquatic portions and *Schoenoplectus acutus* (hardstem bulrush) and *Schoenoplectus pungens* (threesquare) as emergent vegetation, all of which constitute important waterfowl food sources.

Land Use

At Big Lake and Pond 1f, hunting is the only allowed activity; at Pond 2 hunting and grazing is permitted. Grazing has caused conspicuous hummocking in this area.

Exotics

There are numerous exotics in the wet meadow vegetation, including *Melilotus officinalis* (yellow sweet clover), *Thinopyrum intermedium* (intermediate wheatgrass), *Kochia scoparia* (summer cypress), *Sonchus* spp. (sow-thistle), *Cirsium vulgare* (bull thistle), and *Cirsium arvense* (Canada thistle). Several exotic species also occur in the surrounding uplands, including *Agropyron cristatum* (crested wheatgrass), *Salsola kali* (Russian thistle) and *Chenopodium album* (lambsquater). The only exception to this pattern of disturbance-vegetation is the south side of Big Lake, where *Artemisia cana* is dominant with *Stipa* spp. (needlegrass) and native forbs comprising the undergrowth.

Uplands

There is a buffer where no farming or grazing occurs in the uplands immediately adjacent to the wetland. Adjacent to this buffer, the uplands are managed for dryland wheat farming.

Information Needs

The water source for the ponds is unknown but assumed to be groundwater. Big Lake and ponds in the immediate vicinity have emergent vegetation, whereas those ponds further removed apparently do not. Is excessive alkalinity a factor?

Management Needs

A management plan for exotics should be developed, although the exotics do not significantly negatively impact the value of the wetlands to waterfowl.

Blacktail Ponds

Directions

Yellowstone Plateau, ponds on a rim above Blacktail Deer Creek along the Loop Road to Tower Junction about 6 miles east of Mammoth. The ponds are easily accessible,

and lie in a low, flat open valley just to the north of the road.

Description

The ponds lie in an open flat drainage between Blacktail Deer Creek to the east and Lupine Creek. There appears to be either an old lateral moraine or a basalt outcrop on the west bank of Blacktail Deer Creek, which is a natural dam, blocking drainage to the Creek. The ponds never freeze over because they are spring-fed. The valley seems to have filled up with silt over time and lies about 50 feet above Blacktail Deer Creek; it is visually reminiscent of a hanging valley, but is probably not this type of formation in actuality. The surrounding area is open and unforested, composed mostly of rolling hills with exposed basalt outcrops where there is little soil. The soil in the valley has been characterized as a histisol - wet, a tendency to be anaerobic, and highly organic. There is a great deal of *Carex* in the open valley, mixed with forbs and grasses. Ducks are known to use the pond; it is expected that large ungulates forage in the area. Grizzly bears frequent the area according to J. Whipple. The ponds have a classic floating edge of plants. The valley seems to drain both to the east into Blacktail Deer Creek and west into Lupine Creek, which eventually drains into the Gardner River.

Key Environmental Factors

Hydrology and topography.

Climate

A continental, mountain climate prevails - cold winters with a goodly amount of snow, and warm summers with afternoon rainfall.

Rarity

This area is known for bird nesting, and disturbance by fisherman may be a problem. The elements concentrated in the area have GRanks of G4 and G5; none of the occurrences have been ranked, but they may not rank very high due to the heavy use of the area by fisherman. Large ungulates and grizzly bears are known to be in the area, but we do not have specific documentation at this time.

Other Values

High quality scenery.

Land Use

Since the site lies close to the road, it receives heavy use by fisherman and hikers. There is a hiking trail all around the valley, offering easy access to the site. The Loop Road is on the south edge of the site; parking is available.

Exotics

Survey is needed to establish presence or absence of exotic plants.

Information Needs

Survey for elements within the site and to establish more definite boundaries.

Bluewater Springs

Directions

The Bluewater Springs site is located along Bluewater Creek, approximately 5 miles southeast of Fromberg and 5 miles northeast of Bridger, MT. From Bridger, take the county road east to East Bridger, then south and east towards Bluewater Fish Hatchery, about 5.5 miles from East Bridger.

Description

This site consists of a series of springs along Bluewater Creek and several of its tributaries. Soils are fairly sandy and calcareous and are derived from Chugwater sandstone interbedded with thin lenses of limestone. The springs support species-rich wet or saturated meadows, many of which have extensive marl deposits. Wet areas adjacent to springs support populations of *Eleocharis rostellata* (beaked spikerush), *Carex aquatilis* (water sedge), *Carex aurea* (gold sedge), *Carex pellita* (woolly sedge), and *Juncus tracyi* (Tracy's rush). A healthy population of *Epipactis gigantea* (giant helleborine) with *Rorippa nasturtium-aquaticum* (watercress), *Platanthera hyperborea* (northern green orchid), and *Mimulus guttatus* (seep monkeyflower) occurs around one of the upper springs. This site also includes an undeveloped thermal spring, Bluewater warm spring, which flows into Bluewater Creek. Bluewater Creek supports riparian areas that vary in condition depending on grazing intensity.

Key Environmental Factors

Surface and subsurface seeps and springs are critical in maintaining this site. Geothermal activity and calcareous substrate are also important factors.

Rarity

The wet meadows support several rare plant species, including *Asclepias incarnata* (swamp milkweed), S1 G5, *Epipactis gigantea* (giant helleborine), S2 G5, *Eupatorium maculatum* var. *bruneri* (Joe-pye weed), S2 G5, and *Eleocharis rostellata* (beaked spikerush), S2 G5. *Lampropeltis triangulum* (milk snake) is recorded from this site. Springs and seeps as well as thermal springs are rare features, especially in this arid region of the state.

Land Use

The springs are largely undeveloped, except for one spring along the North Fork of Bluewater Creek that has some development for domestic use. Portions of the riparian areas and adjacent grasslands have been disturbed and degraded by overgrazing.

Exotics

Euphorbia esula (leafy spurge) is abundant and increasing at this site. *Phalaris arundinacea* (reed canarygrass) has invaded some of the wet meadows. Pasture grasses, such as *Poa pratensis* (Kentucky bluegrass) and *Bromus inermis* (smooth brome), occur in grasslands adjacent to the springs and some of the drier meadows.

Uplands

Bottomland adjacent to seeps/springs and riparian areas has been converted into hay pastures in places. Vegetation on the canyon walls and rims is in good condition.

Information Needs

Plant community surveys are needed, as are additional surveys for plants and animals. The warm springs could potentially harbor rare or endemic aquatic insects, and specific surveys for these aquatic insects should be undertaken.

Boulder Forks

Directions

Note: A portion of this site is located on private land, and landowner permission is needed to access that area. The Boulder Forks site is located in the foothills of the Beartooth Mountains in south central Montana. From McLeod, travel south on State Route 298 for approximately 0.5 mile. After crossing the West Boulder, turn west (left) at the Boulder Forks Fishing Access.

Description

This site is located at the confluence of the West and Main Boulder Rivers. Much of the site occupies a narrow floodplain and low terrace between the active channel and a high terrace dominated by the exotic grass *Bromus inermis* (smooth brome). *Populus balsamifera* sap. *trichocarpa* (black cottonwood) communities occupy most of this floodplain/terrace. Most cottonwood stands are a *Populus balsamifera* sap. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) community. The shrub component of this community varies from diverse and well developed to sparse, and exotic grasses dominate the herbaceous layer. The most degraded stands are classified as a *Populus balsamifera* sap. *trichocarpa* / mesic graminoids community: they have almost no shrub component and a dense cover of *Bromus inermis*

dominates the herbaceous layer. A senescent stand of cottonwood on a low terrace, with large gaps created by tree mortality, has succeeded to a *Symphoricarpos occidentalis* (western snowberry) community. Old channels and swales support small *Salix lutea* / *Calamagrostis canadensis* (yellow willow / bluejoint reedgrass) and *Carex utriculata* (beaked sedge) communities, which form mesic inclusions within the cottonwood stands. At the southern end of the site on the Main Boulder River, an overflow channel has created a ponded area that supports *Carex utriculata*, aquatic, and *Salix lutea* / *Carex utriculata* communities. Scattered mature *Pseudotsuga menziesii* (Douglas-fir) occupy portions of the slope between the floodplain and high terrace.

This site also contains two seep areas. An old beaver dam that is silting in has modified one. *Typha latifolia* (broadleaf cattail) occupies areas of greater sediment deposition. Deeper portions of the pond support an aquatic community made up of *Sparganium angustifolium* (narrowleaf bur-reed), *Hippuris vulgaris* (common mare's-tail), *Ranunculus gmelinii* (Gmelin's buttercup), and *Potamogeton* sp. (pondweed). The other seep area is fed by outflow from an irrigation ditch. It may also receive groundwater from the uplands. The seep edges are dominated by *Juncus balticus* (Baltic rush) and have a high cover of *Cirsium arvense* (Canada thistle). Wetter areas support a *Carex utriculata* community co-dominated by *Carex aquatilis* (water sedge) and *Glyceria striata* (fowl mannagrass), and the wettest areas are dominated by *Carex utriculata* with *Typha latifolia*. *Salix exigua* (sandbar willow) and *Salix lutea* / *Carex utriculata* communities occur along the outflow swale of this seep area.

Key Environmental Factors

Seasonal flooding and groundwater seepage is the primary factors influencing vegetation at this site. *Castor canadensis* (beaver) modification, hydrologic augmentation from an irrigation ditch, and past grazing practices is also important influences.

Rarity

No special status plant or animal species were observed. Two G3 communities, *Populus balsamifera* sap. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) and *Salix lutea* / *Calamagrostis canadensis* (yellow willow / bluejoint reedgrass), were documented in fair condition.

Land Use

A portion of this site is Montana Department of Fish, Wildlife & Parks fishing access site, and it receives high levels of recreational use. However, road and camp-ground development is restricted to the high terrace, and

the site appears to be little affected by this use. The private portion of the site is not currently grazed and appears to receive little use.

Exotics

Herbaceous exotic species are abundant in drier portions of this site, such as cottonwood stands and the margins of seeps, and often dominate the ground layer in cottonwood communities. Abundant species include *Bromus inermis* (smooth brome), *Poa pratensis* (Kentucky bluegrass), and *Dactylis glomerata* (orchard grass). Other common weeds are *Cynoglossum officinale* (hound's tongue), *Cirsium arvense* (Canada thistle), *Phalaris arundinacea* (reed canarygrass), *Arctium* sp. (burdock), and *Thlaspi arvense* (penny-cress). There are small patches of *Euphorbia esula* (leafy spurge) along the Main Boulder.

Uplands

The riparian zone is very linear and has been greatly influenced by grazing. In some areas it has been reduced to a *Poa pratensis* (Kentucky bluegrass) disclimax. The site is adjacent to the town of McLeod.

Information Needs

What is the grazing history? Is the dominance of exotic grasses, especially on the high terrace, a grazing disclimax? Was *Bromus inermis* (smooth brome) seeded? Is the grazing history of the *Populus balsamifera* sap. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) community different from the *Populus balsamifera* sap. *trichocarpa* / mesic graminoids community?

Management Needs

Some of the noxious weeds, such as *Euphorbia esula* (leafy spurge) and *Cynoglossum officinale* (hound's tongue), are still localized and could be eradicated or contained.

Bull Springs

Directions

Bull Springs is located in the foothills and high plains of south central Montana. From Red Lodge, travel north on U.S. Highway 212 for approximately 5.5 miles. Turn east on a dirt road that is signed for Rock Creek fishing access. Follow this road for approximately 0.5 mile. After crossing Rock Creek, turn left at a T-intersection. The Bull Springs Fishing Access is just past the intersection on the left.

Description

Bull Springs occurs in the floodplain of Rock Creek and is characterized by cottonwood gallery forests and willow communities along wet swales. Rock Creek is

braided with two or three primary channels and many swales, some of which intersect riverine groundwater and have standing or flowing water. These wet microsites occur as narrow stringers within cottonwood communities and support a *Salix boothii* / *Calamagrostis canadensis* (Booth's willow / bluejoint reedgrass) association. Dominant shrubs are *Salix boothii*, *Alnus incana* (mountain alder), and *Betula occidentalis* (water birch). *Calamagrostis canadensis* dominates the herbaceous layer, except for the wettest locations in and immediately adjacent to swales, which have high cover of *Carex utriculata*.

The remainder of the site occurs on higher floodplain deposits that predominately support *Populus balsamifera* saps. *trichocarpa* (black cottonwood) communities. The largest community is *Populus balsamifera* sap. *trichocarpa* / mesic graminoids. An open canopy of mature *Populus balsamifera* sap. *trichocarpa* characterizes this community. Saplings (probably from suckering) form a scattered midstory, and clumps of *Juniperus communis* (common juniper) form a minor shrub component. *Poa pratensis* dominates the herbaceous layer with *Centaurea maculosa* (spotted knapweed) present at low cover. Microtopographic relief provides small mesic swales where native herbaceous species are abundant. These include *Calamagrostis canadensis*, *Poa glaucifolia* (pale-leaf bluegrass), *Carex aenea* (bronze sedge), and *Equisetum arvense* (field horsetail). A smaller *Populus balsamifera* sap. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) association also occurs at the site. Similar to the previous community, this community also has an open overstory of mature *Populus balsamifera* sap. *trichocarpa*, but the shrub component is much better developed. The diagnostic shrub *Cornus sericea* is very restricted and present at very low cover. *Prunus virginiana* (chokecherry) is abundant and is the dominant shrub; *Alnus incana* and *Symphoricarpos occidentalis* (western snowberry) are present at low cover. *Elymus glaucus* (blue wildrye) and *Poa pratensis*, both of which are abundant, dominate the herbaceous layer. *Calamagrostis canadensis* is locally abundant in numerous shallow swales. The exotics *Cynoglossum officinale* (hound's tongue) and *Dactylis glomerata* (orchard grass) are present at low cover and *Bromus inermis* is well represented. Finally, the site also supports a small undescribed *Populus tremuloides* / *Symphoricarpos occidentalis* community. *Populus tremuloides* forms a closed canopy, and *Prunus virginiana* forms a scattered midstory. *Symphoricarpos occidentalis* is very abundant throughout. *Poa pratensis* is abundant and is the dominant herbaceous species, except in swales where *Calamagrostis canadensis* is locally dominant. Herbaceous openings have a high cover of exotic species, such as *Cynoglossum officinale*, *Cirsium* spp. (thistle), *Centaurea*

rea maculosa, and *Euphorbia esula* (leafy spurge). Beaver-caused mortality may be limiting *Populus tremuloides* regeneration in places.

Key Environmental Factors

Seasonal flooding and high groundwater tables are responsible for creating and maintaining the structure and composition of the plant associations at this site. Browsing by native ungulates and beaver and possible past browsing by livestock may be responsible for the sparse shrub layer in the majority of the site. This could also be explained by differences in soil or geomorphic characteristics.

Rarity

No special status plants or animals were observed. One G3? community, *Populus balsamifera* sap. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood), and one undescribed community, *Populus tremuloides* / *Symphoricarpos occidentalis* (quaking aspen / western snowberry), were documented. (The *Populus tremuloides* / *Symphoricarpos occidentalis* community appears to be similar to the G3? ranked *Populus tremuloides* / *Symphoricarpos albus* [quaking aspen / common snowberry] community.) Both were only in fair condition, primarily due to the presence of exotics.

Other Values

Although there are several diversion ditches upstream of and within this reach, this section of Rock Creek appears to support important hydrologic functions, such as dynamic water storage and surface water - groundwater interactions. The floodplain is still accessed by surface and subsurface flooding regimes, and native vegetation appears to be highly connected and to occupy much of the floodplain.

Land Use

Despite being a dedicated recreation site, there is little evidence of use, except for a few trails and some garbage near the parking area.

Exotics

Pasture grasses, especially *Poa pratensis* (Kentucky bluegrass), dominates the ground layer. *Centaurea maculosa* (spotted knapweed) and *Cynoglossum officinale* (hound's tongue) occur at low cover over much of the site. *Euphorbia esula* (leafy spurge) is present (for now) as one patch.

Uplands

Native vegetation occupies the floodplain of Rock Creek along the active channels immediately up and downstream of the site. Adjacent to this corridor, human uses (pasture, houses) dominate, and portions of the floodplain further away from the active channel are grazed.

Information Needs

How do irrigation diversions affect the functionality of the site? What was the grazing history of this site before the Department of Fish, Wildlife & Parks acquired it? Is the paucity of shrubs in cottonwood stands throughout much of the site a product of past livestock grazing, or is it a result of differences in soil texture or geomorphic characteristics?

Management Needs

Although pasture grasses are very well established at the site, noxious weeds, such as *Centaurea maculosa* (spotted knapweed), *Cynoglossum officinale* (hound's tongue), and *Euphorbia esula* (leafy spurge), are currently present at low cover and should be eradicated or controlled with a weed management plan.

Chapman Bench

Directions

Clark's Fork Basin, near the foothills of the Absaroka Mountains on Chapman Bench, which is bounded by Pat O'Hara Creek to the west and Little Sand Coulee to the east. The site extends from the edge of the bench at the south to the Clark's Fork River at the north. The site is bisected by Wy Hwy 120, and is about 17-23 mi north of Cody.

Description

Chapman Bench is a rather subtle bench, lying in a +/- north-south direction and sloping from a high point in the south some 7 mi to the Clark's Fork River. The bench seems to be made up of Quaternary terrace deposits overlying the Willwood Formation, a fossil-rich formation of Eocene origin that is fairly common in the Bighorn Basin. The bench is fairly flat, but does drop off on the edges, to Pat O'Hara Creek, Little Sand Coulee and the Clark's Fork River after it issues out of the Clark's Fork Canyon. The edge of the bench at the south is rather vague with only a slight change in slope between the bench and the land to the south. In general, the Bench is covered with a sagebrush grassland community, although the site includes Pat O'Hara Creek to afford a water source for the animals that live here. The nearly flat topography is attractive to mountain plovers and long-billed curlews for nesting habitat.

Key Environmental Factors

Water in the surrounding streams that have eroded away and defined the bench is necessary for nesting preference for the birds.

Climate

The dry, nearly desert conditions contribute to the very low vegetation, which is preferred nesting habitat.

Rarity

Site provides important habitat for nesting mountain plovers, a G2 species that is declining. It also supports other avian fauna.

Information Needs

Site visit to establish better boundaries, confirm current presence of elements.

Chrome Lake

Directions

Note: a portion of this site is located on private land, and landowner permission is needed to access this area. Chrome Lake is located in the Beartooth Mountains of south central Montana. From Dean, travel southwesterly on Benbow Road for 11.5 miles to an intersection with an un-named 4-wheel drive road to the south. Proceed southerly on the un-named road for 0.6 mile to the first of three Chrome Lake wetlands.

Description

This wetland is a fen that occurs in a relatively narrow drainage divide in the subalpine zone in the Beartooth Mountains. The fen is fed by groundwater seeps from the two adjoining toe slopes, and it drains in two opposite directions via surface water: to the southeast into Chrome Lake, and to the northwest into a small creek. Smaller fens also occur along the outflow streams. *Pinus contorta* (lodgepole pine), *Pinus albicaulis* (whitebark pine), and *Vaccinium scoparium* (grouse whortleberry) dominate the upland. The wetland is dominated by what appears to be a raised and patterned fen: small ridges or "strings" parallel each other and are separated from one another by small troughs or "flarks." The flarks are wetter and dominated by a *Carex utriculata* (beaked sedge) community, which is a fairly species rich example of this type of community. Associated species include *Carex aquatilis* (water sedge), *Carex aurea* (golden sedge), *Eriophorum polystachion* (many-spiked cottongrass), *Caltha leptosepala* (white marsh-marigold), *Utricularia minor* (lesser bladderwort), and brown mosses. The strings or ridges are drier and dominated by a *Salix planifolia* / *Carex aquatilis* (planeleaf willow / water sedge) community, which has the following associated species: *Dasiphora fruticosa* ssp. *floribunda* (shrubby cinquefoil), *Carex utriculata*, *Caltha leptosepala*, *Symphotrichum foliaceum* (= *Aster foliaceus*, leafy aster), *Antennaria corymbosa* (flat-topped pussytoes), and *Sphagnum* (a group of mosses associated with poor fens and bogs). This community also occurs along the outflow streams. Wet areas away from these streams are dominated by *Carex utriculata*. Chrome Lake has an aquatic community of *Potamogeton gramineus* (grassy pondweed), *Potamogeton amplifolius* (large-leafed pondweed), and *Sparganium*

sp. (bur-reed). A small, undescribed community, dominated by *Salix glauca* (glaucus willow) and *Carex aquatilis*, occurs between one of the fens and the upland forest.

Key Environmental Factors

Springs and seeps produce the waters necessary to maintain this raised fen and the associated vegetation patterns.

Rarity

No special status plants, animals, or communities were observed. However, this site is a high quality example of a patterned fen, which is a regionally rare wetland type with only a few other such fens known from the state.

Other Values

Rana pretiosa (spotted frog) and *Pseudacris triseriata* (western chorus frog) were noted in a number of the fen communities.

Land Use

The main fen has ATV tracks.

Exotics

No exotics were documented.

Uplands

Mining and associated roads and woodcutting has occurred in the past. Currently there is no active mining, but hunting, ATV use, and hiking does occur.

Information Needs

Has the hydrology of the site been affected by mining?

Management Needs

ATV use of the site should be halted.

Clark's Fork Waterfowl Production Area

Directions

Clark's Fork Waterfowl Production Area is adjacent to the Clark's Fork Yellowstone River in south central Montana. From Bridger, travel 0.75 mile north on State Route 310. Proceed east for 0.5 mile on an un-named road and then travel north for 0.25 miles to Clark's Fork Waterfowl Production Area.

Description

This site is a human-created marsh located in the historic floodplain of the Clark's Fork of the Yellowstone River. Although a high-magnitude flood event could inundate this wetland, the chief water source is groundwater that is perched on a relatively impermeable clay layer. The

marsh is created by a small impoundment that blocks water flow. The water drains back to the river through a saturated meadow. The marsh is dominated by a *Typha latifolia* (broadleaf cattail) community, which occurs in one to several feet of standing water. A diverse aquatic plant community occurs in the open water of the marsh. The following species were observed in this community: *Potamogeton richardsonii* (red-head pondweed), *Polygonum amphibium* (water smartweed), *Ranunculus aquatilis* (water crowfoot), *Myriophyllum sibiricum* (Siberian water milfoil), *Sagittaria cuneata* (arrowleaf arrowhead), *Lemna minor* (common duckweed), *Alisma gramineum* (narrowleaf waterplantain), and the green alga *Chara*. A large wet meadow planted with *Thinopyrum intermedium* (intermediate wheatgrass) occurs next to the marsh and is dominated by a dense stand of this exotic grass. Below the marsh in the drainage pathway are stands of *Schoenoplectus acutus* (hardstem bulrush) and *Juncus balticus* (Baltic rush). A *Populus angustifolia* / *Symphoricarpos occidentalis* (narrowleaf cottonwood / western snowberry) riparian community occurs along the river. Although the community keys to narrowleaf cottonwood / western snowberry, the shrub understory is dominated by *Elaeagnus angustifolia* (Russian olive) and *Rhus trilobata* (smooth sumac). On the same terrace, adjacent to the cottonwood stand, is a community of the exotic grass *Bromus inermis* (smooth brome).

Key Environmental Factors

Groundwater draining from uplands, intercepted and perched by a relatively impermeable clay layer and impounded by a manmade structure, is the reason this wetland site exists.

Rarity

This is a created wetland and no rare plants, animals, or communities were observed.

Other Values

This wetland site was created to stimulate waterfowl production (and breeding populations of *Anas platyrhynchos* [mallards] and *Anas arcuta* [pintails] were observed). The marsh appears to have an abundance of aquatic foods for waterfowl, in addition to hiding and breeding cover. Other wildlife noted during the site visit included *Ardea herodias* (great blue heron), *Podilymbus podiceps* (pie-billed grebe), *Bufo woodhousii* (Woodhouse's toad), and *Odocoileus virginianus* (whitetail deer).

Land Use

The composition of much of the wetland site is planted pasture grasses, including *Bromus inermis* (smooth brome), *Thinopyrum intermedium* (intermediate wheatgrass), and *Dactylis glomerata* (orchard grass).

Exotics

A number of noxious weeds/increasers are present, although they are not yet abundant. These species include *Centaurea maculosa* (spotted knapweed), *Kochia scoparia* (summer cypress), *Euphorbia esula* (leafy spurge), *Chenopodium album* (lambsquarter), *Melilotus officinalis* (yellow sweet-clover), *Taraxacum officinalis* (common dandelion), *Elymus repens* (quackgrass), *Tamarix chinensis* (salt cedar), and *Convolvulus arvensis* (field morning-glory).

Uplands

The adjacent uplands are farmed for corn and wheat and grazed by livestock, and these uplands probably serve as the source for most of the weed and increaser species.

Information Needs

The source of water for this site has not been pinpointed; is it the ditch or the river? The history of the site has not been documented: was it farmed or did it merely serve as unimproved rangeland?

Management Needs

The marsh portion appears to be functioning well, producing abundant aquatic vegetation and, as a consequence, waterfowl. However, the uplands and wet meadow portion of the WPA are dominated by exotics, and a plan to reduce their coverage and concomitantly increase that of native species needs to be explored.

Clay Butte / Beartooth Butte

Directions

Beartooth Plateau, Beartooth and Clay Buttes on north side of US Highway 212, about 7.5 road miles east of junction with WY highway 296. The site boundary follows the 9000 ft contour interval on the west slope of Clay Butte and includes the calcareous wetland just south of the Clay Butte lookout Road (on the south side of US 212).

Description

This site includes the summits and upper slopes of Beartooth and Clay Buttes, which are remnant caps of sedimentary substrates (including limestone and shales). The area is unique on the Beartooth Plateau, which is otherwise entirely Precambrian granite and gneiss. The summits and upper slopes of these buttes contain a mosaic of talus and tundra communities. A calcareous floating mat wetland is found to the south of Clay Butte that contains a number of boreal disjunct sedge species. The east face of Beartooth Butte contains inclusions of the Beartooth Butte Formation, a Devonian strata well known for fossil fish.

Key Environmental Factors

The boundary was selected to incorporate the entire range of a suite of rare endemic alpine mustard species that are restricted to the calcareous summits and upper slopes of Clay and Beartooth buttes. In addition, a calcareous floating mat wetland to the south of Clay Butte contains a number of boreal disjunct sedge species. The area is important wildlife habitat.

Rarity

This site contains the world's only occurrence of Comb-hair whitlow-grass (*Draba pectinipila*). Little snow draba (*Draba porsildii* var. *brevicula*), a rare regional endemic, also occurs here, as do high quality occurrences of 11 other state and regionally rare or disjunct plant species. Locations for spotted frog may also occur in the area, as might an undescribed subspecies of red fox.

Other Values

Area is important wildlife habitat and is a popular recreation destination for sight-seeing (tremendous views are possible from the tower on Clay Butte).

Land Use

Fire lookout, visited by tourists. Campground on Beartooth Lake.

Information Needs

Periodic monitoring is needed to gauge the abundance and trends of elements of interest within the site.

Management Needs

This is a potential resource natural area (RNA).

Crater Fen

Directions

The Crater Fen site is located in the foothills of the Beartooth Mountains in south central Montana. From Fishtail, travel west and south on State Highway 419 for approximately 1 mile to the intersection with State Highway 425. Turn onto State Highway 425 and travel south for approximately 6 miles to the intersection with Forest Route 2072. Travel south on this road for approximately 5 miles. Park just before the cattle guard where the road crosses onto the Lazy E-L Ranch. Travel west across the ridge that separates the West Rosebud from East Fork Fiddler Creek. The East Fork of Fiddler Creek lies on the other side of the ridge approximately 1 mile from the road.

Description

This site occurs above Crater Lake in a cold air ponding glacial kettle. The site is a poor fen that receives

groundwater from the adjacent toe slopes. The southern half of the fen is mixed mire with boglike *Sphagnum* hummocks interspersed with poorly vegetated flats. Common *Sphagna* include *Sphagnum warnstorffii*, *Sphagnum fuscum*, and *Sphagnum teres*. *Sphagnum* hummocks are relatively diverse and support a stunted *Betula glandulosa* / *Carex utriculata* (bog birch / beaked sedge) community co-dominated by *Dasiphora fruticosa* ssp. *floribunda* (shrubby cinquefoil). Other common vascular species include *Salix planifolia* (planeleaf willow), *Carex buxbaumii* (Buxbaum's sedge), *Calamagrostis canadensis* (bluejoint reedgrass), *Menyanthes trifoliata* (bog buckbean), and *Lilium philadelphicum* (red lily). Interspersed among these hummocks is a depauperate *Carex buxbaumii* community that occurs on bare peat flats. This community becomes dominant in the northern portion of the basin, where it forms a flat/mound complex. Somewhat higher microsites have small inclusions of *Alnus incana* / *Calamagrostis canadensis* (mountain alder / bluejoint reedgrass) shrubland. *Nuphar lutea* ssp. *polysepala* (yellow pond-lily) occupies a narrow open water band in the center of the basin.

Key Environmental Factors

Saturation from groundwater and the stability of the hydrologic regime are key factors that influence the site's vegetation. The *Carex buxbaumii* community is seasonally inundated. The surrounding uplands are underlain by glacial till derived from granitic gneiss; correspondingly, the groundwater draining into the site is nutrient poor. This greatly influences the site's floristic composition and explains the abundance of *Sphagnum*. There is a small eastern outlet that flows seasonally and the intactness of the eastern rim is critical to the hydrological stability of the basin. This wetland is an autotrophic system with peat (derived from *Sphagnum* and sedge species) accumulation.

Rarity

No special status plants or animals were observed. One G3 community, *Carex buxbaumii* (Buxbaum's sedge), was observed.

Other Values

This site is an excellent example of a poor fen, which is a regionally rare wetland type. The site has relatively high species and microhabitat diversity for a poor fen.

Land Use

No evident human uses.

Exotics

No exotic species were observed.

Uplands

The uplands are dominated by *Pinus contorta* (lodgepole pine) on morainal substrate derived from granitic gneissic parent material.

Information Needs

Crater Fen is the highest in a cluster of three wetlands. The other two wetlands are open water bodies that may warrant further consideration: deep-water Crater Lake and Lily Pad Lake, which is a shallow-water open lake to the south with a shoreline border that has some of the same peat-forming sedges as found in Crater Fen.

Management Needs

The uplands surrounding the fen should be managed such that the hydrology and water chemistry of the site remain undisturbed.

Dry Fork Creek Marshes

Directions

This site is located in the foothills of the Beartooth Mountains in south central Montana. From McLeod, travel south on State Route 298 for approximately 2.5 miles. Take the East Boulder Road for approximately 10 miles. The site is located about a mile past the locked gate.

Description

This group of depressional wetlands is probably glacial in origin. They are dominated by either aquatic or marsh vegetation. The water source for each of the wetlands is an intermittent creek, and either groundwater or an intermittent creek drains each wetland. The uplands are dominated by *Pinus contorta* (lodgepole pine) forest.

A *Carex utriculata* (beaked sedge) community dominates substantial portions of each wetland in areas that are seasonally flooded. One wetland has a diverse aquatic community, which includes *Hippuris vulgaris* (common mare's-tail), *Stuckenia pectinata* (sago pondweed), *Ranunculus aquatilis* (water crowfoot), and the green alga *Chara*. The other has extensive seeps along one margin that support an undescribed spruce community, which has an *Picea engelmannii* (Engelmann spruce) overstory and a diverse understory, dominated by *Ledum glandulosum* (Labrador tea). This second wetland has a *Carex buxbaumii* (Buxbaum's sedge) community that occurs on the margins of the depression, and a small patch of an undescribed sedge type, dominated by *Carex flava* (yellow sedge), which occurs in a seepy area. The bottom of the open water portion of this wetland is marl covered, and springs bubble up from the bottom of the open water portion in a few areas.

Key Environmental Factors

The hydrologic regime (seasonal flooding) and calcareous parent material appear to be the primary influence on plant community structure and composition.

Rarity

A population of *Eleocharis rostellata* (beaked spikerush), S2G5, occurs in the marsh. A high quality occurrence of a rare community, *Carex buxbaumii* (Buxbaum's sedge), G3, was documented.

Land Use

Current land use appears restricted to occasional use by hunters. This site may have been grazed in the past, as evidenced by the presence of *Phleum pratense* (common timothy) and the native increaser *Prunella vulgaris* (selfheal) in drier portions of the site.

Exotics

Pasture grasses (*Poa palustris* [fowl bluegrass], *Phleum pratense* [common timothy], *Poa pratensis* [Kentucky bluegrass]), *Trifolium pratense* (red clover), and *Phalaris arundinacea* (reed canarygrass) are present at low cover. This may be indicative of past grazing at the site.

Uplands

The surrounding upland forest is intact. There are nearby mining claims, and one claim is adjacent to one of the marshes.

Information Needs

What is the status and scope of the adjacent mining claims? A series of groundwater monitoring wells are adjacent to one of the marshes - what is their purpose?

Management Needs

The intact character of the uplands and the corresponding hydrologic regime are essential to the integrity and functioning of these wetlands.

East Boulder River

Directions

The East Boulder Site is located on the north face of the Beartooth Range, approximately 23 miles southwest of Big Timber, MT, and within the Gallatin National Forest boundary. The site is accessed via Highway 298 South, from Big Timber, and turning onto the East Boulder Road, three miles south of McLeod, MT. At the Forest Service boundary, follow Forest Service Road 205. The site is approximately 1.5 miles south of the end of FS Road 205.

Description

The site is the upper East Boulder River watershed, from the confluence with Burnt Gulch to the headwaters. This watershed contains populations of pure *Oncorhynchus clarki bouvieri* (Yellowstone cutthroat trout), without contaminating species, and substantial habitat value. Grizzly bear may use this area. Elevations range from 8200 ft. (2500 m) to 10145 ft. (3093 m).

Rarity

This site is valuable as important habitat for genetically pure *Oncorhynchus clarki bouvieri* (Yellowstone cutthroat trout), *Ursus arctos horribilis* (grizzly bear) and *Lynx canadensis* (Canada lynx).

Exotics

Rainbow, brook and brown trout occur downstream from this site.

Information Needs

Information of the existence and distribution of barriers to fish movement is needed. Also, surveys for plants, animals and vegetation communities of special concern are needed.

East Fork Fiddler Creek Complex

Directions

The East Fork Fiddler Creek site is located in the foothills of the Beartooth Mountains in south central Montana. From Fishtail, travel west and south on State Highway 419 for approximately 1 mile to the intersection with State Highway 425. Turn onto State Highway 425 and travel south for approximately 6 miles to the intersection with Forest Route 2072. Travel south on this road for approximately 5 miles. Park just before the cattle guard where the road crosses onto the Lazy E-L Ranch. Travel west across the ridge that separates the West Rosebud from East Fork Fiddler Creek. The East Fork of Fiddler Creek lies on the other side of the ridge approximately 1 mile from the road.

Description

The East Fork Fiddler Creek site is a complex of willow bottomlands and *Castor canadensis* (beaver)-influenced wetlands associated with East Fork Fiddler Creek, narrow draws, and lakes and kettles formed by past glaciation. A *Salix boothii* / *Carex utriculata* (Booth's willow / beaked sedge) community occupies much of the bottomland along East Fork Fiddler Creek. *Carex utriculata* dominates in wet swales; *Calamagrostis canadensis* (bluejoint reedgrass) and *Phleum pratense* (common timothy) are dominant on higher microsites. On higher sites, this community grades into a *Populus tremuloides* / *Calamagrostis canadensis* (quaking aspen / bluejoint reedgrass) community. *Phleum pratense* completely

replaces *Calamagrostis canadensis* on drier portions of the toe and lower slope. The uplands are *Pinus contorta* (lodgepole pine) forest.

On higher sections of Fiddler Creek, the riparian zone is very narrow and has been influenced in places by past beaver activity. Drained and silted in beaver dams have created substrate for marsh communities. Wetter sites support an undescribed community with high cover of *Glyceria grandis* (northern mannagrass), *Carex canescens* (gray sedge), *Agrostis scabra* (ticklegrass), and *Sparganium angustifolium* (narrowleaf bur-reed). A *Carex utriculata* community dominates slightly drier sites. Interspersed with and fringing these beaver ponds are *Salix geyeriana* / *Calamagrostis canadensis* (Geyer's willow / bluejoint reedgrass) and *Alnus incana* (mountain alder) communities.

This site also has narrow seepy draws. These support a *Populus tremuloides* / *Calamagrostis canadensis* community interspersed with *Salix boothii* / *Carex utriculata* and *Alnus incana* communities. These draws feed into a series of small glacially-formed kettle potholes that support a *Carex utriculata* community fringed by *Salix geyeriana* / *Calamagrostis canadensis*. A larger glacial depression, Lily Pad Lake, also occurs on the site. A *Nuphar lutea* *sap. polysepala* (yellow pond-lily) community covers much of the lake surface, and the lake is fringed by a narrow band of *Carex buxbaumii* (Buxbaum's sedge) and a small patch of *Alnus incana* / *Calamagrostis canadensis*.

Key Environmental Factors

Seasonal flooding and high groundwater tables are the primary factors influencing vegetation. Past beaver activity is also important in creating more mesic substrate.

Rarity

No special status plants or animals were observed. One G3 plant community, *Populus tremuloides* / *Calamagrostis canadensis* (quaking aspen / bluejoint reedgrass), was documented.

Other Values

A breeding pair of *Grus canadensis* (sandhill cranes) with a fledgling was observed.

Land Use

Mesic sites along the East Fork Fiddler Creek bottomlands are dominated by *Phleum pratense* (common timothy), so the site was probably grazed in the past. The section contains several old roads. Otherwise land use seems minimal.

Exotics

Phleum pratense (common timothy) and *Cirsium arvense* (Canada thistle) are well established in some communities. Drier *Populus tremuloides* (quaking aspen) communities upslope of the riparian areas are dominated by *Phleum pratense*.

Uplands

The uplands are largely intact.

East Rosebud Complex

Directions

East Rosebud Complex is located in the Beartooth Mountains of south central Montana. From Roscoe, travel 8 miles southwesterly on Forest Route 117 to East Rosebud Complex.

Description

The East Rosebud complex of wetlands occurs in a stream valley along low river terraces in which there are numerous old river meanders. These wetlands are primarily fed by groundwater and many have developed peat, so it is reasonable to assume that they have a fairly stable hydrologic regime. *Castor canadensis* (beaver) have dammed some of the shallow streams that drain into this complex, thus helping to maintain a high water table at the site. The uplands are characterized by *Pinus contorta* (lodgepole pine) and *Populus tremuloides* / *Symphoricarpos occidentalis* (quaking aspen / western snowberry) forest and *Festuca idahoensis* – *Pseudoroegneria spicata* (Idaho fescue – bluebunch wheatgrass) grassland. Open waters of the meanders and small beaver ponds support aquatic vegetation such as *Nuphar lutea* (yellow pond-lily), *Potamogeton pusillus* (small pondweed), *Potamogeton gramineus* (grassy pondweed), *Ranunculus aquatilis* (water crowfoot), and *Utricularia vulgaris* (common bladderwort). Some of the old meanders have silted in and have developed *Equisetum fluviatile* (water horsetail) communities, which are usually permanently flooded. On the margins of the open water there are *Carex utriculata* (beaked sedge) communities. A *Salix planifolia* / *Carex utriculata* (planeleaf willow / beaked sedge) community occupies slightly drier positions. This community has standing water and in some spots high cover of *Sphagnum* (moss species characteristic of poor fens and bogs). An *Alnus incana* (mountain alder) community also occurs around some of the ponds in areas with seasonally standing water. *Typha latifolia* (broadleaf cattail) stands occur around pond outlets where standing water is nearly continuously present. A complex of wet *Picea engelmannii* (Engelmann spruce)-dominated communities compose a large portion of the site. Numerous open water channels run through these communities, and *Alnus incana* (mountain alder) and *Carex utriculata*

(beaked sedge) are common. On slightly higher ground between sloughs is a *Populus tremuloides* / *Calamagrostis canadensis* (quaking aspen / bluejoint reedgrass) community that is ecotonal between wetland and upland. This forested community has relatively high cover of exotic pasture grasses, suggesting that it may have been grazed at some time in the past.

Key Environmental Factors

Much of the surrounding watershed was burned recently which should at least temporarily influence the inflow of groundwater. *Castor canadensis* (beaver) have dammed shallow streams that flow through the old meanders; they continue to inhabit the wetland and feed on shrubby vegetation.

Rarity

Gentianopsis simplex (hiker's gentian, S1 G4) was found in this wetland in 1989. However, attempts to relocate this population in 1999 were unsuccessful, possibly due to the very narrow phenological window available to identify this species. Three relatively high quality occurrences of G3 plant communities, *Populus tremuloides* / *Calamagrostis canadensis* (quaking aspen / bluejoint reedgrass), *Salix planifolia* / *Carex utriculata* (planeleaf willow / beaked sedge), and *Carex buxbaumii* (Buxbaum's sedge) were documented at this site.

Other Values

At the time of visitation several *Alces alces* (moose) were spotted feeding within the fen. *Rana pretiosa* (spotted frogs) were also noted in the *Carex utriculata* (beaked sedge) and *Carex buxbaumii* (Buxbaum's sedge)-dominated portions of the wetland complex. *Accipiter cooperi* (Cooper's hawk) was noted nesting in the near vicinity of, and making hunting forays over, the wetland.

Land Use

Recreation is the only known human use of the wetland.

Exotics

Exotics, including *Cirsium arvense* (Canada thistle), *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (redtop), and *Phleum pratense* (timothy), constitute a very minor problem at this site. For the most part, they are presently confined to the driest portion of the site (the *Populus tremuloides* / *Calamagrostis canadensis* community), with a minor presence in the *Salix planifolia* / *Carex utriculata* community.

Uplands

Significant residential development is occurring downstream from the wetland complex. The uplands have been logged and lightly grazed in the past.

Information Needs

How did the extensive burn within the watershed affect the hydrology and in turn the vegetation?

Management Needs

The exotic species are confined at this time to a given community type or perhaps a couple of types. A management plan should address the issue, and at the very least *Cirsium arvense* (Canada thistle) should be eradicated.

East Rosebud Floodplain Subdivision

Directions

Note: This site is located on private land, and landowner permission is needed to access this site. East Rosebud Floodplain Subdivision is located at the base of the Beartooth Mountains in south central Montana. From Roscoe, travel approximately 4.5 miles southwest on FS RD 117. The midpoint of the site is located where power lines cross the road.

Description

This site is located in a glaciated valley along an unconfined reach of East Rosebud Creek. The site is comprised of floodplain deposits interspersed with oxbows and sloughs associated with old stream meanders. The oxbows and sloughs are mostly silted in and support a *Carex utriculata* (beaked sedge) community. This community is variable across the site and includes small inclusions of *Typha latifolia* (broadleaf cattail) and *Carex aquatilis* (water sedge). Active *Castor canadensis* (beaver) dams have maintained a significant open water component in some oxbows. These open water habitats support an aquatic community dominated by *Hippuris vulgaris* (common mare's tail). Gravel/cobble substrate sidebars are being colonized in places by a *Populus balsamifera* *sap. trichocarpa* / recent alluvial bar (black cottonwood / recent alluvial bar) community. Higher floodplain deposits are dominated by *Salix boothii* / *Calamagrostis canadensis* (Booth's willow / bluejoint reedgrass) with scattered mature *Populus balsamifera* *sap. trichocarpa*. Although *Salix boothii* is abundant throughout, there are patches where *Salix bebbiana* (Bebb willow) or *Salix lucida* *sap. caudata* (shining willow) are locally dominant. This community is characterized by dense willow cover interspersed with many small herbaceous openings dominated by exotic grasses, primarily *Phleum pratense* (common timothy), *Poa pratensis* (Kentucky bluegrass), and *Agrostis stolonifera* (redtop). Floodplain deposits also support a *Populus tremuloides* / *Calamagrostis canadensis* (quaking aspen / bluejoint reedgrass) community. Although this community consists of mature stands of *Populus tremuloides*, it also includes early-seral stands of small trees (4-5 feet high) that are

suppressed by heavy browsing. These early-seral stands are adjacent to active beaver dams and show high beaver use (trails, tree mortality). Pasture grasses (*Poa pratensis*, *Phleum pratense*), dominate higher floodplain and terrace deposits.

Only a representative portion of the site was surveyed. The larger site also contains *Populus balsamifera sap. trichocarpa* / mesic graminoids and *Populus balsamifera sap. trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) communities, but these stands were not inventoried.

Key Environmental Factors

Past and ongoing fluvial dynamics (flooding, erosion, and deposition) are the primary factors influencing vegetation communities. *Castor canadensis* (beaver) have also influenced vegetation patterns by damming oxbows and causing tree mortality.

Rarity

No species of special concern were observed. However, two G3 plant communities in good to excellent condition were documented: *Salix boothii* / *Calamagrostis canadensis* (Booth's willow / bluejoint reedgrass) and *Populus tremuloides* / *Calamagrostis canadensis* (quaking aspen / bluejoint reedgrass).

Other Values

Alces alces (moose) sign was observed at the site.

Land Use

This site has been subdivided into approximately 15 20- to 40-acre parcels. Two 40-acre parcels, which appeared to be representative of the site, were inventoried. Despite the fragmented ownership, the site does not appear to have been developed beyond a few roads. Current land use appears to be mostly light horse grazing and recreational use. The presence of pasture grasses and the absence of willow communities from portions of the floodplain imply that the site has been grazed and/or hayed in the past.

Exotics

Higher portions of the floodplain are dominated by the pasture grasses *Phleum pratense* (common timothy) and *Poa pratensis* (Kentucky bluegrass). These species, in addition to *Agrostis stolonifera* (redtop), also dominate herbaceous openings scattered throughout the *Salix boothii* (Booth's willow) community. Other exotic species present in low abundance are *Phalaris arundinacea* (reed canarygrass) and *Cirsium arvense* (Canada thistle), both of which occur in the *Salix boothii* / *Calamagrostis canadensis* (Booth's willow / bluejoint reedgrass) community.

Uplands

The stream corridor, though subdivided, is still relatively intact. Higher, drier portions have been grazed. The site lies approximately 1 mile downstream of the Custer National Forest boundary. Home development has occurred downstream of the site as well as upstream near the Forest Service boundary. Home development has also occurred on the slopes to the west of the site.

Information Needs

Inventory of the parcels not surveyed might reveal greater community diversity at the site than currently known. For example, *Populus balsamifera sap. trichocarpa* stands occur on the site upstream of the parcels surveyed. Only a relatively small portion of the site was inventoried in 2000.

Management Needs

If possible, the current intact nature of this site should be maintained. Though the dispersed ownership is problematic, conservation easements or other agreements might be used to conserve some or this entire site.

East Rosebud Lake

Directions

Note: A portion of this site is located on private land, and landowner permission is needed to access this area. East Rosebud Lake is located in the Beartooth Mountains in south central Montana. From Roscoe, travel south-southwest on Forest Route 117 for approximately 13 miles to the East Rosebud trailhead and campground. The site lies at the head of East Rosebud Lake, approximately 0.5 mile up Forest Trail 15.

Description

This site occurs on alluvial deposits along and around the inflow of East Rosebud Creek into East Rosebud Lake. Plant communities present include lacustrine fringe herbaceous and willow communities and wet *Picea engelmannii* (Engelmann spruce) forests associated with the East Rosebud Creek floodplain. The lowest and wettest lacustrine fringe community is dominated by *Carex utriculata* (beaked sedge). This community encompasses a topographic and soil moisture gradient. Dominance shifts from *Carex utriculata* in the lowest and wettest portions of the community to co-dominance of *Carex utriculata* and *Calamagrostis canadensis* (bluejoint reedgrass) on slightly higher deposits. Somewhat higher deposits are ecotonal between herbaceous and willow-dominated communities, with *Salix planifolia* (planeleaf willow) occurring as small to medium sized clumps. These grade into a *Salix planifolia* / *Calamagrostis canadensis* community characterized by large clumps of willows dominated by *Salix planifolia* and some cover of *Salix lucida sap.*

caudata (shining willow), *Salix boothii* (Booth's willow), and *Salix bebbiana* (Bebb willow). The ground layer is dominated by *Calamagrostis canadensis* with a substantial *Phleum pratense* (common timothy) component. Moss also forms an important component of this community. Willows at this site have been heavily browsed, probably by *Alces alces* (moose). On slightly higher deposits along the floodplain of East Rosebud Creek, stands of *Picea engelmannii* / *Calamagrostis canadensis* occur. A closed canopy of mature *Picea engelmannii* with a relatively depauperate herbaceous layer dominated by *Calamagrostis canadensis* characterizes this community. Portions of this community have burned, and are now characterized by *Picea engelmannii* snags with a lush ground layer of *Calamagrostis canadensis*. *Picea engelmannii* is also colonizing the *Salix planifolia* / *Calamagrostis canadensis* community in places, forming small clumps of two to three sapling-sized trees.

Key Environmental Factors

Seasonal flooding and elevated groundwater tables are important in maintaining these communities. Herbivory is also important in structuring the *Salix planifolia* / *Calamagrostis canadensis* (planeleaf willow / bluejoint reedgrass) community. Fire has recently burned most of the upland *Pinus contorta* (lodgepole pine) forest and portions of the *Picea engelmannii* (Engelmann spruce)-dominated bottoms.

Rarity

No species of special concern or state or globally rare communities were observed.

Land Use

The site receives recreational, especially fishing, use and there are informal trails along East Rosebud Creek.

Exotics

Pasture grasses, especially *Phleum pratense* (common timothy), are abundant in mesic sites along the wetland/upland border.

Uplands

The entire shoreline of East Rosebud Lake is in private ownership and extensive small lot development has occurred along the north and east shores. The uplands are composed of seral stands of *Pinus contorta* (lodgepole pine), many of which recently burned. The site sits at the edge of the Absaroka-Beartooth Wilderness Area and is relatively undisturbed.

Information Needs

Is the presence of pasture grasses due to previous livestock grazing or stock use?

Management Needs

No noxious weeds were observed.

East Rosebud Oxbow

Directions

Note: A portion of this site is located on private land, and landowner permission is needed to access that area. The East Rosebud Oxbow site is located in the foothills of the Beartooth Mountains in south central Montana. From Roscoe, travel south-southwest on Forest Route 117 for approximately 3.5 miles. After crossing East Rosebud Creek, turn right (south) at a T-intersection. The site can be accessed immediately after this intersection.

Description

This site is a partially silted in oxbow in the floodplain of East Rosebud Creek. An *Equisetum fluviatile* (water horsetail) community with patches of *Schoenoplectus tabernaemontani* (softstem bulrush) occupies the deepest portion of the oxbow, which had two feet of standing water at the time of the field inventory. This community grades into a *Carex utriculata* (beaked sedge) community along the oxbow margins. A *Salix bebbiana* (Bebb willow) community occurs on a terrace between the arms of the oxbow and as a narrow and discontinuous band along the oxbow edge. The portion of this community that occurs on the terrace has a dense understory of *Calamagrostis canadensis* (bluejoint reedgrass) and has an insignificant presence of exotic species. In contrast, a *Populus tremuloides* / *Poa pratensis* (quaking aspen / Kentucky bluegrass) community that occupies the rest of the terrace has a high cover of the exotic pasture grasses *Phleum pratense* (common timothy) and *Poa pratensis* (Kentucky bluegrass).

Key Environmental Factors

Seasonal groundwater fluctuations from the East Rosebud Creek are the primary influence on oxbow vegetation. Past grazing is probably a contributing factor for the abundance of exotic grasses and the paucity of *Calamagrostis canadensis* (bluejoint reedgrass) in the *Populus tremuloides* / *Poa pratensis* (quaking aspen / Kentucky bluegrass) community.

Rarity

No special status or tracked plant or animal species were observed. One G3 community, *Salix bebbiana* (Bebb willow), was documented in excellent condition.

Other Values

An adult *Sphyrapicus nuchalis* (red-naped sapsucker) was observed feeding chicks in the *Populus tremuloides* / *Poa pratensis* (quaking aspen / Kentucky bluegrass) community.

Land Use

The state land section is grazed, but the oxbow area is fenced off and is not currently grazed. It is possible that trespass cattle could access the site from the private land to the west.

Exotics

Exotic species are mostly restricted to the *Populus tremuloides* / *Poa pratensis* (quaking aspen / Kentucky bluegrass) community and to the portion of the *Salix bebbiana* (Bebb willow) community that occurs on the margin of the oxbow. These communities have high cover of *Phleum pratense* (common timothy) and *Poa pratensis* (Kentucky bluegrass). *Cynoglossum officinale* (hound's tongue), *Cirsium arvense* (Canada thistle), and *Arctium sp.* (burdock) are present at low cover. *Poa palustris* (fowl bluegrass) is present at low cover in the *Carex utriculata* (beaked sedge) community.

Uplands

The uplands appear to be used primarily for livestock grazing. Subdivision is occurring throughout the bottomland along East Rosebud Creek, and there are residences immediately adjacent to the site.

Information Needs

When was the fence around the oxbow installed? What was the grazing history? Why is the *Salix bebbiana* (Bebb willow) community so free of exotic pasture grasses?

Management Needs

The noxious weeds are present at low cover and should be eradicated. The western boundary of the State Land section should be fenced.

Flathead Creek / Brackett Creek

Directions

This site is located on the east side of the Bridger Mountains including the watershed from Flathead Pass south to Ross Pass. From Bozeman take Highway 86 approximately 187 miles northeast to Brackett Creek. The site can also be accessed by heading north 1.5 miles from Wilsall, then turning east on the county Road following Flathead Creek towards Flathead Pass, approximately 13 miles.

Description

This site encompasses the upper tributaries of Brackett Creek and Flathead Creek which contain populations of genetically pure *Oncorhynchus clarki bouvieri* (Yellowstone cutthroat trout). For the Brackett Creek drainage, this includes tributaries upstream from Horse Creek (i.e., North, South and Middle Forks of Brackett Creek). Within the Flathead Creek drainage, the tributar-

ies upstream from Green Canyon Creek have been included in this site, including: Cache Creek, Fairy Creek, Corral Creek, and the North, Middle, and South Forks of Flathead Creek. Elevations at this site range from 5412 ft. (1650 m) to 9663 ft. (2946 m).

Rarity

Upper reaches and /or tributaries of Flathead and Brackett Creeks contain populations of genetically pure Yellowstone cutthroat trout with moderate to substantial habitat value (as rated by fisheries biologists).

Exotics

Rainbow, brook and brown trout occur within the Flathead Creek and Brackett Creek watersheds. The occurrence and extent of exotic plant infestations is unknown.

Information Needs

Information is needed on the presence and distribution of barriers to fish movement that would protect the integrity of populations of pure Yellowstone cutthroat trout. Surveys for animals, plants and communities of special concern are needed.

Gardiner

Directions

The Gardiner Site includes the Yellowstone River Watershed from the Lamar River watershed (in Yellowstone National Park) downstream to the Mill Creek drainage on the east and the Trail Creek Drainage on the west. This site includes Mammoth, WY, and Gardiner, Chico, and Emigrant, MT. Follow Highway 89 south from Livingston, MT approximately 18 miles to where the highway intersects the northern boundary of the megasite (ca. 3.5 mi. south of the Loch Leven Campground on the Yellowstone River).

Description

The Gardiner Site includes the northern range of Yellowstone National Park (portions of the Gardner and Lamar River drainages) and numerous smaller drainage basins from the Lamar River Valley to Mill Creek and Trail Creek (south of Livingston). It includes the entire Mill Creek and Tom Miner /Rock Creek drainages. Primary land ownership is by Yellowstone National Park, Gallatin National Forest, and private interests. Extensive winter range and migration routes for *Cervus elaphus* (elk), *Odocoileus hemionus* (mule deer), *Odocoileus virginianus* (white-tailed deer), *Alces alces* (moose), *Ovis canadensis* (bighorn sheep), *Bos bison* (bison) and *Antilocapra americana* (antelope) are present within this megasite. *Ursus arctos horribilis* (grizzly bear) and *Canis lupus* (grey wolf) recovery zones overlap with this megasite. The headwaters of many of the tributaries to

the Yellowstone River contain genetically pure *Oncorhynchus clarki bouvieri* (Yellowstone cutthroat trout) populations, in the absence of contaminating species (e.g., Mol Heron Creek, Tom Miner Creek, Rock Creek, Fridley Creek, and Sixmile Creek). Three USDA Forest Service Proposed Research Natural Areas (Sliding Mountain, Passage Creek and Eask Fork Mill Creek Proposed RNAs) occur within this megasite as well as a portion of the Beartooth-Absaroka Wilderness area. The Mountains and foothills segments of this site contain expansive tracts of relatively undisturbed habitat. Several geothermal springs and cave sites occur within this site. Winter range components of the Upper Yellowstone megasite have been identified by members of the Northern Range Working Group (scientists from state and federal agencies studying ungulate ecology in the northern range). Yellowstone cutthroat trout habitat / population priorities are being incorporated into a multi-agency management (Bruce May, Gallatin National Forest, Pers. Comm.). All drainages with pure strain or even with less than 3% rainbow alleles should be considered a priority for conservation. Elevations range from 4920 ft (1500 m) at the northern boundary along the Yellowstone River valley to 11208 ft. (3417 m) at Mount Cowan, the tallest peak in the Absaroka Mountains. Several geothermally-influenced springs occur within this site.

Key Environmental Factors

The lower elevation ungulate winter range on the northern range (i.e., Lamar Valley to Yankee Jim Canyon along the Yellowstone River) is primarily the result of rainshadow effects. In addition, heavy snow accumulations in the higher elevations (9,000 - 11,000+ ft.) are the recharge for the Yellowstone River watershed. The timing and severity of snow accumulation and cold temperatures are primary determinants of the timing and extent of the ungulate migrations. Fire is also a driving force in the region, particularly for the *Pinus contorta* (lodgepole pine) communities, where stand-replacing fires are important. Fire also plays a critical role in maintaining sagebrush / grassland communities. Geothermal activity is important within this megasite. Climate conditions vary with elevation, slope and aspect. Precipitation ranges from 10 inches at Gardiner to more than 50 inches in the higher elevations. Highest precipitation in Gardiner (ele. 5286 ft.) occurs during April through July, while at Cooke City (ele. 8157 ft.) precipitation falls relatively consistently throughout the year (ca. 2 inches / month).

Rarity

The primary value of this site is the extensive ungulate winter range. The “Northern Range” of Yellowstone National Park provides habitat for more than 20,000 elk, which exhibit the largest ungulate migration in the contiguous United States. This site also contains core habitat for large wide-ranging carnivores (e.g., grizzly

bear, wolverine, and reintroduced wolf populations). The combined presence of the ungulate populations and large predators allows for the existence of major predator-prey relationships, which are probably found nowhere else in the lower 48.

Exotics

There are numerous exotic species that are or potentially could be damaging to native species. The top five noxious plants are spotted knapweed, Russian knapweed, leafy spurge, dalmation toadflax and sulfur cinquefoil. Exotic trout species, primarily *Oncorhynchus mykiss* (rainbow trout) pose a significant threat to Yellowstone cutthroat trout. Domestic livestock compete with native ungulates for forage.

Information Needs

Information on the status and extent of riparian communities is needed as well as information on the fluvial geomorphology of the Yellowstone River and its tributaries. Threats, particularly at the ecosystem level, are not fully identified or understood. Many areas are unsurveyed for species and communities of special concern. Potentially important sites that have either not been surveyed or were incompletely surveyed include: Mill Creek Crystal Cave, Montanapolis Cave, Travertine Caves, Aldrich Pit, Bear Creek Thermal Spring, LaDuke Hot Springs and Chico Hot Springs, and the wetland complex in the Hellroaring Creek, Buffalo Creek, and Sough Creek Drainages on the northern boundary of Yellowstone National Park.

Gardiner / Bear Creek

Directions

This site is located at the base of the Absaroka Mountains along the Yellowstone River valley, beginning approximately 4 miles northwest of Gardiner, MT (northeast of Highway 89) and extending upstream along the Yellowstone River to include the Black Canyon of the Yellowstone River, in Yellowstone National Park, WY.

Description

The Gardiner / Bear Creek site is characterized by mountainous low elevation slopes, ridges and benches, including Deckard Flats and riverine habitats from the Yellowstone River at Black Canyon to the Gardiner River. Elevations within this site range from 5248 ft. (1600 m) to 7705 ft. (2349 m). The climate, topographic exposure, and vegetation provide for critical ungulate winter range, staging and migration. Bear Creek Springs consists of a series of warm-water seeps (24 deg. C / 75.2 deg. F) at the confluence of Bear Creek and the Yellowstone River. Numerous small caves and fissures are found with the travertine deposits adjacent to Gardiner (north and east) and provide habitat for bats. Many of these small caves

have been destroyed by quarrying. The travertine deposits also provide substrate for rare and unusual plant and natural communities.

Key Environmental Factors

Rain-shadow effects from the Gallatin and Yellowstone Plateau are determinants of the winter range within this site. Fire is an important process in maintaining sagebrush grassland / forest ecotone. Ungulate grazing is an important factor in shaping vegetation communities, and the extent of ungulate grazing is heavily dependent upon snow depth, which varies annually.

Rarity

This site is renowned as a critical winter range and migrating route for Yellowstone ungulates. The Deckard Flat and flats south east of the north entrance to Yellowstone National Park are major staging areas for migrating *Cervus elaphus* (elk) and provide important winter range for *Ovis canadensis* (bighorn sheep), *Antilocapra americana* (antelope), *Odocoileus hemionus* (mule deer) and *Bos bison* (bison). Ungulates provide a prey base for *Ursus arctos horribilis* (grizzly bear) that utilize this area, and reintroduced *Canis lupus* (wolves) which may also occur in this site. The lower portion of Bear Creek is an important tributary for spawning trout, both native and exotic. *Haliaeetus leucocephalus* (Bald eagle) and *Pandion haliaetus* (osprey) forage along the Yellowstone and Gardner Rivers and *Histrionicus histrionicus* (harlequin duck) are found on the Yellowstone River in Black Canyon. Two historic *Falco peregrinus* (peregrine falcon) eyries are located within this site. Calcareous soils near the travertine deposits have a *Artemisia nova* / *Pseudoroegneria spicata* (blacksage / bluebunch wheatgrass) shrubland that is uncommon in Montana. Three rare plants are recorded from this site *Erigeron linearis* (linear-leaf fleabane), *Eleocharis rostellata* (beaked spikerush) and a rare *Castilleja exilis* (Indian paintbrush). An isolated population of sagebrush lizards occupies the Bear Creek Springs area.

Exotics

The extent of exotic plant infestations is not known. Yellowstone National Park does map exotic plant populations. Dalmatian toadflax invasion is of primary concern. Exotic *Oncorhynchus mykiss* (rainbow trout) pose threats to the genetic integrity of *Oncorhynchus clarki bouveri* (Yellowstone cutthroat trout).

Information Needs

Surveys of the travertine deposits for rare plants and bat habitat are needed. The Bear Creek Springs area also needs to be surveyed for rare plants and animals. Information on the extent and pattern of grizzly bear use of this area would be beneficial.

Government Island

Directions

Government Island is located at the confluence of the Bighorn River with the Yellowstone River, approximately 3 miles east of Custer, MT.

Description

Government Island is a large island (ca. 0.66 mi. sq.) in the Yellowstone River at the confluence with the Bighorn River. The island is covered with extensive *Populus deltoides* (cottonwood) forests.

Key Environmental Factors

Fluvial processes are necessary for the development of gravel bars, as well as frequent spring floods, to provide suitable habitat for the establishment of cottonwood and willow.

Rarity

Government Island was identified in the 1986 Montana Natural Areas Proceedings as “an excellent example of riparian plains cottonwood galley forest” and as a staging area for migrating *Haliaeetus leucocephalus* (bald eagle) during the spring. The value of this site is attributed to the occurrence of a bald eagle nest and a *Ardea herodias* (great blue heron) rookery on a smaller island less than 0.25 mi. east of Government Island. *Trionyx spiniferus* (spiny softshell) is recorded from this section of the river.

Information Needs

An evaluation of the status and condition of the riparian community is needed and the extent of exotic plant infestations determined. Survey for plants and animals of special concern are also needed.

Grove Creek Aspens

Directions

Note: this site is on private land, and landowner permission is needed to access this site. Grove Creek Aspens is located west of the Clark’s Fork Yellowstone River in south central Montana. From Belfry, travel south 4.5 miles on State Route 72 to an intersection with an un-named road headed west. Travel west on the un-named road for 6 miles to Grove Creek Aspens.

Description

This mosaic of aspen and alkaline meadow lies on a gently sloping plain at the eastern base of the Beartooth Mountains. Several creeks drain through the aspen groves and some spring/seeps that arise in the aspen stands are the primary water source for the site. Because this site occurs in the rain shadow of the Beartooth

Range, the climate is very arid. This fact makes the aspen stands even more significant, as they are surrounded by *Artemisia nova* (black sagebrush)-dominated shrub herbaceous vegetation. The most striking community at this site is the aspen forest, which is composed of both *Populus tremuloides* / *Cornus sericea* (quaking aspen / red osier dogwood) and *Populus tremuloides* / *Prunus virginiana* (quaking aspen / common chokecherry) stands. Both these communities are characterized by an aspen-dominated overstory and a very dense shrub layer, except for some spots on the margins of the stands that have been impacted by cattle grazing. In one wetter area within the *Populus tremuloides* / *Prunus virginiana* stand there is a *Prunus virginiana* community that lacks an aspen overstory. Surrounding the aspen stands are alkaline wet meadows composed of a variety of communities. The most common plant association is *Pascopyrum smithii* (western wheatgrass), which generally occurs on the east side of the aspens. Although this community is dominated by *Pascopyrum smithii*, the canopy is not very dense and much open ground is apparent. Other associated species are *Spartina gracilis* (alkali cordgrass), *Muhlenbergia richardsonis* (mat muhly), *Iris missouriensis* (western blue flag), and *Antennaria* sp. (pussytoes). Dominance shifts to a *Spartina gracilis* community in a few areas, which are otherwise similar in composition to the former community. Salt efflorescence is evident on the soil surface. Two exotic-dominated communities, *Agrostis stolonifera* (redtop) and *Elymus repens* (quackgrass), also occur in the wet meadow. On the west or uphill side of the aspen groves, *Spartina pectinata* (prairie cordgrass) and *Glycyrrhiza lepidota* (American licorice) communities dominate the alkaline meadow community. Canopy coverage in these communities is higher and less open ground is visible. Along some of the creek corridors there are narrow riparian communities dominated by *Betula occidentalis* (water birch). A *Carex utriculata* (beaked sedge) community occupies some of the lower gradient areas. In the ecotone between the alkaline wet meadow and the upland there is an *Artemisia cana* / *Pascopyrum smithii* (silver sage / western wheatgrass) community, which has an overstory dominated by *Artemisia cana* with some *Chrysothamnus viscidiflorus* (green rabbit brush) cover, and an undergrowth dominated by *Pascopyrum smithii*.

Key Environmental Factors

In this very arid valley in the rainshadow of the Beartooth Range, the presence of perennial seepage and springs is the prime driver of plant community development.

Rarity

No rare plants or animals were observed. Four G3 or rarer plant associations in good to excellent condition were surveyed. These are *Populus tremuloides* / *Prunus*

virginiana (quaking aspen / chokecherry), *Betula occidentalis* (river birch), *Spartina pectinata* (prairie cordgrass), and *Spartina gracilis* (alkali cordgrass).

Other Values

The following animal species were observed in the course of inventory: *Centrocercus urophasianus* (sage grouse), *Circus cyaneus* (northern harrier), *Crotalus viridis* (western rattlesnake), and *Odocoileus hemionus* (whitetail deer).

Land Use

Cattle grazing is occurring with the accompanying trails and minor introduction of exotics. At the time of the site visit, utilization of graminoids was quite low. A reservoir just east of the wetlands could concentrate cattle in the vicinity.

Exotics

Exotic pasture grasses, such as *Bromus inermis* (smooth brome), *Poa pratensis* (Kentucky bluegrass), and *Phleum pratense* (common timothy), and noxious weeds, including *Cirsium arvense* (Canada thistle), *Cirsium vulgare* (bull thistle), and *Cynoglossum officinale* (hound's tongue) have increased as result of grazing.

Uplands

On the surrounding private and public lands, intensive grazing is the primary use.

Information Needs

This site should be visited in spring/early summer for a complete description of community composition and a thorough rare plant survey should also be conducted.

Management Needs

The aspen component should be examined to see whether the age/size class structure and disease conditions could be improved by conducting a prescribed burn. Livestock numbers on the wet meadow portion should be carefully monitored and livestock should be kept off for a longer period in the spring to avoid hummocking. A noxious weed management plan is needed to prevent new introductions and pursue eradication/reduction of the existing populations.

Hailstone National Wildlife Refuge

Directions

Hailstone National Wildlife Refuge is located in the Lake Basin in south central Montana. From Rapelje, 24 miles north of Columbus on State Route 306 proceed east on the Rapelje-Molt Road for 4 miles to the Hailstone road. Travel 1 mile north on the Hailstone road to the entrance to Hailstone National Wildlife Refuge.

Description

This is a large, shallow brackish lake in the Lake Basin area of central Montana. Several intermittently flowing creeks drain into the lake, and one intermittent creek drains out of the lake. The north shore of Hailstone Lake has a very low gradient. During wet climatic periods (e.g., several years with ample precipitation), Hailstone Lake fills with water and expands to the north. During drier periods, the lake shrinks and leaves expansive unvegetated alkaline mud flats around a small body of water. The upland is a combination of native and disturbed grassland, and the exotic grass *Poa pratensis* (Kentucky bluegrass) is a common species. Wetland communities tolerant of moderately to highly saline conditions occur as a narrow fringe around the edge of Hailstone Lake and along the outlet creek. Immediately adjacent to the mud flats are narrow patches of *Puccinellia nuttalliana* (Nuttall's alkaligrass) and *Distichlis spicata* (saltgrass) communities. Slightly higher on the topographic gradient and somewhat drier is an exotic-dominated disturbance community. A variety of mustard and *Chenopodium* spp. (goosefoot) species dominate this community. Along the outlet creek there are *Schoenoplectus maritimus* (saltmarsh clubrush) and *Schoenoplectus pungens* (threesquare) communities in the wetter areas. *Distichlis spicata* and *Triglochin concinnum* (graceful arrowgrass) form small patches and narrow fringe communities at just a slightly higher point on the moisture gradient. Aquatic vegetation grows in the standing water, but the mud was too deep for this community to be sampled.

Key Environmental Factors

This site is a closed basin with no surface outlet, and the soils in this vicinity are derived from clay substrates, which means they swell on wetting and are consequently poorly drained. The restricted drainage results in the basin accumulating water in pluvial times and the formation of wetland communities.

Rarity

Two species of special concern were observed: *Himantopus mexicanus* (black-necked stilt) and *Cynomys ludovicianus* (black-tailed prairie dog). No information was collected on the extent of the prairie dog colony.

Other Values

Recurvirostra americana (American avocet), *Limosa fedoa* (marbled godwit), *Numenius americanus* (long-billed curlew), *Dolichonyx oryzivorus* (boblink), and a species of dung beetle were all observed within the wetland site.

Land Use

An impoundment at the outflow on Hailstone Lake raises the lake level several feet. In the past, most of the

uplands were farmed down to and through the low prairie zone. This has resulted in the development of the disturbance communities that now dominate most of the wetland edge.

Exotics

An extensive disturbance community, dominated by *Poa pratensis* (Kentucky bluegrass) and *Sonchus* spp. (mostly *Sonchus uliginosus* [marsh sow-thistle]), now dominates the low prairie and wet meadow zone.

Uplands

The uplands within the National Wildlife Refuge are not grazed or farmed. A road traverses the eastern edge of the lake about 50 feet from the edge of the current mudflat. Outside the Refuge, strip-cropped wheat is grown and these lands drain into the Refuge and lake.

Information Needs

What effects might the farmland drainage water have on the composition of the wetlands, particularly the microfauna and food chain in general?

Management Needs

A management plan for the exotic species in "low prairie" needs to be developed. Strip-cropped wheat farms have led to a hyper salinity problem in Hailstone Lake, which will be placed on 303(d) list in the year 2000 as a water-quality limited water body (R. Apfelbeck, pers. comm.).

Halfbreed National Wildlife Refuge

Directions

Note: a portion of this site is located on private land, and landowner permission is required to access this area. Halfbreed National Wildlife Refuge is north of the Yellowstone River in south central Montana. From Rapelje, 24 miles north of Columbus on State Route 306, travel about 7.25 miles east of Rapelje on the Rapelje-Molt Road to an un-named road to the south. Proceed approximately 0.5 mile due south to Halfbreed National Wildlife Refuge.

Description

This site is located in the Lake Basin area of central Montana. It is a closed basin comprising four large, interconnected, shallow brackish lakes as well as numerous small alkaline potholes. During wet climatic periods (e.g., several years with above average precipitation), the lakes fill with water. However, in dry years and over the course of most growing seasons, the lakes decline and leave expansive unvegetated alkaline mud flats around a shrunken body of water. Several intermittently flowing creeks drain into Halfbreed Lake (one of which is from Hailstone Lake). When Halfbreed Lake is full, it drains into Goose Lake, which is also fed by the

intermittent Cedar Creek. When full, Goose Lake drains into Grass Lake, which in turn drains into Big Lake.

Stuckenia pectinata (sago pondweed) is the dominant species at Halfbreed and Grass Lakes across the dried-out lakebeds, and appears to be a major component of submergent vegetation throughout the series of lakes. *Typha latifolia* (broadleaf cattail) and *Eleocharis sp.* (spikerush) occupy drier habitats. The *Typha latifolia* community occurs along the channel of the outflow creek from Halfbreed Lake (which was dry during the site visit), and the spikerush community occurs in a dry pothole. There are also some patches of apparently dead *Schoenoplectus acutus* (hardstem bulrush) and *Schoenoplectus pungens* (threesquare) in Halfbreed Lake. The low-lying flats surrounding these lakes support patches of *Hordeum jubatum* (foxtail barley) and *Pascopyrum smithii* (western wheatgrass) but are mostly dominated by a *Sarcobatus vermiculatus* / *Pascopyrum smithii* (black greasewood / western wheatgrass) community. It is expansive, and there are small inclusions with very high coverage of exotic species, such as *Agropyron cristatum* (crested wheatgrass), *Lepidium perfoliatum* (clasping pepperweed), and *Bromus commutatus* (meadow brome). However, coverage of exotics is generally low, and the community is in good condition, especially in relation to other examples of this community in the basin. Only one aquatic community was sampled during this site visit. The water at this site is quite saline (conductivity = 17,500 $\mu\text{S}/\text{cm}$).

One-time visits have limited use for evaluating succession, but it appeared that permanent emergent vegetation at the shoreline, including *Hordeum jubatum* (foxtail barley) and *Puccinellia nuttalliana* (Nuttall's alkali grass), was being replaced by annual species of alkali flats, such as *Chenopodium rubrum* (red goosefoot), *Chenopodium glaucum* (oakleaf goosefoot), and *Kochia scoparia* (summer cypress). These changes are consistent with a natural drawdown trend in a drought cycle.

Key Environmental Factors

The closed basin (a relatively uncommon geomorphological feature), coupled with soils weathered from a substrate high in clays and of low permeability, has created a condition promoting intermittent flooding, salt accumulation, and ponding of water. This flooded condition in turn structures the plant communities. The erosion and vegetation at the perimeter of Halfbreed Lake indicates that the lake levels are or were artificially elevated.

Rarity

Three species of special concern were observed: *Athene cunicularia* (burrowing owl), *Himantopus mexicanus*

(black-necked stilt), and *Cynomys ludovicianus* (black-tailed prairie dog).

Other Values

A one-time observation showed the following to be present (in addition to the species of concern): *Recurvirostra americana* (American avocet), *Limosa fedoa* (marbled godwit), *Ardea herodias* (great blue heron, 20+ observed), *Olor columbianus* (tundra swan), numerous duck species, *Thamnophis sirtalis* (common garter snake), and *Antilocapra americana* (pronghorn antelope).

The large complex of wetlands and their abundance of sago pondweed are significant for spring waterfowl migration. The decline of emergent cover in the current drought cycle temporarily reduces waterfowl breeding habitat value.

Land Use

Neither grazing nor hunting is currently permitted. Banding of waterfowl takes place on an annual basis.

Exotics

Numerous exotics/increaser species occur in a 20-30 foot band on the lake margin mud flat. These include *Lepidium perfoliatum* (clasping pepperweed), *Chenopodium album* (lambquarters), *Chenopodium rubrum* (red goosefoot), *Tragopogon dubius* (goat's beard), *Iva axillaris* (poverty-weed), *Rumex spp.* (dock or sorrel), and *Kochia scoparia* (summer cypress). These species are typically found on alkali flats and appear to be replacing patches of dead emergent vegetation including *Schoenoplectus americanus* (American bulrush) and *Schoenoplectus acutus* (hardstem bulrush) along parts of the lakeshore. Patches of *Bromus commutatus* (meadow brome), *Lepidium perfoliatum*, and *Agropyron cristatum* (crested wheatgrass) are found within the *Sarcobatus vermiculatus* / *Pascopyrum smithii* (black greasewood / western wheatgrass) plant association.

Uplands

Most of the surrounding uplands are either strip-cropped wheatlands or heavily grazed rangelands. Greasewood flats extend onto private property in areas. A prairie dog town occurs on both sides of the northern refuge border and extends into the *Sarcobatus vermiculatus* (black greasewood) habitat.

Management Needs

The *Sarcobatus vermiculatus* / *Pascopyrum smithii* (black greasewood / western wheatgrass) habitat that prevails around the lakes is in good to excellent condition, but it has unusual levels of vegetation litter accumulation. This situation warrants further management consideration. Ironically, it is possible that in the

absence of occasional grazing, the idle condition may shift the composition in favor of ruderal species.

Hell's Canyon

Directions

Hell's Canyon is in the Absaroka Range in south central Montana. Hell's Canyon is adjacent to Hells Canyon Campground 24 miles south of McLeod on State Route 298.

Description

This wetland is a series of marshes and wet meadows formed by beaver dams and connected by a small creek. This drainageway, alluvial in origin, flows into the Boulder River. Old beaver dams helped form this wetland, and the uppermost marsh still ponds water year-round. *Carex utriculata* (beaked sedge) and *Calamagrostis inexpansa* (narrow-spiked reedgrass) fringe the pond and an *Alnus incana* (mountain alder) community dominates the creek bottom down to the next marsh. A *Carex utriculata* community that is being invaded by *Calamagrostis inexpansa* and the exotic *Poa palustris* (fowl bluegrass) dominates this next marsh, which appears to be drying out. The part of this marsh just above the beaver dam is very wet and still dominated by *Carex utriculata*. The lowest marsh has another *Carex utriculata* community that also appears to be drying out; *Poa palustris* and *Calamagrostis inexpansa* are also increasing in cover in this marsh. *Pinus contorta* (lodgepole pine) and *Pseudotsuga menziesii* (Douglas-fir) forest dominate the uplands.

Key Environmental Factors

Castor canadensis (beaver) activity and seasonal high water cause flooding that in turn structures the communities present.

Rarity

An uncommon G3 community, *Alnus incana* / *Calamagrostis canadensis* (mountain alder / bluejoint reedgrass), occupies a minor portion of the wetland.

Other Values

Alces alces (moose) have heavily browsed the willow component. *Ondatra zibethica* (muskrats) were noted in the open water. *Rana pretiosa* (spotted frogs) were flushed in a number of plant communities.

Land Use

The only impacts to the site, and these are hypothesized, are trampling from fishermen and past grazing, which would account for the populations of exotic species.

Exotics

Within the *Alnus incana* (mountain alder)-dominated community are inexplicably dense patches of *Cirsium arvense* (Canada thistle). In the wet meadow portion of the site are numerous pasture grasses, including *Poa palustris* (fowl bluegrass), *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), and *Agrostis stolonifera* (redtop), any of which can compete for dominance with the native dominants, primarily *Calamagrostis stricta* (narrow-spike reedgrass). *Phalaris arundinacea* (reed canarygrass) constitutes a threat in the meadow below the pond.

Uplands

A road runs parallel to the west edge of the site at the toe of the slope and crosses the inlet creek as well. Several dispersed campsites were found next to the pond.

Information Needs

What factors account for the high cover of *Cirsium arvense* (Canada thistle) in parts of the site? Could it be that the site is alluvial in nature and the seeds of weedy species are simply washed-in?

Management Needs

Make certain that beaver have access to the area so they in turn can maintain natural processes that result in the wetland's health and extent.

Horsethief Station

Directions

Horsethief Station is located in the foothills and high plains of south central Montana. From Red Lodge, travel north on U.S. Highway 212 for a little over 1 mile. Turn east on a dirt road signed for Rock Creek fishing access. Follow this road for a little less than 2 miles. The access is signed.

Description

Horsethief Station is located in the floodplain of Rock Creek. In this reach, Rock Creek is braided with two or three primary channels and many dry (at time of survey) gravel-cobble bed overflow channels. Channel banks are eroded and the system appears to be downcutting. The microtopography of the floodplain is complex with many swales and old channels. Much of the floodplain appears to be above the flood prone zone (twice the stage height at bankfull).

Most of the site is occupied by mature cottonwood gallery forest. Two communities comprise these forests: *Populus balsamifera* ssp. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) and *Populus*

balsamifera sap. *trichocarpa* / *Symphoricarpos occidentalis* (black cottonwood / western snowberry). The *Populus balsamifera* sap. *trichocarpa* / *Cornus sericea* association occurs on mid-channel bars and more mesic portions of the floodplain, while the *Populus balsamifera* sap. *trichocarpa* / *Symphoricarpos occidentalis* community occurs on higher floodplain deposits above the flood prone zone. Mesic swales that intercept groundwater are interspersed throughout these communities and support an *Alnus incana* / *Calamagrostis canadensis* (mountain alder / bluejoint reedgrass) community.

Old beaver activity has created ponded areas that have silted up and now support small *Carex utriculata* (beaked sedge) and *Carex pellita* (woolly sedge) communities and larger *Salix boothii* / *Carex utriculata* (Booth's willow / beaked sedge) and *Salix boothii* / *Calamagrostis canadensis* communities. There is also a small patch of *Populus tremuloides* / *Prunus virginiana* (quaking aspen / chokecherry).

Key Environmental Factors

Fluvial processes, such as seasonal flooding and high groundwater, and the associated channel migration and microtopography are the primary influences on vegetation structure and composition at this site. Past beaver activity is also very important and has created ponded areas that support mesic sedge and willow communities. Finally browsing by wild ungulates (perhaps elk and moose) has altered the structure of the shrub layer in some cottonwood stands by suppressing and reducing the cover of palatable species, such as *Cornus sericea* (red-osier dogwood).

Rarity

No special status species were observed. Four G3Q or G3? communities were documented: *Populus tremuloides* / *Prunus virginiana* (quaking aspen / chokecherry), *Populus balsamifera* sap. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood), *Alnus incana* / *Calamagrostis canadensis* (mountain alder, bluejoint reedgrass), and *Carex pellita* (woolly sedge). These occurrences range from small (*Carex pellita*) to moderately sized (*Populus balsamifera* sap. *trichocarpa* / *Cornus sericea*) and are in fair to good condition. Generally, more mesic sites are in better condition and less affected by exotic species.

Other Values

Although there are several diversion ditches upstream of and within this reach, this section of Rock Creek appears to support important hydrologic functions, such as dynamic water storage and surface water - groundwater interactions. The floodplain is still accessed by surface and subsurface flooding regimes, and native vegetation

appears to be highly connected and to occupy much of the floodplain.

Land Use

This site is a dedicated recreation site, and there are many informal trail throughout. The site is well browsed, but not apparently by livestock. One low-flow side channel is blocked by a cobble and plastic-lined dam and is diverted into a small ditch, probably for irrigation use.

Exotics

Exotic species are well established in portions of this site. Pasture grasses, such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), and *Dactylis glomerata* (orchard grass), are abundant in drier portions of the site. Some cottonwood stands have herbaceous openings with well-established patches of noxious weeds, including *Centaurea maculosa* (spotted knapweed), *Leucanthemum vulgare* (ox-eye daisy), *Cynoglossum officinale* (hound's tongue), and *Cirsium arvense* (Canada thistle).

Uplands

Native vegetation occupies the floodplain of Rock Creek along the active channels immediately up and downstream of the site. Adjacent land uses are pasture and housing/ranchettes.

Information Needs

How do irrigation diversions affect the functionality of the site?

Management Needs

Although pasture grasses are very well established at the site, noxious weeds, such as *Centaurea maculosa* (spotted knapweed), *Cynoglossum officinale* (hound's tongue), and *Euphorbia esula* (leafy spurge), are currently present at low cover and could be eradicated or controlled with a weed management plan.

Lamar River

Directions

Absaroka Range, Lamar River drainage, ranging from Tower Junction 30 air miles east to Hoodoo Basin and from Slough Creek about 23 air miles south to Pyramid Peak.

Description

Site is focussed on the Lamar River drainage and surrounding watersheds. The site encompasses Little Buffalo, Slough, Rose, Soda Butte, Cache, Calfee, and Miller Creeks on the north side of the drainage, and Mist, Cold, Willow, Buffalo, Timothy, Flint, Opal, Unnamed, Chalcedony, Amethyst, Jasper, and Crystal Creeks on the south.

Rarity

The Lamar River site was designed for wide-ranging carnivore species that occur in the area. The ranges for grizzlies, lynx, wolverine, wolf, and bison overlap here, so this area provides habitat for a variety of species that require large ranges.

Line Creek Plateau To Pryor Mountains

Directions

The site extends from the east side of the Beartooth Mountains eastward to the Pryor Mountains. The west end is located 5 miles south of Red Lodge, MT and is accessed from Highway 212. The site can also be accessed from Billings by taking Interstate 90 to the Laurel, and south on Highway 310 approximately 33 miles (about 2 mi. south of Bridger, MT).

Description

This regional site is a premier alpine and desert region that contains an exceptional array of physiographic, climatic and geologic conditions that results in an extremely diverse flora and fauna. The site includes an extensive alpine area on Line Creek Plateau in the Beartooth Range, the dome shaped Pryor Mountains to the south, and the desert region between. Elevations range from 3739 ft (1140 m) to 10112 ft (3083 m). The abrupt elevational change along the east flank of the Beartooth Mountains near Meeteetsee Spires is one of the most severe in Montana.

Alpine communities occur above 9,500 ft and are dominated by low shrubs and herbaceous vegetation. *Pseudotsuga menziesii* (Douglas fir) and limber pine dominate montane forests; subalpine forest have *Abies lasiocarpa* (subalpine fir), *Picea engelmannii* (Engelmann spruce) and *Pinus albicaulis* (white bark pine). Utah juniper and pine woodlands grow in the foothills and rock-crops in the center of the basin. Bunchgrasses and xerophytic shrubs dominate low elevation arid portions of the bighorn basin. Wetlands are rare in the limestone and desert environment; wet meadows and aspen groves occur sporadically on the alluvial fans just east of the Beartooth front. Saline marshes are found along Sage Creek.

Key Environmental Factors

Primary factors influencing the flora and fauna of this region are the diverse environmental gradients. Extremes in elevation and precipitation (rain-shadow effects) are critical factors. The Line Creek Plateau (ele. 10,000 ft) may receive in excess of 40 inches of annual precipitation, the eastern foothills, alluvial fans and northern Bighorn Basin are in the rainshadow of the Beartooth Mountains and may receive less than 6 inches of annual precipitation. Biogeographic factors, such as the Great

Basin influence and geographic isolation, are also important. Numerous species with Great Basin affinities are at the northern extent of their range in this site.

Fire was probably infrequent in the desert and woodland regions due to paucity of fuels. Coniferous forests were maintained as a mosaic of different age classes by ground and stand-replacing fires.

Rarity

This site has very rich biological diversity values due to the environmental gradient, geographic location and plant endemism. The bighorn desert region contains many endemic and peripherally rare plant and animal species. Desert grasslands, shrubland and woodland communities are more typical of the Great Basin and Colorado Plateau. *Juniperus osteosperma* (Utah juniper) and *Cercocarpus ledifolius* (mountain mahogany) are very unusual and considered rare communities in Montana. Both white tailed and black tailed prairie dogs are found in this site. Mountainous regions have a number of arctic-alpine plant species that are disjunct or at the southern edge of their range. This region may have the highest plant endemism in Montana (eight plant species). In all, there are dozens of plants and animals of concern in this site.

Other Values

The desert region site is potentially a corridor between the Bighorn Mountains and the Greater Yellowstone Ecosystem (Absaroka-Beartooth Wilderness Area) and could serve as a linkage area for migratory ungulates and wide-ranging carnivores.

Land Use

In the lower elevation, agriculture is the primary land use producing alfalfa, sugar beets, corn and cattle. Cattle graze low elevation grassland and shrublands and particularly riparian environments. The region has year round recreational activity. The open vegetation of the desert region is attractive to off road vehicle use; the alpine areas receive visitors via mountain bikes in the summer and snowmobile in the winter. Salvage harvest of windthrow has occurred in the Pryor Mountains and aspen groves have been harvested in the past.

Exotics

Centaurea maculosa (Spotted knapweed) and *Euphorbia esula* (leafy spruce) are locally common on the alluvial fans east of the Beartooth Front. *Cirsium arvense* (Canada thistle) and *Sonchus spp.* (sow thistle) are present in wetlands. Some wet meadows in the grove creek area have been planted to Eurasian meadow grasses and used for hay. *Elaeagnus angustifolia* (Russian olive) and *Tamarix ramosissima* (salt cedar) are found along the Clarks Fork of the Yellowstone River.

Information Needs

Absence of beaver in the Sage Creek and Crooked Creek should be investigated. Inventory for the occurrence and distribution of exotic plant infestations should continue. Additional surveys for animals of special concern are needed. New surveys for terrestrial mollusks should be done in the aspen stands .

Management Needs

Natural fluvial processes are essential to maintain cottonwood forests along the Clark's Fork of the Yellowstone River. Livestock grazing can be a compatible rangeland use, however efforts to continue to control excess use in riparian area in order to maintain willow communities and normal stream geomorphology are needed. Noxious weeds should be controlled. Control of off-road vehicle activity should be considered, especially when damage to rare plants or wildlife is detected

Little Moose Lake

Directions

Beartooth Plateau, complex of lakes, streams, and wetlands between Clay Butte on the east and the Clark's Fork of the Yellowstone River to the west. A pack trail from US Highway 212 leads north through the site, passing through Little Moose Lake.

Description

The boundaries were drawn to include the wetlands that support populations of ten boreal disjunct species and to provide additional habitat for them. This complex of subalpine bogs, lakes, and streams ranges from Bugle Lake on the west to Muddy Creek on the east. The site has subalpine communities of *Pinus contorta* / *Vaccinium scoparium*, *Abies lasiocarpa* / *Vaccinium scoparium*, and *Picea engelmannii* / *Linnaea borealis* on rolling glaciated granitic bedrock. Fens, willow carrs, and hummocks are found around ponds and along streams, and there is an unusual occurrence of floating Sphagnum mats along Little Moose Lake. Riparian areas are characterized by a diversity of vegetation communities including *Betula* stands, *Carex rostrata* Herbaceous vegetation, *Salix wolfii* / *Carex aquatilis*, *Calamagrostis canadensis* herbaceous vegetation, and *Salix planifolia* / *Carex aquatilis* (Jones and Fertig 1999b).

Key Environmental Factors

Floating bogs.

Climate

A continental, mountain climate prevails - cold winters with high snowfall and warm summers with afternoon rainfall.

Rarity

The site contains ten rare plant species, one of which is on the US Forest Service Region 2 Sensitive Species list *Agoseris lackschewitzii* (pink agoseris). Seven of these species are peripherals that are on the edge of their range in Wyoming, although they are common elsewhere. There are also two species that are sparsely distributed throughout their range. Three US Forest Service Sensitive animals have also been recorded in the area (*Lynx canadensis*, *Gulo gulo luscus*, and *Accipiter gentilis*).

Other Values

Wildlife and recreation.

Exotics

Small amounts of *Poa pratensis* and *Taraxacum officinale* have been observed (Jones and Fertig, 1999).

Information Needs

Revisit the rare plant populations for better population estimates.

Lost Lakes

Directions

Lost Lakes are located in the Absaroka Range in south central Montana. From McLeod, travel south on State Route 298 for 0.5 mile. Turn onto the West Boulder Road and travel west-southwest for approximately 12 miles to the West Boulder trailhead. Travel south on Forest Trail 41 for approximately 1 mile. Follow an informal trail up the eastern slope of the valley for a little over 1 mile to Lost Lakes.

Description

This site consists of two lakes located on a small bench on the lower slope above the West Boulder River. The lakes have formed in shallow, glacial depressions, and receive both surface and groundwater inflows. A small creek drains the lower lake. Wetland communities fringe both lakes. *Schoenoplectus acutus* (hardstem bulrush) and *Typha latifolia* (broadleaf cattail) dominate the wettest communities. These communities are semipermanently flooded, and while *Schoenoplectus acutus* fringes both lakes, *Typha latifolia* is confined to small patches. A *Carex utriculata* (beaked sedge) community dominates drier, seasonally flooded sites. The upper edge of this community has a few individual *Alnus incana* (mountain alder) shrubs and sapling-sized *Picea engelmannii* (Engelmann spruce). Pasture grasses, mostly *Poa pratensis* (Kentucky bluegrass) and *Phleum pratense* (common timothy) dominate the immediate uplands, and *Poa pratensis* is well established in the *Carex utriculata* community. There is also a very small *Carex nebrascensis* (Nebraska sedge) community along the lower lake.

Key Environmental Factors

Ground and surface water inflows and water level fluctuations are important influences on plant community structure.

Rarity

No rare plants, animals, or communities were observed at this site.

Other Values

Rana pretiosa (spotted frogs) were observed in the lake.

Land Use

This site receives some recreational use, and there is some pugging in the *Carex utriculata* (beaked sedge) community, possibly from horse use. The presence of pasture grasses implies that the site may have been grazed in the past.

Exotics

Poa pratensis (Kentucky bluegrass) and *Phleum pratense* (common timothy) are present in the uplands. *Poa pratensis* is well established in the drier margins of the wetland.

Uplands

The site is located in the Absaroka-Beartooth Wilderness Area. The lake basin does not appear to receive heavy recreational use.

Information Needs

What is the grazing history of the site? Is presence of pasture grasses a product of recreational stock use?

Mary Bay / Yellowstone

Directions

North shore of Yellowstone Lake starting at the confluence of Pelican Creek, about 1 mile east of Fishing Bridge Campground and about 2 miles east of Lake Junction on East Entrance Road. Site continues east along the shore of Yellowstone Lake and inland about 1 mile from the lakeshore to Steamboat Point. The site includes Mary Bay, Storm Point, Beach Springs, Indian Pond, and Steamboat Springs.

Description

This site contains a thin strand of sandy beaches on the northern shore of Yellowstone Lake. Several thermal features are included along the lakeshore. Surrounding forested areas provide a buffer around the lakeshore. The East Entrance Road bisects the site. Several large ponds are also contained.

Key Environmental Factors

Substrate, wind erosion.

Climate

A continental, mountain climate prevails - cold winters with a goodly amount of snow, and warm summers with afternoon rainfall.

Rarity

The site contains the only confirmed occurrence of a G1 ranked element (*Abronia ammophila*), even though this occurrence is ranked B? It also contains a high ranking occurrence of *Haplopappus macronema* var. *linearis* (T2) and a cluster of S1 state rare plant and animal species. The site also includes habitat for grizzly bears.

Other Values

Habitat for bison, moose, and other large game animals. A suite of rare animals is known from other lakeshore locations and could also occur here (including boreal toad, common loon, American white pelican, trumpeter swan, bald eagle, and Franklin's gull). Area is of high value for scenic qualities and recreation.

Information Needs

Better information is needed on the locations of elements within the site. Several additional rare animals may occur here, but confirmation is needed. Management needs of *Abronia ammophila* need to be determined.

Main Boulder

Directions

Note: This site is located on private land, and landowner permission is needed to access this site. The Main Boulder site is located in the foothills of the Beartooth Mountains in south central Montana. From McLeod, travel south on State Route 298 for approximately 10 miles. The site is located approximately 0.5 mile past the Natural Bridge trailhead.

Description

This site occurs on the floodplain of the Main Boulder River along the active channel and associated oxbows. *Populus balsamifera* sap. *trichocarpa* (black cottonwood) and *Populus tremuloides* (quaking aspen) forest occupies the majority of the floodplain. Most of these stands are affected by historic grazing. They have a minimal shrub component and an herbaceous layer dominated by exotic grasses such as *Agrostis stolonifera* (redtop), *Bromus inermis* (smooth brome), and *Phleum pratense* (common timothy). Cottonwood and aspen cover is primarily from mature trees. In contrast to the above-described stands, this site also supports an outstanding example of a *Populus balsamifera* sap. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) community. Occurring on the inside of a meander bend, this community has an overstory dominated by mature (24-inch diameter-at-breast-height and larger) *Populus balsamifera* sap.

trichocarpa and a well established mid-canopy of *Populus tremuloides*. The shrub layer is diverse with good *Cornus sericea*, *Symphoricarpos occidentalis* (western snowberry), and *Prunus virginiana* (chokecherry) cover, and the presence of exotic species is minimal.

Wetter areas on the site, such as floodplain swales and old oxbows, support well-developed sedge and aquatic communities. A *Carex utriculata* (beaked sedge) community with abundant *Carex vesicaria* (inflated sedge) cover occupies the silted in portions of old oxbows. A small depressional wetland has an open water component that supports a *Potamogeton richardsonii* - *Myriophyllum spicatum* (red-head pondweed - water milfoil) aquatic community. A *Salix exigua* (sandbar willow) community fringes many of these low areas. Willow communities also occur on lower portions of the floodplain such as aggrading point bars. These communities, including *Salix exigua* and small stands of *Salix lucida* ssp. *caudata* (shining willow) and *Salix lutea* / *Calamagrostis canadensis* (yellow willow / bluejoint reedgrass), have high cover of exotic herbaceous species.

Key Environmental Factors

The primary factors influencing vegetation at this site are fluvial dynamics, including flooding, erosion and deposition, and channel migration. Historic grazing is probably an important influence in reducing or eliminating the floodplain forest's shrub component and increasing the abundance of exotic species.

Rarity

No special status plant or animal species were observed. One G2 community, *Potamogeton richardsonii* - *Myriophyllum spicatum* (red-head pondweed - water milfoil), was documented in very good condition. Three G3 communities were documented: *Salix lucida* ssp. *caudata* (shining willow) and *Salix lutea* / *Calamagrostis canadensis* (yellow willow / bluejoint reedgrass) in fair to poor condition and *Populus balsamifera* ssp. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) in excellent condition.

Other Values

Fluvial processes, such as flooding and associated sediment erosion and deposition, are still largely intact. This provides opportunity for cottonwood regeneration at the site.

Land Use

The effects of historic grazing have altered the structure and composition of cottonwood and aspen stands. Current browsing by wild ungulates, such as *Alces alces* (moose), may be contributing to the suppression of palatable native shrubs like *Cornus sericea* (red-osier

dogwood). Horses lightly browse portions of the site. This has created some pugging in oxbow wet sedge communities. Signs of trespass cattle were observed in the riparian area east of the active channel. The site also receives angling use from the adjacent property.

Exotics

Herbaceous exotic species are well established at the site. The exotic grasses *Bromus inermis* (smooth brome) and *Agrostis stolonifera* (redtop) dominate the understory of many of the cottonwood and aspen stands. The noxious weeds *Cirsium arvense* (Canada thistle) and *Tanacetum vulgare* (common tansy) and the highly invasive *Phalaris arundinacea* (reed canarygrass) are locally abundant.

Uplands

The surrounding uplands are largely intact. Livestock grazing is widespread in the bottomland along the river corridor, and some riparian forest has been converted to hay pasture.

Information Needs

What is the site's grazing history? Is the abundance of *Bromus inermis* (smooth brome) and *Agrostis stolonifera* (redtop) affecting the recovery of native shrub species? What is the stability of the active channel?

Management Needs

Controlling exotic pasture grasses is probably not feasible; however, the smaller populations of *Cirsium arvense* (Canada thistle) and *Tanacetum vulgare* (common tansy) might be manageable.

Main Boulder River

Directions

The Main Boulder River Site is located on the north face of the Absaroka-Beartooth complex, north of the Beartooth Plateau. The site is located approximately 24 miles southwest of Big Timber, MT and 18 miles southwest of McLeod, MT, and accessed via Highway 298 and Forest Service Road 6639.

Description

This site includes the main stem of the Boulder River corridor, expanded at the upper (south) end of the drainage to encompass the extreme headwaters (South Fork of the Boulder, Sheep Creek, Basin Creek) of the main Boulder River. Besides these major river tributaries, three naturally occurring caves are within the site, Boulder River Cave, Boulder River Indian Cave, and West Boulder Cave. Natural Bridge State Monument is within this site. Limestone outcrops, steep cliffs and riparian environment enrich the biodiversity at this site. Elevations for this site range from 5500 ft (1676 m) at the

north to 10662 ft (3240 m) at the south end (headwaters) of the drainage.

Key Environmental Factors

The hydrology, limestone geology and topography are important environmental factors.

Rarity

The primary biodiversity features are aquatic, riverine / wetland communities, forest carnivores and ungulate winter range. There are populations of genetically pure *Oncorhynchus clarki bouvieri* (Yellowstone cutthroat trout) in the Hawley Creek and the headwaters of South Fork Boulder Creek. The main Boulder River, near Box Canyon has pure Yellowstone cutthroat trout, but with contaminating species (i.e., rainbow trout). Grizzly bears are likely to occur through the entire site, although the recovery zone is only in the upper portions of this site. Other carnivores that could occur in this site include *Canis lupus* (gray wolf) and *Lynx canadensis* (Canada lynx). The main Boulder River and East Fork of the Boulder provide habitat for *Histrionicus histrionicus* (harlequin duck). The river bottom and lower slopes provide winter range for *Alces alces* (moose), while the west-facing slopes of the drainage are winter range for *Cervus elaphus* (elk) and *Odocoileus hemionus* (mule deer). Winter range for *Ovis canadensis* (bighorn sheep) is found at the very head of the Boulder River. Two historic *Falco peregrinus* (peregrine falcon) eyries are present at this site. A rare *Discus shimaki* (land snail) is present at the Natural Bridge State Monument. Rare plants include *Erigeron eatonii* spp. *eatonii* (Eaton's daisy), *Salix wolfii* var. *wolfii* (wolf's willow) and *Aquilegia brevistyla* (short-styled columbine).

Exotics

Oncorhynchus mykiss (rainbow), *Salmo trutta* (brown) and *Salvelinus fontinalis* (brook) trout occur in the Boulder River drainage and can potentially compete or hybridize with Yellowstone cutthroat trout. The occurrence and extent of exotic plant infestations is unknown.

Information Needs

Surveys of three cave sites (Boulder River Cave, Boulder River Indian Cave, and West Boulder Cave) should continue for bats. Anderson's Spring should be surveyed for endemic insect species. Additional surveys for plants, animals, and communities of special concern are needed in this area.

Mammoth

Directions

Yellowstone Plateau - the site lies to the south and east of Mammoth Hot Springs in Yellowstone National Park on the Loop Road. Mammoth includes the Park Head-

quarters and can be reached from any Park road in the summer; in the winter, the road is open to the north, and one can drive in from Gardiner, MT, about 5 miles north. The site lies just south of the inhabited area and includes some wooded, but mostly open slopes of Mt. Bunsen that undulate down the Gardner River Valley to the river bottom, then east to Lava Creek, and up the other side of the valley. The Hot Springs are included as well, which allows for a wide range of habitats in the area.

Description

The site encompasses a wide range of habitats on the hillsides of the Gardner River where it is joined by Lava Creek. The slopes are open, generally grassy meadows with scattered aspen and conifers; the lower slopes grade into sagebrush grasslands and some rocky, steep cliffs above the river bottom. Both the Gardner River and Lava Creek run through fairly deep canyons, so there is an elevational gradient throughout the site. The site includes the travertine terraces of Mammoth Hot Springs which are used in winter by elk and bison, and perhaps other animals.

Key Environmental Factors

The elevational gradient that characterizes the site is caused by the erosion of the rivers and the surrounding geology that is carved out. The thermal features at the Hot Springs are independent of the rivers and geology.

Climate

A continental, mountain climate prevails - cold winters with significant snow depth, and warm summers with afternoon rainfall.

Rarity

Occurrences in the site generally have a GRank of G4 or G5. However, the regularity with which animals are seen, the concentration of occurrences, and the locations of Mammoth Hot Springs within the site tend to make it a more significant area that would be thought from the ranks of the known species in the area.

Other Values

Although there is a great deal of activity associated with the Mammoth Visitor Center, it is still possible to see a great deal of wildlife in the area, and most of the area is fairly pristine.

Land Use

The land is currently used mostly for recreation by Park visitors. Since this is the Park Headquarters, there is heavy human use in the tourist season (which includes summer and winter), including hiking, mountain biking, visits to the Hot Springs Terraces, heavy car traffic, fishing, etc. in the summer, and as a destination point within the Park for snowmobilers in the winter. In spite of

the heavy use, animals still use the area probably due to the warmth from the Hot Springs. Additionally the elevation drops here rather abruptly from the higher plateau to the south, also making it warmer which may be a factor in the off-season.

Exotics

Many exotic weeds were observed around the Hot Springs terraces, probably brought in by the thousands of summer visitors.

Information Needs

A thorough survey of the site would help define the boundaries.

McDonald Basin

Directions

McDonald Basin is located in the Beartooth Mountains of south central Montana. From Dean, travel southwest-erly on Benbow Road for approximately 1.5 miles to a junction with an un-named road to the south. Follow this road for 0.1 mile to a 4-wheel drive trail continuing to the south. Continue on the 4-wheel drive trail for 2 miles to the site.

Description

This complex of wetlands occurs in the montane zone on the flanks of the Beartooth Mountains. The site is characterized by glacially formed depressions dissected by small streams. These depressions, as well as *Castor canadensis* (beaver) activity along the stream courses, have created the current wetland complex. In addition, a few fens have formed on gently sloping ground around seeps. Both the glacial potholes and the beaver-dammed wetlands are dominated by marsh vegetation, primarily *Carex utriculata* (beaked sedge). Some wetter zones are dominated by *Glyceria borealis* (northern mannagrass), and *Nuphar lutea* (yellow pond-lily) dominates permanently flooded areas in the center of ponds. *Alnus incana* (mountain alder) stands have formed in the seeps and springs that permeate this area. Small inclusions of wetter areas within the alder stands are dominated by graminoids like *Carex utriculata* and *Calamagrostis canadensis* (bluejoint reedgrass). *Alnus incana* stands also occur along streams, as do stands of *Salix geyeriana* / *Carex utriculata* (Geyer's willow / beaked sedge). A couple of small fens have formed either in basins fed by groundwater or around seeps on gentle slopes. A poorly described community type, which has a low coverage of *Dasiphora fruticosa* *sap. floribunda* (shrubby cinquefoil) and undergrowth dominated by *Carex buxbaumii* (Buxbaum's sedge), dominates the fen vegetation. Other associated species are *Carex interior* (inland sedge), *Carex lasiocarpa* (slender sedge), *Juncus alpinus* (northern rush), *Agrostis scabra* (tickle

grass), *Menyanthes trifoliata* (bog buckbean), *Aster junciformis* (rush aster), and a nearly continuous blanket of moss cover. Forests of *Pinus contorta* (lodgepole pine) and *Abies lasiocarpa* (subalpine fir) with undergrowth of *Spiraea betulifolia* (birchleaf spiraea) and *Vaccinium globulare* (globe huckleberry) dominate the surrounding uplands.

Key Environmental Factors

Seeps, streamflow, and beaver activity all contribute to structuring these wetlands.

Rarity

Three G3 communities in good condition were documented: *Alnus incana* / *Carex* spp. (mountain alder / sedge), *Carex buxbaumii* (Buxbaum's sedge), and *Dasiphora fruticosa* *sap. floribunda* / *Carex* spp. (shrubby cinquefoil / sedge). Community diversity at this site is very high.

Land Use

Hiking and hunting can be expected as a trail (old jeep road) does traverse a portion of this wetland. Livestock grazing occurs within the site as well, though only the *Alnus incana* / *Carex* spp. community has received such use as to produce hummocking.

Exotics

The following exotic species generally comprised at most 1% cover in drier portions of the site: *Cirsium arvense* (Canada thistle), *Cirsium vulgare* (bull thistle), *Phleum pratense* (common timothy), *Poa pratensis* (Kentucky bluegrass), and *Poa palustris* (fowl bluegrass).

Uplands

Forests in the immediate upland are second growth. There are a couple of diversion ditches that formerly were used to augment the water levels in the lakes below the McDonald Wetlands.

Information Needs

None were noted.

Management Needs

A weed management plan is particularly needed for the noxious weeds, such as *Cirsium arvense* (Canada thistle), but grazing management should be part of the plan to control the other weeds/increaser species, such as *Poa pratensis* (Kentucky bluegrass).

Meeteetse Spires / Line Creek Foothills

Directions

This site is located on the northeast flank of the Beartooth Mountains (Line Creek Plateau foothills). From Red Lodge, take Highway 212 south 5 miles. The site

boundary is intercepted where Highway 212 crosses the Custer National Forest boundary.

Description

This site encompasses the foothills of the Line Creek Plateau and Meeteetse Spires. The Meeteetse Spires are a high narrow ridge of Madison limestone occurring along the east foothills, below the plateau, where an uplift has raised the sedimentary beds on edge. *Artemisia tridentata* (sagebrush) steppe and *Pinus flexilis* (limber pine) woodland dominate these foothills. Several species of plants in the vicinity of Meeteetse Spires reach the northern limit of their geographical distribution in Carbon County, MT, and a number of northern Rocky Mountain limestone endemics occur on the limestone-derived substrate. At least 5 mammal species of special concern are known or likely to occur within this site. Also, the Madison limestone formations at Meeteetse Spires may provide habitat for a variety of bat species. The higher elevation slopes provide winter range for *Ovis canadensis* (bighorn sheep) and the lower slopes provide winter range for *Alces alces* (moose), *Cervus elaphus* (elk), and *Odocoileus hemionus* (mule deer). Elevations range from 5400 ft in the vicinity of Meeteetse Spires to 9000 ft near the Line Creek Plateau.

Key Environmental Factors

Extreme topographical gradient, rainshadow effects from the easterly position of this site relative to the Beartooth uplift, and local geology (i.e., limestone-derived soils) are major influencing factors.

Rarity

Meeteetse Spires is the largest of three known occurrences of *Shoshonea pulvinata* (Shoshonea) in Montana. Grassland and sagebrush steppe on sandy calcareous soils in the foothills and montane zones have populations of *Haplopappus carthamoides* var. *subsquarrosus* (Beartooth large-flowered goldenweed), a regional endemic. The Madison limestone formations may provide habitat for a variety of bat species. The biodiversity significance of this site is attributed to the inherent conservation value in the extreme elevational gradient and associated diverse habitats, and the occurrence of limestone-endemic plants.

Other Values

The exposed Madison limestone at Meeteetse Spires is an important geologic feature.

Land Use

The site is in relatively pristine condition. It has been used primarily for livestock grazing; there are some mining claim stakes on the ridges. A number of “two-track” roads traverse the area, especially in the lower, eastern portion.

Uplands

Surrounding land use is primarily associated with livestock grazing.

Information Needs

The Madison limestone formations at Meeteetse Spires should be inventoried for bats. Other surveys for animal species of special concern are needed.

Meeteetse Spires Macrosite

Directions

From Belfry, take Hwy. 72 south about 4 miles to County Road on the right; proceed west on this road about 5 miles to a gate; obtain permission, and after gate, proceed west to South Fork Grove Creek. Site is about 5 miles SSE of Red Lodge.

Description

The site encompasses a series of spectacular uplifts on the eastern edge of the Beartooth Mountains. Here the strongly-tilted Madison limestone is the dominant feature. The lower-elevation eastern portion is dominated by desert vegetation, while the higher, western portion comprises *Pseudotsuga menziesii* (Douglas-fir) forests and mountain sagebrush grasslands.

Key Environmental Factors

Soils derived from limestone, and dry climate are important environmental factors.

Rarity

Meeteetse Spires is the largest of three known occurrences of *Shoshonea pulvinata* (Shoshonea) in Montana. Also, these formations may provide habitat for a variety of bat species.

Other Values

The site includes important geological features, especially the greatly-tilted drape folds of Madison limestone that were formed by the uplift of the Beartooth Mountains.

Land Use

The site is in relatively pristine condition. It has been used primarily for livestock grazing; there are some mining claim stakes on the ridges. A number of “two-track” roads traverse the area, especially in the lower, eastern portion.

Exotics

There are currently no serious introduced weed problems.

Uplands

Surrounding land use is primarily for grazing.

Information Needs

The Madison limestone formations at Meeteetse Spires should be inventoried for bats. Rare plant monitoring studies should be established.

Meyers Creek

Directions

The Meyers Creek site is located at the base of the Beartooth Mountains in south central Montana. From Nye, travel north on State Highway 420 for about 1 mile. Turn west on Forest Route 2142, following Limestone Creek. Travel for 8.5 miles (turning north at Limestone) to the Meyers Creek Work Center. The site occurs as a series of discontinuous aspen and willow-dominated stands along Meyers Creek from the Work Center to approximately 1 mile upstream.

Description

This site is located along Meyers Creek. Stands of mesic aspen and willow, which occur as discontinuous patches along the creek and adjacent slopes, are the dominant communities. Throughout the site, riparian communities occur primarily as narrow stringers along the active channel of Meyers Creek. These communities are characterized by very small and discontinuous patches of *Picea engelmannii* / *Cornus sericea* (Engelmann spruce / red-osier dogwood) and small patches of *Salix boothii* (Booth's willow). These communities are very heavily grazed and have high cover of exotic grasses, such as *Bromus inermis* (smooth brome) and *Phleum pratense* (common timothy).

In a few locations, the riparian zone supports larger stands of mesic aspen communities. These stands also occur on adjacent toe slopes subirrigated by groundwater. The stands furthest upstream are *Populus tremuloides* / *Symphoricarpos albus* (quaking aspen / common snowberry) and *Populus tremuloides* / *Osmorhiza occidentalis* (quaking aspen / western sweet-cicely) (the diagnostic *Osmorhiza* species present is actually *Osmorhiza depauperata* [blunt fruit sweet-cicely]). These stands are small and impacted from grazing. A *Populus tremuloides* / *Cornus sericea* community occurs closer to the Work Center along the creek and on an adjacent toe slope. The portion of this community along Meyers Creek is heavily grazed and has abundant *Phleum pratense* and *Bromus inermis* cover. In contrast, the portion of this community on the toe slope appears to be lightly browsed. It has an open canopy of *Populus tremuloides* with minor colonization of *Picea engelmannii*. The shrub component is diverse with *Amelanchier alnifolia* (serviceberry) and *Symphoricarpos albus* abundant and *Cornus sericea* well represented. The herbaceous layer is diverse: *Elymus glaucus* (blue wildrye) is abundant and numer-

ous mesic forbs, including *Solidago canadensis* (Canada goldenrod), *Viola canadensis* (Canadian violet), *Osmorhiza depauperata*, *Heracleum maximum* (cow-parsnip), *Glycyrrhiza lepidota* (American licorice), and *Galium triflorum* (sweet-scented bedstraw) are common. This community also occurs in the Meyers Creek floodplain close to the Work Center, but this stand is characterized by an open overstory of mature and senescent *Populus balsamifera* ssp. *trichocarpa* (black cottonwood) with an open mid-canopy of *Populus tremuloides*. Saplings and small poles of *Picea engelmannii* are well established. *Cornus sericea*, *Salix boothii*, and *Symphoricarpos occidentalis* (western snowberry) dominate the shrub layer, while mesic forbs and grasses similar to the previous stand represent the herbaceous layer. These stands have low cover of several exotic species, including *Phleum pratense*, *Cynoglossum officinale* (hound's tongue), *Cirsium vulgare* (bull thistle), and *Bromus inermis*.

Uplands at the site are characterized by grasslands on south-facing slopes and *Picea engelmannii* / *Physocarpus malvaceus* (Engelmann spruce / ninebark) and *Pseudotsuga menziesii* / *Physocarpus malvaceus* (Douglas-fir / ninebark) stands on north-facing slopes.

Key Environmental Factors

Groundwater flows both along Meyers Creek and from adjacent slopes provide the site moisture that supports the mesic and riparian communities. Meyers Creek is an intermittent stream (dry during the site visit) with very little floodplain development. Portions of the site are heavily browsed, which has altered the structure and composition of vegetation at the site.

Rarity

No plant or animal species of special concern were observed. Very small examples of two G3? communities were documented in fair to good condition. These were *Populus tremuloides* / *Osmorhiza occidentalis* (quaking aspen / western sweet-cicely) and *Populus tremuloides* / *Symphoricarpos albus* (quaking aspen / common snowberry).

Land Use

Livestock actively grazes this site. A fence separates the upper and lower portions of the site. The upper portion is heavily grazed, while the lower portion receives some grazing pressure from horse and cow.

Exotics

Phleum pratense (common timothy) and *Bromus inermis* (smooth brome) are well established at the site. Other exotic species are currently present at low cover but are likely to expand in the future. These include *Cynoglossum officinale* (hound's tongue), *Cirsium vulgare* (bull thistle), and *Cirsium arvense* (Canada

thistle). On south-facing slopes, the adjacent upland communities have abundant *Phleum pratense* and *Bromus inermis* cover. This provides a large seed source for these species to colonize more mesic riparian sites.

Uplands

Livestock grazes the bottomland along Meyers Creek. The surrounding uplands are National Forest lands. These may also be grazed but have no other apparent management activities. Lands below the mouth of Meyers Creek in the Limestone drainage are in private ownership and ranching and agricultural land uses predominate.

Information Needs

What is the grazing history of the site?

Management Needs

Control of noxious weeds, especially *Cynoglossum officinale* (hound's tongue), *Cirsium vulgare* (bull thistle), and *Cirsium arvense* (Canada thistle), is needed. Also, the grazing intensity on the upper portions of the site should be reduced.

Mill Creek

Directions

Mill Creek flows from the Absaroka Mountains into the Yellowstone River from the east. The drainage is accessed from Highway 89 by turning east onto Mill Creek Road, approximately 36 miles north of Gardiner, MT and 17 miles south of Livingston, MT.

Description

The Mill Creek Site includes the entire upper Mill Creek drainage from approximately two miles northwest of the National Forest boundary. Approximately half of the site is within the Absaroka-Beartooth Wilderness. Genetically pure *Oncorhynchus clarki bouveri* (Yellowstone cutthroat trout) occur in the drainage. A barrier in the creek below the East Fork of Mill Creek prevents *Oncorhynchus mykiss* (rainbow trout) from moving upstream in the Mill Creek drainage. Fisheries biologists have rated the habitat for Yellowstone cutthroat trout as limited to moderate. This site provides important winter range for *Cervus elaphus* (elk), *Alces alces* (moose) and *Odocoileus hemionus* (mule deer). *Erigeron formosissimus* var. *viscidus* (fleabane) and *Carex multicosata* (many-ribbed sedge) are S1 plant species found within this site. Two caves (Mill Creek Crystal Cave and Montanaopolis Cave) may provide habitat for bats. However, the precise location of Montanaopolis Cave is unknown. Two proposed Research Natural Areas (East Fork Mill Creek Proposed RNA and Passage Creek Proposed RNA) occur within this site. The East Fork Mill Creek Proposed RNA contains *Picea engelmannii* /

Physocarpus malvaceus (Engelmann spruce / ninebark), *Picea engelmannii* / *Cornus stolonifera* (Engelmann spruce / red-osier dogwood), *Picea engelmannii* / *Linnaea borealis* (Engelmann spruce / twinflower), *Abies lasiocarpa* / *Linnaea borealis* (subalpine fir / twinflower), *Abies lasiocarpa* / *Vaccinium globulare* (subalpine fir / globe huckleberry), *Pseudotsuga menziesii* / *Physocarpus malvaceus* (Douglas-fir / ninebark), *Pseudotsuga menziesii* / *Carex geyeri* (Douglas-fir / elk sedge), *Pseudotsuga menziesii* / *Linnaea borealis* (Douglas-fir / twinflower) and *Festuca idahoensis* / *Agropyron caninum* (Idaho fescue / slender wheatgrass) habitat types. Also, several seeps and bogs occur within the Mill Creek Proposed RNA. The Passage Creek Proposed RNA contains *Picea engelmannii* / *Physocarpus malvaceus* (Engelmann spruce / ninebark), *Picea engelmannii* / *Linnaea borealis* (Engelmann spruce / twinflower), *Abies lasiocarpa* / *Linnaea borealis* (subalpine fir / twinflower), *Abies lasiocarpa* / *Vaccinium globulare* (subalpine fir / globe huckleberry), *Abies lasiocarpa* - *Pinus albicaulis* / *Vaccinium scoparium* (subalpine fir-whitebark pine / grouse whortleberry), *Pseudotsuga menziesii* / *Physocarpus malvaceus* (Douglas-fir / ninebark), *Pseudotsuga menziesii* / *Carex geyeri* (Douglas-fir / elk sedge), *Pseudotsuga menziesii* / *Linnaea borealis* (Douglas-fir / twinflower) and *Festuca idahoensis* / *Agropyron caninum* (Idaho fescue / slender wheatgrass), *Artemesia tridentata* / *Festuca idahoensis* (big sage / Idaho fescue) habitat types. Other forest habitat types and riparian types are present.

Key Environmental Factors

Elevation, slope and aspect are primary determinants in the location of ungulate winter range. Fire is a primary ecological process important to the maintenance of forest / meadow ecotones and a patchwork of vegetation types. Drainages to the north and west of the Passage Creek Proposed RNA burned in 1991.

Rarity

The primary value of the Mill Creek site is the existence of populations of genetically-pure *Oncorhynchus clarki bouvieri* (Yellowstone cutthroat trout). The presence of caves and two proposed Research Natural Areas contribute to the value of this site.

Exotics

Rainbow trout are present in the lower reaches of Mill Creek, apparently below a barrier. The extent of exotic plant infestation is unknown.

Information Needs

Survey of the Mill Creek Crystal Cave for bats and other cave-dwelling organisms is needed. Also an attempt should be made to locate and survey the Montanaopolis Cave. More extensive plant surveys are also needed.

Information on the extent and pattern of grizzly bear use of this area would be beneficial. Evaluation of condition and status of riparian communities is needed. Elevations at the site range from 5412 ft. (1650 m) to 9800 ft. (2809 m).

Mud Lake-Boulder River

Directions

Mud Lake-Boulder River is in the Absaroka Range in south central Montana. From McLeod travel 12 miles south on State Route 298 to Contact Creek. Mud Lake-Boulder River is located 1.5 miles westerly upstream on Contact Creek.

Description

Mud Lake is a shallow, seasonally flooded lake that occurs in a glacially formed depression along an intermittent creek. The creek, which is the primary water source, also drains the lake. The lake apparently dries down to a mud flat by the end of some growing seasons. At the time of the site visit, the lake was a mud flat dominated by equal portions of unvegetated mud and an *Eleocharis palustris* (common spikerush) community. The margins of the lake had a patchy drawdown zone where *Polygonum amphibium* (water smartweed) and *Mentha arvensis* (field mint) were common. At the upstream end of the lake, the *Eleocharis palustris* community graded into a *Carex utriculata* (beaked sedge) community on sites with a shorter period of standing water. Adjacent to the *Carex utriculata* community, and at a slightly drier position, is a *Salix drummondiana* / *Calamagrostis canadensis* (Drummond's willow / bluejoint reedgrass) community. The actual undergrowth dominant was *Calamagrostis inexpansa* (narrow-spiked reedgrass), which is considered by Hansen et al. (1995) to be an ecological equivalent of *Calamagrostis canadensis* for management purposes. The uplands are dominated by *Pseudotsuga menziesii* (Douglas-fir) and *Pinus contorta* (lodgepole pine) forests.

Key Environmental Factors

This wetland is the product of favorable geomorphology (a glacial depression) and proximity to an intermittent creek that seasonally floods. The flooding and drying-down processes structure the resulting plant communities.

Rarity

No rare plants or animals were observed. One G3 plant association, *Salix drummondiana* / *Calamagrostis canadensis* (Drummond's willow / bluejoint reedgrass), was documented in fair condition.

Other Values

Heavy use by ungulates was noted along with *Ursus americanus* (black bear) scat and tracks. *Rana pretiosa* (spotted frog) and *Thamnophis sirtalis* (common garter snake) were also present.

Land Use

No land use was apparent, though the area has high potential for hunting, outfitter, and wildlife watching use. An unconfirmed report indicates that a lodge on the Boulder River stages outfitted trips from this point. The ubiquity and abundance of pasture grasses and increaser forbs implies a past grazing use.

Exotics

Phleum pratense (common timothy) and *Poa palustris* (fowl bluegrass) are prevalent at the lake inlet. *Poa pratensis* is an important component in the upland meadow at the south end of the lake. Scattered populations of *Cirsium arvense* (Canada thistle) and *Trifolium pratense* (red clover) are present throughout the site.

Uplands

The meadow communities immediately adjacent to the wetlands have abundant cover of pasture grasses and increaser forbs, which indicates that the area was grazed in the past. Other uses or disturbances were not documented.

Information Needs

What is the reason for the high populations of pasture grasses?

Management Needs

None were identified.

Nurses Lake

Directions

Note: a portion of this site is located on private land, and landowner permission is needed to access that area. Nurses Lake is east of the West Boulder River in south central Montana. From McLeod, travel south on West Boulder Road for approximately 11 miles to un-named road bearing east. Proceed on the un-named road for 2 miles in a generally southeasterly direction to Nurses Lake wetland.

Description

This site is a complex of small, steep-sided, muck-bottomed glacial potholes located in a morainal landform surrounded by aspen-conifer forest. Based on the convex shape of the moraine and the low conductivity (160 $\mu\text{S}/\text{cm}$) of water in the potholes, the water source for this site is primarily precipitation and subsequent drainage into the potholes. Smaller potholes (0.5-1 ac)

generally have a fringe of *Carex utriculata* (beaked sedge) on the margin and a *Sparganium angustifolium* (narrowleaf bur-reed) community growing in the mucky-bottomed central portion of the pothole. *Sparganium angustifolium* grows as an emergent community in this setting; associated species include *Sagittaria cuneata* (arumleaf arrowhead), *Potamogeton gramineus* (grassy pondweed), *Ranunculus gmelinii* (Gmelin's buttercup), *Lemna minor* (common duckweed), and *Lemna trisulca* (star duckweed). Larger potholes (2-4 ac) have an aquatic community in the middle with *Carex utriculata* growing on the margins. Nearly all the potholes have scattered shrubs growing on the margins, including *Salix boothii* (Booth's willow), *Salix geyeriana* (Geyer's willow), and *Salix bebbiana* (Bebb willow). The surrounding uplands are mostly dominated by a *Populus tremuloides* / *Symphoricarpos* (trembling aspen / snowberry) cover type, which also has a high cover of *Calamagrostis rubescens* (pinegrass).

Key Environmental Factors

These glacial depressions are seasonally flooded by (mostly) overland flow. This dynamic is the primary factor for maintenance of these communities.

Rarity

No rare plants, animals, or communities were observed.

Other Values

Abundant *Rana pretiosa* (spotted frog) were found in the *Sparganium angustifolium* (narrowleaf bur-reed) community, and *Alces alces* (moose) were feeding in the various aquatic communities. Several specimens of a given type of snail were collected for identification.

Land Use

The *Carex utriculata* (beaked sedge) community is lightly grazed whether from *Alces alces* (moose) or cattle is unknown. Past grazing may have been intense, judging from the extent of exotic species and hummocking.

Exotics

The only exotics are in the bankfull area of drawdown zone and the immediate upland. These include *Cirsium vulgare* (bull thistle), *Cirsium arvense* (Canada thistle), *Cynoglossum officinalis* (hound's tongue), *Trifolium pratense* (red clover), and pasture grasses such as *Agrostis stolonifera* (redtop) and *Phleum pratense* (common timothy).

Uplands

Adjacent public lands are lightly grazed while those in private ownership are heavily impacted. Cattle use ponds in the near vicinity.

Information Needs

Some of the potholes had unusual algal blooms. Is this the result of excessive fertilization from cattle use in the basin?

Management Needs

The site could benefit from a weed management plan, while the population levels are still controllable.

Obsidian Creek

Directions

Yellowstone Plateau - along Obsidian Creek from Roaring Mountain downstream (north) to Willow Park. The site lies along the Loop Road for about 8 miles between Norris and Mammoth, starting at about 2.5 miles north of Norris. This road is closed in winter.

Description

The site encompasses the riparian area along upper Obsidian Creek. The creek occupies a generally narrow valley from the vicinity of Roaring Mountain downstream (north) to Willow Park. At times the valley is quite narrow, at other times it is broader, and only opens up to a meadow in the vicinity of Obsidian Cliff. The eastern edge of the valley is generally steep; the western edge increases and decreases with the underlying geology. The headwaters of Obsidian Creek are at Roaring Mountain, a thermal hillside that is quite active. The water and steam vents in the area tend to move around on a regular basis, triggered by earthquakes and landslumps. The creek is fed by hot springs (Clearwater and Apollinaris Springs) and geysers (Semi-Centennial Geyser) directly on the creek, and from tributaries to the east which also arise in thermal areas (Amphitheater Springs). It could be that these features tend to warm the temperature of Obsidian Creek enough so that it remains flowing throughout the year, but this hypothesis needs to be substantiated. The Loop Road closely follows Obsidian Creek for about 7.75 miles and is thus included in the site.

Key Environmental Factors

Since the site is a riparian area, continued creek flow is the primary key. The creek is known to flow all year long, so this is not a problem.

Climate

A continental, mountain climate prevails - cold winters with a high amount of snow, and warm summers with afternoon rainfall.

Rarity

Most of the occurrences within the site are ranked G4 or G5. The occurrence of *Rana lutrieventris*, G3G4, is historical, based on a specimen. *Eleocharis flavescens*

var. thermale has a rank of G5T2T3Q, but the occurrence itself is unranked. Due to the lack of information about the elements with higher priority GRanks, including the “Q” for the *Eleocharis sp.*, a preliminary rank of B4 has been assigned.

Other Values

Very scenic. It is expected that wide-ranging megafauna also use the area.

Land Use

Current land use is visits by summer tourists, for picnics and sightseeing. Many cars drive the road in summer, and there are 2 designated picnic grounds along the Creek. A campground is marked on both the 1:100,000 and the 1:24,000 maps at the north end of Willow Park, with accompanying structures like restrooms, water pumps, garbage shelters, etc.; it may no longer be operating. The road is closed in winter, but it is suspected that the area is used by winter visitors, both skiers and snowmobilers; the extent of the use is unknown.

Exotics

In a very brief survey in September 1997, no exotics were seen, but survey is needed. Exotics are expected near the road and visitor areas.

Information Needs

Survey to establish boundaries and determine associated elements are present. There may also be other elements in the area.

Pat O’Hara Mountain

Directions

Absaroka Mountains, Pat O’Hara Mountain on the eastern flank of the mountains. It is a distinctive east-west trending mountain about 15 miles northwest of Cody, on the divide between the Clark’s Fork and the North Fork Shoshone River drainages. In general, access is by foot from the numerous trails in the area. From the north, one can drive close to the site on a recent FS logging road off the Chief Joseph Highway. Roads also come near the site from the south and east, but they cross private land and may be closed or may be too muddy to drive on. Trails from the Rattlesnake Creek/Mountain area and Dead Indian Meadows allow access to the western part of the site; the hike can be from 5 to 10 miles on these trails.

Description

The area includes limestone outcrops on the flank and summit of Pat O’Hara Mountain, a distinctive east-west trending mountain at the edge of the Absaroka Range. Lower slopes are vegetated with Engelmann spruce/

heartleaf arnica forests, but there are also small stands of limber pine woodlands. Idaho fescue-tufted hairgrass, curly sedge-sheep cinquefoil, and mountain avens-curly sedge communities occur on the upper parts of ridges and on dry slopes. The underlying substrate is paleozoic dolomite, which supports a suite of plant species endemic to calcareous substrates. The tableland on the ridgeline of the mountain is very exposed and windy, and alpine habitat occurs at a lower elevation than usual. In some areas, the finer soil has blown away completely, leaving only pebbles and rocks. The site follows the 8800 foot contour up to Pat O’Hara Peak, at the summit of the ridge, although there are several other high points separated by saddles. WYNDD conducted a biological survey in the summer of 1997 to assess RNA values (Jones and Fertig 1999). There are many springs above 8800 feet due to the extensive faulting of the overthrust of limestone. The headwaters of seven creeks are within the site: Rattlesnake, Big Tree, and Iron Creeks draining into the North Fork of the Shoshone River; Pat O’Hara, Dry Fork of Pat O’Hara, Morning, and Dead Indian Creeks draining into the Clark’s Fork.

Key Environmental Factors

Geology - the limestone outcrop makes this a unique area.

Rarity

The rank of this site is based on the presence of several rare plant populations, including one of *Lomatium attenuatum* (Absaroka biscuitroot), a G3-ranked regional endemic, and *Festuca halli* (Hall’s fescue), a Region 2 Sensitive Species. There are also five uncommon regional endemics and peripheral species, including *Pyrrcoma carthamoides var. subsquarrosa* (a Region 2 Sensitive Species).

Land Use

There are many trails in the area, and a main trail over the divide between Dead Indian Meadows and Rattlesnake Creek runs across the western section of the site. The Mooncrest VABM (microwave repeater) is located on the top of Pat O’Hara Peak, and an old 4-wheel drive road to the installation is indicated on the map.

Exotics

No significant populations.

Management Needs

Most of the site is within the North Absaroka Wilderness Area. There are no obvious threats to the site, such as large populations of exotic plants, heavy livestock grazing, or heavy recreational use. Higher elevation areas are relatively difficult to access, and motor vehicles are prohibited (Jones and Fertig 1999).

Pine Ridge

Directions

Pine Ridge is located north of Hardin in south central Montana. From Hardin, take I-90 north to exit 495. Follow Hwy. 47, 2.5 miles north. Turn left at road 282. Travel 6 miles to road 34 which eventually reaches the top of Pine Ridge (approx. 6.5 miles). Follow road 271 to Section 22 which is state school section.

Description

Pine Ridge is an extensive uplifted sandstone plateau defined by a steep sandstone escarpment on the southwest and gently dipping towards the Yellowstone River to the northwest. It is typical of the arid uplifted plateaus and mesas in the sedimentary plains surrounding Billings, Montana. Pine Ridge is dissected by intermittent streams and coulees resulting in coulee slopes, ridges and benchlands. *Pinus ponderosa* / *Pseudoroegneria spicata* (ponderosa pine / bluebunch wheatgrass) woodlands occur on the ridge outcrops and coulee slopes where it forms a dominant woodland throughout. The woodland is interrupted by small patch *Pseudoroegneria spicata* herbaceous grassland types. Gentle slopes and benchlands on the plateau are dominated by *Pseudoroegneria spicata* grasslands; *Pascopyrom smithii* (western wheatgrass), *Stipa comata* (needle-and-thread grass), *Poa secunda* (sandberg's bluegrass) or *Koeleria macrantha* (junegrass) co-dominant with the *Pseudoroegneria* to form a matrix of four different herbaceous vegetation types. Pine Ridge drains to the north; alluvial materials collect in the intermittent stream bottom.

Key Environmental Factors

The arid environment coupled with coarse sandy soils weathered from sandstone contribute to a rather dry environment. Fire helps maintain the herbaceous grassland community ecotone and the low woodland cover values.

Rarity

The woodland and four grassland associations are all relatively common within the sedimentary plains. The uplifted sandstone plateau lends itself to an intact landscape with no barriers to fire spread or seed dispersal. The site is a large extensive area unbroken by crops or housing developments. Ungulates can cross the many fence lines that serve to keep cattle within pastures.

Other Values

Echinacea angustifolia is scattered along grassland benches throughout the state school sections. The site provides suitable habitat for Mule deer and antelope.

Land Use

Pine Ridge is primarily private property with some state school sections. The site was inventoried and described from a block of state land located on the benchlands and upper coulee slopes. Cattle grazing occurs throughout with subsequent fencing and salting sites and probably some water developments. Some logging has occurred in the past and many roads dissect the benchland.

Exotics

Annual bromes, *Bromus tectorum* (cheatgrass) and *Bromus japonicus* (Japanese brome) as well as *Plantago patagonica* (Indian-wheat) provide evidence of past grazing.

Information Needs

An inventory of the intermittent stream drainage bottoms at Kaiser Creek and Sand Creek would contribute to a more complete record for this site.

Management Needs

In many places, young *Pinus ponderosa* (Ponderosa pine) are filling in the grassland edges, a successional consequence of fire suppression. A prescribed burn, especially to control the young seedlings and saplings, would keep this successional sequence in check and maintain the herbaceous vegetation.

Pruit Park

Directions

Note: Pruit Park is located on private land, and land-owner permission is required to access this site. Pruit Park is located in the foothills of the Absaroka Range in south central Montana. From McLeod, travel south on State Route 298 for 0.5 mile. Turn onto the Wet Boulder Road and travel west-southwest for approximately 12 miles to the West Boulder trailhead. Hike east on Forest Trail 14. After reaching the top of the hill slope (approximately 1 mile), head cross-country bearing south-southeast for approximately 0.8 mile. The site is located on the northern edge of Pruit Park.

Description

Pruit Park occurs on an elevated bench of glacial origin, and the site receives groundwater from the adjacent slope. The site is dominated by a *Salix wolfii* / *Deschampsia caespitosa* (Wolf willow / tufted hairgrass) community. Shallow swales are more mesic and support *Carex aquatilis* (water sedge). Pole and sapling-sized clumps of *Picea engelmannii* (Engelmann spruce) are scattered throughout this community.

Key Environmental Factors

Subirrigation from the adjacent slope is the primary environmental influence on the vegetation at this site.

Rarity

No special status plant or animal species were observed. One G3 plant community, *Salix wolfii* / *Deschampsia caespitosa* (Wolf willow / tufted hairgrass), was documented in fair to good condition.

Land Use

Use of the site appears to be minimal. Cattle sign was observed, and willows are heavily browsed, although probably more by *Alces alces* (moose) than by cattle.

Exotics

Poa pratensis (Kentucky bluegrass) is well established in drier portions of the site.

Uplands

A cabin is located in Pruitt Park near the site. The site borders the Absaroka-Beartooth Wilderness Area and the landscape context is largely pristine.

Information Needs

What is the grazing history of the site? How heavy is wild ungulate browsing pressure?

Rattlesnake Mountain

Directions

Absaroka Range, Rattlesnake Mountain, extending from US Highway 14, 16 and 20 near Buffalo Bill Reservoir northwest to Pat O'Hara Basin, west-northwest of Cody (north side of North Fork Shoshone River drainage). Includes The Palisades and the upper end of the Rattlesnake Creek canyon.

Description

The site contains a broad, long ridgecrest with grasslands and forb communities, interspersed with lodgepole pine and subalpine fir forest stands. Soils are derived from limestone or the Chugwater formation and are often gravelly or high in organic matter. The Palisades portion is composed of steep, forested cliffs with limestone outcrops that are important rare plant habitat. Open meadows on the slopes and summits of low knolls are often dominated by *Festuca idahoensis*, *Koeleria macrantha*, or locally by *Festuca hallii*. They also may contain *Artemisia tridentata* var. *vaseyana* or, along draws, *Artemisia tridentata* var. *wyomingensis*. Boundaries were selected to encompass the habitat of a suite of calciphilic rare plants and communities. The site contains a broad, long ridge crest with grasslands and forb communities interspersed with lodgepole pine and subalpine fir forest stands. Soils are derived from limestone or the Chugwater formation and may be gravelly or high in organic matter. The Palisades portion is composed of steep, forested cliffs with limestone outcrops that are important rare plant habitat. Open meadows on the slopes and summits of low knolls are

often dominated by *Festuca idahoensis*, *Koeleria macrantha*, or locally by *Festuca hallii*. They also may contain *Artemisia tridentata* var. *vaseyana* or, along draws, *Artemisia tridentata* var. *wyomingensis*. Scenic values are high.

Key Environmental Factors

Limestone substrate.

Rarity

The site contains 2 A-ranked occurrences of *Shoshonea pulvinata* (G2G3S2) and a cluster of at least 8 other high ranking regional endemic plant species. Among the rare species are *Shoshonea pulvinata* (Shoshonea), *Festuca hallii* (Hall's fescue) and *Pyrrocoma carthamoides* var. *subsquarrosa* (Absaroka goldenweed), which are listed as sensitive by the U.S. Forest Service. *Lomatium attenuatum* (Absaroka biscuitroot) and *Selasphorus rufus* (Rufous hummingbird) also occur off of the Forest on nearby BLM land.

Other Values

Great scenery, wildlife habitat.

Land Use

Timber, recreation, possibly oil/gas in future, rangeland (grazing).

Information Needs

Site evaluation (Suitability Investigation Report).

Riverfront Park

Directions

Riverfront Park is located in the sedimentary unglaciated Great Plains of south central Montana. In Billings, travel south on South Billings Boulevard from Interstate 90. Riverfront Park is located just before the road crosses the Yellowstone River.

Description

Riverfront Park occurs on the floodplain of the Yellowstone River. The site is a mosaic of cottonwood forest interspersed with shrub openings, ponds, sloughs, and developed recreation and parking areas. Most cottonwood stands at this site are open gallery forests of mature *Populus deltoides* (plains cottonwood) with a mid-story of the exotic *Elaeagnus angustifolia* (Russian olive) and an understory dominated by exotic pasture grasses, predominately *Bromus inermis* (smooth brome) and *Poa pratensis* (Kentucky bluegrass). Within this community there are small inclusions where native shrubs are present. These patches have low to moderate cover of *Cornus sericea* (red-osier dogwood), *Acer negundo* (box-elder), *Salix lutea* (yellow willow), and *Toxicodendron rydbergii* (poison ivy). The eastern

portion of the site contains *Populus deltoides* stands with a dense cover of the exotic shrub *Rhamnus cathartica* (common buckthorn).

Fluvial processes, including erosion, deposition, and associated channel migration, are active at the site, and this has created suitable habitat for cottonwood regeneration. Young stands of *Populus deltoides* and *Salix exigua* (sandbar willow) are colonizing recent bars, with small *Populus deltoides* saplings primarily colonizing raised deposits of silt. In many areas, especially along side channels not having received recent deposition, there are stands of *Salix exigua* with a dense ground layer dominated by the aggressive exotic *Phalaris arundinacea* (reed canarygrass). Higher deposits have an older cohort of pole-sized *Populus angustifolia* (narrowleaf cottonwood) with an understory dominated by *Bromus inermis* and the noxious weed *Euphorbia esula* (leafy spurge).

This site also contains a small *Symphoricarpos occidentalis* (western snowberry) community with high cover of *Pascopyrum smithii* (western wheatgrass), small stands of *Typha latifolia* (broadleaf cattail) around ponds, and a very small stand of *Populus balsamifera* *sap. trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood).

Key Environmental Factors

Seasonal flooding and the resulting floodplain development is the primary abiotic influence at the site. *Castor canadensis* (beaver) are also important and are causing cottonwood and willow mortality in places.

Rarity

No rare plants or animals were observed. A very small example of a G3 community, *Populus balsamifera* *sap. trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) was documented in fair condition.

Other Values

While most of the cottonwood forests at this site are degraded, they still provide important habitat for wildlife, including nesting habitat for many species of Neotropical migrant birds. Also, active cottonwood regeneration is occurring at this site.

Land Use

This site is a county park, and it receives heavy recreational use, especially fishing use around the lakes. There are many paved roads and trails throughout the site, and vehicle tracks were observed on recent floodplain deposits.

Exotics

Exotic pasture grasses, primarily *Bromus inermis* (smooth brome) and *Poa pratensis* (Kentucky blue-

grass), dominate the ground layer at this site. In addition, several species of noxious weed are established, including *Euphorbia esula* (leafy spurge), *Centaurea maculosa* (spotted knapweed), and *Cynoglossum officinale* (hound's tongue). Wetter sites have heavy cover of *Phalaris arundinacea* (reed canarygrass). Perhaps most troubling, most of the cottonwood stands have a midstory dominated by *Elaeagnus angustifolia* (Russian olive). It is likely that as the cottonwoods die (and many of the cottonwoods are mature or senescent), these stands will convert to an *Elaeagnus angustifolia*-dominated community. This conversion will have unknown habitat and biodiversity implications.

Uplands

The surrounding area is dominated by urban and agricultural land uses.

Information Needs

What is the history of gravel extraction at the site?

Management Needs

The park needs a noxious weed management plan.

Sage Creek

Directions

Sage Creek is located west of the Pryor Mountains in south central Montana. From Warren, travel 1.25 miles south on State Highway 310 to Sage Creek wetland.

Description

This site is composed of marsh and willow bottom vegetation associated with the floodplain of Sage Creek, a meandering, low gradient stream in the northern end of the Bighorn Basin between the Beartooth Plateau and the Pryor Mountains. Surface and groundwater from Sage Creek are the water sources for this wetland. Some very old beaver dams suggest that beaver played a historic role in shaping these wetlands. There was no water flowing in Sage Creek at the time of the site visit. The adjacent upland is dominated by *Artemisia tridentata* (big sagebrush), *Sarcobatus vermiculatus* (black greasewood), and *Leymus cinereus* (basin wildrye). The wettest and largest community at the site is *Typha latifolia* (broadleaf cattail). Two minor communities, *Schoenoplectus maritimus* (alkali bulrush) and *Eleocharis palustris* (common spikerush), occupy slightly drier positions. *Carex pellita* (woolly sedge) is also a dominant community at the site and it occurs on positions somewhat drier than the previously listed communities. All these emergent communities occur in what are perhaps old oxbows or old beaver ponds associated with Sage Creek. Willow communities also form a significant portion of the site. *Salix exigua*

(sandbar willow) is a minor community that occurs on both low and high terraces. *Salix lutea* (yellow willow) forms the largest willow community. It occurs on a higher terrace, and it lacks any significant graminoid or forb coverage within the ground layer, possibly because of past grazing. Small patches of *Distichlis spicata* (saltgrass) can be found in the driest areas at the margins of the wetland.

Key Environmental Factors

This site receives annual floods and may be somewhat expanded in size due to past beaver activity.

Rarity

No rare plants, animals, or communities were observed.

Land Use

Though there has been grazing in the past current evidence points to low levels of grazing.

Exotics

Various combinations of *Sonchus uliginosus* (marsh cow-thistle), *Chenopodium album* (lambsquarters), *Alopecurus arundinaceus* (creeping foxtail), *Arctium minus* (common burdock), *Cardaria sp.* (hoarycress), and *Cirsium arvense* (Canada thistle) were found in all communities except for *Schoenoplectus maritimus* (saltmarsh clubrush).

Uplands

Upstream on Sage Creek there is a limestone mill and adjacent to the west is an active railroad line (effects of either, unknown). Livestock grazing occurs on adjacent private and public lands.

Information Needs

How has the highway and railroad affected the riparian ecology?

Management Needs

The dewatering of Sage Creek needs to be halted to preserve the extent of the wetland.

Sawtooth Fen-Palsa

Directions

Beartooth Plateau, wetlands about 0.8 air miles east of Sawtooth Lake and south of Sawtooth Mountain (south of Beartooth Pass).

Description

Sawtooth Fen-Palsa is the only known fen-palsa in the lower 48 states, representing the southernmost such occurrence in North America. Boundaries were drawn to enclose the fen-palsa and a buffer area. The area is a sub-alpine, shallow topographic drainage basin with

moderate slopes of southwest exposure surrounding flat, wet, boggy, bottomlands. The sub-alpine meadow has raised, frost-fractured peat polygons. The graminoid palsa is raised approximately 3 ft. above the surrounding *Carex* fen, and is underlain by permafrost and thermokarst topography, such as thaw depression lakes, rock polygons, and frost pillows. Additionally, peat beds have formed in the past. No high-priority plant or animal species are known at this time. Mosses (but no sphagnum), *Carex spp.*, and rushes characterize the fen, and low graminoids are found in the fellfields around the peatbeds. Shrubs and forest communities surround the area.

Climate

An alpine climate with cold winters, persistent snowfall, late springs, summers with cold nights and afternoon rainfall, and the possibility of snow at any time.

Rarity

This site was selected for its unusual permafrost-influenced peat and wetland communities and its *Deschampsia cespitosa* - *Carex spp.* herbaceous vegetation. This is the only known fen-palsa in the conterminous U.S., and the southernmost such occurrence in North America.

Other Values

Wyoming's only documented permafrost site; great scenery.

Land Use

Grazed, sometimes heavily; primitive dirt road nearby.

Information Needs

Suitability Investigation Report/Establishment Record. Field work is necessary to establish whether the site boundaries are sufficient to maintain the features for which the site was designed.

Sliding Mountain / Sixmile Creek

Directions

This site is located within the Absaroka Mountains, approximately 7 miles south of Emigrant, MT. Sixmile Creek flows into the Yellowstone River from the east. The site is accessed from Highway 89 by crossing the Yellowstone River at Emigrant to the East River road and following the East River Road south to Sixmile Creek Road.

Description

Sixmile Creek, from Gold Prize Creek to the North Fork of Sixmile Creek contains genetically pure Yellowstone cutthroat trout and the habitat value is rated as substantial by fisheries biologists. The North Fork of Sixmile

contains potentially pure Yellowstone cutthroat trout, with no record of contaminating species. Also, Big Pine Creek (tributary of Sixmile Cr.) may contain pure Yellowstone cutthroat trout. The Sliding Mountain Proposed RNA is located completely within the Sixmile Creek drainage. This proposed RNA contains *Picea engelmannii* / *Physocarpus malvaceus* (Engelmann spruce / ninebark), *Picea engelmannii* / *Galium triflorum* (Engelmann spruce / sweetscented bedstraw), *Picea engelmannii* / *Linnaea borealis* (Engelmann spruce / twinflower), *Abies lasiocarpa* / *Linnaea borealis* (subalpine fir / twinflower), *Abies lasiocarpa* / *Vaccinium globulare* (subalpine fir / globe huckleberry), *Abies lasiocarpa* / *Vaccinium scoparium* (subalpine fir / grouse whortleberry), *Abies lasiocarpa* / *Alnus sinuata* (subalpine fir / Sitka alder), *Pseudotsuga menziesii* / *Physocarpus malvaceus* (Douglas-fir / ninebark), *Pseudotsuga menziesii* / *Carex geyeri* (Douglas-fir / elk sedge), *Pseudotsuga menziesii* / *Spiraea betulifolia* (Douglas-fir / shiny-leaf spiraea), *Artemisia tridentata* / *Festuca idahoensis* (big sagebrush / Idaho fescue) and *Festuca idahoensis* / *Agropyron caninum* (Idaho fescue / slender wheatgrass) habitat types. *Pinus albicaulis* (whitebark pine) communities occupy the high elevation forests. The Sliding Mountain area contains exposed Madison Limestone, which is uncommon in the volcanic-derived Absaroka Range. Grizzly bear occur within the Sixmile drainage and may inhabit the proposed RNA at times. The Sixmile drainage provides important winter range for *Alces alces* (moose) and *Cervus elaphus* (elk). Also, contained within this site is the Dome Mountain Wildlife Management Area, which protects crucial ungulate winter range.

Key Environmental Factors

Exposed wind-blown slopes and southern exposures are key factors determining ungulate winter range distribution. Due to the extremely steep topography in the vicinity of Sliding Mountain, avalanche and rock / land slides may be important natural disturbances, in addition to fire.

Rarity

The primary values of this site are the populations of genetically-pure Yellowstone cutthroat trout (G4T2), ungulate winter range and Sliding Mountain Proposed Research Natural Area.

Exotics

The extent of exotic plant infestations in this site is unknown. Rainbow trout are in the Sixmile Creek drainage downstream from Gold Prize Creek. We have no information on the presence of barriers to fish movement.

Information Needs

Plant and animal surveys are needed, as well as an assessment of the threats to the site (e.g., exotic plant

distributions). Information on the extent and pattern of grizzly bear use of this area would be beneficial.

Slough Creek / Lamar River

Directions

Yellowstone Plateau, confluence of Slough Creek and the Lamar River just north of Specimen Ridge. The site is an open flat area of wetlands and meandering river and creeks. It lies on the Northeast Entrance Road about 5 miles west of Tower Junction; this road is open all year round. The site can be easily reached by taking the turnoff to Slough Creek Campground and horse corral, and parking along this road.

Description

The Slough Creek/Lamar River site is open grassland meadow of grasses and *Carex spp.* with the meandering courses of the Lamar River and Slough and Crystal Creeks. The site includes the wetlands in the area, as well as some of the surrounding upland benches. The area is ringed by conifer forests. Substrate on the northern half of the site is volcanic, but the southern part is probably Paleocene deposits.

Key Environmental Factors

Flat topography, meandering rivers.

Land Use

The area is heavily used for fishing in the summer time.

Stillwater River-Flume Creek

Directions

The Stillwater River-Flume Creek site is located at the base of the Beartooth Mountains in south central Montana. From Nye, travel west and then southwest on State Route 419 for approximately 5.5 miles. Cross the Stillwater River on a bridge across from the Stillwater Mine tailing pond. Park on the east side of the river; permission is needed to park on Stillwater Mine property. Take the road that switchbacks up the mountain. At the first switchback, leave the road and continue along an informal trail that parallels the Stillwater River. The site is located approximately 0.5 mile upstream at the confluence of the Stillwater River and Flume Creek.

Description

The site is located on the floodplain of the Stillwater River, where it confluences with Flume Creek. At the confluence, Flume Creek forms a long backwater slough; a *Carex utriculata* (beaked sedge) community occurs along the margin of the slough. The rest of the site is mesic and is subirrigated by groundwater. It is a mix of aspen, willow, and cottonwood communities. A *Salix*

boothii / *Calamagrostis canadensis* (Booth's willow / bluejoint reedgrass) community occupies wetter sites. This community has clumped cover of willow, mostly *Salix boothii* and *Salix bebbiana* (Bebb willow), with *Cornus sericea* (red-osier dogwood) and *Symphoricarpos occidentalis* (western snowberry) also common. The herbaceous layer is divergent: under *Salix* cover, *Calamagrostis canadensis* dominates, while in herbaceous-dominated openings, *Agrostis stolonifera* (redtop) is the dominant species. Drier sites (but still seasonally saturated) along Flume Creek are characterized by a *Populus tremuloides* / *Cornus sericea* (quaking aspen / red-osier dogwood) community. This community has a vigorous overstory of *Populus tremuloides* with a diverse shrub component. *Symphoricarpos occidentalis* and *Cornus sericea* are the most abundant species. Common herbaceous species are *Equisetum arvense* (field horsetail), *Elymus glaucus* (blue wild rye), *Rudbeckia laciniata* (cutleaf coneflower), and *Heracleum maximum* (cow-parsnip). A *Populus balsamifera ssp. trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) community occupies the driest, most well-drained portions of the site. The cottonwoods are mostly senescent, and sapling and pole-sized *Pinus contorta* (lodgepole pine) and *Picea engelmannii* (Engelmann spruce) are well represented. The shrub layer is heavily browsed; many shrubs, especially *Cornus sericea*, are of small stature and appear to be suppressed from browsing. The herbaceous layer has a high proportion of the exotics *Poa pratensis* (Kentucky bluegrass) and *Phleum pratense* (common timothy).

Key Environmental Factors

Fluvial dynamics associated with the Stillwater River and seasonal surface and groundwater inflow from Flume Creek are the most important influences on the vegetation. Signs of old beaver activity are apparent at the site. Browsing by wild ungulates and livestock is effecting the structure of the *Populus balsamifera ssp. trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) community by suppressing palatable species, such as *Cornus sericea* (red-osier dogwood).

Rarity

No tracked or special status plant or animal species were observed. A G3? community, *Populus balsamifera ssp. trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood), was documented in fair condition.

Land Use

The site is grazed by livestock; however, except for the *Populus balsamifera ssp. trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) community, the site appears lightly grazed. Otherwise the site appears unmanaged.

Exotics

Several exotic species are abundant at the site. *Poa pratensis* (Kentucky bluegrass) and *Phleum pratense* (common timothy) are common on the driest sites with rocky, well-drained soil. *Agrostis stolonifera* (redtop) is abundant and *Poa palustris* (fowl bluegrass) is present in herbaceous openings in the *Salix boothii* / *Calamagrostis canadensis* (Booth's willow / bluejoint reedgrass) community. *Cirsium arvense* (Canada thistle) is present at very low cover in the *Populus tremuloides* / *Cornus sericea* (quaking aspen / red-osier dogwood) community.

Uplands

The riparian zone has been heavily impacted in this reach. Across the river and upstream of the site, livestock grazing appears to have greatly limited the development of riparian vegetation, although pockets of good condition cottonwood and willow communities are present. Downstream, the Stillwater Mine has channelized the river and developed the floodplain.

Information Needs

What are the past and current grazing practices at the site?

Management Needs

Cirsium arvense (Canada thistle) is present at the site at very low density, and it should be eradicated.

Sunlight Peak To Conical Peak

Directions

This is a high peaks region, centrally located in the Crazy Mountains, on the Shields River - Sweetgrass Creek divide. This site can be accessed either from the west by Cotton Wood Creek Road to FS Road 6620, then FS Trails 168 and 197; or the east by the Big Timber Road to FS Road 197, and FS Trails 118 and 119. The site is approximately 18 miles northeast of Clyde Park.

Description

This site contains the high peaks on the Crazy Mountains and consists primarily of alpine with only a small amount of subalpine habitat. Elevations range from 8200 ft. (2500 m) to 10745 ft. (3276 m). Several lakes and wetlands occur within the site.

Rarity

The high elevation forested region is habitat for *Lynx canadensis* (Canada lynx). Two species of special concern, *Papaver kluanensis* (alpine poppy) and *Carex norvegica ssp. inserrulata* (toothed Scandinavian sedge) are found within this site; two others *Agoseris lackschewitzii*, and *Erigeron flabellifolius* occur nearby.

Other Values

This site has recreational values, particularly hiking and hunting.

Land Use

This site is a mixture (checkerboard pattern) of private and public (Gallatin National Forest) lands.

Information Needs

Additional surveys are needed to document the extent of the distribution of plant species of special concern. Also, surveys for animals of special concern, particularly endemic insects, are needed

Swamp Lake

Directions

Northern Absaroka Mountains, Swamp Lake area along Hwy 296 (Chief Joseph Highway), south of the Clark's Fork of the Yellowstone River. Swamp Lake is a calcareous bog at the foot of the Cathedral Cliffs, a limestone ridge system just to the south of the wetlands.

Description

The boundary includes Swamp Lake and surrounding floating mats and marshlands on the north side of the Cathedral Cliffs south of Wyoming Highway 296. The Swamp Lake wetland is marl-rich from outwash of calcareous material from the Cathedral Cliffs. The entire area is underlain by non-porous granite, accounting for the accumulation of base-rich soils. The area is surrounded by white spruce forest.

Key Environmental Factors

Runoff and subsurface water flow off the calcareous slopes to the south maintain the wetlands.

Climate

A continental, mountain climate prevails - cold winters with high snowfall, and warm summers with afternoon rainfall.

Rarity

By the book, this is a B3 site, but that rating fails to reflect the importance of the site. It contains a far larger concentration of S1 and S2 elements in a small area than any other site in Wyoming, and probably in the region. This includes two boreal species known only from northern Canada and Alaska, and several other disjuncts known from Canada and Alaska and a few other locations in the continental U.S. Trumpeter swans (G4S2S3B) also are known to nest in the wetland. Measuring only about 1.5 square miles in area, Swamp Lake contains the states densest concentration of rare and uncommon plants, with over 25 such species documented here. Many of these plants are boreal disjunct species more

typical of wetlands in taiga forest. One species, *Arctostaphylos rubra*, occurs here and no place else in the lower 48 states. In all, 7 USFS Region 2 Sensitive plants occur here, along with 13 other rare plants correctly tracked by WYNDD. Rare animals are also present, including occasional nesting populations of trumpeter swan, grizzly bear, and gray wolf. At least 8 wetland vegetation types have been identified (Fertig and Jones 1992).

Other Values

Wetland provides habitat for a variety of waterfowl, and the site is very scenic, visible from the top of the Chief Joseph Highway.

Land Use

A paved highway traverses the north part of the site and crosses the outflow from the wetland. The water level in the wetland apparently was raised when the current highway crossing was built. Commercial trucks use this highway and a spill of liquids on the highway could end up in the wetland. A dirt Forest Service road runs along the south side of the wetland (and forms the southern boundary of the Special Botanical Area); exotic plants (including Canada thistle, a noxious weed) are common along that road. Spruce seedlings and saplings have been cut from the muskeg on the south side of the wetland, apparently to improve waterfowl nesting habitat, but this practice is forbidden by the current management prescription. The slopes south of the wetland have been logged in the past, both with small clearcuts and with selective logging. Some salvage logging has been done since the 1988 fires. Three debris flows came off the slopes into the wetland in 1989 but little evidence of them existed by 1992 and they apparently had little effect on the wetland. A guest ranch at the west end of the wetland takes horseback trail rides along the dirt road south of the wetland and an old two-track road along the north side of the wetland. Horses graze the upland around the wetland but apparently do not enter the wetland.

Exotics

Numerous exotic forbs and grasses grow in the white spruce forest along the dirt road on the south side of the wetland and in the logged area on the slopes above the wetland. These include *Cirsium arvense* (Canada thistle), a noxious weed. Control efforts should recognize the threats of herbicides to the wetland vegetation.

Information Needs

Forest Service managers need to collect information for a hydrological/ecological model of the wetland that allows them to assess effects of management on the slopes above and threats from the highway. A monitoring program should be established to keep track of hydrological factors (water levels, inflow, outflow), distributions of wetland plant communities, and distributions and

abundances of rare plants; the effects of logging should be considered. The surrounding watershed drains into the swamp and influences the hydrology and quality of the site.

Swan Lake Flat

Directions

Yellowstone Plateau, Swan Lake, in an open, flat meadow along the Loop Road. The site can be reached by driving about 4-5 miles south of Mammoth, or 16 miles north of Norris Junction; both roads are closed in winter.

Description

The site is a flat, open meadow bounded by rises to the north, east and south, and a dropoff to the Gardner River to the west. The slight rise in topography allows for drier soil, where sagebrush shrubland and conifer forest are found. The meadow seems to be dominated by *Carex*, with some willows, grass, and forbs. Swan Lake lies in the middle of the meadow, along with some other ponds. The site is drained by several small streams to the east and west, and Glen Creek to the north.

Key Environmental Factors

Hydrology and flat topography tends to keep the soil wet to moist and prevents the establishment of trees and shrubs in the meadow. The flat topography also contributes to keeping the soil wet.

Climate

A continental, mountain climate prevails - cold winters with a high amount of snow, and warm summers with afternoon rainfall.

Rarity

The occurrences in the area have a GRank of G4 or G5. There is an historic occurrence of *Rana lutiventris*, G3G4. The area supports some grazing by large ungulates.

Other Values

Although there is a great deal of human use in the summer associated with the Mammoth Visitor Center, it is still possible to see a wildlife at the area, and most of the area is fairly pristine.

Land Use

The Loop Road runs through the middle of the Flats, and there is a parking turnout at Swan Lake. Some trails used mainly by fishermen and birders ring the Flats.

Exotics

Unknown, needs to be assessed.

Information Needs

A thorough survey of the site would help define the boundaries and the occurrences to be found.

Tom Miner Basin / Rock Creek

Directions

The Tom Miner drainage is approximately 13 miles northwest of Gardiner, MT. The drainage is accessed via the Tom Miner Road, 17 miles north of Gardiner, off of Highway 89. Rock Creek is the next drainage to the north of Tom Miner Basin.

Description

On the east side of the Gallatin Range, the Tom Miner and Rock Creek watersheds drain an area from Sheep Mountain and Bighorn Peak north to Fortress Mountain and flow northeast to the Yellowstone River. Elevations range from 4920 ft (1550 m) at the confluence with the Yellowstone River to 10295 ft (3138 m) at Ramshorn Peak.

Key Environmental Factors

Rain shadow-effects are important in maintaining low snow cover and increasing the availability of forage for ungulates. Also, southern exposures on the north side of Tom Miner Basin are major determinants of winter range on the northern side of the drainage. Fire is likely to be an important factor in maintaining open parks and meadow / forest ecotones.

Rarity

Other Values

This area provides substantial recreation opportunities and has been used for education and research purposes.

Land Use

Current land use includes logging, subdivision for human dwellings, livestock grazing and various recreational uses.

Information Needs

An evaluation of plant communities and surveys for plants and animals of special concern are needed. Evaluations of stream / riparian habitat condition are lacking.

Twin Lakes / Montana

Directions

Twin Lakes are located in the Crazy Mountains in south central Montana. From Big Timber, travel north on U.S. Highway 191 for approximately 10 miles. Turn left onto County Road 25 and travel west for approximately 13

miles to Half Moon Campground. Hike west on Forest Trail 119 for approximately 3.5 miles to Upper Twin Lake.

Description

Twin Lakes occur near timberline in a glacially formed cirque basin at the headwaters of Big Timber Creek. Wetland communities are lacustrine fringe and slope wetlands. A *Salix planifolia* / *Carex scopulorum* (planeleaf willow / Holm's Rocky Mountain sedge) community fringes the upper (western) edge of Upper Twin Lake. This community grades into an early-seral *Abies lasiocarpa* / *Streptopus amplexifolius* (subalpine fir / clasping twisted stalk) community, which occurs on a subirrigated toe slope. A mid-seral stand of this community, with a *Picea engelmannii* (Engelmann spruce)-dominated overstory, occurs in between the two lakes. Lower Twin Lake has a very narrow lacustrine fringe with *Carex scopulorum* and *Equisetum arvense* (field horsetail) forming the dominant cover. Most of the wetlands along Lower Twin Lake are subirrigated slope wetlands with some peat development that has numerous seeps and springs. A *Carex scopulorum* community occupies most of these wetlands. This well vegetated community has high cover of *Carex scopulorum*, *Carex illota* (sheep sedge), and *Pedicularis groenlandica* (elephant head), and also has abundant brown moss cover, including *Philonotis fontana* and *Drepanocladus aduncus*. *Sphagnum* moss, including *Sphagnum squarrosum*, is locally common around seep margins. This community has numerous linear clumps and breaks of *Picea engelmannii* and *Abies lasiocarpa*. Uplands are predominantly an *Abies lasiocarpa* / *Vaccinium scoparium* (subalpine fir / grouse whortleberry) habitat type.

Key Environmental Factors

This is a subalpine site greatly influenced by glacial topography. Hydrological regime is driven by subirrigation from snowmelt.

Rarity

No special status plant or animal species or rare community types were observed.

Other Values

Rana pretiosa (spotted frog) was observed in small ponds in slope wetlands along Lower Twin Lake.

Land Use

A popular recreation trail skirts the upper boundary of the site. Campsites and informal trails are located in the spruce-fir forest between the lakes and at the head of Upper Twin Lake. Evidence of cattle use was observed in some communities.

Exotics

The only exotic noted was *Trifolium repens* (white clover). This species was localized and present at low cover. Its presence may be explained by use of pack animals.

Uplands

The setting is pristine. The area receives some livestock grazing, but it appears to be light. This is a popular recreational area and receives heavy use. Land ownership is a checkerboard pattern of National Forest and private land.

Twin Lakes / Wyoming

Directions

The site is located in the southeastern Beartooth Mountains approximately 36 air miles northwest of Cody, Wyoming. From Cody, proceed north on Wyoming State Highway 120 about 16 miles to State Highway 296 (Chief Joseph Scenic Highway). Travel west on Highway 296 for 46 miles to the junction with highway 212 (Beartooth Highway). Proceed east on US 212 for about 23 miles. The Beartooth Highway is only open during the summer and early fall (typically from 1 June-15 October) and may be closed at night during inclement weather. The southern boundary of the site can be accessed from the highway.

Description

The central feature of the site is the Twin Lakes Basin, a glacial cirque near the summit of the Beartooth Plateau. Headwalls of the cirque are 600-700 feet high on the eastern and southern rim and are composed of steep, loosely consolidated gneissic talus and boulders. The bottom of the basin contains over 14 major lakes and ponds that cover approximately 82 acres of surface area. Numerous small snow melt streams connect these lakes to form the headwaters of the Chain Creek drainage. The plateau on the west side of Twin Lakes Basin slopes gently to the north. This area contains numerous examples of soil-surface features associated with cryopedogenic processes (Johnson & Billings 1962). Among the prominent features are stone circles and stripes, frost hummocks, frost boils, and solifluction terraces. The site contains excellent examples of *Geum rossii* and *Deschampsia cespitosa* alpine turf and meadow community types as well as several other well-represented alpine community types (*Abies lasiocarpa* / *Vaccinium scoparium* (*Pinus albicaulis* phase), *Salix planifolia* / *Carex scopulorum*, *Juncus drummondii* / *Antennaria lanata*, and *Carex elynoides*).

Key Environmental Factors

Hydrology, altitude.

Climate

A continental mountain climate prevails - cold winters with a large amount of snow, and warm summers with afternoon rainfall.

Rarity

Ranking was based on the presence of 29 state rare species, including four that are listed as Sensitive by Region 2 of the US Forest Service: Dwarf shrew, North American lynx, Pink agoseris, and Hall's fescue. Although most of these species are globally common, the aggregation of so many is remarkable. In addition, the site contains occurrences of 8 species that are no longer tracked by WYNDD but are still uncommon. This area is rich in disjunct plant species that have arctic and boreal affinities, as well as providing habitat for animals that are uncommon in the Greater Yellowstone Ecosystem.

Two Moon Park

Directions

Two Moon Park is located along the Yellowstone River in the unglaciated High Plains. This site is located within the city of Billings.

Description

Two Moon Park is located in the floodplain of the Yellowstone River. This site occurs between low bluffs that overlook the river and the river's active channel. The site is a mosaic of communities that occur on different fluvial landforms. On recently created mid-channel bars, the vegetation is very weedy and is dominated by *Euphorbia esula* (leafy spurge) and *Salix exigua* (sandbar willow). *Salix exigua* and the exotic *Phalaris arundinacea* (reed canarygrass) dominate recently deposited sidebars and sloughs, with wetter microsites occupied by monospecific stands of *Phalaris arundinacea*. Higher portions of the floodplain are a mosaic of *Populus deltoides* / *Symphoricarpos occidentalis* (plains cottonwood / western snowberry) woodland and herbaceous openings. The cottonwood stands are open woodlands with a locally abundant mid-canopy of the exotic *Elaeagnus angustifolia* (Russian olive). The herbaceous layer is dominated by the exotic grasses *Poa compressa* (Canada bluegrass), *Poa pratensis* (Kentucky bluegrass), and *Bromus inermis* (smooth brome). The herbaceous openings are also largely dominated by the same exotic grasses; however, patches of *Pascopyrum smithii* (western wheatgrass) still dominate some low-lying swales, although some of these are being invaded by *Bromus tectorum* (cheatgrass). Seepy, groundwater-receiving sites at the base of the bluffs are dominated by *Typha latifolia* (broadleaf cattail) and *Phalaris arundinacea*. A small stand of *Salix amygdaloides* (peachleaf willow) occurs along one of the sloughs.

Key Environmental Factors

Flooding, and the associated erosion, deposition, and channel migration, is the dominant process influencing vegetation. Vegetation is also influenced by microtopography and by seepage from the toe slope of the bluffs.

Rarity

No special status plants or animals were observed. One G2G3 community, *Populus deltoides* / *Symphoricarpos occidentalis* (plains cottonwood / western snowberry), and one G3 community, *Salix amygdaloides* (peachleaf willow), were documented in fair to poor condition.

Other Values

This site offers habitat for many Neotropical migrant birds and other wildlife. This site is locally important because of habitat fragmentation in the greater Billings metropolitan area.

Land Use

The site is a city park and receives heavy recreational use. There are several trails and old roads through the park, and a portion of the park was mined for gravel. Most of the use appears to be limited to the trails.

Exotics

Exotic grasses dominate the ground layer of this site, especially *Poa pratensis* (Kentucky bluegrass) and *Bromus inermis* (smooth brome). *Phalaris arundinacea* (reed canarygrass) dominates many mesic portions of the site, such as sloughs. *Bromus tectorum* (cheatgrass) currently occurs as several small monospecific stands, but it is likely to spread. *Euphorbia esula* (leafy spurge) is scattered in small patches except on mid-channel bars where it is the dominant species. *Cynoglossum officinale* (hound's tongue) and *Cirsium arvense* (Canada thistle) are common throughout the site. *Elaeagnus angustifolia* (Russian olive) is well established in the cottonwood stands. It is likely that as the cottonwoods die (and many of the cottonwoods are mature or senescent), these stands will convert to an *Elaeagnus angustifolia*-dominated community. This conversion will have unknown habitat and biodiversity implications.

Uplands

The site occurs as an isolated fragment of riparian vegetation within the urban/industrial context of Billings.

Information Needs

What was the history of gravel extraction and grazing at the site?

Management Needs

Although it is unlikely that native species will reclaim the herbaceous layer, the more aggressive exotic species

such as *Euphorbia esula* (leafy spurge) and *Bromus tectorum* (cheatgrass), should be controlled.

Upper And Lower Deer Creeks

Directions

The Upper and Lower Deer Creek Site is located on the north edge of the Beartooth Mountains, 10 miles southeast of Big Timber, MT. The site is accessed from the Greycliff exit off of Interstate 90 (ca. 10 miles east of Big Timber). Follow the Frontage Road west approximately 1.5 miles, then turn south onto the Deer Creek Road, which becomes Forest Service Road 482. The site is approximately 8.5 miles south of the Frontage Road.

Description

This site consists of the upper portions of the Upper and Lower Deer Creek drainages, which contain populations of genetically pure Yellowstone cutthroat trout. Specifically these drainages are Upper Deer Creek, from the West Fork of Upper Deer Creek to the Headwaters, which has moderate habitat value; and Lower Deer Creek from Placer Creek to the headwaters, which has substantial habitat value. Elevations range from 4920 ft. (1500 m) to 8600 ft. (2622 m).

Rarity

The populations of genetically-pure Yellowstone cutthroat trout make the Upper and Lower Deer Creeks a significant site. *Sorex preblei* (prebles shrew) has been recorded from this site.

Exotics

Salmo trutta (brown trout) and *Salvelinus fontinalis* (brook trout) occur in some of the drainages. Although these species compete with cutthroat trout, they are reproductively isolated from cutthroat trout. We have no information regarding the distribution or extent of exotic plant infestations.

Information Needs

Information on the occurrence and distribution of barriers to fish movement is needed. Also, surveys for plants, animals and vegetation communities of special concern are needed.

Upper Hellroaring Creek / Slough Creek

Directions

The Hellroaring and Slough Creek site is located north of the Yellowstone River in Yellowstone National Park between the Hellroaring Creek and Slough Creek drainages. It includes portions of Yellowstone National Park and the Absaroka-Beartooth Wilderness. The site is

accessed from the Cooke City Highway in Yellowstone National Park, approximately 12 miles northeast of Gardiner, MT.

Description

The Hellroaring and Slough Creek site is within the “Northern Range” of Yellowstone National Park, including portions of the Yellowstone River and the Lamar River Valleys. Elevations range from 5900 ft (1800 m) to 9800 ft (3000 m). Exemplary willow communities are found along Slough Creek on the Gallatin National Forest and Yellowstone National Park. Extensive wetland complexes are found in the upper portions of the Hellroaring Creek, Buffalo Creek, and Slough Creek drainage’s. *Histrionicus histrionicus* (harlequin Duck) are found on Hellroaring Creek; *Ranunculus jovis* (Jove’s buttercup) has been documented on the Hellroaring Creek-Buffalo Creek divide.

Key Environmental Factors

Fire is an integral component of the forest and grassland communities of this region. Part of this area was burned during the 1988 fires. Spring flooding is an important component of the riparian communities. Rain-shadow effects are important in determining the extent of ungulate winter range. Ungulate grazing is an important factor in shaping vegetation communities and the extent of ungulate grazing is heavily dependent upon snow depth, which varies annually.

Rarity

This area has substantial value as winter range for *Cervus elaphus* (elk), *Alces alces* (moose), and *Bos bison* (bison). *Ursus arctos horribilis* (grizzly bear) use this area extensively and an experimental population of *Canis lupus* (grey wolf) have been reintroduced into this site. *Lynx canadensis* (Canada lynx) may also occur here. Genetically pure *Oncorhynchus clarki bouvieri* (Yellowstone cutthroat trout) occur in Slough Creek, although *O. mykiss* (rainbow trout) occur in the lower reaches of Slough Creek in Yellowstone National Park.

Other Values

This site receives considerable recreational use, primarily in the form of wildlife viewing, hiking, outfitting, fishing and hunting. Numerous research projects have included all or part of this area.

Exotics

The extent of exotic plant infestations within this area is unknown. Exotic *Oncorhynchus mykiss* (rainbow trout) are found in the Yellowstone River and lower Slough Creek. Rainbow trout pose a threat to populations of genetically pure Yellowstone cutthroat trout. Increased recreational use of this area could have adverse impacts to the areas natural resources.

Information Needs

Extensive wetlands surveys for rare plants, vegetation communities, and animals are needed. In addition, information on the occurrence and extent of exotic plant infestations and the extent and pattern of grizzly bear use of this area would be beneficial.

Upper Shields River

Directions

The site is located in the upper Shields River drainage. Follow the Shields River Road north from Wilsall approximately 13 miles, then take Forest Service Road 844 northeast. The site boundary is encountered near the beginning of FS Road 844.

Description

This site encompasses the watershed of the upper Shields River and its tributaries where populations of genetically pure Yellowstone cutthroat trout are found. The Shields River is nested in a moderately wide montane valley bottom on the west slope of the Crazy Mountains. Forested slopes are primarily *Pinus contorta*. The floodplain and floodplain terrace is dominated by *Picea engelmannii*. *Populus balsamifera ssp. Brichocarpa* occur infrequently and *Salix drummondiana* shrub communities occur in places along the current and old river channels. This drainage also contains moose winter range. Elevations range from 5740 ft. (1750 m) to 10086 ft. (3075 m). This watershed has recreational values and economic values from timber and livestock grazing.

Key Environmental Factors

The floodplain terrace is undulated with microtopography created by wind throw, old channels, springs and seeps.

Rarity

The significance of this area is due to the occurrence of genetically-pure Yellowstone cutthroat trout in the upper Shields River and its tributaries.

Exotics

A small amount of *Carduus nutans* (musk thistle) is present along the floodplain terrace. *Oncorhynchus mykiss* (Rainbow trout) may also occur in the lower Shields River inside the site boundary.

Uplands

The upper watershed exhibits extensive silviculture treatments including clearcuts.

Information Needs

An evaluation of the presence / absence of barriers to

fish movements is needed. Also, surveys of animals, plants, and vegetation communities are needed.

Management Needs

The *Carduus nutans* (musk thistle) found on the floodplain terrace should be hand removed.

Water Birch

Directions

Water Birch is located in the foothills and high plains of south central Montana. From Red Lodge, travel north on U.S. Highway 212 for approximately 8.5 miles. Access to Water Birch is signed.

Description

Water Birch is located in the floodplain of Rock Creek. In this reach, Rock Creek is braided with two or three primary channels. Channel banks are eroded and the system appears to be downcutting. The microtopography of the floodplain is complex with many swales and old channels. This microtopographic relief, augmented by *Castor canadensis* (beaver) activity, has created a mosaic of interspersed shrub and cottonwood communities that occupy most of the floodplain. Swales and old channels are occupied by an *Alnus incana* / *Calamagrostis canadensis* (mountain alder / bluejoint reedgrass) community, which also includes dense stands of *Carex utriculata* (beaked sedge) around wet margins of beaver ponds. Interspersed with these mesic areas is a *Populus balsamifera ssp. trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood) community. This community includes small inclusions of sapling and pole-sized *Populus balsamifera ssp. trichocarpa* regenerating on point and side bars. Beaver have caused substantial mortality among these saplings. This site also supports a small *Salix bebbiana* (Bebb willow) community that is seasonally saturated from seepage from an irrigation ditch. Higher portions of the floodplain support *Populus balsamifera ssp. trichocarpa* / *Symphoricarpos occidentalis* (black cottonwood / western snowberry) and *Populus tremuloides* / *Calamagrostis canadensis* (quaking aspen / bluejoint reedgrass) communities. These communities are probably above the flood prone zone (twice bankfull stage height) and so may be less influenced by riverine groundwater. Moisture at these sites is probably more influenced by subirrigation from a toe slope that forms a topographic break between the active floodplain and an older glacial outwash terrace.

Key Environmental Factors

Fluvial processes, such as seasonal flooding and high groundwater, and the associated channel migration and microtopography are the primary influences on vegetation structure and composition at this site. Past and

current beaver activity is also very important and has created ponded areas that support mesic sedge and alder communities.

Rarity

No special status plant and animal species were observed. Four G3 plant associations were documented in fair to very good condition: *Populus balsamifera* ssp. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood), *Populus tremuloides* / *Calamagrostis* (quaking aspen / bluejoint reedgrass), *Alnus incana* / *Calamagrostis canadensis* (mountain alder / bluejoint reedgrass), and *Salix bebbiana* (Bebb willow).

Other Values

Although there are several diversion ditches upstream of and within this reach, this section of Rock Creek appears to support important hydrologic functions, such as dynamic water storage and surface water - groundwater interactions. The floodplain is still accessed by surface and subsurface flooding regimes, and native vegetation appears to be highly connected and to occupy much of the floodplain.

Land Use

Water Birch is a dedicated recreation site, and receives camping and fishing use. However, except for the parking/camping area, the site appears to be little affected from use.

Exotics

Poa pratensis (Kentucky bluegrass) is abundant throughout the site, especially on drier locations. Other exotic species were present at low cover and include *Taraxacum officinale* (common dandelion), *Leucanthemum vulgare* (ox-eye daisy), *Centaurea maculosa* (spotted knapweed), *Cirsium* spp. (thistle), *Arctium* spp. (burdock), *Cynoglossum officinale* (hound's tongue), and *Dactylis glomerata* (orchard grass). *Centaurea maculosa* has been spot sprayed around the parking/camping area.

Uplands

Native vegetation is mostly intact along the riparian corridor upstream and downstream from the site. Livestock grazes the adjacent upstream parcel. Adjacent land use is pasture and ranchettes.

Management Needs

More aggressive control of noxious weeds is needed.

West Boulder Meadows

Directions

The West Boulder Meadows site is located in the foothills of the Absaroka Range in south central Mon-

tana. From McLeod, travel south on State Route 298 for 0.5 mile. Turn onto the Wet Boulder Road and travel west-southwest for approximately 12 miles to the West Boulder trailhead. Travel south on Forest Trail 41 for 3 miles to the West Boulder Meadows.

Description

This site is a large complex of riverine-associated wetlands along an unconfined reach of the West Boulder within a glaciated valley. Confined river reaches delimit the site both upstream and downstream. In the unconfined reach, the West Boulder is low gradient and meandering. Plant associations are distributed along topographic, soil moisture, and flood disturbance gradient. Communities range from flooded and saturated sedge and willow communities to wet spruce forests. Along the active channel, overbank deposition has created natural levees. These levees, which are higher and drier than the adjacent floodplain, are dominated by exotic species, including *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), and *Taraxacum officinale* (common dandelion). The native *Juncus balticus* (Baltic rush) is also well represented. The lower floodplain next to these levees is semi-permanently flooded by groundwater from the West Boulder, and is dominated by a near-monospecific stand of *Carex utriculata* (beaked sedge). A *Salix boothii* / *Carex utriculata* (Booth's willow / beaked sedge) community occupies slightly higher sites that are seasonally saturated by groundwater. This community is characterized by a mosaic of clumped shrubs, dominated by *Salix boothii* and *Salix drummondiana*, interspersed with herbaceous openings dissected by many small channels. *Carex utriculata* is the dominant herbaceous species, especially in wetter microsites. *Calamagrostis canadensis* (bluejoint reedgrass) may be locally dominant in drier areas, especially where shaded by willows. Exotics, such as *Poa pratensis* and *Agrostis stolonifera* (redtop), are also common in these drier microsites. Where this community occurs near to *Picea* (spruce) forest, *Picea engelmannii* (Engelmann spruce) and *Cornus sericea* (red-osier dogwood) are colonizing higher microsites.

The driest locations at this site are occupied by *Picea engelmannii* / *Cornus sericea*. An open *Picea engelmannii* canopy with a patchy shrub layer of *Alnus incana* (mountain alder) and *Cornus sericea* characterizes this community. The herbaceous layer has a high cover of *Phleum pratense* (common timothy), with lesser amounts of *Equisetum arvense* (field horsetail), *Rudbeckia laciniata* (cutleaf coneflower), and *Carex microptera* (small-wing sedge). Moss cover, mostly *Climacium dendroides*, is locally very high. The adjacent uplands are dominated by *Picea engelmannii* / *Maianthemum stellatum* (Engelmann spruce / starry

false Solomon's seal) and *Picea engelmannii* / *Linnaea borealis* (Engelmann spruce / twinflower) communities.

Key Environmental Factors

The unconfined river reach has allowed for floodplain development. Seasonal flooding and groundwater saturation maintains the plant communities at the site.

Rarity

No special status plant or animal species were observed. One G3 community, *Picea engelmannii* / *Cornus sericea* (Engelmann spruce / red-osier dogwood), was documented in good to fair condition.

Land Use

The site is within the Absaroka-Beartooth Wilderness Area. The meadows receive moderate recreational pressure, primarily from fishermen. No permanent trails were observed in the wet meadow. Site does not appear to be currently grazed, although one cowpie was observed.

Exotics

Pasture grasses, such as *Poa pratensis* (Kentucky bluegrass) and *Phleum pratense* (common timothy), dominate much of the drier portions of the site. Natural levees along the Boulder River are completely dominated by these grasses and *Juncus balticus* (Baltic rush). *Phleum pratense* is also the dominant herbaceous species in the wetland *Picea* (spruce) community.

Uplands

This site occurs in the Absaroka-Beartooth Wilderness Area. Similar wetland complexes occur along the West Boulder as geomorphology allows.

Information Needs

What is grazing history of the site? Is the dominance of exotic pasture grasses a legacy of past grazing? What role does imported horse feed play?

West Fork Rock Creek Fens

Directions

West Fork Rock Creek Fens is located in the Beartooth Mountains of south central Montana. From Red Lodge, travel 10.25 miles on Forest Service Route 71 to West Fork Rock Creek Fens.

Description

This site consists of three small slope fens that occur at the toe of a slope along West Fork Rock Creek in the Beartooth Mountains. The water source for the fens is apparently groundwater discharge from the toe of the adjacent slopes. There are no surface outlets, and water

apparently discharges to the creek as groundwater. The uplands are dominated by *Abies lasiocarpa* (subalpine fir) and *Pinus contorta* (lodgepole pine) forests wherein the dominant undergrowth species are *Vaccinium globulare* (globe huckleberry) and *Vaccinium scoparium* (grouse whortleberry). Each of these fens is dominated by *Salix planifolia* / *Carex aquatilis* (planeleaf willow / water sedge) and *Salix planifolia* / *Carex utriculata* (planeleaf willow / beaked sedge) communities. Other common species at these fens are *Betula glandulosa* (bog birch), *Dasiphora fruticosa* ssp. *floribunda* (shrubby cinquefoil), *Carex utriculata* (beaked sedge), *Viola macloskeyi* (small white violet), and *Sphagnum* spp. (mosses of poor fens and bogs). A small forested spruce wetland, dominated by a *Picea engelmannii* / *Calamagrostis canadensis* (Engelmann spruce / bluejoint reedgrass) plant association, occurs at one of the fens; *Sphagnum* ssp. appear to be invading this moist forest from the adjacent fen.

Key Environmental Factors

These wetlands are maintained by groundwater recharge from the adjacent uplands.

Rarity

Paludella squarrosa, an S1 G3G4 moss, is a component of the *Sphagnum* moss layer. An excellent example of the G3 community *Salix planifolia* / *Carex utriculata* (planeleaf willow / beaked sedge) was documented.

Other Values

The undergrowth of the willow community is extremely diverse, especially in the moss layer. One of the fens has at least 60% cover of *Sphagnum* species with limited brown moss development, another has both mosses strongly represented and yet another has reduced moss cover but high cover values for *Carex scopulorum* (Holm's Rocky Mountain sedge). Within a limited area the varieties of expression of one plant association are well displayed.

Land Use

No land use was apparent.

Exotics

No exotic plants or animals were documented from this site.

Uplands

A well-used trail and trailhead is adjacent to the westernmost fen, and a road is adjacent to the other two fens in this complex.

Information Needs

Is the road influencing the hydrology of these fens?

Management Needs

No management considerations were identified at the initial inventory.

West Rosebud Complex

Directions

Note: a portion of this site is located on private land, and landowner permission is required to access that section. The West Rosebud Complex is located in the foothills of the Beartooth Mountains in south central Montana. From Fishtail, travel west and south on State Highway 419 for approximately 1 mile to the intersection with State Highway 425. Turn onto State Highway 425 and travel south for approximately 6 miles to the intersection with Forest Route 2072. Travel south on this road for approximately 8 miles and park at the Pine Grove Campground.

Description

West Rosebud Complex occurs in the floodplain of West Rosebud Creek and on adjacent toe slopes. Wetland and riparian vegetation communities occur adjacent to the active channel, along overflow channels and swales modified by past and current beaver activity, and on toe slope swales modified by historic beaver dams. Stream-side communities include *Picea engelmannii* / *Calamagrostis canadensis* (Engelmann spruce / bluejoint reedgrass), *Salix geyeriana* / *Carex utriculata* (Geyer's willow / beaked sedge), and what was historically probably *Salix geyeriana* / *Calamagrostis canadensis*. This latter community is now dominated by *Poa pratensis* (Kentucky bluegrass) and *Phleum pratense* (common timothy), due to the competitive dominance of these exotic species and grazing pressure.

Historic and current beaver dams have significantly altered portions of this site and provide habitat for many of the plant associations that are present. On the floodplain, beaver activity has raised water tables in swales and old channels, which support a *Salix boothii* / *Carex utriculata* (Booth's willow / beaked sedge) community. This community is interspersed with *Salix boothii* / *Calamagrostis canadensis*, which occurs on higher floodplain deposits. *Pinus contorta* (lodgepole pine) is well represented in this latter community. A small *Populus tremuloides* / *Calamagrostis canadensis* (quaking aspen / bluejoint reedgrass) occurs in draws on the lower hill slope and on seepy areas on the toe slope. On slope wetlands at the bottom of the adjacent toe slopes, historic beaver dams have created a series of terraces. The ponds have completely silted in and dams are visible only as well-vegetated, shrub-dominated berms. These areas now support *Salix geyeriana* / *Calamagrostis canadensis* and *Salix geyeriana* / *Carex utriculata* communities with wetter inclusions of *Carex*

utriculata. There is also a small community dominated by *Salix planifolia* (planeleaf willow) and *Carex utriculata* with a continuous cover of *Sphagnum teres*.

Key Environmental Factors

Site hydrology (surface and groundwater from West Rosebud Creek and groundwater from adjacent toe slopes) and extensive modification by beaver are the primary factors supporting and maintaining the site's vegetation communities.

Rarity

No special status plant or animal species were observed. One G3 community, *Populus tremuloides* / *Calamagrostis canadensis* (quaking aspen / bluejoint reedgrass) was documented in fair condition. This site also contained a *Salix planifolia* / *Carex utriculata* (planeleaf willow / beaked sedge) with abundant cover of *Sphagnum teres*.

Other Values

Some of the beaver ponds support *Rana pretiosa* (spotted frog) populations and a breeding pair of *Grus canadensis* (sandhill crane) was observed at the site.

Land Use

Livestock actively grazes the portion of the site on private land. Drier riparian communities, such as *Salix geyeriana* / *Calamagrostis canadensis* (Geyer's willow / bluejoint reedgrass) have been altered by historic grazing and are now a grazing disclimax dominated by pasture grasses in the herbaceous layer. The northeastern portion of the site on public land also receives some current livestock use (an electric fence runs perpendicular to the channel just upstream from the Pine Grove Campground). Livestock use does not appear to be high. Wild ungulate browse appears to be moderate. *Alces alces* (moose) browse is locally heavy. The site is adjacent to a developed campground. Hiking, fishing, and hunting use has created some informal trails.

Exotics

Phleum pratense (common timothy) and *Poa pratensis* (Kentucky bluegrass) dominate drier portions of the floodplain and lower toe slope. *Poa palustris* (fowl bluegrass), *Cirsium arvense* (Canada thistle), *Phalaris arundinacea* (reed canarygrass), *Trifolium repens* (white clover), *Taraxacum officinale* (common dandelion), and *Agrostis stolonifera* (redtop) are present at low cover. The portion of the site on private land has higher cover of exotic species.

Uplands

Historic grazing has altered some upland communities, especially on the private land portion of the site. Otherwise the structure and composition of offsite

vegetation communities reflects natural processes. The hydrologic regime is largely intact, except for a small hydroelectric dam upstream.

Information Needs

What is the past grazing history? Have there been recent changes in the course of the active channel? What effect has Mystic Lake dam had on the site's hydrology?

Management Needs

A management plan to control the noxious weeds at the site should be developed.

West Rosebud Moraine

Directions

Note: This site is located on private land, and landowner permission is needed to access this site. The West Rosebud Moraine site is located in the foothills of the Beartooth Mountains in south central Montana. From Fishtail, travel west and south on State Highway 419 for approximately 1 mile to the intersection with State Highway 425. Turn onto State Highway 425 and travel south for approximately 6 miles to the intersection with Forest Route 2072. Travel south on this road for approximately 6.75 miles until the road skirts the east shore of Reeves Lake. The rest of the site lies east of West Rosebud Creek. A gravel road that turns off to the west approximately 0.25 mile past Reeves Lake can access this portion.

Description

This site encompasses a series of kettle potholes in a recessional moraine along West Rosebud Creek. These wetlands are isolated and occur as small to medium-sized glacially formed depressions. The water source is groundwater, and all these wetlands lack an outlet, except for Reeves Lake, which is culverted. These potholes are dominated by *Carex utriculata* (beaked sedge) communities or have an open water component with a *Carex utriculata* fringe. Mesic toe slopes adjacent to these depressions are subirrigated and in some places are dominated by willow or *Populus tremuloides* / *Calamagrostis canadensis* (quaking aspen / bluejoint reedgrass) communities. Higher, slightly less mesic portions of the toe slope are occupied by *Populus tremuloides* with a *Phleum pratense* (common timothy)-dominated ground layer. This community was once probably *Populus tremuloides* / *Calamagrostis canadensis* and now represents a grazing disclimax. One of the larger potholes has been ditched, although its fringes are still dominated by a wet and robust *Carex utriculata* community.

Reeves Lake is the largest and most diverse of these depressional wetlands. The lake has a large open water component that supports a *Nuphar lutea* ssp. *polysepala* (yellow pond-lily) aquatic community. An *Eleocharis palustris* (common spikerush) community occurs on intermittently exposed mudflats on the north end of the lake. A *Carex utriculata* community occurs on slightly higher substrate. This community is variable, with lower, wetter portions dominated by a near-mono-specific stand of *Carex utriculata* with some patches of *Glyceria grandis* (American mannagrass). On drier substrate, *Carex utriculata* still dominates but species richness increases with *Agrostis scabra* (ticklegrass), *Galium trifidum* (small bedstraw), *Rorippa palustris* (marsh yellowcress), *Potentilla rivalis* (river cinquefoil), *Scutellaria galericulata* (marsh skullcap), and other species present. The exotics *Phleum pratense* and *Cirsium vulgare* (bull thistle) are also present. A *Salix bebbiana* (Bebb willow) community occurs on higher deposits that still have saturated soil conditions. *Salix bebbiana* and *Alnus incana* (mountain alder) occupy an open overstory with *Dasiphora fruticosa* ssp. *floribunda* (shrubby cinquefoil) present as a low shrub. *Carex utriculata* and *Carex aquatilis* (water sedge) dominate the ground layer with *Calamagrostis canadensis* becoming important on drier portions of the community. On higher topographic positions, this community grades into a *Salix boothii* / *Calamagrostis canadensis* (Booth's willow / bluejoint reedgrass) community. Shrub cover is clumped, with *Salix boothii*, *Salix bebbiana*, and *Betula occidentalis* (water birch) all present at low cover and *Alnus incana* having the greatest individual cover. *Calamagrostis canadensis* dominates the ground layer with *Bromus ciliatus* (fringed brome) and *Heracleum maximum* (cow-parsnip) present at low cover. Uplands are dominated by *Phleum pratense* or *Populus tremuloides* / *Phleum pratense*.

Key Environmental Factors

Seasonal groundwater infiltration is the primary influence in maintaining these systems.

Rarity

No species of special concern were observed. Small examples of *Salix bebbiana* (Bebb willow), G3, and *Salix boothii* / *Calamagrostis canadensis* (Booth's willow / bluejoint reedgrass), G3G4Q, were inventoried.

Other Values

These depressions, especially Reeves Lake, provide breeding habitat for numerous bird species, including *Aythya affinis* (lesser scaup), *Branta canadensis* (Canada goose), *Fuliea americana* (American coot), *Agelaius phoeniceus* (red-winged blackbird), and *Porzana carolina* (sora). A breeding pair of *Grus canadensis* (sandhill crane) with young was also observed at this site.

Land Use

Grazing is the primary land use. Electric fencing suggests that cattle are actively moved from area to area. Although this site is not currently overgrazed, its long history of grazing (and perhaps past overgrazing) has altered the composition of many of the drier wetland and wetland-upland transitional communities. Pasture grasses, especially *Phleum pratense* (common timothy), now dominate these communities, and the historic native herbaceous dominants can only be guessed at.

Exotics

Phleum pratense (common timothy) and *Poa pratensis* (Kentucky bluegrass) are the dominant upland grasses. *Cirsium vulgare* (bull thistle) and *Phleum pratense* are present with low abundance in some of the wetland areas.

Uplands

The uplands are grazed but are largely intact.

Management Needs

The present active grazing management should be continued.

West Rosebud Trailhead

Directions

The West Rosebud Trailhead site is located in the foothills of the Beartooth Mountains in south central Montana. From Fishtail, travel west and south on State Highway 419 for approximately 1 mile to the intersection with State Highway 425. Turn onto State Highway 425 and travel south for approximately 6 miles to the intersection with Forest Route 2072. Travel south on this road for approximately 12.5 miles. The site is located just before the Mystic Lake trailhead.

Description

This site occurs in the glaciated valley bottom of West Rosebud Creek. Fluvial processes and old beaver dams have created a diverse microtopography with numerous swales, low areas, and channels. Vegetation is a mosaic of intermixed willow and sedge communities distributed along a microtopographic gradient. Old beaver dams are well vegetated with willow and sedge. The wettest sites, which occupy approximately 20 percent of the site, are open water. A semipermanently flooded *Carex utriculata* (beaked sedge) community fringes this open water and also occurs on wetter microsites throughout the site. This community is dominated by *Carex utriculata* but has inclusions of *Carex buxbaumii* (Buxbaum's sedge) and *Deschampsia caespitosa* (tufted hairgrass) on drier microsites. Higher sites are occupied by a *Salix boothii* / *Calamagrostis canadensis* (Booth's willow / bluejoint reedgrass) community. This commu-

nity is seasonally flooded to saturated and is characterized by high cover of *Salix boothii* and *Salix planifolia* (planeleaf willow). *Calamagrostis canadensis* is the dominant herbaceous species, but the exotic *Poa palustris* is widespread. Exotic pasture grasses are common on the highest microsites. An undescribed community, dominated by *Salix boothii* and *Carex buxbaumii*, is transitional between the *Carex utriculata* and *Salix boothii* communities. These communities have indistinct boundaries, and there is significant intergradation and many small inclusions depending on microtopography. Uplands are *Pinus contorta* (lodgepole pine) forest.

Key Environmental Factors

Seasonal flooding, floodplain development, and beaver activity are all critical in maintaining this site. No current beaver activity was observed at this site. Old beaver dams add to the diversity of this site by creating many wet and saturated microsites. Although these dams are well vegetated by willow and sedge, small headcuts are present in many places from overtop flow and subsequent erosion. Failure of these dams will alter the structure and composition of this site by increasing the extent of willow communities.

Rarity

No special status plant or animal species were observed. A fair to good example of a G3G4Q community, *Salix boothii* / *Calamagrostis canadensis* (Booth's willow / bluejoint reedgrass) was inventoried.

Land Use

The site receives moderate recreational use by fishermen. A few recreational trails are present, especially along the channel of West Rosebud Creek. Willow communities are moderately grazed, probably by deer, elk, and moose.

Exotics

Exotic grasses are well established on drier portions of this site. Species include *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), and *Bromus inermis* (smooth brome). Wetter sites are largely free from exotics, except for *Poa palustris* (fowl bluegrass), which is present in wetter willow communities.

Uplands

The surrounding uplands are largely undisturbed. Mystic Lake, which is upstream of the site, is dammed for hydropower. The penstocks return their flow to the stream immediately upstream of the site. This undoubtedly has an effect on the site's hydrology.

Information Needs

What effect has Mystic Lake dam and associated penstocks had on the hydrology of the site? Is the large

open water area a product of riverine processes or is it a depressional glacial feature?

West Thumb

Directions

The West Thumb site lies on the western shore of Yellowstone Lake around the West Thumb Geyser Basin. The site extends from the junction of the Loop Road with the South Entrance Road at West Thumb north along the lakeshore about 2 miles and includes the Potts Hot Spring Basin. The area is easily accessible in the summertime since it lies along these roads, but it is closed in the winter.

Description

The lakeshore around West Thumb junction contains many thermal features. Some of the rare species are restricted to these warm areas (*Dichanthelium acuminatum*, *Gnaphalium microcephalum* var. *thermale*). The site includes a low-lying area with so-called paint pots and hot springs along the shore. Duck Lake is about 0.25 miles west of the shore.

Key Environmental Factors

Thermal features.

Rarity

Ranking based on GRanks of known elements at the site. Although most occurrences are not ranked, the site is heavily used during tourist season so occurrences are probably lower quality.

White Bird

Directions

White Bird Fishing Access is located in the high plains of south central Montana. From Columbus, travel south on State Highway 78 for approximately 6 miles. Turn west at the sign for White Bird Fishing Access.

Description

White Bird is located on the floodplain of the Stillwater River. Most of the site is dominated by mature stands of *Populus balsamifera* ssp. *trichocarpa* (black cottonwood). These stands are primarily grazing disclimaxes with no or minimal native shrub cover, and the understory is dominated by exotic herbaceous species, including *Poa pratensis* (Kentucky bluegrass) and *Phalaris arundinacea* (reed canarygrass). The site also supports a stand of *Populus balsamifera* ssp. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood). This stand has a well-established tall shrub layer of *Prunus virginiana* (chokecherry), but the *Cornus sericea* is heavily browsed by wild ungulates and *Phalaris arundinacea* is abundant in the ground

layer. Cottonwood regeneration is occurring at this site: a gravel/cobble bar supports a well-established stand of sapling-sized *Populus angustifolia* (narrowleaf cottonwood) and *Populus balsamifera* ssp. *trichocarpa*. Side channels below bankfull elevation are hydric and support a *Phalaris arundinacea* community.

Key Environmental Factors

Flooding and associated substrate deposition and proximity of groundwater are the primary abiotic factors that influence vegetation at this site. Ungulate browsing is also an important influence on the structure and composition of shrubs at the site.

Rarity

No special status plants or animals were observed. One G3 community, *Populus balsamifera* ssp. *trichocarpa* / *Cornus sericea* (black cottonwood / red-osier dogwood), was documented in fair condition.

Land Use

This site is a Department of Fish, Wildlife & Parks Fishing Access site. It receives heavy recreational use, and the roads and campsites degrade the integrity of the site. A recent fire burned a small stand of *Salix exigua* (sandbar willow).

Exotics

Exotic species are abundant. *Phalaris arundinacea* (reed canarygrass) dominates hydric sloughs and more mesic cottonwood stands. Other common exotic species include *Cynoglossum officinale* (hound's tongue), *Cirsium* spp. (thistle), *Centaurea maculosa* (spotted knapweed), *Euphorbia esula* (leafy spurge), *Poa pratensis* (Kentucky bluegrass), and *Dactylis glomerata* (orchard grass). *Euphorbia esula* has been spot sprayed along roadsides.

Uplands

Away from the riparian area, land use is primarily livestock grazing, dispersed housing, and agriculture.

Information Needs

What was land use before site was acquired by FWP?

Management Needs

Greater weed control efforts are needed, although with high public use and upstream seed source, this effort will be perpetual.

Wyoming Line

Directions

Note: a portion of this site is located on private land, and landowner permission is needed to access that area. Wyoming Line is located east of the Beartooth Moun-

tains in south central Montana. From Belfry, travel 8.5 miles south on State Route 72 to an intersection with a county road to the southwest. Follow this road for 0.7 mile to a junction with a county road to the west. Continue westerly on this road for approximately 1 mile to junction with an unimproved road extending north and south. Travel south on this road for approximately 0.5 mile to an intersection. Continue south on the southerly fork for 0.1 mile to another junction with another unimproved road. Travel in a general southwesterly direction for 1.5 miles to the Wyoming Line wetland.

Description

This wetland is located just east of the Beartooth Plateau in a small valley that has springy areas throughout. The wetland has a small, intermittent creek that drains the site. The uplands are dominated by *Artemisia tridentata* (big sagebrush), *Sarcobatus vermiculatus* (black greasewood), and *Leymus cinereus* (basin wildrye). *Carex pellita* (woolly sedge) dominates the marsh. Cover ranges from very high in the central portion of the marsh to moderate on the margins. The water in this community is slightly brackish, with a conductivity of 1020 $\mu\text{S}/\text{cm}$. The cover of exotics increases at the edges of this community, perhaps because this drier portion of the community receives more grazing pressure. There are small inclusions of *Typha latifolia* (broadleaf cattail) and *Schoenoplectus sp.* (bulrush) within the *Carex pellita* community. A *Pascopyrum smithii* (western wheatgrass) community forms a small patch in the driest portion of this marsh.

Key Environmental Factors

Localized groundwater upwelling and seep areas constitute, apart from scant precipitation, the only source of water in this very dry environment.

Rarity

This site consists predominately of a high quality occurrence of a *Carex pellita* (woolly sedge) community.

Land Use

Livestock grazing has been and continues to be the primary use of this landscape.

Exotics

Only two exotic/increaser species were observed: *Sonchus uliginosus* (marsh sow-thistle) and *Ambrosia artemisiifolia* (annual ragweed).

Uplands

Livestock grazing and hunting are conducted in the landscape surrounding this site.

Information Needs

The ultimate source of water for this site is unknown.

Identification of this source would be useful so that any actions that threaten its continued flow could be avoided.

Management Needs

Managing livestock to minimize or avoid the spread of weeds would be beneficial.

Yellowstone Lake

Directions

Yellowstone Plateau, all of Yellowstone Lake.

Description

Site encompasses Yellowstone Lake and surrounding aquatic habitats (streams, rivers, wetlands).

Rarity

The site contains many high-ranking animal occurrences (see list) as well as Yellowstone cutthroat trout spawning areas adjacent to the lake, which are also an important food source for grizzly bears. Site contains the entire global population of *Abronia ammophila* (G1/S1).

Other Values

National Park, high use by boaters in some areas.

Yellowstone Lake Southeast

Directions

Yellowstone Plateau, Southeast Arm of Yellowstone Lake, extending from the confluence of Columbus Creek south to Trail Creek and including the eastern half of the peninsula on the west shore of the southeast arm. Site includes the Molly Islands in the south end of the lake.

Description

This site incorporates nearly the entire Southeast Arm of Yellowstone Lake as well as a about 1 mile band inland of the adjacent shore. In addition, it includes the Molly Islands about 0.5 miles off shore, one of the most important colonial nesting waterbird sites in Wyoming. The Southeast Arm is closed to boats with motors, and requires a permit for use. At the extreme south end of the Arm, the Yellowstone River enters Yellowstone Lake in a series of wetlands.

Key Environmental Factors

Water levels, degree of disturbance.

Climate

A continental, mountain climate prevails - cold winters with a goodly amount of snow, and warm summers with afternoon rainfall.

Rarity

Contains an A ranked occurrence of an American white pelican breeding colony (G3 S1B) and colonies of other state rare breeding waterfowl.

Yellowstone River Corridor

Directions

This site is located along the Yellowstone River in south central Montana. The upper boundary can be reached from Hwy. 89 near Gardiner, MT. The central portion can be reached from I-90, from Livingston to Custer, MT.

Description

This site has a rich diversity of aquatic, riverine, wetland and adjacent upland habitats along the main-stem of the Yellowstone River from the Wyoming border to the confluence with the Bighorn River. Unlike most major rivers in the west, the Yellowstone River is free from major impoundments that have dramatically altered the hydrologic regime. The Yellowstone is characterized as a relatively free-flowing river. The intact hydrology and river dynamics give rise to important cottonwood floodplain communities. The aquatic environments include both cold water and warm water species. Adjacent uplands (within the 1 kilometer buffer) include benches, slopes, cliffs, rock outcrops and historic river-bottom that support shrublands of sagebrush (all three subspecies of *Artemisia tridentata*), grasslands consisting of bluebunch wheatgrass, and woodlands of primarily *Pinus ponderosa* (ponderosa pine).

Key Environmental Factors

Seasonal flooding is the principal process facilitating the establishment and regeneration of cottonwood forests and riparian communities. Consequently, the process of seasonal flooding has direct implications to the numerous plant and animal species occurring within the river corridor.

Rarity

The site boundary includes a kilometer buffer on either side of the river and therefore contains a diverse environment. In the headwaters near the Wyoming border, the river corridor includes habitat for *Ursus arctos horribilis* (grizzly bear), *Lynx canadensis* (Canada lynx), and *Canis lupus* (gray wolf). Cold water aquatic environments support *Oncorhynchus clarki bouvieri* (Yellowstone cutthroat trout); downstream warm water aquatic species include *Scaphirhynchus albus* (pallid sturgeon), *Polyodon spathula* (paddlefish), *Cycleptus elongatus* (blue sucker), the *Hybopsis meeki* (sicklefin chub) and sturgeon chub. River and floodplain habitats are very important; three species of cottonwoods, *Populus angustifolia* (narrowleaf cottonwood), *Populus balsamifera* spp. *trichocarpa* (black cottonwood) and

Populus deltoides (plains cottonwood) occur in gallery forests and terraces and provide habitat for nesting, wintering and migrating *Haliaeetus leucocephalus* (bald eagle) and rookery sites for blue heron. Channel gravel and sand bars provide habitat for *Rorippa calcyina* (persistent-sepal yellowcress), although this species has not been relocated in recent years and *Trionyx spiniferus* (spiny softshell). Riparian communities include the rare plants *Eleocharis rostellata* (beaked spikerush) and *Cyperus schweinitzii* (Schweinitz's flatsedge). A notable shorebirds recorded from this stretch include the *Sterna antillarum athalassos* (interior least tern). Two reptiles, the *Heterodon nasicus* (western hognose snake) and *Lampropeltis triangulum* (milk snake) have been reported from the river corridor.

Other Values

The Yellowstone river is a relatively free flowing river, restricted only by the occasional riprap along the banks and numerous irrigation diversions and pumping stations. This site captures the nesting and foraging habitats of a plethora of species associated with the river and its floodplain.

Land Use

Agriculture, rural and urban developments and subsequent bank stabilization activities take place along the corridor. Diversions and dams for irrigation canals exits along the main stem and tributaries of the upper Yellowstone River. Irrigation is the major water use. Both irrigation and municipal use of groundwater has increased since 1970, with over 7,000 new wells within 5 miles of either side of the bank along the upper Yellowstone River in Montana (MT Bureau of Mines and Geology Wells database).

Exotics

There are infestations of numerous exotic plant species and populations of exotic fish species. Non-native salmonid species compete and /or hybridize with the *Oncorhynchus clarki bouvieri* (Yellowstone cutthroat trout).

Information Needs

An assessment of the health, population structure, and age of cottonwoods along islands in the main channel would quantify the dynamics of cottonwood and channel bar establishment.

Yellowstone River-Stillwater River

Directions

Note: This site is located on private land, and landowner permission is required to access this site. Yellowstone River-Stillwater River site is located at the mouth of the Stillwater River in south central Montana. From Colum-

bus, travel 1.6 miles southwesterly on State Route 78 to an unimproved road to the west. Follow the unimproved road for 0.25 mile to a side channel of the Yellowstone River. Yellowstone River-Stillwater River is approximately 0.4 mile upstream in a westerly direction.

Description

This site occurs on a terrace at the confluence of the Yellowstone and Stillwater Rivers. A well-developed *Populus deltoides* / *Symphoricarpos occidentalis* (plains cottonwood / western snowberry) community occurs at this site. The overstory is dominated by *Populus deltoides*, and there is also significant cover of *Populus angustifolia* (narrowleaf cottonwood) and *Populus balsamifera* ssp. *trichocarpa* (black cottonwood). All of these trees are 90-100 feet tall and average 20 inches or more diameter at breast height. The shrub understory is quite diverse and well developed, but is clearly dominated by *Symphoricarpos occidentalis*. Other shrubs include *Ribes aureum* (golden currant), *Toxicodendron rydbergii* (poison ivy), *Rosa* sp. (rose), *Prunus virginiana* (chokecherry), *Shepherdia argentea* (thorny buffaloberry), *Cornus sericea* (red-osier dogwood), *Parthenocissus inserta* (Virginia creeper), *Clematis ligusticifolia* (western clematis), *Ribes* sp. (gooseberry), and *Juniperus scopulorum* (Rocky Mountain juniper). *Glycyrrhiza lepidota* (American licorice), *Rudbeckia laciniata* (cutleaf coneflower), and the exotic grass *Bromus inermis* (smooth brome) dominate the ground layer. Small inclusions of wetter communities like *Carex pellita* (woolly sedge) and open-water pools occur in a series of old overflow channels that wind through the cottonwood stand. The soil has a loam texture.

Key Environmental Factors

Seasonal flooding and sediment deposition are responsible for creating and maintaining this community. Fluvial processes appear to be largely intact at this site.

Rarity

A relatively old stand of a G2G3 community, *Populus deltoides* / *Symphoricarpos occidentalis* (plains cottonwood / western snowberry), in good condition was documented. *Carex tenera* (soft sedge), a watch species that is under consideration for addition to the Montana plant species of special concern list, was documented at this site. This may be only the second known documented occurrence for this species in Montana.

Other Values

This tall cottonwood stand represents highly significant habitat for fish-eating birds of prey because of its stature and location at a large confluence on the Yellowstone River. This cottonwood stand contains mature individu-

als of the three cottonwood species that occur in Montana. Analysis of this stand could help refine our understanding of the distribution and habitat requirements for these species. This stand represents the best condition cottonwood community documented on the Yellowstone River from Greycliff to Columbus.

Land Use

The heavy cover of *Bromus inermis* (smooth brome) in the understory suggests that historically this stand could have been grazed. A small number of cattle were present, though the stand did not show signs of regular grazing. It is not known whether these cows had escaped or management is changing.

Exotics

There is low cover of three noxious weeds, *Cynoglossum officinale* (hound's tongue), *Cirsium arvense* (Canada thistle), and *Calystegia sepium* (hedge bindweed), in this stand. Exotic pasture grasses, predominantly *Poa pratensis* (Kentucky bluegrass) and *Bromus inermis*, dominate the ground layer beneath the native shrub layer. Grass cover is relatively low because of the high shrub cover.

Information Needs

Knowing the land use history of this site would be useful to understanding the present-day species composition of the stand. Both cattle and wild ungulates show a strong browsing preference for *Cornus sericea* (red-osier dogwood), and the scarcity of *Cornus sericea* in this stand may be a product of past grazing.

Stands of tall cottonwood approximately 0.5 mile upstream on the Stillwater River were noted but not surveyed. In addition, nearby islands have been documented as having nesting bald eagles. This site may be part of a larger woodland complex of significance at the Stillwater River confluence. We do not know the extent of the stand, and this affects the significance of the site.

Management Needs

A noxious weed management plan is needed for the Yellowstone River corridor. *Euphorbia esula* (leafy spurge) is established and a growing threat in the area though not currently present on this site. Coordinated efforts are needed to improve control efforts for this pernicious species. Grazing poses a threat to stand condition.

Yellowstone River-Work Creek

Directions

Note: this site is located on private land, and landowner permission is required to access this site. Yellowstone

River-Work Creek is an island in the Yellowstone River in south central Montana. From Reedpoint, travel 4 miles west on Interstate 90. Yellowstone River-Work Creek is due north approximately 0.25 mile.

Description

This site is an island in the Yellowstone River. It is dominated by a well-developed *Populus angustifolia* / *Cornus sericea* (narrowleaf cottonwood / red-osier dogwood) community. The average height of the cottonwood canopy is about 80-90 feet, with the red-osier dogwood forming dense 6-10 foot high shrub undergrowth. The shrub layer is diverse and other associated shrubs include *Symphoricarpos occidentalis* (western snowberry), *Salix exigua* (sandbar willow), *Salix lutea* (yellow willow), and *Ribes sp.* (gooseberry). There is a considerable amount of microtopography in the form of small channels. This creates habitat for a variety of forbs and graminoids, some of which are tolerant of moister conditions. The soils on this old terrace are silt loam textured with very little organic horizon.

Key Environmental Factors

Seasonal flooding and sediment deposition are responsible for creating and maintaining this community; lack of ungulate access probably is instrumental in maintaining the species composition, particularly the dominance of *Cornus sericea* (red-osier dogwood).

Rarity

Although no rare species or communities were observed at this location, it is significant because it is one of the few stands of mature cottonwood forest with an intact

native shrub understory in the stretch of the river from Greycliff to Columbus. Most cottonwood stands in this river reach, and apparently elsewhere judging from casual observation, are dominated by undergrowth of exotic pasture grasses.

Land Use

The high level of coverage by exotic pasture grasses on the island could indicate some past grazing, possibly at a time when this island was connected to the shore.

Exotics

Three noxious weeds occur at low cover in this stand: *Cirsium vulgare* (bull thistle), *Cirsium arvense* (Canada thistle), and *Euphorbia esula* (leafy spurge). Exotic pasture grasses dominate the ground layer beneath the native shrub understory. These grasses include *Agrostis stolonifera* (redtop), *Poa pratensis* (Kentucky bluegrass), *Elymus repens* (quackgrass), *Bromus inermis* (smooth brome), and *Phleum pratense* (common timothy). *Phalaris arundinacea* (reed canarygrass) is also present in wetter locations.

Uplands

Irrigated agricultural crops dominate most of the uplands, though cattle grazing occurs in the immediate riparian zone. All of fluvial processes are intact.

Management Needs

A noxious weed management plan is needed for the Yellowstone River corridor. *Euphorbia esula* (leafy spurge) is established and a growing threat in the area and coordinated efforts are needed to improve control efforts for this pernicious species.