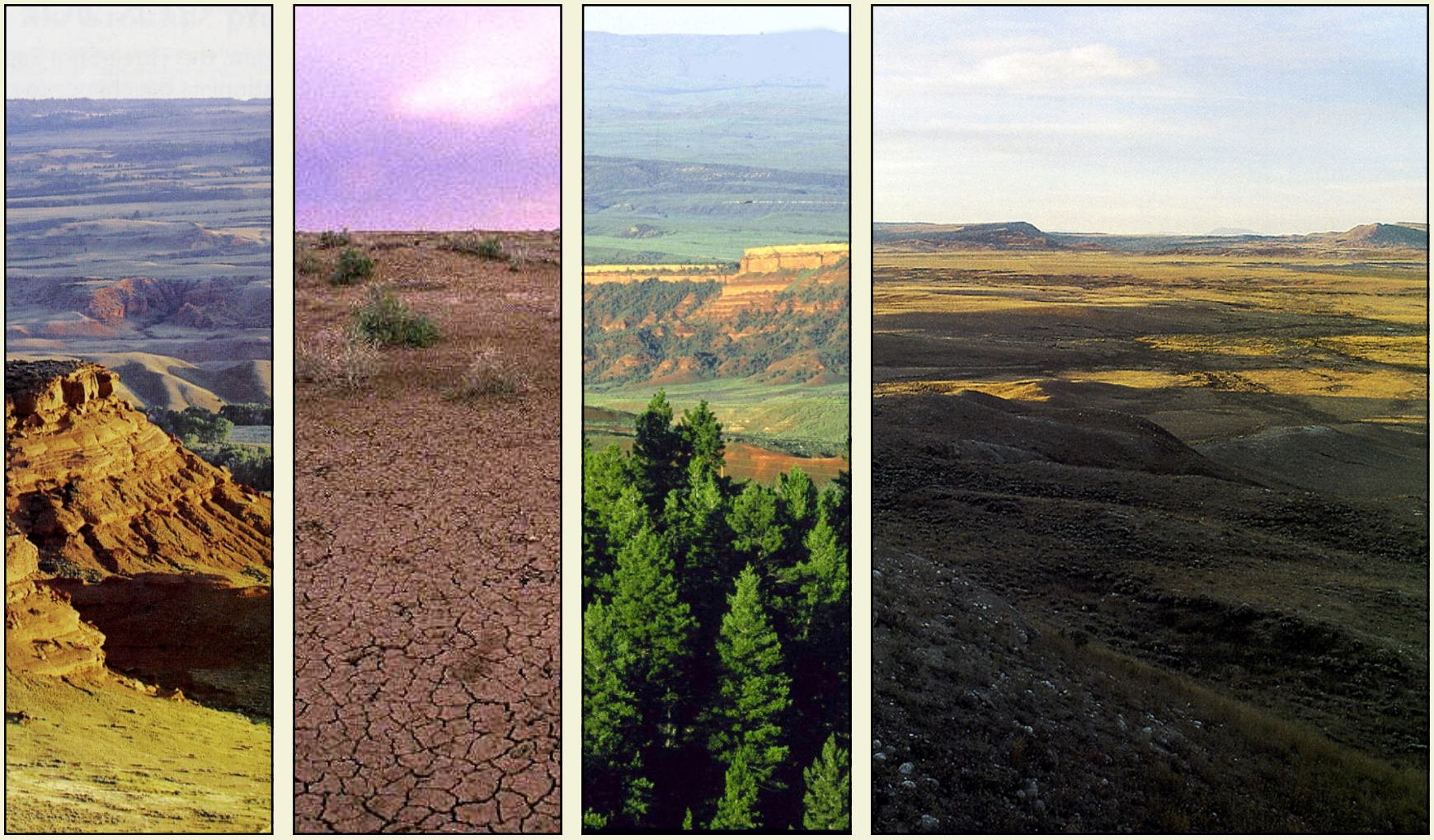

The Wyoming Basins Ecoregional Plan

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The Wyoming Basins Ecoregional Plan

January 1, 2001

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Ecoregional Planning

In 1996, The Nature Conservancy (TNC) began planning for conservation at the landscape scale. In an initiative to treat biological conservation across state lines and political boundaries, The Conservancy instituted "Ecoregional Planning" nationwide (The Nature Conservancy 1996). Ecoregions are large units of land and water delineated by biotic environmental factors which regulate the structure and function of ecosystems within them. The ecoregions of the US were delineated by Bailey (1995) who provided a starting point for TNC planners. Bailey's boundaries were modified by TNC staff to create TNC's ecoregional map of the US (The Nature Conservancy 1997). Additional ecoregional assessment was done by Ricketts et al. 1999. In the intervening years, ecoregional plans have been initiated or completed in many of the ecoregions.

In each ecoregional plan, the goal has been to conserve the viable native species and natural communities (called "conservation targets") by identifying certain areas on the ground ("a portfolio of sites") which, if protected, would provide the greatest protection for all the plant and animal species of the entire ecoregion. Ecoregional planning has attempted to identify those species of maximum concern, while at the same time considering all of the common species as well.

By choosing a "portfolio of sites" the Conservancy incorporates the concept of "reserve design" (Bedward et al. 1992, Pressey et al. 1993, Noss & Cooperrider 1994) meaning that the group of sites should include as many targets but as little area as possible. This is based on a traditional strategy in which conservation is accomplished by purchase of important areas. In Wyoming and other western states, however, the paradigm is somewhat different. Here, we work with willing partners, (e.g., ranchers, agency personnel and other landowners), interested in community-based conservation. Using the tools of conservation easements, agency designations, and Coordinated Resource Management plans (CRM's), we encourage conservation and compatible human activities. Without respect to land ownership, the site boundaries shown in this plan are intended as a guide to areas of greatest biological importance.

In the past, most conservation action focused on single species of concern although species are clearly linked to one another. Yet there are important advantages to considering species in groups and over large areas. Working

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on multiple species allows us to conserve groups of species in jeopardy. Working on large landscapes allows planners to consider ecological functions such as fire, disturbance regimes, and interactive effects. It acknowledges the fact that living things don't recognize human borders and that many species may be impacted by the same types of human activities.

Nature Conservancy plans consider both individual target species (typically rare or sensitive species) and also more broadly distributed common species (Master 1991). To do this, TNC evolved a two-part approach referred to as the "coarse filter" and the "fine filter. "The "fine filter" is the known location of rare plants and animals of concern. If we know where they are, we can prioritize such areas for conservation.

The "coarse filter" refers to delineating where all viable, native, plant communities occur. These natural communities, described in the National Vegetation Classification (Grossman et al. 1998), are useful in the conservation of multiple species because they reflect the ecological processes operating across the landscape and they can serve as surrogates in areas where little is known about distributions of species. The "coarse filter" is based on the notion that protecting a plant community will protect roughly 85% of the animal species living there. For example, conserving aspen stands will have the effect of capturing or "netting" aspen-living animals in our "coarse filter" (Noss 1987).

The Wyoming Basins Ecoregional Plan was produced by gathering as much existing data as possible on the distribution of plants and animals in the region. Next, we developed a list of both rare and common species and community types in the region. These were prioritized using The Nature Conservancy's Natural Heritage program rankings (Groves et al. 1995). Land cover-types were derived from Gap analyses done by each of the states. Using best available data, we decided upon target goals for each of the rare species or community types, that is, how many of each thing we sought to conserve. Finally, locations of these species and cover-types were mapped by a computerized Geographic Information System (GIS). The GIS plotted maps of where the largest number of targets overlapped. Using the plotted locations of rare species and representative cover-types, we drew lines (i.e., polygons) on the map to capture our targeted numbers of animals or acres. In the final stage of portfolio selection, sites were prioritized and their boundaries refined as best as possible without actually visiting them.

This document presents the methods used and the portfolio obtained for the Wyoming Basins. Ecoregional plans are intended to be iterative, living, documents. They show the state of knowledge at the time of their inception and are intended to be updated as information and methods improve. In this document, plants and animals are identified by their common names, a list of scientific names appears in Appendix 1. Copies of the Wyoming Basins Ecoregional Plan are available from The Nature Conservancy Wyoming Field Office (WYFO) or from TNC's home office in Arlington, VA.

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SETTING THE SCENE

The Wyoming Basins ecoregion comprises 51,605 square miles (33 million acres or 13.3 million hectares) of basin, plain, desert, and "island" mountains in Wyoming, Montana, Idaho, Colorado, and Utah. The area is a veritable "ocean" of sagebrush interspersed with unusual rock formations, sand dunes, and saltbush communities. Mountains rising from the basins are timbered with limber pine, Douglas fir, and stands of aspen. The basins are separated into distinct watersheds of the Green River, the Bighorn River, the North Platte, the Yampa, the Little Snake, and several smaller rivers. In this dry country, water imposes strong limits. The riparian zones support important populations of neotropical migrant birds and are the habitat of several rare or endangered fish species including Bonneville and Colorado River cutthroat trout and the Colorado River pikeminnow.

Because most of the ecoregion is gently rolling sagebrush rangeland, the human observer can easily fall into a false sense that this is an empty or biologically dull place. The opposite, however, is true. Fully two thirds of the rare plants endemic to Wyoming are found here. The ecoregion is home to numerous grassland birds (such as Brewer's sparrow, grasshopper sparrow, and mountain plover), identified as the nation's most endangered group (Samson & Knopf 1996). The prairie rangelands are also home to prairie dogs whose range has now been reduced to less than 2% of that they formerly occupied. Prairie dog colonies, in turn, are important to black-footed ferrets (America's most endangered species), ferruginous hawks, swift fox, mountain plovers and burrowing owls.

The Wyoming Basins were considered by Bailey (1995) a part of the Intermountain Semi-desert Province. TNC scientists decided to detach the Wyoming Basins, in part because of the vegetational differences between Wyoming

Ferruginous Hawks at Nest - Gus Wolfe

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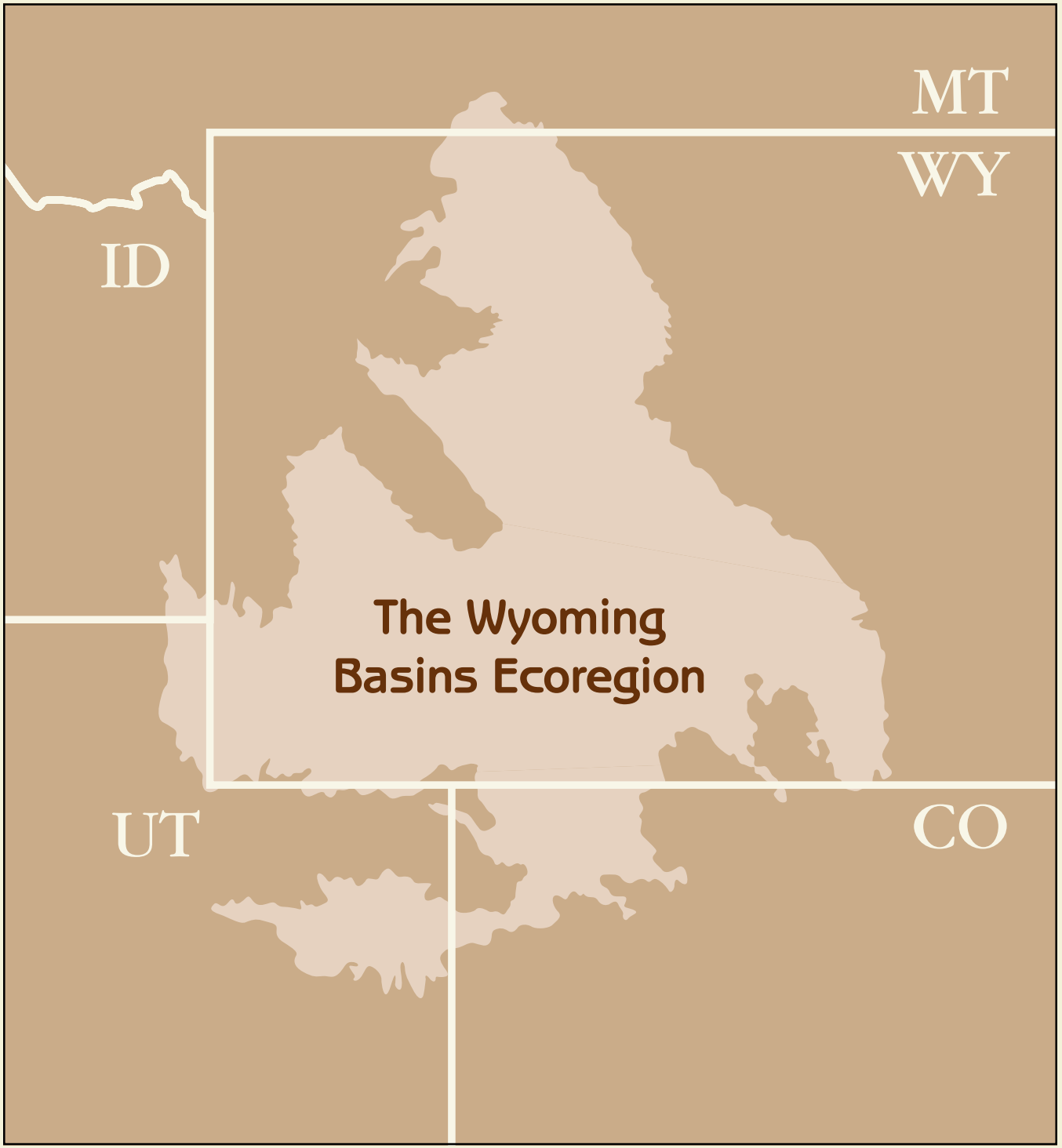
The Wyoming Basins ecoregion comprises 51,605 square miles of basin, plain, desert, and "island" mountains in Wyoming, Montana, Idaho, Colorado, and Utah.



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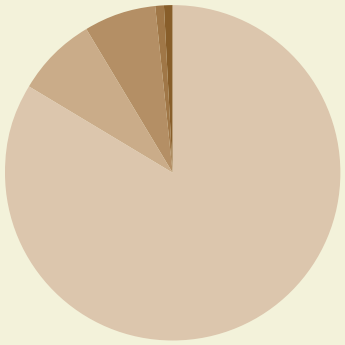
WY	43236	83. 8%
UT	3982	7. 7%
CO	3581	6.9%
MT	462	0. 9%
ID	344	0. 7%



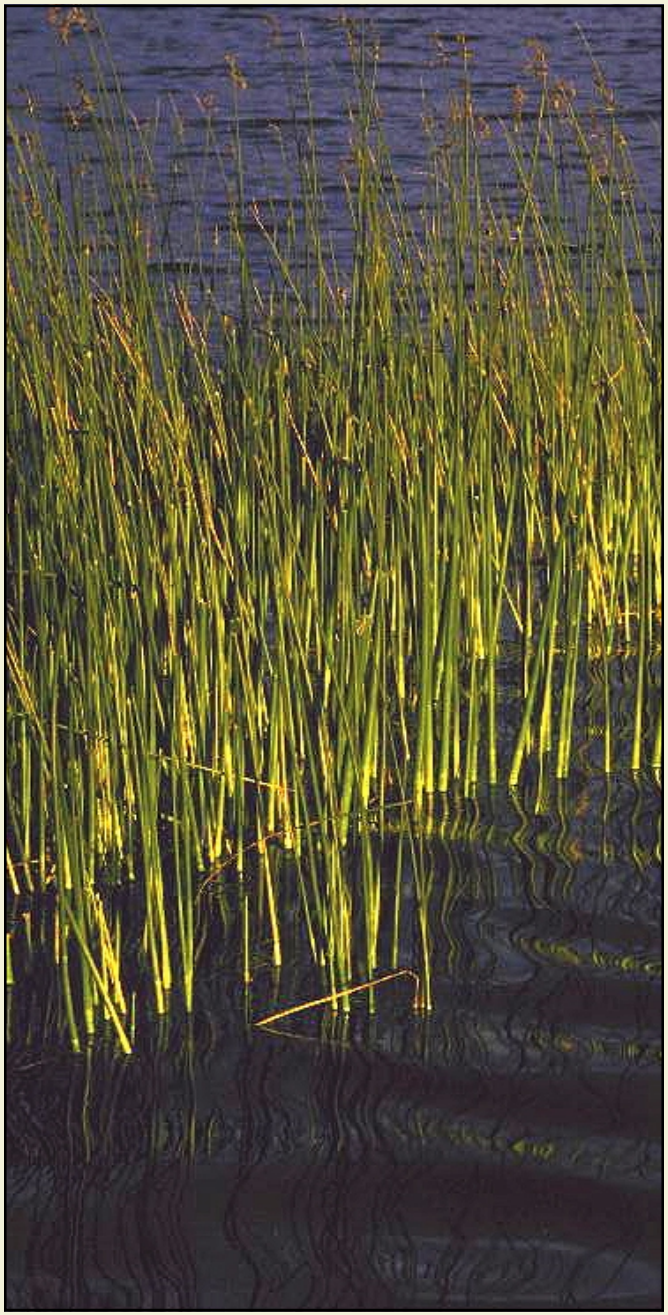
Acres in each state and their percentage of the total.

and points west. Although the entire area is dominated by sagebrush species, many of which are common, the Wyoming Basins contain blue grama grass (basically a great plains species) which the Great Basin deserts lack. Rhizomatous grasses like Western wheatgrass are more common in WY than in the Great Basin desert. The separation from the Intermountain Province was also made to simplify the ecoregional planning process.

The Wyoming Basins ecoregion comprises the central part of Wyoming including the Bighorn Basin, the Red Desert, the Upper Green River drainage, the Great Divide Basin and other basins and ranges as far east as the Laramie Basin. It includes a part of Montana at the north end of the Bighorn Basin and the Pryor Mountains. To the west, the ecoregion includes Bear Lake and its associated wetlands in extreme southeastern Idaho. To the south, the ecoregion includes the Bear River drainage in extreme eastern Utah and the Uinta Basin of Utah and Colorado.

The ecoregion is very largely comprised of Wyoming's central basins. The percentage of land in Utah and Colorado are similar, with less than 1% in either Montana or Idaho.

Weather in the Wyoming Basins is harsh. Although rainfall may reach 16" (40 cm) annually along the base of the mountains, the Basins are mostly in the mountains' rain shadow. Precipitation in the Basins is typically 6-10" a year. Rainfall less than 10" annually is generally considered desert (Jaeger 1957) and the Wyoming Basins ecoregion contains the driest areas of Wyoming (Martner 1986). Temperatures range from bitter cold to hot in summer with freezing possible in any month of the year. Although snowfall is less in the Basins than in the mountains, snowfall is very important because snowmelt is slower and more readily absorbed by plants than sudden rainfall (Knight 1994).



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Habitats

Most of the Wyoming Basins is sagebrush steppe; actually a shrubland mosaic dominated by Wyoming big sagebrush. In places of shallow soil and on windswept ridges, Wyoming big sagebrush may be replaced by black sagebrush or communities of cushion plants. Gardner saltbush and greasewood are especially common on alkaline soils and basin big sagebrush or silver sagebrush may thrive in more moist locations (Knight 1994). The sagebrush landscape of low rolling hills and rugged ravines extends for hundreds of square miles in the Wyoming Basins ecoregion. With the exception of the few riparian areas, much of the sagebrush steppe is devoid of trees offering panoramic vistas as far as the eye can see.

Despite their appearance to a human driving through, the Wyoming Basins are surprisingly diverse. Areas of higher salinity and less precipitation are considered desert shrublands dominated by greasewood, shadscale saltbush, fourwing saltbush or winterfat. These plant communities are typically found where precipitation is less than 10" (25 cm) annually and where the soils contain high concentrations of salts. In some places, the soil surface can be white from accumulated salts. If alkaline areas occur in moist spots or seeps, playas may form with differing amounts of vegetation regulated by soil characteristics (Knight 1994).

Running throughout the ecoregion as arteries of life-blood, are riparian corridors. Vegetated by several cottonwood species, willow and alder thickets, ninebark, and occasionally boxelder, these corridors provide abundant food, physical shelter, and life-giving water to dozens of species of wildlife and neotropical migrant birds. The Sweetwater, the North Platte, the Upper Green, the Yampa, and the Bighorn Rivers are major fluvial systems fed by hundreds of smaller streams.

Another outstanding feature of the Wyoming Basins are long, linear ridges of sand dunes, some running 100 miles or more. The dunes may be either actively moving as winds deposit and rearrange the sand, or they may be stabilized by the growth of plants. Ponds frequently occur between the dunes. Plant life on the dunes may be quite specific to these harsh locations and may include blowout grass, Indian ricegrass, sandhill muhly and others (Knight 1994).

Some areas of the ecoregion contain soils rich in clay. These areas expand and contract as

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they wet and dry, preventing much establishment of vegetation. Derived from mudstones and shales, these areas are highly erodible, forming the characteristic buttes and cliffs we know as badlands.

Mountain ranges occur throughout the Wyoming Basins Ecoregion, although most have peaks lower than 9,000 ft. A single point in the Wind River mountains near Dubois marks the high point of the ecoregion at 11,112 ft., but more than 90% of the ecoregion lies between 5,900 and 7,800 ft. (1,800-2,400 m). The dozen or more mountain ranges (e.g., the Ferris, Bridger, Owl Creek, and Pryor Mountains, and the Rattlesnake Hills) are in many respects mountain "islands" in a "sea" of sagebrush. Vegetated with pine, spruce, fir, Douglas-fir, and aspen, these mountains contain habitat for forest creatures. Some species may exist as truly isolated populations on these "islands" (e.g., red squirrels and southern red-backed voles). Other species such as black bears, snowshoe hares, and boreal owls use these "islands" as stepping stones between larger blocks of suitable habitat.

LuRay Parker

Wildlife

Early explorers noted the gradual change from grassland on the prairies into the rolling sagebrush shrubland of the Wyoming Basins (Wilcove 1999). Soil and climatic conditions are largely responsible for the shift in habitat. These areas were the open plains grazed by vast bison herds for thousands of years (Noss & Cooperrider 1994, Samson & Knopf 1996). Large numbers of scavengers (bears, coyotes, vultures, wolves, wolverines) followed the bison herds, cleaning the plains of the millions of dead bison as they died in life's great circle. Today, the scavenger part of the food chain is largely absent.

In the days before European settlement, the sagebrush shrublands were home to millions of prairie dogs whose burrows and digging activities provided food, shelter, and soil aeration (Whicker & Detling 1988). The prairie dog lands were home to an entire community of animals associated with prairie dog habitat. Ferruginous hawks, mountain plover, swift fox, burrowing owls, and black footed ferrets were frequently found in connection with prairie dog colonies.

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Today, black-footed ferrets hover near the edge of extinction and the others are declining as prairie dog numbers decline (Davitt et al. 1996).

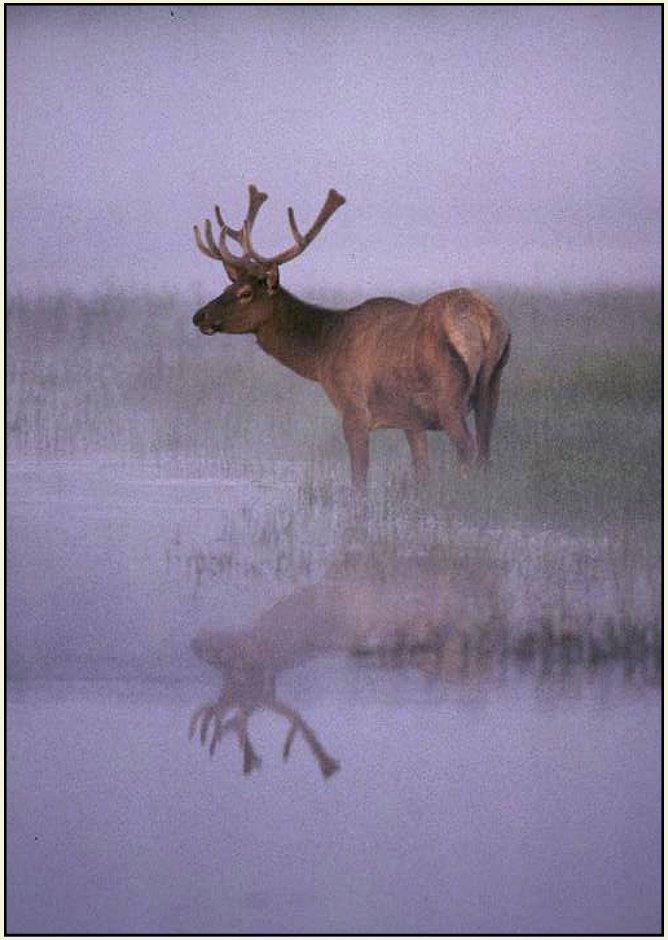
Despite human conversion of the prairies (in the Midwestern states) to intensive agriculture, the sagebrush shrublands remain surprisingly intact (Knight 1994). As a landscape, areas once dominated by sagebrush are still dominated by sagebrush. Cattle and sheep today graze lands which were formerly grazed by bison (Hartnett et al. 1997), although today the bodies of the livestock feed humans, not wild scavengers. Many of the grassland birds of the prairie find refuge today on the sagebrush lands although they are threatened by agriculture elsewhere. This has led to the pronouncement that grassland birds are our "most endangered" group (Samson & Knopf 1996) and places additional importance on their conservation in the Wyoming Basins.

As with deserts or other harsh habitats worldwide, the Wyoming Basins are easily under-estimated or under-appreciated by humans.

What is perhaps less well known, however, is that many animals we think of today as forest species (elk, grizzly bears, wolverines) were lowland or prairie species in the 19th century when they were first described by Lewis and Clark (Botkin 1996, Cutright 1969). Mountains in the Wyoming Basins today serve as refugia from which these animals might again roam as lowland species if their conservation could be assured.

The small moist pockets and sinuous stream edges of the Wyoming Basins are home to a surprising diversity of endemic fishes, neotropical migrant birds, and a small number of amphibian species (many of which are disappearing). Although the largest rivers are dammed and regulated (e.g., the Green, the Platte, and the Bighorn), several others (the Yampa, the Sweetwater) maintain a natural flow regime and are biologically precious because of it.

As with deserts or other harsh habitats worldwide, the Wyoming Basins are easily under-estimated or under-appreciated by humans. These vast spaces and sweeping panoramas reward the inquiring naturalist and deserve a great deal more than a cursory drive-through.



Thomas Mangelson

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Recent Human History

Grazing:

The cultural history of the Wyoming Basins has been largely influenced by grazing animals. For the American Indians these were the bison lands. When European settlers arrived, the bison were replaced by sheep and cattle. In the late 1840s, accidental and intentional releases of livestock, coupled with the presence of feral horses and knowledge of herds of other large ungulates, led people to question the popular notion that stock could not survive northern winters. The massive migration of settlers through this region on the Oregon, Mormon, and Overland trails influenced the landscape along the chosen corridors. At times, the trails were miles wide by the time the lagging settlers passed through with many such areas severely used throughout the summer months. By the 1870s, cattle and sheep were actively moved into and through the region, and the shortgrass prairie was settled by farmers, as well as stock owners whose investments in cattle profited greatly from grass owned by no one. The Wyoming basins were settled later, as indigenous populations were moved out, but most of the area was largely homesteaded by the turn of the century.

The concept of livestock production was built on observation of large herds of bison, elk, bighorn sheep and other native animals that used the grasses of the northern latitudes effectively. At first, large herds of cattle were brought into the area in a "migratory" fashion to fatten over summer and fall, trailed at first to markets in western localities such as burgeoning Denver and Cheyenne, later shipped by rail to markets in the Midwest. At the time, beef and lamb were fattened on grass and sold directly to the packers; supplemental feeding of livestock was not a common practice. By the turn of the century, the livestock industry had seen its share of disaster, most notably the "Blizzard of 1886," where a young artist named Charles Russell immortalized the last of the great range herds in pen and ink. Still, numbers of animals were maintained as settlers irrigated native hay meadows and found farming a viable use of landscapes along rivers and streams.

Throughout the early portion of the 20th Century, stocking was primarily done in the fashion best described as "a tragedy of the commons." Each rancher took as much grass for his own cattle as he could, knowing that if he didn't, others would... and with no concern for the future. Most of the Wyoming Basins were not suited to farming, and as homesteaders were limited to 160 acre parcels, sagebrush steppe and prairie lands were ignored. As a result, these vast ranges were used by anyone who owned stock, leading to the need for such laws as the Maverick Act, and establishment of brand laws which ostensibly determined ownership of cattle and sheep. In some cases, the lands of the Wyoming Basins was used throughout the year, with wildlife and cattle grazing in the summer, and sheep use in the winter months. Within a short period, there was little disagreement that unchecked use of western ranges was excessive and needed to be regulated in some manner. This led to passage of the Taylor Grazing Act in the early 1930s, and establishment of the predecessor of the Bureau of Land Management.

The effect of early settlement and migratory livestock grazing was not uniform on the landscape. In some cases, ranges were so sorely

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depleted that they may have changed entirely. However, other rangelands remain intact as relict sites, or even large expanses of native range with a vegetative composition dating back millennia. Water distribution, predators, fire regimes, poisonous plants, and other natural phenomena may have influenced the use of ranges over time, but management of livestock played a role as well. In most of the region, large "roundup districts" were created to move livestock throughout the landscape in response to grass phenology and climate, or to avoid hazards such as larkspur. Sheep were almost universally herded, and moved to higher grasslands in the summer.

Saratoga Valley - The Nature Conservancy

One of the major factors influencing livestock and native ranges came as a result of technological advance and depleted manpower during the Second World War. Traditional roundups and herding of livestock was difficult as men enlisted for military service, and fencing of "private" rangeland allotments left the landscape pieced into smaller units. Even with decreased numbers of cattle and sheep, the migratory pattern of use was interrupted by grazing units, most of which were grazed as long as the grass held. It was not until the late 1940s and early 1950s that rotational grazing was first proposed, coincidentally concurrent with an aggressive curtailment of natural fire. At the same time, the Society for Range Management was formed to coordinate research and share learning about the natural landscape and management of livestock in that setting.

Today, the landscape of the Wyoming Basins is not singularly owned or managed. Much of the land is managed by the Bureau of Land Management, with some U. S. Forest Service ownership as well. Within each township, sections 16 and 36 were granted to the states. Much of the valuable riparian and wetland habitats were homesteaded in the 1800s. Consequently, ranches are defined by the landscape they are responsible for, not simply by deeded property lines. Within this patchwork of land ownership, no single owner has the capacity to provide the full range of biological values and

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Although grazing management has probably had the most profound and widespread effect on this ecoregion, other activities have also had their impact.

meet the needs of all species. In order to manage for multiple values and uses, agencies and landowners must work to find alternatives that are ecologically, economically, and culturally sound. Coordinated Resource Management (CRM) is one means of achieving those objectives. This open, collaborative process allows ranchers, land managers, wildlife agencies, and other interested parties to collectively address multiple objectives and means of achieving multiple values. While this process does not circumvent applicable law, it does allow agencies and others greater flexibility in management, consistent with the adaptive management techniques applied in business worldwide.

In more recent years, as scientific inquiry and observation have advanced ecological knowledge, management of animals has taken on more importance. In many cases, the migratory pattern of use has been reinstated as a means of managing large grazing animals. Fire, rest, and other manipulations of natural influences such as selective grazing are slowly being explored and better understood. Better recognition of the functional needs of riparian and wetland habitats has led to an increased focus on those areas. Discovery and analysis of rare species, as well as those which may be key indicators or species in peril, has led to management approaches which are directed toward biological diversity and retention of biological values.

Logging:

Although grazing management has probably had the most profound and widespread effect on this ecoregion, other activities have also had their impact. Many of the wooded mountains were heavily logged in the late 19th century for railroad ties. A roadside monument to these "tie-hacks" is located on Wyoming highway 287 just north of Dubois, but many other ranges closer to the Union Pacific route in southern Wyoming were also heavily cut. Logging activity continues today in the ecoregion, much of it on lands supervised by the USDA Forest Service (e.g., Shoshone, Medicine Bow, and Ashley National Forests). Although higher elevations in some areas fall outside of the Wyoming Basins boundary, logging practices in the forests have strong effects on downstream ecological processes within this ecoregion (Bilby & Bisson 1992, Vannote et al. 1980).

Agriculture:

Although the growing season is short in the Wyoming Basins, areas near reliable water sources have been exploited for growing crops since the 19th century. Many if not most riparian areas are today used as hay meadows for livestock feed either with or without supplementary irrigation. A considerable sugar beet industry exists in parts of the ecoregion.

Mining:

In the late 19th century land ownership patterns were driven by the Union Pacific Railroad's routing along the edge of southern Wyoming and northern Utah. The railroad route was influenced by the important coal seams at Hannah, Rawlins, and Rock Springs. Land along the railroad right-of-way was designated a checkerboard preventing large contiguous private ownership and impeding agency planning today. This "southern tier" of Wyoming remains a major site for coal, gas, methane and trona production. In the 20th century, oil, gas, coal, coal-bed methane and trona (soda ash) production saw dra-

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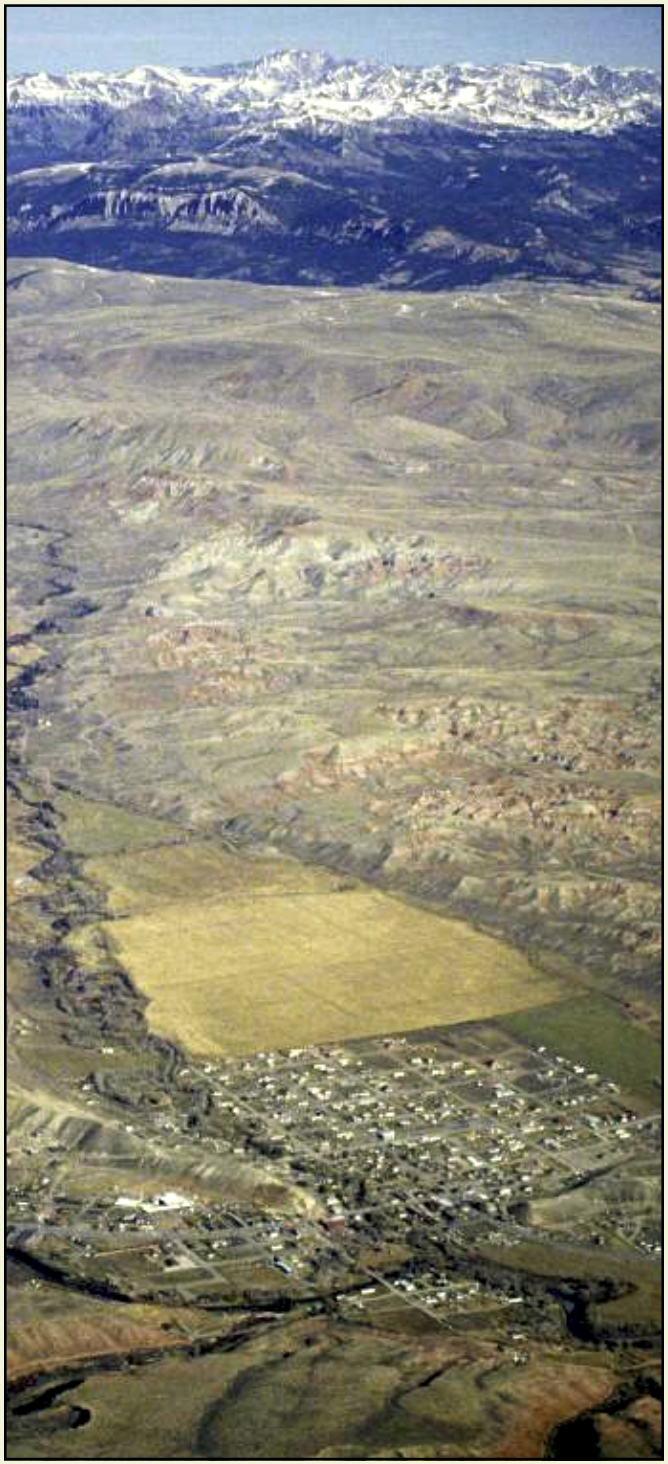
matic increases in the ecoregion. The area contains the nation's largest natural gas reserve while coalbed methane is another very important resource and a fast-growing industry. A major source of air pollution today is the coal-fired Jim Bridger power plant near Rock Springs. Roads, powerlines, and pipelines needed to support these industries continue to fragment and impact this part of the ecoregion. Significant impacts were caused from the 1950's forward by aggressive uranium exploration and mining. With the decline of the cold war and public reticence about nuclear power, many uranium mines are now inactive but few have been reclaimed. Test digs and roads to them remain on the landscape.

Although more centered in location than agricultural practices and thus more limited in scope, industrial activities have strong effects on the surrounding flora and fauna. Responding as it does to human needs and economics, it is difficult to predict future mineral production, but clearly the ecoregion is rich in natural resources and it seems likely that industrial pressures will continue to mount.

Despite all the activities mentioned in this section, this ecoregion remains one of the least impacted and least populated regions of the United States. The largest city in the entire ecoregion is Laramie, WY with a population of 25,000 (1998 data). Most of the ecoregion is rural, sparsely populated, and relatively far from big city amenities. With its aridity, harsh weather, and short growing season, the ecoregion seems unlikely to undergo the huge population increases seen, for example on Colorado's front range. But crystal balls are notoriously prone to error.



Dubois, WY and the Absaroka Mountains - The Nature Conservancy

METHODS

To understand how TNC prioritizes species, it is important to know about ranking terminology. In an effort to assign conservation priorities to plants and animals worldwide, TNC uses a system of codes to indicate global or state rarity of each species, subspecies, or variety. Although it may sound clumsy, target species are usually referred to as "elements" and documented places where they occur as "element occurrences." Species are evaluated by a nationwide system of Natural Heritage Programs in each state. The reader of this Plan need know only the basics of how species are ranked. In brief, "G" ranks are global ranks and "S" ranks refer to status within a state. The "S" or "G" is followed by a number from one to five signifying conservation status. Here is a brief synopsis of the five ranks:

1 Critically imperiled because of extreme rarity (5 or fewer extant occurrences, or very few remaining individuals) or because of factors demonstrably making a species vulnerable to extinction.

2 Imperiled because of rarity (6-20 occurrences) or because of factors demonstrably making a species vulnerable to extinction.

3 Rare or local throughout its range or found locally in a restricted range (21-100 occurrences).

4 Apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.

5 Demonstrably secure, although the species may be quite rare in parts of its range, especially at the periphery.

Spotted Frog - Bob Luce

Asters - The Nature Conservancy

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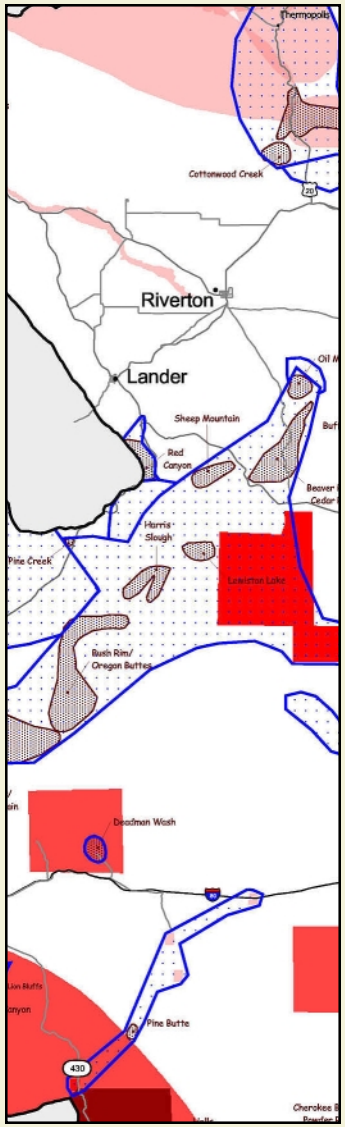

Plant and Animal Targets Map, detail - Tom Kohley

TNC's plan for the Wyoming Basins Ecoregion was conducted using existing knowledge available at the time of writing. The process involved four tasks, each of which will be discussed in a separate section.

- Task 1 - Target Selection. Included all imperiled, endangered or sensitive species as determined by experts in the Natural Heritage Program in each state. It also included all native, terrestrial ecological communities identified by the TNC National Vegetation Classification.
- Task 2 - Establishing Target Goals. Heritage experts in each state established initial viability criteria and conservation goals (numbers, distribution of each conservation target).
- Task 3 - Mapping. Known locations of all the conservation targets in the five states were compiled on computerized maps (GIS) by Tom Kohley at Beartooth Mapping, Red Lodge, MT. Cover-type maps from the Gap Analyses (explained below) in the five states, along with limited Natural Heritage Program element occurrences, were used to locate examples of terrestrial community targets.
- Task 4 - Portfolio Creation. Overlaps of conservation targets and ecological communities were visually inspected on maps. A team of experts from the Wyoming Natural Diversity Database (WYNDD), the Wyoming Field Office of The Nature Conservancy (WYFO), and other experts created a portfolio of conservation sites selected by centering attention on known locations of sensitive or imperiled species and then adding to those areas enough surrounding lands to capture representations of all the ecological communities in the ecoregion.

Each section of this ecoregional plan was written by specialists in consultation with a larger group of their peers. Animals, plants, and representative communities were each examined in considerable detail in each of the five states included in the ecoregion. This report summarizes the selection of targets and their eventual use in identifying a "portfolio" of conservation sites. Because of the large amount of detail required, supporting documentation has been assigned to several Appendices including scientific names of organisms, their Natural Heritage Program sensitivity rankings, details on the numbers chosen for conservation, etc. The reader should examine the Appendices both for specific details and for a clearer view of how many conservation decisions were made. Here is a list of Appendices with clickable hot links that will take you to them.

List of Appendices:

- Common and scientific names of species mentioned in this document.
- Sensitive plant species, potential sites, and conservation goals.
- Vertebrate animal targets, sites and conservation goals.
- Descriptions of Wyoming Basins cover-types.
- Terrestrial vegetation (cover-types) goals and goal attainment.

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Task 1: Target Selection

Imperiled and Sensitive Plants:

Target vascular plant species were chosen because of their global rarity, limited geographic distribution, and evidence of decline based on data from state Heritage programs and regional floras. Highest priority was assigned to ecoregional endemics or species known from 20 or fewer extant populations rangewide, i.e., G1 and G2's. Species at the periphery of their range were not included in this analysis, even though they may be considered "species of special concern" in their respective states. We assumed that species peripheral to this ecoregion would be appropriately conserved in adjacent ecoregions or else would be picked up by our "coarse filter." Two-hundred fifty-eight plant taxa were evaluated as potential targets, of which 122 are included in this report Appendix 2. The plants actually selected as targets were chosen based on expert knowledge of Heritage biologists.

Lesquerella prostrata - Walter Fertig

LuRay Parker

Imperiled and Sensitive Animals:

Target taxa were identified based on current rangewide abundance, historical and recent trends in abundance, severity and immediacy of threats, and degree of endemism. Selected taxa are either rare, declining, demonstrably threatened, endemic to the region, or some combination of these characteristics. The same information was used to categorize the taxa into high, medium, and low priority groups. All species ranked by Heritage as G1 and G2 were included. In addition, all G3 species and higher ranked (G4-G5) species of known sensitivity, ecological importance, or under direct threat of human persecution (e.g., prairie dogs) also were considered.

Although less is known about the distribution of invertebrates than vertebrates, TNC and the Heritage programs do track such well-studied groups as dragonflies (Odonata), butterflies (Lepidoptera) and tiger beetles (Coleoptera: Cicindellidae). Records for these taxa in the Wyoming Basins ecoregion failed to include any species of G1 to G3 concern, so the selected animal targets were all vertebrates. It is likely that the absence of invertebrates is due mainly to a lack of knowledge of these taxa in the ecoregion.

A total of 45 vertebrate taxa were selected as targets Appendix 3. This includes 34 species (e.g., Wyoming toad, Northern tree lizard), eight

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Townsend's big-eared bats roosting - Bob Luce

subspecies (e.g., midget faded rattlesnake, Columbian sharp-tailed grouse), and three species groups (Bear lake endemic fish, colonial nesting waterbirds, major bat roosts and hibernacula). The three species groups perhaps require explanation. Bear Lake in southeast Idaho contains an assemblage of three unique fish species found nowhere else in the world. Because of their rarity and their geographically small area, we consider them here as a single entity. "Colonial nesting birds" refers to habitat usually along lakeshores with sufficient cover and food resources to support large numbers of nesting water, marsh, and wading birds as shown in historical records. "Major bat roosts and hibernacula" refers to areas known to contain either overwintering sites or maternal nursery shelters for large numbers of bats of several species.

Prioritizing these targets yielded the following breakdown:

High Priority	12 taxa
High / Medium Priority	1 taxon
Medium Priority	9 taxa
Low / Medium Priority	5 taxa
Low Priority	18 taxa

A variety of anthropogenic factors were important in the selection of targets. For example, prairie dogs face widespread persecution in many parts of the ecoregion. Although various groups have petitioned the US Fish & Wildlife Service to list the black-tailed prairie dog as threatened (Van Putten & Miller 1999), the animals are still shot for sport by citizens and poisoned by landowners and government agencies. The danger in this deliberate persecution is not only to prairie dogs. Prairie dog colonies are important to a host of other species: burrowing owls, ferruginous hawks, swift foxes, mountain plovers, and most importantly, black-footed ferrets. Added to this difficult situation is the incidence of sylvatic plague among prairie dogs. This human-introduced disease destroys prairie dogs and complicates efforts to protect even large colonies because populations may decline precipitously and cyclically (Davitt et al. 1996). Our target goals reflect the current realities of this persecution.

Other animals face less targeted and more diffuse threats. For example, roading and habitat fragmentation is occurring in areas of oil, gas, and mineral development. Pygmy rabbits, sage grouse, and Wyoming pocket gophers occupy these habitats but there is virtually no literature pointing to specific impacts of these activities.

We faced a difficult choice in deciding how to treat historically abundant species. For example, bison were dominant herbivores in the ecoregion for millennia before European settlement. They are still present today in small numbers on private ranches and government lands. The ideal of reestablishing the vast herds was considered beyond the scope of this plan, so bison were not considered conservation targets, a subjective decision. The same thinking guided our failing to include as targets bighorn sheep, grizzly bears, wolverines, and other animals that formerly ranged over the sagebrush lands. Several of these were selected as "peripheral targets" where they occur in the forested, adjacent lands of the Greater Yellowstone but their restoration to the basins remains only a hope for the future.

In contrast, although black-footed ferrets are now largely extirpated from the ecoregion, reintroduction efforts are underway by the US Fish & Wildlife Service and reintroduced animals

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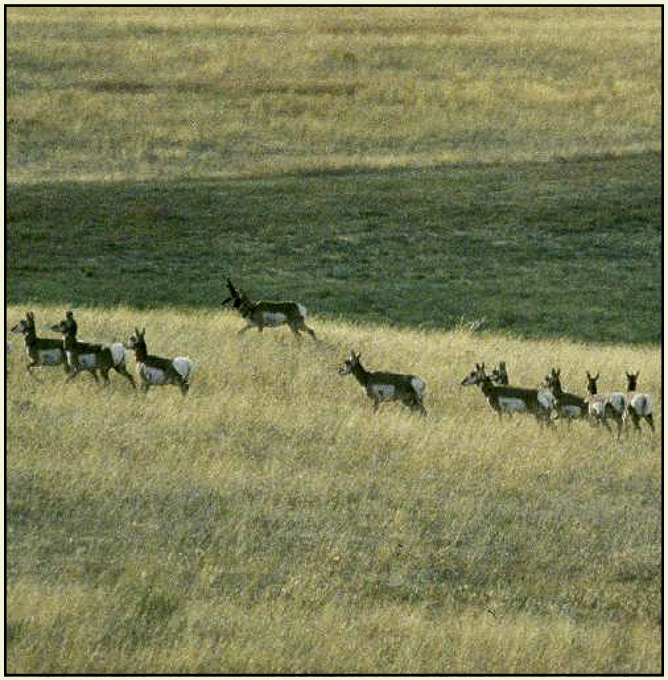
occur within our area. The Shirley Basin site is thought to hold as many as 50 animals surviving from reintroductions in the 1980's (Bob Luce, WY Game and Fish Dept., personal communication). Occasional unconfirmed sightings in other parts of the ecoregion encourage hope that tiny populations might still be found elsewhere where suitable protection and prairie dog colonies exist. We considered black-footed ferrets as targets and included them in prairie dog complexes without explicitly distinguishing between reintroduced animals, surviving remnant pockets, or potential sites for restoration. This approach allows for future conservation action throughout the ecoregion that could protect ferrets in adequate numbers.



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Terrestrial Ecological Communities:

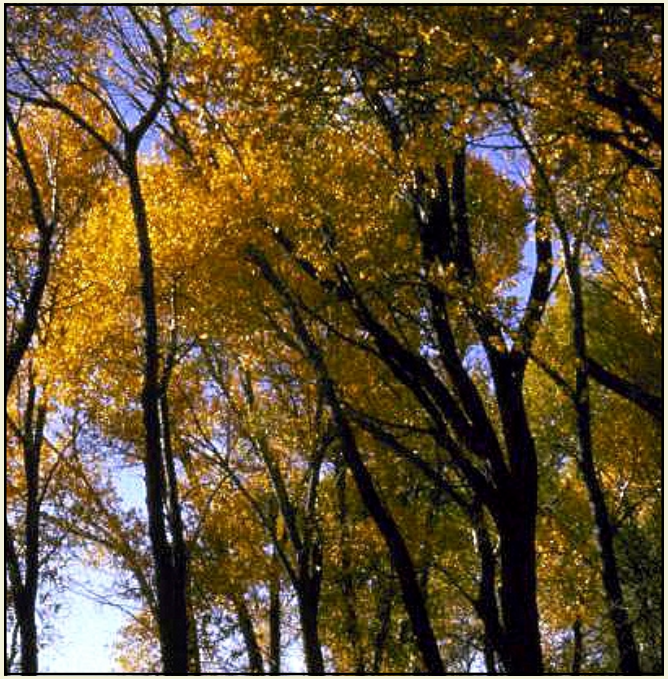
The Plan's intent was to include representation of every ecological community in the ecoregion. In order to preserve their associated fauna and flora, it is most desirable to include the finest practical level of discrimination in describing these ecological types. A list of communities (plant associations) for the ecoregion (which contains portions of 5 states) was produced by TNC's Western Conservation Science Center in Boulder, CO, consistent with community names as identified in the US National Vegetation Classification (NVC)(Grossman et al. 1998, Anderson et al. 1998).

Unfortunately, for most of the ecoregion, documented occurrences of plant associations do not exist. The Colorado Natural Heritage Program provided the only available community occurrences for the ecoregion. To solve the problem of incompatible data resolution among the states, we used Gap cover-type maps from the five states as a surrogate for terrestrial ecological communities. The limited Natural Heritage element occurrences were used only as a secondary data source.

The Gap Analysis Program is a national effort of the US Geological Survey, Biological Resource Division (USGS/BRD) established by Dr. J. Michael Scott in Boise, ID (Ricketts et al. 1999, Scott et al. 1993, Stoms et al. 1998). Gap analyses, undertaken state-by-state, map known occurrences of vertebrates, plant cover-types (identified roughly at the Alliance scale of the NVC), and land ownership. Using GIS, Gap analyses locate areas where certain sensitive or threatened species are unprotected. These "Gaps" in protection give the process its name. Although

nationally coordinated, Gap analyses performed by states have differed in details of their technique resulting in maps made at differing resolutions. For example, the Wyoming Gap, completed in 1996 (Merrill et al. 1996) used vegetation cover with 1-km^2 (247 acres) minimum mapping unit. This means that for most of Wyoming, only features of 247 acres or larger can appear on the map. Any community or patch smaller than this simply disappears. By contrast, the MT Gap analysis (Redmond et al. 1998), used a mapping resolution of 90-m^2 (2 acres), which obviously captures much finer detail than the map for Wyoming.

Because of the coarse resolution of the cover-types, some cover-types fail to appear where they can be found on the ground. For Wyoming and Colorado (the bulk of the ecoregion), mapping was done through processing and interpretation of satellite images and the identification of the primary cover-type (i.e., the most common cover-type in each polygon). For most polygons, a secondary cover-type (the second-most common type) also was identified. Other cover-types may be present in the area represented by the polygon, but they fail to appear on the map because they cover less area than do the primary and secondary types. If these additional cover-types are small-patch vegetation types, such as playas, cushion-plant vegetation, or basin big sagebrush stands along streams, then their omission from the map can result in a significant under-representation on the map used in this analysis.



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The cover-type classifications from each of the five states were "crosswalked" to develop an ecoregion-wide coverage. Appendix 4. Using descriptive information from each of the Gap Analysis programs, each cover-type was then linked directly to the NVC. So for example, one could expect to find any of five different limber pine plant associations listed from the NVC at locations mapped as a "Limber Pine" cover-type, or seven different Gardner's saltbush plant associations at locations mapped as "Gardner's Saltbush" cover-type. Appendix 4. This linkage to the TNC-NVC allows for others from neighboring ecoregional planning efforts to more clearly evaluate where shared ecological communities were identified in potential conservation sites for the Wyoming Basins.

The cover-type maps were used to evaluate the overall extent, distribution, and patch size characteristics of each cover-type. These attributes were used in the development of conservation goals and the evaluation of ecological representation among potential conservation sites. The cover-type map may be viewed by clicking on this link. cover-type map

Peripheral Targets

In addition to the target categories described above, a fourth group of "Peripheral" targets also were considered. The Wyoming Basins Ecoregion borders the Greater Yellowstone Ecosystem where wolves, grizzly bears, wolverines, and lynx are known to occur. This richest of all unspoiled regions in the lower 48 states is part of The Nature Conservancy's "Utah/Wyoming Rockies Ecoregion." Because the Wyoming Basins and the UT/WY Rocky Mountains are closely meshed at several locations (notably the upper Wind River and the South Fork of the Shoshone River), the carnivores just listed are considered targets "Peripheral" to the Wyoming Basins, but of great concern in those areas. Although the ecoregion does not now provide primary habitat for these targets, these animals historically lived in areas now dominated by humans. Most of these animals move across the area and increasing habitat fragmentation and human activities are a significant stress to their populations (Brooker et al. 1999, Beier & Lowe 1992, Knight & Gutzwiller 1995). Two sites, the Dunoir Valley and South Fork of the Shoshone River are particularly important for the peripheral targets and are indicated with a distinctive color on the maps.

Although the ecoregion does not now provide primary habitat for these targets, these animals historically lived in areas now dominated by humans.

Another type of peripheral target considered was cross-ecoregion movement of ungulates. In historic times large populations of elk, antelope, and deer moved seasonally from the Utah/Wyoming Rockies Ecoregion (which includes the Wind River, Bighorn, and Uinta Mountains) to lower elevations in the Wyoming Basins. Some of these historic migration patterns are now altered by human activities. For example, a major migration of elk from Grand Teton National Park has, since the early 1900's, been blocked by the town of Jackson, WY. The National Elk Refuge in Jackson has fed and otherwise regulated these elk herds since then. The Wyoming Game and Fish Department regulates elk movements along the flanks of the Wind River range and elsewhere in the state, through use of winter feedlots and strategically placed fences. Despite these efforts, some movement of elk still occurs from the southern Wind River Mountains into the Red Desert area of the Wyoming Basins. Recent research has also shown that numbers of antelope from as far north as Grand Teton continue to migrate south along the flanks of the Wind River Mountains into the Green River drainage. This ecoregional plan recognized that these animals spend a part of their year in the Wyoming Basins. The Upper Green River, Western Wind River Foothills, and Sweetwater Basins sites are especially important to these animals.

Yellowstone predators and ungulate movements are important peripheral components to the Wyoming Basins ecoregion. The difficulty we faced was in assessing how to address these issues that were historically important and may be even more important in the future, but that are only peripherally important now. We decided that both categories of peripheral targets would be adequately conserved by the sites mentioned in this section. Formal target goals and viability analyses were not performed for the Peripherals.

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Task 2: Establishing Target Goals

Conservation goals represent the end toward which conservation efforts are directed for targeted species and ecological communities. Defining goals is one of the most difficult, and most important, scientific questions in biodiversity conservation (e.g., How much is enough? How many discrete populations and what spatial distribution is needed for long-term viability?). For our purposes, we define a *viable species* or *population* as one that has a high probability of continued existence (i.e.,95% certainty of surviving 100 years and/or 10 generations) in a condition that maintains its vigor and potential for evolutionary adaptation over a specified period of time. Potential for evolutionary adaptation here implies that the species or population has sufficient genetic variation to adapt by natural selection to changing environmental conditions within a predicted range of frequency and amplitude of disturbance and change. This same definition extends to multiple species that characterize recurring ecological communities.

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Our experience to date suggests several practical approaches to this issue. First, it is helpful to view conservation goals as addressing questions of species viability and ecosystem integrity at multiple scales. We first assess the local-scale occurrence of a given target species or community and evaluate the *size, quality/condition, and landscape context* of the example, relative to other, apparently viable/functional examples. Criteria in these categories are briefly defined as:

Size is a measure of the area or abundance of the conservation target's occurrence, relative to other known, and/or presumed viable, examples. For ecological systems and communities, size is simply a measure of the occurrence's patch size or geographic coverage. For animal and plant species, size takes into account the area of occupancy and number of individuals. Minimum dynamic area, or the area needed to ensure survival or re-establishment of a target after natural disturbance, is another aspect of size.

Quality/Condition is an integrated measure of the composition, structure, and biotic interactions that characterize the occurrence. This includes factors such as *reproduction, age structure, biological composition* (e.g., presence of native versus exotic species; presence of characteristic patch types for ecological systems), *structure* (e.g., canopy, understory, and groundcover in a forested community; spatial distribution and juxtaposition of patch types or seral stages in an ecological system), and *biotic interactions* (e.g., levels of competition, predation, and disease).

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Landscape context is an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the target occurrence, and connectivity. *Dominant environmental regimes and processes* include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes: temperature and precipitation), fire regimes, and many kinds of natural disturbances. *Connectivity* includes such factors as species targets having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and systems, and the ability of any target to respond to environmental change through dispersal, migration, or re-colonization.

Once we have identified a set of occurrences for each species and community that would likely remain viable/functional (usually requiring good stewardship), we may then address questions of viability and ecosystem integrity for each target species and community throughout the ecoregion, and rangewide. There is little empirical research that addresses representation goals of species and ecological communities, though meta-population theory and population viability analyses offer some insights into this issue. In general, we are looking to conserve a combination of "core" interconnected populations along with outlying, unconnected isolates. The relative emphasis on interconnected vs. isolated populations may vary, depending on the species/community. For example, with species that typically occur in small, isolated habitats (e.g., some rare plants), the probability of long-term species survival may increase by protecting numerous, isolated populations. On the other hand, wide ranging species may be protected with a greater emphasis on habitat connectivity among fewer, discrete subpopulations. Given the limits of current knowledge, we state conservation goals simply as initial objectives. They must be tested and refined through time by monitoring the status and trends of individual species and ecological communities. Conservation of multiple examples of each target, stratified across its geographic range, is necessary to capture the variability of the target and its environment, and to provide replication to ensure persistence in the face of environmental stochasticity and likely effects of climate change.

Goals for Plants:

The development of specific conservation goals for individual plant taxa is hampered by our lack of detailed knowledge about the life history, demographic structure, genetic composition, and metapopulation dynamics of most species (Given 1994, Primack 1993). In addition, the ability of many plants to produce long-lived seed banks and reproduce asexually confounds our abilities to determine the minimum population size needed for long-term survival (Menges 1991). While a universal "magic number" for the minimum viable population size of plants is probably unattainable (Given 1994), theoreticians have suggested that minimum population sizes of 500 individuals may be sufficient for large-bodied, long-lived perennial plants of stable environments, while a minimum of 10,000 individuals might be needed for the survival of annual plants in unstable environments (Primack 1996).

The number of individuals in a single population may be less important than the total number and spatial extent of all populations for ensuring the long term survival of a plant species (Given 1994). A conservation strategy that

protects a suite of populations scattered across the geographic range of a species is likely to capture greater genetic variability than single populations and reduce the risk of a species being extirpated due to localized, stochastic environmental disturbances. How many sites are needed to ensure adequate representation will vary depending on a species' life history, growth form, population size, pollination biology, and genetic variability (Given 1994, Primack 1993). In the absence of concrete demographic and genetic data for most plant species in the Wyoming Basins Ecoregion, we used the following generalized system to determine the number of occurrences needed for long term survival of selected targets. Note that the letters marking these categories (A through D) are referenced in Appendix 2 as the rationale for each species' inclusion:

A All species in this class are G1 narrow endemics, which by definition, are known from 1-5 extant occurrences worldwide. All populations of such species are critical for their long term persistence, and all should be afforded special management attention, although priority should be given to the largest or most abundant colonies or those that occur at a distance from the core of the species' range. Specific goals for each species in this group will range from 1-5 protected occurrences, depending on the number of known populations for that species (i.e., the goal for *Yermo xanthocephalus*, known from a single extant location, will be the protection of 1 population). Goals for any given species may change as new populations are discovered, but the maximum number of target protected populations will be 5.

B Plants in this category are G2 or are narrowly endemic G3 species. Typically, species in this group are known from approximately 6-30 extant populations worldwide. Noss and Cooperrider (1984) have recommended protecting at a minimum 25% of the known populations of such rare species. We recommend a goal of 5-8 protected populations for species in this category rangewide, with 5 representing a minimum number for those species in which 25% protection would entail saving under 5 locations, and 8 representing 25% of 30 locations. .These populations should either be 15-20 km apart or sufficiently dispersed to represent the full spatial and environmental range of the plant. Priority should be given to the largest and most abundant populations, although those outside the core of the range should also be considered. Determination of which populations to protect should be conducted in consultation with experts in adjoining ecoregions for those species found outside of the Wyoming Basins Ecoregion.

If fewer than five populations occur in the Wyoming Basins Ecoregion, all should be considered high priority for conservation. Each population needs to contain a minimum of 500 reproductive-age individuals for perennial species or 5,000-10,000 individuals for annuals (unless no larger populations exist).

C This category includes plants ranked G3 or higher and are regional endemics or sparsely distributed. Typically, species in this category are known from 30-45 populations rangewide. Using the same goal of protecting 25% of known, extant populations, conservation planners should protect 8-12 populations across the range of these species Unlike groups A and B, species in this category may be habitat generalists and opportunities may exist to protect them under the "coarse filter." These populations should be located throughout the range of the species to ensure that adequate genetic representation is achieved. Priority should be given to those habitats in the best condition and which harbor other rare species. Each population should contain a minimum of 500 reproductive-age individuals for perennial species or 5,000-10,000 individuals for annuals (unless no larger populations exist). Protection of fewer populations can be justified if the range of the species is not centered in the Wyoming Basins Ecoregion.

D No goals have been established for plants in this category for 2 reasons: (1) insufficient data exist on their distribution throughout the Wyoming Basins Ecoregion (information is vague or historical) to identify potential conservation sites, or (2) location and status data are lacking for 1-2 key states within the ecoregion, suggesting that the species may be of low priority overall. These species should be considered important targets for additional field research and hopefully can be addressed in future iterations of the plan.

Areas of critical habitat for G1 and G2 endemic plants and locations with unusually high concentrations of rare species were selected as potential conservation sites. Local experts from Heritage programs, government agencies, and academia selected a suite of sites for each state in the ecoregion, focusing on those areas that would fulfill the conservation goals for target plants. Over 120 sites were identified in the ecoregion. In cases where a rare plant occurred in more than one of the seven map sub-sections, spatially separated locations were included to broaden the geographic and genetic variation captured by the portfolio. Specific discussion of the numbers of plants, the numbers of sites, and the rationale behind each decision are given in Appendix 2.

Cary beardtongue - Laura Welp

Goals for Animals:

In the best of all worlds, we would know the precise distribution of each target animal species in the ecoregion and the variation in population density across that distribution. It would then be relatively simple to identify areas for conservation goals. Unfortunately, for most taxa in the Wyoming Basins, there is no way to know population densities or even accurate distributions. Instead, the approach we took was to begin with sites of known occurrence of target species ("element occurrences") to which we added additional areas of suitable habitat. For this reason, in the following discussion we refer to "patches" of suitable habitat in place of populations.

"Conservation goals" refer to the number, size, and distribution of patches of suitable habitat within the initial sites necessary for long-term persistence of a given taxon in the ecoregion. Population viability is an extremely complex subject, and is the focus of much debate among conservation biologists; there are few universally accepted guidelines for determining the habitat configuration necessary for persistence of any taxon. A list of target animals and the reasoning behind our target goals is contained in Appendix 3. In view of the widely differing status of the many animal species, the Appendix is particularly important, as each species was considered carefully with respect to present knowledge. The following were general guidelines.

Minimum patch size: For taxa that occur in relatively restricted portions of the ecoregion (e.g., pygmy rabbit, Idaho pocket gopher), the main principle that informed the conservation goals was that vertebrate populations require 50-500 individuals to maintain genetic variability over the short term (Gilpin 1996, Gilpin & Soulé 1986). The mean of this range (275 individuals) was specified as the minimum desired population size. In most cases, the area of suitable habitat required to support such a population was derived by extrapolating from known population densities and/ or home range or territory sizes. In the case of white-tailed prairie dogs, large complexes of discrete colonies (rather than individual colonies) were identified as conservation units. Each complex contained as many as 10 separate colonies.

Uinta ground squirrel - Joe Tite©

For wide-ranging habitat generalists: that occur throughout the ecoregion (e.g., ferruginous hawk, swift fox), it was difficult to identify discrete populations; indeed, many of these taxa exist as only one population throughout the whole ecoregion. In these cases, minimum patch sizes refer to areas of high-quality habitat that will serve as reproductive sources, and usually do not encompass enough area to support 275 individuals. It is important to realize that the long-term persistence of many of these species in the ecoregion is determined more by the importation of individuals from adjacent areas rather than productivity within the ecoregion. Our intent was to provide enough high-quality habitat to insure persistence assuming such dispersal continues.

Minimum number of patches: Minimum number of patches required for persistence was scaled to taxon priority, and was different for taxa with restricted ranges in the ecoregion than for wide-ranging habitat generalists. For taxa that occur in only a restricted portion of the ecoregion, conservation goals were as follows: high priority = 4-5 separate populations; medium priority = 3-4 separate populations; and low priority = 3 separate populations. For widespread habitat generalists, conservation goals were specified as: high priority = 8-10 patches of high-quality habitat; medium priority = 6-8 patches; and low priority = 5-6 patches.

The reason for this approach was that lower priority animals are more common and widespread within this and adjacent ecoregions. Thus, their long-term persistence is facilitated by coarse-filter conservation actions, and is not solely dependent on fine-filter action taken specifically on their behalf. In contrast, higher priority taxa are largely regional and ecoregional endemics, often with high degrees of habitat specificity. Thus, their long-term persistence is much more dependent on fine-filter considerations.

Distance between patches: Spatial separation between patches is important to isolate each patch from potentially disastrous large-scale disturbances, to ensure room for dispersal and metapopulation dynamics, and to guarantee that taxa are represented across as much of their geographic range as possible. For many taxa, separation between patches was defined by specifying that patches must be placed in separate initial sites; in effect, separation distance was determined by locations of the initial sites. For situations where multiple patches were placed in one initial site, separation distance was set at about three times the diameter of a circular patch of the minimum area. Intervening geographic features (e.g., major river, stream confluence) were specified in some cases to ensure that patches were insulated from common disturbances. Finally, for taxa that occur throughout the ecoregion, patches were distributed across major river basins to ensure rangewide representation. Species known to have suitable habitat throughout the ecoregion were targeted in each of the seven map subsections.

Goals for Terrestrial Ecological Communities:

The basis for setting goals using the surrogate cover-types is the recommendation made by Anderson et al. (1999) for target plant associations. Following Anderson et al. we considered vegetation cover-types as forming small patches and linear corridors, large patches, or matrix (wide expanses).

The two major factors effecting conservation goals for these coarse filter targets include 1) distribution, relative to the ecoregion, and 2) the typical spatial pattern of the vegetation on the landscape. Numbers of viable examples needed within the ecoregion increase with more endemic distributions, and with smaller typical patch types. Preliminary conservation goals should serve as a mid-term objective (perhaps 25 years) while longer-term goals develop as empirical and theoretical work develops further. A baseline goal of 10 occurrences is recommended for a matrix community endemic to an ecoregion. Distribution information on each plant association from the TNC-NVC was used to establish the relative ecoregional distribution of each surrogate cover-type. The cover-type maps, and knowledge of Heritage ecologists, were used to assign patch type characteristics to each cover-type in Appendix 4. Specific goals were then derived for each of the cover-types Appendix 5.

The more variable in species composition and structure the vegetation type, the more occurrences are likely needed to adequately represent the target. The cover-types used as surrogate targets typically represent several plant associations, as described in the National Vegetation Classification. In many cases, the goals (in terms of number of occurrences) for the surrogate cover-types in the Wyoming Basins are larger than the recommendations for plant associations from Anderson et al. (1999). For some cover-types, review of the cover-type maps indicated that increasing the number of occurrences beyond the recommendation of Anderson et al. (1999) may be appropriate, but may also require field inventory to identify additional occurrences Appendix 5.

Given the intent to represent a wide range of ecological variability in the terrestrial coarse filter, conservation goals for the Wyoming Basins ecoregion used the five USDA Forest Service ECOMAP sections that were delineated for the area (coded 342A, 342E, 342F, 342G, and 341A). The relative distribution of each cover-type within each USFS section was noted and customized conservation goals were established for each cover-type surrogate Appendix 5.

Preliminary conservation goals for terrestrial ecological communities (plant associations) for an hypothetical ecoregion. Goals expressed as numbers of occurrences for the entire ecoregion (from Anderson et al. 1999).

	Matrix	Large Patch	Small Patch/ Linear
Endemic	10	18	25
Limited	5	9	13
Widespread	2/3	4/5	5/6
Disjunct	1*	2*	3*
Peripheral	*	*	*

*Objectives should be determined on a case by case basis. For peripheral types, preference should be given to including occurrences on the northern or upper elevation periphery of the range.

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Assumptions of Using Land Cover-types

Is it truly acceptable to use land cover-types as surrogates for vegetation associations and their related fauna? We based our conservation goals using cover-type surrogates on the following assumptions:

1. The approach of Anderson et al. (1999) for recommending goals for plant association targets can be adapted for use in setting goals for cover-type surrogates. Specifically, their use of information on the geographic distribution of the target, and the scale and pattern at which the target occurs, are useful in setting goals for the Wyoming Basins cover-types. First, the cover-types were linked to plant associations from the National Vegetation Classification. The documented range of these plant associations were used as a guide to determining whether a cover-type represented associations with endemic, limited, widespread, disjunct, or peripheral, relative to the Wyoming Basins ecoregion.
2. Cover-types include a broader range of variation in species composition, vegetation structure, and habitat than do ground-truthed occurrences of plant associations, so more occurrences of cover-types surrogates are needed to encompass ecological variation than would be the case with many documented occurrences of plant associations. Consequently, when the recommendations of Anderson et al. (1999) are applied to cover-types, the number of occurrences was usually increased, sometimes by two or three times.
3. The cover-types used in this project, as derived from Gap Analysis projects in the individual states, are adequate for the initial identification of potential conservation sites that encompass the diversity of the most of the ecoregion's natural communities. As noted above, this excludes those that naturally occur as patches <247 acres, since those are not represented in the cover-type maps. Differences in cover-type classifications among states prevent the development of a completely uniform classification for the entire ecoregion. This should be a priority for future research.
4. Cover-types representing potential natural community occurrences cannot provide information on the relative quality of the occurrence. We used indirect information, such as the occurrence of other target species, distance from intensive urban/agricultural development, etc. as an indirect measure of the quality of natural community occurrences, but this provides an inadequate substitute for field inventory.
5. The cover-type map of the ecoregion, developed from the cover-type maps of the individual states, gives a picture of the distribution, abundance, and scale of occurrence of each cover-type that is acceptable for setting and applying initial goals using cover-type surrogates, and for the initial identification of potential conservation sites. Problems introduced by differences in map resolution across states, and by errors in identifying the cover-type of each polygon, can be corrected with field inventory during site conservation planning.

6. A given number of occurrences will more likely represent the composition of component plant associations in a cover-type if those occurrences are represented across environmental gradients, such as elevation zones, substrate differences, etc. Short of providing a more rigorous assessment of environmental gradients represented by potential conservation sites, sites were identified so that they are distributed throughout the ecoregion, preferably representing all US Forest Service sections and subsections where they are known to occur. This is preferable to having the same number of occurrences clustered in a small portion of their range within the ecoregion.
7. The five sections delineated by the federal interagency ECOMAP project within the Wyoming Basins ecoregion provide an ecologically meaningful basis for distributing the occurrences of a cover-type throughout the ecoregion.

Dubois badlands -The Nature Conservancy

The Problem of Representing Diversity Throughout the Ecoregion

The stated conservation goals assume a minimum level of viability or integrity for individual occurrences. While viability of individual occurrences of terrestrial ecosystems may be characterized in categories of size, condition, and landscape context, as mentioned above, these factors are very difficult to evaluate from remotely sensed data sources such as the cover-type maps. As previously mentioned, we assumed that we had a relatively high probability of representing coarse filter targets in remote, least developed landscapes that also support viable occurrences of target species. This approach was intended to address, at least in part, some of the quality/condition attributes of viability.

For terrestrial ecosystems, size and landscape context attributes of viability are often entwined. We need to protect examples of sufficient size to represent characteristic patch dynamics and landscape-scale processes, while supporting the area and habitat juxtaposition requirements for most native species. In this ecoregion where most major vegetation types occur in similar patterns to those likely found in 1800, combined with our lack of ground-truthed data, we placed an emphasis on representing the diversity of spatial patterns among the mapped cover-types. We treated each cover-type as a patchwork of variously sized polygons. Minimum size estimates for examples of each cover-type were developed by calculating spatial statistics (e.g., mean, maximum, minimum, etc.) of each cover-type for each USFS section, and for the ecoregion as a whole. In most cases, the *mean size* of each cover-type, for the ecoregion as a whole was used as an

initial *minimum size* estimate to evaluate occurrences within conservation sites. In some instances where the characteristic size of the cover-type varied widely within the ecoregion (e.g. mixed grass prairie, basin big sagebrush cover-types) we established variable minimum size requirements or for occurrences within selected USFS sections. The likely reality on the ground is that this variation reflects real differences in environments and processes that result in quite distinct biotic assemblages.

In the most obvious example, a few USFS sections might contain large extents of stabilized sand dunes whereas another section might contain very little. In such cases, we included patches of this sparsely-occurring cover-type in every section where it occurred to provide wide geographic distribution and included as much acreage of those patches as possible in sections where only a small amount was found. Unlike heavily impacted areas where restoration might one day be possible, we felt that these largely unimpacted areas represented a natural condition. It seemed to us unreasonable to expect that additional sand dunes could be created (i.e., by people) in areas where they do not now exist.

Much future work is required to characterize terrestrial ecological systems in the Wyoming Basins so we can combine ground-truthed knowledge with information gathered from space. This knowledge is essential to develop and refine occurrence viability criteria, and to establish solid, ecologically conservation objectives on the ground.

It is not enough to fight for the land; it is even more important to enjoy it. While you can. While it is still there...

Edward Abbey

Keith Lenard

The Nature Conservancy

Task 3: Mapping

Computerized mapping, i.e., Geographic Information System software (GIS) was a vital tool in the development of the Wyoming Basins Ecoregion Plan. This technology was used in almost every aspect of the conservation plan – from defining the ecoregion boundary to producing the final maps you see in this report. Most importantly, GIS allowed us to visualize and quantify our conservation goals and objectives, and will also be used to monitor the future implementation of our plan. The Wyoming Basins Ecoregional Plan will be maintained as a living and continuously updated dataset maintained by TNC in Wyoming. Primary custodian for the data will be the GIS specialist at WYFO.

Overview

The GIS database was built from existing sources of mapped information whenever possible. Databases from the Gap Analysis and the Natural Heritage Programs were used extensively in this conservation plan. Yet many of these data had to be re-structured into one standardized database for the entire ecoregion. For example, all of the mapped data had to be converted into a common geographic coordinate system in order to develop a single map that covered the entire ecoregion. We chose the Albers Conic Equal Area projection because it minimized shape and area distortions throughout the Ecoregion and was most appropriate for area measurements over large geographic areas.

To ensure compatibility with adjacent ecoregional plans we used ArcView and Arc/Info GIS software (Environmental Systems Research Institute, Redlands, CA) to automate, manage and analyze mapped information. We documented our GIS databases with metadata ("data about data") that conform to the national standard (FGDC 1998). The metadata contain information about the source, map scale, accuracy, and usability of data compiled for the conservation plan. Proper documentation of our GIS databases will help avoid misinterpretation or misuse of these data. It will also help secure the longevity of these data for future conservation plan updates.

Setting the Ecoregion Boundary

One of our first tasks was to refine the ecoregion boundary originally mapped by the U.S. Forest Service (ECOMAP 1993). Refinement was necessary to include the Owl Creek and Bridger Mountains in Wyoming, an area that we agreed should be part of the Wyoming Basins rather than the UT/WY Rocky Mountains Ecoregion. These low elevation mountains, consisting mostly of grassland, sagebrush, and juniper habitats, are more characteristic of the basin environment. We used surficial and bedrock geology layers within the GIS to identify logical division between the two ecoregions and re-map that portion of the Wyoming Basins Ecoregion boundary.

Mapping Biological Targets

The land cover layer developed for the plan is a composite coverage from each of the five respective state Gap projects. To do so, we had to merge each of these land cover layers, each with their own land cover classifications, mapping methodologies and minimum mapping units (MMU), into one ecoregion-wide layer. We began by creating a new land cover classification for the ecoregion in order to address the different land cover nomenclature from each state's Gap projects (see Terres-

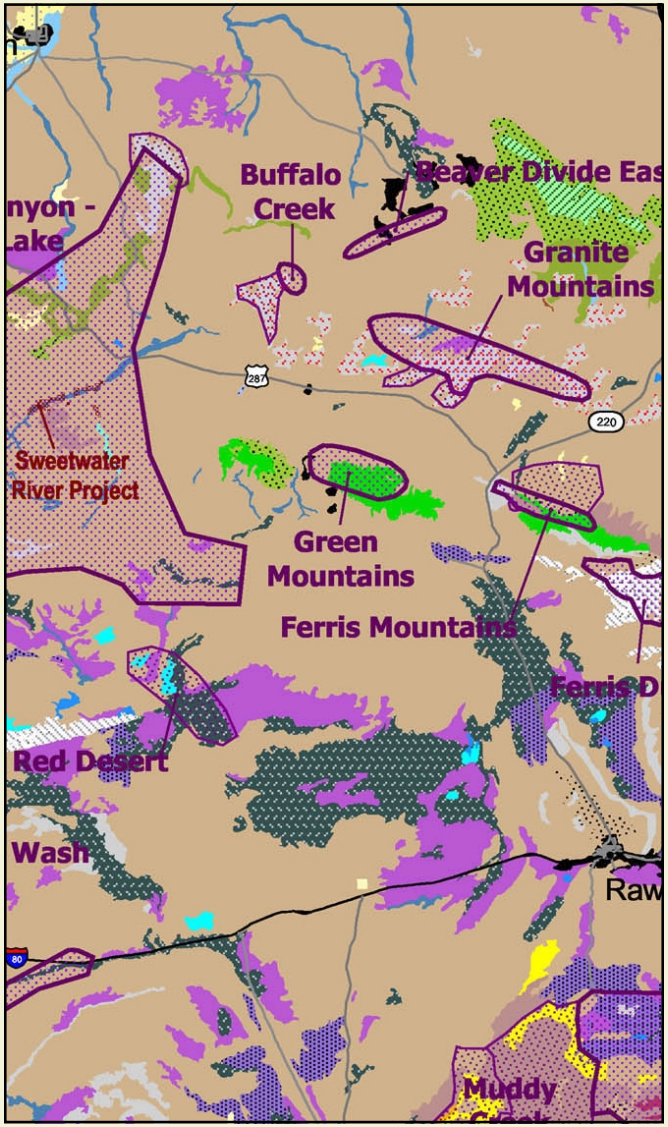
trial Ecological Communities, above). Land cover-types from each state's Gap map were carefully matched to types in our new classification. This allowed us to produce a consistent map of land cover-types throughout the ecoregion. However, very little could be done with the inconsistencies in map resolution caused by the different mapping methodologies from each state's Gap maps. For example, the Gap projects in Utah, Idaho and Montana all used satellite imagery and a machine-based approach to map land cover which resulted in greater map detail (MMU = 0.09 ha) but sometimes less spatially accurate classifications. In Wyoming and Colorado, a manual approach was used to interpret the satellite imagery and produce a less-detailed (MMU = 100 ha), but a generally more spatially accurate land cover map.

Rare plant communities and many of the animal distributions were digitized from paper maps prepared by the Wyoming Natural Diversity Database and each of the other state Heritage programs. In some cases we utilized the GIS to produce more refined animal distribution maps than those prepared with pen and paper. For example, the GIS was used to map a 100 meter "buffer" along selected river corridors and lakes in order to capture the adjacent riparian and/or wetland habitats along these open water features. This mapping technique allowed us to produce more accurate maps for aquatic and colonial nesting bird targets.

We also used the GIS to create a habitat suitability map for the mountain plover, a dispersed and widespread target within the ecoregion. Using digital land cover and slope maps, we produced a derivative map that showed the most suitable plover habitat in the ecoregion that helped us focus on key conservation areas for this sensitive bird species.

Mapping Conservation Sites

GIS was also used to delineate the portfolio of conservation sites in the ecoregion. Our goal was to develop a map to capture the maximum number of localized targets while minimizing the area of each site. Conservation areas were digitized directly into the GIS while reviewing the distribution of the each target element on-



Cover Type Map, detail - Tom Kohley

screen. One by one, we displayed the distribution of each rare plant and animal and carefully located conservation sites. After each of the targets were reviewed and initial portfolio of sites delineated, we added additional sites (or expanded existing ones) to capture community types not adequately represented in the current portfolio. The result was 47 conservation sites that captured representative areas of each target. The next step was to evaluate each site to determine how close we came to reaching our conservation goals. Click here for a graphic illustration of the site creation process.

Site Analyses

The success of our site selection was determined through a GIS analysis that analyzed the predicted presence of each rare target and land cover-type within each site. In addition, the GIS was used to calculate the amount of land owned by each of the principle land stewards (BLM, USFS, USFWS, state, private, etc.) for each site.

Completed GIS Databases

The Wyoming Basins Ecoregional plan resulted in the compilation and development of several GIS layers. Below is a complete listing of GIS layers developed for the plan in addition to metadata hotlinks describing each layer in greater detail. Click on each of the GIS layers for more information.

GIS Layer	Data Format	Data Source
Land Cover	Grid	WY, CO, UT, ID, & MT Gap Programs
Rare Plant Targets	Shape File	WY, CO, UT, ID, & MT Natural Heritage Programs
Vertebrate Distributions	Shape File	WY, CO, UT, ID Natural Heritage Programs / Modeled within GIS
Land Ownership	Grid	WY, CO, UT, ID, & MT Gap Programs
Special Management Areas	Grid	WY, CO, UT, ID, & MT Gap Programs
Ecoregion Subsections	Coverage	U.S. Forest Service ECOMAP Project
Elevation	Grid	U.S. Geologic Survey
Hydrography (lakes & major river systems)	Coverage	Geographic Data Technology, Inc.
Hydrography (small rivers & streams)	Coverage	Geographic Data Technology, Inc.
Transportation	Coverage	Geographic Data Technology, Inc.
Public Land Survey	Shape File	WY, CO, UT, ID & MT State GIS Clearinghouses
Conservation Sites	Shape File	Wyoming Basins Ecoregion Project
Cities & Towns	Shape File	Geographic Data Technology, Inc.
Mountain Plover Habitat	Grid	Wyoming Basins Ecoregion Project

Task 4: Portfolio Creation

Portfolio assembly was performed as a manual task involving visual inspection of co-occurring taxa.

After all conservation targets were chosen and goals established for each, we produced maps showing co-occurrences of the conservation targets we had plotted. Portfolio assembly was performed as a manual task involving visual inspection of co-occurring taxa. We performed this task in several steps, beginning with the premise that rare, threatened, or sensitive species were most important.

Species of concern identified by each of the Heritage programs in the five states were mapped either from known "element occurrences" or from expert knowledge of botanists and zoologists in each state. Most of the work was done by Heritage scientists, but all decisions were checked by state field offices of TNC and by conservation agency personnel. We did not hold experts' workshops as has been done by some other ecoregional plans, but we did check our work with representative agencies or academic experts in each state.

Locating the Terrestrial Ecological Communities (or cover-types), required a special effort. The correlation (or "crosswalk") of the cover-types in each state (performed by Dr. George Jones of the Wyoming Natural Diversity Database in Laramie and Patrick Comer at TNC's Boulder office) relied on expertise and maps from the Gap analysis and each state's Heritage office. After the cover-types were matched-up among the states, new maps of these cover-types were printed and mailed out to approximately 30 experts, chiefly botanists and community ecologists working for government agencies. These experts were requested to check the maps for accuracy and to identify locations of specific cover-types of high quality in their local area. Quality, in this case, refers to patches of large size, in protected areas, or otherwise good representatives of that type. Nearly every one of the experts responded with marked-up maps allowing us to target best locations for certain less abundant cover-types.

After assembly of all the data layers, we identified those areas where three, four, five or more rare targets all occurred together. These areas became centers of attention or "proto-sites," areas of likely conservation interest. Boundaries of these areas were selected with respect to geological substrate, altitudinal gradients, hydrology, or other ecologically meaningful considerations, but land ownership did not enter into these decisions. A map Plant and Animal Targets Map showing proto-sites with vertebrate animal targets and rare plants is included.

On the Plant and Animal Targets Map, rare plant locations are shown as stippled zones. Overlapping animal targets are indicated by progressively darker shades of red. Light pink areas are locations of one or two vertebrate targets, whereas dark red areas may have as many as ten targets found in the same place.

In most cases, distributions of rare plants or animals drove the establishment of proto-sites. All such occurrences were considered of equal importance and their overlaps were considered equally important. Once these locations of rare or sensitive species were mapped, we performed an analysis to find the cover-types and acreage of representative terrestrial plant communities enclosed within those areas. In other words, once the rare or sensitive species were mapped, we obviously had "captured" the representative com-

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munities at those sites. Our premise was that if we could choose sites to protect rare or sensitive species (the "fine filter") we would simultaneously be protecting many other species found at those locations (the "coarse filter").

The proto-site boundaries were extended to include nearby patches of representative communities needed to meet community goals. In many cases, we were able to change the border of a "fine filter" site just a few miles and thereby "capture" important occurrences of particular cover-types. Target goals for a few representative communities required that sites be designated solely to include them.

Great effort was expended to ensure that cover-types were represented in diverse parts of the ecoregion. Occurrences of as many cover-types as possible were selected in each of the seven map sub-sections to maximize their geographic and genetic variability. In some cases, for example, sand dunes, the target community occurs in only limited places. We tried to include all of these rare examples, even if only a small piece occurred in a given map subsection.

The following pages graphically illustrate the site creation process.

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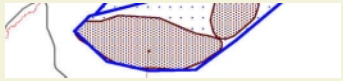
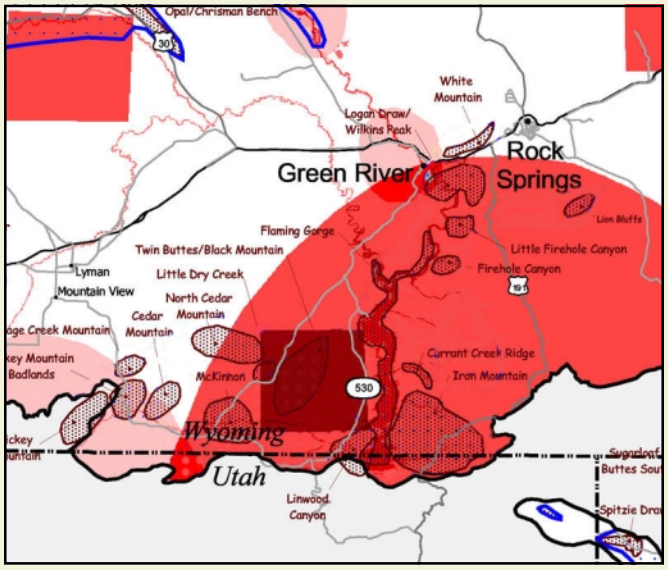
Establishing Site Boundaries

Map Legend

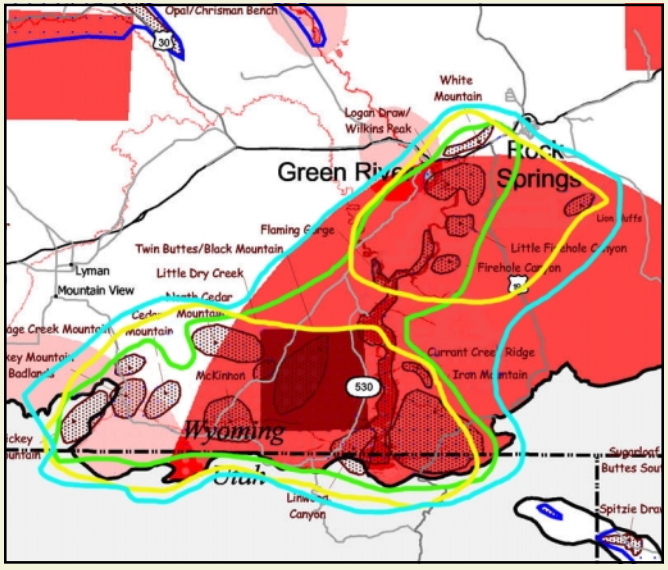


Rare plant sites are shown as stippled areas.

Animal targets are shown as colored areas. The lighter colors indicate fewer species present, from one in the lightest areas up to ten in the darkest zones.



This map detail shows the Flaming Gorge area, rich in both plant and animal targets. But where should site boundaries be drawn? In this plan we used mapped areas such as these and our subjective knowledge of the ground to draw site boundaries.



A multitude of possible site boundaries might have been drawn to enclose the targets. The colored lines indicate various ways this might have been done. These include efforts to include the whole area (turquoise) or various ways of dividing the area into multiple sites (yellow).

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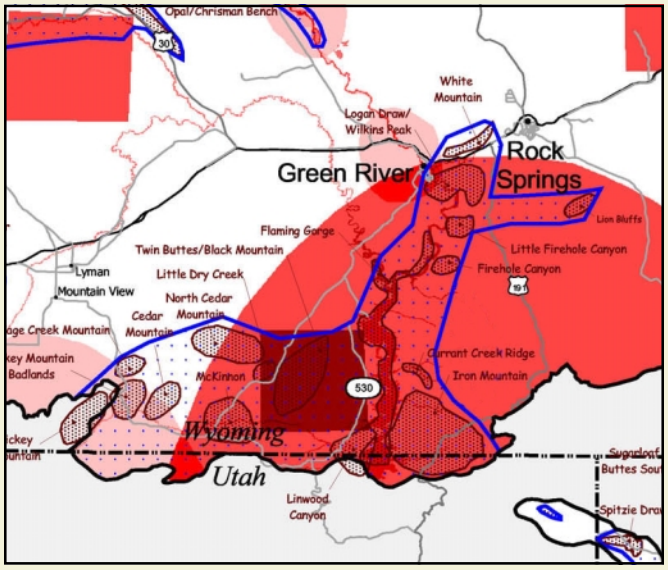
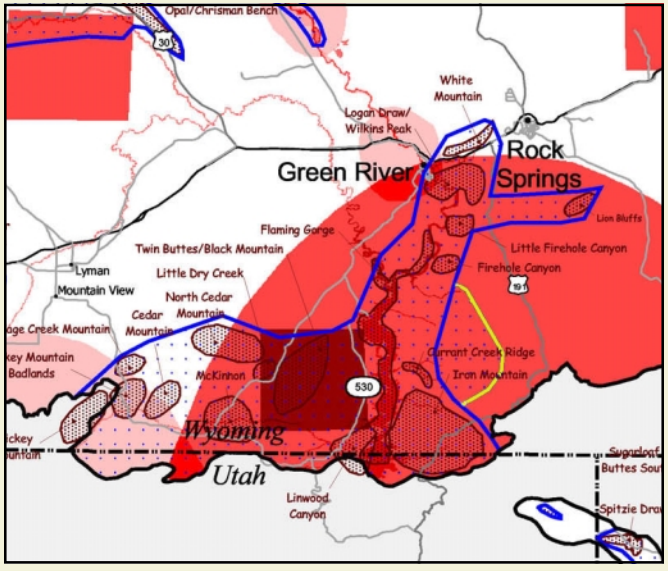


Through discussions with Heritage biologists and agency experts, we came to a decision on the shape enclosed by the heavy blue line. We felt that this boundary struck a good balance between capturing as many targets as possible and keeping the total area as small and tight as possible.



After the site boundary had been decided upon, we calculated the number of representative cover types occurring within the blue line. We then consulted our complete list of cover types to find additional cover types needing representation, and that could be added to this site with only a small additional expansion of total area. As a result we added the area of Juniper Woodland outlined in yellow.

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Results

The portfolio of sites chosen by the planning team yielded 47 sites totaling 8,735,925 acres (3,535,315 hectares) and representing 26.5% of the total area in the ecoregion.

Click on the site name, shown at right, to go to a page describing that site, its targets, and maps.

Click here to go to a section addressing how well these sites captured the stated conservation goals.

Red naped sapsucker - Joel B. Dyer

Sites List

- Ace-in-the-Hole Draw
- Bamforth Lake
- Bear Lake
- Beaver Divide East
- Bighorn Canyon
- Bridger Butte
- Brown's Draw
- Buffalo Creek
- Calamity Ridge
- Cherokee Basin
- Deadman Wash
- Dunoir Valley
- East Cody
- Ferris Dunes
- Ferris Mountains
- Flaming Gorge
- Flat Top Mountain
- Granite Mountains
- Green Mountains
- Green River at Brown's Park
- Greybull River Basin
- Laramie Plains Lakes
- Lower Green River
- Muddy Creek Basin
- No Wood River
- Overthrust Belt
- Pine Butte
- Ragan
- Red Canyon / Dry Lake
- Red Desert
- Saratoga Valley
- Seedskadee
- Sheep Mountain
- Shirley Basin
- South Fork Shoshone
- Sugarloaf
- Sweetwater River Basin
- Table Mountain
- Uinta Benches
- Upper Green River
- Upper Wind River
- Walton Canyon
- West Boone Draw
- Western Wind River Foothills
- Whiskey Springs East
- Wind River Canyon
- Yampa River

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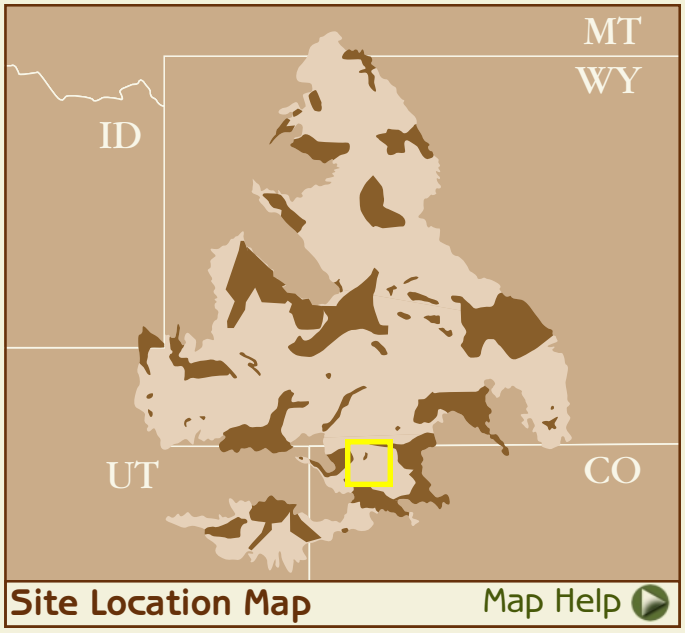
Ace-in-the-Hole Draw

Nelson's Milkvetch - Dwayne Atwood



Ace-in-the-Hole Draw is a salt desert shrub region of clay buttes and badlands with small washes and sandy canyon walls. Centered around the Dry Creek area, this site contains the only CO population of Nelson milkvetch (*Astragalus nelsonianus*) G2 in the ecoregion. This rare plant occurs on sandy hillsides under juniper bushes. The site also contains a large amount of the under-protected *Atriplex gardneri* / *Oryzopsis hymenoides* (gardner saltbush / indian ricegrass) plant association. Oil and gas wells spotted throughout the area are of concern.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 1,283

1,283 Acres ..... BLM 100%

Rare Plants
Nelson's Milkvetch

Rare Animals
None

Communities
Basin Big Sage
Gardner Saltbush Flats
Juniper Woodland

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Bamforth Lake

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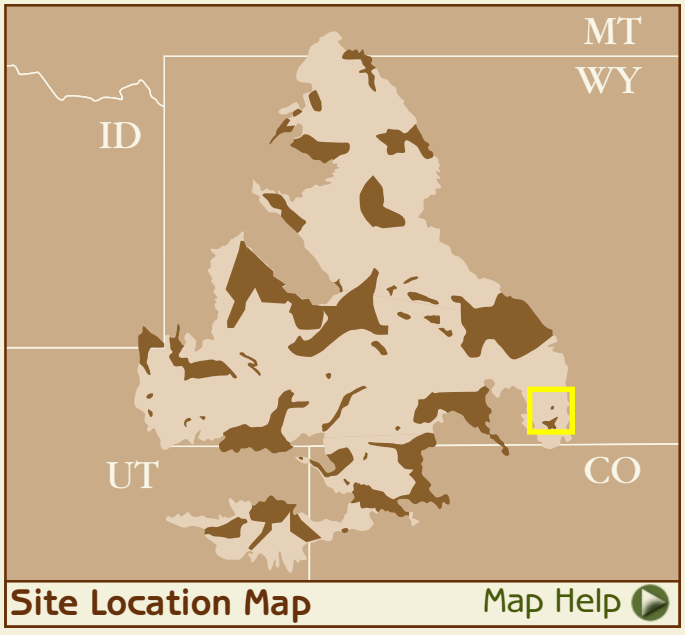


Out in the wide open spaces of the Laramie Basin, Bamforth Lake is a wind deflation basin or saline playa lake with some emergent rushes (*Scirpus*). The lake is surrounded by greasewood flats, sagebrush, and grassy hills of alkali sacaton and inland salt grass and western wheatgrass on a bedrock of saline cretaceous shales.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 910

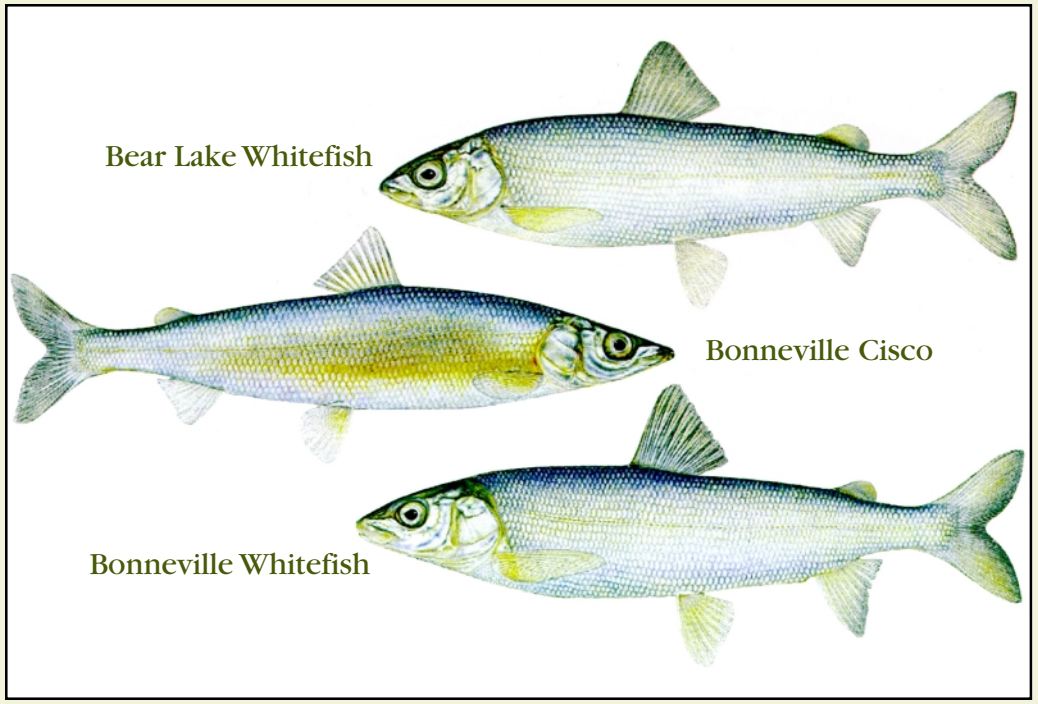
119 Acres	FWS	13%
44 Acres	State Lands	5%
177 Acres	Private Lands	19%
570 Acres	Water	63%

Rare Plants
None

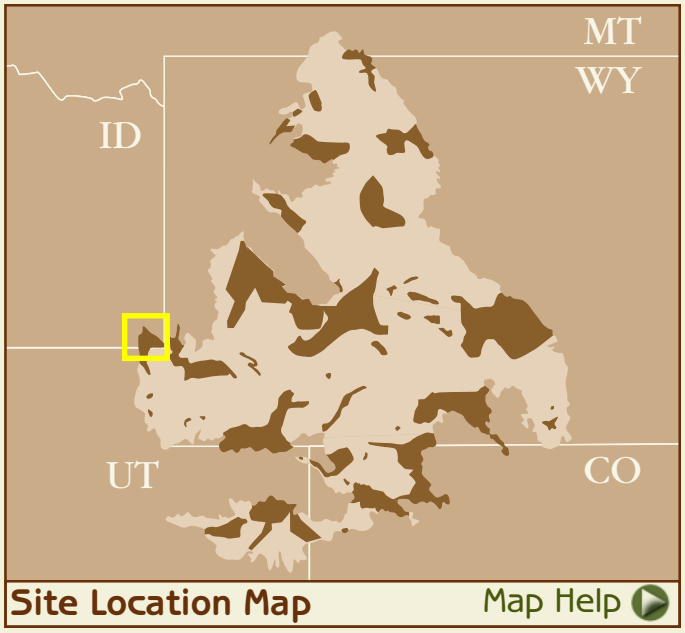
Rare Animals
Mountain Plover
American White Pelican
Colonial Nesting Birds

Communities
Mixed Grass Prairie
Wyoming Big Sage
Barren

Bear Lake



Joe Tomelleri ©



Located partly in Idaho and partly in Utah, this extraordinary lake harbors no less than four unique endemic species of fishes. The lake is 20 mi long, 5-7 mi wide and over 100 feet deep. It is fed from springs to the south. Nestled between the Bear River Range to the west and the Bear Lake Plateau to the east, the lake drains to the north forming the Bear River which winds its way into SW Wyoming.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 188061

40868 Acres	BLM	22%
15808 Acres	FWS	8%
3609 Acres	State Lands	2%
58580 Acres	Private Lands	31%
69196 Acres	Water	37%

To list of rare plants, animals, and community types

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Bear Lake

Rare Plants

Starveling Milkvetch
Tufted Cryptanth
Logan Wild Buckwheat

Rare Animals

Uinta Ground Squirrel
Idaho Pocket Gopher
Leatherside Chub
Bonneville Cutthroat Trout
Bear Lake Sculpin
Bonneville Cisco
Bonneville Whitefish
Bear Lake Whitefish
Colonial Nesting Birds

Communities

Foothills Grassland
Subalpine Grass and Forb Meadow
Mesic Upland Shrub
Deciduous Oak
Mountain Mahogany Woodland
Bitterbrush
Low Sagebrush
Wyoming Big Sage
Mountain Big Sagebrush
Salt Desert Scrub
Greasewood
Aspen
Big-Tooth Maple
Subalpine Forest
Mountain Fir
Juniper Woodland
Pinyon-Juniper Woodland
Aspen/Conifer
Forest Riparian
Grass Riparian and Meadow
Shrub-Dominated Riparian
Wetland
Playa
Barren

Beaver Divide East

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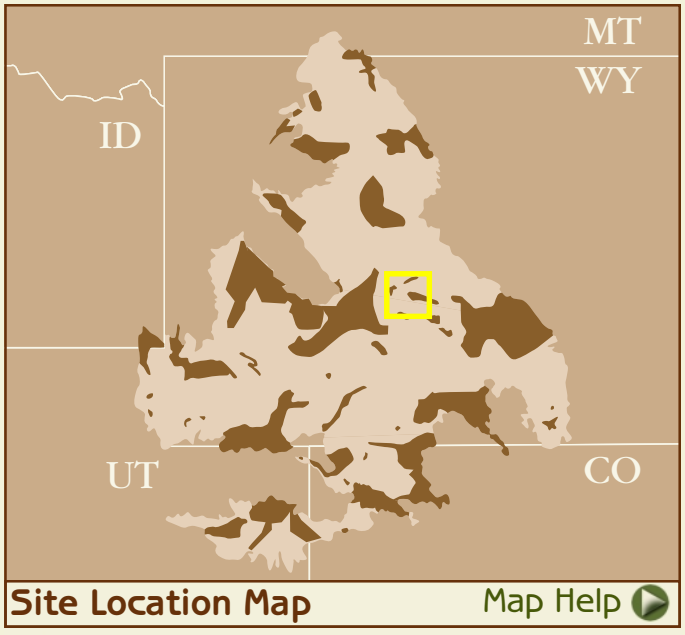

This area is part of the Beaver Rim forming the divide between the Wind and Sweetwater drainages. The site features unusual cushion plant communities on Eocene-Miocene volcanic deposits along barren ridge crests. Higher elevations are mainly steep, severely eroded, north facing slopes vegetated with Limber pine and Douglas fir.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 9,508

8,795 Acres	BLM	93%
481 Acres	State Lands	5%
187 Acres	Private Lands	2%
46 Acres	Water	<1%

Rare Plants
Starveling Milkvetch
Tufted Cryptanth
Logan Wild Buckwheat

Rare Animals
None

Communities
Wyoming Big Sage
Mixed Grass Prairie
Limber Pine

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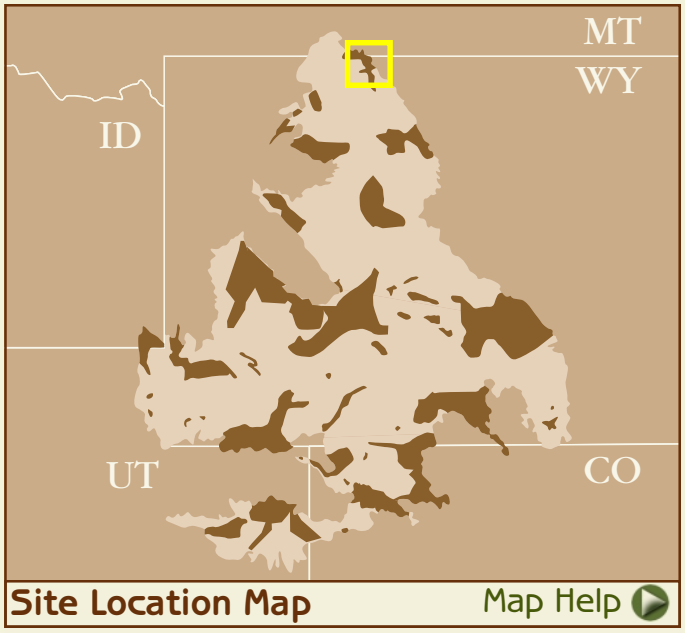
Bighorn Canyon

George Wuerthner



This site includes a series deep canyons cut into sheer limestone walls of the Bighorn Dolomite and Madison Limestone on the west flank of the Bighorn Mountains.The mountainsides are vegetated with Curl-leaf mountain mahogany and UT Juniper woodlands.The edge of the Bighorn River includes extensive Cottonwood riparian while the reservoir banks provide habitat for the rare plant, *Rorippa calycina*. Moving north, there are steeply dipping shales, sandstones, and limestones in the foothills of the Pryor mountains. Cushion plant communities occur on these ridges and barren redbed slopes including many regional endemic plants.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 138,697

81,186 Acres	BLM	59%
2,066 Acres	USFS	1%
15,707 Acres	NPS	11%
3,990 Acres	Native American Lands	3%
6,693 Acres	State Lands	5%
20,665 Acres	Private lands	15%
8,388 Acres	Water	6%

To list of rare plants, animals, and community types

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Bighorn Canyon

Rare Plants

Astragalus Grayi
Astragalus aretioides
Bighorn Fleabane
Rabbit Buckwheat
Sheathed Musineon
Cary Beardtongue
Persistent Sepal Yellowcress
Shoshonea
Sphaeromeria capitata
Stanleya tomentosa Var Tomentosa
Hapeman's Sullivantia
Sword Townsendia

Rare Animals

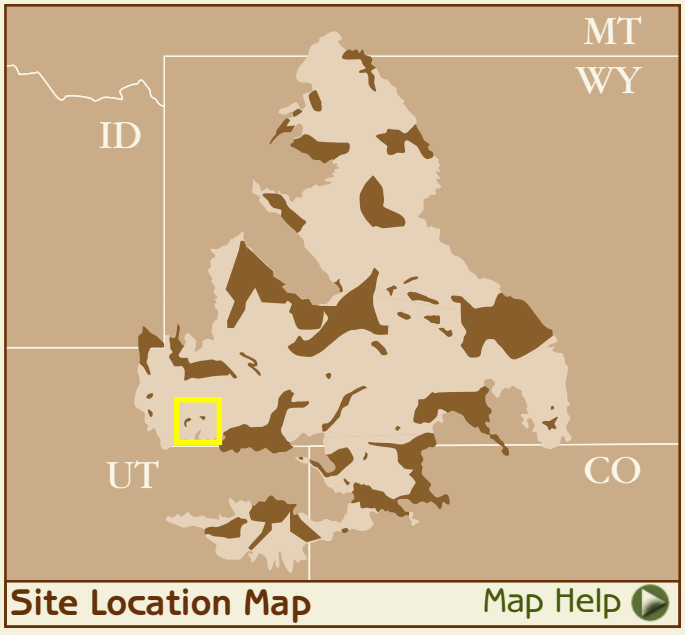
Sturgeon Chub
Peregrine Falcon
Bald Eagle
Bighorn Sheep
Important Bat Roosts

Communities

Mixed Grass Prairie
Subalpine Grass and Forb Meadow
Mesic Upland Shrub
Mountain Mahogany Shrubland
Wyoming Big Sage
Salt Desert Scrub
Gardner Saltbush Flats
Aspen
Mountain Fir
Limber Pine
Juniper Woodland
Aspen/Conifer
Forest Riparian
Grass Riparian and Meadow
Shrub-Dominated Riparian
Wetland
Barren

Bridger Butte

Payson Beardtongue, Walter Fertig / George Wuerthner



Bridger Butte is an isolated flat-topped mesa with a cap of resistant glacial outwash underlain by the Bridger Formation and covered by desert shrub vegetation and cushion plant communities.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 3,381

1,815 Acres	BLM	54%
1,566 Acres	Private lands	46%

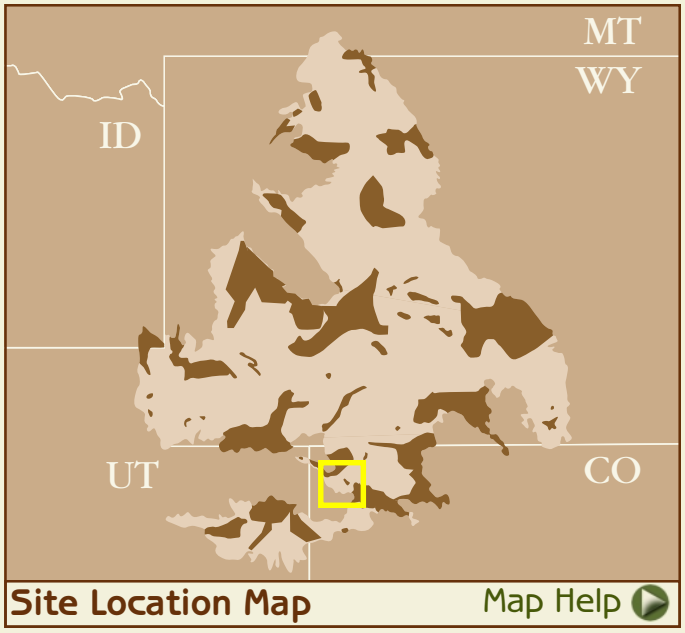
Rare Plants
Prostrate Bladderpod
Maybell Locoweed
Payson Beardtongue
Tufted Twinpod

Rare Animals
Uinta Ground Squirrel
Idaho Pocket Gopher

Communities
Wyoming Big Sage
Salt Desert Scrub
Aspen

Browns Draw

George Wuerthner



Surrounded by rocky canyon walls on the northwest and east, and a grassy limestone ridge running along the west, Browns Draw is a scenic area. Ponderosa pine occurs throughout the rocky canyon sides, dropping into a sagebrush covered canyon bottom. Pinyon / juniper mix is also along and on top of the rocky canyons. The site allows for open vistas and cool shade. Browns draw continues south, draining into the Yampa river in Dinosaur National Monument.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 408

258 Acres	BLM	63%
150 Acres	Private lands	37%

Rare Plants

Narrow-Leaf Evening Primrose

Rare Animals

None

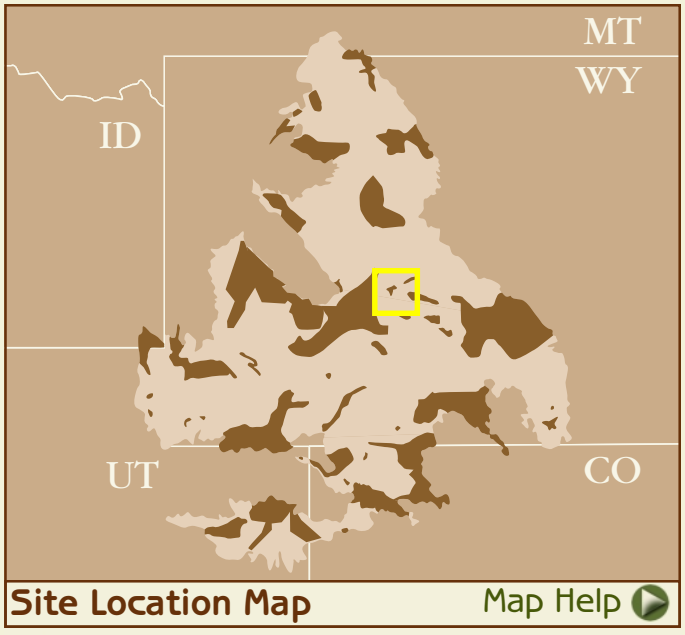
Communities

Ponderosa Pine
Basin Big Sage

The Nature Conservancy

Buffalo Creek

Ellen Ramsey



Buffalo Creek is an area of open, rolling, uplands typical of the Sweetwater River basin. Where underground springs come to the surface, boggy or moist areas appear similar in appearance to "Ice Slough" a well-known historic spot along WY highway 287. The site is formed from subirrigated tributary streams of Sweetwater River dominated by grasses and surrounded by matrix of upland dry sagebrush vegetation.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 14,283

12,820 Acres	BLM	90%
1,417 Acres	State Lands	10%
46 Acres	Private lands	<1%

Rare Plants
Meadow Pussytoes

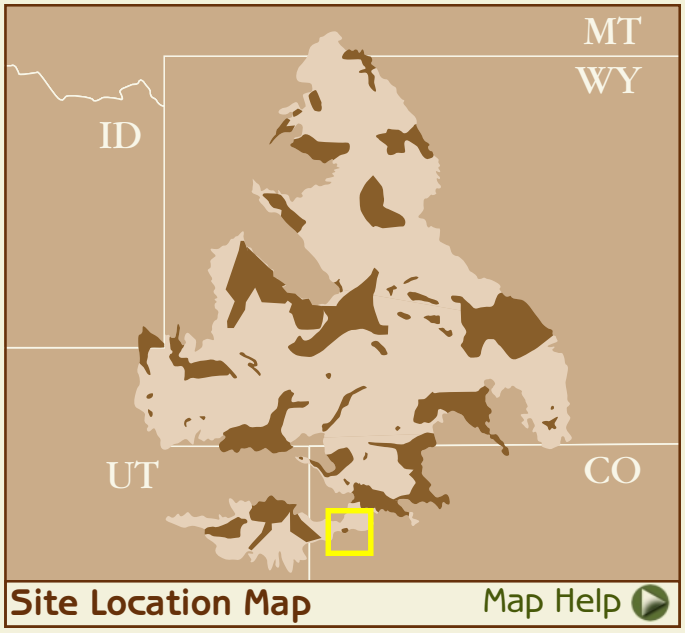
Rare Animals
None

Communities
Mixed Grass Prairie
Wyoming Big Sage
Granite Knobs

The Nature Conservancy

Calamity Ridge

George Wuerthner



Calamity Ridge is an extension of the Cathedral Bluffs, a prominent ridge separating the Douglas Creek and Piceance Creek drainages and extending down to the White River. The ridgetops are mostly of the sandy Uinta Formation with bedrock mainly shale of the Green River Formation. Vegetation ranges from pinyon/juniper woodlands to shrublands dominated by Mountain Mahogany and Utah Serviceberry.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 7,825

7,799 Acres	BLM	99%
26 Acres	Private lands	1%

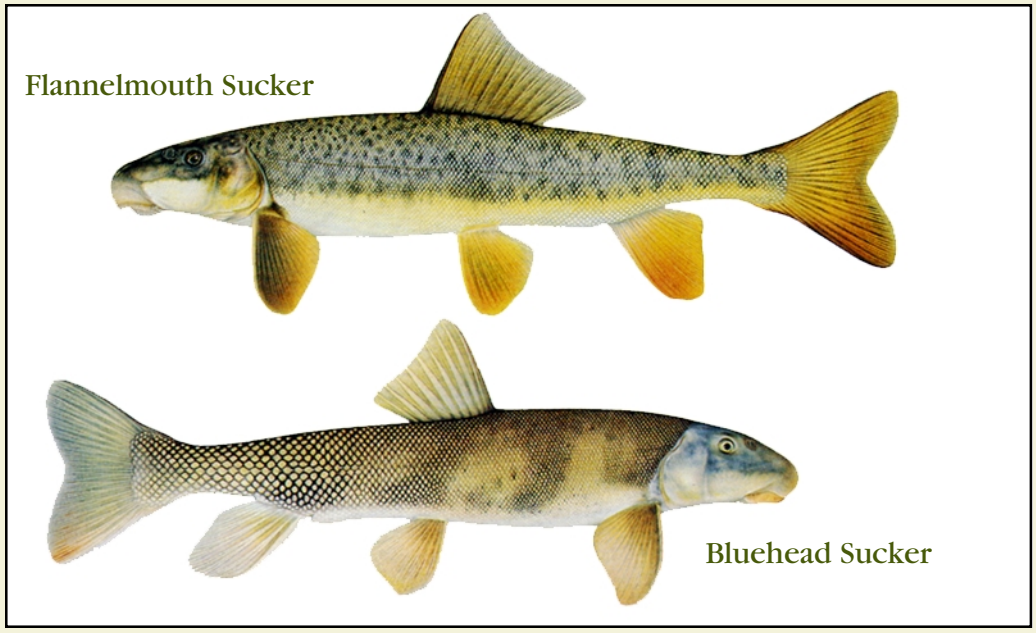
Rare Plants
Debris Milkvetch

Rare Animals
None

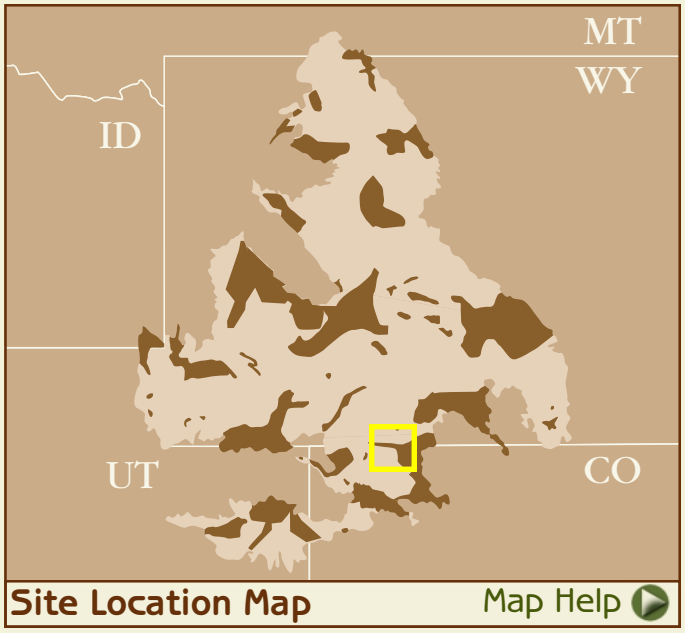
Communities
Deciduous Oak
Basin Big Sage
Juniper Woodland
Pinyon-Juniper
Woodland

The Nature Conservancy

Cherokee Basin



Joe Tomelleri ©



This site consists partly of the western foothills of the Sierra Madre range with aspen, sagebrush, and some conifers. To the west is the course of the Little Snake River, with Cottonwood riparian. Still farther west is an extensive ridge and basin system with outcrops of sandstones, clays, and shales. These ridges are covered with a mosaic of juniper woodland, Wyoming big sagebrush, bitterbrush, and cushion plant communities. Wetter valleys include Fremont cottonwood riparian communities of importance for migrant wildlife and native fish. Juniper woodlands are important for juniper obligate songbirds. The site includes two large occurrences of *Penstemon gibbensii* (G1).

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 309,302

139,454 Acres	BLM	45%
42,721 Acres	State Lands	14%
127,023 Acres	Private Lands	41%
103 Acres	Water	<1%

To list of rare plants, animals, and community types

Cherokee Basin

Rare Plants

Selby Rock Cress
Erect Cryptantha
San Rafael Daisy
Gibben's Beardtongue

Rare Animals

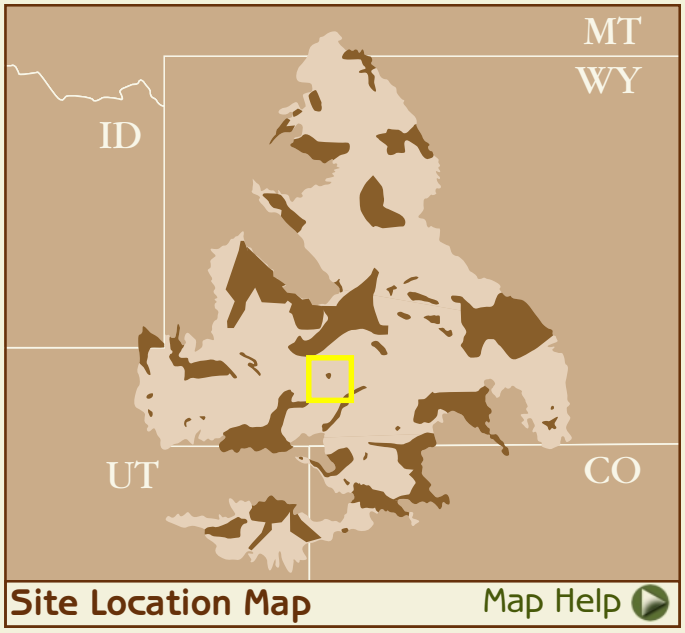
Smooth Green Snake
Columbian Sharp-Tailed Grouse
Roundtail Chub (Bonytail)
Bald Eagle
Bluehead Sucker
Colorado Cutthroat Trout

Communities

Mixed Grass Prairie
Mesic Upland Shrub
Deciduous Oak
Wyoming Big Sage
Mountain Big Sagebrush
Basin Big Sage
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Aspen
Juniper Woodland
Forest Riparian
Shrub-Dominated Riparian
Barren

Deadman Wash

Joel B. Dyer



Deadman Wash is an area of ephemeral clay playa basins surrounded by low sandstone/shale ridges. It is the only known, confirmed site for *Artemisia biennis* var. *diffusa* (G5T1Q). Permanent wetlands in the area are important bird areas but may have been impacted by pollution from a nearby power plant in recent years.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 6,888

2,979 Acres	BLM	43%
14 Acres	State Lands	<1%
3,537 Acres	Private Lands	51%
357 Acres	Water	5%

Rare Plants
Mystery Wormwood

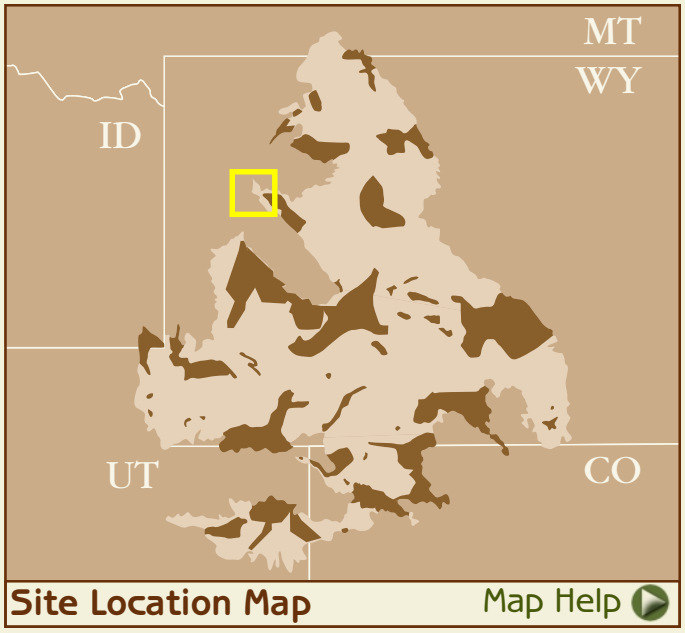
Rare Animals
Black-Footed Ferret
White-Tailed Prairie Dog
Ferruginous Hawk
Burrowing Owl

Communities
Mixed Grass Prairie
Wyoming Big Sage
Salt Desert Scrub
Greasewood
Barren

The Nature Conservancy

Dunoir Valley

Rick Konrad / The Nature Conservancy



A spectacular valley actually part of the Greater Yellowstone Ecosystem. Higher elevations are densely forested with conifers and aspens, grading down to open meadows and willow-dominated riparian. The Dunoir Valley is home to the large, mobile predators designated peripheral targets.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 52,353

7,853 Acres	BLM	15%
26 Acres	FWS	<1%
9216 Acres	USFS	18%
5,821 Acres	State Lands	11%
29,410 Acres	Private Lands	56%
28 Acres	Water	<1%

To list of rare plants, animals, and community types

Dunoir Valley

Rare Plants

None

Rare Animals

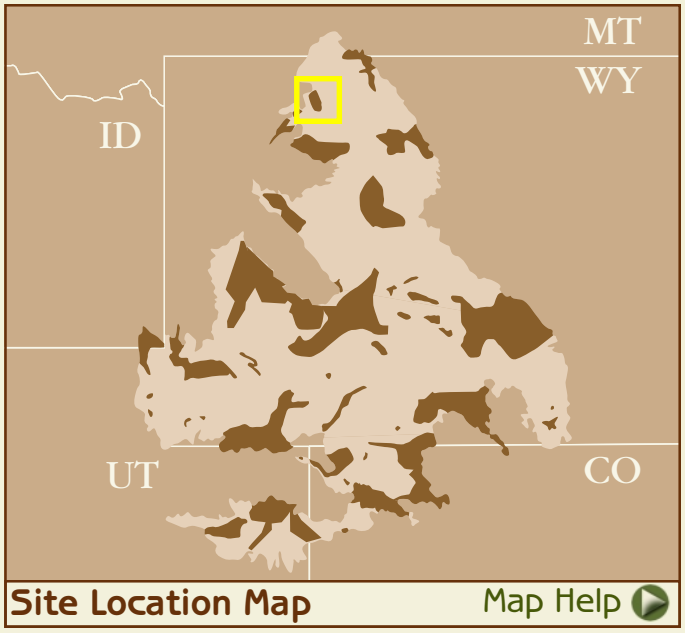
Bald Eagle
Bighorn Sheep
Peripheral Targets

Communities

Mixed Grass Prairie
Wyoming Big Sage
Mountain Big Sagebrush
Aspen
Subalpine Forest
Lodgepole Pine
Mountain Fir
Limber Pine
Forest Riparian
Grass Riparian and Meadow
Shrub-Dominated Riparian
Barren

East Cody

Ed Orth / Bob Luce



A major feature of this site is an unusual occurrence of black-tailed prairie dogs, miles from their normal range. The site is in the Sage Creek basin, an area of clayey soil with sagebrush and shadscale/saltbush shrublands. The site also includes Heart Mountain Ranch, a conservation property acquired by The Nature Conservancy in 1998 with numerous rare plant and several sensitive animal species.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 66,671

25,743 Acres	BLM	39%
2,170 Acres	State Lands	3%
38,338 Acres	Private Lands	58%
420 Acres	Water	1%

Rare Plants

Shoshonea

Rare Animals

Black-Tailed Prairie Dog

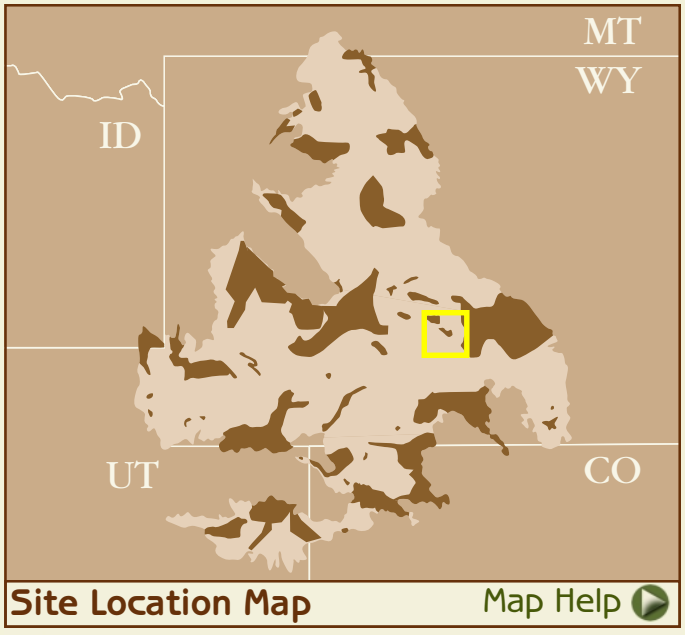
Communities

Mixed Grass Prairie
Wyoming Big Sage
Salt Desert Scrub
Gardner Saltbush Flats
Forest-Dominated Riparian
Shrub-Dominated Riparian

The Nature Conservancy

Ferris Dunes

Ellen Ramsay



At the foot of the Ferris Mountains, this site consists of gently undulating terrain of active sand dunes partially stabilized with vegetation. There are surprising occurrences of moist areas and small pools in wet weather especially along periphery of the dunes.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 22,551

10,028 Acres	BLM	44%
1,952 Acres	State Lands	9%
10,547 Acres	Private Lands	47%
25 Acres	Water	<1%

Rare Plants

Blowout Penstemon

Rare Animals

Black-Footed Ferret
White-Tailed Prairie Dog
Ferruginous Hawk
Burrowing Owl
Swift Fox
Peregrine Falcon

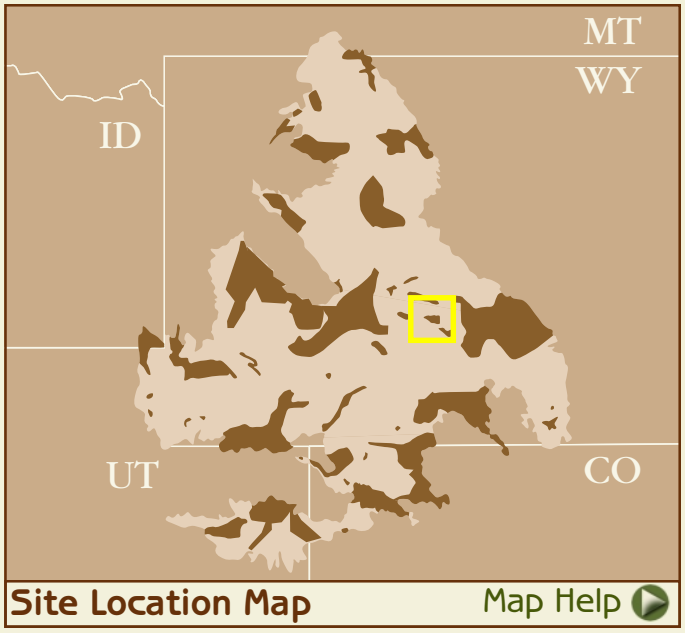
Communities

Wyoming Big Sage
Mountain Big Sagebrush
Vegetated Dunes
Limber Pine
Active Dunes
Barren

The Nature Conservancy

Ferris Mountains

George Wuerthner



The Ferris Mountains are a steep, narrow, east/west trending range of Precambrian, granitic rock. A substantial altitudinal gradient is represented in the long alluvial fans coming off the mountains. A variety of rare plants are found on these slopes, particularly in the stream-laid alluvium from water courses.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 33,804

27,641 Acres	BLM	82%
3,067 Acres	State Lands	9%
3,096 Acres	Private Lands	9%

To list of rare plants, animals, and community types

The Nature Conservancy

Ferris Mountains

Rare Plants

Daggett Rock Cress
Bun Milk-Vetch
Cedar Rim Thistle
Erect Cryptantha
Wyoming Point-Vetch
Devil's Gate Twinpod

Rare Animals

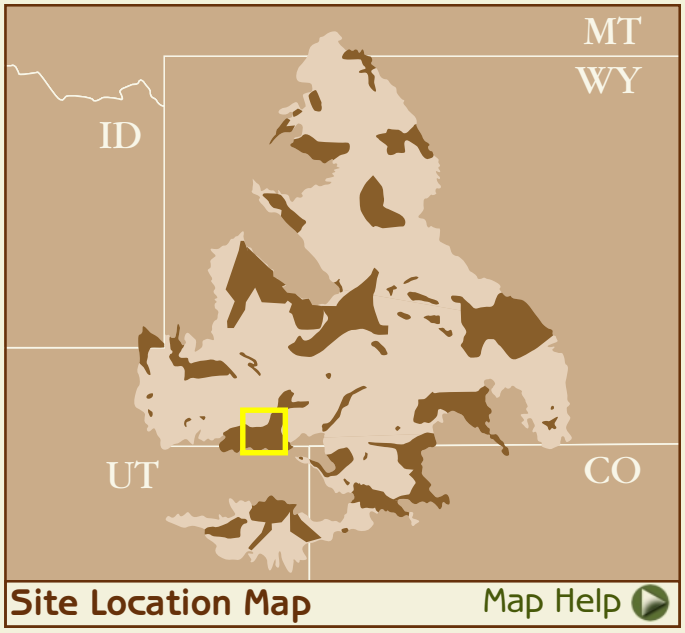
Black-Footed Ferret
White-Tailed Prairie Dog
Ferruginous Hawk
Burrowing Owl
Peregrine Falcon
Swift Fox

Communities

Mixed Grass Prairie
Mountain Mahogany Shrubland
Wyoming Big Sage
Mountain Big Sagebrush
Black Sage
Greasewood
Lodgepole Pine
Mountain Fir
Limber Pine
Shrub-Dominated Riparian
Barren

Flaming Gorge

LuRay Parker / Phlox opalensis - Cherie Winner



The Flaming Gorge site includes the sharply dissected mesas, badlands, mountains, and canyons surrounding the dammed Green River. Due to the exposure of several unusual rock substrates, notably the Bridger Formation, the area provides habitat for a wide diversity of rare or endemic plant species. Combined with this is wild country of pinyon and juniper providing habitat for Pygmy rabbits, Idaho pocket gophers, prairie dogs and their associates. All of these diverse habitats and conservation targets make this perhaps the richest portfolio site in the WY Basins ecoregion.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 716,947

423,635 Acres	BLM	59%
61,644 Acres	USFS	9%
30,702 Acres	State Lands	4%
166,349 Acres	Private Lands	23%
34,617 Acres	Water	5%

To list of rare plants, animals, and community types

Rare Plants

Crandall's Rock-Cress
Daggett Rock Cress
Selby Rock Cress
Moab Milk-Vetch
Starveling Milkvetch
Nelson's Milkvetch
Precocious Milkvetch
Fullstem
Ownbey's Thistle
Erect Cryptantha
Echo Spring-Parsley
Wyoming Tansymustard
Uinta Draba
Single-Stemmed Wild-Buckwheat
Utah Greasebush
Compact Gilia
Watson's Prickly-Phlox
Narrowleaved Bladderpod
Tufted Cryptanth
Rollins Cryptanth
Maybell Locoweed
Stemless Beardtongue
Sheep Creek Beardtongue
Payson Beardtongue
Garrett's Beardtongue
Desert Glandular Phacelia
Western Phacelia
Opal Phlox
Persistent Sepal Yellowcress
Sphaeromeria argentea
Sphaeromeria capitata
Green River Greenthread
Uinta Greenthread
Cedar Mountain Easter Daisy
Nuttall Townsend-Daisy
Strigose Easter-Daisy
Trifolium andinum

Rare Animals

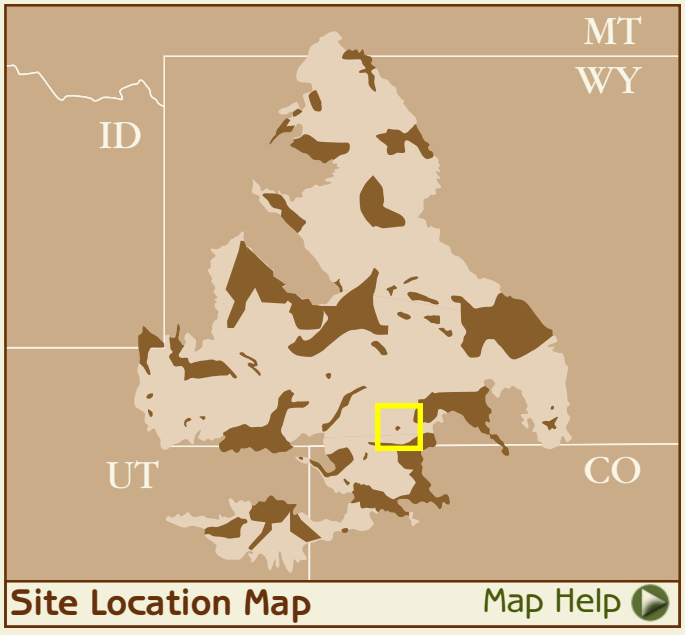
Uinta Ground Squirrel
Black-Footed Ferret
White-Tailed Prairie Dog
Idaho Pocket Gopher
Ferruginous Hawk
Burrowing Owl
Sage Grouse
Roundtail Chub (Bonytail)
Pygmy Rabbit
Flannelmouth Sucker
Peregrine Falcon
Dwarf Shrew
Virginia's Warbler
Northern Plateau Lizard
Northern Tree Lizard
Midget Faded Rattlesnake
Bluehead Sucker
Important Bat Roosts

Communities

Foothills Grassland
Mixed Grass Prairie
Mesic Upland Shrub
Deciduous Oak
Mountain Mahogany Shrubland
Wyoming Big Sage
Mountain Big Sagebrush
Basin Big Sage
Black Sage
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Aspen
Subalpine Forest
Ponderosa Pine
Lodgepole Pine
Mountain Fir
Limber Pine
Juniper Woodland
Pinyon-Juniper Woodland
Aspen/Conifer
Forest Riparian
Grass Riparian and Meadow
Shrub-Dominated Riparian
Wetland
Barren

Flat Top Mountain

Walter Fertig



Most of the site consists of barren ridges of sandstone and shale with a small colony of the very rare endemic plant Gibben's Beardtongue (*Penstemon gibbensii*)(G1).The nearby slopes covered with montane shrubs and siltbush (*Zuckia*) are important big game winter range.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 4,908

4,748 Acres	BLM	97%
160 Acres	State Lands	3%

Rare Plants

Starveling Milkvetch
Gibben's Beardtongue
Sheep Creek Beardtongue

Rare Animals

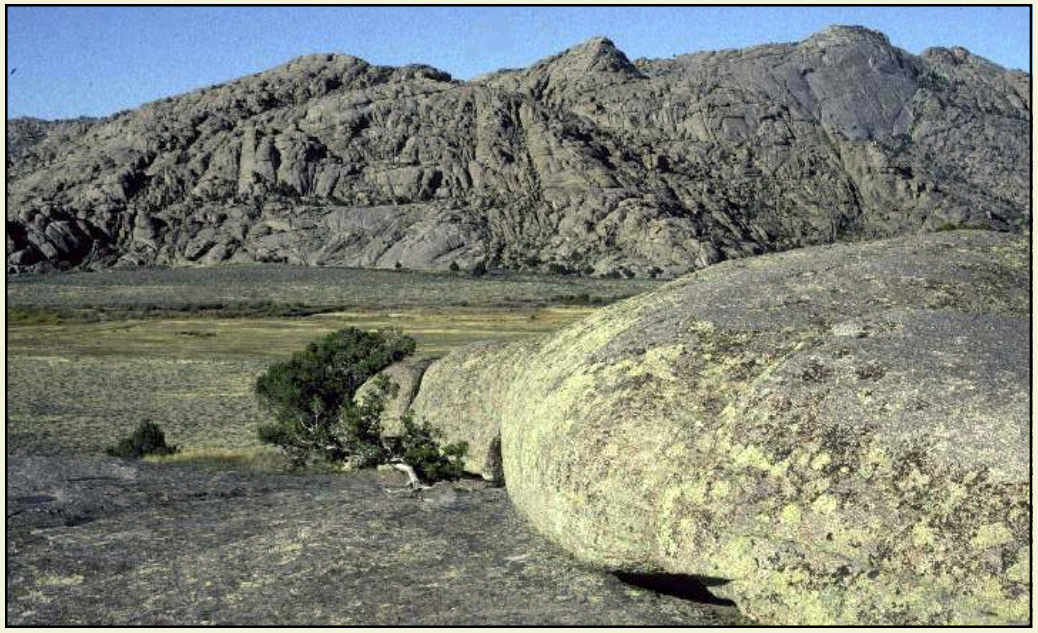
None

Communities

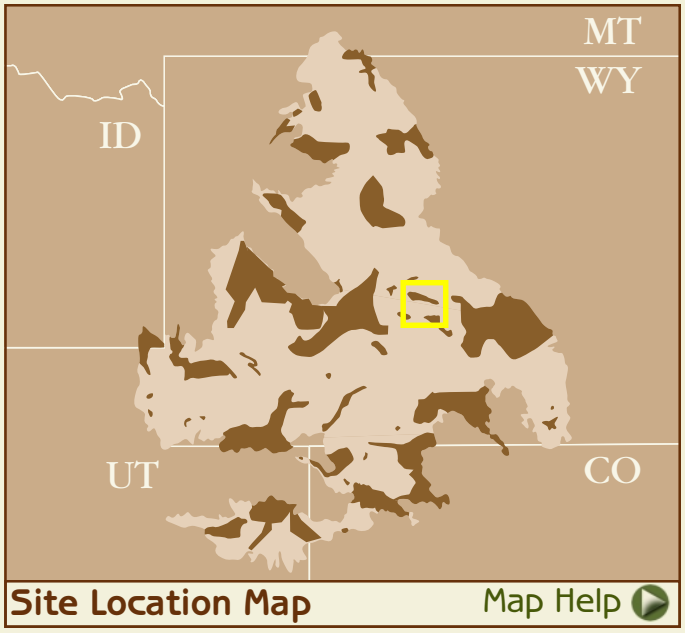
Wyoming Big Sage
Salt Desert Scrub
Gardner Saltbush Flats
Barren

The Nature Conservancy

Granite Mountains



George Wuerthner



The Granite Mountains are spectacular, rounded granite outcrops with sparse limber pine woods and cushion plant communities. The site includes surrounding lowlands with patches of riparian vegetation and sagebrush meadows.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 63,340

47,156 Acres	BLM	74%
3,742 Acres	State Lands	6%
12,307 Acres	Private Lands	19%
135 Acres	Water	<1%

Rare Plants

Wyoming Point-Vetch
Devil's Gate Twinpod

Rare Animals

Peregrine Falcon

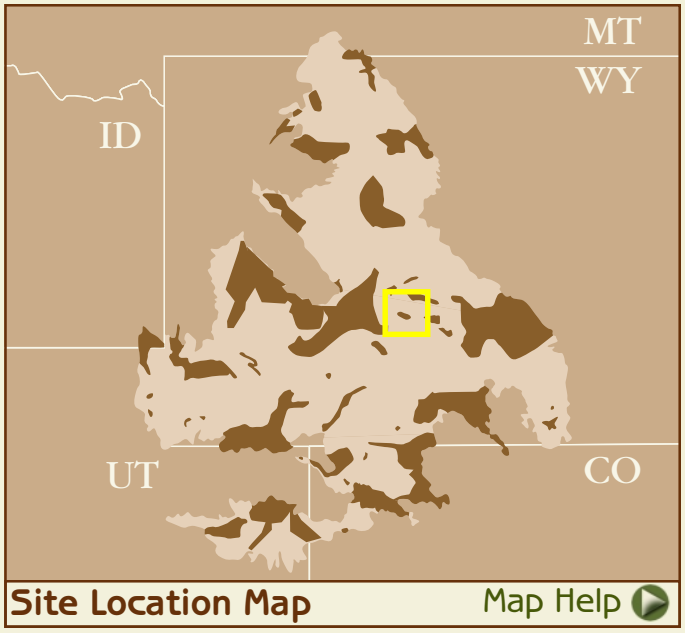
Communities

Mixed Grass Prairie
Wyoming Big Sage
Basin Big Sage
Salt Desert Scrub
Limber Pine
Shrub-Dominated Riparian
Barren
Granite Knobs

The Nature Conservancy

Green Mountains

George Wuerthner



The Green Mountains are an east/west trending range of low mountains longer and lower than the Ferris Mountains, but of the same rock. Like the Ferris range, these peaks may be considered islands in a sea of sagebrush, providing high elevation habitat for species like Boreal owls. The range is densely timbered at higher elevations, mostly with lodgepole pine, Engleman spruce and subalpine fir.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 23,767

18,824 Acres	BLM	79%
1,632 Acres	State Lands	7%
3,311 Acres	Private Lands	14%

Rare Plants

Erect Cryptantha
Devil's Gate Twinpod

Rare Animals

None

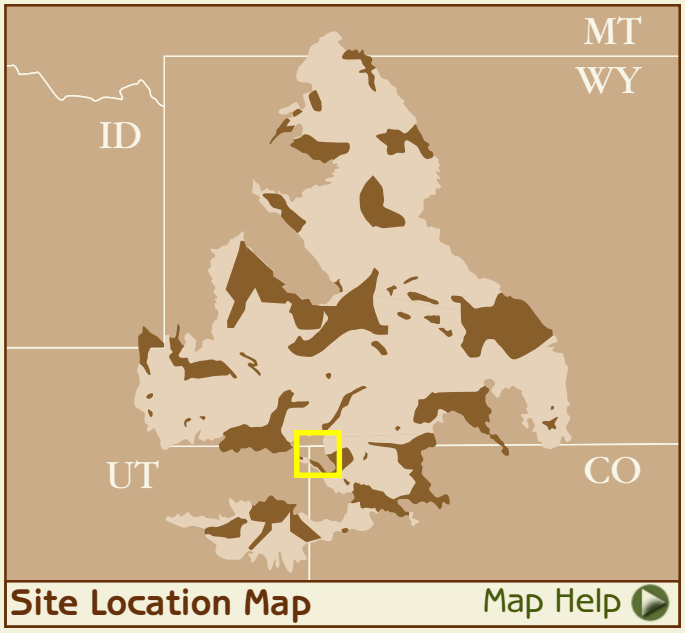
Communities

Mixed Grass Prairie
Wyoming Big Sage
Lodgepole Pine
Limber Pine

The Nature Conservancy

Green River at Brown's Park

George Wuerthner



The Green River site is located in Brown's Park, a broad valley of the Green River. Bordered by the Uinta Mountains to the south, the site is largely comprised of sedimentary benches with desert shrubs and willow-dominated riparian. The river bottom is loose unconsolidated Quaternary alluvium, bounded south and north by the Precambrian quartzite core of the Uinta Mountains. Bedrock is the Browns Park Formation of tuffaceous Tertiary age material and conglomerates.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 1,247

1,092 Acres	BLM	88%
120 Acres	State Lands	10%
34 Acres	Private Lands	3%

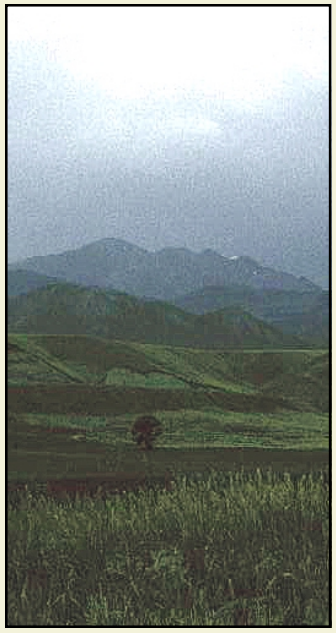
Rare Plants
Opal Phlox
Ute Ladies' Tresses

Rare Animals
None

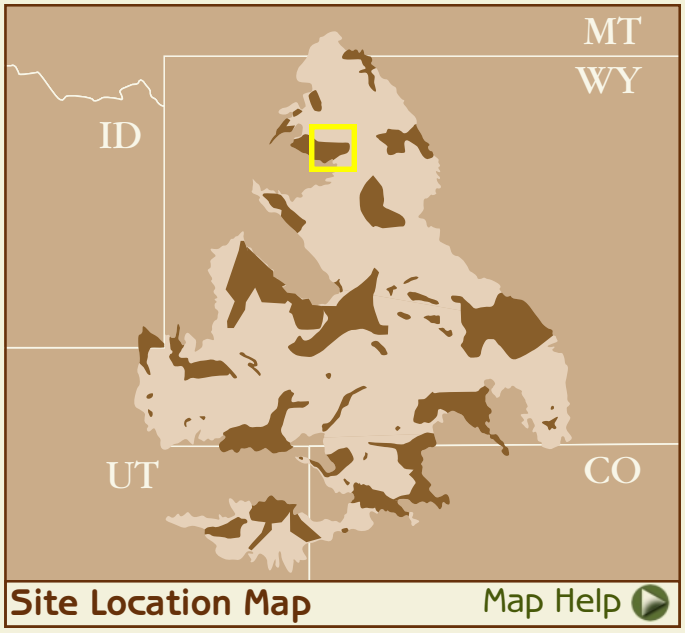
Communities
Basin Big Sage
Salt Desert Scrub
Greasewood
Juniper Woodland
Forest Riparian

The Nature Conservancy

Greybull River Basin



Ellen Ramsey



This spectacular landscape ranges from high alpine country on Carter Mountain down onto the sagebrush flats of the Greybull River Basin. Abundant water from Pickett Creek, Franc's Fork and other streams add to the Greybull River, supporting native populations of Yellowstone cutthroat trout. This area has many prairie dogs and is where black-footed ferrets were found in 1981 after being presumed extinct for many years.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 317,387

106,817 Acres	BLM	34%
2,795 Acres	U.S.F.S.	1%
66,229 Acres	State Lands	21%
140,177 Acres	Private Lands	44%
1,368 Acres	Water	<1%

To list of rare plants, animals, and community types

Greybull River Basin

Rare Plants

Evert's Waferparsnip
Rocky Mountain Twinpod
Stanleya tomentosa Var tomentosa

Rare Animals

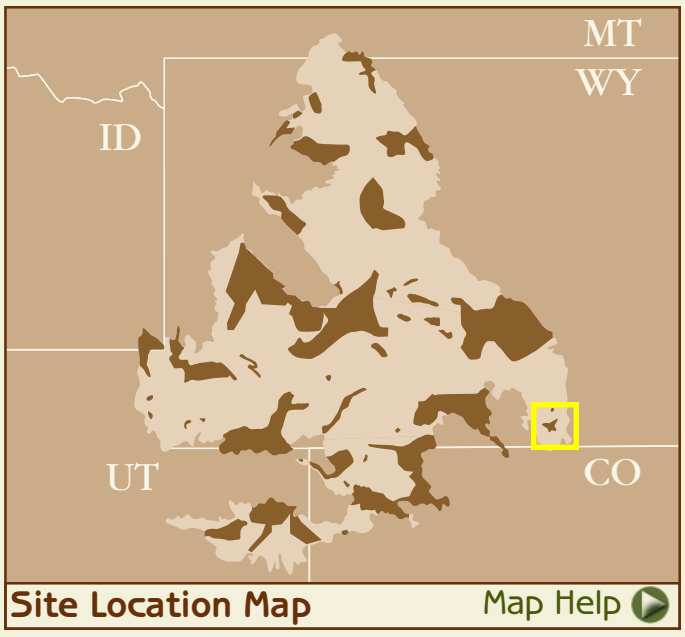
Ferruginous Hawk
Burrowing Owl
Swift Fox
Black-Footed Ferret
White-Tailed Prairie Dog
Yellowstone Cutthroat Trout
Bald Eagle
Bighorn Sheep

Communities

Mixed Grass Prairie
Subalpine Grass and Forb Meadow
Mesic Upland Shrub
Wyoming Big Sage
Mountain Big Sagebrush
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Aspen
Subalpine Forest
Lodgepole Pine
Limber Pine
Juniper Woodland
Forest Riparian
Shrub-Dominated Riparian
Barren

Laramie Plains Lakes

Chris Garber / The Nature Conservancy



The Laramie Plains are very gently rolling open country. Uplands are mostly mixed grass prairie. The many small lakes are typically closed basins, often without outlets. Many of the lakes are in wind deflation basins, areas scoured out by the wind. Ground water and some surface water feeds these lakes although some have recently been augmented by human irrigation works and dams.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 29,565

321 Acres	BLM	1%
2,968 Acres	FWS	10%
1,824 Acres	State Lands	6%
22,341 Acres	Private Lands	76%
2,110 Acres	Water	7%

Rare Plants

Ward's Goldenweed
Pale Blue-Eye-Grass

Rare Animals

Mountain Plover
Wyoming Toad
Dwarf Shrew
Colonial Nesting Birds

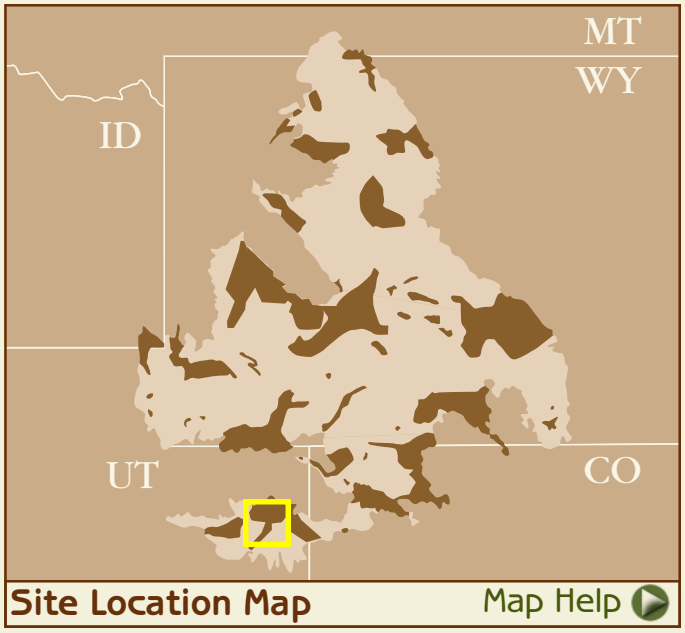
Communities

Mixed Grass Prairie
Wyoming Big Sage
Greasewood
Forest Riparian
Shrub-Dominated Riparian
Barren

The Nature Conservancy

Lower Green River

Joe Tomelleri ©



The channel of the mighty Green River south of Dinosaur National Monument is lined with occasional cultivated hayfields, occasional cottonwood riparian, and occasional steep-walled canyons. The river is a major water source in the west and is home to several rare and endangered native fish species.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 505,129

301,525 Acres	BLM	60%
8,918 Acres	FWS	2%
2,278 Acres	NPS	<1%
21,475 Acres	Native American Lands	4%
61,627 Acres	State Lands	12%
108,678 Acres	Private Lands	22%
627 Acres	Water	<1%

To list of rare plants, animals, and community types

Lower Green River

Rare Plants

Duchesne Milkvetch
Horseshoe Milkvetch
Hamilton Milkvetch
Dinosaur Milkvetch
Ligulate Feverfew
Uinta Basin Spring-Parsley
Ephedra Buckwheat
Hedysarum boreale Var gremiale
Tufted Cryptanth
Rollins Cryptanth
Goodrich Penstemon
Graham Beardtongue
White River Penstemon
Intermountain Phacelia
Yucca Harrimaniae Var sterilis

Rare Animals

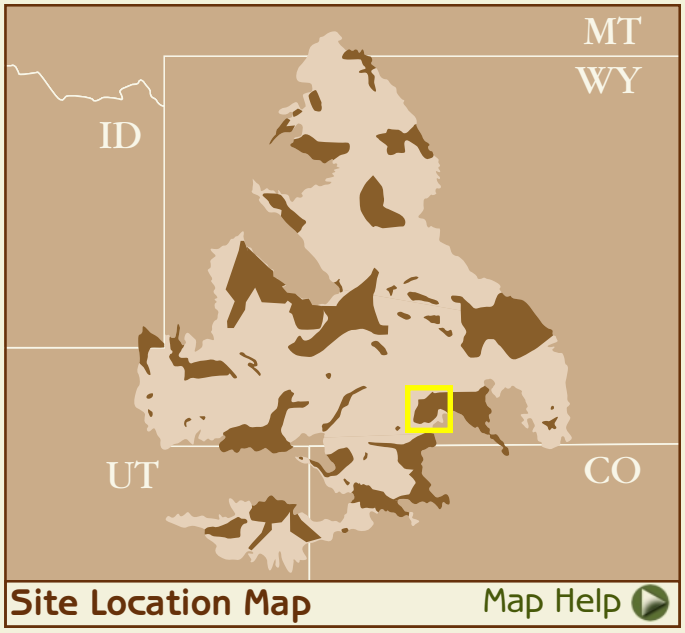
Bonytail
Black-Footed Ferret
Smooth Green Snake
White-Tailed Prairie Dog
Ferruginous Hawk
Burrowing Owl
Razorback (Humpback) Sucker
Colorado River Pikeminnow
Important Bat Roosts

Communities

Foothills Grassland
Mesic Upland Shrub
Deciduous Oak
Wyoming Big Sage
Basin Big Sage
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Juniper Woodland
Pinyon-Juniper Woodland
Forest Riparian
Shrub-Dominated Riparian
Wetland
Barren

Muddy Creek Basin

Joel B. Dyer



Muddy Creek Basin and the area up to Cow Creek are on the rim of the Great Divide Basin. Although there is a surprising amount of aspen in the wooded draws, the region is mostly sagebrush-dominated hills. This site constitutes a western extension of the Saratoga Valley site and was included for its prairie dog colonies and many representative plant communities.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 180,281

108,441 Acres	BLM	60%
36,349 Acres	State Lands	20%
35,463 Acres	Private Lands	20%
29 Acres	Water	<1%

To list of rare plants, animals, and community types

Muddy Creek Basin

Rare Plants

None

Rare Animals

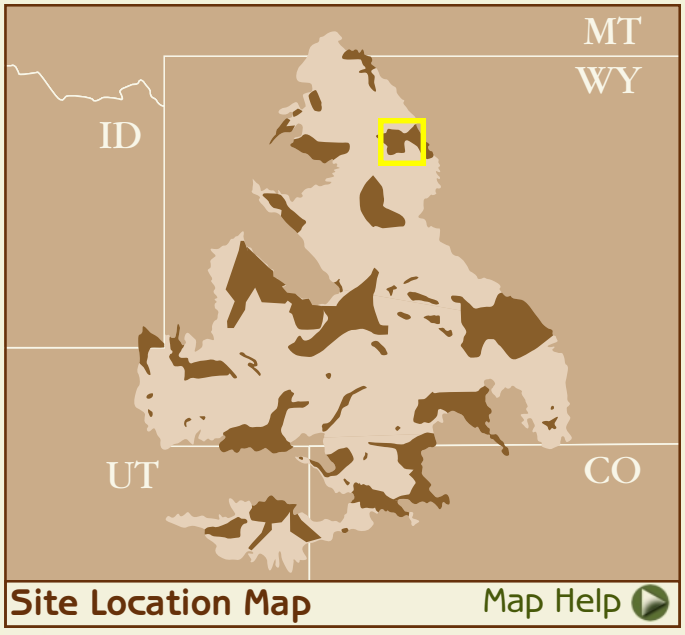
Black-Footed Ferret
White-Tailed Prairie Dog
Ferruginous Hawk
Columbian Sharp-Tailed Grouse
Burrowing Owl
Swift Fox

Communities

Mixed Grass Prairie
Mesic Upland Shrub
Bitterbrush
Wyoming Big Sage
Mountain Big Sagebrush
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Aspen
Juniper Woodland
Barren

No Wood River

Harold Malde / Hapeman's Sullivantia, Laura Welp



The No Wood River site lies on the west flank of the Bighorn Mountains and runs onto the foothills of that range. In addition to its important riparian along the No Wood River, the site includes red rock of the Chugwater Formation, sedimentary shales of the Bighorn Basin (e.g., Cody Shale) and sandstones. There is an abundance of bare soil, oil wells, and sugar beets.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 287,271

187,460 Acres	BLM	65%
18,414 Acres	State Lands	6%
79,924 Acres	Private Lands	28%
1,473 Acres	Water	1%

To list of rare plants, animals, and community types

No Wood River

Rare Plants

Hyattville Milkvetch
Bighorn Fleabane
Cary Beardtongue
Stanleya tomentosa Var tomentosa
Hapeman's Sullivantia

Rare Animals

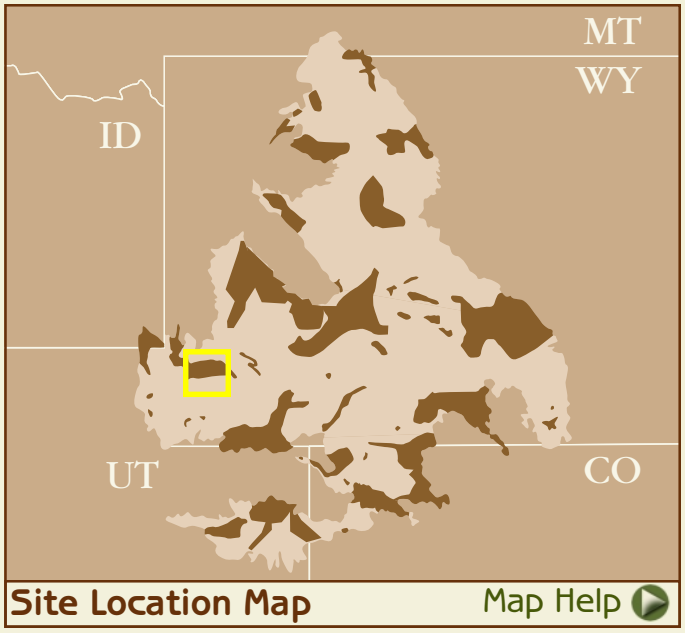
Black-Footed Ferret
White-Tailed Prairie Dog
Ferruginous Hawk
Yellowstone Cutthroat Trout
Burrowing Owl
Swift Fox
Sturgeon Chub
Peregrine Falcon
Bald Eagle
Allen's Thirteen-Lined Ground Squirrel
Important Bat Roosts

Communities

Mixed Grass Prairie
Wyoming Big Sage
Basin Big Sage
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Ponderosa Pine
Lodgepole Pine
Mountain Fir
Juniper Woodland
Forest Riparian
Shrub-Dominated Riparian
Barren

Overthrust Belt

The Nature Conservancy



Because this site includes a large diversity of landforms and geology, it also contains a high concentration of regional endemics, state rare plants and at least seven rare vegetation types. The headwaters of the Smith's Fork of the Bear River is shrub-dominated with Curl-leaf mountain mahogany and sagebrush. There are barren clay-shale badlands with sparse cushion plant communities and flats of sagebrush grasslands. Cushion plant communities grow on rims of limey-clay rolling hills within a matrix of sagebrush grasslands. Finally, there are mesas of mudstone, sandstone, and limestone of the Wasatch and Green River formations dominated by desert shrub, cushion plant, and bunchgrass communities.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 341,830

176,997 Acres	BLM	52%
578 Acres	FWS	<1%
8,080 Acres	NPS	2%
25,286 Acres	State Lands	7%
130,690 Acres	Private lands	38%
199 Acres	Water	<1%

To list of rare plants, animals, and community types

Overthrust Belt

Rare Plants

Starveling Milkvetch
Bun Milk-Vetch
Echo Spring-Parsley
Single-Stemmed Wild-Buckwheat
Compact Gilia
Entire-Leaved Peppergrass
Prostrate Bladderpod
Ternate Desert-Parsley
Tufted Cryptanth
Swallen Mountain-Ricegrass
Payson Beardtongue
Opal Phlox
Beaver Rim Phlox
Tufted Twinpod
Dorn's Twinpod

Rare Animals

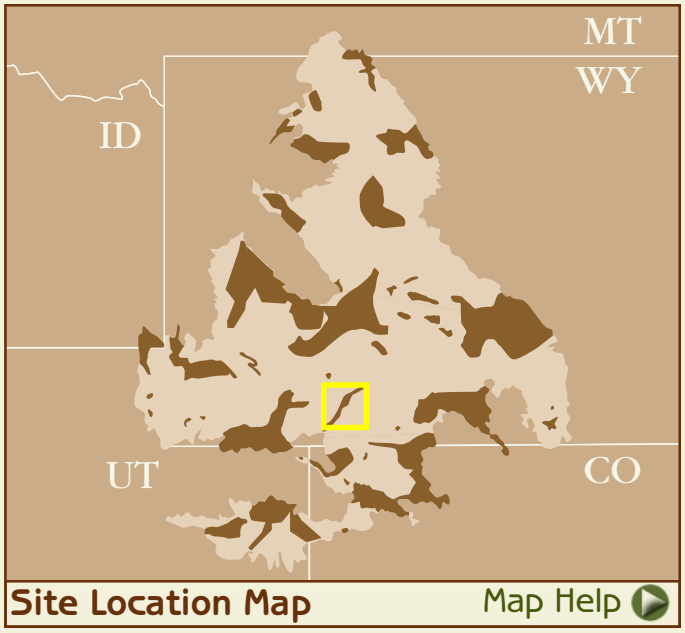
Black-Footed Ferret
White-Tailed Prairie Dog
Ferruginous Hawk
Burrowing Owl
Roundtail Chub (Bonytail)
Pygmy Rabbit
Leatherside Chub
Flannelmouth Sucker
Bald Eagle
Bonneville Cutthroat Trout
Uinta Ground Squirrel
Idaho Pocket Gopher
Bluehead Sucker
Colonial Nesting Birds
Important Bat Roosts

Communities

Mixed Grass Prairie
Mesic Upland Shrub
Mountain Mahogany Shrubland
Wyoming Big Sage
Mountain Big Sagebrush
Salt Desert Scrub
Greasewood
Aspen
Mountain Fir
Limber Pine
Juniper Woodland
Forest Riparian
Shrub-Dominated Riparian
Barren

Pine Butte

Hollis Marriott



Pine Butte is an isolated sandstone escarpment with Douglas-fir and aspen woods on steep north slopes and sagebrush grasslands. Its rugged talus cliffs provide habitat for Wyoming tansymustard (*Descurainia torulosa*) (G1), a rare endemic plant. This site is one of a series of steep sandstone rims and ridges SE of Rock Springs.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 83,129

47,166 Acres	BLM	57%
1,158 Acres	State Lands	1%
34,805 Acres	Private lands	42%

Rare Plants

Wyoming Tansymustard

Rare Animals

Wyoming Pocket Gopher
Black-Footed Ferret
White-Tailed Prairie Dog
Ferruginous Hawk
Burrowing Owl
Virginia's Warbler
Northern Plateau Lizard
Northern Tree Lizard
Midget Faded Rattlesnake

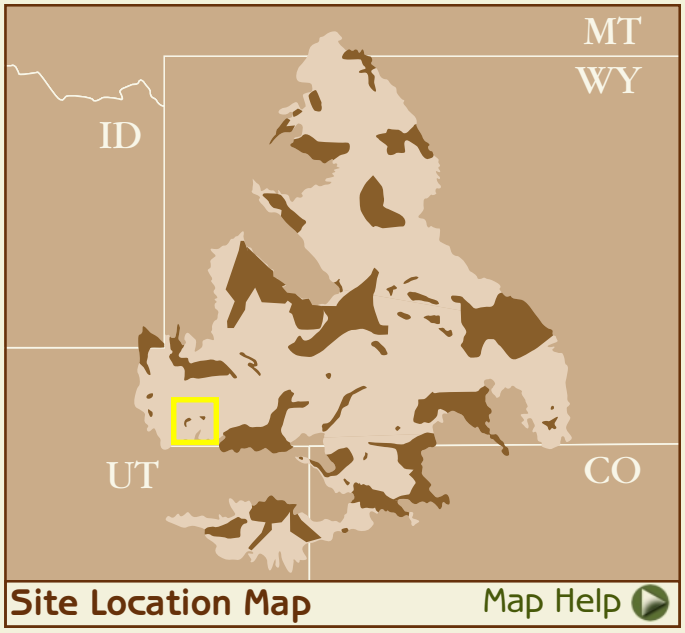
Communities

Mixed Grass Prairie
Wyoming Big Sage
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Limber Pine
Juniper Woodland
Shrub-Dominated Riparian
Barren

The Nature Conservancy

Ragan

Lesquerella prostrata - Walt Fertig / Don Schmidt© / Walt Fertig



Site Location Map Map Help

Ragan is characterized by slopes and ridges of claystone, siltstone, and sandstone dominated by Utah juniper woodlands and desert shrubs. Several rare plants are found here including Starveling milkvetch and Dorn's twinpod, both rare endemics. The site was also selected to include the Uinta ground squirrel and Idaho pocket gopher.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 5,418

1,806 Acres	BLM	33%
3,612 Acres	Private lands	67%

Rare Plants
Starveling Milkvetch
Tufted Cryptanth
Prostrate Bladderpod
Dorn's Twinpod

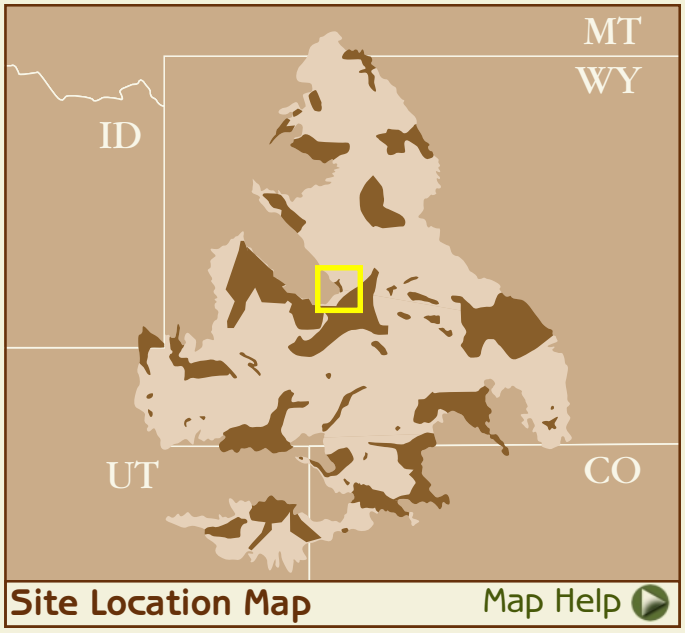
Rare Animals
Uinta Ground Squirrel
Idaho Pocket Gopher

Communities
Mountain Mahogany Shrubland
Wyoming Big Sage Juniper Woodland

The Nature Conservancy

Red Canyon /Dry Lake

John Eastcott



Set at the foot of the Wind River Range, this site includes bands of Mesozoic bedrock moving older from east to west. Red Canyon itself is rimmed by cliffs of the red rock of the Chugwater Formation. Barneby's clover (G1), a rare endemic, is found above the rim. Nearby Dry Lake is a magnet for waterfowl, shorebirds, and other migrating species.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 14,516

5,147 Acres	BLM	35%
2,204 Acres	State Lands	15%
7,082 Acres	Private lands	49%
83 Acres	Water	1%

Rare Plants

Fremont Bladderpod
Payson Beardtongue
Beaver Rim Phlox
Rocky Mountain Twinpod
Barneby's Clover
Persistent Sepal Yellowcress

Rare Animals

Sage Grouse
Colonial Nesting Birds

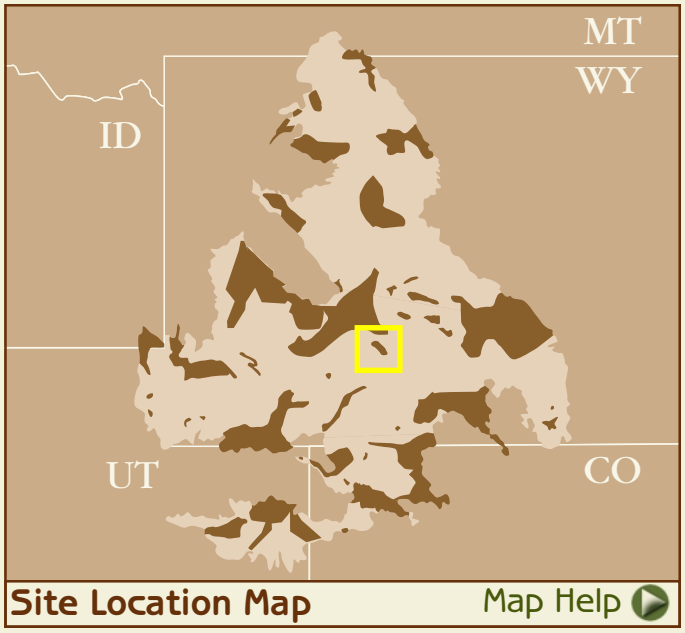
Communities

Mixed Grass Prairie
Wyoming Big Sage
Mountain Big Sagebrush
Aspen
Juniper Woodland
Shrub-Dominated Riparian

The Nature Conservancy

Red Desert

Joel B. Dyer



This site includes playas and the surrounding shrub and grass vegetation typical of the red desert. Broad shallow basins and low rolling hills are occasionally broken up with cliffy mesas or bouldery mounds. This area was included for its importance in adding several representative vegetation communities to the portfolio of sites.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 34,302

30,778 Acres	BLM	90%
2,342 Acres	State Lands	7%
1,014 Acres	Private lands	3%
168 Acres	Water	<1%

Rare Plants
None

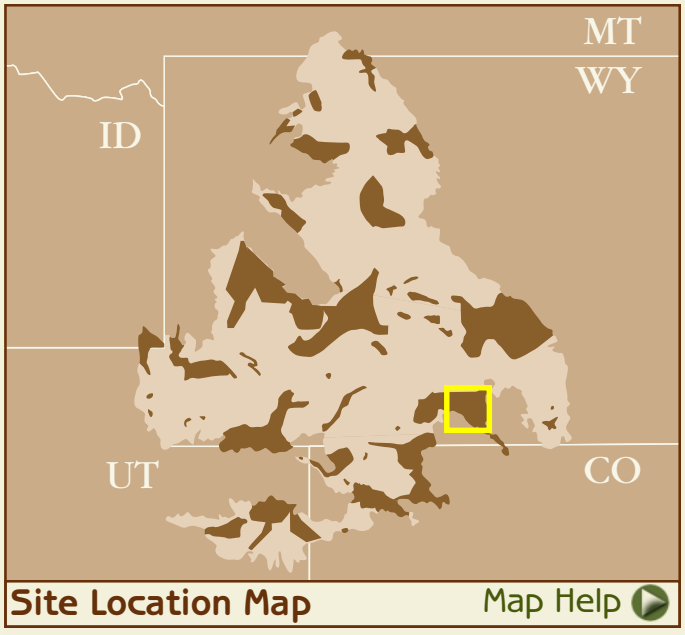
Rare Animals
None

Communities
Mixed Grass Prairie
Wyoming Big Sage
Salt Desert Scrub
Greasewood
Playa

The Nature Conservancy

Saratoga Valley

Glenn Titus / The Nature Conservancy



The Saratoga valley includes the enormous floodplain of the North Platt River with extensive cottonwood riparian zones grading up onto foothills of the Medicine Bow and Sierra Madre ranges. This area is well known for its superb fishing, heron rookeries, bald eagle nests, and important wet meadows. The area is now seeing increasing pressure due to recreation and home-building.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 496,581

171,601 Acres	BLM	35%
1,200 Acres	USFS	<1%
35,967 Acres	State Lands	7%
285,328 Acres	Private lands	57%
2,485 Acres	Water	1%

To list of rare plants, animals, and community types

Saratoga Valley

Rare Plants

Astragalus simplicifolius
Single-Stemmed Wild-Buckwheat
Tufted Cryptanth
Gibben's Beardtongue
Sphaeromeria capitata
Towsendia spathulata

Rare Animals

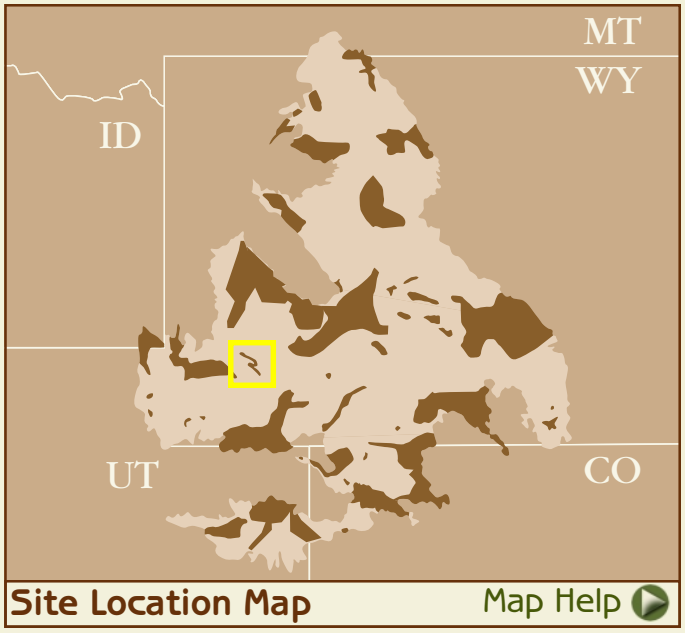
Wyoming Pocket Gopher
Black-Footed Ferret
White-Tailed Prairie Dog
Mountain Plover
Ferruginous Hawk
Burrowing Owl
Swift Fox
Sage Grouse
Bald Eagle

Communities

Foothills Grassland
Mixed Grass Prairie
Mesic Upland Shrub
Mountain Mahogany Shrubland
Bitterbrush
Wyoming Big Sage
Mountain Big Sagebrush
Basin Big Sage
Black Sage
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Aspen
Subalpine Forest
Lodgepole Pine
Juniper Woodland
Forest Riparian
Shrub-Dominated Riparian
Wetland
Barren

Seedskadee

The Nature Conservancy



The floodplain of the Green River above Flaming Gorge Dam is now part of Seedskadee NWR. Here the US Fish & Wildlife Service has established intensive habitat improvements to stimulate nest success for waterfowl, trumpeter swans, sandhill cranes, and mammal species. Water impoundments, cottonwood stand enhancements, and other wildlife management practices have created a very significant hotspot for the naturalist.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 40,405

7,490 Acres	BLM	19%
20,733 Acres	FWS	51%
765 Acres	State Lands	2%
9,913 Acres	Private lands	25%
1,504 Acres	Water	4%

To list of rare plants, animals, and community types

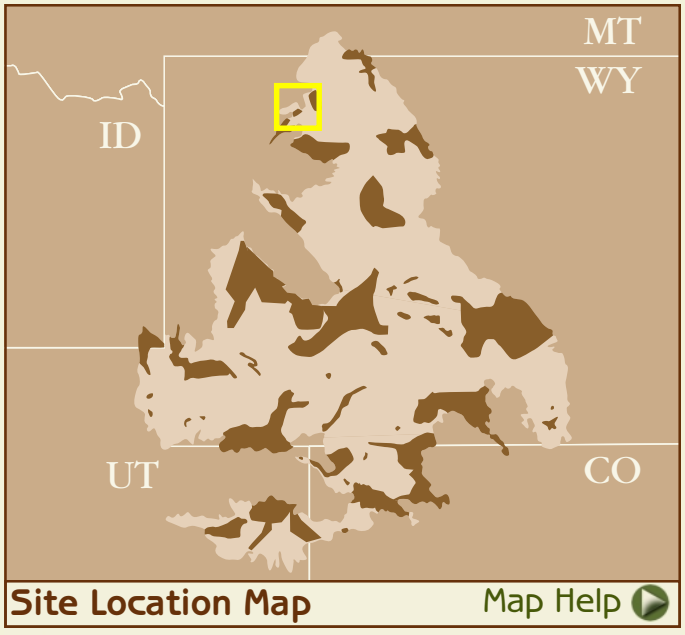
RARE PLANTS
Dwarf Milkweed
Echo Spring-Parsley
Rollins Cryptanth
Opal Phlox

RARE ANIMALS
Idaho Pocket Gopher
Whooping Crane
Roundtail Chub (Bonytail)
Pygmy Rabbit
Flannelmouth Sucker
Bald Eagle
Bluehead Sucker
Colonial Nesting Birds
Important Bat Roosts

COMMUNITIES
Mixed Grass Prairie
Wyoming Big Sage
Basin Big Sage
Salt Desert Scrub
Greasewood
Juniper Woodland
Forest Riparian
Shrub-Dominated Riparian
Barren

Sheep Mountain

Ellen Ramsey / Chris Garber



Dominated by Absaroka volcanics, the Sheep Mountain site includes habitat for four rare plant species. Sheep Mountain is a prominent peak overlooking the Buffalo Bill Reservoir near Cody, WY. The rugged hillsides include an unusually high concentration of state rare and regionally endemic plant species. The Reservoir itself sees significant waterfowl use and has potential for white pelican nesting.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 22,444

7,239 Acres	BLM	32%
1,021 Acres	State Lands	5%
8,581 Acres	Private lands	38%
5,603 Acres	Water	25%

Rare Plants

Aromatic Pussytoes
Absaroka Biscuitroot
Persistent Sepal Yellowcress
Shoshonea

Rare Animals

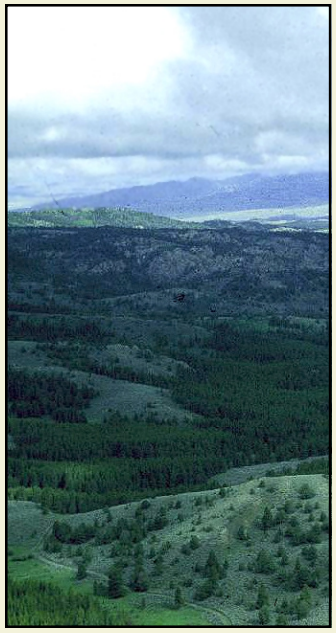
Yellowstone Cutthroat Trout
Peregrine Falcon
Dwarf Shrew
Bighorn Sheep

Communities

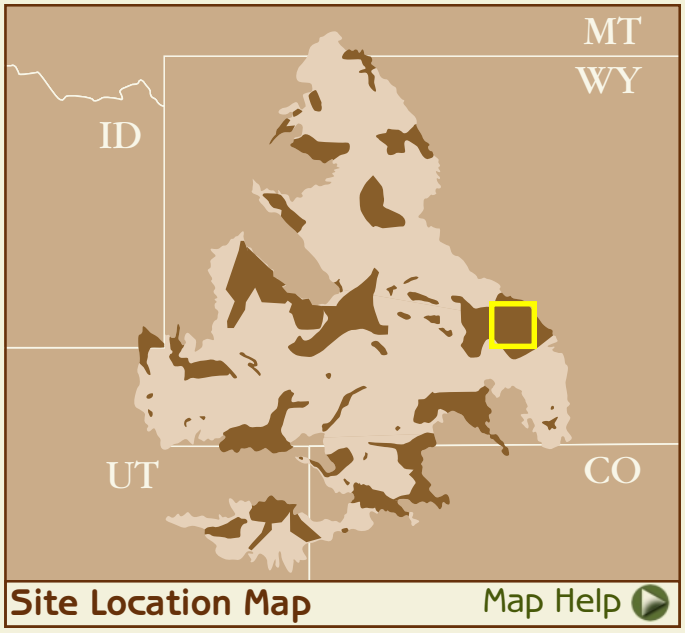
Mixed Grass Prairie
Wyoming Big Sage
Salt Desert Scrub
Limber Pine
Juniper Woodland
Shrub-Dominated Riparian

The Nature Conservancy

Shirley Basin



Prairie Dogs - Bob Luce / The Nature Conservancy



Shirley Basin is a vast landscape of wooded mountains, rough hog-backs, and sweeping extents of open sagebrush land. With one of the largest extant colonies of white-tailed prairie dogs, the Shirley Basin has been the site of black footed ferret reintroductions since 1991. Superb fisheries, riparian bird refugia, and extensive habitat for large carnivores round out this site.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 1,356,701

615,691 Acres	BLM	45%
11,133 Acres	FWS	1%
109,820 Acres	State Lands	8%
577,934 Acres	Private lands	43%
42,122 Acres	Water	3%

To list of rare plants, animals, and community types

Shirley Basin

Rare Plants

Daggett Rock Cress
Bun Milk-Vetch
Many-Stemmed Spider-Flower
Single-Stemmed Wild-Buckwheat
Slender-Leaved Buckwheat
Ward's Goldenweed
Lomatium Nuttallii
Colorado Tansy-Aster
Tufted Cryptanth
Wyoming Point-Vetch
Alpine Fever-Few
Devil's Gate Twinpod
Persistent Sepal Yellowcress
Sphaeromeria capitata
Laramie False Sagebrush
Nuttall Townsend-Daisy

Rare Animals

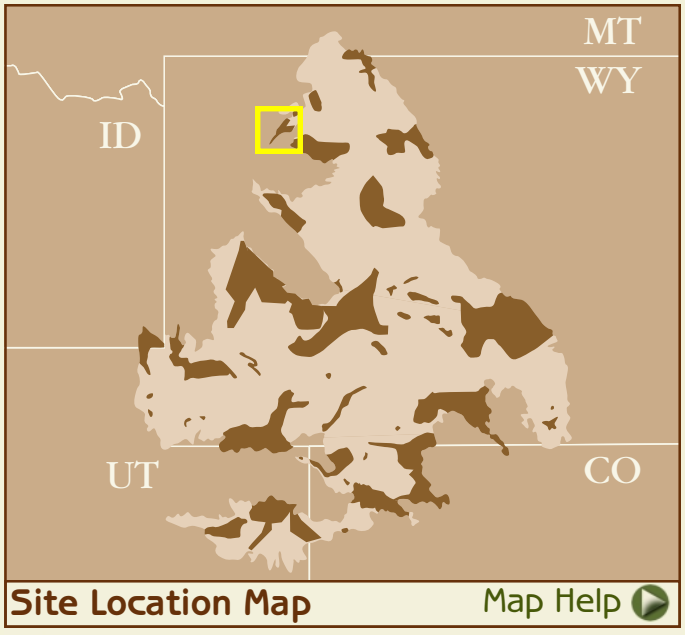
Black-Footed Ferret
Smooth Green Snake
White-Tailed Prairie Dog
Mountain Plover
Ferruginous Hawk
Burrowing Owl
American White Pelican
Sage Grouse
Peregrine Falcon
Bald Eagle
Colonial Nesting Birds
Important Bat Roosts

Communities

Mixed Grass Prairie
Mountain Mahogany Shrubland
Wyoming Big Sage
Mountain Big Sagebrush
Black Sage
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Vegetated Dunes
Aspen
Ponderosa Pine
Lodgepole Pine
Limber Pine
Juniper Woodland
Forest Riparian
Shrub-Dominated Riparian
Playa
Barren
Granite Knobs

South Fork Shoshone

Bob Luce



The spectacular valley of the South Fork of the Shoshone River is, like the Dunoir Valley, a piece of the Greater Yellowstone Ecosystem with volcanic cliffs of the Absaroka mountains, dense forests, and cottonwood riparian. All the native Yellowstone carnivores cross and use this valley on their way up and down slope and in crossing onto the adjacent Carter Mountain.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 66,149

1,906 Acres	BLM	3%
26,849 Acres	USFS	41%
1,762 Acres	State Lands	3%
35,633 Acres	Private lands	54%

To list of rare plants, animals, and community types

The Nature Conservancy

South Fork Shoshone

Rare Plants

None

Rare Animals

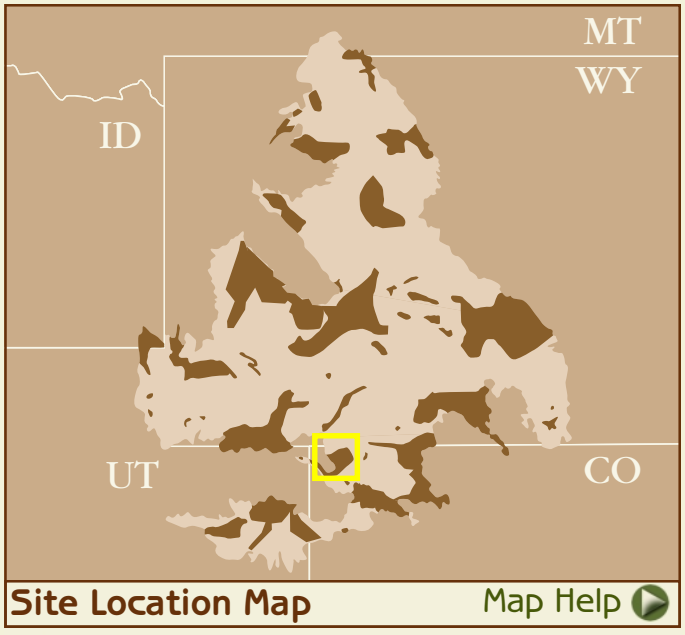
Peregrine Falcon
Bighorn Sheep
Peripheral Targets

Communities

Foothills Grassland
Mixed Grass Prairie
Subalpine Grass and Forb Meadow
Wyoming Big Sage
Mountain Big Sagebrush
Aspen
Subalpine Forest
Lodgepole Pine
Mountain Fir
Limber Pine
Juniper Woodland
Forest Riparian
Shrub-Dominated Riparian
Barren

Sugarloaf

George Wuerthner



The Sugarloaf site is an aggregation of rare plant localities centered around the drainages of Vermilion and Talamantes Creeks. The area is composed of low elevation saltbush flats with greasewood bottoms and clay soils. The flats are incised with deep ravines from the small drainages. Gardner saltbush and shadscale are common here.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 187,929

170,667 Acres	BLM	91%
8,308 Acres	FWS	4%
1,690 Acres	NPS	1%
4,739 Acres	State Lands	3%
2,524 Acres	Private lands	1%

To list of rare plants, animals, and community types

The Nature Conservancy

Rare Plants

Debris Milkvetch
Duchesne Milkvetch
Ligulate Feverfew
Uinta Basin Spring-Parsley
Woodside Buckwheat
Tufted Cryptanth
Maybell Locoweed
Yampa Beardtongue
Gibben's Beardtongue
Sphaeromeria argentea

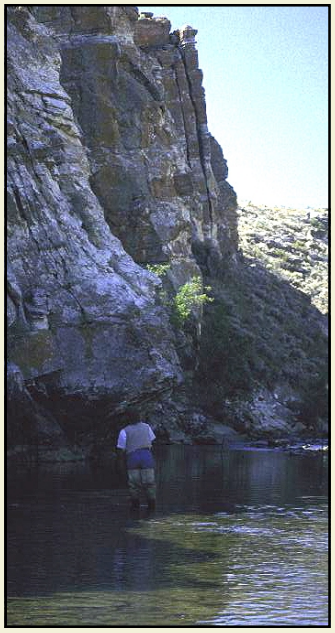
Rare Animals

Black-Footed Ferret
Burrowing Owl
Virginia's Warbler
Northern Plateau Lizard
Midget Faded Rattlesnake
White-Tailed Prairie Dog
Ferruginous Hawk
Northern Tree Lizard

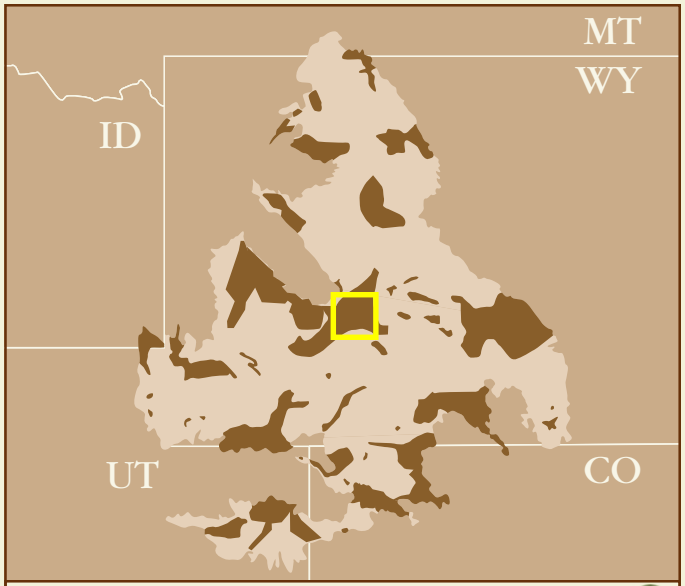
Communities

Mixed Grass Prairie
Bitterbrush
Wyoming Big Sage
Basin Big Sage
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Ponderosa Pine
Juniper Woodland
Pinyon-Juniper Woodland
Shrub-Dominated Riparian
Wetland
Barren

Sweetwater River Basin



The Nature Conservancy



Site Location Map Map Help

This broad floodplain is the historic site of the Mormon and Oregon Trails. Running through the famous pass south of the Wind River range, this river is a riparian life blood for dozens of migratory bird species. Although the river course is nearly totally lacking trees, the banks are shrub-lined with willow, chokecherry, silver sagebrush, thinleaf alder, and fringed sagewort. This large site contains upland pockets of other rarities including Desert yellowhead, a showy sunflower family plant known from only a single nearly barren "badland" location above the Beaver Rim.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 997,775

848,601 Acres	BLM	85%
2,300 Acres	USFS	<1%
63,150 Acres	State Lands	6%
82,541 Acres	Private lands	8%
1,182 Acres	Water	<1%

To list of rare plants, animals, and community types

Sweetwater River Basin

Rare Plants

Meadow Pussytoes
Daggett Rock Cress
Small Rock Cress
Porter's Sagebrush
Nelson's Milkvetch
Astragalus oreganus
Bun Milkvetch
Cedar Rim Thistle
Alkali Wildrye
Single-Stemmed Wild-Buckwheat
Compact Gilia
Fremont Bladderpod
Large-Fruited Bladderpod
Lomatium Nuttallii
Oreocarya caespitosa
Tufted Cryptanth
Maybell Locoweed
Wyoming Point-Vetch
Payson Beardtongue
Intermountain Phacelia
Nelson Phacelia
Beaver Rim Phlox
Devil's Gate Twinpod
Rocky Mountain Twinpod
Towsendia spathulata
Trifolium andinum
Barneby's Clover
Desert Yellowhead

Rare Animals

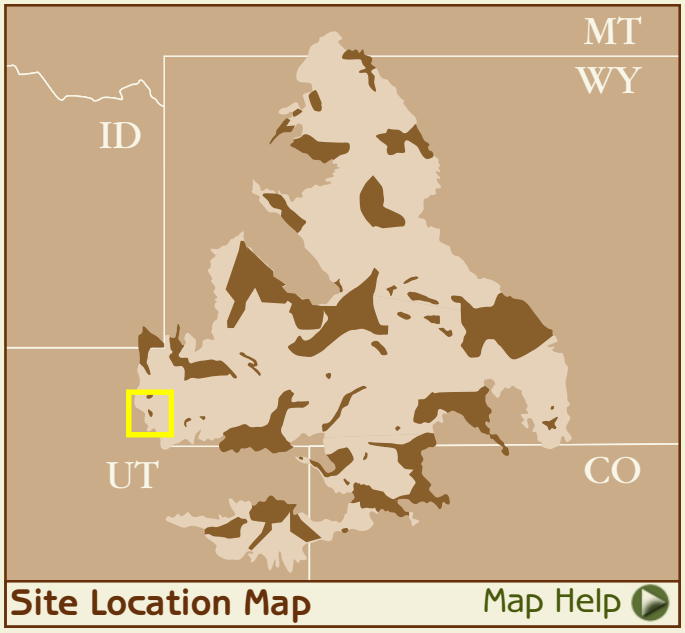
Sage Grouse
Black-Footed Ferret
White-Tailed Prairie Dog
Mountain Plover
Ferruginous Hawk
Burrowing Owl
Swift Fox
Pygmy Rabbit

Communities

Mixed Grass Prairie
Wyoming Big Sage
Mountain Big Sagebrush
Basin Big Sage
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Vegetated Dunes
Aspen
Ponderosa Pine
Limber Pine
Juniper Woodland
Forest Riparian
Grass Riparian and Meadow
Shrub-Dominated Riparian
Playa
Active Dunes
Barren

Table Mountain

Idaho Pocket Gopher - Bob Luce



This is an area of sagebrush/rabbitbrush grasslands on red clay sandstones. It has Knight conglomerate on side slopes with Twin Creek Limestone in the bottoms. The site was added to the portfolio to include *Astragalus jejunus* var. *jejunus* (G3T1), a narrow habitat endemic, and additional vegetation communities.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 8,935

125 Acres	BLM	1%
8,809 Acres	Private lands	99%

Rare Plants
Starveling Milkvetch

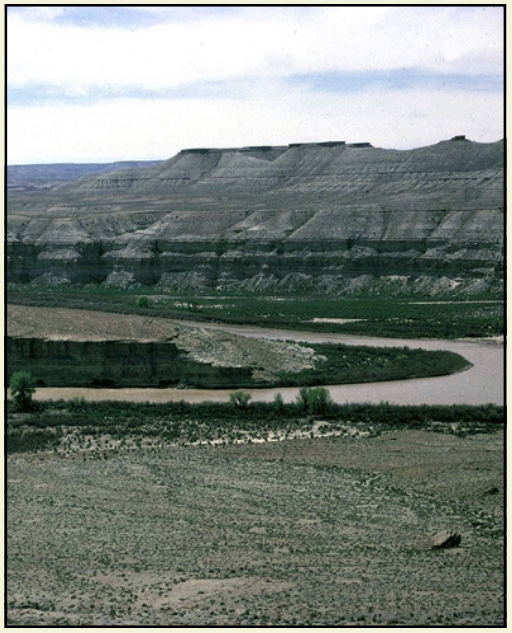
Rare Animals
Idaho Pocket Gopher
Leatherside Chub

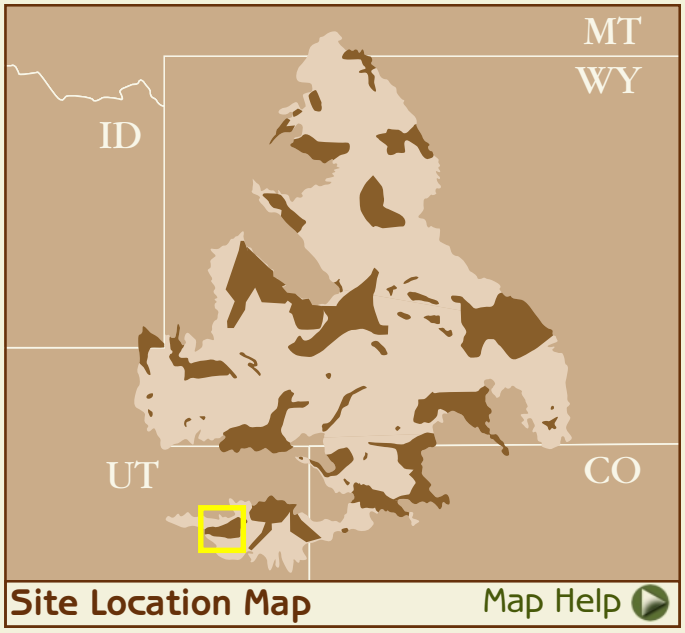
Communities
Foothills Grassland
Mesic Upland Shrub
Wyoming Big Sage
Shrub-Dominated Riparian

The Nature Conservancy

Uinta Benches

Uinta Basin Hookless Cactus - Larry England





Site Location Map Map Help

A large number of rare plant species are found in this rolling hilly country of scrubby juniper and salt desert shrub (*Atriplex*) communities. Cottonwood and willow communities in riparian exist in areas adjoined by grazed or hayed agricultural use. Some of the washes may include greasewood (*Sarcobatus*) with benches and arroyos. The site includes large amounts of the Uinta Formation consisting of quaternary gravel, fluvial and lake deposits. These are interspersed with lenses of sandstone with outcrops of finer grained shale and mudstone deposits.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 161,909

17,595 Acres	BLM	11%
27,780 Acres	Native American Lands	17%
3,120 Acres	State Lands	2%
113,014 Acres	Private Lands	70%
400 Acres	Water	<1%

To list of rare plants, animals, and community types

The Nature Conservancy

Uinta Benches

Rare Plants

Arabis pulchra Var duchesnensis
Needle-Leaf Fleabane
Barneby Pepper Grass
Duchesne Penstemon
Flowers Penstemon
Sclerocactus brevispinus
Uinta Basin Hookless Cactus
Ute Ladies'Tresses
Green River Greenthread

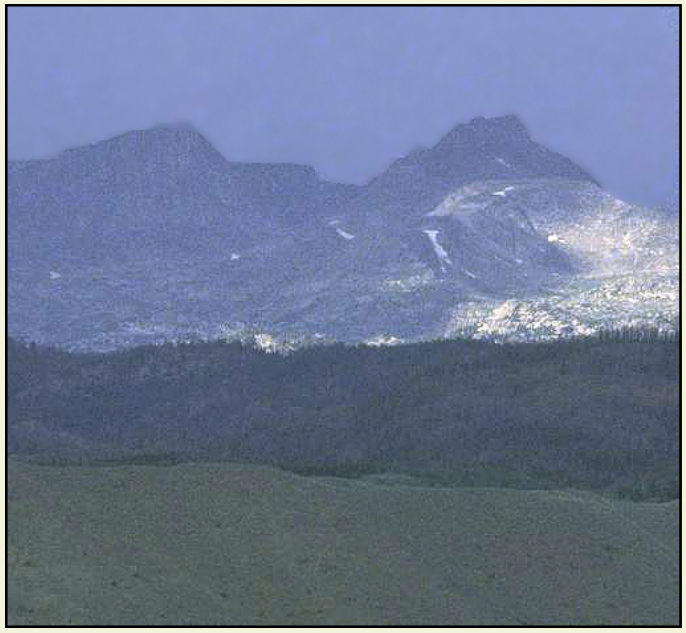
Rare Animals

Mountain Plover

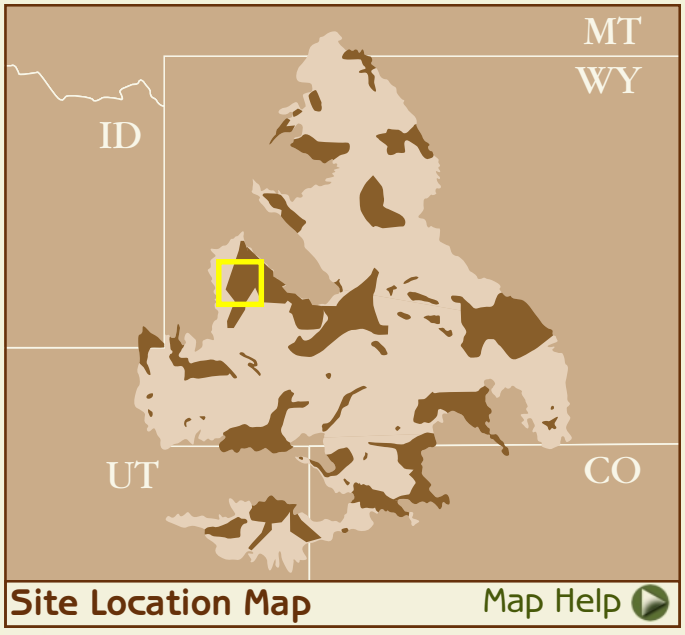
Communities

Foothills Grassland
Mesic Upland Shrub
Deciduous Oak
Wyoming Big Sage
Salt Desert Scrub
Greasewood
Juniper Woodland
Pinyon-Juniper Woodland
Forest Riparian
Wetland
Barren

Upper Green River



Joel B. Dyer / Physaria condensata, Walter Fertig



The Green River originates in the Wind River Mountains of Wyoming and then flows through the cold desert of the broad Green River Basin. The extensive riparian contains a mix of narrowleaf cottonwood, water birch and willow shrubs. There are only a few small towns scattered throughout this landscape, the largest being Pinedale (pop. 1181). The river is home to Bluehead and Flannelmouth Suckers, while the rich riparian and nearby pothole ponds are home to trumpeter swans, migrating cranes and numerous other neotropical migrants.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 473,708

277,174 Acres	BLM	58%
2,546 Acres	USFS	1%
19,870 Acres	State Lands	4%
170,637 Acres	Private Lands	36%
3,482 Acres	Water	1%

To list of rare plants, animals, and community types

The Nature Conservancy

Upper Green River

Rare Plants

Meadow Pussytoes
Daggett Rock Cress
Big Piney Milkvetch
Starveling Milkvetch
Compact Gilia
Large-Fruited Bladderpod
Tufted Cryptanth
Swallen Mountain-Ricegrass
Payson Beardtongue
Desert Glandular Phacelia
Nelson Phacelia
Opal Phlox
Beaver Rim Phlox
Tufted Twinpod
Nuttall Townsend-Daisy
Strigose Easter-Daisy
Towsendia spathulata

Rare Animals

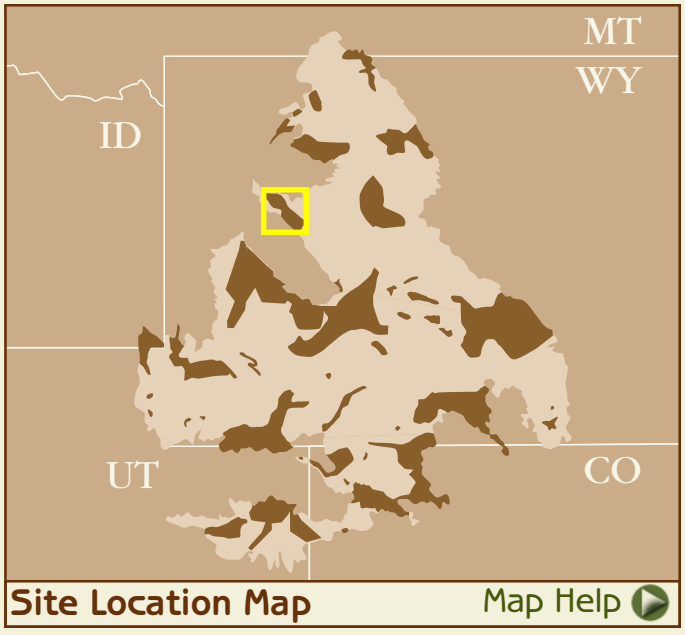
Black-Footed Ferret
White-Tailed Prairie Dog
Idaho Pocket Gopher
Ferruginous Hawk
Burrowing Owl
Whooping Crane
Sage Grouse
Roundtail Chub (Bonytail)
Flannelmouth Sucker
Peregrine Falcon
Bald Eagle
Bluehead Sucker

Communities

Mixed Grass Prairie
Wyoming Big Sage
Mountain Big Sagebrush
Salt Desert Scrub
Greasewood
Subalpine Forest
Lodgepole Pine
Forest Riparian
Shrub-Dominated Riparian
Barren

Upper Wind River

The Nature Conservancy



Like the Upper Green River, this site includes the upper reaches of a significant river from where it emerges from the forest, down to the sagebrush flats and cottonwood riparian. In this case, the Wind River roars out of the eponymous mountains, supplied by numerous heavily forested tributaries. The site includes large extents of the river's riparian as well as unusual badlands of the Wind River Formation near Dubois, habitat for several rare, endemic plants. This area is important home to ungulates most notably the Whiskey Mountain herd of bighorn sheep, one of the largest in the world.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 187,904

17,224 Acres	BLM	9%
2, 870 Acres	FWS	2%
123,639 Acres	Native American Lands	66%
22,191 Acres	State Lands	12%
20,385 Acres	Private Lands	11%
1,594 Acres	Water	1%

To list of rare plants, animals, and community types

Upper Wind River

Rare Plants

Dubois Milkvetch
Bun Milk-Vetch
Wyoming Point-Vetch

Rare Animals

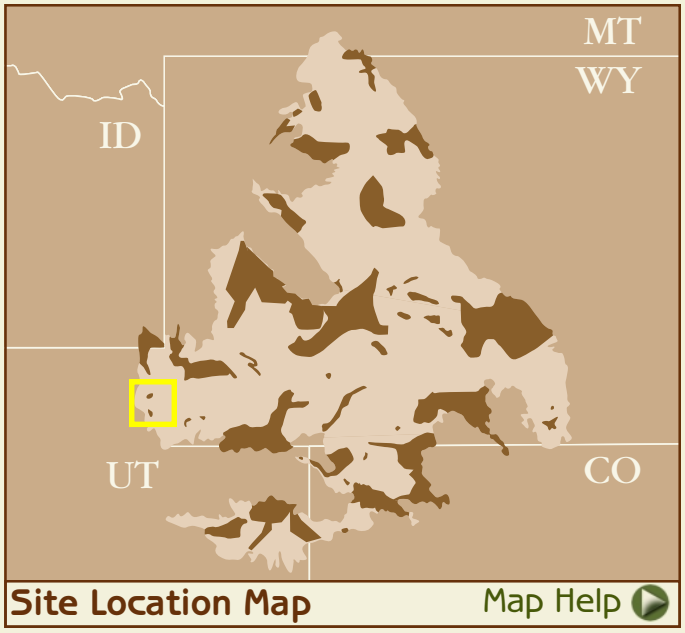
Peregrine Falcon
Bald Eagle
Bighorn Sheep

Communities

Mixed Grass Prairie
Subalpine Grass and Forb Meadow
Wyoming Big Sage
Mountain Big Sagebrush
Salt Desert Scrub
Aspen
Mountain Fir
Limber Pine
Forest Riparian
Shrub-Dominated Riparian
Barren

Walton Canyon

Starveling Milkvetch, Walter Fertig



Clayey ridges of sagebrush grassland between Woodruff and Huntsville. Slopes are of Knight conglomerate of tertiary age. Twin Creek limestone (Jurassic) is in the bottom of Walton Canyon. As with the nearby Table Mountain site, Walton Canyon was added to include several rare plant species and communities not otherwise represented in the portfolio.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 7,180

2,607 Acres	BLM	36%
8 Acres	State Lands	<1%
4,565 Acres	Private Lands	64%

Rare Plants

Wasatch Rockcress
Starveling Milkvetch
Logan Wild Buckwheat

Rare Animals

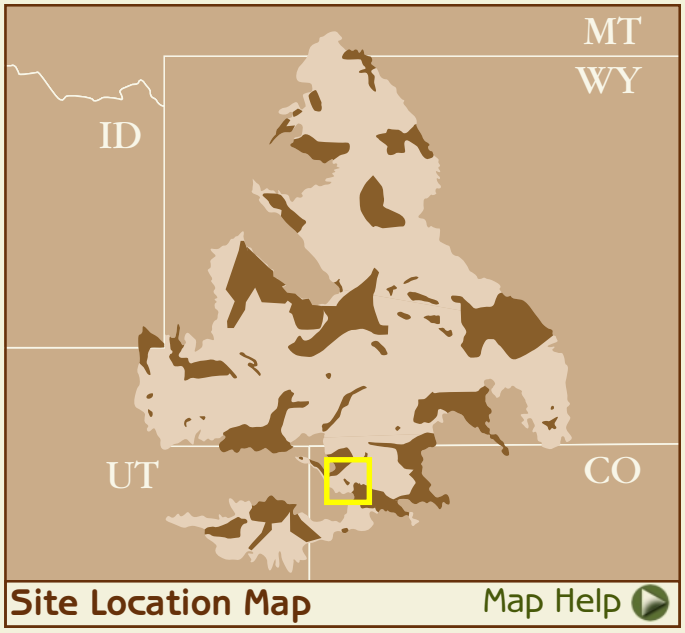
Idaho Pocket Gopher
Leatherside Chub
Bluehead Sucker

Communities

Foothills Grassland
Mesic Upland Shrub
Wyoming Big Sage
Big-Tooth Maple
Juniper Woodland
Pinyon-Juniper Woodland
Shrub-Dominated Riparian

West Boone Draw

George Wuerthner



Important as habitat for Narrow-leaf evening primrose, this area consists of many small finger canyons draining into the larger main West Boone Draw. The main canyon bottom is open with a dominant rabbit brush vegetation cover, intermixed with sagebrush. Sagebrush flats spread over the Sheephead Basin area on the northeast side of the draw. The high ridges overlooking the smaller canyons display a view of sandy canyon sides with a pinyon / juniper cover. The dry, sandy soils, and the many small side canyons give this site the feeling of a quiet retreat.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 120

38 Acres	BLM	31%
82 Acres	Private Lands	69%

Rare Plants

Narrow-Leaf Evening Primrose

Rare Animals

None

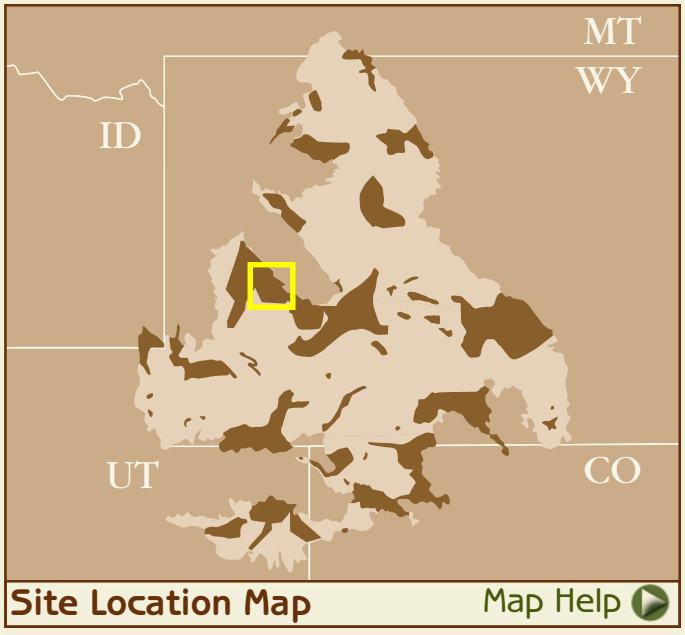
Communities

Bitterbrush
Basin Big Sage
Pinyon-Juniper Woodland

The Nature Conservancy

Western Wind River Foothills

Ellen Ramsey



This very large site on the western slope of the Wind River Range consists of mountain big sage and aspen and foothills grasslands mainly on sedimentary hogback escarpments. Chief reason for this site in the portfolio was the presence of mountain big sage, an important but under-protected vegetation community.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 607,425

425,207 Acres	BLM	70%
11,986 Acres	USFS	2%
50,279 Acres	State Lands	8%
110,827 Acres	Private Lands	18%
9,126 Acres	Water	2%

To list of rare plants, animals, and community types

Western Wind River Foothills

Rare Plants

Meadow Pussytoes
Daggett Rock Cress
Small Rock Cress
Nelson's Milkvetch
Alkali Wildrye
Single-Stemmed Wild-Buckwheat
Compact Gilia
Large-Fruited Bladderpod
Payson Beardtongue
Intermountain Phacelia
Nelson Phacelia

Rare Animals

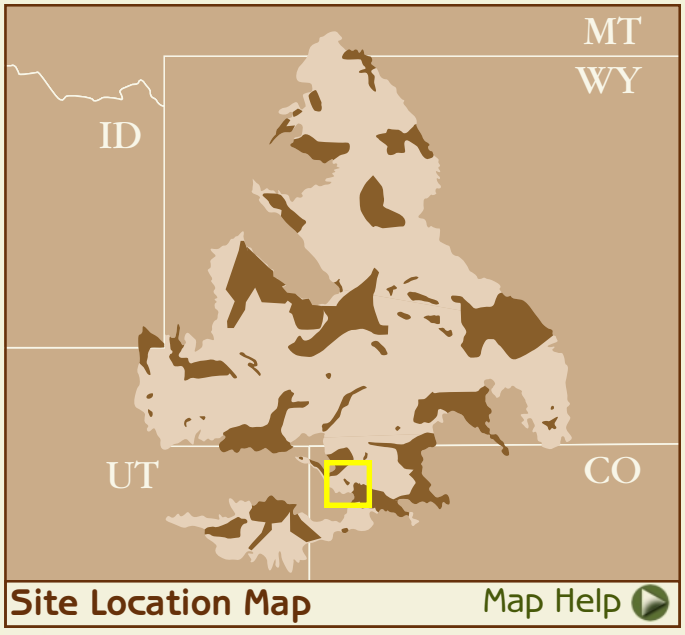
Black-Footed Ferret
White-Tailed Prairie Dog
Ferruginous Hawk
Burrowing Owl
Whooping Crane
Sage Grouse
Pygmy Rabbit
Flannelmouth Sucker
Peregrine Falcon
Bluehead Sucker

Communities

Mixed Grass Prairie
Subalpine Grass and Forb Meadow
Wyoming Big Sage
Mountain Big Sagebrush
Basin Big Sage
Salt Desert Scrub
Greasewood
Aspen
Subalpine Forest
Lodgepole Pine
Mountain Fir
Limber Pine
Forest Riparian
Shrub-Dominated Riparian
Wetland
Barren

Whiskey Springs East

Yampa Beardtongue, Larry England



Just north of Dinosaur National Monument and bisected by the Douglas Mountain Boulevard road, the Whiskey Springs area is easily accessible to all. Ponderosa pine dotted throughout the site gives a majestic feeling to the area. Sagebrush / bitter brush vegetation mix, along with pinyon / juniper and serviceberry, interspersed with low, flat rock outcrops, creates a mosaic of bare rock and vegetation. The abundant *Purshia tridentata* (Bitter brush) makes the site a palatable area to wildlife. Important plant targets here are Yampa beardtongue and Narrow-leaf evening primrose.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 127

127 Acres ..... BLM 100%

Rare Plants

Narrow-Leaf Evening Primrose
Yampa Beardtongue

Rare Animals

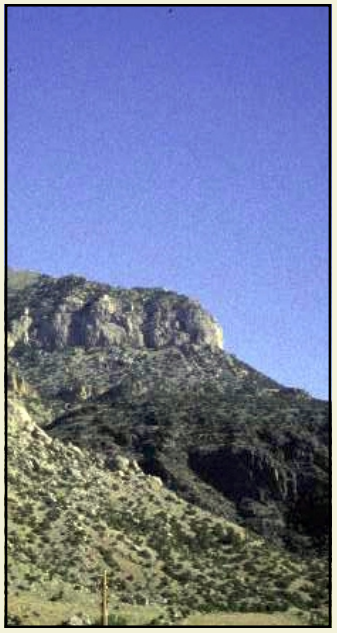
None

Communities

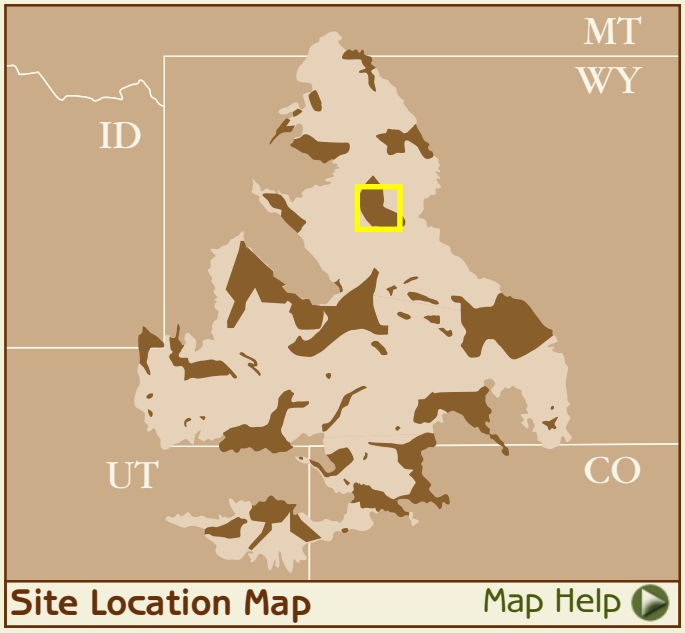
Basin Big Sage
Ponderosa Pine
Pinyon-Juniper Woodland

The Nature Conservancy

Wind River Canyon



Jerry Freilich



Wind River Canyon, a stunning landform, cuts into the recent rock layers all the way down to the ancient Precambrian bedrock. Running through the canyon, the Wind River exposes all the "pages of stone" from earth's history book and divides the Bridger and Owl Creek Mountains. The adjacent dry mountains and canyons are dominated by grassland, sagebrush shrublands, and juniper. The southeast part of the site includes some of the driest parts of WY characterized by sparse shrubland.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 409,386

164,534 Acres	BLM	40%
79,504 Acres	Native American Lands	19%
20,112 Acres	State Lands	5%
132,292 Acres	Private Lands	32%
12,944 Acres	Water	3%

To list of rare plants, animals, and community types

Wind River Canyon

Rare Plants

Porter's Sagebrush
Astragalus Grayi
Owl Creek Miner's Candle
Tufted Cryptanth
Persistent Sepal Yellowcress
Sphaeromeria capitata
Stanleya tomentosa Var tomentosa

Rare Animals

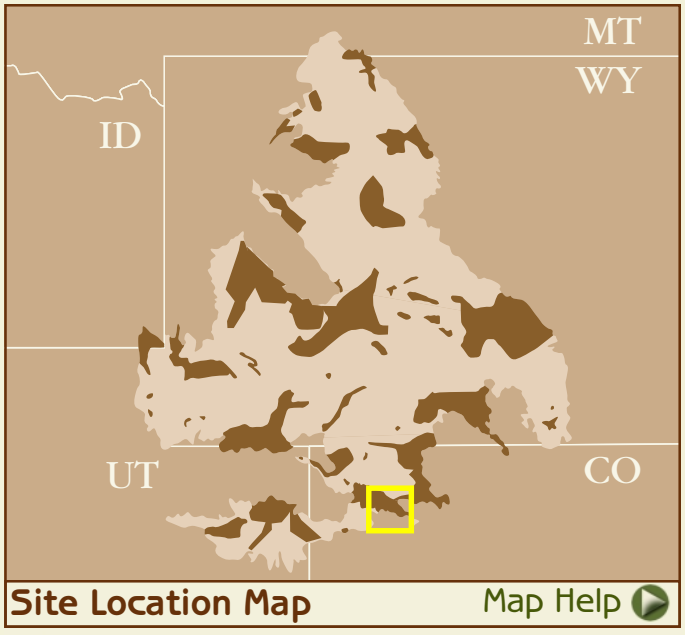
Peregrine Falcon
Bald Eagle
Bighorn Sheep
Important Bat Roosts

Communities

Mixed Grass Prairie
Wyoming Big Sage
Mountain Big Sagebrush
Salt Desert Scrub
Gardner Saltbush Flats
Greasewood
Mountain Fir
Limber Pine
Juniper Woodland
Forest Riparian
Shrub-Dominated Riparian
Barren

Yampa River

George Wuerthner



The Yampa River meanders across a wide floodplain of Quaternary alluvium ranging in elevation from approximately 6320 to 6400 ft. The Site supports some outstanding of Box elder-narrowleaf cottonwood/ Red-osier dogwood a G2/S2 community type restricted to 15 known occurrences in northwest Colorado. This is the best staging area in northern Colorado for the greater sandhill crane and is winter range for the federally endangered bald eagle (G4/S1B/S3N). Four federally-listed endangered fish species: Colorado pikeminnow (G1/S1), humpback chub (G1/S1), roundtail chub (G2G3/S2), and razorback sucker (G1/S1) occur in the lower reaches of the Yampa.

- Shaded Relief Map
- Land Ownership Map
- Targets Map
- Targets Spreadsheet

Total Acres 528,690

156,819 Acres	BLM	30%
417 Acres	NPS	<1%
51,730 Acres	State Lands	10%
319,725 Acres	Private Lands	60%

To list of rare plants, animals, and community types

Yampa River

Rare Plants

Wetherill Milkvetch
Ownbey's Thistle
Maybell Locoweed
Yampa Beardtongue

Rare Animals

Roundtail Chub (Bonytail)
Bald Eagle
Bonytail
Razorback (Humpback) Sucker
Humpback Chub
Colorado River Pikeminnow
Bluehead Sucker
Columbian Sharp-Tailed Grouse

Communities

Foothills Grassland
Mesic Upland Shrub
Deciduous Oak
Bitterbrush
Basin Big Sage
Salt Desert Scrub
Gardner Saltbush Flats
Juniper Woodland
Pinyon-Juniper Woodland
Forest-Dominated Riparian
Shrub-Dominated Riparian

Success at Meeting Conservation Target Goals

Shirley Basin - TNC

The goal of ecoregional planning is to develop a list of conservation targets (whether plants, animals or communities) and then to "capture" those targets in a group of sites on the ground. This section summarizes those target goals that were reached and those that were not. As the above sections indicate, considerable thought and evaluation went into establishing the following list of targets.

Target	Number of Targets	G1-G3's	Federally Listed	% Meeting all Target Goals
• Rare or Sensitive Vertebrates	45	13	8	87%
• Rare or Sensitive Plants	121	77	5	60%
• Representative Vegetation Communities	36	N/A	N/A	61%

Forty-seven sites were selected to encompass all these targets in adequate numbers to ensure their long term survival. Special effort was made to disperse the occurrences of these plants and animals throughout the ecoregion. With the exception of narrowly distributed endemics, examples of each target species or community were made in a variety of locations throughout the ecoregion so that gene flow would be possible and to insure against natural disasters to one population.

The Nature Conservancy

How Well Did Vertebrates Meet Conservation Target Goals?

Of the 45 vertebrate targets, all but six met their target goals in the selected portfolio of sites. The six that failed to meet their goals were:

Target	% Goal Attainment
Yellowstone cutthroat trout	75%
Bear River cutthroat trout	75%
Leatherside chub	75%
Mountain plover	50%
Dwarf shrew	33%
Colorado River cutthroat trout	25%

These animals failed to meet their goals for a variety of reasons. In the case of Yellowstone and Bear River cutthroat trout, distributions of these fish are restricted to small pockets where natural barriers, management actions, or chance has allowed genetically unmixed populations to endure. In most cases, it was impossible to find additional waters that would have increased goal attainment.

A different scenario existed with respect to the Colorado River cutthroat trout. Although numerous sites contain these fish, most of those waters are considered genetically compromised (e.g., Upper Green River, Flaming Gorge). The single site we did select (Cherokee Basin) is considered of high quality, resulting in the 25% figure above. But we decided against making several small, single-species, sites which would have been required to include three small, known, locations for Colorado River cutthroat just west of Big Piney, Wyoming Appendix 3.

In the case of the Mountain plover, it is likely that the stated 50% attainment is underestimated. We modeled suitable habitat for Mountain plovers using GIS, but the model is untested. Additional plover locations may be assumed to be present because we did reach full goal attainment for both prairie dogs and a suite of prairie-dog related species (e.g., ferruginous hawk) so that it is likely that Mountain plovers are better represented than we are now aware. Finally, in the case of the Dwarf shrew, these animals are secretive and little known. We would have had to add additional portfolio sites specifically for the shrew in order to increase the goal attainment figure. But we hesitated to do this due to the uncertainty of where the animals truly live and our belief that the animal would be found more widely in western Wyoming if additional trapping effort was put to the task.

How Well Did Rare Plants Meet Conservation Target Goals?

Of the 121 plant species selected as targets, 73 completely met the stated target goals. The remaining 48 species ranged from nearly meeting the goals (75-88% success) to being completely absent in the portfolio. These results are summarized in Appendix 2 with an explanation of rationales and showing the percentage of goal attainment.

Of the five federally listed species on the targets list (*Lepidium barneybianum*, *Penstemon haydenii*, *Spiranthes diluvialis*, *Schoenocrambe argillacea*, and *Sclerocactus glaucus*), the *Lepidium* and *Penstemon* both meet their goals at 100%. The remaining species are narrow endemics whose distributions lie at the extreme edges of the Wyoming Basins Ecoregion. All are characterized by localized, small patch distributions lying just outside the ecoregional boundaries (e.g., in the UT Book Cliffs area for the *Schoenocrambe* and *Sclerocactus*) Appendix 2.

The Nature Conservancy

Beyond peripheral endemics, it would be safe to say that the largest single reason explaining failure to meet goals is insufficient knowledge of where the plants occur on the ground. Either we lacked sufficient information for a particular area, or we lacked data on the population size or status of known populations for some poorly studied species. Note that this Plan did not include any new fieldwork or ground truthing of existing records.

How Well Did Representative Communities Meet Target Goals?

Of the 37 targeted cover-types, 14 failed to meet all target goals (39%). We were quite conservative in this evaluation, requiring the targeted communities to be not only present in each subsection of the ecoregion, but to be in patches above a given size Appendix 5. In many cases, representative acreage of significant size is present in the ecoregion, but the patches in one subsection were smaller than the required size. In these cases, we considered the entire cover-type to be insufficient for goal attainment.

Recall that vegetation communities were mapped from Gap based cover-types in the five states, and that these Gap maps varied in their resolution, accuracy, and classifications. Because of these limitations, the representative community goals described here should be considered conservative. We feel that closer to 80% target attainment would be reached if better mapping or ground-truthing were available.

Upper Dunoir Valley - The Nature Conservancy

A Wyoming Field Office Conservation Strategy

Each ecoregional plan is a multi-state, multi-party collaboration involving many people and many opinions. This plan is no exception. As presently conceived, each state's office of TNC will continue to have responsibility for conservation work and implementation of the plans within their respective boundaries. This section describes a conservation strategy used at WYFO. This strategy has been used with great success in over 100 locations throughout Wyoming receiving both praise and occasional skepticism. We present this discussion as a potential and already successful strategy for conservation within the Wyoming Basins. By outlining this strategy, we do not imply that other states should adopt these practices or implement their conservation actions the way we do. It did, however, seem germane to include these thoughts inasmuch as 84% of the ecoregion falls within Wyoming and much of the plan's implementation will fall to WYFO.

In Conservation by Design (TNC 1996), TNC's mission is stated as "the design and conservation of portfolios of sites within ecoregions." The document defines sites as "areas selected and defined on the basis of the ecological requirements of and threats to elements." The "elements" "refer to viable vulnerable native species and viable native communities." TNC often protects rare or vulnerable species in small pockets of unspoiled habitat, often within a landscape impacted by human activities. It is

Near South Fork Shoshone River - Bob Luce

The Nature Conservancy

In the Wyoming Basins Ecoregion, much of the land is ecologically intact, with undiminished viable ecosystems, a large percentage of the native species and presenting the appearance it had before European colonization.

certainly true that human activities are hard on native biota. Industrial activities, habitat fragmentation, and wholesale paving are responsible for the depauperate ecosystems we see today (Wilcove et al. 1998). There are, however, significant differences between lands in different parts of the United States.

In the Wyoming Basins Ecoregion, much of the land is ecologically intact, with undiminished viable ecosystems, a large percentage of the native species and presenting the appearance it had before European colonization (Knight 1994). Knight's assessment, based on plant communities, palynology, and historical photographs might be judged an optimistic botanic view. But even if the animal diversity is less intact, less diverse, or differently distributed than it was in the 18th century, there are arguably few other places in the temperate latitudes less spoiled. Of those places left on earth, only a handful would be capable of holding the full complement of species they once held, presuming that reintroductions could be made.

The reasons for the region's biotic integrity can be summarized in a few words: harsh winters, a short growing season, absence of easily exploited resources, and sparsity of water. Despite considerable oil, gas, and coal exploitation, the area is still among the least populated in the nation. Today, recreation is one of the fastest growing sectors with its attendant land development and home construction. Yet, the dominant landscape is of rangeland grazed by large ungulates: formerly by bison and today by cattle (Hartnett et al. 1997). These circumstances create the present opportunity for conservation in this ecoregion.

A great literature exists on reserve design (e.g., Angermeier & Karr 1994, Kerr 1997, Pimm & Lawton 1998, Pressey et al. 1993, Ryti 1992, Schonewald-Cox 1998, and Soulé 1986), much of it the outgrowth of MacArthur's famous island biogeography (MacArthur & Wilson 1967). TNC scientists also have spent considerable time and effort thinking about reserve design (TNC Geography of Hope, Poiani et al. 2000). While authors invariably dispute and refine individual points, a consensus seems to support certain basic principles (List adapted from Shafer 1990):

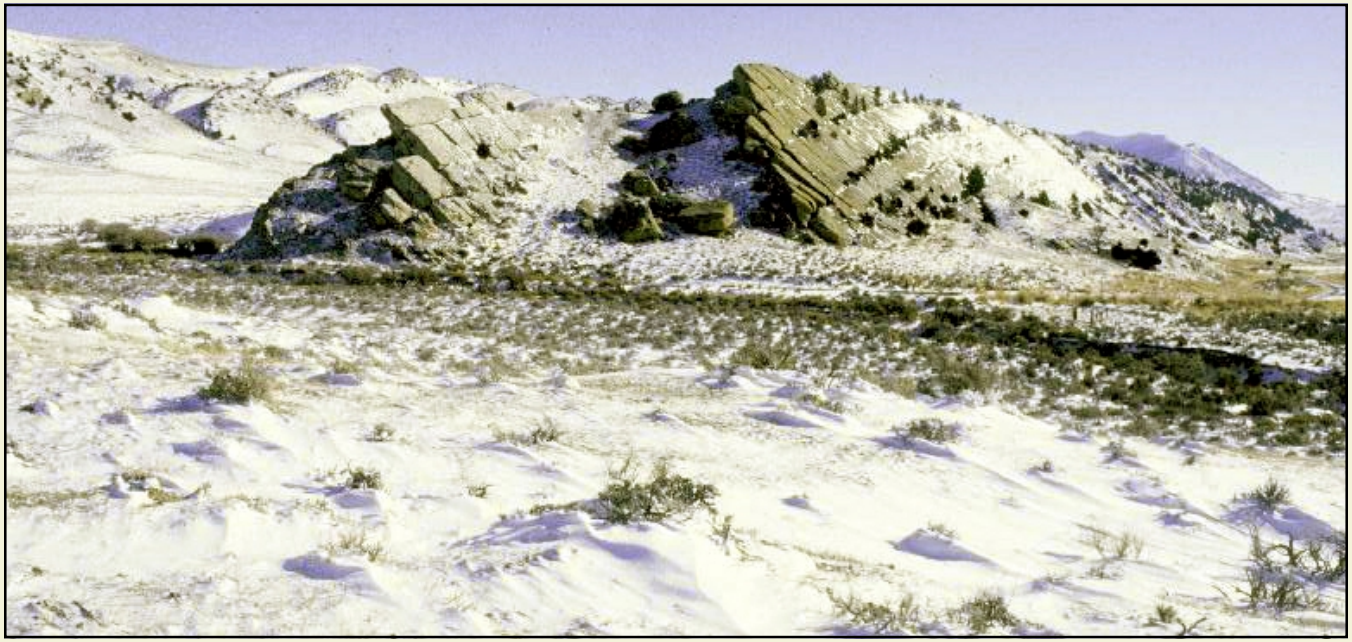
- The more land set aside, the more species will be conserved.
- Larger areas capture more species up to a point but with diminishing returns beyond a certain size.
- A large reserve is better than a small one, all else being equal.
- Fragmentation should be avoided.
- Reserves are needed in as many biotic communities as possible.
- Rare species and large-bodied, wide-ranging ones are most vulnerable to extinction.
- Reserves should be large enough to accommodate the largest widest ranging mammals, on the basis of their life history and territorial behavior. These will then serve as umbrella species for others.
- Regional planning for reserves must take human population growth into account.

Any discussion of natural reserves takes its form from practical realities. No one could ever raise enough money to buy all the land to protect all the species against all threats for all time. So most discussions tend to center on the issue of targeting rare or threatened species and the issue of reserve size. An assumption in most cases, is that knowledge exists to identify the

rare or threatened targets of interest. The truth of this assumption varies from place to place with relatively more known about those areas closest to human populations and longest settled. Because little is known about the vast majority of plant and animal species, it is nearly always necessary to consider a few well known species as surrogates or umbrellas for those less-known. This is the basis for TNC's "coarse filter."

The coarse filter presumes that by conservation of each of the known plant community associations in an area, that most of the endemic plants and animals (> 85%) are "captured" without need to enumerate each one (Noss 1987). This assumption, frequently made in the literature (Anderson et al. 1999, Franklin 1993, Pagel et al. 1991) seems intuitively likely, but is based on little empirical data. The cost of proving this assertion, over large areas, and as a generality, would likely be daunting. Vegetation communities are difficult and costly to map. But even more importantly, they are human constructs; lines drawn on maps using ordination and other statistics to fit the grays of nature into black and white lines on a map (Noss & Cooperrider 1994).

Whether using TNC's coarse and fine filters, or other landscape attributes (e.g., Nichols et al. 1998) each reserve design paradigm rests on basic assumptions. The SLOSS debate (Harris 1994, Murphy 1989, Noss & Cooperrider 1994), for example, centers on deciding which is better, "Single Large Or Several Small" reserves. The presumption is that finances and logistics require a choice between the two alternatives. Similarly, there are numerous papers on the co-occurrence of rare species (Ando et al. 1990, Dobson et al. 1997, Flather et al. 1998). They are based on the assumption that if you can only protect certain specific areas, which few would be best? The presumption is that land costs and



Ferris Mountain hogbacks - George Wuerthner

logistics limit the area available. It is important to consider that each of these paradigms rests on certain assumptions. But what if the basic assumptions could be changed?

The conservation strategy outlined below *does* change the basic assumptions. Instead of spending large amounts of resources on small and carefully chosen targets, we suggest the low-cost tool of conservation easements to capture as much land as possible. Naturally, we do prioritize these in various ways. But the important presumption is that each one costs very little — typically staff time — so that huge areas are conserved over a short time period. The down side is that less is known about each. The Wyoming Field Office has long wrangled with a rationale for land protection in the state. The following table summarizes some Wyoming Basins conditions presenting opportunities for conservation.

Traditional Conservation	In the Wyoming Basins
• Land cost limits the area conserved.	• Conservation easements are very inexpensive.
• Purchase is often the best or only way to conserve targets.	• Ranching may be compatible with most of TNC's conservation goals.
• Large areas are unavailable for conservation except under unusual circumstances.	• Large areas are owned by individual ranchers to whom easements can be highly desirable.
• Targets are relatively well known and many of their locations mapped.	• Every landscape contains substantial areas which have never been surveyed.
• Ecosystems are surrounded by large human - dominated landscapes. Targets are often points surrounded by matrix.	• Most large areas are ecologically intact. Points of unusual biological interest may be expansive. The matrix and targets blend together.
• Even when target locations are known, prioritizing and conserving them can be costly.	• Large expanses undoubtedly contain important targets. Easements can protect them inexpensively.
• Many Threatened or Endangered (T&E) species are present because human threats have impacted them over the years. Many exist only in small pockets.	• Relatively few T&E species. Many targets of concern are endemics, small habitat obligates, or require large areas (e.g., grizzlies, wolves).
• T & E species dominate concerns	• Protection of ecological integrity, ecological function, and native species diversity dominate concerns.
• TNC's acquisition of "protected land" or disposition to the government viewed favorably by an important segment of the population.	• "Locking up" land or transfer to the government are viewed unfavorably. Community-based conservation is popular and supported.

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We use the definition of landscape given by Forman (1995):

"a mosaic where the mix of local ecosystems or land uses is repeated in similar form over a kilometers-wide area...Within a landscape several attributes tend to be similar and repeated across the whole area, including geologic land forms, soil types, vegetation types, local faunas, natural disturbance regimes, land uses, and human aggregation patterns. Thus, a repeated cluster of spatial elements characterizes a landscape."

Scientists often debate the issues of spatial scale, of time, space and stability, or of ecological "grain." We know that there is no single solution suitable for all ecological domains. But in this ecoregion, the landscape scale is appropriate because of the region's history, the distribution of animals and plants in it, and the peculiarities of endangered species distributions.

Most of the Wyoming Basins Ecoregion has been grazed for millennia, first by bison and today by livestock. The plants are long-adapted to grazing and because grazing lands are open spaces, most of these lands are still open spaces with big skies (Knight 1994). The 19th century history documents how lowlands and riparian areas were quickly claimed by white settlers for ranching (Larson 1990). Highlands in some areas were heavily timbered for railroad ties except for areas (e.g., the Yellowstone) deemed too high, too far, and too cold for yearlong habitation (Sellars 1997, Wilcove 1999).

The Wyoming Gap analysis (Merrill et al. 1996) showed that a disproportionate amount of high-elevation land is protected (through public ownership). It also showed that species requiring low to mid elevations, riparian habitat, or connectivity between low and high are under-protected. These factors are a result of the 19th century decisions to make Yellowstone a national park, and the Shoshone, the nation's first national forest. In many parts of the Great Plains, tilled agriculture and human settlement have taken their toll on wildlife populations. This has led to the severe endangerment of the grassland bird guild (Samson & Knopf 1996), and reductions of other species including Black-footed ferrets, Mountain plover, Burrowing owls, Ferruginous hawks, and now Black-tailed prairie dogs. In Wyoming, open range and low human populations have been the rule. It is not coincidental that the last wild Black-footed ferrets were found at Meeteetse, WY and that many areas in the state continue to support substantial populations of these elsewhere declining species. Low human populations and use of the land for grazing have contributed to the relatively intact character of the ecoregion.

What do we mean by 'intact ecosystems?' One definition would be a place containing the full complement of species found before European settlement. The Greater Yellowstone Ecosystem is arguably in that condition today. But in addition, the reference includes the capability to support natural cycles and phenomena: fire, migrations of large animals, succession, self-sustaining populations, and unfettered predator-prey relations. All of these conditions exist, in one form or another in the Wyoming Basins.

Today, the Wyoming Basins Ecoregion has both the species and the space where pre-European conditions could be restored. The area also has enough unsettled land and enough opportunity for large-scale conservation to allow burning, migrations and all the other

properties of intact ecosystems. It is perhaps coincidence that ranching has been responsible for the long-term maintenance of unparalleled biodiversity. But that coincidence, taken together with the above conditions, leads to the strategy we suggest for the Wyoming Basins: using conservation easements as inexpensive tools to conserve large tracts of land in ever-increasing numbers.

We suggest a strategy treating entire landscapes as targets. Our ecoregional planning efforts and the data tracked by the Wyoming Natural Diversity Database (WYNDD) show us that there are rare plants and animals scattered about the state. But there are relatively few of them here, both numerically, and in spatial extent (Dobson et al. 1997, Wilcove et al. 1998). It remains for us to develop attainable goals couched in language defining intactness, process, and not just species but entire ecosystems as targets. It can be argued that setting goals and measuring attainment in these terms is experimental and subject to error (Caro & O'Doherty 1999). This may be a challenge, but the "top down" approach prioritizing landscapes rather than species makes intuitive sense here. This paradigm, combined with the economics of conservation easements, presents a high leverage strategy for conservation.

Certain key points still remain uncertain in our policy. The chief of these is the compatibility of grazing with conservation goals. Even if we assume that grazing and biological conservation have certain points of conflict, there are surely better and worse ways of managing grazing. If we work to adopt and promote the most enlightened, most environmentally friendly, and most profitable practices, we are surely doing as little harm as possible. A stand opposed to grazing would alienate us from the people of the state and our best opportunities to educate people and influence policy.

What about the selection of priority sites? In every case, we use "best available" knowledge, which in many cases may be scant. A wide disparity exists between the botanic and zoological knowledge of the state. Dr. Ron Hartman of the University of Wyoming Rocky Mountain Herbarium, (personal communication) says that the locations of 95% of the rare plants in the state are known. Zoologists take the opposite point of view, maintaining that less than 5% of the animal distributions are known (Dr. Steve Buskirk, University of Wyoming, Dept. of Zoology and Physiology, personal communication). Whatever the truth, spatially explicit sampling as part of ecoregional planning should be directed to testing the validity of these assertions.

How can we measure our success if whole landscapes are the targets? At the present time, TNC's coarse filter operates on vegetation community maps. We could also create new measures based on landscape surrogates (e.g., Boulinier et al. 1998, Burnett et al. 1998, Podolsky et al. 1992). But the most important thing would be to continue to press the fringes of biological knowledge by rigorously sampling and monitoring both the extent and richness of biological communities in our target landscapes at the species level. Such measures of biodiversity (weighting, for example, native or "preferred" species) although time-consuming and expensive, are the only way to prove, beyond any doubt, that the landscape scale is working. Ultimately, both natural selection and natural science operate on individuals. Ecologists work with species or genes because the higher level systems are simply too complex

... the "top down" approach prioritizing landscapes rather than species makes intuitive sense here. This paradigm, combined with the economics of conservation easements, presents a high leverage strategy for conservation.

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and variable to give clear answers. Moreover, efforts to use surrogates or "ecological processes" in reserve design have often led to vagueness and circularity. Goldstein (1999) presents a cogent argument that only species and their distributions can be evaluated by scientific inquiry:

"I recognize the folly of trying to monitor every population of every species in a given management area and do not advocate such an approach. It behooves us, however, to make an effort to understand the limitations of shortcuts, even when imposed by feasibility, and to choose appropriate target organisms for monitoring and management so that they may inform and enhance our understanding of process in a management context. Where resources permit, it will no doubt prove worthwhile to monitor multiple focal taxa that exhibit a range of sensitivities to various management techniques and a range of life-history requirements with respect to parameters specified as critical to ecosystem function."

Can we really afford the alternative position, dispensing with biological surveys in the interest of economy? If we rely on theory and intuition, convincing ourselves that larger areas *do* capture more species, and so on, we face the valid criticism of being hopeful but naïve.

Sweetwater river - The Nature Conservancy

Suggestions for Follow-up

Although this plan allows readers in the year 2000 to view the Wyoming Basins ecoregion with a broad-brush knowledge of important biological resources, it falls short in several important ways. First of all, this plan was done entirely with existing information and involved neither ground-truthing, accuracy assessment, nor analysis of demography, sociology or threats. These shortfalls must be considered the first priority for follow-up work.

Although we used best available data at the time of writing, there is always some danger in placing complete trust in Heritage records. There are several reasons for this. First, some records may be historic in nature and represent areas where the species no longer occurs. Second, Heritage records indicate places where previous surveys were conducted and absence of that species from other areas may only indicate that those areas were not surveyed. Third, errors of omission and commission can sneak into any data set. And finally, no validation or ground-truthing was part of this plan.

From a scientific point of view, systematic random sampling of specific plant and animal occurrences would be helpful in validating this plan. A stratified sampling plan targeting species and areas of special concern could be adopted to serve two purposes: checking the overall accuracy of the plan while simultaneously providing information on areas of greatest interest to TNC.

Threats analysis is another major consideration absent from this plan. In many of TNC's ecoregional plans, threats analysis is an important or even central component to the portfolio design. In the Wyoming Basins where most land is arguably unimpacted, threats from human development, industry, and agriculture are nonetheless important. A reevaluation of the Wyoming Basins portfolio incorporating demography and other human impacts would be most valuable and would greatly improve the quality of the portfolio with a relatively small dollar investment.

The final important follow-up is in the hands of the planning staffs in each of the states affected. Typically, ecoregional plans become the starting points for further refinement of each site using TNC's "Five-S Framework for site conservation" planning process. In this process, a detailed study is made of each of the proposed sites. Considerations such as land ownership, ecological boundaries, and careful threats analysis are all brought to bear in order to refine and delineate proposed site boundaries. The resulting conservation sites may bear little resemblance to those proposed here using the coarse methods and remote sensing we employed.

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And finally...

The Wyoming Basins are harsh lands of severe weather, vast spaces and few trees. These rolling hills and distant vistas have never attracted humans the way, say, mountains or seacoasts do. Nonetheless, there are not only biological treasures but also passionate human emotions to be found here for those who can stop their cars and savor these lands. The following are only a few of the many words written about the Wyoming Basins...

Wyoming

And men have called you desolate and bare,
Unwarmed by life, forsaken, barren still.
But they have never seen the sun's red flare
A-smouldering behind some purple hill.
And they have never smelled the sage at dawn
When dew has spiced the smell of all the plain,
Nor have they seen the clean and green-gray lawn
That fledges all the desert after rain.
They have not felt the purple, velvet gloom,
Nor seen the stars march by in slow array;
They have not seen the desert burst and bloom
In pastel colors at the new-born day.
Nor have they heard the sultry desert night
Give back its echoes to the thunder's might.

Joe Morris
The Parchment, 1927

(From Wyoming Student Verse 1927-1937, W.O Clough, Editor, University of Wyoming, 1937, Laramie Printing Company, 53 p.)

Lupine Ridge

Long after we are gone,
Summer will stroke this ridge in blue;
The hawk still fly above the flowers,
Thinking, perhaps, the sky has fallen
And back and forth forever he may trace
His shadow on its azure face.

Long after we are gone,
Evening wind will languish here
Between the lupine and the sage
To die a little death upon the earth,
As though over the sundown prairies fell
A requiem from a bronze-tongued bell.

Long after we are gone,
This ridge will shape the night,
Lifting the wine-streaked west,
Shouldering the stars. And always here
Lovers will walk under the summer skies
Through flowers the color of your eyes.

Peggy Simson Curry
Summer Range, 1981

(From Summer Range, 1981. Dooryard Press, Story WY. Ms. Curry was declared Wyoming's first Poet Laureate by act of the legislature in 1981.)

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Literature Cited

Anderson, M., P. Comer, D. Grossman, C. Groves, K. Poiani, M. Reid, R. Schneider, B. Vickery, and A. Weakley. 1999. Guidelines for representing ecological communities in ecoregional conservation plans. Unpublished manuscript. The Nature Conservancy, Arlington, VA.

Ando, A., J. Camm, S. Polasky, and A. Solow. 1998. Species distributions, land values and efficient conservation. Science 279 (March 27, 1998): 2126-2128.

Angermeier, P.L. and J.R. Karr. 1994. Biological integrity versus biological diversity as policy directives. BioScience 44 (10): 690-697.

Bailey, R. G. 1995. Descriptions of the eco-regions of the United States. USDA Forest Service, Misc. Publication #1391. US Government Printing Office: 1995-393-835.

Bedward, M. , R. L. Pressey, and D.A. Keith. 1992. A new approach for selecting fully representative reserve networks: addressing efficiency, reserve design and land suitability with an iterative analysis. Biological Conservation 62: 115-125.

Beier, P. and S. Loe 1992. "In my experience..." A checklist for evaluating impacts to wildlife movement corridors. Wildlife Society Bulletin 20: 434-440.

Bilby, R. E., and P.A. Bisson. 1992. Allochthonous versus autochthonous organic matter contributions to the trophic support of fish populations in clear-cut and old-growth forested streams. Canadian Journal of Fisheries and Aquatic Science 49:540-551.

Botkin, D. B. 1996. Our Natural History: The Lessons of Lewis and Clark. Perigree Publishing. 320 p.

Boulinier, T., J.D. Nichols, S.R. Sauer, J.E. Hines, and K.H. Pollock. 1998. Estimating species richness: The importance of heterogeneity in species detectability. Ecology 79 (3): 1018-1028.

Brooker, L., M. Brooker, and P. Cale. 1999. Animal dispersal in fragmented habitat: measuring habitat connectivity, corridor use, and dispersal mortality. Conservation Ecology [online] 3(1):4. Available on the web at: http://www.consecol.org/vol3/iss1/art4

Burnett, M.R., P.V. August, J.H. Brown, Jr., and K.T. Killingbeck. 1998. The influence of geomorphological heterogeneity on biodiversity. I. A patch-scale perspective. Conservation Biology 12 (2): 363-370.

Caro, T.M. and G. O'Doherty. 1999. On the use of surrogate species in conservation biology. Conservation Biology 13 (4): 805-814.

Cutright, P. R. 1969. Lewis and Clark: Pioneering Naturalists. University of Nebraska Press. Lincoln, NE. 506 p.

Davitt, K., R. Grandi, C. Neasel, and T. Skeele. 1996. Conserving prairie dog ecosystems on the northern plains: learning from the past to insure the prairie dog's future. The Predator Project, Bozeman, MT. 28 p.

Dobson, A.P., J.P. Rodriguez, W.M. Roberts, and D.S. Wilcove. 1997. Geographic distribution of endangered species in the United States. Science 275: 550-553.

ECOMAP. 1993. National hierarchical framework of ecological units. Unpublished administrative paper. Washington, DC. U.S. Department of Agriculture, Forest Service. 20p.

FGDC. 1998. Federal Geographic Data Committee. FGDC-STD-001-1998. Content standard for digital geospatial metadata (revised June 1998). Federal Geographic Data Committee. Washington, D.C.

Flather, C.H., M.S. Knowles, and I.A. Kendall. 1998. Threatened and endangered species geography: Characteristics of hot spots in the conterminous United States. BioScience 48 (5): 365-376.

Forman, R.T.T. 1995. Land Mosaics: the ecology of landscapes and regions. Cambridge University Press, Cambridge, UK. 632 p.

Franklin, J.F. 1993. Preserving biodiversity: species, ecosystems or landscapes? Ecological Applications 3(2): 202-205.

Gilpin, M. 1996. Forty-eight parrots and the origins of population viability analysis. Conservation Biology 10 (6): 1491-1493.

Gilpin, M. and M.E. Soulé. 1986. Minimum viable populations: the processes of species extinction. Pages 9-34 in M.E. Soulé, editor. Conservation Biology: the science of scarcity and diversity. Sinauer Associates, Sunderland, MA.

Given, D. R. 1994. Principles and Practice of Plant Conservation. Timber Press, Portland, OR.

Grossman, D. H. , D. Faber-Langendoen, A. S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International Classification of Ecological Communities: Terrestrial Vegetation of the United States. Volume I: The National Vegetation Classification Standard. The Nature Conservancy, Arlington, VA.

Groves, C. R. , M. L. Klein, and T. F. Breden. 1995. Natural Heritage Programs: public-private partnerships for biodiversity conservation. Wildlife Society Bulletin 23 (4):784-790.

Harris, L. D. 1984. The Fragmented Forest: Island Biogeographic Theory and the Preservation of Biotic Diversity. University of Chicago Press, Chicago. 211 pp.

Hartnett, D. C. , A. A. Steuter, and K. R. Hickman. 1997. Comparative ecology of native versus introduced ungulates. Pp. 72-101 in: F. Knopf and F. Samson (editors). Ecology and conservation of Great Plains vertebrates. Springer-Verlag, NY.

Jaeger, E. C. 1957. The North American Deserts. Stanford University Press, Stanford, CA. 308p.

Kerr, J. T. 1997. Species richness, endemism, and the choice of areas for conservation. Conservation Biology 11(5): 1094-1100.

Knight, D. H. 1994. Mountains and Plains: the Ecology of Wyoming Landscapes. Yale University Press, New Haven, CT. 338 p.

Knight, R. L. and K. J. Gutzwiller. 1995. Wildlife and recreationists: coexistence through management and research. Island Press, Covelo, CA. 384 p.

Larson, T. A. 1990. History of Wyoming. Second Edition, revised. University of Nebraska Press, Lincoln, NE. 663 p.

MacArthur, R. H., and E. O. Wilson. 1967. The Theory of Island Biogeography. Princeton University Press, Princeton. 203 pp.

Martner, B. E. 1986. Wyoming climate atlas. University of Nebraska Press, Lincoln, NE.

Master, L. L. 1991. Assessing threats and setting priorities for conservation. Conservation Biology 5: 559-563.

Menges, E. S. 1991. The application of minimum viable population theory to plants. In: D. A. Falk and K. E. Holsinger (eds.), Genetics and Conservation of Rare Plants, pp. 45-61. Oxford Univ. Press, New York.

Merrill, E. H. ,T.W. Kohley, M. E. Herdendorf, W.A. Reiners, K. L. Driese, R. W. Marrs, and S. H. Anderson. 1996. The Wyoming Gap Analysis Project. USGS, Biological Resources Division, Wyoming Coop Unit, Cooperative Agreement #14-16-0009-1542, Laramie, WY.

Murphy, D.D. 1989. Conservation and confusion: wrong species, wrong scale, wrong conclusions. Conservation Biology 3: 82-84.

Nichols, W.F., K.T. Killingbeck, and P.V. August. 1998. The influence of geomorphological heterogeneity on biodiversity. II. A landscape perspective. Conservation Biology 12 (2): 371-379.

Noss, R. F. 1987. From plant communities to landscapes in conservation inventories: a look at The Nature Conservancy (USA). Biological Conservation 41 (1987): 11-37.

Noss, R. F. and A. Y. Cooperrider. 1994. Saving Nature's Legacy: Protecting and Restoring Biodiversity. Island Press, Washington, D. C. 416 p.

Pagel, M.D., R.M. May, and A.R. Collie. 1991. Ecological aspects of the geographical distribution and diversity of mammalian species. American Naturalist 137 (6): 791-815.

Pimm, S.L. and J.H. Lawton. 1998. Planning for biodiversity. Science 279 (27 March 1998): 2068-2069.

Podolsky, R., J.E. Freilich and R. Knehr. 1992. Predicting plant species richness from remotely sensed data in a high desert ecosystem. ISPRS/ASPRS Global Change Conference Proceedings, International Symposium on Photogrammetry and Remote Sensing, Washington, DC, August 1992.

Poiani, K. P., B. D. Richter, M. G. Anderson and H. E. Richter. 2000. Biodiversity conservation at multiple scales: functional sites landscapes, and networks. BioScience 50 (2): 133-146.

Pressey, R. L. , C. J. Humphries, C. R. Margules, R. I. Vane-Wright, and P. H. Williams. 1993. Beyond opportunism: key principles for systematic reserve selection. Trends in Ecology and Evolution 8 (4): 124-128.

Primack, R. B. 1993. Essentials of Conservation Biology. Sinauer Associates, Inc. Sunderland, MA.

Primack, R. B. 1996. Lessons from ecological theory: dispersal, establishment, and population structure. In: D.A. Falk, C. I. Millar, and M. Olwell (eds.), Restoring Diversity: Strategies for Reintroduction of Endangered Plants, pp 209-233. Island Press, Washington, DC.

Redmond, R. L. , M. M. Hart, J. C. Winne, W. A. Williams, P. C. Thornton, Z. Ma, C. M. Tobalske, M. M. Thornton, K. P. McLaughlin, T. P. Tady, F. B. Fisher, S. W. Running. 1998. The Montana Gap Analysis Project: final report. Unpublished report. Montana Cooperative Wildlife Research Unit, The University of Montana, Missoula. 136 p. + appendices.

Ricketts, T.H., E. Dinerstein, D.M. Olson, C.J. Loucks, W. Eichbaum, D. DellaSala, K. Kavanagh, P. Hedao, P.T. Hurley, K.M. Carney, R. Abell, and S. Walters. 1999. Terrestrial ecoregions of North America: a conservation assessment. World Wildlife Fund and Island Press, Covelo, CA.

Ryti, R.T. 1992. Effect of the focal taxon on the selection of nature reserves. Ecological Applications 2 (4): 404-410.

Samson, F. and F. Knopf (Editors). 1996. Prairie Conservation: Preserving North America's most endangered ecosystem. Island Press, Washington, DC. 339 p.

Schonewald-Cox 1988. Boundaries in the protection of nature reserves. BioScience 38(7): 480-486.

Scott, J. M. , F. Davis, B. Csuti, R. Noss, B. Butterfield, C. Groves, H. Anderson, S. Caicco, F. D'erchia, T. C. Edwards, Jr. , J. Ulliman, and R. G. Wright 1993. Gap Analysis: A geographical approach to protection of biological diversity. Wildlife Monographs No. 123. 41p.
Sellars, R.W. 1997. Preserving Nature in the National Parks : A history. Yale University Press, New Haven, CT. 416 p.

Shafer, C.L. 1990. Nature Reserves: Island Theory and Conservation Practice. Smithsonian Institution Press, Washington, D.C. 189 p.

Soulé, M.E. (ed.). 1986. Conservation Biology: The Science of Scarcity and Diversity. Sinauer Associates, Inc. Sunderland, MA. 584 p.

Stoms, D.M., F.W. Davis, K.L. Driese, K.M. Cassidy, and M.P. Murray. 1998. Gap analysis of the vegetation of the intermountain semi-desert ecoregion. The Great Basin Naturalist 58 (3): 199-216.

The Nature Conservancy. 1996. Conservation by design: a framework for mission success. The Nature Conservancy, Arlington, VA. 16 p.

The Nature Conservancy. 1997. Archipelagos of hope: guidelines for ecoregion-based conservation in the Nature Conservancy. The Nature Conservancy, Arlington, VA. 84 p.

Vannote, R. L., G. W. Minshall, K. W. Cummins, J. R. Sedell, and C. E. Cushing. 1980. The river continuum concept. Canadian Journal of Fisheries and Aquatic Sciences 37 (1) : 130 - 137.

Van Putten, M. and S.D. Miller. 1999. Prairie dogs: the case for listing. Wildlife Society Bulletin 27 (4): 1113-1120.

Whicker, A. D. and J. K. Detling. 1988. Ecological consequences of prairie dog disturbances. BioScience 38: 778-785.

Wilcove, D. S. 1999. The Condor's Shadow: The Loss and Recovery of Wildlife in America. W. H. Freeman Publishing, NY. 288 p.

Wilcove, D.S., D. Rothstein, J. Dubow, A. Phillips and E. Losos. 1998. Quantifying threats to imperiled species in the United States. BioScience 48 (8):607-615.