

# Heart of the West

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## Conservation Plan



# Heart of the West Conservation Plan

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### Chief authors and developers of the wildlands network and conservation plan

While many individuals offered assistance in writing and editing the plan, the chief designers of the wildlands network and authors of the plan and focal species accounts are:

Allison Jones  
Jim Catlin  
Tom Lind  
Jerry Frelich  
Kirk Robinson  
Liz Flaherty  
Erik Molvar  
Jeff Kessler  
Kathy Daly

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Wolf

Howie Garber and  
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Bill Hayden provided instrumental assistance as the chief designer of this plan, and was in charge of the layout. Additional assistance was given by Allison Jones, Jim Catlin and Jerry Frelich. Duplication of both CD and hard copy versions of this report are the responsibility of the Wild Utah Project. To receive a CD or hardcopy of the conservation plan, please contact:

### **Wild Utah Project**

**68 South Main Street, Suite 400**

**Salt Lake City, UT 84101**

**(801) 328-2550**

**wup@xmission.com**

**www.wildutahproject.org**

# Heart of the West Conservation Plan

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|   |           |
|---|-----------|
| <b>Chapter 1 - Introduction and Background .....</b>  | <b>1</b>  |
| 1.1 Introduction to the Heart of the West Region .....  | 2         |
| 1.2 Regional Description .....  | 4         |
| 1.2.1 The Physical Environment .....  | 6         |
| 1.2.2 Vegetation Communities .....  | 10        |
| 1.2.3 Wildlife .....  | 13        |
| 1.3 Land Use History, Management and Patterns .....   | 15        |
| 1.3.1 Overview and History .....  | 15        |
| 1.3.3 History of Wildlife and Habitat Conservation in<br>the Heart of the West .....                  | 20        |
| 1.3.4 Land Use and Industry in the Heart of the West .....  | 21        |
| 1.4 Need for Large-scale Conservation Planning for<br>the Heart of the West .....                     | 27        |
| 1.5 Ecological Wounds .....   | 30        |
| 1.6 Mission, Goals and Objectives of this Conservation Plan .....                                     | 33        |
| 1.6.1 Mission .....   | 33        |
| 1.6.2 Goals .....   | 33        |
| 1.6.3 Objectives .....  | 34        |
| <br>  |           |
| <b>Chapter 2 - Methods for Creating the Wildlands Network .....</b>                                   | <b>35</b> |
| 2.1 Study Area .....  | 35        |
| 2.2 Our Approach to Conservation Assessment and Reserve Design .....                                  | 38        |
| 2.2.1 Three-track Approach .....  | 38        |
| 2.2.2 Core/Linkage Model .....  | 42        |
| 2.2.3 The Precautionary Principle .....   | 43        |
| 2.3 The SITES Model .....   | 44        |
| 2.3.1 Variables in SITES Model .....  | 44        |
| 2.3.2 Special Elements .....  | 49        |
| 2.3.3 Representation Analysis .....   | 51        |
| 2.3.4 Focal Species .....   | 56        |
| 2.3.5 Determining Core Areas, Linkages and Compatible Use Areas in<br>Lowland Wildlands Network ..... | 59        |
| 2.4 Advanced work on Lowlands Wildlands Network .....   | 60        |
| 2.5 Irreplaceability and Vulnerability of Lowland Cores .....   | 62        |
| 2.6 Expert Assessment .....   | 66        |
| 2.7 Assumptions and Limitations .....   | 66        |

# Heart of the West Conservation Plan

---

|   |            |
|---|------------|
| <b>Chapter 3 - Results of SITES Analysis .....</b>  | <b>69</b>  |
| 3.1 Results of Natural History Literature Reviews and Focal Species Models .....                  | 69         |
| 3.2 Proposed Set of Cores, Linkages and Compatible Use Areas for Lowlands Study Area .....        | 70         |
| 3.3 Irreplaceability vs. Vulnerability Assessment .....   | 79         |
| 3.4 Linking Lowland Solution with Other Conservation Planning Efforts .....                       | 83         |
| 3.5 Goal Attainment .....   | 89         |
| <br>  |            |
| <b>Chapter 4 - Introduction to the Heart of the West Wildlands Network .....</b>                  | <b>91</b>  |
| 4.1 Wildlands Network Unit Classification and Management Guidelines .....                         | 93         |
| 4.1.1 Core Areas .....  | 93         |
| 4.1.2 Core Recovery Areas .....   | 94         |
| 4.1.3 Linkages .....  | 95         |
| 4.1.4 Compatible Use Area .....   | 96         |
| 4.2 A Closer Look at Key Core Areas - Heart of the West Lowlands .....                            | 97         |
| 4.3 Highlighting Key Linkages in the Lowlands Heart of the West Wildlands Network .....           | 128        |
| 4.3.1 The Powder Rim Linkage .....  | 128        |
| 4.3.2 The Green River Corridor Linkage .....  | 129        |
| <br>  |            |
| <b>Chapter 5 - Implementation of the Heart of the West Wildlands Network ..</b>                   | <b>135</b> |
| 5.1 Introduction .....  | 135        |
| 5.2 General Implementation Approach: Affecting Management Change for Wildland Network Units ..... | 138        |
| 5.2.1 Recommended Changes in Land Use or Management .....   | 139        |
| 5.2.2 Design Management Tools Based on Conservation Biology .....                                 | 139        |
| 5.2.3 Conservation Action: Planning Amendment or Project Action .....                             | 141        |
| 5.2.4 Conservation Initiatives .....  | 143        |
| 5.2.5 Monitoring of Focal Species and their Habitat .....   | 143        |
| 5.2.6 Further Scientific Study and Conservation Plan Revision .....                               | 143        |
| 5.2.7 Using the Implementation Flowchart - Sage Grouse Example .....                              | 144        |
| 5.3 Conservation Plan Prescriptions .....   | 146        |
| 5.3.1 Baseline Information .....  | 146        |
| 5.3.2 Measurable Ecological Goals .....   | 146        |

# Heart of the West Conservation Plan

---

|   |  |            |
|---|--|------------|
| 5.3.3   | Monitoring .....   | 147        |
| 5.3.4   | Prescription Stipulations for Activities in Cores and Linkages .....                   | 148        |
| 5.3.5   | Stipulations that Apply Throughout the Network .....                                   | 149        |
| 5.3.6   | Private Lands Within the Wildlands Network .....                                       | 151        |
| 5.4   | Protective Land Designations .....   | 152        |
| 5.5   | An Implementation Example: BLM’s Vernal Field Office<br>Resource Management Plan ..... | 153        |
| 5.6   | A Note on Implementation Strategies .....  | 160        |
| 5.7   | Conclusions .....  | 162        |
| <b>Chapter 6 - Discussion and Conclusions .....</b> |  | <b>163</b> |
| 6.1   | The Benefits of a Wildlands Network to Local Communities .....                         | 164        |
| 6.2   | The Future of the Heart of the West .....  | 165        |
| 6.3   | Data Gaps, and Research/Inventory/Monitoring Needs .....                               | 168        |
| 6.4   | Conclusions and Recommendations .....  | 169        |

# Heart of the West Conservation Plan

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Medicine Bow Peak, in the Medicine Bow National Forest, WY

Erik Molvar

## Chapter 1 - Introduction and Background

This plan features the culmination of three years of work by numerous organizations seeking to produce a blueprint for effective land conservation across a region of the Middle Rockies that we call “the Heart of the West.” We chose to follow the lead of the Wyoming Game and Fish’s sagebrush habitat modeling effort, the Wyoming Wildlife Federation’s “Restoring Wild Patterns” campaign, and the U.S Forest Service’s linkage directive, and produce a comprehensive plan for habitat protection in this often overlooked heart of the Rockies. If implemented, this wildlands network could ensure the protection and restoration of biodiversity and ecological integrity throughout the Heart of the West Region of northeast Utah, southeast Idaho, western Wyoming and northwest Colorado.

With the rapid expansion of energy exploration and development in the region,

there is a grave need to take a proactive approach to biological conservation in the Heart of the West in order to prevent future listings of threatened and endangered species and further losses of important native species and communities. The analysis described in this report seeks to take this proactive approach to regional conservation by using a comprehensive and scientifically rigorous process of delineating core areas for proposed protective measures, linkages to connect those cores together, and compatible use areas that will ensure human uses in a manner compatible with ecosystem needs.

This analysis and conservation plan is focused on the scale of entire ecoregions to better capture and subsequently protect biodiversity across a range of environmental gradients. Ecoregions are large areas sharing similar vegetation, climatic re-

## Chapter 1 - Introduction and Background

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gimes, and ecological processes. The models used to delineate wildlands networks use vast amounts of data inputs, ranging from information on past, current, and future land uses to specific locations of conservation targets in the region. We used the best data available to us, but because of incomplete information and data provided at various scales, combined with the reality

of ecological change over time, we acknowledge the limitations of our analysis. We therefore will employ the precautionary principle as we forge ahead into the implementation stage of land protection for the Heart of the West. This will be an iterative process, in which we will periodically update or revisit parts of this design as new information becomes available.

### 1.1 Introduction to the Heart of the West Region

Our world is increasingly crowded by people and their needs, both real (air, water) and imagined (SUVs, trophy homes). The past 30 years has seen a doubling of the global population from 3 to 6 billion people. Our planet's life-support system continues making oxygen, purifying our wastes, and cycling the nutrients we need to survive. But how long can the planet continue to support human increases of this magnitude? The world's other creatures and the native plants that support all life are pushed into smaller and smaller enclaves. It is from this vantage point that we consider the Heart of the West.

The western Great Plains and Rocky Mountain Front present a vast area formerly grazed by bison that were a staple of Native Americans for thousands of years. When Lewis and Clark crossed the West, the U.S. population was a scant 5 million according to the 1800 Census. Current estimates of the Native American population range from 1-10 million before Europeans arrived. Two hundred years later, with a U.S. population of 285 million, the western plains and the region we call the Heart of the West represent one of the least populated parts of the country outside Alaska. Despite the eradication of the bison and their replacement with cattle and the settlement of a few large cities, the Heart of the West region still presents one

of the most intact regions to be found in the contiguous 48 states (Freilich et al. 2001). We need this wild country to remain intact, not only for ecological services like clean air and water, but also for a grounding in and honing of self-reliance, independence, and the myriad other qualities that formed the basis of the western frontier.

The Heart of the West includes both the Wyoming Basins Ecoregion and the Utah-Wyoming Mountains Ecoregion that surround the Wyoming Basins, as well as some adjoining connections with the adjacent Southern Rocky Mountains Ecoregion and Utah High Plateaus Ecoregion (Figure 1.1). Totaling more than 65 million acres, the Heart of the West includes almost the entire state of Wyoming with the exception of its eastern plains. It also includes pieces of Idaho, Montana, Colorado and Utah.

The Greater Yellowstone Ecosystem anchors the northwest corner of the Heart of the West. It is a land of superlatives. It contains the greatest concentration of thermal activity (i.e. geysers, hot springs) in the world. The region contains a minimum of 337 species of mammals, birds, and fish, and more than 12,000 species of insects. Not surprisingly, the Greater Yellowstone Ecosystem is a world heritage



## Chapter 1 - Introduction and Background

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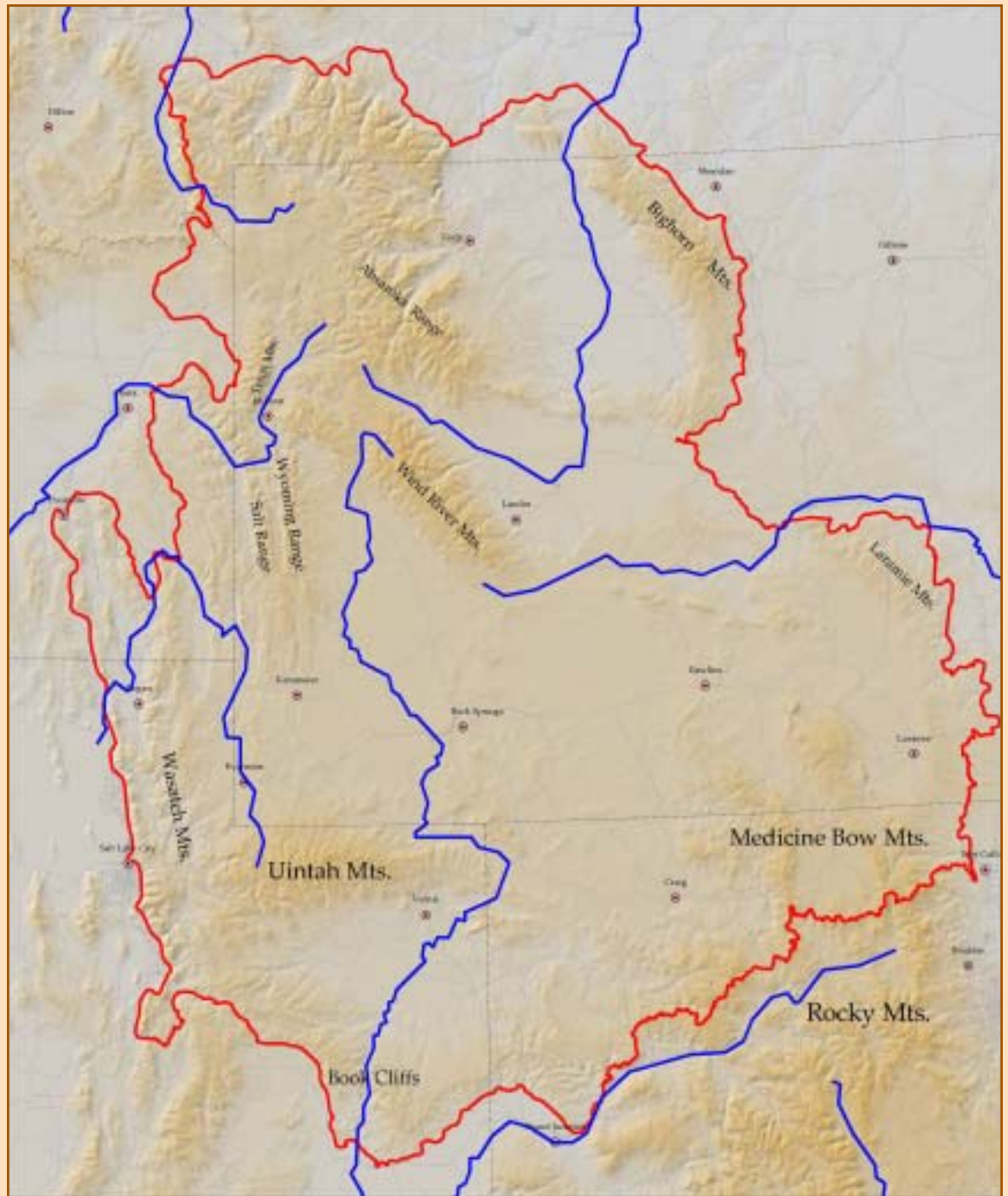


Figure 1.1 The greater Heart of the West region

site (World Heritage 2003). Totalling over 18 million acres (Greater Yellowstone 2003), it includes the headwaters of 12 major rivers, Yellowstone and Grand Teton National Parks, parts of seven National Forests (4 million acres of which are man-

aged as wilderness), three National Wildlife Refuges, plus BLM, State, private, and Native American Sovereign lands. In 1872 Yellowstone National Park was set aside, in part because the US government decided the land was not, and would not

## Chapter 1 - Introduction and Background

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likely become, “useful.” This American treasure was protected due to its perceived remoteness, inaccessibility, and harsh climate. Due to the fortunate preservation of Yellowstone as the nation’s first National Park, this area still contains nearly its full complement of native species.

Surrounding the Greater Yellowstone to the east and south are low-lying basins of sagebrush punctuated with forested mountain “islands.” Although often disrupted by human activities today, the lowlands were the winter destination of a vast hooved migration, following patterns existing for millennia. They were joined by a cornucopia of predators, scavengers, and decomposers that used to follow this

mobile feast. These lowlands were homesteaded by European settlers in the later 1800s and early 1900s. The settlers discovered what the Native Americans had known for thousands of years - that the land and its climate are harsh. Rainfall is sparse and winters are brutal. It’s a rough spot for people to live. Despite the bison being gone and oil and gas drilling rigs dotting the landscape, the land still presents much of the appearance it did hundreds of years ago. True, the large predators have been nearly extirpated, leading to significant shifts in the species present. But these lands still offer the empty space and freedom from pavement and permanent development that could promise a future for ecosystem restoration.

### 1.2 Regional Description

Our Heart of the West study area encompasses two complete ecoregions (the Utah-Wyoming Mountain and the Wyoming Basins Ecoregions), and small parts of two adjacent ecoregions - the Southern Rocky Mountain and Utah High Plateau Ecoregions, (Figure 1.2). The US Forest Service was among the first to realize the need for planning across state lines, following more natural boundaries. The Forest Service’s Robert Bailey (1995a, 1995b) wrote several important works delineating boundaries for ecoregions of North America. Bailey recognized the Greater Yellowstone Ecosystem as part of his Southern Rocky Mountain Steppe Ecoregion and its surrounding sagebrush basins as the Columbia-Snake River Plateaus/Wyoming Basin Ecoregion. In the 1990s, The Nature Conservancy (TNC) changed these names and somewhat altered the boundaries, including the Yellowstone in the Utah-Wyoming Rockies Ecoregion and the lowlands into the Wyoming Basins Ecoregion. TNC’s Utah-Wyoming Rockies

Ecoregion also includes the Wasatch and Uinta Mountains of Utah and the Bighorn Mountains of Wyoming which we also include in the Heart of the West.

Large, natural landscapes such as ecoregions may be the most appropriate scale for conservation and land management activities (Noss and Cooperrider 1994). The myriad ecosystems contained within ecoregions have close ecological relationships, including corresponding natural processes such as nutrient flows and natural disturbances. Recognizing these relationships across the landscape has become an essential component of conservation efforts and natural resource management activities. This is in sharp contrast to resource management and protection activities of the past that were largely carried out within politically defined landscape units, such as national parks, national forests, or states.

## Chapter 1 - Introduction and Background

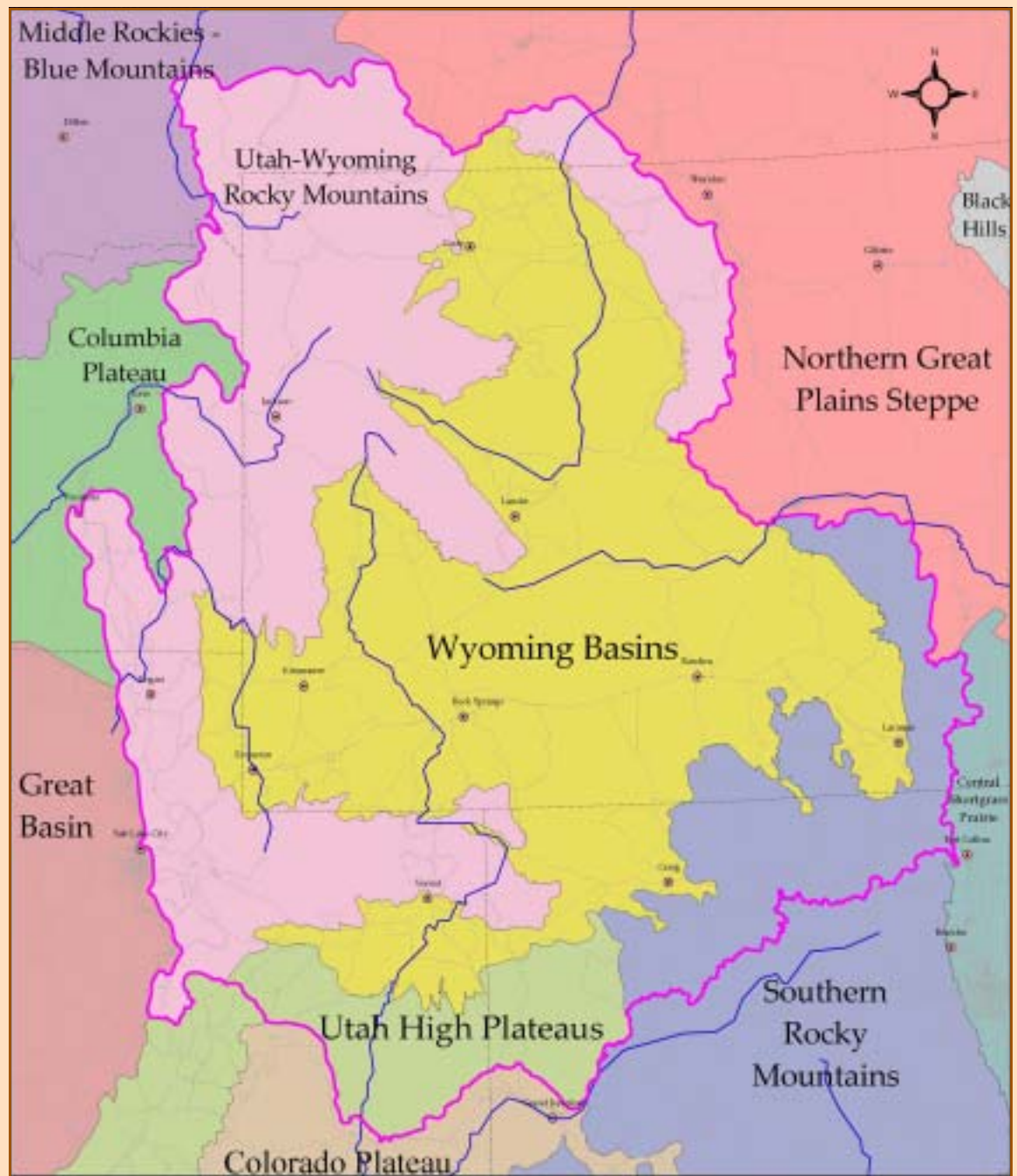


Figure 1.2 The various ecoregions that comprise the greater Heart of the West region

Although TNC and other conservation organizations have found it useful to make plans for specific ecoregions, our plan for the Heart of the West encompasses two entire ecoregions and crosses two additional ecoregional boundaries. Our boundary accounts for large animals (particularly

ungulates and carnivores) that moved freely across these ecoregional boundaries before European settlement. The area that we describe below was until very recently a wilderness of immense biological richness... and to some degree it remains so today.

## Chapter 1 - Introduction and Background

### 1.2.1 The Physical Environment

Cold desert basins form the heart of the region and include more than 35 million acres of sagebrush (*Artemisia sp.*) steppe. This includes most of western Wyoming including the Bighorn Basin, the Wind River Basin, the Green River Basin, and the Great Divide Basin, and extends into the upper North Platte watershed along the Sweetwater, North Platte, and Laramie rivers. To the south, the Piceance Basin, Uinta Basin, and Bear Lake and its associated drainage basin form the southern boundary of the Heart of the West lowlands. This basin region includes the only part of Montana in our study area, at the north end of the Bighorn Basin and the Pryor Mountains. To the west, the Heart of the West lowlands include Bear Lake and its associated drainage basin in extreme southeastern Idaho and northeastern Utah.

Forming the southern boundary, the Heart of the West lowlands includes the Uinta Basin and Book Cliffs of Utah and the Roan Cliffs in Colorado. The Basins are separated into the distinct watersheds of the Green, the Bighorn, the Sweetwater, the North Platte, the Yampa, the Little Snake, and several smaller rivers (Figure 1.3). Although the largest rivers are dammed and regulated (e.g., the Green, the Platte, and the Bighorn), several others (e.g. the Yampa and the Sweetwater) maintain a natural flow regime and are biologically precious because of it.

One particularly outstanding feature of the Wyoming Basins is the existence of long, linear ridges of sand dunes (some running 100 miles or more) such as the Killpecker dune field that stretches approximately from the town of Farson to the Ferris Moun-



Killpecker sand dunes, WY

Scott Smith - [www.ScottSMithPhoto.com](http://www.ScottSMithPhoto.com)

## Chapter 1 - Introduction and Background

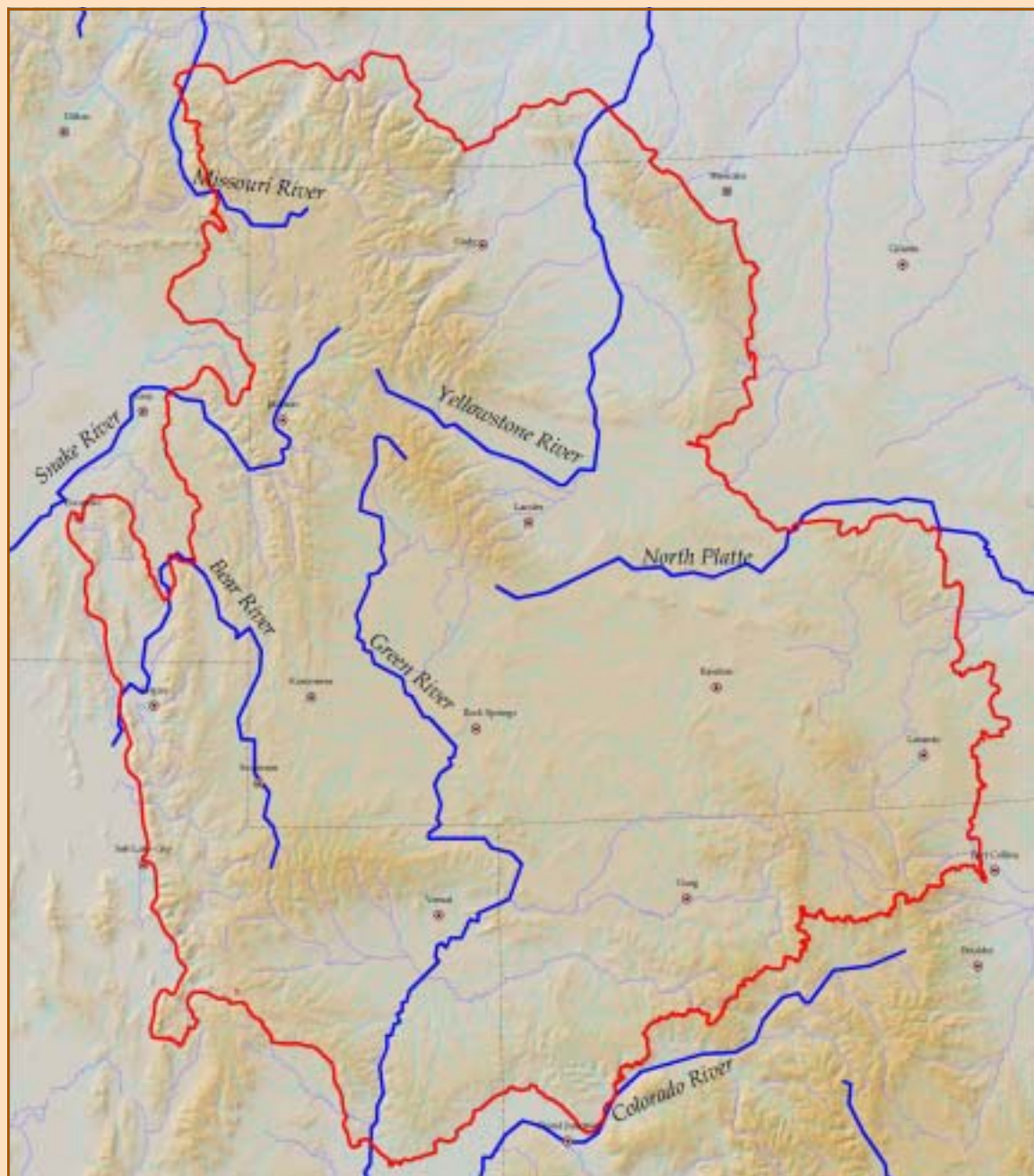


Figure 1.3 Major rivers and their tributaries in the greater Heart of the West region

tains. The dunes may either be 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 (*Redfieldia flexuosa*), Indian ricegrass (*Oryzopsis*

*hymenoides*), sandhill muhly (*Muhlenbergia pungens*), and the federally endangered blowout penstemon (*Penstemon haydenii*) (Knight 1994, Fertig 2001).

The mountains of the Heart of the West are anchored by the 26.8 million acres of the high elevation Greater Yellowstone

## Chapter 1 - Introduction and Background

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Ecosystem which includes the Absarokas, Wind Rivers, and Wyoming Ranges. (figure1.1) Moving away from the Yellowstone area to the east, the Heart of the West encompasses the Bighorn Mountains. Moving west and south the Heart of the West includes the Commissary and Salt River ranges of southwest Wyoming and southeast Idaho, the Wasatch Range and Uintas of northern Utah, and a portion of the southern Rockies, including the Medicine Bow and Laramie ranges which reach north towards the Bighorns to complete the circle of ranges which define the Heart of the West. Although the majority of these Heart of the West mountain ranges have peaks lower than 9,000 ft., a single point, Gannett Peak, in the Wind River Range, marks the high point of the ecoregion at 13,804 ft.

Smaller mountain ranges occur throughout the large basins of the Heart of the West lowlands. These dozen or so mountain ranges (e.g., the Ferris, Bridger, Owl Creek, Pryor Mountains, and the Rattlesnake Hills) are in many respects mountain "islands" in a "sea" of sagebrush. As described below, some of these isolated mountains have led to many animal races evolving unique traits compared to other subspecies or disjunct populations on larger and contiguous ranges nearby.

The Heart of the West is primarily a high elevation system. More than ninety percent of the ecoregion lies between 5,900 and 7,800 ft. (1,800-2,400 m). For this reason, and the northern latitude of the area (40-45o), the climate is harsh. In the low-lying basins within the Heart of the West, annual precipitation is only 6-10" a year, though rainfall amounts may reach 16" at the base of the mountains (Western Regional Cli-

mate Center 2003). Temperatures in the basins range from bitter cold in winter to hot in the summer, with temperatures below freezing possible every month of the year. The fact that most of the precipitation in the basins falls as snow is beneficial to the desert plant communities found there; snowmelt is more readily absorbed by plants than sudden rainfall (Knight 1994). Lastly, it's hard to ignore the wind in southern and central Wyoming as a driving factor in shaping vegetation communities in some sites. Indeed, it is as important as soils and precipitation.

The climatic conditions of the mountains that surround the low-lying basins are even harsher than those of the lowlands. The climate in these mountains is generally characterized as cold continental, with most precipitation falling as snow during the winter months (Noss et al. 2002). Winters in the Heart of the West mountains are generally long and summers short. Snow cover at 7,000 feet in the Yellowstone region typically lasts for about 213 days per year, and lasts another 29 days for every 1000 feet of elevation gain (Despain 1990). In general, the western part of the Utah-Wyoming mountains in Idaho and adjacent parts of Montana and Wyoming receives the greatest annual precipitation, in part because it is influenced to some extent by Pacific storms (Noss et al. 2002). For example, the southern part of the Yellowstone region receives more than 80 inches of precipitation annually (Despain 1990).

Alternatively, the eastern and northern edge of the Utah-Wyoming mountains downslope from high mountains like the Wind Rivers, Absarokas, Gravelly's and Beartooth Mountains, are the driest part of the mountain ranges. For instance, the

## Chapter 1 - Introduction and Background

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Bridger Desert, just east of the Beartooth Front on the Montana-Wyoming border, receives as little as 6 inches of precipitation a year (Merrill and Jacobson 1997). This is generally the result of a rainshadow effect. Also, areas further south and east in the Utah-Wyoming mountains receive proportionally more precipitation in the summer, particularly by thunderstorms (Whitlock and Bartlein 1993). Areas receiving this pattern of rainfall include the Wind Rivers, Wyoming, Salt, Wasatch and Uinta ranges.

The soils of the region are quite varied, and reflect the result of interacting forces during thousands of years and the varying influences of climate, topography, geologic substrate, vegetation and time. The soils are often shallow and not well developed, largely a result of recent glaciation in the mountains, an abundance of erodible slopes, and a comparatively dry, cool environment that slows soil development (Knight 1994). Some areas of the Wyoming Basins Ecoregion, such as places that



Adobetown, WY

Erik Molvar

## Chapter 1 - Introduction and Background

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contain the Mowry, Steele, Belle Fourche, Pierre and Thermopolis formations that are high in shale content, have soils rich in clay (Freilich et al. 2001). These areas expand and contract as they wet and dry, preventing much establishment of vegetation. Other areas derived from mudstones and siltstones are highly erodible, forming the characteristic buttes and cliffs we know

as badlands (i.e. Hell's Half-acre west of Casper, Freilich et al. 2001). In general, organic matter of soils increases near historic deposits of lava and ash (i.e. the Absaroka mountains and Yellowstone Plateau), and when elevation is gained from basin bottoms to mid-level mountain ranges, where plant production and weathering are highest (Knight 1994).

### 1.2.2 Vegetation Communities

Vegetation is extraordinarily diverse within the Heart of the West (Figure 1.4) because the region spans across numerous life zones from the highest alpine zones of bare rock, cirque lakes, and glaciers, to the lowest, driest areas at 4,500 feet dominated by sagebrush and greasewood (*Sarcobatus baileyi*). Two thirds of the rare plants endemic to Wyoming are found within the Heart of the West (WNDD 2003) in part due to this impressive diversity of life zones in the region.

Most of the Wyoming Basins Ecoregion is sagebrush steppe - a shrubland mosaic dominated by Wyoming big sagebrush (*Artemisia tridentata*) and various species of bunchgrass, such as western wheatgrass (*Elymus smithii*), blue grama (*Bouteloua gracilis*), Idaho fescue (*Festuca idahoensis*) and needle-and-thread grass (*Stipa comata*). In places of shallow soil and on wind-swept ridges, Wyoming big sagebrush may be replaced by black sagebrush (*Artemisia nova*) or communities of cushion plants. In more moist locations silver sagebrush (*Artemisia cana*) may thrive (Knight 1994). Areas of higher salinity, alkaline soils and less precipitation tend to be dominated by greasewood, shadscale

saltbush (*Atriplex confertifolia*), four wing saltbush (*Atriplex canescens*) or winterfat (*Ceratoides lanata*), interspersed with a few bunchgrasses such as bluebunch wheatgrass (*Pseudoroegneria spicata*) and prairie junegrass (*Koeleria macrantha*). These plant communities are typically found where precipitation is less than 10" annually and where the soils contain high concentrations of salts (Freilich et al. 2001). In some places, the soil surface is 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). Threatened and endangered plants found in the lower elevations within the Heart of the West include desert yellowhead (*Yermo xanthocephalus*) and blowout penstemon (*Penstemon haydenii*).

Moving up into the mountains of the Heart of the West that surround the basins,<sup>1</sup> Rocky Mountain juniper (*Juniperus scopulorum*) is typically the tree species that delineates the lower boundary between shrub zones and coniferous zones, and is common in transition zones such as the fringes of the Bighorn Mountains, in the southern Uintas, and in most of southeast

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<sup>1</sup>Present vegetation in the various life zones in the Heart of the West, while predictable to some degree, are not static forest stands. Depending on moisture, temperature, and type of disturbance and how recent it was, the dominant species in these communities can shift (i.e., mid seral lodepole pine can become dominated by other species such as douglas fir, and seral sub-alpine fir can be dominated by other species).



## Chapter 1 - Introduction and Background

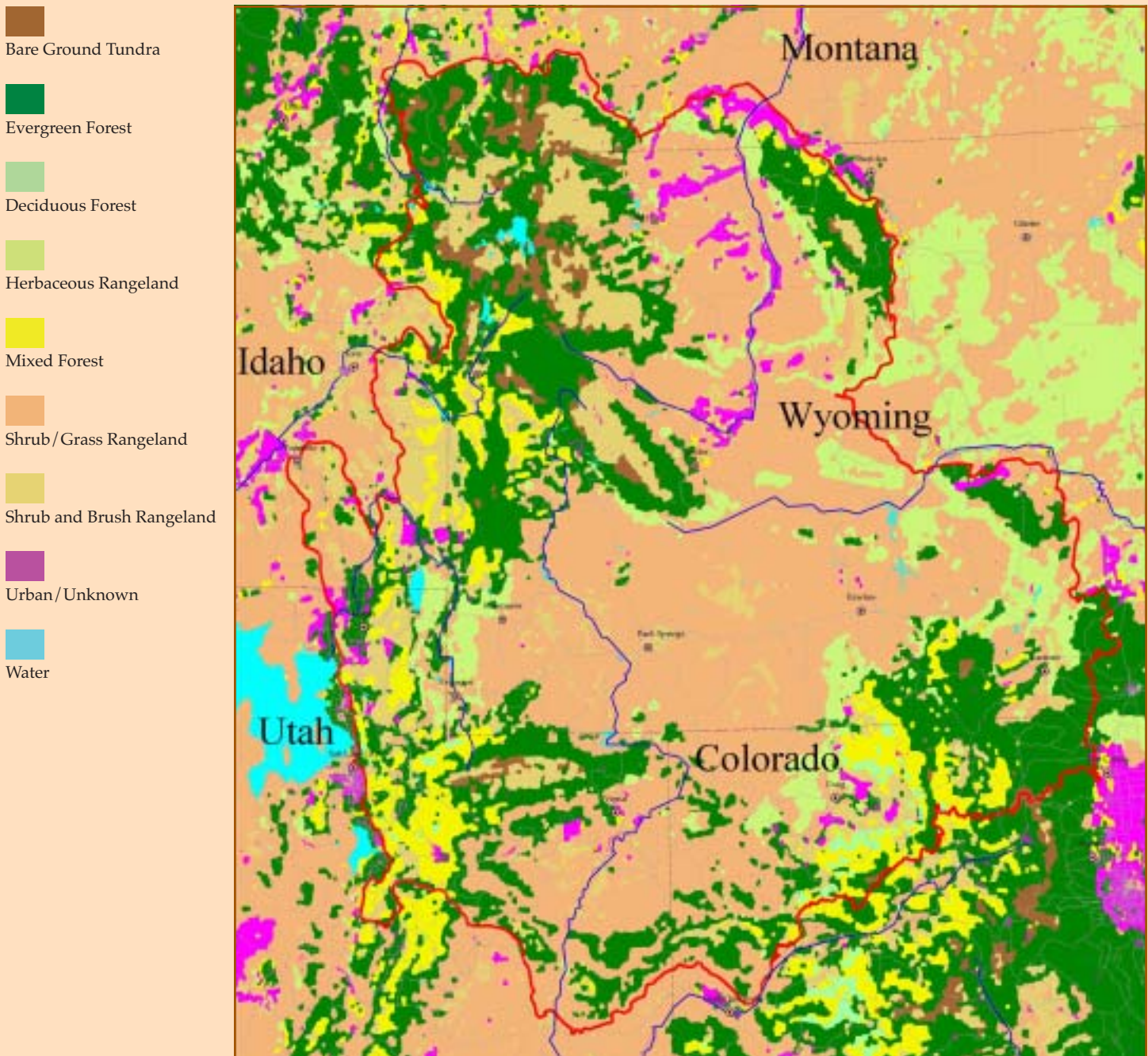


Figure 1.4 Vegetation types in greater Heart of the West region

Idaho (Noss et al. 2002). Ponderosa pine (*Pinus ponderosa*) is relatively scarce in the region and tends to be found in areas where summer precipitation is highest, such as on the eastern and southern slopes of the Uintas (Knight 1994). Douglas fir

(*Pseudotsuga menziesii*) somewhat takes the place of ponderosa where the latter species is absent. Douglas fir then transitions to lodgepole pine (*Pinus contorta*) at higher elevations. Lodgepole pine is the most numerous tree species on lower and flatter

## Chapter 1 - Introduction and Background

areas in the Utah-Wyoming mountains. Lodgepole pine trees by the millions are the dominant landcover over most of Yellowstone and Grand Teton National Parks. Leaving the lodgepole tracts, middle elevation slopes are covered with subalpine fir (*Abies lasiocarpa*) and Engleman spruce (*Picea engelmannii*). Moving higher still, the vegetation transitions through limber pine (*Pinus flexilis*)

extensive continuous occurrence of alpine tundra in the lower 48 states (Noss et al. 2002). Extensive tracts of alpine tundra are also common in the Wind Rivers, Absarokas, Uintas, and Bighorns (Despain 1973).

In the Utah-Wyoming mountains, areas further to the south and east (i.e. the Wind Rivers, Wyoming, Salt, Wasatch and Uinta ranges) receive relatively more summer precipitation than the mountains in the north and west (Despain 1990, Whitlock and Bartlein 1993). This may be one of the driving factors in the observed increased abundance of aspen (*Populus tremuloides*) and willows (*Salix sp.*) in the southern and southeast portions of the Utah-Wyoming Mountains, and the near absence of large concentrations of these species in the northeast part of the Utah-Wyoming mountain chain (Noss et al. 2002). Rare and endemic plants found in the higher elevations within the Heart of the West include Shultz's milkvetch (*Astragalus shultziorum*) and Absaroka beardtongue (*Penstemon absarokensis*).

Running throughout both the mountains and basins as arteries of life-blood, are riparian corridors. Vegetated by aspen and several cottonwood species (*Populus sp.*), willow and alder (*Alnus sp.*) thickets, ninebark (*Physocarpus sp.*), red osier dogwood (*Cornus sericea*), wild rose (*Rosa woodsii*), chokecherry (*Prunus virginiana*) and occasionally box elder (*Acer negundo*), these corridors provide abundant food, physical shelter, and life-giving water to dozens of species of wildlife such as neotropical migrant birds (Freilich et al. 2001).



Lodgepole Pine

NPS

and, in northern portion of the area, whitebark pine (*Pinus albicaulis*) communities, and eventually into tundra-like mat-forming plant communities with a unique flora and extreme resistance to harsh conditions. More than half of the Beartooth Mountains consist of tundra, the most

## Chapter 1 - Introduction and Background

### 1.2.3 Wildlife

The stream courses and rivers include habitat for several rare and federally listed fish species including Bonneville (*Oncorhynchus clarki utah*) and Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*) (Baxter and Stone 1985). Sinuous riparian corridors and small patches of off-corridor wetlands are home to a small number of amphibian species such as the boreal toad (*Bufo boreas*), many of which are disappearing (Blaustein and Wake 1995).

More than 350 species of birds are reported in the Heart of the West, including such rare breeding species as the harlequin duck (*Histrionicus histrionicus*), bald eagle (*Haliaeetus leucocephalus*), trumpeter swan (*Cygnus buccinator*), and boreal owl (*Aegolius funereus*). The Heart of the West is home to numerous grassland birds, such as McCown's longspur (*Calcarius mccowni*), grasshopper sparrow (*Ammodramus savannarum*), and mountain plover (*Charadrius montanus*). The grassland bird guild has been identified as the nation's most endangered group of birds (Samson and

Knopf 1996). This list of rare and sensitive bird species barely begins to describe the biological treasure found in this vast area.

In the Utah-Wyoming mountains, the present fauna includes some of the most charismatic mammal species found in the continental U.S. Federally listed grizzly bears (*Ursus horribilis*), Canada lynx (*Lynx canadensis*) and gray wolves (*Canis lupis*), as well as bighorn sheep (*Ovis canadensis*) make this area home. Wolverine (*Gulo gulo*), fisher (*Martes pennanti*) and other forest carnivores, now declining elsewhere, can still be found here. Vast numbers of elk (*Cervus elaphus*) roam the area as well.

Thanks to reintroduction, the most significant remaining herd of bison (*Bison bison*) in North America can be found in the Heart of the West (Clark and Stromberg 1987). The southern-most chain of the Utah-Wyoming mountains (Salt, Commissary, Wasatch and Uinta ranges) and the northwest corner of the Southern Rocky Mountains have suffered greater species losses than the Greater Yellowstone Ecosystem (Noss et al. 2002). Populations of some species, particularly predators, were locally extirpated in the nineteenth and twentieth centuries. Still, some of these



Grizzly Bear



NPS Trumpeter Swan

NPS

## Chapter 1 - Introduction and Background

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areas, such as the Uinta and Bighorn mountains, may be large enough to some-day support self-sustaining populations of large predators such as lynx, wolverine, gray wolf and grizzly bear.

As described above, small isolated mountain ranges dot the basins in the Heart of the West. These isolated “island” mountain ranges support distinct populations of mammals that have differentiated from their conspecifics on larger, more contiguous mountain ranges. For example, the existence of unique subspecies in the Bighorn mountains such as the Bighorn Mountain snowshoe hare (*Lepus americanus seclusus*) and pika (*Ochotona princeps obscura*) suggest that populations of other boreo-alpine mammals, such as American marten (*Martes americana*), red squirrel (*Tamiasciurus hudsonicus*), and red-backed vole (*Clethrionomys gapperi*), may have similarly diversified across this region (Beauvais 2000). Other species such as black bears (*Ursus americanus*) and boreal owls use these “islands” as stepping stones between larger blocks of suitable habitat in the Heart of the West.

In the basins at the feet of the Utah-Wyoming mountain chains, one can find other examples of unique and important fauna. A little known biological wonder housed within the Red Desert of southern Wyoming is North America’s largest desert elk herd.<sup>2</sup> In the days before European settlement, the sagebrush shrublands were home to millions of white-tailed prairie dogs (*Cynomys leucurus*), whose burrows and digging activities provided soil aeration, and food and shelter for other animals (Whicker &

Detling 1988). The prairie dog lands were home to an entire community of animals associated with prairie dog habitat. Frequently found in connection with prairie dog colonies were ferruginous hawks (*Buteo regalis*), mountain plover, swift fox (*Vulpes velox*), burrowing owls (*Athene cunicularia*), and black footed ferrets (*Mustela nigripes*), one of the nation’s most endangered species. Today, black-footed ferrets hover near the edge of extinction and the other prairie dog-dependent species are declining as prairie dog numbers decline due to sylvatic plague, deliberate poisoning, shooting, and widespread habitat degradation (Davitt et al. 1996, Clark and Stromberg 1987).

Today we think of grizzly bears, wolverines, elk, and wolves as forest animals. But Lewis and Clark did not. These species have been prohibited from persisting at lower elevations because humans claimed their sagebrush/grassland homes and eliminated them (Freilich et al. 2001). In truth, if bison were re-established, and wolves, grizzlies, and prairie dogs flourished on the plains and prairies, Americans could again see the land as the early Native Americans or early settlers saw it. The Heart of the West project is a planning effort that attempts to depict the ecology of this area as it once was, and as it once again might be.

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<sup>2</sup>This desert elk herd – one of only a very few in the world - is the result of reintroductions of Rocky mountain elk in the earlier part of the 20th century to the Jack Morrow Hills region of the Red Desert. Today numbering between 1,000 and 2,000 individuals, there is currently debate among scientists and conservationists regarding whether this herd is genetically distinct from montane elk in southwest Wyoming, and whether the elk remain fidelic to the desert because they are restricted by roads and other developments.

## Chapter 1 - Introduction and Background

### 1.3 Land Use History, Management and Patterns

#### 1.3.1 Overview and History

##### The Days of the Mountain-Men and the Trapper

A few French fur traders first penetrated the Heart of the West country in the 1790s, but it was famed mountain man and Lewis and Clark expedition veteran John Colter who first brought back tales of Yellowstone and its abundant wildlife after spending the winter of 1807-1808 there. Robert Stuart, a young Scotsman, in 1812 led a party of Astorian fur trappers from the mouth of the Columbia River all the way over South Pass. He was the first known white man to cross the Great Divide, although his discovery was largely ignored until trapper Jedediah Smith, traveling westward in search of rich hunting grounds, stumbled through South Pass in 1823. Due to Smith's reports and subsequent reports from General William Ashley in 1825 and the success of two female missionaries, Narcissa Whitman and Eliza Spalding, who were the first white women to cross the Divide in 1836, the stream of pioneers flowing westward over South Pass to the Oregon Territory, California and Utah exponentially increased, starting the largest mass migration westward in North American history. By 1900, over 450,000 pioneers crossed through South Pass along the Oregon, California and Mormon Pioneer Trails. Some would stay in South Pass and throughout parts of Wyoming, but most would doggedly continue onto the west coast or Utah.

The fur-trade flourished from the 1820s well into mid 1830s, until the international fur trade largely collapsed in 1839. By the 1870s most of the beaver (and much of the other fur-bearing wildlife) in the Wind River Range, Green River and other parts of Wyoming were fairly well trapped out. The last wild bison was shot in the Red Desert by 1890. Inevitably, the heavy



Beaver Chewed Cottonwood Stump

NPS

trapping and hunting conducted by the mountain men and pioneers, coupled with the bison extirpation policies of the Federal Government (to keep the American Indians in check) led to a huge toll on the region's wildlife.

Between 1867 and 1869, the Union Pacific Railroad received Government grants totaling \$27 million to build a railway across the states of Utah, Wyoming, and Nebraska, thus linking the West and East coasts. In the summer of 1868, up to 6000 men were employed in railroad construction and "railway towns" were brought to the Heart of the West where none had existed before- including Cheyenne, Laramie, Rawlins and Green River. In 1886, the railroad would come out of Nebraska to tie in Lusk, Douglas and finally, Casper. By the time the territory became a state in 1890, the railroads had brought increased commerce, communication and an important outlet to the outside world. Bringing settlers and businessmen to the territory, in turn, the railroads provided invaluable shipping for coal, oil and other products.

## Chapter 1 - Introduction and Background

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### Maturation of settlement and transition to the present

Several historical facts explain why the landscapes across the Heart of the West are lightly populated and relatively intact today. At the turn of the twentieth century, more Native Americans lived here than European settlers, and in many ways, this was the farthest edge of the frontier. The area was considered so remote, so difficult to reach, and had such severe climate that no one in Washington D.C. saw much economic potential for it. Gradually, hardy cattle ranchers settled the valleys and river edges. The high country was intensely logged in some places, but early protection was granted to both Yellowstone (the nation's first National Park, 1872) and Shoshone National Forest (the nation's first National Forest, 1891), which form the northwest anchor of the Heart of the West today. When all was said and done, much of the Heart of the West went directly from

being Native American territory into some form of federally protected status. Although ranching did eventually become quite popular on the lower lands, the region's elevation and brutal climate enforced a low population density throughout the twentieth century.

Today, as with the cattle and sheep ranching "boom" of the twentieth century, the Heart of the West exhibits a general pattern of lowland settlement and development, and upland protection. Indeed, this pattern is common throughout the West. Recent studies (notably Gap Analysis) show that protected lands are disproportionately at high elevation where the land was not originally viewed as "useful," whereas lowlands and river corridors are today most impacted by human activities (Scott et al. 2001).



The Pinnacles, in the Great Divide Basin, WY

Erik Molvar

## Chapter 1 - Introduction and Background

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The Heart of the West reflects the consequence of that dichotomy. Willow thickets and cottonwood river bottoms are now widely replaced by hay fields. Since the end of World War II, oil and gas exploration and development and the accompanying roads have permeated the Heart of the West basins, from the Bighorn to the Uinta. Long-time ranchers continue to raise cattle despite harsh conditions and low commodity prices. Successful conservation strategies used by TNC and other land trusts encourage ranchers to continue ranching through conservation easements and their related tax benefits.

Today, at less than 500,000 people (and with more pronghorn than people), Wyoming has the lowest population in the 50 states. However, there are indications that this may not be the case for long. Five million Americans visit the Greater Yellowstone Ecosystem each year to see and experience wild nature, especially bears, wolves, and large ungulates. Gateway communities reap substantial economic benefits from these tourists. Vacation homebuilders and telecommuters are rapidly developing the scenic regions near these communities, capitalizing on the eternal appeal of unspoiled nature. Today, we see a trend in settlement, where property values in scenic areas are steadily increasing. Wealthy capitalists from cities buy huge spreads that may continue to be ranches but without the need to turn a profit. Post-war development of the interstate highway system and affordable automobiles have also affected the region, helping Americans better access the popular Yellowstone Park and develop a strong affinity for nature that includes glorification of the “cowboy life style.” Today, tourism based on the outdoors is one of the biggest industries in much of the Heart of the West.

In general, the largest population centers in the region (Salt Lake City, Denver, Pocatello, Idaho Falls, Billings and Bozeman) lie on the fringes of the Heart of the West. (figure 1.1) Still, population levels are increasing rapidly in some parts of the region. For example, the twenty counties comprising the Greater Yellowstone Ecosystem grew at an average rate of 14% from 1990 to 1999 (Merrill and Jacobson 1997). Teton County, Idaho on the west slope of the Teton Mountains has recently experienced the greatest growth in the Heart of the West with a staggering 66% growth rate between 1990 and 1999 (Noss et al. 2002). These population expansions, whether driven by eco-tourism in the heart of the region or by the cities on the fringe, ultimately lead to more development, agriculture, roads, motorized recreation, and subdivisions in the Heart of the West.



Douglas Fir Cones

NPS

## Chapter 1 - Introduction and Background

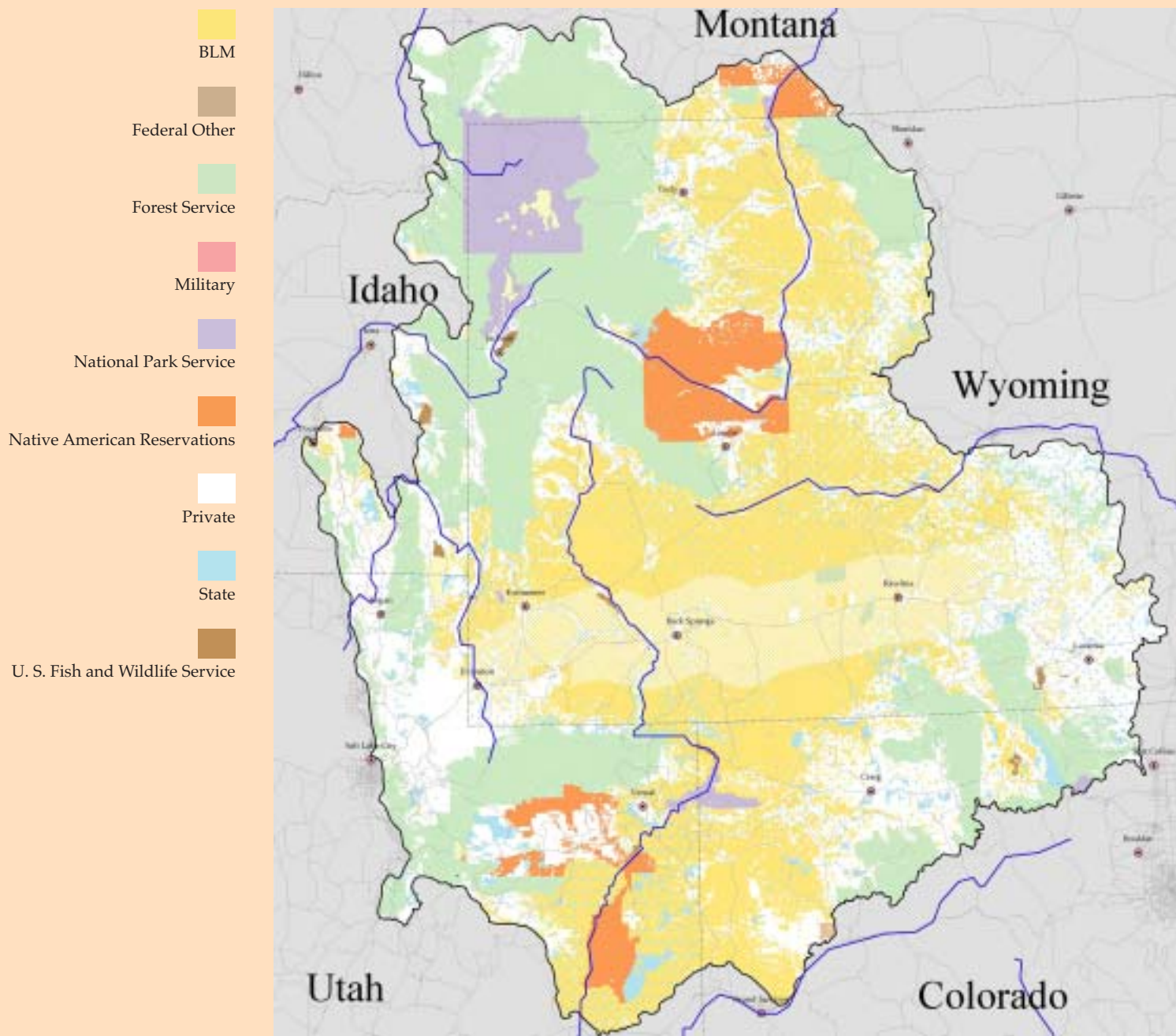


Figure 1.5 Land ownership of greater Heart of the West region

### 1.3.2 Land Ownership: Patterns and Protection

The vast majority of the lands in the Heart of the West are public lands, including three National Parks, parts of ten National Forests, many wilderness areas, multiple National Wildlife Refuges, plus a large amount of BLM, State and Native American Sovereign lands (Table 1.1). Private land

holdings in the region, while less than public, are not insignificant (Figure 1.5). Certain areas of public and private lands are managed for maintenance of biological diversity or natural values. These are principally lands identified by GAP Analysis programs as GAP Land Status



## Chapter 1 - Introduction and Background

Categories 1 and 2 (Table 1.2). These areas include National Parks and Wildlife Refuges, Wilderness and Wilderness Study Areas, state parks, Research Natural Areas, and BLM Areas of Critical Environmental Concern.

Status 1 areas are typically areas designated by Congress that afford a high level of biodiversity protection, and that are managed to mimic natural processes as

closely as possible. Status 2 lands have permanent protection from conversion of natural land cover to a non-natural state. Currently 4,046,474 hectares of the Heart of the West, or 13.7% of the region, are included in GAP 1 and GAP 2 Status lands, with the majority of these in the mountainous part of the Heart of the West.

**Table 1.1 - The number of hectares, by land ownership type, in the Heart of the West region, and the percent of total area of those designations**

|                             | <b>Forest Service</b> | <b>BLM</b> | <b>NPS</b> | <b>USFWS</b> | <b>State</b> | <b>Tribal</b> | <b>Private</b> |
|-----------------------------|-----------------------|------------|------------|--------------|--------------|---------------|----------------|
| <b>Total Hectares</b>       | 6,856,343             | 9,233,361  | 1,070,829  | 71,006       | 1,572,479    | 1,284,329     | 8,437,956      |
| <b>% of Total Land Area</b> | 23.20%                | 31.20%     | 3.60%      | 2.40%        | 5.30%        | 4.30%         | 28.50%         |

**Table 1.2 GAP management status level descriptions.**

|                 |   |
|-----------------|---|
| <b>Status 1</b> | An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, and intensity) are allowed to proceed without interference or are mimicked through management. |
| <b>Status 2</b> | An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive use or management practices that degrade the quality of existing natural communities.                                      |
| <b>Status 3</b> | An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type or localized intense type. It also confers protection to federally listed endangered and threatened species throughout the area. |
| <b>Status 4</b> | Lack of irrevocable easement or mandate to prevent conversion of natural habitat types to anthropogenic habitat types and allow for intensive use throughout the tract, or existence of such restrictions is unknown.   |

## Chapter 1 - Introduction and Background

### 1.3.3. History of Wildlife and Habitat Conservation in the Heart of the West.

Throughout the nineteenth century, immigrants entered the country in a steady flow and changed the lay of the land and the course of history as no migration heretofore had done. In the spirit of "Manifest Destiny," settlers came into places such as the Green River Basin and found it to be a grassy cornucopia free for the taking. As

common in occupations that have historically occurred around the world, this influx had a considerable impact on local wildlife. The land-hungry people encountered an estimated 60 million bison, 40 million pronghorn and countless other species. The pioneers were accompanied by thousands of livestock which increased to millions of animals that not only grazed the rangelands year around, but outcompeted the native wildlife. In less than fifty years, populations of fish and wildlife had been significantly reduced by miners, market hunters, hide-hunters, settlers, and ranchers (McClung 1969). Bison were reduced from enormous herds to a couple of dozen at their low point in the late nineteenth and early twentieth centuries (Blair 1987). Bighorn sheep were subjected to intensive market hunting pressure while simultaneously hit by diseases from domestic sheep and cattle; many herds disappeared. Pronghorn, mule deer, and elk were shot without limits and they lost much of their native range to livestock grazing, homesteads and other human enterprise. Trumpeter swan skins were an important trade commodity in the late 1800s, and the number of swans surviving dropped to fewer than 100 in the early 1900s. Like many imperiled species, the few remaining survivors held out in the rough ramparts of the Rocky Mountains.

By 1900, most of the large predators and many of the big game animals had virtually disappeared. Except for animals in Yellowstone National Park and a few scattered local herds, elk were considered to be nearly extinct, there were no wolves, bighorn sheep were rare, and even deer were considered uncommon. Public concern was developing during this period, but for some species such as



Pronghorn

NPS

## Chapter 1 - Introduction and Background

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grizzly bear and wolf it was too late, and for others it appeared that time was running out (USDI 1987).

A semblance of a conservation movement had begun. Well before the advent of the twentieth century, concerned leaders had taken the proposal forward to designate Yellowstone as America's first National Park. Protection of the land and wildlife was slow to follow, but the seed was sown. With the end of free-ranging wildlife in sight, hunters and sportsmen issued a warning call in an effort to prevent what had already occurred throughout Europe and even America's East Coast. Conservation organizations such as League of American Sportsmen began to lobby their politicians to protect the region's wildlife and its habitat. These groups evolved into the National Wildlife Federation, Wildlife

Management Institute and the Isaac Walton League with affiliates in many of the western states where the idea of wildlife conservation was conceived.

In the late nineteenth and early twentieth centuries sportsmen organized and engaged politicians to develop and enforce state and federal game laws, and the killing slowed. The Lacey Act of 1900 "drastically reduced the power of the markets by prohibiting interstate shipment of game taken or possessed in violation of the laws of the state, from which or to which it was shipped" (Foss 1971). Once the unlimited killing was under control with game laws, it was clear that habitat conservation was necessary to restore the once prolific populations of wildlife to their native range.

### 1.3.4. Land Use and Industry in the Heart of the West

Blessed with an abundance of wildlife, open space and minerals, the Heart of the West region has had a long and extensive history of resource extraction, from the earliest days of the mountain-men trapping beavers and hunting bison to recent times when oil and gas companies and the federal government work together to optimize oil, gas and coal development in many parts of the Wyoming Basins Ecoregion. As we construct a wildlands network and implementation strategy for the Heart of the West, we consider the five main land uses that once shaped, and in many ways still shape, the economy of the Heart of the West:

#### Logging

Many of the forests in the mountains of the Heart of the West were logged in the late nineteenth century for railroad ties. During

railroad construction hundreds of "tie-hacks" were hired, selectively logging to bring the railroads much-needed timber for ties. Later, when railroads would expand north, towards Casper and Lander, "tie-hacks" would selectively log the forests around Dubois and other locales.

Although some environmental damage was incurred by tie-hack practices, this fairly environmentally benign logging was nearly beneficial when compared to the clearcutting practices which occurred in the Heart of the West in the 1960s and 1970s. Due to the region's severe winters and short growing season, timber has never been an essential element to region's economy, although some towns such as Evanston, Sheridan and Dubois were largely dependent on the timber companies, such as Louisiana Pacific,

## Chapter 1 - Introduction and Background

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that took advantage of some of the old growth stands of the Heart of the West larger forests.

Logging activity continues today in the Heart of the West, though not as intensely, and primarily on US Forest Service lands. The Wyoming Range and western flank of the Wind River Range are under the management of the Bridger-Teton National Forest (BTNF). The BTNF now has a reduced annual allowable sale quantity of 4.4 million board feet, reduced significantly from the original volume of the BTNF Forest Plan of 12 million board feet. Most large timber sales are now cut by multi-national corporations, however, a few multi-product sales are still sold to local operators for house logs, post/pole contracts, and firewood. The predominant merchantable species are aspen, lodgepole pine, and spruce. With regeneration rates so low in the semi-arid basins, there is much less timber available for harvest, so cutting rates have been substantially reduced during the past few decades.

### Agriculture (cultivation/farming)

Large scale agriculture is generally not practiced in the mountains of the Heart of the West, but is concentrated in the basins. Although the growing season is short in the Wyoming Basins, areas near reliable water sources have been used for growing crops since the nineteenth century. Currently, the Uinta front in extreme Southwest Wyoming and northern Utah is a relatively important area for farming, and the main sugar beet center in the region is along the Bighorn River in the Bighorn Basin. Many of the riparian areas in the basins are today used as hay meadows for livestock, with or without supplemental irrigation.

### Coal, Oil and gas development

The mining boom that was to pervade much of the Heart of the West lowlands in the 1800s and 1900s (mostly in Wyoming but also limited amounts in northwest Colorado) was kicked off after the discovery of significant coal seams at Hannah, Rawlins and Rock Springs. Today, the heart of the Wyoming Basins (Green River Basin, Great Divide Basin, Red Desert, Uinta Basin, etc.) remain a major site for coal, gas, methane and trona (soda ash) production, all of which have experienced dramatic production increases through the twentieth, and into the twenty-first, century.

Although coal production initially started slowly, with the first mines starting in Carbon and Rock Springs in 1868 and at Almy, near Evanston in 1869, coal would become one of Wyoming's economic mainstays. By 1918, over nine million tons of coal were produced by mines throughout the State. By World War II, coal was literally flowing from over 100 Wyoming mines to all corners of the United States. By the 1960s, strip-mining throughout much of the state became the status quo for coal companies, increasing production exponentially, but leading to losses in the work force. Now, in 2003, Wyoming is the number one producer of coal in America. In 2002, 368 million tons of coal were produced in Wyoming from federal lands, shipped to 37 states for electricity, generating over 222 million dollars in federal royalties. Since 1986- until the present day- coal production has increased 150%.

In 1832, Mountain men at the Green River rendezvous spoke to explorer Bonneville about a "great tar spring" near South Pass and pioneers and travelers throughout the 1800s described oil seeps. In 1883,

## Chapter 1 - Introduction and Background

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### Box 1.1



Jonah II Gas Field, Upper Green River Basin, WY

Peter Aengst

This aerial photograph shows the vast network of roads and well pads that make up a portion of the Jonah II natural gas field, located in Wyoming's Upper Green River basin, 35 miles south of the town of Pinedale. The Jonah II field graphically illustrates the significant impacts currently occurring to America's public lands from new oil and gas development. For example, despite use of the latest technology (all of the drilling you see in this picture is post 1995), the federal lands in this picture have essentially been converted from important habitat for antelope, mule deer, sage grouse, and other wildlife species to an industrial landscape of roads, drill pads, powerlines, compressor stations, and other infrastructure.

With a lease area covering an area of over 59,000 acres of Bureau of Land Management (BLM) lands, the Jonah II gas field has quickly grown over the last several years from a few dozen wells to over 300 wells. This boom continues today, as the BLM's 1998 Environmental Impact Statement allows for a total of up to 490 wells to be developed in the lease area over the next decade. Furthermore, while the BLM's original permit allowed for 80 acre well spacing, the primary operators in the gas field, Amoco and McMurry Oil, successfully petitioned the BLM in April 2000 for an amendment to allow 40 acre spacing in the eastern half of the gas field. In late 2002, industry applied for permits to allow 20 acre well spacing (i.e. double the density of wells pictured) and the BLM has begun an EIS process to address this change.

In any case, with ten drilling rigs currently operating in the Jonah II field and year-round activity allowed, the oil and gas "footprint" presented in this picture is rapidly spreading beyond the 23,000 acres of the permit area that has already been developed.

Approximately 90% of the BLM's Pinedale Resource Area is currently under lease and including the Jonah field, there are six major natural gas fields in operation.

## Chapter 1 - Introduction and Background

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Wyoming's first oil well was drilled outside of Lander in what would become the Dallas Field. Subsequently, the Salt Creek oil field would be developed in the same year near Casper. The Pennsylvania Oil and Gas Company was the first energy company to show interest in this "black gold" and while drilling increased, the state's first refinery was built in 1895 near Casper. With the passage of the Oil and Gas Leasing Act of 1920, industry was ensured oil leasing on federal lands throughout Wyoming. During World War I, and the subsequent rise of the automobile and the need for more tar-based roads, the need for oil within the Heart of the West and throughout the U.S. increased exponentially.

In the mid 1920s, oil production declined for a decade, largely due to overproduction and the impacts of the Great Depression. But by the late 1930s and 40s, the need for crude oil rose dramatically. By the 1960s, Wyoming was producing nearly 45% of the Rocky Mountain region's oil. By the late 1960s, Wyoming Governor Stan Hathaway would go stumping for industry in New York and California, "courting industrialists with Wyoming moose and elk steak dinners." (Wall Street Journal 1969). In the 1970s, oil production continued to rise, resulting in a boom that swept the Heart of the West, followed in turn by a bust in the mid 80s- an event that would leave the region reeling. There were attempts to diversify the region's economy, for example with tax-breaks for companies experimenting with "clean coal technology," but this in turn led to lost revenues. Declaring that "Wyoming is open for business," the state elected an energy commission comprised almost entirely of industry representatives, and pushed hard for tax breaks for the industry.

The increases in energy production in the lowlands of the Heart of the West are being driven in part by the Bush administration's Energy Plan. This plan is trumping past decisions by the BLM to protect certain sensitive areas of public land in the region from energy development. For example, according to the 1997 BLM Green River Resource Management Plan (RMP), there is an "Oil Shale Withdrawal" extending over the entire Seeskadee National Wildlife Refuge, and beyond Farson and Green River nearly to Rock Springs to protect the wildlife values of this area. However, the majority of the BLM land surrounding the Wildlife Refuge has recently been leased for oil and gas development. Moreover, although 84,000 acres along the Wind River Front was considered by the BLM for withdrawal from mineral entry in the 1997 Green River BLM RMP, the final decision was made that the land would "be managed to allow for the ongoing development of minerals while providing for recreation uses and other resource values" (BLM Green River RMP, 1997).

Indeed, the outlook in the region in terms of upcoming energy development is daunting. The Heart of the West lowland region contains the nation's largest gas reserve (314 trillion cubic feet), and there are currently about 8,500 producing oil and gas wells in the region today. It is difficult to say how many new oil and gas wells will be added to this already large number, but current proposals on the table tell us the number could be as high as 20,000 new gas wells in the Wyoming Basins Ecoregion in the next fifteen years.

## Chapter 1 - Introduction and Background

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### Hunting

Hunting big game is very popular today in the Heart of the West. Hunting of ungulate species is managed by hunting seasons set by the Wyoming, Idaho, Montana, Colorado and Utah state wildlife agencies, which receive the majority of their funding from license fees. According to a synthesis (Coupal et al. in preparation) of economic data from the Wyoming Game and Fish Department (Lee et al. 1989, Responsive Management 1998, Wyoming Game and Fish Department 2001), hunting of the six major big game species generated over \$142 million of hunter expenditures in Wyoming in 1999 alone. Fishing, small game, game bird, and waterfowl hunting also generates significant monies. In 1998, anglers contributed \$492 million to Wyoming, according to the Wyoming Game and Fish Department. In general, hunting and fishing are major components of the economic and cultural landscape of this region, and they are dependent to at least some degree on wild country. There are drawbacks to these pursuits, namely stocking of exotic fish and game birds, and the concomitant use of off-road vehicles (ORVs).

### Livestock grazing

The first groups of cattle in the Heart of the West were brought in around 1830. In the 1840s and 1850s, tens of thousands of cattle were driven along the emigrant trails by pioneers and in the late 1860s, the first season-long grazing/open grazing was established by settlers. By the 1870s, the number of livestock brought into the Heart of the West by settlers and stockmen increased to take advantage of the open range throughout the region; cattle grazing was seen as the Wyoming territory's most promising economic activity. In 1885, over 1.5 million cattle were registered within Wyoming and the business was booming, with cattle being brought in from Oregon, Montana, and especially Texas, in which large trail herds moved up the Texas and other trails into the Heart of the West (Hunt 1941). At its peak, the livestock industry claimed there were about 8 million cattle and 6 million sheep present on the rangelands across the West. The Wyoming Stockgrowers' Association, the first organization of its kind ever formed, represented a capitalization of over one hundred million dollars when Wyoming was still a wilderness. According to livestock capitalization then, Cheyenne was the richest city in the world on a per capita basis. (Bartlett, 1918). But the livestock boom in the Heart of the West, and indeed, across the West, could not be sustained. The environmental results were immediate- the range was quickly becoming overstocked with resulting overgrazing and the large-scale kill off of predators (Wyoming had the highest bounties for predators than any surrounding states), rivers and streams were becoming quickly diverted for pastures, and the fencing off of large tracks of public land illegally contributed to the large-scale die-offs of ungulates, not to mention the rising anger of hunters and citizens. Huge losses



Cow

George Werthner

## Chapter 1 - Introduction and Background

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were experienced by cattle and sheep ranchers alike in a series of bad winters such as 1886-87, when the majority of the livestock on open range starved to death, stranded in snowdrifts. These high densities of livestock on the public domain took a toll on the forage available for native wildlife and the cattle themselves. One account describes the beginning of the cattle “bust” in the Heart of the West:

*“The great flocks of game and the extensive herds of range cattle show marked decrease each year. At one time we ranged 14,000 head of white-faced steers in the uppermost end of the Green River Valley. Today I would estimate them at 6,000. And in terms of the Big Piney herds over to the west added to the Green River Valley, we used to run 40,000-50,000 cattle in the balmy days when cattle were supreme. Now (1930) they are all dwindled down to perhaps less than half that amount.”*

(Sublette County Artist Guild, 1963)

Due to the severe overgrazing that occurred as a result of the year-round grazing throughout the West, and the influx of stock from out-of-state, the Taylor Grazing Act was passed in 1934. That was the end of an era of uncontrolled livestock use of the public domain. This watershed legislation marked the end of free land and the start of permanent federal management of the public domain (Donahue 1999). The number of livestock on the western range fluctuated throughout the twentieth century, but eventually decreased to approach a more realistic carrying capacity. The actual number of livestock that is really sustainable on these rangelands is today still being debated.

Of course, with livestock grazing comes fencing. A recent fence inventory project initiated in 1992 documented at least 1695

fences spreading a tangled wire web over thousands of miles in the southwestern quarter of Wyoming (WWF 2000). Of the 1695 fences, 139 fences are within crucial winter range for native ungulates, 289 fences are within a migration route, and 535 or 31% of the fences need modifications to meet state and federal “wildlife-friendly” fence standards (DeGroot, 1992). Pronghorn migrating between Jackson Hole and the Green River must cross at least 35 fences (Sawyer, 2000).

### Recreation and Tourism

The Heart of the West’s wild open spaces and wildlife have been some the region’s greatest assets. Yellowstone and Teton National Parks, from their inception, have drawn healthy crowds of wildlife enthusiasts and recreationists. In as early as 1955 it was estimated that tourism and wildlife watching contributed \$150 million to Wyoming’s economy (Bell 1955). That same year, all Wyoming crops combined—alfalfa, barley and wheat—only produced about \$20 million. By contrast, in 1955, total agricultural production in the state, including cattle and sheep, was about \$100 million.

Today, tourism contributes approximately two billion dollars annually to Wyoming’s coffers and is the number two money-maker in the state today, after minerals. In 1997 \$1,351,806,000 in direct expenditures were attributed to nearly 4 million travelers in Wyoming (Morey and Associates 1997). In 1997, tourism - including hunting, fishing and outdoor recreation - created 50,000 total full-time and part-time jobs in Wyoming, \$848 million in total personal income and \$53,270,000 in state and local tax revenues.



## Chapter 1 - Introduction and Background

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### 1.4 Need for Large-scale Conservation Planning for the Heart of the West

It is because of this richness of life, the relatively sparse human population, and superlative natural values that we have initiated our planning effort for the Heart of the West. Not only is the wildlife diversity and abundance considerable in this area, but here we might see a conservation wonderland to benefit all people and wildlife if only appropriate care could be taken towards protecting these values. Through our planning effort, we will illustrate the potential of this land. By showcasing specific wildlife species in need of protection and pointing out threats to them, we will identify priority areas for conservation. We will create a vision for this land as it might be in a future where wildlife matters.

Perhaps the chief reason there is a critical need to undertake large-scale conservation planning for this region is that, up to now, conservation has been done in an ad hoc and opportunistic manner, where areas have been protected not for the biodiversity they contain, but rather for natural beauty or lack of resource value (Soule and Noss 1998, Soule and Terborgh 1999). Because of this ad hoc approach to conservation, many ecosystem types are not currently represented in protected areas in the region, especially lowland systems. In addition, this method of selecting areas for conservation similarly does not take the needs of native species into account, such as protection of large units, linked together, to provide for continued viability for process-limited, dispersal-limited, and resource-limited species.

Recently, a number of biologists, conservation activists and Wildlands Project affiliates began to focus on this critical piece of the “puzzle” that links other reserve design projects between the northern Rockies and

the southern Rockies. The urgency to complete comprehensive conservation planning for this region is underscored by “fast-track” oil and gas development ushered in by the Bush administration (TWS 2003), and a number of regional Forest Plans that are coming up for renewal.

There are currently other landscape-scale conservation initiatives underway in the greater Heart of the West Region. Our Wildlands Network Design and Conservation Plan for the Heart of the West is meant to complement ongoing regional efforts by The Nature Conservancy and other Wildlands Project affiliates (i.e., the Yellowstone to Yukon Initiative and the Southern Rockies Ecosystem Project) who have mapped critical areas of habitat with important conservation value along the Rocky Mountains. The Nature Conservancy has recently completed two separate Ecoregional Planning projects for the Heart of the West region. The more recently completed project, which covers the higher elevation regions along the Wyoming-Utah mountains, is a sophisticated computer modeling effort (using the SITES model) that uses the typical 3-track reserve design approach (representation, special element mapping, and focal species analysis) to delineate “portfolio sites” or core areas (Noss et al. 2002). A previously completed ecoregional planning effort for the lower-lying Wyoming Basins involved a rougher estimate of key portfolio sites, based on special elements and representation (Freilich et al. 2001), but not on focal species analysis, and without detailed computer modeling or a vulnerability assessment, as Noss et al. (2002a) utilized.

The Geographic Information System (GIS) analysis presented in this report is in-

## Chapter 1 - Introduction and Background

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tended to build on the progress already made by The Nature Conservancy's ecoregional plan for the Wyoming Basins. We accomplished this by building in critical spatial needs of focal species and current and future threats to the region and by using the SITES model to delineate best core areas. In this document, we feature the results of our intensive analysis for the (primarily) lowland areas in the Heart of the West which match up with the analyses of the highlands for The Nature Conservancy's Utah-Wyoming Mountains Ecoregional Plan (Figure 2.1, next chapter). We believe that the two completed analyses, side-by-side, will together constitute a comprehensive roadmap for protection for the entire Heart of the West region.

The Heart of the West Wildlands Network Design will also complement ongoing wildlands network development in adja-

cent regions by other Wildlands Project affiliates. To the north of the Heart of the West, the Yellowstone to Yukon Initiative is also working on the design of a wildlands network for that project area. To our south, the Southern Rockies Ecosystem Project Wildlands Network is very near completion. The Heart of the West network will essentially serve to link those two Wildlands Project efforts together<sup>3</sup> (Figure 1.6). Our Wildlands Network Design and Conservation Plan should prove useful to land managers faced with on-the-ground management choices, planners who are wrestling with local growth and development, local landowners concerned with wildlife and other conservation issues, biologists charged with inventorying the natural heritage of this region, and conservationists working to preserve biodiversity and wild landscapes in the Heart of the West.



*Calypso bulbosa*

NPS

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<sup>3</sup>Currently, a high priority of the Wildlands Project is reconnecting, restoring, and rewilding the "Spine of the Continent MegaLinkage." The Heart of the West Wildlands Network Design is a key part of this continental vision, linking into a continuum of wildlands networks (Yellowstone to Yukon, Southern Rockies Ecosystem Project) which in turn links into others, and eventually will be connected into one "megalinkage" along the Rocky mountains, from Mexico through Canada.

# Chapter 1 - Introduction and Background

*The mission of this effort to craft and implement a comprehensive wildlands network design for the Heart of the West is to help heal the many wounds plaguing this region.*



Figure 1.6 The greater Heart of the West region, the Southern Rockies Wildlands Study area, and the Yellowstone to Yukon study area. All three projects are Wildlands Project affiliates.

## Chapter 1 - Introduction and Background

### 1.5 Ecological Wounds

Aldo Leopold wrote:

*“One of the penalties of an ecological education is that one lives alone in a world of wounds... An ecologist must either harden his shell and make believe that the consequences of science are none of his business, or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise.”*

(Leopold 1972)

The mission of this effort to craft and implement a comprehensive wildlands network design for the Heart of the West is to help heal the many wounds plaguing this region. Whereas the core of the Yellowstone region is arguably one of the best protected natural areas in North America, that protection does not extend to the low-lying basins south and east of the Park that are vital to wildlife. Nor does this protection extend through the Utah-Wyoming Mountains, where places such as the High Uintas wilderness are grazed by tens of thousands of domestic sheep.



*Claytonia sp. - Spring Beauty*

NPS

Viewed from the air, some of the obvious impacts of human activities in the Heart of the West are roads and the resulting habitat fragmentation. Logging still has considerable impacts in the region as well, especially in National Forests. And of course, one of the chief surface land uses today is livestock grazing; outside of the National Parks, most of the basins are currently grazed by cattle. Activities related to energy extraction are also serious threats to wildlife in the Heart of the West. Although it has so far escaped ecological ruin, massive industrial efforts now underway to extract large amounts of coal, natural gas and coalbed methane will have significant impacts on the region. In addition, hard rock mining, water diversions, residential subdivisions and roading attendant to all these activities is dissecting this large expanse into smaller, disconnected patches, as is the case in much of the United States.



*Arctostaphylos uva-ursi - Kinikkinik*

NPS

## Chapter 1 - Introduction and Background

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### The Six Major Wounds in the Heart of the West<sup>4</sup> are:

#### Loss and Decline of Species

Many species of native animals—especially carnivores and keystone rodents—have been extirpated or greatly reduced in numbers. This can have considerable ramifications; for example the depletion of beaver has significant consequences for stream flow, nutrient retention, streambank morphology, and riparian vegetation.

#### Loss and Degradation of Ecosystems

Watersheds, stream channels, and riparian forests have been quite damaged. Beginning in the 1870s with cutting for mine timbers, railroad ties, and firewood and continuing to the present day with industrial logging operations, many headwater forests have been degraded. Since the 1880s, due to grazing by domestic livestock, grasslands, woodlands, forests, and desert scrubland have been deeply wounded.

#### Loss and Decline of Natural Processes (Disturbance)

More than a century of fire suppression has eliminated a natural disturbance regime vital to the integrity and function of forest, woodland, and grassland ecosystems. With the extermination or decline of large carnivores, vital top-down regulation of prey species has lessened. Through degradation of watersheds and flood-control engineering, natural flooding and other hydrological processes have been lost. Another major process that has been significantly reduced in this area is regional and continental-scale transfer of energy and nutrients. 150 years ago there were huge populations of Rocky Mountain locusts and bison that would move carbon and nutrients between the Great Plains and the Heart of the West - now they're gone. Salmon performed the same service



Limber Pine

NPS

between the Heart of the West and the north Pacific (even though salmon likely infrequently entered the area along the Snake River, their energy and nutrient pulses still probably affected our study area as large animals moved marine carbon across the Continental Divide).

#### Fragmentation of Habitat

The region has been fragmented by roads, dams, and other works of civilization, potentially isolating wide-ranging species in nonviable habitat islands.

#### Invasion by Exotic Species and Diseases

Aggressive and disruptive exotic species, both plants and animals, have invaded or been purposefully introduced, threatening ecosystem integrity and the survival of individual species.

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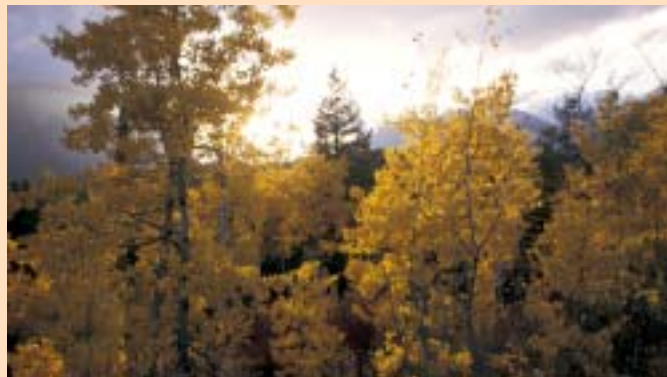
<sup>4</sup>These wounds are adapted from Wildlands Project's general wounds (Foreman et al. 2003).

## Chapter 1 - Introduction and Background

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### Pollution

Forest insect spraying, mines, feedlots, smelters, power plants, automobiles, and urban areas have spread biocides, heavy metals, toxic wastes, and chemicals in the air, land, and water, affecting species, ecosystems, and climate. Historically and today, there are considerable amounts of deliberate poisoning of carnivores and prairie dogs, with concomitant effects of these poisons on other organisms.



Aspen

NPS

Each of these wounds has more than one cause, and several of the causes contribute to more than one wound. The overall impact of these wounds is greater than their sum and they are highly interactive. Among the specific causes of these wounds are (in no particular order):

- Overhunting, overfishing, and trapping (including poaching).
- Predator and “pest” extermination (shooting, poisoning, trapping).
- Livestock grazing.
- Logging and fuelwood collection.
- Mining (mineral extraction)
- Energy exploitation (oil and gas exploration and development)
- Off-road vehicle abuse.
- Urban, suburban, and “ranchette” sprawl.
- Agriculture (cultivation or farming)
- Expansion of non-native species.
- Road building (usually related to one or more of the other stressors listed here).
- Fire suppression.
- Dam construction.
- Irrigation diversions.
- Groundwater depletion.
- Channelization of streams and rivers.
- Fencing.
- Biocides.
- Global warming.
- Human overpopulation and overconsumption (the fundamental cause).

As stated previously, many of the wounds plaguing the Heart of the West, such as habitat fragmentation, are caused by more than one stressor. For example, habitat fragmentation is currently being caused by many of the above land uses in the region, including logging, energy drilling/development, urban/suburban development and sprawl, road building, dam building, and fencing. In addition, a single species of wildlife is not likely to be negatively impacted by all of these stressors. For instance, again using the example of habitat fragmentation, a species of amphibian will be negatively impacted by dams, a forest carnivore by logging, and a lowland ungulate species by fencing. Thus, the mission of the Heart of the West Wildlands Network Design effort aims to heal all the wounds suffered by the region,<sup>5</sup> regardless of the stressor or the individual systems, communities and species that are perhaps suffering most.

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<sup>5</sup> We wish to stress that the mission of the Heart of the West effort is NOT to completely do away with the 20 various stressors mentioned above. Rather the mission and goals of this effort lead us to determine how many of these uses (i.e. grazing, ORV use, energy development, etc. can occur in a fashion that is sustainable and complementary with the Heart of the West wildlands network and this conservation plan.

## Chapter 1 - Introduction and Background

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### 1.6 Mission, Goals and Objectives of this Conservation Plan

Conservation planning is not value free (Franz 2001, Lackey 2001). With this in mind, our Heart of the West planning team crafted this project's mission, goals and objectives to reflect our values, and the values and desires of others who live in this place and manage its many resources.

#### 1.6.1 Mission

Our hope in this effort is to heal the wounds of the Heart of the West by protecting and restoring biodiversity and ecological integrity throughout the Heart of the West Region of northeast Utah, southeast Idaho, western Wyoming and northwest Colorado by designing and implementing a wildlands network made up of core protected areas and linkages. Our mission is to restore and promote the health and productivity of the land in the Heart of the West, and sustain the communities (plant, animal, and human) dependent on those lands. The indicators of the health of the land include functioning ecological processes, and maintenance of biodiversity.

#### 1.6.2 Goals

Each of our established six goals is tied to halting and healing a major wound, as identified above:

##### Goal 1:

Viable populations of all native plants and animals (including some that have been extirpated) within the Heart of the West are protected and restored.

##### Goal 2:

Sufficient amounts of all habitat types protected from further degradation and loss.

##### Goal 3:

All ecological and evolutionary processes are protected and restored.

##### Goal 4:

Land is protected from further fragmentation. Functional connectivity for wide-ranging species native to the region is protected and restored.

##### Goal 5:

The spread of exotic species is prevented. Reduced distribution and abundance of exotics, with the ultimate goal of elimination.

##### Goal 6:

Further introduction of ecologically destructive pollutants into the region is prevented or reduced.



Porcupine

NPS

## Chapter 1 - Introduction and Background

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### 1.6.3 Objectives.

#### ...for Goal 1:

- Focal species populations and special element species and communities maintained via the identification and protection of core areas and important landscape linkages.
- Certain native species whose presence is key to properly functioning systems and communities are reintroduced or otherwise recovered.

#### ...for Goal 2:

- All major vegetation types in the region are represented within the Wildland Network.
- Key aquatic habitats that support aquatic focal species are identified, protected and restored.

#### ..for Goal 3:

- Core areas are large enough to accommodate natural disturbance regimes and a full complex of interacting species and communities.
- Practices which should be restricted from core areas because they tend to hinder ecological processes (i.e. predator control, livestock grazing, dam building, fire suppression...) are carefully defined.

#### ...for Goal 4:

- Natural linkages between core areas that will serve the greatest number and diversity of native species are identified and protected.
- Practices which should be restricted from linkages because they tend to reduce connectivity and species movement (i.e. road building, logging) are carefully defined.

#### ...for Goal 5:

- A program to control and prevent spread of exotics within designated core areas, and minimize or prevent new introductions in these areas is implemented.

#### ...for Goal 6:

- Closure and remediation of polluting mines/drilling sites within core areas, and discouragement of additional mining and oil and gas development within these areas.
- Restoration of river ecosystems and other water bodies that have been polluted by mining/drilling activities.

The above Goals and Objectives can be achieved by designing and implementing a wildlands network with strategically placed cores and linkages of adequate size and width, and by implementing the management and restoration objectives outlined in this Conservation Plan.<sup>6</sup> If we can achieve these goals, we can restore integrity to ecological systems and safeguard the rich biodiversity of the Heart of the West region.

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<sup>6</sup>Specific implementation steps and restoration recommendations are detailed in the Implementation Section (chapter 5).



# Heart of the West Conservation Plan

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Wild Cow Creek, Medicine Bow

Biodiversity Conservation Alliance

## Chapter 2 Methods for Creating the Wildlands Network

Below, we describe the study area that was used to perform GIS analysis for the Heart of the West Wildlands Network, outline our specific approach to reserve design and conservation planning, describe the SITES computer model and how we applied it in

this conservation planning exercise, and outline the steps taken to produce a “final” wildlands network for the Heart of the West. In addition, we discuss the role of expert review in this process, as well as assumptions and limitations of our analysis.

### 2.1 Study Area

While the “greater” Heart of the West encompasses both the Wyoming Basins Ecoregion and the mountains that surround the basins (Figure 1.1, previous chapter), we chose to limit our study area for the GIS analysis to the land area not already included in The Nature Conservancy’s recent ecoregional plan for the Utah-Wyoming Mountains (Noss et al. 2002), which encompasses most of the mountainous regions within the greater Heart of the West (Figure 2.1). Our work complements The Nature Conservancy’s (TNC) Ecoregional Plan for

the Wyoming Basins Ecoregion, which did not utilize focal species analyses, connectivity modeling, threats or the SITES model.

We used a GIS to clip the lower-lying basins and other parts of the Greater Heart of the West region (i.e., a small portion of the southern Rocky mountains) not included by Noss et al., and focused our GIS analysis on this area (Figure 2.2). In the remainder of this report, we refer to our study area upon which GIS analysis was performed as the “lowland study area,” and the resulting

## Chapter 2 - Methods for Creating the Wildlands Network

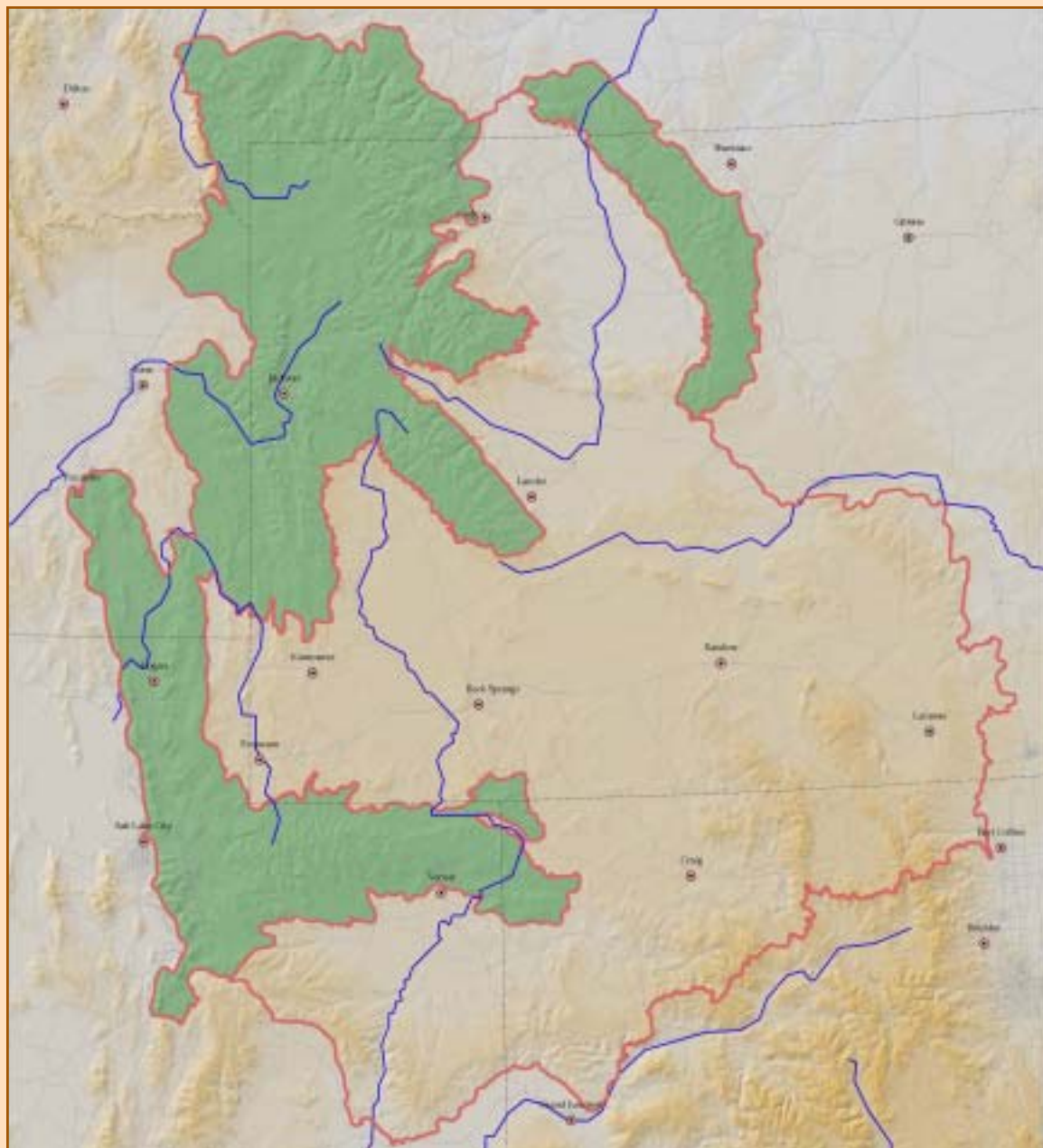


Figure 2.1 The Nature Conservancy's Utah Wyoming Mountain study area – the mountainous region of the greater Heart of the West region

wildlands network as the “lowland Wildlands Network.” One of the goals of this strategy is to link our completed lowland Wildlands Network with TNC’s ecoregional plan for the Utah-Wyoming Mountains. We anticipated that our completed lowland Wildlands Network Design would be

congruent with this ecoregional plan, since development of our Wildlands Network followed methods nearly identical to that of Noss et al. (2002). The results of Noss et al.’s ecoregional plan are included as a full exhibit in Appendix A.<sup>1</sup>

<sup>1</sup> The full appendix, because of its length, is only available on the CD version of this report. Noss et al.’s report can be obtained from the authors or The Nature Conservancy.

# Chapter 2 - Methods for Creating the Wildlands Network



Figure 2.2 Our clipping coverage for GIS analyses – the lowlands Heart of the West study area

## Chapter 2 - Methods for Creating the Wildlands Network

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### 2.2 Our Approach to Conservation Assessment and Reserve Design

#### 2.2.1 Three-track Approach

The framework for conservation planning for the Heart of the West lowland study area applies the core/linkage model. To determine the location and size of core areas and linkages, we integrate three basic planning approaches<sup>2</sup> that scientists have adopted over the last several decades to identify areas for protection (Noss and Cooperrider 1994, Noss et al. 1999a):

- representation of all regional habitats, or vegetative community types, within a network of core areas,
- identification and protection of special elements, such as rare species occurrences, “biodiversity hotspots,” intact riparian zones, etc.,
- identification and protection of key habitat of (focal) species that serve critical ecosystem roles and/or whose presence is indicative of healthy, functioning systems.

Together, these three elements comprise a comprehensive approach to conservation planning. Representation of all regional habitats within the wildlands network design is an example of a “coarse filter” approach to biological conservation (Groves et al. 2000). The idea behind a coarse filter approach to conservation is that if you “catch” large representative pieces of habitat in your “filter” of conserved lands, you will also “catch” many of those individual species that rely on these same habitats. One assumption of this strategy is that populations of species that rely on these habitats will remain healthy if adequate amounts of the habitat types are protected within the region. One

advantage of using a coarse filter approach is that habitat (or vegetation type) spatial data is easy to obtain and map, as opposed to demographic data on the myriad of species that rely on those habitat types. Though few empirical studies have explicitly demonstrated that representation analysis leads to increased species viability, The Nature Conservancy estimates that 85% to 90% of all species in a region can be protected through a coarse filter approach (Noss et al. 2002). Another reason to utilize a land cover representation approach is that, currently, there is not representation of all the Heart of the West lowland vegetation types in existing GAP 1 and 2 status lands (Table 2.1).

Identification and conservation of special elements in a region is an example of a “fine filter” approach to conservation planning. In our case, rare species occurrences are mapped and used to help delineate core areas. The fine filter approach complements the coarse filter approach; species that “fall through the cracks” of the coarse filter - such as narrow endemics - can be protected through the fine filter of special element mapping.

Representation of a species or a habitat type in a wildlands network will by itself not necessarily ensure that species will persist in a region. This acknowledgment leads to the third element in our conservation planning approach: focal species mapping. Focal species are organisms that can be used in planning and managing reserves because their requirements

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<sup>2</sup> The core/linkage model and 3-track approach is also invoked by Noss et al. (2002) in the Ecoregional Plan for the Utah-Wyoming Mountains in the upland portion of the Heart of the West. We followed Noss et al.’s methods as closely as possible in our approach.

## Chapter 2 - Methods for Creating the Wildlands Network

for survival represent factors important to maintaining the natural state of the entire region (Miller et al. 1999). They play an important role in wildlands network design because ultimately, questions about ecological patterns and processes cannot be answered without reference to the species that live in that landscape (Lambeck 1997). Representation analysis and high densities of special elements point to areas which should be considered in a reserve, but focal species analysis identifies additional high-value habitats and addresses the questions, “how much area is needed?,” “what is the quality of habitat?” and “in what configuration should we design core areas?” (Miller et al. 1999).

Our focal species approach is tailored to the specific landscape-level issues at play in the Heart of the West, as well as the ecosystems it incorporates, and to our goals for the Heart of the West Wildlands Network. Although there are many different “types” of focal species typically used in reserve design approaches

to landscape conservation (e.g. “flagship” and “umbrella” species, etc.), we use only three broad types of focal species in our planning process: habitat quality indicators, keystone species, and foundation species.<sup>3</sup> Although some of our focal species may act as a flagship species in our implementation campaign for the Wildlands Network, none were chosen solely for this reason.

Indicator species are a very helpful tool to use in the design of a wildlands network. There is evidence that certain species can serve as indicators of areas of high biodiversity (Humphries et al. 1995, Caro and O’Doherty 1999, Chase et al. 2000), and that certain guilds (e.g. woodpeckers) are useful in predicting diversity of larger groups (e.g. forest birds, Mikusinski et al. 2001). Indicator species are tightly linked to properly functioning habitats (Welsh and Droege 2001), which may in turn be critically important for a host of other species dependent on that same habitat. If we capture the habitats of key indicator species in a wildlands network, these same species can offer a

**Table 2.1 - An example of some of the land cover types that are currently under-represented in protected areas in the lowland study area.**

|                                      | Playa | Salt Desert | Mixed Grass Prairie | Lowland Riparian | Mesic Upland Shrub | Deciduous Oak | Pinion Juniper |
|--------------------------------------|-------|-------------|---------------------|------------------|--------------------|---------------|----------------|
| Total Hectares in Lowland Study Area | 9,900 | 1,437,563   | 700,798             | 189,450          | 173,966            | 469,782       | 1,469,746      |
| Hectares of Each Type in GAP 1/2     | 61.5  | 12,314      | 12,213              | 6,065            | 5,493              | 15,443        | 186,363        |
| % of Each Type in GAP 1/2            | 0.60% | 0.90%       | 1.70%               | 3.20%            | 3.20%              | 3.30%         | 12.6%          |

<sup>3</sup>Foundation species, like keystone species, enrich ecosystem function in a unique and significant manner, but which occur in much higher numbers (i.e. prairie dogs, salmon, and bison).

## Chapter 2 - Methods for Creating the Wildlands Network

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future barometer of success of the implemented network. Since most indicator species are sensitive to human disturbance and ecological change (Burdick et al. 1989, Stolte and Mangis 1992), the presence or absence of these species within (protected) cores and linkages in the Heart of the West Network can be used to assess conservation goals such as maintenance of ecosystem integrity and ecological health (Welsh and Droege 2001).

Keystone and foundation species are also good focal species around which to build a wildlands network. Keystone species exert critical effects on a system through various interactions and processes. These include, but are not limited to, dispersal, competition, mutualism, pollination, and by “engineering” or otherwise modifying habitats (Menge et al. 1994, Power et al. 1996, Jeo et al. 2000). Because of the important role keystone species play, by definition, in their respective communities, they - and their habitats - are perhaps the most crucial element to include in the design of a wildlands network. Foundation species, like keystone species, enrich ecosystem function in a unique and significant manner, but occur in much higher numbers (e.g. prairie dogs, salmon, and bison). The loss of keystone or foundation species in a system can trigger cascades of direct and indirect changes, usually on more than one trophic level (Soule and Noss 1998).

Often, apex predators can play a keystone species role where these top-level carnivores make substantial contributions to ecosystem function. Top predators have been shown to play a key role in systems where they exist by maintaining ecosystem structure, diversity, and resilience through “top-down” effects through various trophic levels (Estes et al. 1978, 1998;

Terborgh 1988; Henke and Bryant 1999). The disappearance of apex predators in a region can cause acute changes in that system, many of which can lead to loss of species in the area (Mills et al. 1993, Berger et al. 2001). Most frequently this involves release of herbivores from predation pressure, which in turn exerts unnatural pressure on plant communities, often resulting in biotic simplification (Terborgh et al. 1999). But reduced diversity can also result from the “Paine effect,” or reduced diversity of competitive herbivores after the loss of the apex predator (Paine 1966), or “meso-predator release” which can result in noticeable declines of smaller prey species (Soulé et al. 1988, Palomares et al. 1995). Meso-predator release involves a striking increase in smaller predators (called meso-predators), chiefly because the top predators would normally prey upon and inhibit the foraging of these smaller predators. This increased abundance can negatively affect smaller prey animals such as birds (Cote and Sutherland 1997, Terborgh et al. 1999).

Focal species are used in three ways in the development of our Heart of the West Wildlands Network and this Conservation Plan: 1) to directly inform GIS (Geographic Information System) development of the lowland Wildlands Network, through habitat suitability maps that are overlaid with other map layers to help delineate cores and linkages, 2) to use a retrospective approach (Mehlman 1997) to determine whether the proposed lowland Wildlands Network includes the general range of the focal species and whether linkages have widths that are functional for that species, and 3) as a monitoring mechanism (indicator species only) for the completed - and implemented - Wildlands Network, by testing whether the Network

## Chapter 2 - Methods for Creating the Wildlands Network

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and its associated management recommendations for cores, linkages, focal species and their habitats are tending to maintain, preserve, and/or increase populations of these important ecological indicator species. Some of the focal species will fall under more than one of these three categories of Wildlands Network Design/Conservation Plan development. Additionally, we make management recommendations for all of our focal species.<sup>4</sup>

We chose this three-track approach – representation analysis, special element mapping, and focal species analysis – because there are weaknesses inherent in each of the three methods, and relying on only one or two of these approaches may not provide sufficient protection for a large region. For example, representation analysis (when done in a coarse manner) usually treats all vegetation types as equal, where the goal is to protect some arbitrary amount of each type of habitat within a wildlands network. Special element map-

ping does not take spatial needs of the species being mapped into account. And focal species analysis usually assumes that the species being modeled can act as an adequate surrogate for many other, smaller-bodied species that use similar habitat. However, empirical research has shown that this is not always the case (e.g. Kerr 1997, Bonn et al. 2002, Lindenmayer et al. 2002). Furthermore, we have not tested whether our suite of focal species is the most complementary set of species possible. By combining the three tracks of conservation planning strategies, we aim to capitalize on the strengths of each and rely on some measure of redundancy among the three approaches to ensure that large enough cores of the most ecologically significant areas are protected within the Heart of the West. In addition, by purposely including redundancy in this conservation planning exercise, we are also invoking the precautionary principle in our work. We address this principle later in this chapter.



**American Marten**

**NPS**

<sup>4</sup>These management recommendations are included in the Focal Species Accounts (Appendix B).

## Chapter 2 - Methods for Creating the Wildlands Network

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### 2.2.2 Core/Linkage Model

Most conservation plans propose some sort of zoning system to achieve their conservation goals. We use an extension of the biosphere reserve concept (UNESCO 1974),<sup>5</sup> referred to as the core/linkage model, as refined by Noss (Noss and Cooperrider 1994, Noss et al. 1997, Soulé and Noss 1998), publicized by the Wildlands Project (Noss 1992, Trombulak 1996), and used in conservation planning projects by many researchers and conservation planners (Hunter et al. 1999, Jeo et al. 2000, Foreman et al. 2000, Long et al. 2002, Foreman et al. 2003). We adopted this model, which features protected wilderness cores and natural landscape linkages.

Core areas are defined as wilderness, or wilderness-like areas, managed so as to maintain ecological processes and biodiversity within them. Cores serve as the “backbone” of a wildlands network and are designated to protect those landscape features that are either under-represented elsewhere, critical for focal species viability, or are nearly irreplaceable in terms of their rare and important biota. Core areas can be comprised of either private or public land, and selectively allow for human uses that are compatible with maintenance of ecosystem health and ecological processes (e.g. hunting, fishing, hiking, research, etc.). While core areas ideally are not subject to invasive management techniques (e.g. reseeding, prescribed burning, plantings, biological pest control, etc.), in the short term, limited active management of cores may be desirable in order to restore natural processes upset by past human alterations to the landscape.

Though the size of core areas is typically determined by the dimensions of existing roadless areas and needs of key focal species, as a rule core areas should be large because:

- wide-ranging species require large areas to meet all their life-history requirements,
- ecological disturbances (such as fire) can best be restored in large areas,
- the dynamic, nondeterministic character of natural communities requires protection and restoration of large areas in order to promote the long-term viability and adaptability of populations and communities (Simberloff et al. 1999).

Linkages are helpful in overcoming the effects of habitat fragmentation in a region. They serve to link core areas so wildlife can move between them (Mech and Hallett 2001), while also allowing evolutionary and ecological processes (e.g. fire, succession, predation, etc.) to continue operating within an otherwise fragmented system. By ensuring that plants and animals have unsevered connections to other population centers, linkages can prevent or mitigate deleterious population-level effects resulting from isolation - such as inbreeding, low genetic diversity, and extirpation (Noss 1983, Harris 1984, Dobson et al. 1999), and may actually increase the population sizes, viability, and movement of habitat-restricted species (Noss and Cooperrider 1994, Haddad 1999, Haddad and Baum 1999).

Compatible use areas are areas outside cores and linkages, are often located on public lands, and are ideally lightly roaded and adjacent to core areas. We recommend

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<sup>5</sup> The biosphere approach uses core areas surrounded by one or more types and use-intensities of buffer zones. One function of these buffers might secondarily be to provide linkage among cores.



## Chapter 2 - Methods for Creating the Wildlands Network

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that compatible use areas only be subjected to low-intensity uses such as recreation, hunting, light livestock grazing, selective logging, and limited oil and gas development. In general, human use in these areas is practiced in deference to the needs of the natural ecosystems and communities.

Compatible use areas can serve to 1) ameliorate edge effects on core areas, 2) provide a suitable habitat matrix for animals to move between core areas, and 3) provide supplemental habitat for populations of native species inhabiting core areas (Foreman et al. 2000).



Flat Top

Erik Molvar

### 2.2.3 The Precautionary Principle

This exercise in conservation planning is conducted under the auspices of the Precautionary Principle. This principle suggests that it is more favorable to err on the side of protecting too much habitat than too little. We invoke this principle against a backdrop of uncertainty and incomplete data. The Precautionary Principle leads us to act in a manner that accounts for uncertainty by trying to avoid results that preclude future options. Basically, the less we know, the more cautious we need to be. As scientists who acknowledge the inherently stochastic nature of the

communities and systems we are studying, we underscore that conservation planners and managers need to make every effort to err on the side of caution, and incorporate wide margins of safety to guard against loss of healthy ecosystems or ecological processes.

## Chapter 2 - Methods for Creating the Wildlands Network

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### 2.3 The SITES Model

In developing this Wildlands Network, we sought to identify core areas within the Heart of the West lowland study area that have the most to lose if not protected. These sites are often irreplaceable. The enormity of the task of delineating core areas and linkages that included our numerous targets (such as special elements and focal species habitat) precluded a manual approach. In addition, we strove to make our analysis as objective as possible. Therefore, we decided to use the SITES model to delineate cores, linkages and compatible use areas. The SITES model was developed for The Nature Conservancy by GIS land-use planning experts, and has been used by the Conservancy to develop ecoregional plans for nine different ecoregions (Andelman et al. 1999). The SITES model is now commonly used by both TNC and The Wildlands Project (TWP), and four different TWP-sponsored wildlands network designs were developed (or are under development) using SITES (Long et al. 2002, Foreman et al. 2003, Miller et al. 2003, this plan).

SITES allows the user to assemble an initial set of conservation targets that best represent a selected set of elements at chosen target levels. The SITES model attempts to minimize reserve design “cost” while maximizing attainment of conservation goals in a compact set of core areas. This set of objectives constitutes the “objective cost function,” in which:

$$\text{Cost} = \text{Area} + \text{Penalty} + \text{Boundary Length}$$

where Cost is the objective (i.e. for core areas to be minimized), Area is the number of hectares in all cores, Penalty is a cost imposed for failing to meet conservation target goals, and Boundary Length is a cost determined by the total boundary length of all core areas (thus causing core areas to be compact and maximizing core to exterior ratios).

#### 2.3.1. Variables in SITES Model

When using the SITES model, the user needs to make decisions regarding the size and number of planning units, the penalty that will be applied to the model for failing to meet conservation target goals, and the value of the boundary length modifier. SITES is a relatively new tool that has been utilized by a rather limited number of users. Thus the knowledge and use of this program is still evolving, and as of yet there is no standard approach to using this tool (Wilmer, in prep). In part, the decisions that must be made (i.e. on planning unit size and boundary length) depend on the size of the study area, goals, and inputs

to the model. To add rigor to our selection process for some of these variables, we applied a sensitivity analysis on two of these variables and corroborated the results with reference data and expert knowledge (Box 2.1). This gave us confidence in the values we chose for these SITES variables in our model.

The entire lowland study area was divided into 15,642 hexagonal planning units of 1,250 hectares (ha) each. We chose this shape over other shapes or entities (e.g. square cells or watershed boundaries) because it provides a relatively smooth

## Chapter 2 - Methods for Creating the Wildlands Network

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### Box 2.1

In order to decide the ultimate size of our planning units and the value of the boundary length modifier (blm) that would be employed in the SITES model, we conducted experimental SITES runs using two different cell sizes (2,500 hectare hexes and 1,250 ha hexes), and three levels of boundary length modifier (0.0001, 0.00015, 0.0002) to see how the outcomes varied in terms of size and placement of cores, "neatness" around the edges, connectivity between cores, and total number of hectares in the Best Solution. We chose these experimental values primarily based on the planning unit sizes and blm values that many of our colleagues used when running SITES. We ran each test run 100 times with 1,000,000 iterations. The results were as follows:

With the smaller (1250 ha) hexes, there is a total of 15, 640 planning units in the study area, and

- when the boundary length modifier (blm) is set at .0001, the Best Solution puts 7,419,400 hectares out of a total 18,654,300 in the study area (39.8% of the total study area) into solution (*map on page 12*)
- when the boundary length modifier (blm) is set at .0002, the Best Solution puts 8,882,200 hectares (47.6% of the total study area) into solution (*map on page 13*)



SITES: 1250 Hectare Planning Units, BLM .0001



SITES: 1250 Hectare Planning Units, BLM .0002

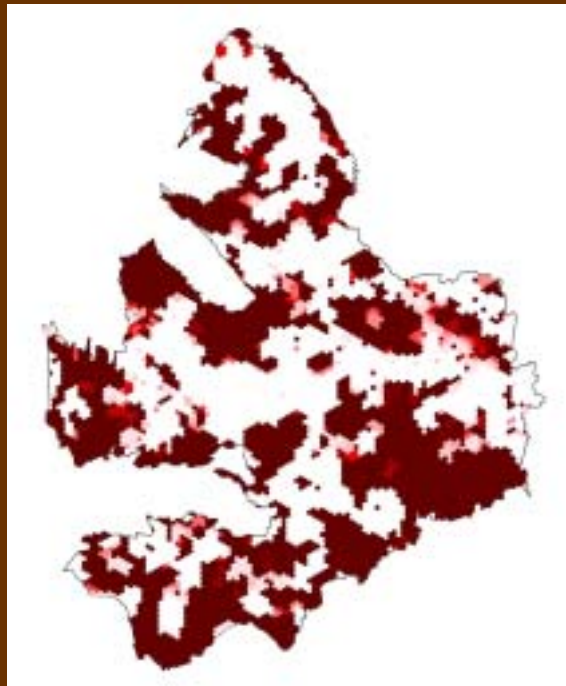
## Chapter 2 - Methods for Creating the Wildlands Network

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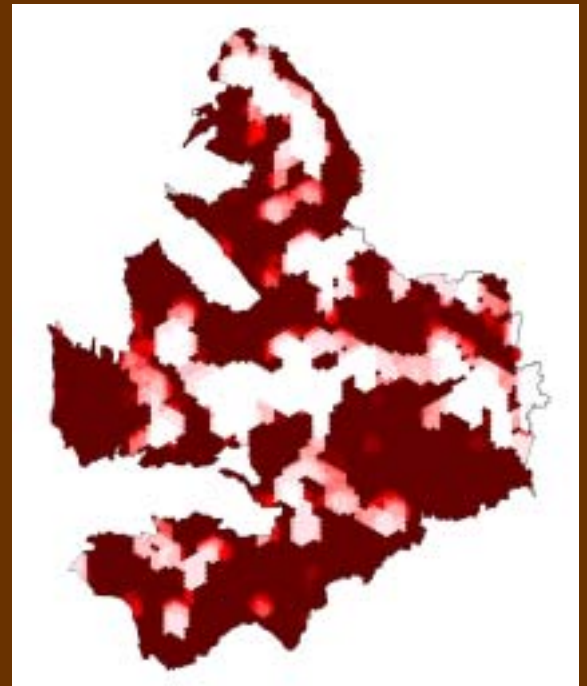
With the larger (2500 ha) hexes, there is a total of 7,940 planning units in the study area, and

- when the boundary length modifier (blm) is set at .0001, the Best Solution puts 9,545,700 hectares (51.2% of the total study area) into solution (*map on page 13*)
- when the boundary length modifier (blm) is set at .0002, the Best Solution puts 12,497,700 hectares (67.0% of the total study area) into solution (*map on page 12*)

One of our findings in this sensitivity analysis was that the same, general areas were picked by every solution to form the basis of cores. Based on this sensitivity analysis, discussions with other experienced users of SITES, and our peer review process, we decided to use the smaller (1250 ha) planning units with the .0001 blm for our SITES run.



SITES: 2500 Hectare Planning Units, BLM .0001



SITES: 2500 Hectare Planning Units, BLM .0002

## Chapter 2 - Methods for Creating the Wildlands Network

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OR Buttes upper Red Desert

Erik Molvar

output (as compared with square cells), approximates a circle - which has a low edge-to-area ratio, and the unit size remains constant (planning units that vary widely in size can present problems for the SITES algorithm). Moreover, if we had used something like watershed boundaries, larger watershed planning units would have been seen by SITES as having a greater cost than smaller ones.

We chose the 1,250 ha. size based on our sensitivity analysis (Box 2.1), and because it was comparable to cell sizes used in SITES analyses in adjacent ecoregions by The Nature Conservancy (TNC 2001) and the Wildlands Project (Miller et al. 2003), and so would allow us to achieve some consistency from area to area. In addition, the 1,250 ha.

planning unit size has an easily measured diameter of 4 km, and provides good resolution for the lowland study area but is still considerably larger than the coarsest input data set. We attempted to keep the number of planning units under 25,000, as SITES outputs can be less reliable where the planning unit number exceeds 25,000 hexagons (Menke, unpublished data).

Another variable unique to SITES is the penalty cost. The SITES algorithm will “try harder” to meet the assigned targets for specific elements if those elements have higher penalty values than the penalty values of other targets. In our model, all elements were assigned the same penalty value of 1.0, so that each planning unit is equivalent in terms of cost and the SITES model is unconstrained in selecting where

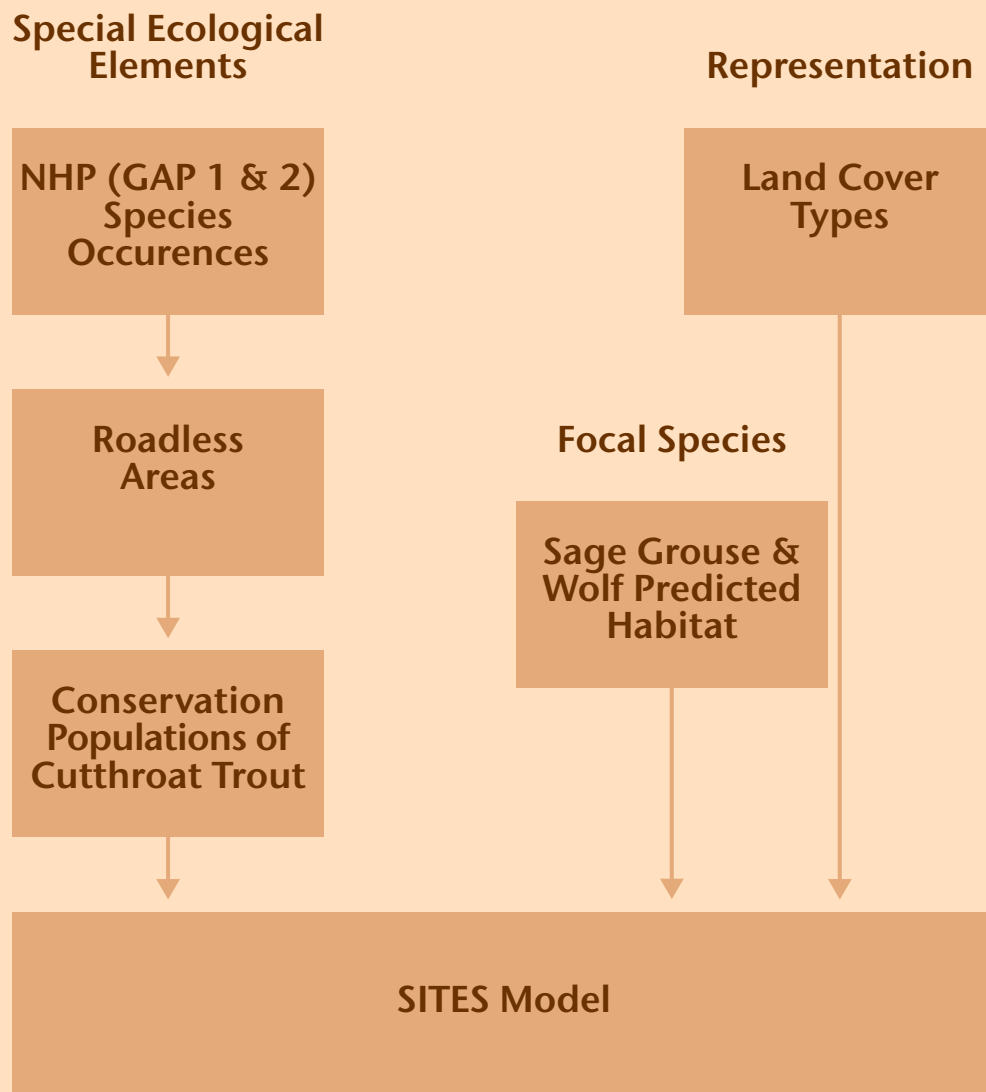
## Chapter 2 - Methods for Creating the Wildlands Network

to achieve its goals. Choosing the penalty value of 1.0 means that all elements had an equal chance of being represented in the final solution at approximately the levels for which we targeted them.

SITES allows users to control the amount of clumping of planning units in the solution. This is accomplished by increasing or decreasing the total length of the solution boundary. This is achieved by setting a

particular value for the boundary length modifier. A boundary length modifier of 0 results in no influence over clumping, and increasing the value results in more clumping of planning units within cores. Based in part on our sensitivity analysis (Box 2.1), and in part on the boundary length modifier used by other SITES users with whom we consulted (Foreman et al. 2003, Miller et al., 2003), we chose a boundary length modifier of 0.0001.

Figure 2.3 A schematic showing how SITES works



## Chapter 2 - Methods for Creating the Wildlands Network

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Our 15,642 planning units were used as the individual units that SITES used to “build” best core areas, linkages and compatible use areas, as SITES sought to include as many of our targets as possible in a minimum-area set of cores. We ran the SITES

model with numerous combinations of input levels, varying each input to assess the outcome based on the following project goals: special elements, under-protected vegetation types, and high-quality habitats for several focal species within the Heart of the West lowland study area.

### 2.3.2. Special Elements

We assembled Natural Heritage Program (NHP) Element occurrence data<sup>6</sup> for the lowland study area from the state Heritage Programs in Wyoming, Montana, Colorado, Utah and Idaho (Figure 2.4). We included 161 plant and 42 animal species in our final list of target species (Appendix C lists all NHP plant and animal species and the target levels we chose). The animal targets included 13 mammals, 7 reptiles, 3 amphibians, 13 birds, and 6 species of fish. This list was derived from The Nature Conservancy’s target list for the Wyoming Basins Ecoregion, plus all S1 and S2<sup>7</sup> species within the Book Cliffs in Utah and the portion of the Southern Rockies that falls within the lowland study area. Using the SITES model, we attempted to target 100% of G1 and G2 occurrences<sup>8</sup>, and 25%-75% of all species occurrences of lower rank to be included in cores and linkages.<sup>9</sup> We selected these target levels based on what Noss et al. (2002) had targeted in the Utah-Wyoming mountains (i.e. 100% of G1 and G2 species), as well as the number of occurrences in the entire study area, and target goals set for the same species in The

Nature Conservancy’s Ecoregional Plan for the Wyoming Basins. Appendix C lists the individual SITES goals for each plant and vertebrate target.

Another special element used in the SITES analysis was stream reaches containing “conservation populations” of cutthroat trout (Figure 2.5). We chose this as a special element because of the importance of cutthroats to stream ecosystems, the fact that they are rare, are indicator species, and also because this element was not likely to have been covered by the terrestrial focal species analyses and land cover representation analysis. Using the SITES model, we targeted 100% of all occurrences of cutthroat trout stream segments.

Due to the important conservation value of roadless areas (Hitt and Frisell 1999, Noss et al. 1999b, Wilcove et al. 2000, Strittholt and DellaSala 2001), we wanted to insure that all roadless areas were included in the final Network. These roadless areas include all existing or citizen-proposed protected areas (Figure 2.6), and all lands

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<sup>6</sup>All GIS data used to generate the SITES model are briefly described in Table 2.2. (page 58)

<sup>7</sup>The Natural heritage Program operates at the state level and catalogues all rare species in the state. Natural Heritage Program S1 designation indicates extreme rarity or other factor(s) making the species especially vulnerable to extinction or extirpation (typically 5 or fewer occurrences or very few remaining individuals or acres) in the state where the list is kept. S2 indicates rarity or other factor(s) making the species very vulnerable to extinction or extirpation (6 to 20 occurrences or few remaining individuals or acres) in the state where list is kept.

<sup>8</sup>A G1 ranking by the Natural Heritage Program means that the species is critically imperiled globally, and a G2 ranking means that the species is imperiled globally.

<sup>9</sup>Using The Nature Conservancy guidelines (Comer 2001, TNC 2001), we corrected for unequal survey efforts for NHP species by capping targets at 25 occurrences.

## Chapter 2 - Methods for Creating the Wildlands Network

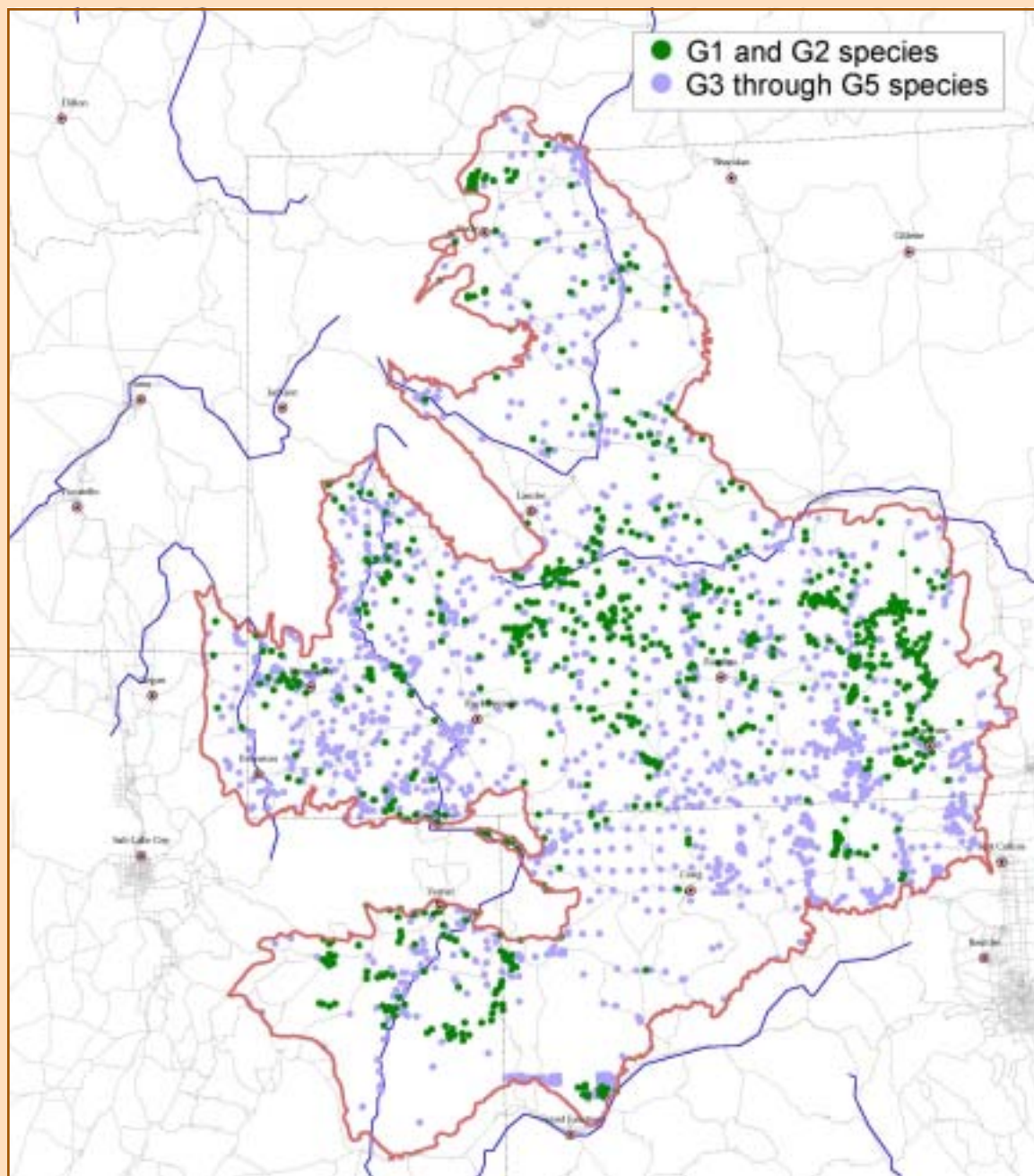


Figure 2.4 Natural Heritage Program Element Occurrences in the Heart of the West study area

with GAP 1 or GAP 2 status. These areas were not fed into SITES in the same manner as the other special elements. Rather, we used the feature in SITES that enabled us to guarantee that all roadless areas were included in the final SITES solution of cores and linkages. This ensured that we captured 100% of this particular target.

We made ten repeat runs in SITES to meet our various goals for these target elements. The number of times planning units were selected for core areas was used to determine irreplaceability of planning units and their inclusion in our final set of cores and linkages.



## Chapter 2 - Methods for Creating the Wildlands Network



Figure 2.5 Conservation population segments for cutthroat trout in the lowlands Heart of the West study area

### 2.3.3 Representation Analysis.

The actual level of representation necessary to ensure, when adequately protected, persistence of any given land cover type depends on many different variables including the overall area occupied by each community type, and the degree of connectivity of the land cover type. Noss and Cooperrider (1994) observed that, “science cannot tell us precisely how many times or in what size reserves each...ecosystem type must be represented to be viable.” We propose, therefore, that representation values be used to identify elements that may be relatively under-represented within the proposed network, and not to speculate what level would provide adequate representation within the network. Thus, we utilized a 25%

representation goal for all community types as recommended by The Nature Conservancy (Appendix C lists the individual targets for each land cover type). This was the same target used by Noss et al. (2002) for the Utah-Wyoming Mountains Ecoregional Plan, although their representation analysis combined both biotic and physical components. All of the community types within the Heart of the West lowland study area are featured in Figure 2.7.

## Chapter 2 - Methods for Creating the Wildlands Network

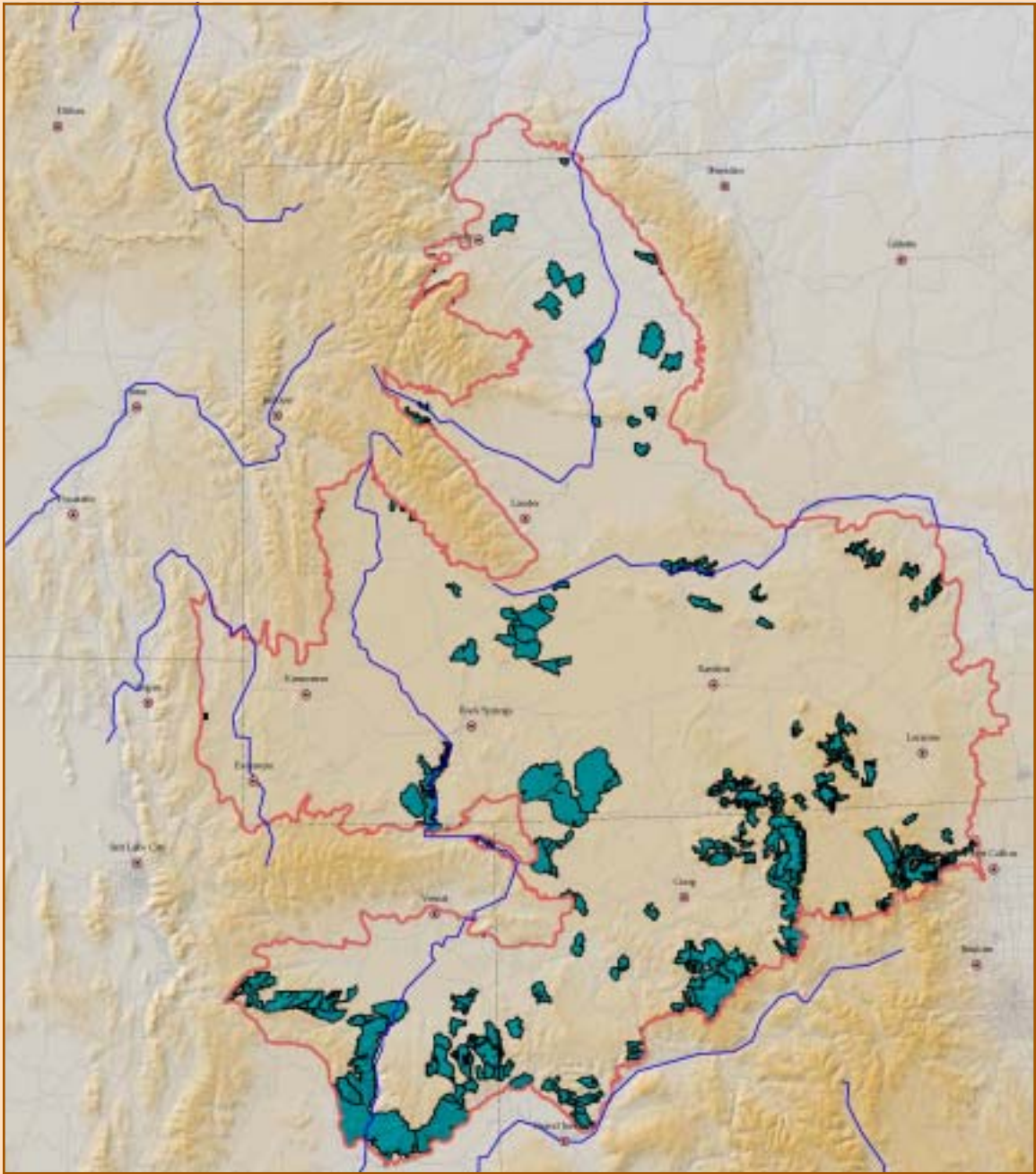


Figure 2.6 Roadless areas in the lowlands Heart of the West study area

## Chapter 2 - Methods for Creating the Wildlands Network

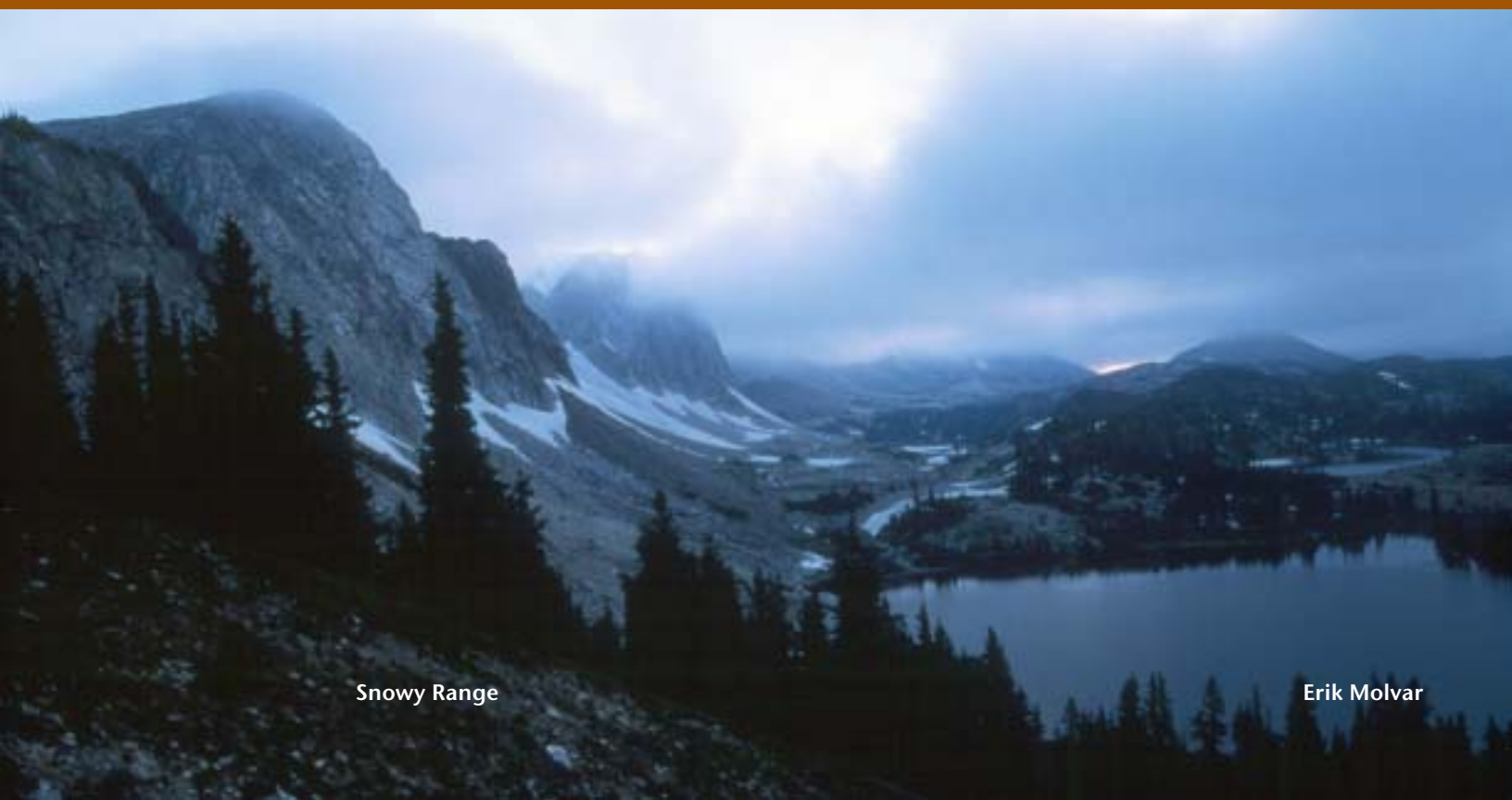
Table 2.2 Spatial data used in the Heart of the West Wildlands Network Design

| Type of data                | GIS data layer                                    | Analysis used in   | Scale Resolution                  | Source  |
|-----------------------------|---|--|-----------------------------------|---|
| Biological/ Landscape (B/L) | Elevation (Digital Elevation Model)               | Wolf habitat model   | 7.5 minute DEM with 30 m. spacing | US Geological Survey  |
| Biological/ Landscape (B/L) | Aspect  | Wolf habitat model   | 7.5 minute DEM with 30 m. spacing | Derived from elevation (US Geological Survey)                     |
| Biological/ Landscape (B/L) | Wolf prey (elk, deer) habitat use data (polygons) | Wolf habitat model   | Multiple (usually 1:100,000)      | Various state fish and game agencies                              |
| Biological/ Landscape (B/L) | Slope   | Wolf and sage grouse habitat models                          | 7.5 minute DEM with 30 m. spacing | Derived from elevation (US Geological Survey)                     |
| Biological/ Landscape (B/L) | Sage grouse habitat (current, historic, etc.)     | Sage grouse habitat model                                    | 1:2,000,000                       | Washington Department of Fish and Wildlife                        |
| Biological/ Landscape (B/L) | Streams/ Hydrology                                | Sage grouse habitat model                                    | 1:100,000                         | National Hydrology Dataset  |
| Biological/ Landscape (B/L) | Land cover (vegetation types)                     | Sage grouse habitat model, and SITES Representation Analysis | 100 m. grid                       | GAP Analysis Program  |
| Biological/ Landscape (B/L) | Cutthroat trout conservation population segments  | Special Elements analysis (SITES)                            | Derived from 1:100,000 data       | Young et al. 1996 (adapted by Biodiversity Conservation Alliance) |
| Biological/ Landscape (B/L) | NHP Element Occurrences                           | Special Elements analysis (SITES)                            | Various                           | Various State Natural Heritage Programs                           |

## Chapter 2 - Methods for Creating the Wildlands Network

Table 2.2 Spatial data used in the Heart of the West Wildlands Network Design  
*continued*

| Type of data                              | GIS data layer                | Analysis used in   | Scale Resolution   | Source   |
|---|-------------------------------|--|--|--|
| Anthropogenic/<br>Human impact layers (H) | Road density<br>(TIGER data)  | Wolf habitat<br>model  | Usually 1:100,000<br>but used 1:24,000<br>where available      | U.S. Census Bureau and<br>state data clearinghouses                            |
| Anthropogenic/<br>Human impact layers (H) | Oil and Gas wells             | Sage grouse<br>habitat model,<br>and<br>Irreplaceability<br>Analysis | Usually 1:24,000;<br>some datasets to<br>nearest Section       | Various state oil and gas<br>divisions   |
| Anthropogenic/<br>Human impact layers (H) | Roadless Areas<br>(polygons)  | Special Elements<br>analysis (SITES)                                 | Various (most<br>coverages<br>digitized from<br>1:24,000 maps) | GAP Data, citizen roadless<br>inventories, BLM and USFS<br>Roadless Data       |
| Anthropogenic/<br>Human impact layers (H) | Future oil and<br>gas threats | Irreplaceability<br>Analysis   | Various  | Various oil and gas project<br>data from BLM, energy<br>companies and partners |



## Chapter 2 - Methods for Creating the Wildlands Network

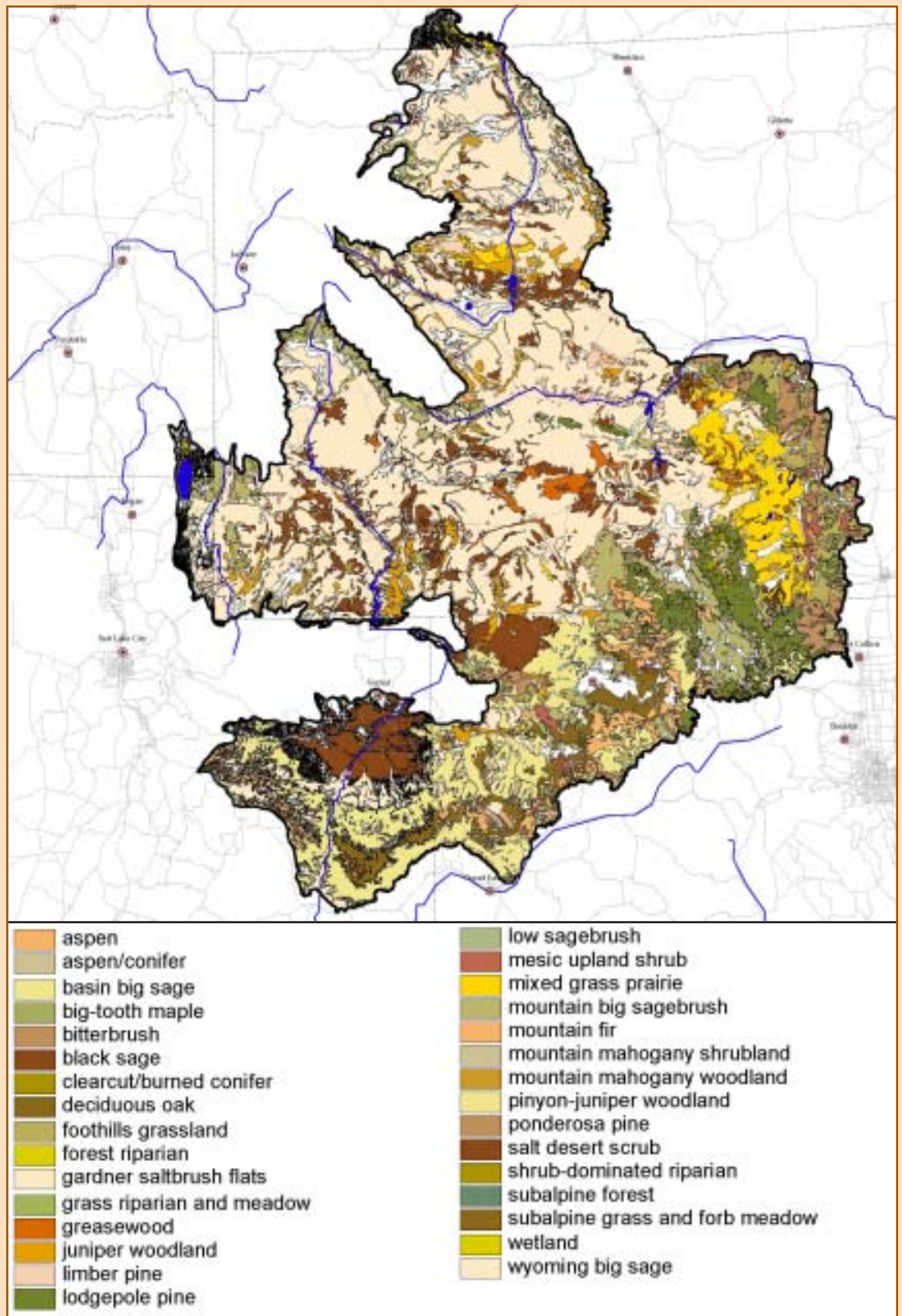


Figure 2.7 Vegetation types in the lowlands Heart of the West study area

## Chapter 2 - Methods for Creating the Wildlands Network

### 2.3.4. Focal Species

Our suite of focal species was selected to achieve a balance of both habitat quality indicators and keystone species represent-

ing all the principal community types within the greater Heart of the West region<sup>10</sup> (Table 2.3).

**Table 2.3 Focal species used in the greater Heart of the West Wildlands Network Design effort**

| <b>Focal Species or Guild<sup>1</sup></b>   | <b>Landcover Association</b> | <b>Type of Focal Species</b> | <b>Justification</b>   |
|---|------------------------------|------------------------------|--|
| native cutthroat trout (Yellowstone, Colorado River, Bonneville, Greenback subspecies)            | aquatic                      | habitat quality indicator    | Recovery and protection of native cutthroats would help achieve goals such as stream restoration and watershed connectivity.   |
| lowland chubs/suckers (Utah, roundtail, and leatherside chubs; bluehead and flannelmouth suckers) | aquatic                      | habitat quality indicator    | These species exist in smaller tributaries, and in greater numbers and in more parts of the study area than other focal fish guilds, and are good indicators of natural flow regimes . |
| endangered Colorado River fish  | aquatic                      | habitat quality indicator    | Recovery and protection of these fish would help achieve goals such as stream restoration and watershed connectivity.  |
| beaver  | riparian/aquatic             | keystone species             | These are a critical keystone species in riparian zones. Recovery and protection of beaver would achieve goals such as riparian restoration and connectivity.                          |
| river otter   | riparian/aquatic             | habitat quality indicator    | This species has been shown to accumulate contaminants, and they prefer in-stream structure found in relatively undisturbed systems.   |
| white-tailed prairie dog  | grasslands                   | foundation species           | Habitat used, and modified, by this species serves a myriad of others, and prairie dogs also serve as ecosystem regulators.  |
| bison   | grasslands                   | foundation species           | Bison have an important, and disproportionate effect on grassland ecosystems, and their recovery will signal recovery of degraded grasslands.  |

<sup>10</sup> We adopted most of the same focal species used by Noss et al. in their SITES model for The Nature Conservancy's Utah-Wyoming Mountains ecoregional plan, along with those that chiefly represent the lower elevation habitats within our lowland study area.

## Chapter 2 - Methods for Creating the Wildlands Network

Table 2.3 Focal species used in the greater Heart of the West Wildlands Network Design effort - *continued*

| Focal Species or Guild <sup>1</sup> | Landcover Association                                  | Type of Focal Species                           | Justification  |
|-------------------------------------|--|---|--|
| sage grouse                         | sagebrush (sage/bunchgrass)                            | habitat quality indicator                       | One of the best representative species for sagebrush ecosystems, and good conservation target to indicate grazing impacts                        |
| goshawk                             | coniferous forests                                     | habitat quality indicator                       | Protection of highly suitable (open forest) goshawk habitat could help achieve goals such as restoration of a more natural fire regime.          |
| boreal owl                          | coniferous forests                                     | habitat quality indicator                       | Good indicator of mature, and old growth, forests  |
| lynx                                | coniferous forests                                     | habitat quality indicator                       | This species is especially vulnerable to human threats/presence, and uses different habitat types within forests                                 |
| American marten                     | coniferous forests                                     | habitat quality indicator                       | This species is especially vulnerable to clearcuts. Recovery and protection of pine marten would help achieve goals such as forest connectivity. |
| wolverine                           | coniferous forests                                     | habitat quality indicator                       | This species is very wide ranging within forests, and uses rock outcrops/rocky cirques for den locations (unlike lynx).                          |
| bighorn sheep                       | rocky outcrops, canyons and cliffs                     | habitat quality indicator                       | Study area was the heart of historic bighorn sheep range, and they are sensitive to disturbance  |
| gray wolf                           | Habitat generalist found in more than one habitat type | keystone species                                | Wolves are an apex predator, and are one of the key large carnivores in the study area that we expect to use the Heart of the West linkages      |
| grizzly bear                        | Habitat generalist found in more than one habitat type | keystone species, and habitat quality indicator | Grizzlies are an apex predator, and only ecosystems of high quality and security can support grizzlies.  |

<sup>1</sup>Instead of using single focal species to represent the aquatic habitats, we chose to use guilds of fish (i.e. cutthroat trout, lowlands chubs and suckers, etc.) to represent this target.

## Chapter 2 - Methods for Creating the Wildlands Network

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This suite was initially selected by our science team, with refinement of the focal species list following the completion of natural history literature reviews for each species (Appendix B), and an expert peer review process. Our team considered other wide-ranging mammals (i.e. black bear, mountain lion, elk, deer, bobcat, etc.) as potential focal species, but we assumed the final Wildlands Network Design would adequately capture the necessary habitat for those species and so did not choose them as focal species. In general, these species are relatively numerous and adaptable, and thus their populations are generally considered secure.

We used habitat characteristics important to focal species, along with landscape level threats that are considerable to those species, to construct static habitat suitability models for selected focal species (wolf and sage grouse) in the study area. Habitat data used in these models included vegetation type, slope, aspect, elevation, important prey habitat, and proximity to streams. Threats included road density and oil and gas development. The methods

used in constructing these static models, and the results achieved, are featured in Box 2.2 (sage grouse) and Box 2.3 (wolf).

The results of the sage grouse and wolf habitat suitability models were used as inputs for the SITES analysis. These two focal species were selected as inputs into SITES because, more than any of our other focal species, these two represent the habitats that are most prevalent in the study area. We targeted 100% of all top-scoring sage grouse habitat, and 25% of all areas that scored in the second highest sage grouse habitat category to be included in cores and linkages. We targeted 75% of all top-scoring wolf habitat, and 25% of all areas that scored in the second highest wolf category to be included in cores and linkages. In general, the very top-scoring habitat for these species is the most desirable to include in the wildlands network - that's why those thresholds were set high. We set these particular targets (100% and 75%) for sage grouse and wolf habitat based on trial runs, expert opinion and focal species target goals used in other SITES models (i.e. Miller 2003).



Chain Lakes

Biodiversity Conservation Alliance



## Chapter 2 - Methods for Creating the Wildlands Network

Table 2.4 The target elements used in the lowland SITES analysis, and the levels for which they were targeted.

| Target                                   | SITES target level      |
|--|-------------------------|
| G1, G2 NHP element occurrences           | 100%                    |
| G3-G5 NHP element occurrences            | taxa-specific (25%-75%) |
| Cutthroat trout population segments      | 100%                    |
| Roadless areas                           | 100% (locked in)        |
| Veg community types (land cover)         | 25% of each type        |
| Top scoring ("best") wolf habitat        | 75%                     |
| 2nd highest scoring wolf habitat         | 25%                     |
| Top scoring ("best") sage grouse habitat | 100%                    |
| 2nd highest scoring sage grouse habitat  | 25%                     |

### 2.3.5 Determining Core Areas, Linkages and Compatible Use Areas in Lowland Wildlands Network.

The SITES model gradually closes in on a best set of cores that meet the target goals (summarized in table 2.4) while minimizing total area. It does this by running many (thousands to millions) iterations of the model. The planning units that are consistently picked again and again indicate their importance towards meeting target goals and thus these units are included in the final proposed core areas. We used the Best Runs feature of SITES to delineate cores and linkages because the Best Runs is as close to an optimal solution as SITES can get (in terms of "cost"). We ran the final model 100 times, each with a million iterations.

SITES also reported how often each planning unit was included in the initial set of cores during the trial runs. This information helped us delineate linkages after the cores were chosen. Even if these potential "connecting units" sometimes were not included in the final solution model, if they were selected once that meant they likely included one or more of our targets. This justified using these planning units as building blocks to construct linkages between cores, along with natural ungulate migration linkages, stream linkages, and lightly roaded, public land. When stream or river linkages were used as the basis for linkages, they were used as the backbone of the linkage, with at least a 0.5 km buffer on either side of the stream or river.

## Chapter 2 - Methods for Creating the Wildlands Network

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The term “compatible use area” has slightly different meanings for different scientists working on conservation planning efforts. In this wildlands network

design effort, we refer to all areas outside of cores and corridors as Compatible Use Areas (except for municipal areas), and label them as such on our maps.

### 2.4 Advanced Work on Lowlands Wildlands Network.

Once the SITES model produced a first draft Wildlands Network Design for the lowland study area with delineated cores and linkages, we made final adjustments on this first draft with both a retrospective lens, and also with the help of regional scientists and land managers with on-the-ground experience in the Heart of the West.

To account for needs of focal species whose habitat suitability models were not directly entered into the SITES model or whose known ranges were not included as a special element (all our focal species besides sage grouse, wolves and cutthroat trout), we used GIS to overlay GAP habitat models for focal species<sup>11</sup> with the draft Wildlands Network Design. We calculated the total percentage of each focal species’ range that was captured by the Network. When less than 50% of a species’ range was captured, slight modifications to cores and linkages were made to increase habitat for it within the Wildlands Network Design. We took a more finely scaled approach with our analysis of proposed linkages within the Network. Through an expert peer review process, we considered whether the linkages were likely to be used by volant, terrestrial, and aquatic focal species. Adjustments to linkages were then made based on expert opinion. We also referred to our Focal Species

Accounts (Appendix B) to determine whether the cores and linkages were accommodating the needs of all focal species, based on size of cores, habitat types within cores and linkages, range and distribution of focal species, general population characteristics and demographics of focal species, placement of and connectivity between cores, etc.

We also conducted a retrospective analysis to ensure that adequate representation of aquatic systems was captured in our initial set of cores and linkages. Whereas cutthroat trout conservation population segments were the only aquatic special element, we did include high ranking sage grouse habitat as a target in the SITES analysis and both perennial and ephemeral streams were in turn key inputs into our sage grouse habitat suitability model. We overlaid the draft set of cores and linkages with all perennial rivers and streams to check the overall representation of these water bodies in the draft set of cores, with a goal of 60% representation of perennial streams and rivers in our draft wildlands network.

We similarly carried out a retrospective analysis to make sure we achieved adequate representation of Nature Conservancy portfolio sites in our initial set of

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<sup>11</sup> GAP habitat models are created by each of the GAP Analysis programs in each of the states in the Heart of the West study area. Historic habitat, in addition to predicted and possible habitat, was included for those focal species that are extirpated from the study area (bison and grizzly bear). We did not include our focal fish guilds in this retrospective analysis; rather we evaluated the solution for representation of perennial streams and rivers (see below). Similarly, we did not overlay those focal species whose principal habitats are primarily found in the Utah-Wyoming Ecoregion (i.e. lynx and wolverine, etc.).

## Chapter 2 - Methods for Creating the Wildlands Network

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cores and linkages. We did not believe it was appropriate to include TNC portfolio sites as a SITES input,<sup>12</sup> but we felt it was very important to make sure there was good agreement between our SITES solution and what TNC determines to be important areas for conservation. In order to gauge representation of TNC portfolio sites in our draft set of cores, we overlaid the draft set of cores and linkages with TNC sites that exist for our lowland study area with a goal of at least 60 % representation of TNC portfolio sites in our solution.

An important component of our advanced work on the draft Wildlands Network Design was to consider the size and shape of cores from the perspective of critical ecological and evolutionary processes. We evaluated the cores and linkages for their ability to respond to large-scale natural disturbance cycles in the region, and their role as refugia or movement linkages for various organisms in case of long-term climate change. The team addressed future climate change effects by making sure the Wildlands Network Design as a whole spanned the full range of climatic gradients within the lowland study area.

Next we overlaid various anthropogenic layers, such as major roads, road density, land ownership, and existing oil and gas wells, as well as threats such as imminent oil and gas development with the draft Network. This allowed us to identify instances where certain linkages seemed particularly unrealistic or misplaced, considering human modifications such as major roads. In these instances, we adjusted the placement of linkages, taking care to follow lightly-roaded public land and riparian linkages to the extent possible

when adjusting linkages. Cores were considered, and adjusted if necessary, in a similar manner. The anthropogenic overlay also allowed us to identify where private-land conservation is most likely or already in practice. Planning units within core areas and linkages that were seriously affected by human activities but were integral to keep, usually because they were embedded deep within a core or were essential for connectivity, were renamed Core Recovery Areas and Linkage Recovery Areas. Density of oil and gas wells was the prime determining factor in reclassifying areas as Recovery Areas. While road density could have been an additional determinant of Recovery Areas, we assumed that road density was correlated with well density. Recovery Areas were further broken down into long-term Core Recovery Areas and short-term Core Recovery Areas. Long-term Core Recovery Areas are those planning units with more than 25 oil and gas wells per planning unit - or more than one well per 50 acres - and Short-Term Recovery Areas are those with between 5 and 25 oil and gas wells per planning unit. Lastly, we used the anthropogenic data to help us take a close look at large, key core areas, and rank them in terms of both their vulnerability and irreplaceability (see next section).

Compatible Use areas were added to the lowlands wildlands network after the “final,” biologically-based set of cores and corridors was delineated. All remaining lands outside of core areas and corridors, but outside of municipal areas, were labeled Compatible Use.

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<sup>12</sup>TNC portfolio sites are also based on inputs of multiple kinds of spatial data, and we would risk compounding uncertainty (and thus error) by using TNC outputs or solutions as our inputs into SITES.

## Chapter 2 - Methods for Creating the Wildlands Network

### 2.5 Irreplaceability and Vulnerability of Lowland Cores

A key concept in conservation planning is irreplaceability (Pressy and Cowling 2001). This concept provides a measure of the relative contribution different core areas make to reaching overall conservation goals, thus helping planners prioritize protection for various core areas in a wildlands network. Irreplaceability can be described in two ways: (1) the likelihood that a particular area is needed to achieve an explicit conservation goal, or (2) the extent to which the options for achieving an explicit conservation goal are narrowed if an area is not conserved. A core area that ranks high in terms of irreplaceability is essential to meeting a particular goal; if that core area is turned over to oil and gas production, it's likely that that conservation goal will not be attained. An example would be a core area that contains the only known occurrence of a species in the

region. Conversely, a core with a very low irreplaceability value might have a number of replacements. The irreplaceability values of core areas will vary depending on the specific goals that are set. One core area might be irreplaceable for meeting the goal of protecting all viable occurrences of a G1 species, but very replaceable for meeting the goal of conserving high quality habitat for a focal species, such as sage grouse.

Because our analysis considers multiple values of core areas and attempts to achieve a broad set of conservation goals, we invoked a method for calculating irreplaceability of cores that has been recently developed by other conservation planners (Jeo 2002). We assigned irreplaceability values to lowland cores based on the following criteria:

- 1) Contribution to the goal of protecting set targets of Natural Heritage Program species in lowland study area,
- 2) Contribution to the goal of protecting 100% of stream segments with Conservation Populations of cutthroat trout in lowland study area,
- 3) Contribution to the goal of protecting 100% of all roadless areas in lowland study area,
- 4) Contribution to the goal of representing at least 25% of each vegetative community type in the lowland study area,
- 5) Contribution to the goal of protecting 75% of top scoring wolf habitat, and 25% of second highest scoring wolf habitat in lowland study area, and
- 6) Contribution to the goal of protecting 100% of best-scoring class of sage grouse habitat, and 25% of second best-scoring class of sage grouse habitat in lowland study area.



Cedar Waxwings

NPS

## Chapter 2 - Methods for Creating the Wildlands Network

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To allow for direct comparison of the ability of core areas to meet multiple targets, we first normalized the quantity of any particular target by dividing the amount by the standard deviation, and then calculated a standard Z-score for each core area based on how well that core area did in picking up targets. The Z-score was calculated for all targets (1-6 above) within a core area. This procedure allowed us to directly compare the number of targets in each core using meaningful units, since the mean Z-score for the entire study area is, by definition, approximately 0, and 1 unit represents one standard deviation from the mean value. For example, a Z-score of 0.5 for sage grouse habitat for a certain core means that particular core has 0.5 standard deviations greater than the mean for sage grouse habitat compared to all other core areas. Using Z-score values allows values to be combined such that each target receives equal weight and with explicit consideration of the relative rarity of any target. For example, in order to rank cores based on NHP data, we combined all NHP targets into a single index score. This method was particularly helpful in determining irreplaceability of small core areas compared to large core areas.

Another key consideration in conservation planning is threat or vulnerability (Margules and Pressey 2000). Understanding the current and future threats to individual core areas helps determine which cores are in urgent need of immediate protection, and can help conservationists prioritize core areas for attention while also developing specific strategies and conservation plans for cores. Somewhat the reverse of methods used to calculate Z-scores for irreplaceability of cores, we calculated Z-scores for the vulnerability of each core based on road density in that

core, current oil and gas well density in the core, and degree of future oil and gas activity threatening the core area.

Based on the Z-score analysis described above, along with expert opinion on the threats faced by each core area, we assigned a vulnerability score of 0-100 to each core area. Core areas were then plotted on a graph of irreplaceability (y axis) versus vulnerability (x-axis) and the graph divided into four quadrants (see Margules and Pressey 2000, and Noss et al. 2002). The upper right quadrant, which includes core areas with high irreplaceability and high vulnerability, comprises the highest priority core areas for conservation.

We considered these threats (current and future oil and gas development, and road density) in our calculation of vulnerability of core areas because our conservation partners as well as expert reviewers agreed that these are the chief threats in the Heart of the West lowlands and, therefore, negative anthropogenic influences on core areas. The scientific literature, outlined below, further justifies treating these two variables as the “chief threats” in the lowland study area:

### **Impacts of oil and gas exploration and development.**

There are multiple layers of disturbance that are widely known to accompany oil and gas development. Access roads permanently reduce and fragment habitat, and provide additional long-term opportunities for off-road vehicle intrusions into sensitive habitats. The amount of road development per well pad constructed is partly a factor of well density, but recent estimates include one mile of road per oil well (USDA-USFS Bridger-Teton National Forest 2000), 0.4 miles of road per conventional natural gas

## Chapter 2 - Methods for Creating the Wildlands Network

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well (USDI-BLM, Pinedale Field Office 2000), and 0.3 miles of road per coalbed methane well (USDI-BLM, Buffalo Field Office 2002). Comer (1982) explains that after an oil or gas field is developed, one can expect increased recreation, particularly by off road vehicles (ORVs). New powerlines, pipelines, and railroad tracks are often constructed, further reducing and fragmenting habitat (Weller et al. 2002). Ground disturbances may introduce noxious weeds (Shuman and Whicker 1986), eliminate mycorrhizal fungi (Knapp 1996), and destroy biological soil crusts (Belnap 1995). Compressor stations and well pumps release pollutants into the air, and waste products contaminate habitat (Clarren 1999; Clifford 2001). In addition, oil and gas mining can remove rock outcrops that provide important habitat for specialized species (Weller et al. 2002, citing BLM 1999).

### **Impacts of roads and high road densities**

Roads and trails are the primary vectors by which human impacts are dispersed over the landscape (e.g., Hobbs and Huenneke 1992, DeFarrari and Naiman 1994, McIntyre and Lovoral 1994). Without ground access, human impacts are restricted to those by air, long-range cross-country travel, or those associated more diffusely with pollution or global change. Without question, most human impacts harmful to ecosystems are contingent on access, even where these impacts occur away from the roadbed.

Roads and “ways” have been identified directly or indirectly with numerous factors that diminish or destroy wildlands and natural values. By their nature, roads are incompatible with wilderness (Hendee et al. 1990). Human activity and associated impacts on or near roads and trails disturb and displace a wide range of wildlife species, especially those that have been hunted or are nesting (Brattstrom and Bondello 1983,

Bowles 1995). Roads almost always lead to accelerated erosion and associated diminished water quality (Froehlich 1978, Burroughs and King 1989). Ease of access also leads to modified fire regimes by facilitating fire control. Use, maintenance and upgrading of roads grant easier access to illegal plant collectors. Finally, roads facilitate the dispersal of off-road impacts - such as those associated with all-terrain vehicles or livestock - over larger areas than would otherwise be the case.

Roadbeds and associated construction disturb or remove native vegetation and act as vectors for non-native exotic plants (Frenkel 1970). Furthermore, vehicles create seedbeds for weeds and promote their dispersal (Clifford 1959, Frenkel 1970, Wace 1977, Schmidt 1989, Tyser and Worley 1992, Lonsdale and Lane 1994). These two factors, compounded with the upgrading and increased use of roads in the intermountain West, facilitate the spread of exotic weeds which often outcompete the native flora. More than 50% of the West is now dominated by exotic weeds, and greater than 300,000 acres of habitat are irrevocably converted to exotic annual grasslands each year (Belnap 1998). Once they are established, weeds negatively impact western arid ecosystems in numerous ways, such as: changing community composition (Bock et al. 1986), reducing biodiversity (Randall 1996), increasing fire frequency (Esque 1999, Brooks et al. 1999), altering soil microclimate (Evans and Young 1984), expediting loss of topsoil (Lacy et al. 1989), reducing effectiveness of wildlife habitat (Davidson et al. 1996, Knick and Rotenberry 1997), and ultimately, leading to such profoundly altered ecosystems that nutrient cycling is disturbed and various disturbance regimes are altered (Mack and D’Antonio 1998).

## Chapter 2 - Methods for Creating the Wildlands Network

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Wildlife mortality is one of the most direct impacts of roads, but it is the indirect effects on wildlife that are far more insidious. Ungulates such as mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), and mountain sheep (*Ovis canadensis*) are most vulnerable to human disturbance during the winter while on winter ranges (Leslie and Douglas 1980, MacArthur et al. 1982, Edge and Marcum 1985, King and Workman 1985, Freddy et al. 1986, Cassirer et al. 1992). Disturbances can lead to reduced fecundity (Yormalov et al. 1988), especially if they interfere with feeding (Hobbs 1989). Importantly, the intrusion of humans on wintering ungulates is largely contingent on road access. Vertebrates subject to legal harvest are also substantially affected by human-caused mortality, which is also critically dependent on access. For example, the vulnerability of elk to hunter harvest has been shown to be positively related to road density (Basile and Lonner 1979, Lyons 1979, Cole et al. 1992, Unsworth et al. 1993). These are significant considerations because they affect the quality and size of elk and deer populations as well as the quality of elk and deer hunts. This same point holds for all of the other legally hunted or trapped mammals, especially carnivores such as black bears (*Ursus americanus*) and bobcats (*Felis rufus*). Where there is easy access to critical winter ranges or key habitats of hunted mammal populations, it is difficult to mitigate for human impacts short of closing roads or reducing hunts. For example, although most mammals can habituate to the presence of humans, this is less likely to happen in hunted populations, and, if it does occur, leads to increased vulnerability among the affected animals (Douglas 1971, Knight and Gutzwiller 1995). It is also noteworthy that illegally hunted animals are highly suscep-

tible to the indirect negative effects of roads; in Utah, poaching incidents are greater in areas adjacent to roads (Davidson et al. 1996).

High densities of roads have been shown to negatively impact certain species of mammals. In particular, densities of more than one mile of road/mile<sup>2</sup> represent a level of access that is associated with more pronounced effects on wildlife species such as wolves (*Canis lupus*) and bears (*Ursus spp.*) that are sensitive to contact with humans (Thiel 1985, Van Dyke et al. 1986, Mech et al. 1988, Lovallo and Anderson 1996, Mace et al. 1996). However, results that point to one mile of road/mile<sup>2</sup> as a rule-of-thumb threshold to major access-related effects on wildlife are predominantly from forested environments. The impact is likely even greater to wildlife in more open habitats that typify the Heart of the West lowlands.

Roads can also fragment habitat of dispersal-limited species. Some of these species, which tend to be small, display “acute road-avoidance effect” in which animals remain at some distance from the road and never or very rarely attempt to cross. For example, white-footed mice (*Peromyscus sp.*), chipmunks (*Tamias sp.*) and several species of beetles have trouble crossing roads greater than a certain width. This serves to effectively isolate one group of animals from the rest, in some cases virtually cutting the population in half. Populations are thus fragmented into subpopulations in which movement is either drastically lower among subpopulations than it was in the unfragmented population, or is cut off completely. Much evidence from the field of population biology indicates that this will result in increased risk of demographic fluctuation,

## Chapter 2 - Methods for Creating the Wildlands Network

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extinction due to demographic fluctuation as well as environmental stochasticity, genetic inbreeding and random drifts in gene frequencies, and less chance for colonization after extinction (Charlesworth and Charlesworth 1987, Soulé 1987).

In closing, roads lead to many direct and indirect impacts on native ecosystems and

wildlife in the West. It is perhaps the indirect impacts that are actually the most damaging. Roads enable motorized access into remote areas, and then enable motorized use off those roads into pristine areas. These sorts of activities are usually not planned for by management agencies, nor are they usually monitored.

### 2.6 Expert Assessment

Quantitative data on which to evaluate conservation priorities are always limited. Thus, we recognized that our SITES analysis would need to be supplemented by expert opinion. Practitioners, local scientists and on-the-ground activists can provide valuable and often undocumented information on targets, important habitats, threats and feasibility of site protection. In addition to providing key information, involvement of experts can simultaneously help develop strong partnerships, provide necessary peer review, and generally help garner acceptance and credibility of the final wildlands network.

Therefore, we utilized many forms of expert assessment in the design of the Heart of the West Wildlands Network. All focal species accounts and focal species habitat models were peer reviewed by experts on those species in the Heart of the West region. These experts included wildlife researchers in academia, and state and federal agencies. Once our prelimi-

nary maps were produced, we convened a workshop with regional conservationists and environmental activists from Utah, Wyoming and Colorado in order to receive input on threats, placement of cores and linkages, and additional information on targets and important habitats. We also convened separate workshops with TNC regional science employees, Natural Heritage Program Employees, BLM employees, and other regional scientists in order to acquire expert advice, as well as benefit from their expertise with ecoregional planning and large scale conservation assessment techniques. Lastly, all maps and text of the Conservation Plan went through a rigorous round of expert peer review by regional, independent scientists with expertise in focal species analysis, large-scale conservation planning and GIS modeling. These scientists were from academia, government agencies, and conservation science research groups.

### 2.7 Assumptions and Limitations

The individuals and organizations involved in developing the Heart of the West Wildlands Network have been guided by several assumptions. It is important to acknowledge these assumptions and limitations in interpreting the results of the analyses and implementing the plan. The assumptions we are operating under are as follows:

- 1) This conservation assessment and reserve design exercise is primarily GIS-based. We understand the inherent risks and uncertainties involved with relying heavily on mapped information, such as our own habitat models (in turn based on GIS layers), NHP data, GAP data, etc. We do not have the means to



## Chapter 2 - Methods for Creating the Wildlands Network

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ground truth and field check all input maps, or boundaries of proposed core areas and linkages. Thus, we accept the data we were able to acquire, and acknowledge that all of the inputs (and thus outputs) could contain some misrepresentations.

- 2) No historical, archeological, or cultural data (i.e. historic sites, pioneer trails, archeological ruins or petroglyphs, etc.) were used to identify priority sites for conservation. We aimed to keep inputs primarily biological in nature.
- 3) We do not attempt to ensure viability of all native species within the Wildlands Network. Population Viability Analysis for certain species and meta-populations is a very laborious task, involving great inputs of data. Population viability of species is best addressed with sophisticated computer modeling, and is beyond the scope of our analysis.
- 4) Goals and targets for focal species and Heritage-ranked species in the wildlands network design process are somewhat arbitrary, and could be improved with a more in-depth population viability analysis, with a spatial analysis component, for each species. Many of these goals are essentially

statements of (our) policy, and not necessarily based on concrete scientific data. But they were necessary to make, in order to run SITES.

- 5) When setting our goals for the representation analysis, we had no set standard to follow. In this analysis, we strove to set representation goals similar to those used in Wildlands Project sponsored wildlands network design efforts (Miller et al. 2003, Foreman et al. 2003) and TNC ecoregional planning efforts that overlap our own (TNC 2001, Freilich et al. 2001). Again, these representation goals are essentially statements of (ours, TNC's, and others) policy, not necessarily based on scientific data. But they were necessary to make, in order to run SITES.
- 6) In the process of forming our coalition, creating the Wildlands Network and obtaining expert peer review, we have attempted to account for and monitor all other compatible conservation initiatives by other groups in the region. These independent initiatives play an important role in implementing various aspects of the Heart of the West Wildlands Network Design and Conservation Plan. While these initiatives may support the wildlands network in part



Ferris Mountains

George Wuerthner

## Chapter 2 - Methods for Creating the Wildlands Network

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or in whole, they are not necessarily affiliated with the Heart of the West Coalition or its Conservation Plan. There are many compatible conservation initiatives in the region not addressed in this Conservation Plan; listing all the regional initiatives and describing how they can contribute to implementation is beyond the scope of this document. Rather, we have created a document which contains maps and tools that can easily be incorporated into ongoing campaigns in the area.

- 7) We believe that regional, comprehensive conservation strategies have to be implemented over the long term (in the range of 100 years or more). This first iteration of the Heart of the West Wildlands Network is, however, relatively short-term (approximately 20 years). Later iterations will identify long-term recovery goals.
- 8) Future studies will need to be conducted to analyze the social and economic impacts of implementing this network, and to better evaluate market-based economic incentives for the protection of Nature in this region.

Every effort was made to use the best available scientific data in the region. Many groups and individuals are working to fill in the data gaps and the Wildlands Network Design will be periodically updated as new information becomes available. However, a number of technical limitations have been recognized:

- 1) Biological data used in the development of the Wildlands Network Design are incomplete and have uneven accuracy. For example, data on element occurrences obtained from the various Natural Heritage Program show many “holes” with no

occurrences. However, it is not possible to distinguish holes that result from absence of surveys from holes that reflect true absences of occurrences.

- 2) The SITES algorithm does not guarantee an optimal solution (i.e., the most efficient design possible) given a set of goals. Rather, the solution selected in each run will be at least slightly different from those selected in other runs. Even the “best” (lowest-cost or most efficient) of 10 or 100 runs is different, albeit in a minor way, from the best of another 10 or 100 runs.
- 3) Calculating the true biological irreplaceability of an area is impossible. Hence, our analysis used objective estimates of irreplaceability based on the extent to which different planning units (and ultimately clusters of planning units into cores) contributed to stated conservation goals, as expressed by SITES sum runs.

Above all, the Heart of the West Wildlands Network is a work in progress. Conservation planning is an iterative and adaptive process. This Wildlands Network and associated Conservation Plan is presented as a working document for guiding conservation actions, not as the final word on how to conserve the health of the land and its productivity in the Heart of the West. Future revisions will benefit from additional research, data gathering, field study, and public involvement. Involvement by conservationists, outdoor recreationists, users of the land, local residents, private landowners, scientists, organizations, institutions, and agency managers will lead to iterative improvements. New information, comments, and suggestions are welcome.

# Heart of the West Conservation Plan

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Sweetwater Rocks

Erik Molvar

## Chapter 3 - Results of SITES Analysis

### 3.1 Results of Natural History Literature Reviews and Focal Species Models

We wrote detailed natural history literature reviews, or species accounts, for all of our focal species. Most of the information in the species accounts is specific to the Heart of the West region, but basic ecological and life history information is also used from other regions. All species accounts are included in Appendix B.

We found that the Heart of the West region contains ample, suitable habitat for both wolves and sage grouse. The mapped results of these habitat suitability models are featured in Boxes 2.2 (sage grouse) and

2.3 (wolf). There is a considerable amount of good wolf habitat throughout the lowland study area. This finding may be surprising to some, as many people do not think of shrublands as providing adequate habitat for the gray wolf. This assumption that shrublands are not good wolf habitat probably stems from the fact that the only places wolves were able to maintain presence in the earlier parts of this century were remote, rugged and forested areas, due to persecution from humans.

## Chapter 3 - Results of SITES Analysis

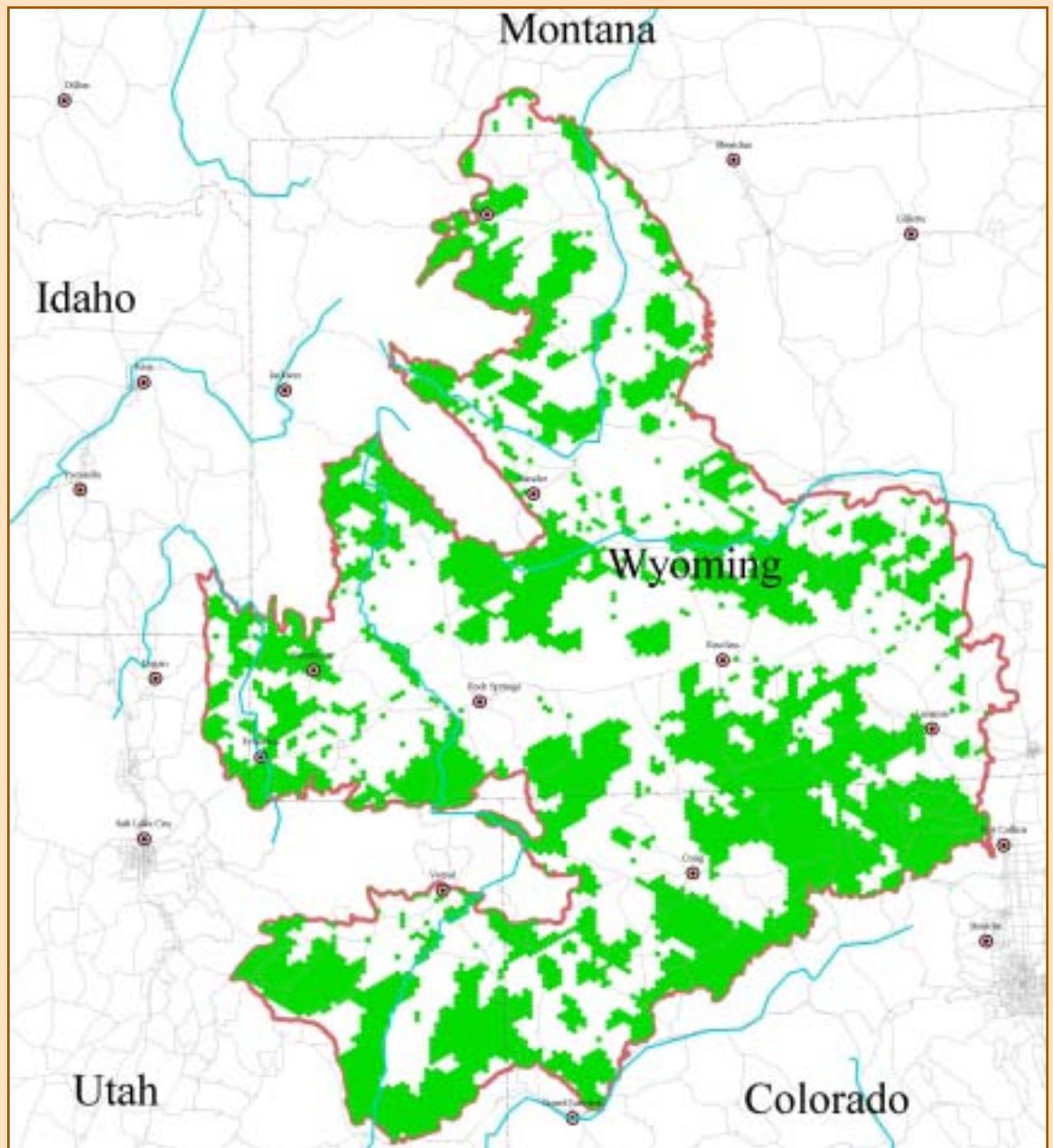


Figure 3.1 Initial SITES output of draft solution for lowlands study area.

### 3.2 Proposed Set of Cores, Linkages and Compatible Use Areas for Lowlands Study Area

The SITES model identified an initial “best” set of core areas in our Heart of the West lowlands study area, which was comprised of individual planning units, hexagonal in shape, that represented the most efficient and compact set of cores containing the various inputs (focal species

habitat, special elements, representation analysis) at, above, or extremely close to the pre-assigned target levels (Figure 3.1). This seemingly large solution (7,859,772 hectares, or 42.1% of the lowland study area) can be attributed to the many different kinds of targets selected, which in-

## Chapter 3 - Results of SITES Analysis

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cluded wide ranging mammals such as the gray wolf; and also the existing natural variability in the lowland study area and the need to adequately represent it in the SITES solution.

This initial SITES output set the stage for the advanced work on the Wildlands Network (as described in Chapter 2 the advanced work includes retrospective analyses for inclusion of other focal species habitat and Nature Conservancy portfolio sites, assessment of aquatic representation, and delineation of linkages). The SITES model included in its initial solution other key variables that were not direct inputs into SITES. The initial output represented at least 50% of all suitable habitats for all terrestrial focal species<sup>1</sup> in the lowland study area, except for bighorn sheep and white-tailed prairie dog. Our initial SITES output captured only 45% of suitable bighorn habitat in the study area (as predicted by GAP analysis) and only 36% of the GAP habitat predicted for prairie dog. Our initial output met our original goal of 60% representation of all perennial streams and rivers. The initial output captured 57% of TNC portfolio sites in the lowland study area, somewhat short of our 60% representation goal for this variable.

To increase the amount of these retrospective targets in cores and linkages,<sup>2</sup> and to increase connectivity between draft core areas, we added hexes (planning units) by hand to better meet our retrospective targets, and select key connectivity areas between cores.<sup>3</sup> The added hexes on the

edges of cores helped capture additional TNC portfolio sites and habitat for prairie dogs and bighorn sheep. This advanced work, based in part on expert input, also identified known locations of sage grouse leks, important mountain plover nesting areas, potential reintroduction sites for black-footed ferret, and other ecologically important areas. The advanced work also identified areas important for connectivity between cores, such as perennial water-courses and known important migration linkages for pronghorn, deer and elk. The new planning units we added to the solution are color coded in Figure 3.2.

At this stage of manual delineation and adjustment, we also looked at which targets were driving the occurrence of disjunct, outlier hexes that were isolated from other core areas (Figure 3.1). In those cases where one of the 161 plant and 42 animal Natural Heritage Program (NHP) species was not driving the selection of the outlying hexagon (i.e. it was selected to help meet target goals for representation, or wolf or sage grouse habitat, etc.) the outlier was eliminated (Figure 3.2). In those cases where a single NHP species occurrence was driving the selection of the outlier, we eliminated the isolated hexagon in most cases, provided we could add a planning unit somewhere else in the study area that contained that NHP species. In the cases where we could not find another satisfactory planning unit to replace an isolated hexagon (i.e. adjacent to an existing core), we only eliminated it as

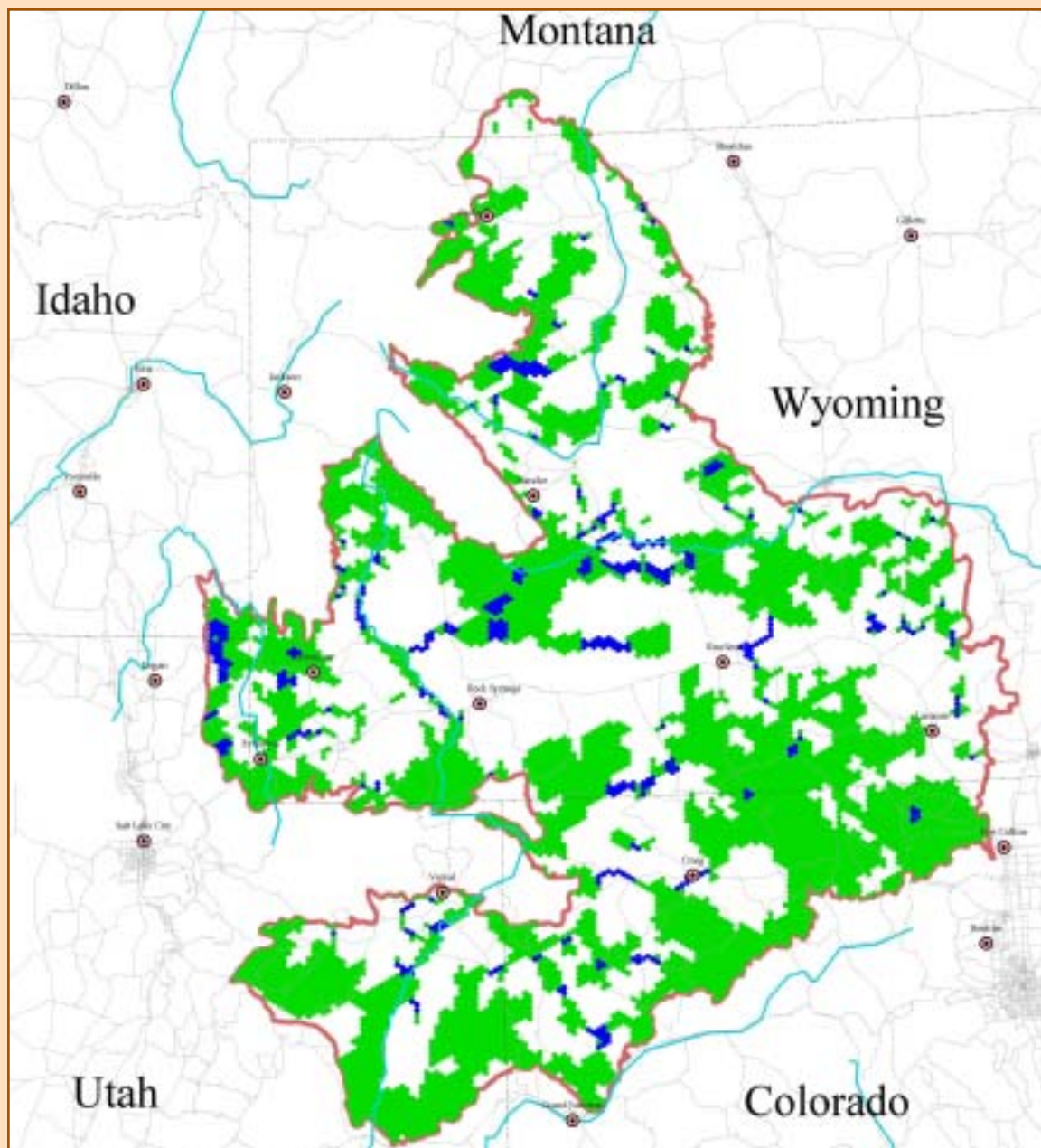
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<sup>1</sup> We considered beaver and river otter as terrestrial focal species in this retrospective analysis.

<sup>2</sup> We did not set the prairie dog habitat representation target at 50% like the other focal species. This was because the GAP-predicted suitable habitat for the prairie dog is very extensive, essentially covering the entire lowland study area. However, as seen in Table 3.5, we did increase representation of good habitat for this focal species, through our advanced work, in the final Wildlands Network.

<sup>3</sup> As described in Methods, much of the advanced work needed to be carried out by hand. Individual hexes were added to cores and linkages, based both on retrospective analyses described in chapter 2, and expert review, feedback and workshops.

## Chapter 3 - Results of SITES Analysis



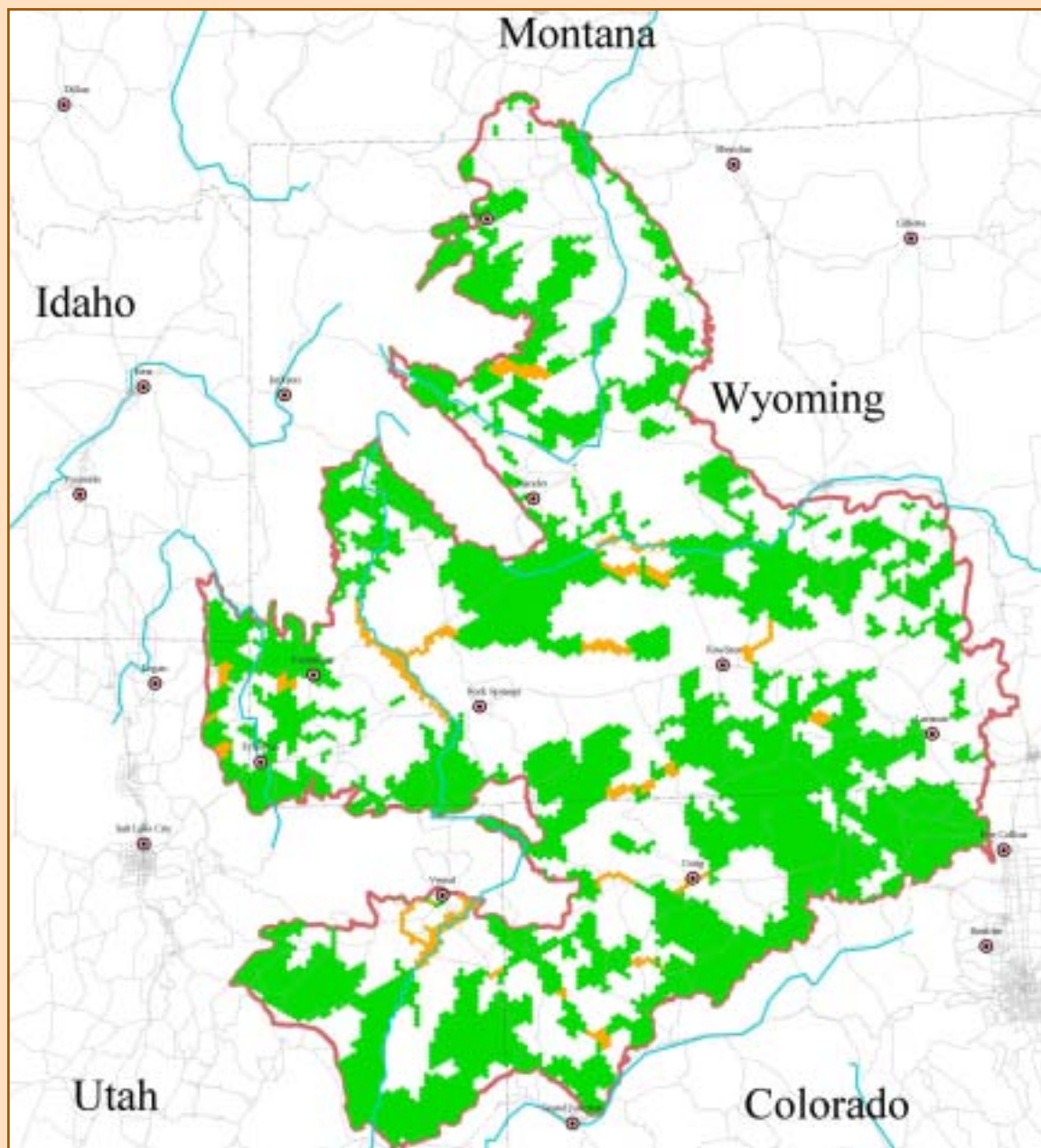
3.2 Draft solution for lowlands after new planning units added by hand (blue cells), and with tiny “outliers” removed (compare with figure 3.1).

long as we didn’t reduce the number of element target occurrences to more than 25% less than the original NHP species representation goal.

The retrospective analyses, and manual adjustments to the SITES output that resulted from those analyses (described

above), led to the final set of core areas and linkages for the lowland Wildlands Network Design (Figure 3.3). These cores and linkages fulfill all SITES pre-selected goals at or extremely close to their respective target levels, with some targets being represented well above their specified targets (Table 3.1 and Appendix C).

## Chapter 3 - Results of SITES Analysis



3.3 Final lowland solution, or wildlands network. Core areas shown in green and linkages in yellow.

After the advanced work, the final biologically-based solution of core areas and linkages met the various retrospective goals discussed above. Our proposed set of cores and linkages for the lowland study area captured over 67 % of all perennial streams in the study area, 63% of all TNC portfolio sites that exist

within the lowland study area (Figure 3.4), and existing suitable habitat for terrestrial focal species at the level of 50% or greater<sup>4</sup> (Table 3.2).

While cores were designed with general knowledge of the size requirements for populations of focal species (attained from

<sup>4</sup> As mentioned earlier, we did not strive to meet the 50% representation goal for prairie dog habitat

## Chapter 3 - Results of SITES Analysis

Table 3.1. Target goals, actual numbers of targets included in lowlands Wildlands Network, percent of total amount of target in study area, and percentage of goal achieved.

| Element                             | Total in study area (ha)             | Amount targeted (ha, and %)             | Amount achieved in network (ha) | Amount achieved in network (ha) | Percent of target achieved in final network               |
|-------------------------------------|--------------------------------------|---|---------------------------------|---------------------------------|---|
| Good wolf habitat                   | 6,281,519                            | 1,570,377 (25%)                         | 2,348,820                       | 37.4%                           | 149.60%   |
| Best wolf habitat                   | 188,615                              | 141,461 (75%)                           | 145,948                         | 77.4%                           | 103%  |
| Good sage grouse habitat            | 7,604,780                            | 1,901,195 (25%)                         | 3,306,773                       | 43.5%                           | 174%  |
| Best sage grouse habitat            | 476,308                              | 476,308 (100%)                          | 442,426                         | 93%                             | 93%   |
| Cutthroat trout population segments | 17,157 (linear ha)                   | 17,157 (100%)                           | 17,157                          | 100%                            | 100%  |
| Roadless areas                      | 199,864                              | 199,864 (100%)                          | 199,864                         | 100%                            | 100%  |
| Land cover (Veg) types              | varies for each type <sup>a</sup>    | 25% of each type                        | See Appendix C                  | varies for each type            | anywhere between 107% and 349% of the target              |
| NHP species, G1s and G2s            | varies for each species <sup>a</sup> | 100% of each species                    | See Appendix C                  | varies for each species         | anywhere between 75% and 1896% of the target <sup>b</sup> |
| NHP species, G3s through G5s        | varies for each species <sup>a</sup> | 25% to 75% of each species <sup>c</sup> | See Appendix C                  | varies for each species         | anywhere between 70% and 608% of the target <sup>b</sup>  |

<sup>a</sup> Individual target goals for each land cover type and each NHP species are in Appendix C.

<sup>b</sup> Overshooting targets by large amounts will happen when species are overestimated due to sampling bias (i.e. listed and/or candidate species such as bald eagle, mountain plover, boreal toad, etc. that are sampled for much more frequently than others, and so by comparison appear to be “more common” than others).

<sup>c</sup> G3 to G5 species target goals ranged from 25% to 75% of occurrences, based on the number of occurrences in entire study area, and target goals set for the same species in The Nature Conservancy’s Ecoregional Plan for the Wyoming Basins.



## Chapter 3 - Results of SITES Analysis

**Table 3.2. Amount of suitable habitat for terrestrial focal species (not including sage grouse and wolf) in the lowland study area, and in cores and linkages.**

| Focal Species | Amount of suitable habitat in lowland study area (ha) | Amount of suitable habitat captured in wildlands network (ha) | Percent of suitable habitat in network |
|---------------|---|---|--|
| River otter   | 1,030,703   | 662,007   | 64.2%                                  |
| Bighorn sheep | 4,718,692   | 2,668,449   | 56.6%                                  |
| Beaver        | 3,401,126   | 2,106,050   | 61.9%                                  |
| Bison         | 2,247,698   | 1,191,744   | 53%                                    |
| Prairie dog   | 13,299,975  | 5,215,688   | 39.2%                                  |
| Grizzly bear  | 3,640,541   | 2,174,557   | 59.7%                                  |

our focal species accounts, Appendix B), the individual core areas do not necessarily include the specific waters or lands needed to maintain viable populations of each target in each core. Rather, the overall network was designed under the working assumption that, assuming cores are relatively connected across the landscape, viable populations of all focal species could be maintained across the Heart of the West. Practitioners and scientists utilizing our wildlands network may want to validate this assumption.

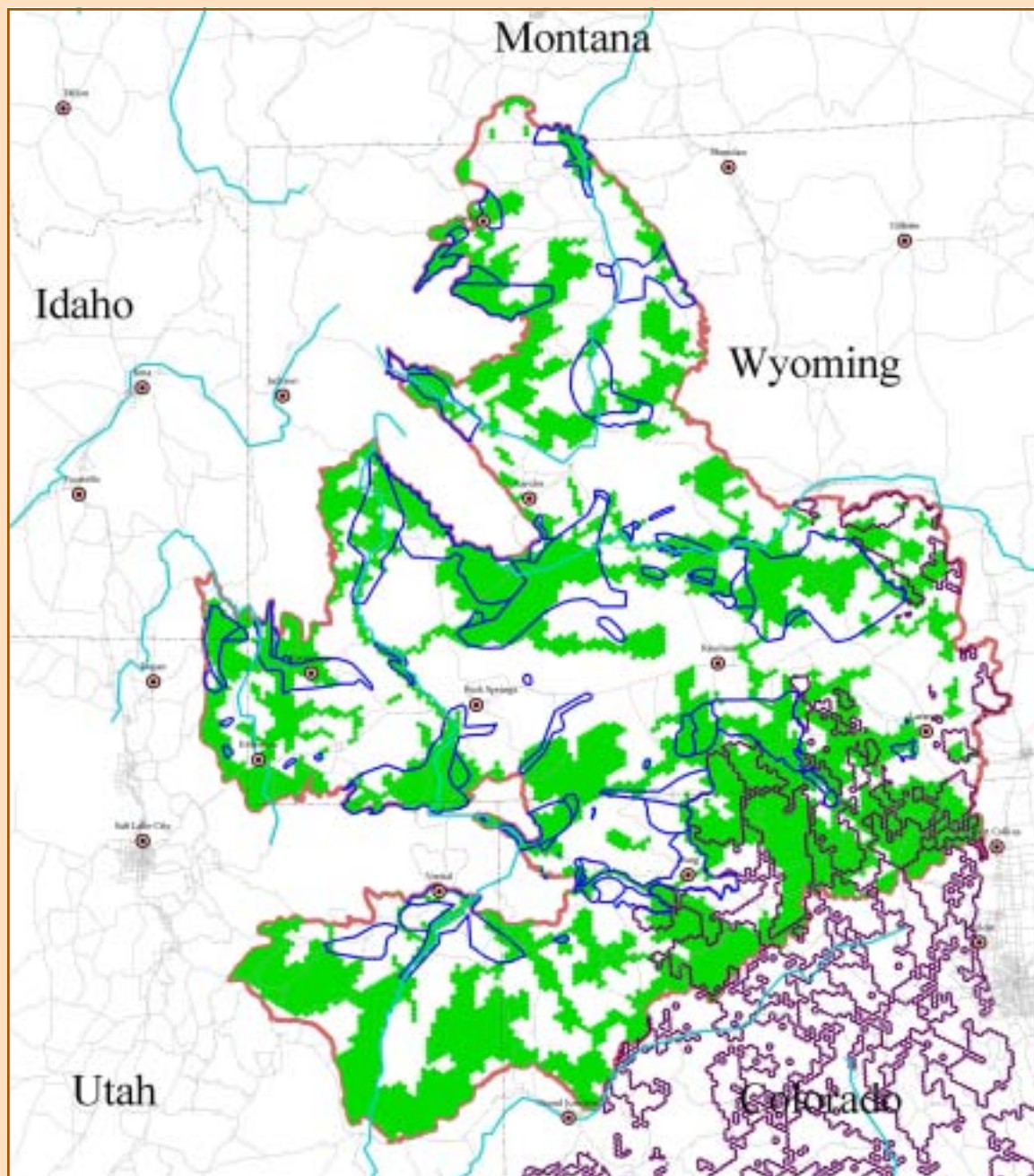
Compatible use areas were added to the lowlands Wildlands Network after the final, biologically based set of cores and linkages was delineated. (Figure 3.5). These areas included the remainder of the lowlands study area, outside of municipal areas.

The final analysis step was to overlay anthropogenic GIS layers (current oil and gas wells, major roads, towns and cities,

etc.) with the Wildlands Network and determine whether some hexes should be removed from the network in light of these impacts. Based on these overlays, and expert opinion, very few hexes were removed from core areas or linkages. Rather, parts of cores and linkages that appeared to be considerably affected by current human activities were labeled as Core Recovery Areas. Long-term Core Recovery Areas are those hexes with more than 25 wells per planning unit - or more than one well per 50 acres - and Short-term Core Recovery Areas are those with between 5 and 25 oil and gas wells per planning unit (Figure 3.6).

The final lowland Wildlands Network includes approximately 8,387,190 ha of cores (including Core Recovery Areas) and linkages, or 44.9 % of the total lowland study area. Only 4.1 % of the proposed lowland Wildlands Network is already in some form of protective federal status (i.e. GAP 1 or 2 status lands, which are prima-

## Chapter 3 - Results of SITES Analysis

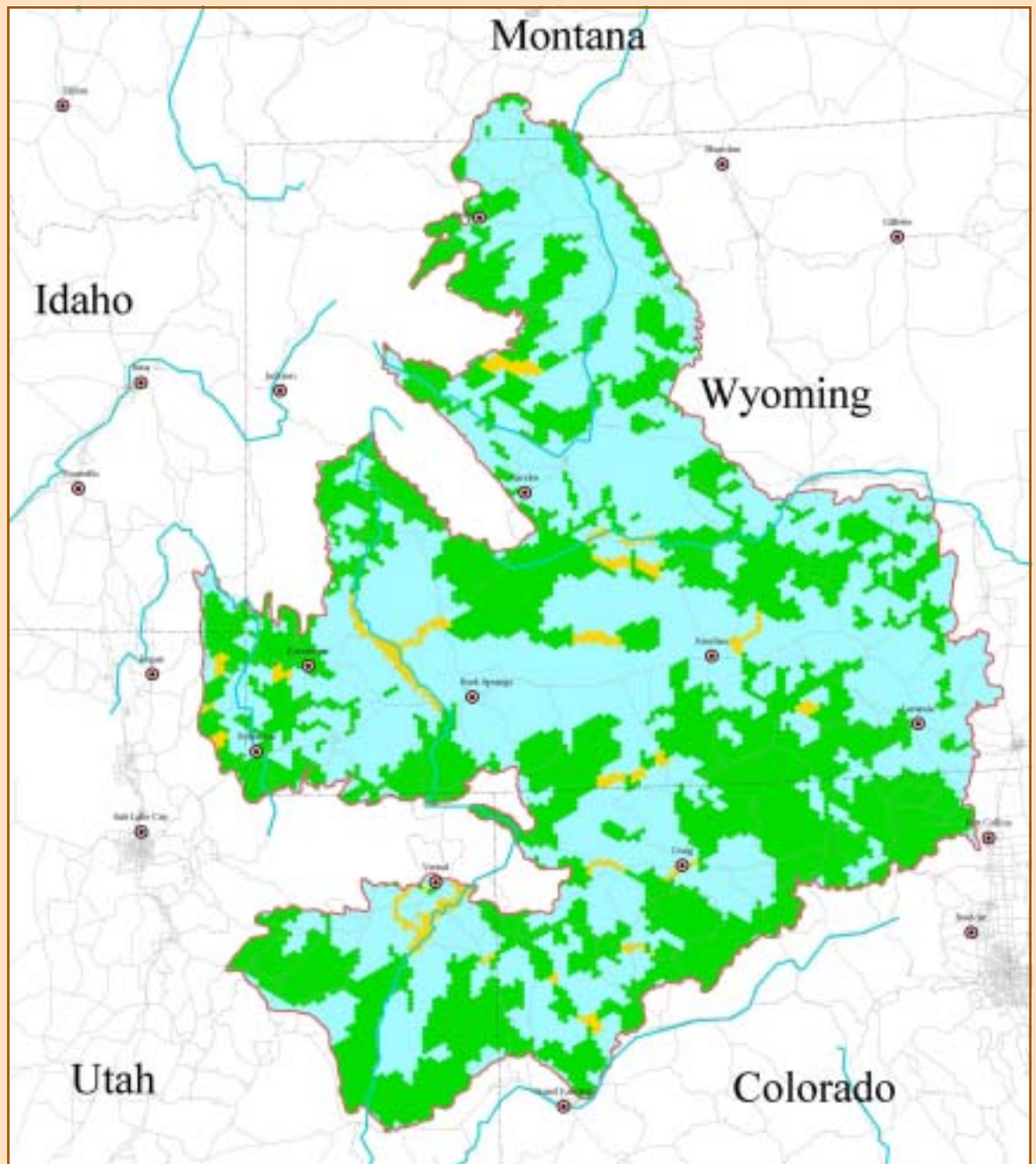


3.4 Overlap between our lowlands wildlands network (green) and TNC's Wyoming Basins portfolio sites (open blue polygons) and TNC's Southern Rocky Mountain portfolio sites (open red polygons).

rily managed for maintenance of biological diversity or natural values) (Figure 3.7). A concerted effort by conservationists, local communities, land managers and politicians will be required to increase the amount of area in cores and linkages that are protected at the state and federal level.

Currently, 29% of the Wildlands Network is comprised of privately held lands (Table 3.3). Private lands offer different and innovative options for land protection, such as "conservation ranches," private nature reserves, conservation easements, and sale to organizations who carry out all

## Chapter 3 - Results of SITES Analysis



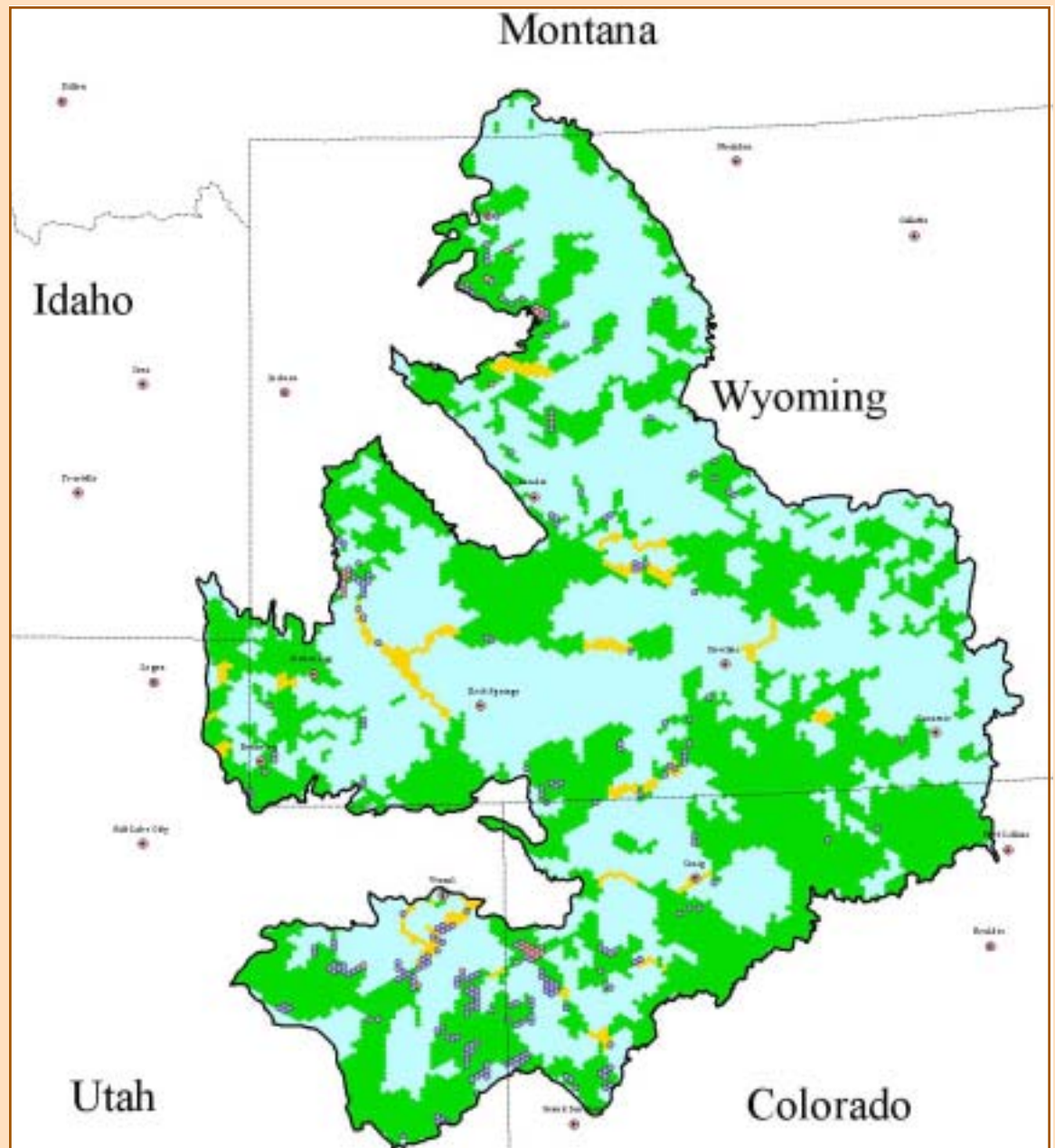
3.5 Lowlands wildlands network with compatible use areas added (blue)

of the above activities, such as TNC and other land trusts. The Heart of the West Implementation Team intends to work with private landowners who own land in cores and linkages, and work towards controlled road access, management for biodiversity conservation purposes, and toleration of large carnivores. Figure 3.8

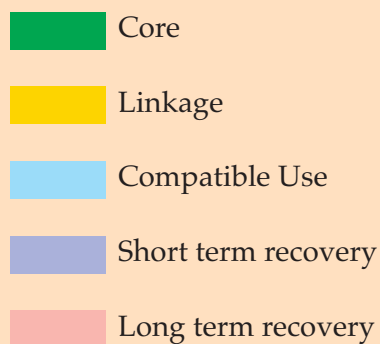
illustrates the sections of cores and linkages that are privately held.

Figure 3.9 depicts the names we have given to the larger lowland core areas (Figure 3.9). These distinctive, larger core areas are featured below in the results of our Irreplaceability-Vulnerability analysis, and also in

## Chapter 3 - Results of SITES Analysis

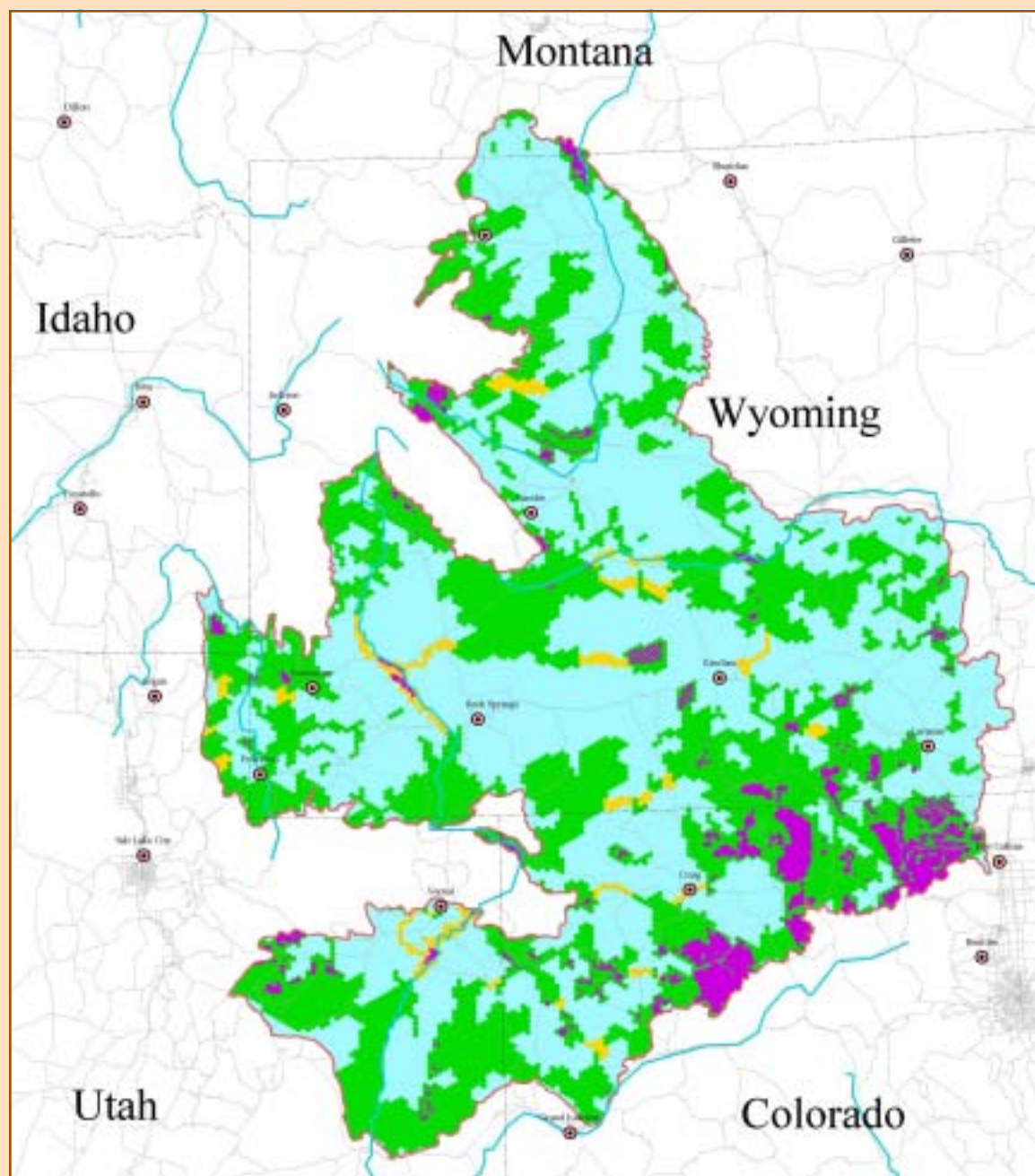


3.6 Lowlands wildlands network with short and long-term core recovery areas added



Chapter 4 we feature the specific components of the Heart of the West Wildlands Network Design and describe aspects of these larger cores in more detail.

## Chapter 3 - Results of SITES Analysis



3.7 Lowlands wildlands network with GAP 1 and 2 areas (purple) shown within cores and linkages

### 3.3 Irreplaceability vs. Vulnerability Assessment

The irreplaceability and vulnerability assessments for the 28 larger lowland cores (Figure 3.9) were based on (GIS-based) site-specific knowledge of the individual cores, and expert opinion. Using the approach of Margules and Pressey (2000) and Noss et al. (2002), we plotted all core

areas on a graph of irreplaceability (y-axis) versus vulnerability (x-axis) and divided the graph into four quadrants (Figure 3.10). The upper right quadrant, which encompasses clusters with high irreplaceability and high vulnerability, is generally the highest priority for conservation. This

## Chapter 3 - Results of SITES Analysis

Table 3.3. Amount of various land ownership categories in the lowland study area, and in cores and linkages.

| Land Owner                | Total amount of land type in study area (km <sup>2</sup> ) | Amount of land ownership in Wildlands Network (km <sup>2</sup> ) | % of Wildlands Network in each ownership |
|---------------------------|--|--|--|
| Bureau of Land Management | 85,066,192   | 35,748,207   | 42.62%                                   |
| Fish and Wildlife Service | 491,893  | 491,892  | 0.59%                                    |
| Forest Service            | 13,871,971   | 12,217,816   | 14.57%                                   |
| National Park Service     | 267,297  | 267,297  | 0.32%                                    |
| Tribal Lands              | 8,973,856  | 2,679,022  | 3.19%                                    |
| Private                   | 63,743,259   | 24,360,297   | 29.04%                                   |
| State                     | 12,582,600   | 6,559,577  | 7.82%                                    |
| Water                     | 1,294,799  | 911,732  | 1.09%                                    |
| <b>Total</b>              |  |  | <b>99.40%</b>                            |

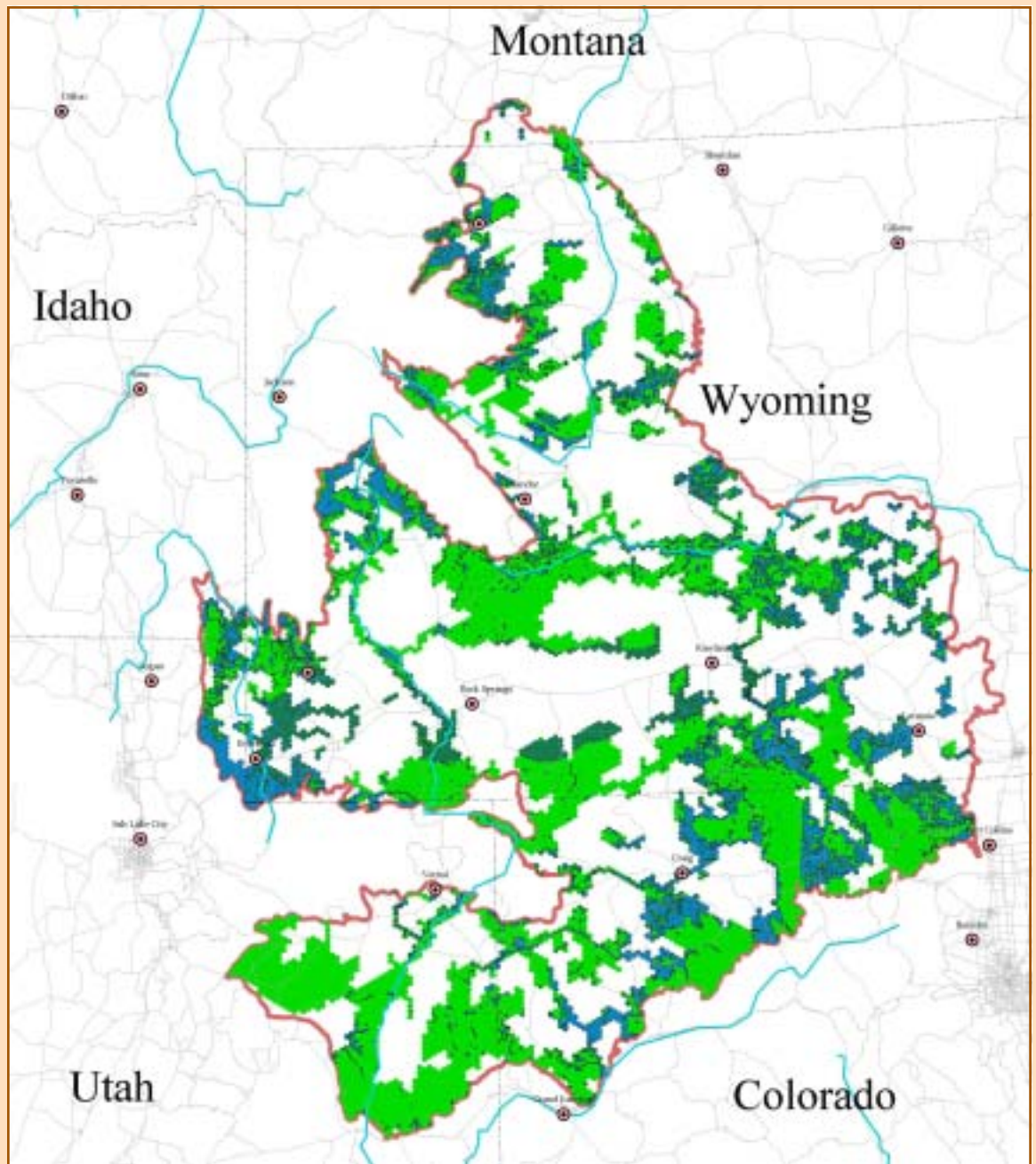
top tier of core areas is followed by the upper left and lower right quadrants (moderate priority), and finally, by the lower left quadrant, encompassing cores that are relatively replaceable and face less severe threats (Noss et al. 2002). Of course, the quadrant lines are arbitrary, so for example, core areas in the lower left quadrant that are “further up” on the irreplaceability axis (y-axis) would warrant higher priority than cores lower in irreplaceability.

Our Irreplaceability vs. vulnerability prioritization of the final set of lowland cores resulted in seven core areas falling into the high irreplaceability/high vulnerability quadrant, giving them the highest priority for conservation action. The

analysis resulted in seven second quadrant priority sites (high irreplaceability/low vulnerability), seven third quadrant priority sites (low irreplaceability/high vulnerability), and seven fourth quadrant priority sites (low irreplaceability/low vulnerability).

We urge that regional conservationists and activists give very high priority to those lowland core areas in the upper left quadrant over the lower right quadrant (Fig 3.10). Areas of high and irreplaceable biological value deserve conservation action even if not highly threatened today, and protection of these areas while they are relatively ecologically intact is more efficient than having to restore them in the future.

## Chapter 3 - Results of SITES Analysis



3.8 Private land holdings (blue) within lowlands core areas and linkages.

It is likely that the biggest threat to lowland core areas in the near future is oil and gas extraction efforts. Indeed, this factor weighed most heavily in the vulnerability analysis described above. Figure 3.11 depicts the degree of the future oil and gas threat facing core areas, where red areas portray areas where over 500 wells are

expected per project area in the next 20 years, pink areas represent 100-500 wells per project area in the next 20 years, and beige areas represent up to 100 new wells per oil and gas project area during that same period.





## Chapter 3 - Results of SITES Analysis



Figure 3.10. Irreplaceability versus vulnerability graph. The X axis measures Z-scores for vulnerability (as described in Chapter 2). As you move along the X-axis from left to right, cores are more vulnerable to loss of protection and degradation. The Y axis measures Z-scores for irreplaceability. As you move along the Y-axis, cores are more irreplaceable. Cores in the upper right hand quadrant have the highest priority for protection, as they are both irreplaceable, and vulnerable.

### 3.4 Linking Lowland Solution With Other Conservation Planning Efforts

One of the original goals of this planning effort was to link a wildlands network for the lowland study area to the conservation assessment already completed by Noss et al. and The Nature Conservancy for the Utah-Wyoming mountains. Figure 3.12

depicts our lowland study area solution alongside the SITES solution featured in TNC's ecoregional plan for the Utah-Wyoming Mountains (as featured in Noss et al. 2002). The areas along the borders between the two SITES results generally

Chapter 3 - Results of SITES Analysis

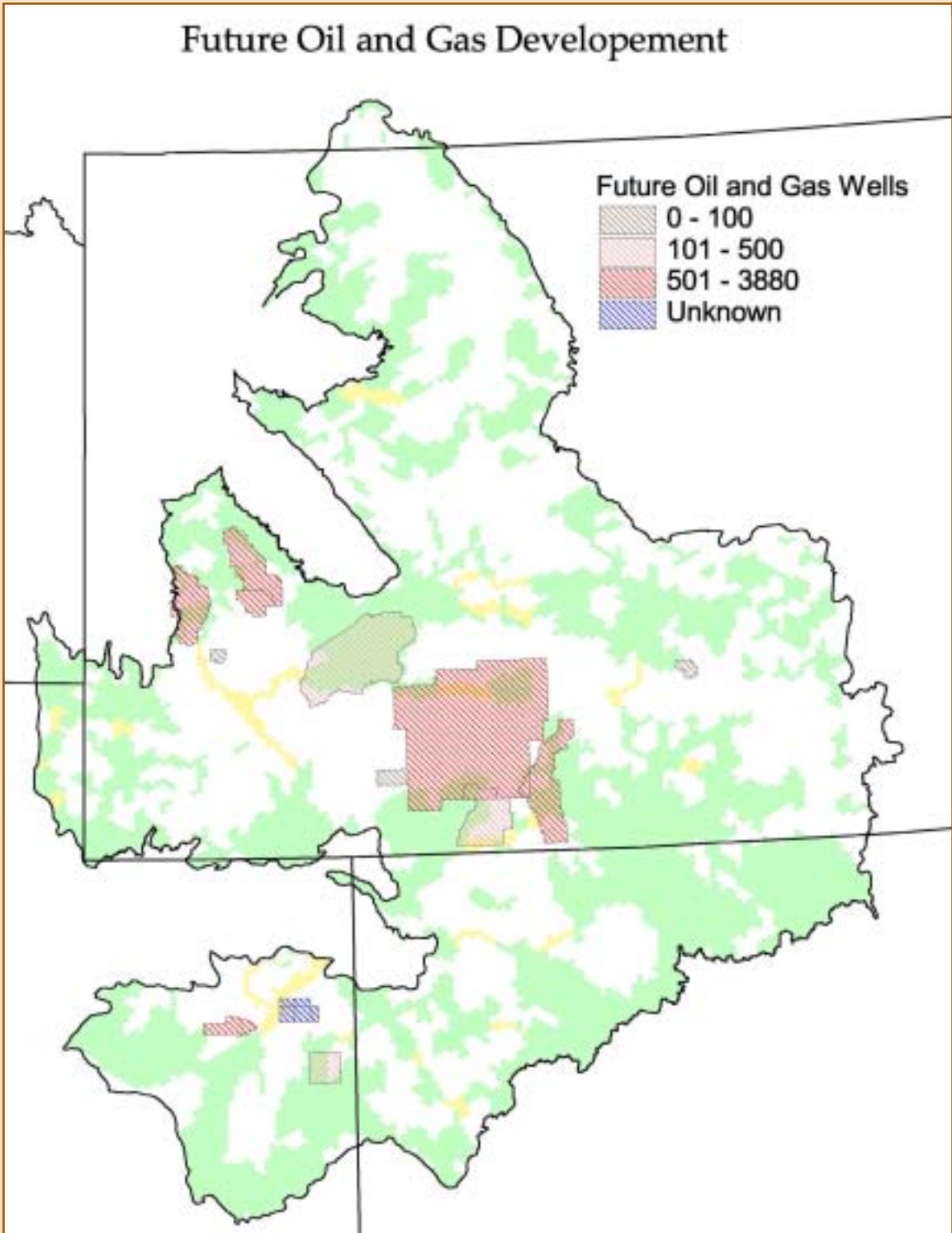


Figure 3.11 Principle energy extraction threats facing lowland cores and linkages in the near future. Polygons reflect approved oil and gas project sites.

## Chapter 3 - Results of SITES Analysis

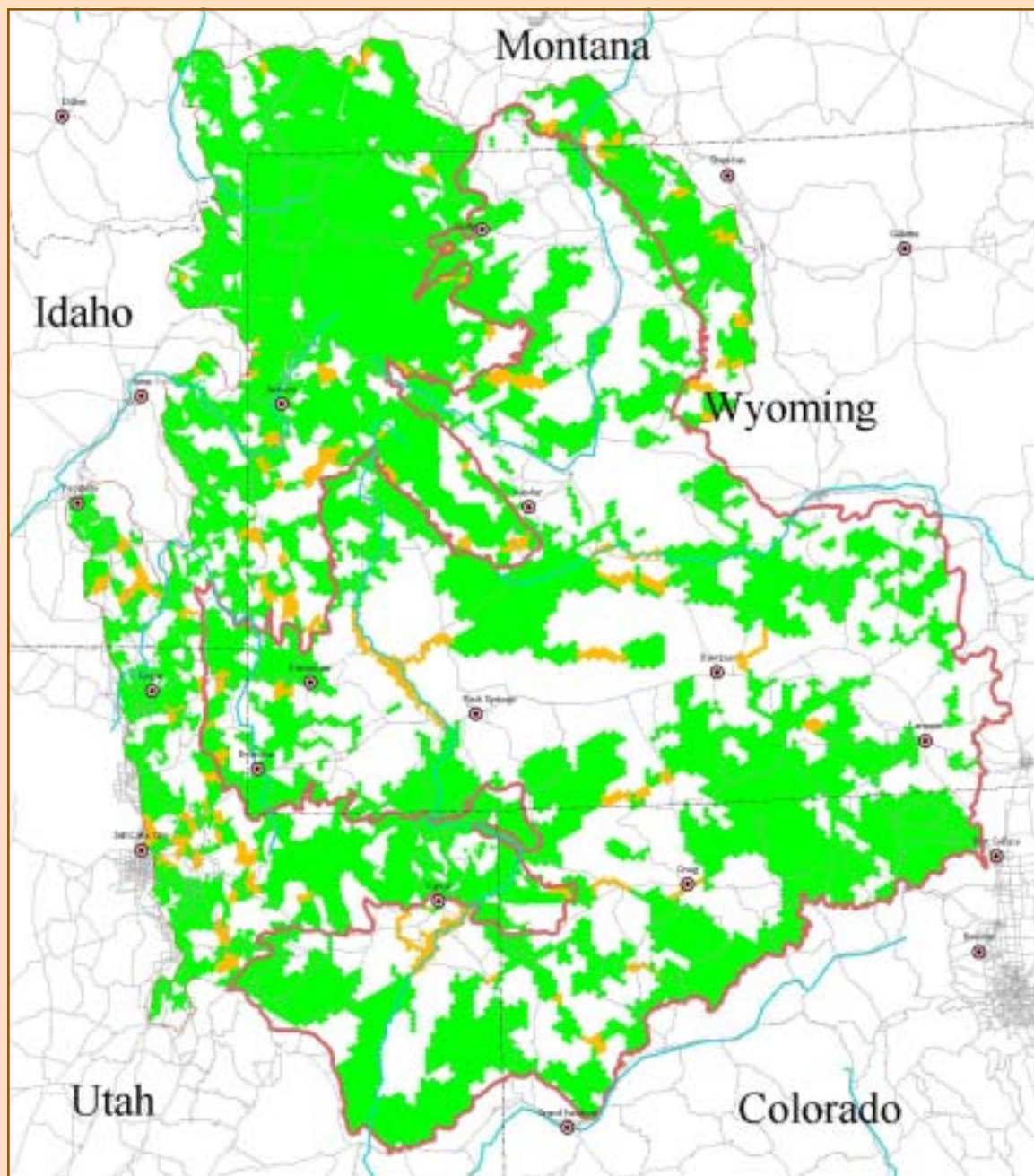


Figure 3.12 Lowlands wildlands network alongside SITES solution for TNC's Utah-Wyoming Mountains Ecoregional Plan (Noss et al. 2002).

showed strong agreement as to which areas should be considered cores and linkages. Areas that were found not to be congruent were shaded to convey Transition Study Areas between core areas in the two adjacent study areas (Figure 3.13). While these Transition Study Areas are not formally designated as cores or linkages,

we recommend that development and other sources of habitat fragmentation be minimized within these zones until detailed studies of wildlife movement allow identification of critical travel routes. Transition Study Areas that were also identified by American Wildlands as being areas important to ungulates and bears in

## Chapter 3 - Results of SITES Analysis

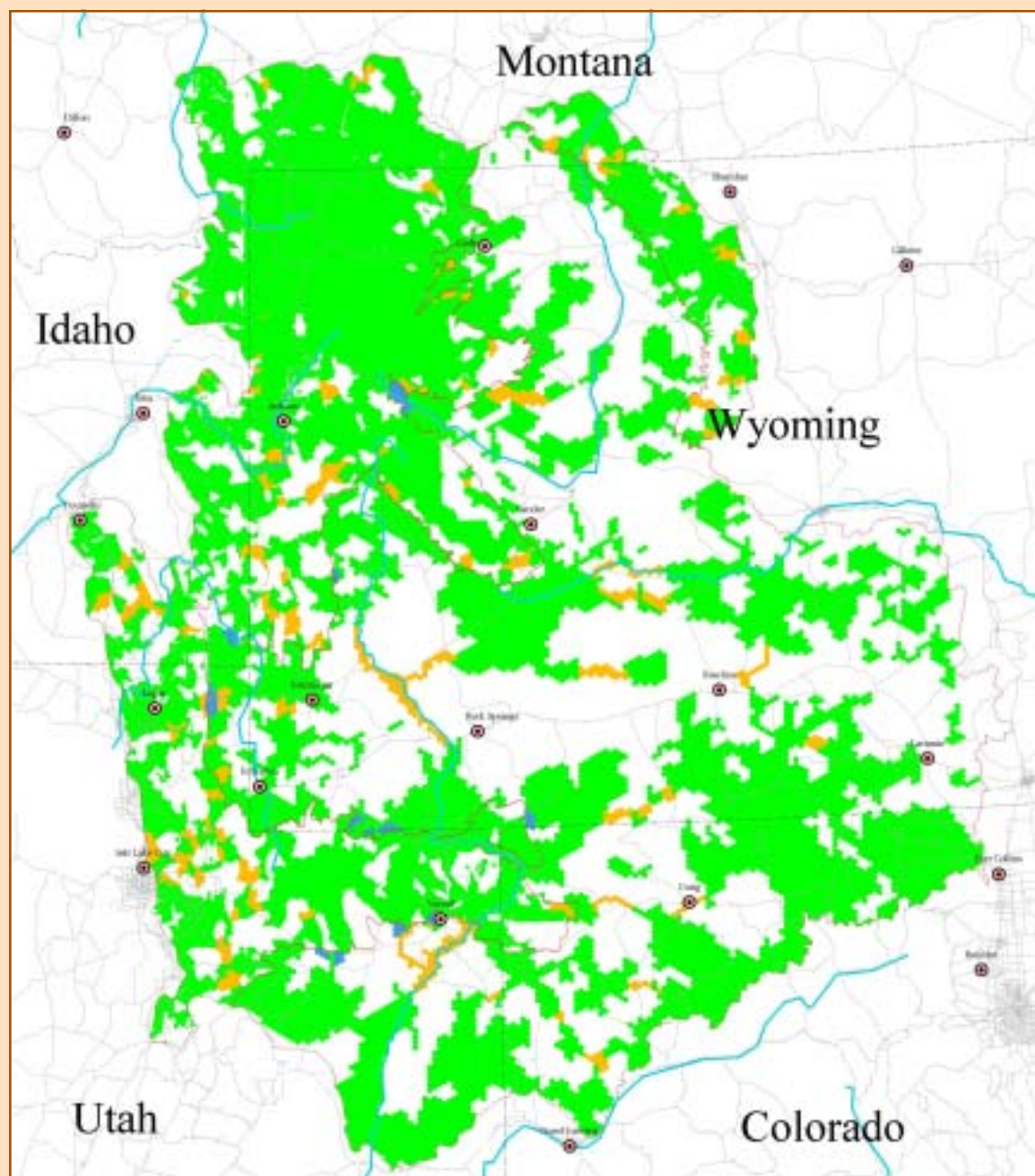


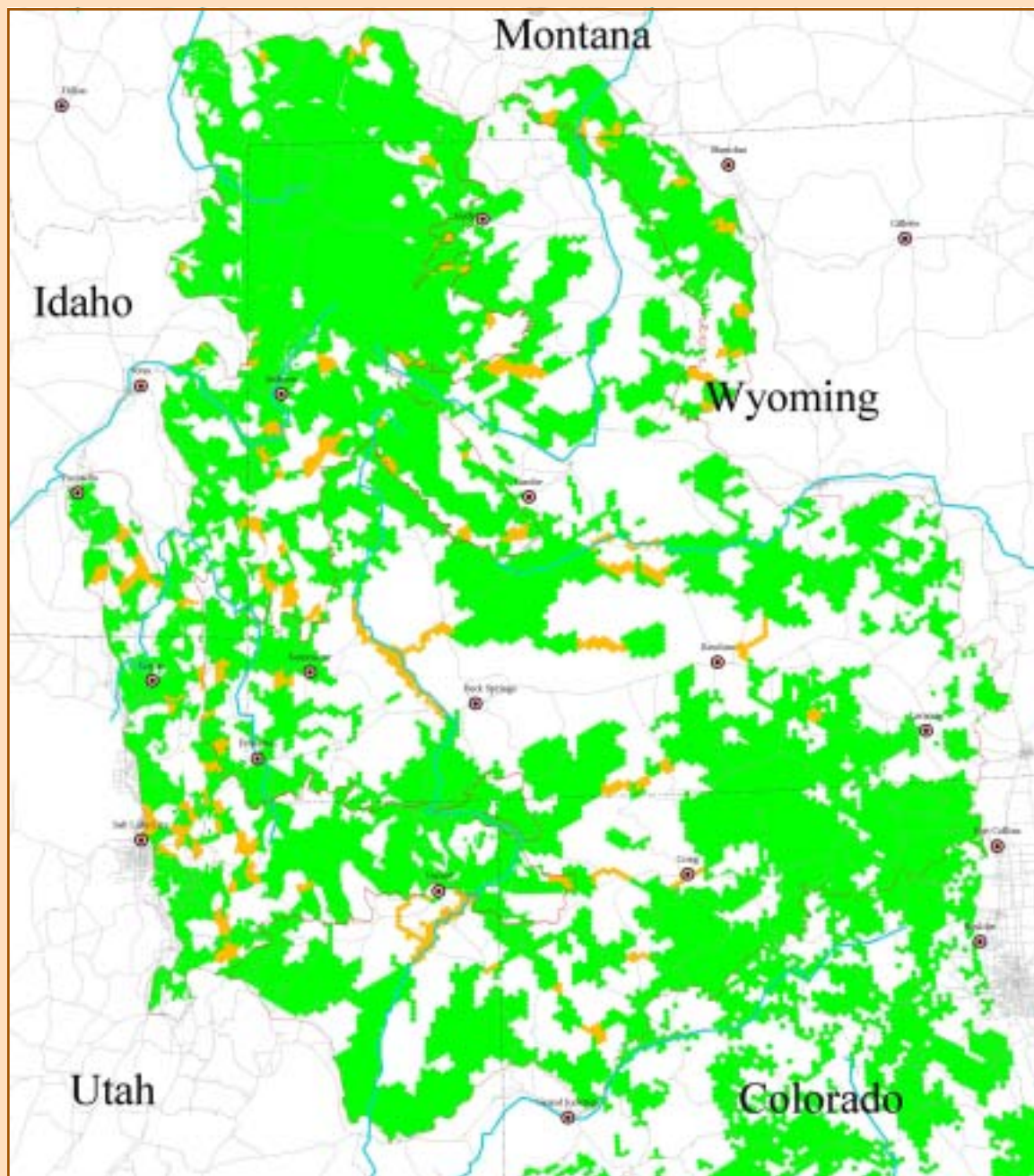
Figure 3.13 Lowlands wildlands network alongside SITES solution for TNC's Utah-Wyoming Mountains Ecoregional Plan (Noss et al. 2002) with Transition Study Areas shown in blue.

their recent "Least Cost Path analysis" for the greater Heart of the West region (American Wildlands, in prep) are likely to be shown through field research to be very important travel linkages between the TNC Utah-Wyoming Mountains portfolio sites and our lowland Heart of the West

core areas. American Wildlands' Least Cost Path analysis for the greater Heart of the West region is featured in Appendix D.

Overall, the Heart of the West lowlands SITES analysis, combined with The Nature Conservancy's Ecoregional Plan

## Chapter 3 - Results of SITES Analysis



3.14 Lowlands wildlands network alongside SITES solution for TNC's Southern Rocky Mountains Ecoregional Plan. Lack of tight clustering in TNC's Southern Rockies Ecoregional Plan reflects a looser boundary length modifier than that used in our analysis for the Heart of the West lowland study area.

for the Utah-Wyoming Mountains offers a comprehensive vision for large-scale landscape protection for the greater Heart of the West region. If the proposed protections in the Utah-Wyoming Moun-

tains Plan are combined with our lowland study area (hereafter referred to the greater Heart of the West region), an impressive amount (over 15,831,000 hectares, or about 53.5%) of the greater

## Chapter 3 - Results of SITES Analysis

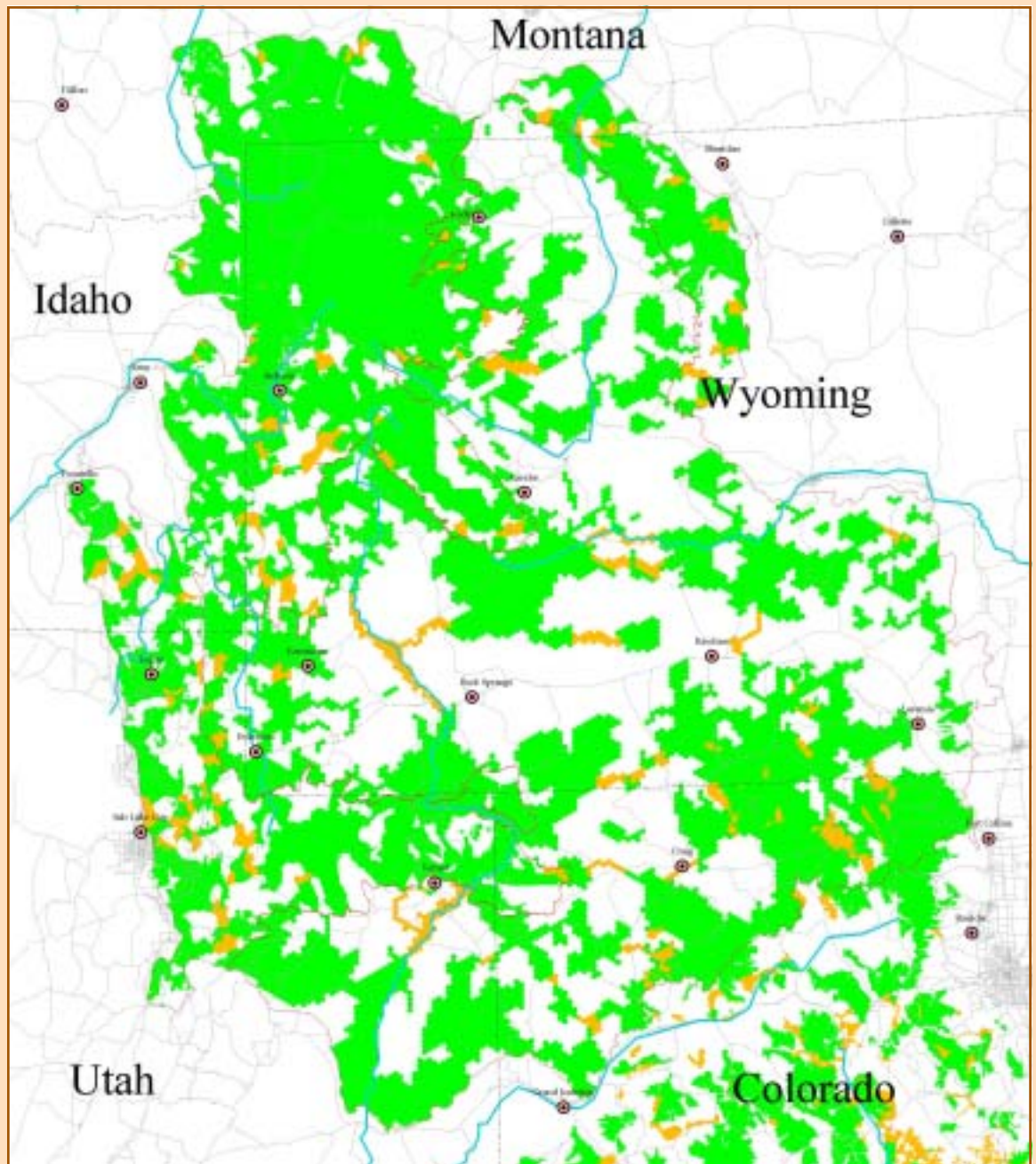


Figure 3.15 Lowlands wildlands network alongside The Southern Rocky Ecosystem Project's (TWP) wildlands network.

Heart of the West region is proposed for protective status.

It is also instructive to link our greater Heart of the West Wildlands Network design with other TNC and Wildlands Project-sponsored network designs to the

south. Figure 3.14 depicts the greater Heart of the West Wildlands Network linked to TNC portfolio sites in the Southern Rockies. Figure 3.15 depicts the greater Heart of the West Wildlands Network linked to The Wildlands Project sponsored Southern Rockies Wildlands Network.

## Chapter 3 - Results of SITES Analysis

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### 3.5 Goal Attainment

The Heart of the West SITES analysis and Wildlands Network seeks specific representation, special element, and focal species conservation goals. We evaluated how well our final lowlands Wildlands Network (Figure 3.6) achieves these goals. Overall, conservation goals were met or exceeded for all 211 targets (including all the individual focal species, NHP species, and land cover types), except for a few targets that were met at ranges of 70% to 99% (Table 3.1, Appendix C).

In addition to meeting the quantitative goals of specific elements, our proposed Wildlands Network for the Heart of the West, if implemented in part or in full, should help attain four key conservation goals necessary for the establishment and maintenance of lasting ecological integrity (i.e. representing all kinds of ecosystems in protected areas, maintaining viable populations of native species, maintaining ecological and evolutionary processes, and building a conservation network resilient to environmental change, Noss 1992, Noss et al. 1997). For example, the greater protection given to rare and imperiled species, whether it be Natural Heritage species occurrences clustered in cores, or wide-ranging focal species benefiting from protected linkages, might increase the probability for long-term population persistence in the Heart of the West. The greater connectivity and reduced fragmentation of habitats that will be achieved through implementation of this Wildlands Network should promote operation of natural processes as well as the natural movements of organisms. Movements of individuals along elevational gradients and into suitable microhabitats in the face of future regional climate change should also be enhanced, hence making the

Wildlands Network more resilient to change. We offer these predictions as testable hypotheses to evaluate with monitoring.

Our GIS analysis for the lowland portion of the Heart of the West revealed that 4.1 % of our lowland study area (and 9.1% of our proposed wildlands network solution) was already included as GAP 1 and GAP 2 status lands. We recommend that an additional 838,642 ha (or 40.8 %) of the lowland study area be managed in a similar fashion to GAP 1 and 2 lands, for a total of 44.9 % of the lowland study area recommended for protection. When our lowland study area Wildlands Network is connected to Noss et al.'s conservation assessment for the Utah-Wyoming Mountains Ecoregion, 53.5% of the greater Heart of the West region would be protected if both plans were implemented and cores and linkages protected. Both our study and that of Noss et al. (entire study is featured in Appendix A) arrived at these figures empirically, by evaluating and ranking targets and sites for protection based on their biological values, without a preconceived idea of how much land would need to be protected in the region. Not surprisingly, however, our proposal falls in line with previous estimates of how much land should be secured to meet conservation goals; most estimates fall in the range of 25% to 75%, and generally average about 50% (Odum and Odum 1972, Margules et al. 1988, Noss 1992, Ryti 1992, Saetersdal et al. 1993, Noss and Cooperrider 1994).





# Heart of the West Conservation Plan

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**Copper Mountain, Wind River**

**Erik Molvar**

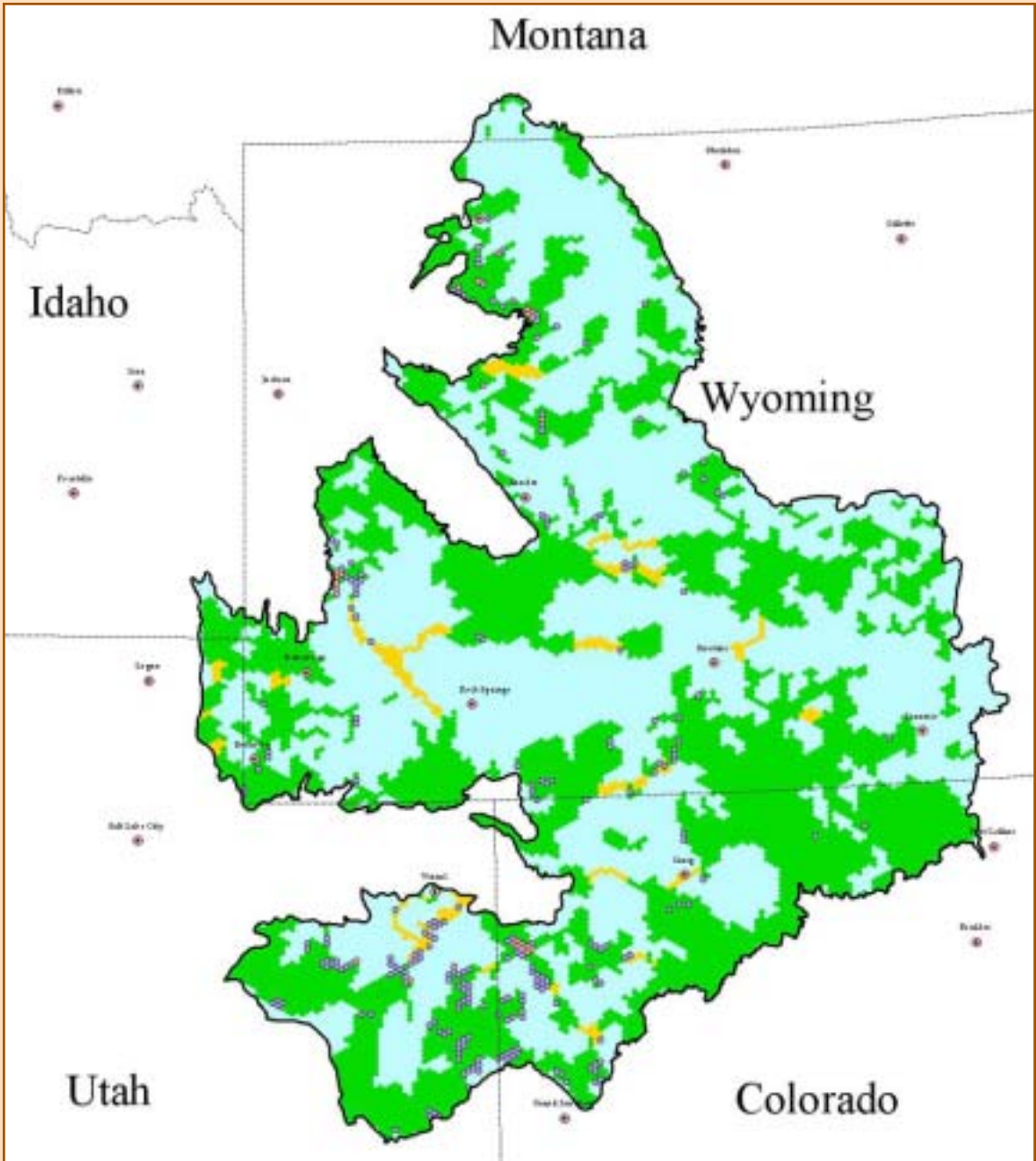
## Chapter 4 - Introduction to the Heart of the West Wildlands Network

Our SITES model helped delineate a lowlands wildlands network of draft core areas, linkages, and compatible use areas that, through advanced work and refinement, resulted in a final proposed Wildlands Network for the lowland areas of the Heart of the West (Figure 4.1). However, we wish to underscore that simply by delineating these important areas on a map certainly does not mean that the protection we desire for these areas will automatically be achieved. Rather, it's the management of these areas - not what we or others call them - that will ultimately

matter the most. Better coordination and communication among conservationists, land managers, and private landowners is needed to achieve shared goals and objectives. These goals and objectives are compatible with those outlined in this conservation plan.

Below, we describe the types of goals and management recommendations that accompany our wildlands network classifications, showcase 28 of our larger, key core areas in the lowland study area, and describe two of the most important linkages in the network.

Chapter 4 - Introduction to the Heart of the West Wildlands Network



4.1 Lowlands wildlands network with short and long-term core recovery areas added

- Core
- Linkage
- Compatible Use
- Short term recovery
- Long term recovery

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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### 4.1 Wildlands Network Unit Classification and Management Guidelines

This chapter describes the wildlands network for the lower elevation region of the Heart of the West. Traditional conservation areas (e.g., National Parks, Wilderness Areas, and National Wildlife Refuges in the United States) generally have clear guidelines for management that have been developed over decades. Management guidelines for science-based conservation areas, such as those included in the lowlands Heart of the West Wildlands Network<sup>1</sup>, emphasize biological values and are still in the process of development and

refinement. The unit classifications and general management recommendations below are our refinements based on those classifications and guidelines featured in recent Wildlands Project Wildlands Network Conservation Plans (Foreman et al. 2003, Miller et al. 2003), which were in turn based on Noss's (1992) original reserve design classification system. Further discussion and revision of these broad classifications and management guidelines is encouraged.

#### 4.1.1 Core Areas

Core areas are wilderness, or wilderness-like areas, managed so as to maintain ecological processes and biodiversity within them. These areas comprise the bulk of the wildlands network featured in the previous chapter. Core areas include all GAP 1 and GAP 2 status lands, as well as all roadless areas, as all of these features were captured in our initial lowland SITES model. Core areas are clusters of planning units that include not only roadless areas but also important biological and ecological features of the landscape.

We recommend that all core areas in the Heart of the West that possess wilderness characteristics be managed in accordance with the 1964 Wilderness Act. Core areas should be managed such that no new permanent roads are built, use of motorized/mechanized equipment and vehicles is prohibited or substantially limited, logging and other tree removal activities are curtailed, and new surface mineral extraction

activities avoided. In addition, predator control and trapping should be prohibited, unless necessary for restorative management or recovery of focal species. Human use should be managed to protect the ecological integrity of the area. In general, we recommend that the chief human uses in core areas include nonmotorized activities. Hunting and fishing should be managed in a manner that prevents degradation of the ecological integrity of the area. Livestock grazing should be limited to levels of use that ensure diverse plant community composition, forage production at potential, and unimpaired riparian areas. We recommend that certain exotic species be controlled and/or eliminated in core areas. Species such as exotic trout, and monocultures of noxious weeds, are especially detrimental in these areas. Lastly, monitoring of habitat, focal species, and habitat function should establish critical thresholds needed for species (especially carnivore) persistence.

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<sup>1</sup> In this chapter we principally refer to the lowlands Heart of the West Wildlands Network. Appendix A features Noss et al.'s report on the Utah-Wyoming Mountains conservation assessment, which includes unit ("megacore") descriptions and management guidelines for these important units in the mountainous regions of the Heart of the West. More detailed prescriptions for individual units in the Utah-Wyoming Mountains is work in progress by The Nature Conservancy and the Heart of the West Implementation Team.

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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Many lowland Heart of the West core areas have established roads, jeep tracks and trails. A few of the cores possess oil and gas wells. We recognize the reality that continued vehicle use related to oil or gas production will continue for some of these routes. In core areas, we recommend that the land manager reduce road density to a level that encourages return of wildlife and prevents further population loss of certain species. Such road densities will vary depending on habitat type and species.

A couple of examples demonstrate this prescription. Studies have shown that vehicle use and oil and gas well sitings closer than two miles to a sage grouse lek leads to measurable changes in grouse populations (Lyon 2000). This translates into a minimum well density of one well per every 640 acres for sage grouse breeding habitat. In terms of elk, when road

density in forested habitat exceeds one mile per square mile, elk habitat effectiveness is reduced by 25% (Hartley 2003). In more open habitat, common in much of the Heart of the West, wildlife avoidance of roads increases. In rolling shrublands with road densities of 0.8 miles of road per square mile, elk cease using much of such habitat (Lyon 1979).

To meet road density and well spacing requirements for focal species, land managers have several options. New oil and gas wells can use existing well pads to drill directional wells<sup>2</sup>. Public motorized use can be restricted to designated routes only. Routes not needed by the public can be closed with a gate or the route removed and reclaimed. These sorts of actions in core areas would lead to lower road use levels and road densities that would better meet the needs of wildlife.

### 4.1.2 Core Recovery Areas

These areas are places within core areas that have more than 5 oil and gas wells per planning unit (or more than one well per 250 hectares). The core recovery areas are further divided into short-term recovery areas (5 to 25 wells per planning unit), and long-term recovery areas (more than 25 wells per planning unit, or more than one well per 50 hectares). Because of impacts at this level, these recovery areas are functioning at a level that prevents the habitat function needed for focal species. However, the SITES model still selected these areas to be an integral part of our wildlands network because of the ecological attributes they possess, and/or their importance in maintaining integrity of cores and connectivity between cores.

Therefore, core recovery areas are incorporated in the Heart of the West core areas as an important step in restoring these areas to an ecologically functioning and natural state, and eventually an integral component of intact core areas.

Areas identified for short-term and long-term recovery differ because of the magnitude of recovery needed. Areas mapped for short-term recovery generally have fewer impacts and have habitat that still partly functions for wildlife. Long-term recovery involves restoring habitat in an area with a much higher density of impacts.

Recovery schedules are affected by a number of factors including the legal right

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<sup>2</sup> The details of this approach are explained more fully in Molvar (2002).

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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of land users to continue their activities. Where possible, current uses should be modified to allow for use in deference to the need of habitat to function for wildlife. In some cases this may not be possible and recovery will not begin until, for example, oil production ends at a specific well. Short-term recovery for a producing oil field would require that future wells be drilled from existing wells, and that nonproducing well sites be reclaimed. Recreational vehicle use must be limited to principle roads. Power lines should be moved underground in areas where raptors predation may affect a focal species. Mineral extraction operators should anticipate the need for these sorts of restoration activities, and their costs need to be part of the permit bonding process.

Long-term recovery applies to areas with a high density of wells, roads, pipelines, and

power lines. Reclamation of such an area may not begin for one or more decades and could take several decades to complete.

We recommend that core recovery areas be managed to restore and protect natural ecological conditions. Examples of restorative management might include:

- Closing impacting vehicle use routes
- Phasing out domestic livestock grazing as has been traditionally practiced. Limit livestock grazing to a level that ensures recovery of plant community structure and productivity necessary for the focal species of this area.
- Reclaim habitat related to oil and gas wells that are not economically viable.
- Rely on directional drilling from past well sites to reduce oil and gas well spacing to acceptable densities

### 4.1.3 Linkages

Linkages are connecting segments of land between core areas that link core areas together so wildlife can move between them, while also allowing evolutionary and ecological processes (e.g. fire, succession, predation, etc.) to continue operating within an otherwise fragmented system. There are several primary functions for linkages. One, they provide dwelling habitat as extensions of core areas. Two, they provide for seasonal movement of wildlife (e.g., elk and pronghorn migratory movement). Three, they provide for dispersal and genetic interchange between species in core wild areas (to tie metapopulations together). Four, they allow for latitudinal and elevational range shifts with climate change. Any given linkage in the Heart of the West Wildlands Network fulfills one or more of these functions.

One of the chief ways linkages were delineated in the lowlands Heart of the West Wildlands Network was by major river linkages between existing core areas. These linkages thus serve as critical connecting corridors for aquatic species (native fish, beaver, river otter, and invertebrates), riparian woodland-dependent species, and other terrestrial wildlife species that use riparian areas for seasonal movements and dispersal. Specific linkages should be managed for movement by both terrestrial and aquatic species known to use those areas, with management guidelines based on the needs of those particular species.

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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Linkages are critically important and we suggest the following management criteria for these areas:

- When intersecting moderate- or high-use highways, linkages should include wildlife underpasses, tunnels, bridges, viaducts, and other structures that allow wildlife to cross roads safely.
- Limit additional human development along linkages to ensure that the habitat of linkages functions for focal species.
- Restorative management in linkages will ensure that the habitat of linkages functions for focal species.
- Limit vehicle use to designated routes so that the habitat of linkages functions for focal species.
- Ensure that mineral development prescriptions that cater to native wildlife are validated and implemented.

### 4.1.4 Compatible Use Areas.

Areas outside core areas and linkages allow for a higher level of activity, yet these activities must still protect land use values and productivity. All federal lands managed for multiple use are required to have use managed in a manner that provides adequate habitat for wildlife, and prevents the impairment of biological productivity.

Compatible use areas can facilitate connectivity between core areas. There are several primary ecological functions of Compatible use areas. One, they ameliorate edge effects on core areas (insulate core wild areas from intensive land use). Two, they provide additional habitat for animals to move between core wild areas, including movements in response to climate change (i.e., enhance connectivity). Three, they provide supplemental habitat for populations of native species inhabiting core areas – in particular for species who require several different habitat types, perhaps on a seasonal basis. The supplemental habitat provided by Compatible use areas can lead to greater population sizes, viability, or stabilization of population dynamics of certain native species.

We believe the following human activities to be suitable for Compatible Use Areas:

- Mechanical recreation (both motorized and mountain bike) on designated routes only.
- Camping
- Livestock grazing management that uses stocking levels and seasons of use that ensure that range health goals are met and sustained, and riparian areas are restored. Grazing should be conducted in a manner that allows predator populations to reach traditional levels, by utilizing “predator friendly” livestock grazing which utilizes non-lethal methods to deal with livestock depredation wherever and whenever possible.
- Limit wood cutting to a level that ensures a presettlement patch work stands in varying structure and condition. The native condition of much of the lower elevation forest in the Heart of the West was very few late-seral stands scattered widely through a matrix of open grass- and shrub-dominated vegetation. Reforestation of lower timberline is a problem for some native wildlife (i.e. compromising migration routes). Burning and small area cuts have been successful at opening up dense forested areas.
- Restoration management should limit habitat manipulation to that necessary for focal plant and animal species.

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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- All fencing needs to meet state fence standards for wildlife (i.e. Wyoming Game and Fish Department standards, which are wildlife-friendly).
- Oil and gas should focus surface disturbance as much as possible to existing oil fields. Directional drilling should be utilized with all new wells that are established, and these should be drilled from existing pads. Spacing between wells should be at least 3 miles (6.6 km) between well pads. No Surface Occupancy stipulations should be mandated for areas within 3 miles of sage grouse leks, and within  $\frac{1}{2}$  mile of active raptor nests, important biological areas outlined by the Wyoming Natural Diversity Database and other local experts, and all sensitive plant and wildlife habitats (including ungulate crucial winter range, prairie dog colonies, sage grouse wintering grounds, wetlands, and 100-year floodplains). In addition, all human activities associated with oil and gas production (including surface disturbance) should cease between November 15 and April 15 on all big game winter ranges. We recommend shothole exploration only, hand-laying of lines in particularly sensitive areas, and banning the use of large vibrator trucks for seismic exploration.

Current laws, regulations, policies, and management techniques for federal lands can integrate many of the recommendations of the Heart of the West Wildlands Network and Conservation Plan into current management decisions. Subsequent implementation of this wildlands network might involve a proposed workshop to bring together experts from government, academia, conservation groups, and land-use groups to develop guidelines for 1) protection and ecological restoration in core areas, and 2) management for linkages and compatible-use lands.

### 4.2 A Closer Look at Key Core Areas - Heart of the West Lowlands

In this section we describe in more detail 28 of the larger core areas in the lowland study area (Figure 4.2). These core areas vary from 32,500 to 1,367,680 hectares in size, and are featured below starting with those in the north and moving south.

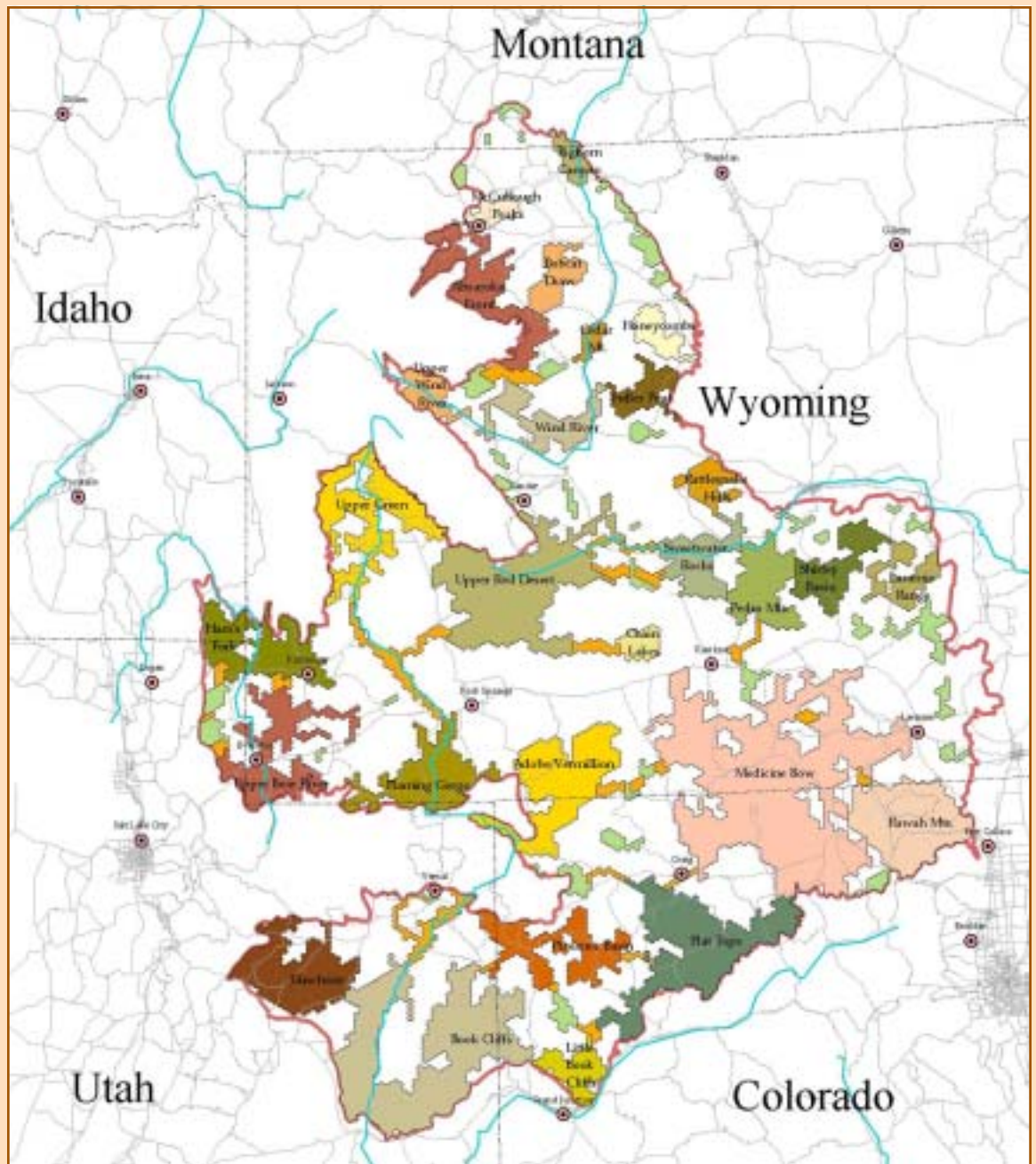
#### 1. Bighorn Canyon:

General Description: At 50,976 hectares in size, this core area straddles the Montana-Wyoming border in the Bighorn Basin. This area spans a range of community types, including mountains with coniferous forest, foothills robed in juniper scrub and mountain shrub communities, and sagebrush steppe lowland types. The Pryor Mountains form the western portion of this core, while the thousand-foot limestone walls of Bighorn

Canyon form the heart of the area. Here the Bighorn River, impounded by Yellowtail Dam, is now a long reservoir - a significant impact to the river system. An important overland trail bypassing Bighorn Canyon and used by native peoples in prehistoric and historic times runs through the area. The Demi-John Archaeological District, listed on the National Register of Historical Places, lies within this area.

Ecological Values: In our analysis of irreplaceability versus vulnerability of cores, this core area scored very high for wetland and riparian values, and also was a substantial contributor of good sage grouse (*Centrocercus urophasianus*) habitat to the wildlands network. It is also notable that a herd of bighorn

## Chapter 4 - Introduction to the Heart of the West Wildlands Network



**4.2 Key core areas of the lowland wildlands network.**

sheep (*Ovis Canadensis*) inhabits Bighorn Canyon proper. In addition, this core area contains 100% of all element occurrences of two of our Natural Heritage Program (NHP) species targets: rabbit buckwheat (*Eriogonum lagopus*) and Wind River milkvetch, (*Astragalus oreganus*) and two-thirds of the occurrences of another NHP target: bighorn

fleabane (*Erigeron allocotus*). Other occurrences of NHP species are known in this core area, including dagget rock cress (*Arabis pendulina var. russeola*), persistent sepal yellowcress (*Rorippa calycina*), hairy prince's plume (*Stanleya tomentosa var. tomentosa*), peregrine falcon (*Falco peregrinus*), and sturgeon chub (*Macrhybopsis gelida* [*Hybopsis*



## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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**Bighorn Canyon**

**Erik Molvar**

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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*gelida*). There are several major cave complexes in this area (Natural Trap Cave, Horsethief Cave, and Bighorn Caverns, plus cave complexes in the Pryor Mountains), which harbor cave fauna including ten species of bats.

Recommendations: A Citizens' Proposed Wilderness Unit (Pryor Mountain), which is also receiving special management for

wild horses, exists within this core area. Much of this core falls within the Bighorn Canyon National Recreation Area, managed by the National Park Service. We recommend that the BLM conduct the necessary inventory work and/or research to determine whether this unit qualifies for Wilderness Study Area (WSA) status.

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### 2. McCullough Peaks:

General Description: An arid 47,557 hectares of badlands and arid foothills flanking the Shoshone River in the Bighorn Basin define this wild desert core. This is a low desert area in the rain shadow of the Beartooth and Absaroka Mountains. At the heart of the core, the McCullough Peaks rise up from the sagebrush steppes to the south to break into a maze of eroded badlands that descends to the Shoshone River floodplain. In the badlands, a

painted desert landscape is populated by a sparse saltbush-greasewood community.

Ecological Values: This core area contains important NHP occurrences such as sturgeon chub and whooping crane (*Grus Americana*). A herd of 400 mule deer (*Odocoileus hemionus*) finds year-round habitat in this area. Swift foxes (*Vulpes velox*), wild horses, and mountain lions (*Puma concolor browni*) are also found here. Prairie falcons (*Falco mexicanus*), merlins



Whistle Creek, McCullough Peaks

Erik Molvar

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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(*Falco columbarius*), and golden eagles (*Aquila chrysaetos*) nest in the badlands, while sage grouse are found in the flatter sagebrush steppe areas. The western part of the core affords important winter range for the Yellowstone elk herd.

Recommendations: A Citizens' Proposed Wilderness Unit (McCullough Peaks) exists within this core area. We recommend that the BLM conduct the necessary inventory work and/or research to determine whether

additional lands in the Whistle Creek badlands should be added to the existing WSA.

Threats: Natural gas exploration and development is ongoing in the area, and the USGS estimates that 2 billion cubic feet of natural gas and 5,000 barrels of oil underlie the WSA alone. The fragile badlands and desert vegetation are vulnerable to damage inflicted by Off Road Vehicles (ORVs) and other off-trail motorized vehicles.

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### 3. Absaroka Front:

General Description: A substantial 265,156 hectares in size, this core area is located along the outskirts and foothills of the Absaroka Mountains in the northern part of the lowland Heart of the West study area. Semi-arid foothills rising to precipitous peaks and cliff-walled plateaus define this core. Numerous streams and small rivers descend through the foothills, lined with cottonwood lowlands. These foothills are robed in a mosaic of montane grasslands and stands of conifers and aspens.

Ecological Values: In our irreplaceability versus vulnerability analysis of cores, this core area scored very high for riparian values. It also contains nearly a dozen occurrences of rare G1 and G2 NHP species, such as Evert's waferparsnip (*Cymopterus evertii*), and Rocky Mountain twinpod (*Physaria saximontana* var. *saximontana*). The Absaroka Front core contains over half of the hairy prince's plumes (*Stanleya tomentosa*) and a full two-thirds of the shoshoneas (*Shoshonea pulvinata*) in the lowlands wildlands network. Wildlife is similarly abundant and diverse on the Absaroka Front. Forested areas are home to boreal owls (*Aegolius funereus*), northern goshawks

(*Accipiter gentiles*), lynx (*Lynx lynx*), pine martens (*Martes pinus*), and fishers (*Martes pennanti*). This area also harbors established populations of gray wolves (*Canis lupus*) and grizzly bears (*Ursus arctos horribilis*). Cliff habitat supports nesting peregrine falcons as well as healthy populations of bighorn sheep. Crucial winter ranges for elk (*Cervus elaphus*), moose (*Alces alces*), and mule deer that summer in Yellowstone National Park can be found in this core area.

Recommendations: Roadless areas and BLM WSAs adjacent to the Washakie Wilderness should be added to the wilderness through Congressional designation. Crucial winter ranges for ungulates should be placed off-limits to road-building and oil and gas development.

Threats: There have been past efforts to open the Absaroka Mountain Front to oil and gas drilling, but these efforts demonstrated that steep slopes and unstable soils would have made environmental impacts extremely heavy. Outbreaks of endemic forest insects and parasites in recent years have set the stage for a potentially major timber harvest program under the guise of maintaining "forest health."

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

### 4. Bobcat Draw:

**General Description:** 104,999 hectares in size, this core area in the center of the Bighorn Basin is an area of sweeping badlands tinted in reds, pinks, and purples. This is an arid land in the rainshadow of the Absaroka Range, typified by saltbush-greasewood deserts in badlands with highly saline soils, while more mesic stretches harbor sagebrush steppe vegetation. Some of the most colorful desert badlands in Wyoming are found here.

**Ecological Values:** This core was a substantial contributor of good sage grouse habitat to the wildlands network, as well as sharp-tailed grouse (*Tympanuchus phasianellus*) lek sites. It also contains a full third of the Evert's wafer parsnip in the lowlands wildlands network, and appreciable amounts of sturgeon chub. The Tatman Mountain and Fifteenmile wild horse herds are found here, as well as year-round populations of bighorn sheep, mule deer, and pronghorn antelope (*Antilocapridae cabri*) in the uplands. Mountain lions and bobcats (*Lynx rufus*) are known to roam the badlands.

**Recommendations:** The Gooseberry Badlands were once proposed as a National Natural Landmark by the National Park Service. Three WSAs (Sheep Mountain, Red Butte, and Bobcat Draw Badlands), along with adjacent wilderness-quality lands nominated for WSA status by citizens' groups, exist within this core area. We recommend that the BLM conduct the necessary inventory work and/or research to determine whether additional lands adjoining these units qualify for WSA status.

**Threats:** Billions of cubic feet of natural gas and hundreds of thousands of barrels of oil are thought to underlie this area. Much of the natural gas is deep (15,000 to 20,000 feet underground), tempering its attractiveness to the oil and gas industry. A recent gas drilling project in the Paradise Alley are (an area just south of Bobcat Draw WSA and in the Citizens' Wilderness Proposal) is currently underway. The Dobie Creek and Worland Anticline oil fields adjoin the core area.



**Bobcat Draw**

**Erik Molvar**

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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### 5. Honeycombs:

**General Description:** 76,227 hectares in size, this wild core area of rolling sagebrush steppe and heavily eroded badlands lies along the eastern edge of the Bighorn Basin. Immediately north of the Fuller Peak core, the Honeycombs core abuts the eastern edge of the lowland Heart of the West study area.

**Ecological Values:** This area contains an abundance of crucial winter range for both mule deer and antelope, as well as sage grouse lek sites and nesting habitat for golden eagles.

**Recommendations:** Two Citizens' Proposed Wilderness Units (Honeycombs WSA and surrounding wilderness-quality lands as well as the Buffalo Creek citizens' proposed wilderness) exist within this core area. We recommend that the BLM take the necessary actions to designate these areas for wilderness study.

**Threats:** Coal deposits in the area have been worked in historical times. The coal itself is thought to be of marginal economic potential, but coalbed methane may be a more attractive possibility for industry. The Worland Anticline oil field, a massive industrial development, is creeping into this core area as time goes on. Black sandstone deposits found in the area may have the potential for producing niobium, titanium, tantalum, and other strategic minerals used in making high-tech alloys.



**Honeycombs**

**Erik Molvar**

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

### 6. Cedar Mountain:

**General Description:** This 32,499 hectare core area surrounds a small and isolated range of hills that is dissected into steep and eroded ridges along its north slope. The hills rise above the Bighorn River at the southern end of the Bighorn Basin. The hills are robed in sparse woodlands of juniper (which is how Cedar Mountain got its name), while the surrounding lowlands to the north of Cedar Mountain are typified by sagebrush steppe and saltbush-greasewood desert.

**Ecological Values:** Based on our irreplaceability versus vulnerability analysis of cores, this core area received a high score for its contribution of good wolf habitat to the lowland wildlands network. This area's juniper woodlands are a rare community type in Wyoming. It also contains appreciable numbers of burrowing owl (*Athene cunicularia* [*Speotyto cunicularia*]). Bald eagles (*Haliaeetus leucocephalus*) roost and forage along the Bighorn River in this

area, and merlins, golden eagles and prairie falcons nest in this core. The western silvery minnow (*Hybognathus argyritis*) is known in this area, in the Bighorn River.

**Recommendations:** One WSA (Cedar Mountain) exists within this core area, and is associated with other wilderness-quality lands that have never received interim protection. We recommend that the BLM conduct the necessary inventory work and/or research to determine whether additional lands adjoining these units qualify for WSA status.

**Threats:** There is moderate potential for oil and gas production in the northeast part of the Cedar Mountain core area. Additional dams have been proposed along this reach of the Bighorn River; such dams would destroy important cottonwood gallery forests and other riparian habitats.



**Cedar Mountain**

**Erik Molvar**

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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### 7. Fuller Peak:

**General Description:** 94,910 hectares in size, this core area is adjacent to The Wind River core area and abuts the eastern boundary of the Heart of the West study area and the southern edge of the Bighorn Mountains and the Bighorn Basin. From the tip of the Bighorn Mountains, this core area spans across an east-west running expanse of highlands, to the Bridger Mountains and almost to the Wind River corridor. Dominated by grasslands, sagebrush shrublands and juniper, this core area includes some of the driest parts of Wyoming (Freilich et al. 2001).

**Ecological Values:** This core area contains many NHP species occurrences, such as black-footed ferret, bun milkvetch (*Astragalus simplicifolius*), Devil's Gate twinpod (*Physaria eburniflora*), and hairy prince's plume. The Fuller Peak core also contains a full third of all the Owl Creek

miner's candle (*Cryptantha subcapitata*) in the lowland wildlands network, and over a third of a very rare (G1) sage variety called Porter's sagebrush (*Artemisia porteri*) in the network. Golden eagles, ferruginous hawks (*Buteo regalis*), and burrowing owls also nest in the area. A rare specimen of Allen's thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*) was recorded in this area in 1938.

**Recommendations:** Two Citizens' Proposed Wilderness Units (Lysite Mountain and Fuller Peak) exist within this core area. We recommend that the BLM take the necessary actions to designate these areas for wilderness study.

**Threats:** Other than Uranium mining, which occurred in this area in the past, the immediate threats to this core area are relatively low.

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### 8. Upper Wind River:

**General Description:** The upper valley of the Wind River is characterized by semi-arid grasslands and eroded badlands stretching between the Wind River Range and the Absaroka Mountains. A broad stretch of the Wind River Badlands, including the Dubois Badlands, has been recommended as a National Natural Landmark. Portions of this core fall within the Wind River Reservation, administered by the Shoshone and Arapaho tribes. The Upper Wind River core area is 80,788 hectares in size.

**Ecological Values:** Important NHP species can be found in this core area, including bun milkvetch, Wyoming point-vetch (*Oxytropis nana*), Weber's saw-wort (*Saussurea weberi*), Jones' columbine (*Aquilegia jonesii*), aromatic pussytoes (*Antennaria aromatica*), William's rockcress

(*Arabis williamsii* var. *williamsii*), sweet-flowered rock jasmine (*Androsace chamaejasme* ssp. *Carinata*), Rocky Mountain twinpod (*Physaria saximontana* var. *saximontana*), and almost 90% of all the Dubois milkvetch (*Astragalus gilviflorus* var. *purpureus*) in the lowlands wildlands network. Whiskey Mountain is home to the nation's largest bighorn sheep herd, and this herd supplies the breeding stock for transplantings of bighorn sheep to their native range throughout the West. Other rare species such as the lynx, river otter (*Lontra canadensis pacifica*), and fisher inhabit this area. The lowlands between the mountains offer important winter ranges for elk and mule deer.

**Recommendations:** Two WSAs (Dubois Badlands and Whiskey Mountain) exist within this core area. We recommend that

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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the BLM conduct the necessary inventory work and/or research necessary to determine whether additional lands adjoining these units qualify for WSA status. Unauthorized fences in the area should be removed, and all fences should be brought into Wyoming Game and Fish Department compliance (bottom wire smooth and at least 16 inches above the ground) to facilitate antelope passage. County-level planning is needed in this area to protect open space and arrest second-home sprawl.

Threats: The Dubois Arch oil fields are near this core area, and exploration wells in the core have yielded shows of oil from the Phosphoria formation. Illegal off-trail ATV use and illegal dumping are major problems here, particularly within the fragile formations of the Dubois Badlands. Suburban sprawl from second homes in the Dubois area is contributing to substantial habitat fragmentation and loss.



**Upper Wind River**

**Erik Molvar**



## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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### 9. Wind River:

**General Description:** Serving as a potential linkage between the greater Yellowstone Ecoregion and the Bighorn Mountains, the Wind River core area links to both the Absaroka Front core and the Fuller Peak core as it hugs the north bank of the Wind River as it in turn drains the Wind River Mountains and heads north through the Bighorn Basin. The 164,999 hectares of low grassland basins and a portion of the rugged Owl Creek Mountains and Wind River Canyon define this core area. Wind River Canyon, a stunning landform that divides the Bridger and Owl Creek Mountains, cuts into various geologic layers all the way down to ancient Precambrian bedrock.

**Ecological Values:** In our irreplaceability versus vulnerability analysis of cores, this core area scored high for its contribution of good sage grouse habitat to the lowland wildlands network. This core area contains many NHP species occurrences, such as bun milkvetch, Rocky mountain twinpod, Hapeman's sullivantia (*Sullivantia hapemaniai*), Watson's prickly-phlox (*Leptodactylon watsonii*), and hairy prince's plume. The Wind River core also contains

two-thirds of the Owl Creek miner's candle in the lowland wildlands network, and one-third of the persistent sepal yellowcress in the network.

**Recommendations:** A great deal of this core area falls within the Wind River Reservation, governed by the Shoshone and Arapaho tribes. One WSA (Copper Mountain) exists within this core area. We recommend that the BLM conduct the necessary inventory work and/or research to determine whether lands adjacent to this unit qualify for WSA status. The Wind River Canyon has been proposed as a National Natural Landmark and is sacred to the Shoshone and Arapaho people.

**Threats:** Oil and gas development are present in and around this core area. The Copper Mountain Uranium District was once viewed as a highly promising mining area, before accidents at nuclear power plants reduced the public demand for nuclear power generation. Over-utilization of water in the Wind River drainage for irrigation is contributing to stream flow losses in the Wind River and its tributaries, threatening the survival of aquatic ecosystems and the trout fisheries they support.

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### 10. Rattlesnake Hills:

**General Description:** The Rattlesnake Hills, a core area along the eastern border of the Heart of the West lowlands, are the result of volcanic intrusions into a large anticline, since weathered into sharp divides and narrow canyons and gulches. The hills are surrounded by grasslands and sagebrush steppe. A portion of the Rattlesnake Hills encompassing Garfield Peak has been nominated for National Natural Landmark status. The Rattlesnake Hills core is 82,679 hectares in size.

**Ecological Values:** In our irreplaceability versus vulnerability analysis of cores, this core area scored high for its contribution of good sage grouse habitat to the lowland wildlands network. This core area hosts ferruginous hawks, and contains one quarter of all the lowland wildlands network's occurrences of a the rare Porter's sagebrush.

**Recommendations:** We recommend that no new permanent roads are built in this core, use of motorized/mechanized equip-

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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ment and vehicles are prohibited or substantially limited, and new surface mineral extraction activities avoided. Livestock grazing should be limited to levels of use

that ensure diverse plant community composition, forage production at potential, and unimpaired riparian areas.

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### 11. Upper Green River:

**General Description:** Tucked between the Wyoming Range and the Wind River Mountains, this core area includes at its heart the Green River, just emerging from its headwaters in the Wind Rivers and starting its long path towards the confluence with the Colorado. At 323,678 hectares in size, it's one of the larger core areas in the lowland study area, and is rich in riparian areas and mesic meadows.

**Ecological Values:** This core area significantly contributes to the area of both forested and shrub-dominated riparian zones – contributing almost 9% of these land cover types that are captured in the wildlands network. In addition, the Upper Green River core is a bastion for globally imperiled (G2) endemic plants, for example housing over 57% of the occurrences of beaver rim phlox (*Phlox pungens*) in the network, almost 95% of the Big Piney milkvetch (*Astragalus drabelliformis*), 75% of the Cedar Rim thistle (*Cirsium aridum*), and over 22% of the large fruited bladderpod (*Lesquerella macrocarpa*) in the wildlands network. Other natural heritage plants found in the Upper Green River core area in significant amounts include the desert glandular phacelia (*Phacelia glandulosa* var. *deserta*), Nelson's phacelia (*Phacelia salina*), swollen mountain ricegrass (*Oryzopsis swallenii*), and trelease's racemose milkvetch (*Astragalus racemosus* var. *treleasei*).

This entire area offers key sage grouse nesting habitat, as well as potential habitat for the pygmy rabbit, a specialist of thick-

ets of large, old sagebrush that occur in draw bottoms. A herd of about 130 pronghorn antelope migrates through this area from its summer ranges in Grand Teton National Park to the fringes of the Red Desert. The upper Green River valley also provides a primary winter range for local populations of elk, mule deer, moose, and bighorn sheep in the neighboring Wyoming Range and Wind River Range, providing critical winter range for tens of thousands of migratory big game species. The importance of this core area to migrating ungulates, and the importance of the crucial Green River Corridor Linkage that allows for migration of wildlife to both the Upper Red Desert core and the Flaming Gorge core, are discussed in more detail in Section 4.3.2 below.

**Recommendations:** We recommend that the BLM, USFS, and other land management agencies implement the "Restoring Wild Patterns" initiative (and the various proposed protections that are a part of this initiative) throughout the upper Green River core area. More details on Restoring Wild Patterns can be found in Box 4.1 (in Section 4.3.2).

**Threats:** The entire region that contains the Upper Green core area is under siege from accelerating oil and gas development, including the massive Jonah I & II oil and gas field, which will see over 1000 wells drilled in the near future. Gas wells are planned or pending for three of the four proposed wilderness units contained within the core area. Nearly the entire region is presently leased for oil and gas

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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exploration, often with the few existing restrictions being waived. With this expedited oil and gas exploration and development we shall see more and more pipelines, treaters, refineries, compressor stations and a wide web of roads connecting them. In addition, open spaces and ranch lands have been subdivided with

more access roads and fences blocking the historic ungulate migration routes. Aggressive noxious weeds have invaded disturbed and overgrazed sites. ORVs displace wildlife, especially on winter range. Fences block large-scale winter range and wildlife movements.

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### 12. Upper Red Desert:

**General Description:** A substantial 602,303 hectares in size, this core area includes an impressive acreage of wilderness and near-wilderness quality lands in a wide expanse of sagebrush desert that encircles the southern tip of the Wind River Mountains. Proposed wilderness units include the Honeycomb Buttes/Harris Slough, Oregon Buttes, Big Empty, Joe Hay Rim, Whitehorse Creek, Oregon Buttes Badlands, Pinnacles, South Pinnacles, Alkali Draw, Parnell Creek, Sand Dunes, Buffalo Hump, East Sand Dunes, Red Lake, Sweetwater Canyon, and Elk Mountain units, along with potential wilderness as yet unsurveyed atop Steamboat Mountain. The historic South Pass portion of the Oregon-California Trail used by early pioneers traverses this core area, as does the Pony Express Trail and the Point of Rocks/South Pass Stage Road. The ruins of 1860s-era goldfields can also be found near Atlantic City, Miner's Delight, and South Pass City. The Indian Gap trail was used by Native Americans during the period pre-dating the frontier era. Volcanic features such as Boar's Tusk and Steamboat Mountain, the erosional remnants of the Oregon Buttes and Continental Peak, have been nominated as National Natural Landmarks, as have the Killpecker Sand Dunes.

**Ecological Values:** Many rare plants, including large-fruited bladderpod,

meadow pussytoes (*Antennaria corymbosa*), and Payson's beardtongue (*Penstemon paysoniorum*), can be found in this core area. A good portion of the area achieves the highest biodiversity site ranking by the Wyoming Natural Diversity Database due to the only known occurrence of the basin big sagebrush/lemon scurfpea association. In general, this core area offers important habitat for pronghorn, desert elk, mule deer, sage grouse, mountain plover (*Charadrius montanus*), prairie dogs, pygmy rabbits (*Brachylagus idahoensis*[*Sylvilagus idahoensis*]), Wortman's golden-mantled ground squirrel (*Spermophilus lateralis*), mountain lion and swift fox (*Vulpes velox*). In particular, this core area contains crucial habitat for high desert herds as well as Wind River migratory herds of elk, deer, moose, and pronghorn, as well as birthing grounds for both elk and mule deer. The Steamboat Mountain elk herd in this area is particularly noteworthy because it is one of the nation's only elk herds that lives in a desert environment. Ferruginous hawks, prairie falcons, and golden eagles nest here. Overall, this core area houses what may be the highest diversity of raptor species in Wyoming.

In the extreme southeast portion of the core area, the Pinnacles Citizens' Proposed Wilderness Unit and the adjacent East Sand Dunes and Red Lake Units offer a relatively rare undisturbed portion of the Great Divide Basin. The area includes

## Chapter 4 - Introduction to the Heart of the West Wildlands Network



Upper Red Desert

Erik Molvar

seasonal migration corridors and crucial winter range for elk and deer, as well as important habitat for sage grouse, eastern short-horned lizards (*Phrynosoma douglassii brevirostre*), mountain plover, burrowing owls, pygmy rabbits, white-tailed prairie dogs (*Cynomys leucurus*), Wortman's golden-mantled ground squirrel, and the Great Basin gopher snake (*Pituophis catenifer deserticola*). Overall, the Wyoming GAP analysis predicts over 150 different vertebrate species to inhabit this region - indeed, a biodiversity hotspot in Wyoming. Because of these biological values and the fact that the Pinnacles are a well-known natural landmark in the Red Desert, this area has been considered by the BLM for designation as an Area of Critical Environmental Concern (ACEC).

In the extreme southwest portion of the core area, the Buffalo Hump/Boar's Tusk/Sand Dunes Citizen Proposed Wilderness Unit lies along the western margins of the

Killpecker Dune Field. Consisting of sand valleys, blowouts, shifting and unvegetated sand dunes, and a most unique feature - interdunal wetland ponds within the sand dunes, fed by snowdrifts buried under the sand - the Buffalo Hump area is a varied and ecologically significant landscape.

Recommendations: Many Citizens' Proposed Wilderness Units exist within this core area. We recommend that the BLM conduct the necessary inventory work to determine whether these units qualify for WSA status.

Threats: Motorized vehicle use on and off trails continues to degrade habitat and disrupt wildlife in the Buffalo Hump area and along high rims throughout the region. Even within the current Buffalo Hump WSA, evidence of illegal ORV use is evident. The lands outside the WSA are even more threatened. Cattle concentrate in dune pond areas of the Killpecker Dunes, destroying

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

fragile wetland ecosystems. Gold mining has occurred historically in this area, and there are a few would-be miners who believe that important gold deposits remain to be found in it. There is a very real threat of increased oil and gas exploration and development (including coalbed methane) in this core area. In fact, the Alkali Draw WSA in the Citizens' Proposed Pinnacles Unit was

actually recommended by the BLM as being unsuitable for wilderness because of its value for oil and gas production, and the fact that the area is underlain by Cretaceous coal beds, leaving open the possibility of strip mining or coalbed methane production. Both the Wind River Front and the Jack Morrow Hills area are currently under great oil and gas development pressure.

### 13. Sweetwater Rocks:

**General Description:** 166,249 hectares in size, this core area encompasses a large area south of the Sweetwater river in central Wyoming that includes the Sweetwater Rocks Roadless Area complex, the Ferris Mountain Citizens' Proposed Wilderness Unit, and the area between. This core area is perhaps the best remaining example of the transitional uplands that form the ecotone between the Red Desert ecosystem and the forest ecosystem of the Sierra Madre Range. It also contains a significant part of the Oregon Trail, as well as important land-

marks of historical significance such as Split Rock and Devil's Gate. Both Split Rock and Devil's Gate have been nominated as a National Natural Landmarks, as has Muddy Gap, an excellent example of synclines and anticlines.

**Ecological Values:** This core area provides winter, yearlong and summer range for elk and pronghorn antelope, and includes critical winter and yearlong range for mule deer as well as important migration corridors for this species. A bighorn sheep herd reintroduced into this area is struggling for



**Sweetwater Rocks**

**Erik Molvar**

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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survival. Montane forests provide habitat for animals such as pine marten, mountain lion, and northern goshawk (*Accipiter gentiles*). Bald eagles have winter roosting sites along the Sweetwater River in this area. Rare plant species found here include the Devil's Gate twinpod, Payson's beard-tongue, many-stemmed spider-flower, parry sedge (*Cleome multicaulis*), bun milkvetch, slender seepweed, Wyoming point-vetch, and Brandegee's Jacob's-ladder (*Polemonium brandegeei*). The Whiskey Gap area is known for a particularly high density of rare native plants.

Recommendations: Two WSAs (the greater Sweetwater Rocks roadless area complex and the Ferris Mountain) exist within this core area. We recommend that the BLM conduct the necessary inventory work and/or research to determine whether additional

lands adjacent to these units qualify for WSA status. The state of Wyoming has surface ownership of several parcels within the multiple roadless areas proposed by the Citizens' Wilderness Inventory for suitable wilderness. We recommend that land owners and managers consider land exchanges that would add to public lands those lands identified in core areas and establish additional private lands outside these core areas. This plan encourages BLM to inventory newly acquired public lands for wilderness qualities.

Threats: Heavy logging has occurred in the Green Mountain massif, at the southwest edge of this core. Oil and gas potential is currently believed to be low in this area, but there has been some small-scale mining for nephrite jade in the area.

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### 14. Pedro Mountains:

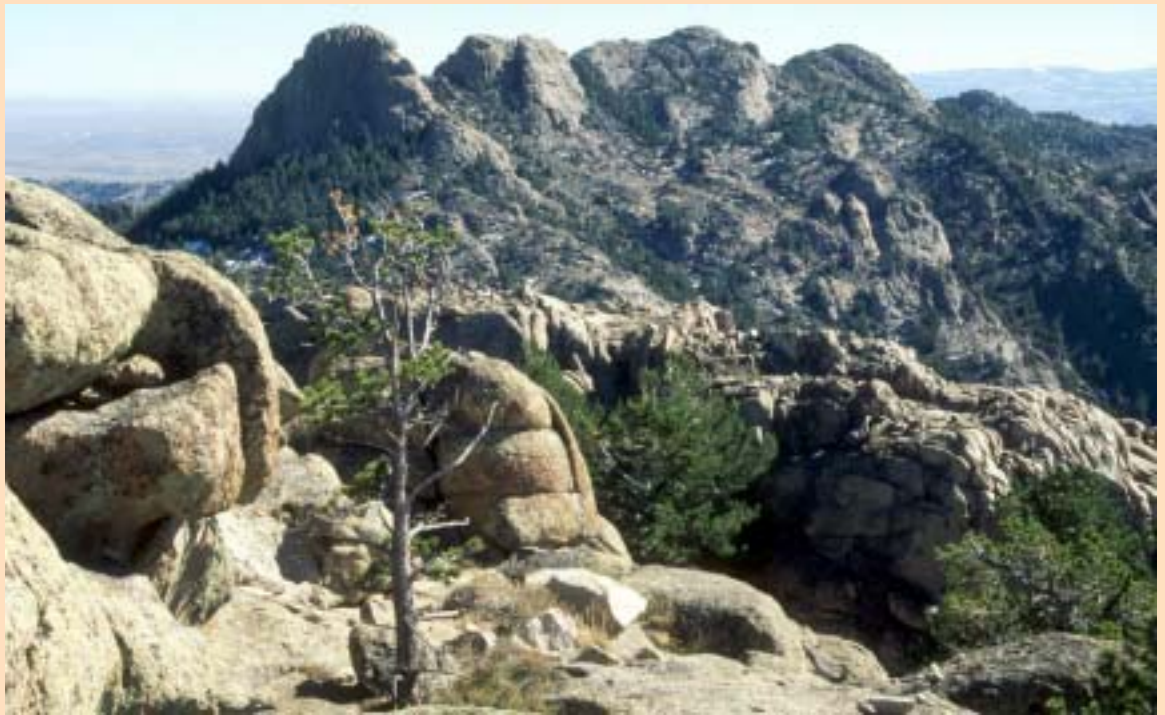
General Description: This 201,249 hectare core area encompasses the granitic Pedro Mountains and the sedimentary syncline of the Seminoe Mountains, plus extensive tracts of sagebrush steppe between the ranges. The Pedros are an exceedingly rugged granitic range, with little soil development and a woodland of limber pine and aspen growing wherever chinks in the bedrock can be found. The Seminoe range is a sedimentary monocline dissected by narrow draws and canyons, wooded with ponderosa pine and limber pine savannas as well as juniper scrub, with cottonwood gallery forests along the draw bottoms. The Ferris Dunes, an eastern extension of the Killpecker Dune Field, run through the southern part of this core.

Ecological Values: In our irreplaceability versus vulnerability analysis of core areas,

this core area scored high for its contribution of good wolf habitat to the lowland wildlands network. It is also one of the few core areas in the lowland network that contains active sand dunes. Partly because of this environment, the Pedro Mountain core contains 100% of the rare (G1) blow-out penstemon (*Penstemon haydenii*) in the wildlands network. It also contains one-third of the persistent sepal yellowcress and over half of the alpine fever few (*Parthenium alpinum*) in the lowlands network. The Pedro Mountains also contain bald eagle winter roosts where these raptors may congregate in numbers of up to 20 individuals. Long-billed curlew (*Numenius americanus*) are known from this area. Large complexes of white-tailed prairie dog towns as well as important mountain plover nesting areas are also found within this core.

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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**Sweetwater Rocks**

**Erik Molvar**

Recommendations: One WSA (Bennett Mountain) and one Citizens' Proposed Wilderness Unit (Pedro Mountains) exist within this core area. We recommend that the BLM conduct the research necessary to determine whether unprotected lands associated with these candidate wilderness units qualify for WSA status. In addition, the Ferris Dunes area (home to the blow-out penstemon) and the Seminoe prairie

dog colony west of Seminoe Reservoir have been petitioned for ACEC status.

Threats: Some 1,240 coalbed methane wells have been proposed for the lands surrounding Seminoe Reservoir, at the south edge of this unit. Conoco once held uranium claims in the Pedro Mountains area, but they have since expired.

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### **15. Shirley Basin:**

General Description: 166,249 hectares in size, the Shirley Basin core area is a high depression ringed with clusters of small, rugged mountains. The bulk of the basin is grassland and sagebrush steppe, but woodlands can be found in the Shirley Mountains in the western part of the core. The monuments, pillars, and turreted castles in the Bates Hole/Chalk Mountain area have been nominated as a National Natural Landmark.

Ecological Values: Within this core area can be found two of the four most important concentrations for mountain plovers in Wyoming, as recently identified by ongoing research at the University of Wyoming, Laramie. This area also contains Wyoming's only reintroduced population of black-footed ferrets (*Mustela nigripes*), as well as the major white-tailed prairie dog complexes that support them. The Shirley Basin is also home to some of the most successful swift fox populations in the state.

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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**Recommendations:** Much of the Shirley Basin has been petitioned for designation as an ACEC, and we recommend that the BLM make the designation.

**Threats:** There has been past uranium mining activity in the Shirley Basin. While

not presently economically viable, policies of the new administration may lead to increased nuclear activity in the near future. As a result, uranium mining may once again become a major impact in this area. Oil and gas resources are marginal here.

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### 16. Laramie Range:

**General Description:** 109,345 hectares of isolated granite peaks surrounded by forests of lodge pole and ponderosa pine characterize this core area. Numerous grassy parks intrude into the forest, creating a rich mixture of landscape types. This area is an ecological mixing zone between the shortgrass prairies of the Great Plains and the coniferous forests of the Southern Rocky Mountain Ecoregion.

**Ecological Values:** This core area adds significantly to the upper elevation habitat types captured in the wildlands network – notably including almost 15% of the limber pine vegetation type and 26% of the ponderosa pine type found in the Heart of the West Network. Significant forest fires and outbreaks of pine beetles have occurred in this area, making it an important

natural laboratory for studying natural disturbance patterns. This core is also extremely important habitat for the very rare (G2) Laramie columbine (*Aquilegia laramiense*); a significant 78% of the occurrences included in the network can be found in this core area. In addition, the Laramie Range core houses 33% of all occurrences of federally listed Preble’s meadow jumping mouse (*Zapus hudsonius preblei*) in the wildlands network, and also 25% of Virginia’s warbler (*Vermivora virginiae*) – a neotropical migrant – occurrences. This core is also home to important populations of Townsend’s big-eared bat (*Corynorhinus townsendii*) and Lewis’ woodpecker (*Melanerpes lewis*). Flammulated owls (*Otus flammeolus*) have recently been discovered here. There is a high ridge of ponderosa pine savannas extending eastward from this core all the



**Buffalo Peak, Laramie Range**



## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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way to the Thunder Basin National Grassland, which is a migratory route for an elk herd that summers in the Laramie Range and winters on the national grassland.

Since the Laramie Range core is the furthest east of any core area in the Wyoming Basins Ecoregion portion of the lowland study area, it serves as an important “transitional zone” between the Wyoming Basins and the short and midgrass prairie systems of the Northern Great Plains Ecoregion. The fact that many species of plants and animals reach the edge of their range in this transitional zone is significant because individuals at the edge of their range often possess slight genetic variation, or are more susceptible to conditions that can induce slight variation, in comparison to those at the core of the species’ distribution (Frey 1993, Lesica and Allendorf 1995, Garcia-Ramos and Kirkpatrick 1997). This makes this outreaching segment of these populations a dynamic focus of evolutionary change, in which those individuals may be more likely to survive and adapt to regional perturbations, or climate shifts. From both an evolutionary perspective, and from the perspective of conservation of all species in the Wyoming Basins, populations at

their distributional limits are extremely important.

**Recommendations:** This area contains six Forest Service roadless areas totaling 89,516 acres, which deserve long-term protection from high-impact activities such as logging and off-road vehicle use.

**Threats:** Logging has occurred on a small scale in this area, but could increase under some forest management policies. Illegal ORV use is rampant in this area, and one of the roadless areas also contains a trail which is open to motor vehicles and which the Forest Service has been promoting for motorized use. The grazing of domestic sheep in areas inhabited by bighorns is a major concern from the standpoint of transmission of pasteurella and other diseases that could potentially wipe out the bighorn herds. Second-home development, particularly on the many private parcels that intersperse with public lands, is becoming an increasing source of habitat loss and fragmentation. In a political climate where there is great pressure to log areas near private residences, this is an area that could potentially suffer from major habitat degradation and fragmentation as a result projects claiming to reduce fire fuels.

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### 17. Chain Lakes:

**General Description:** 51,249 hectares in size, this core area is located at the very heart of the lowland study area. The site includes alkaline wetlands and playas with surrounding shrub and grass vegetation typical of southwestern Wyoming. This core area also contains unique mud volcanoes that are interesting from a geological standpoint.

**Ecological Values:** The Chain Lakes are alkaline wetlands trapped in the Great Divide Basin with no outlet to the sea. They are magnets for waterfowl and shorebirds, a biological oasis in the midst of the Red Desert. According to Knight et al. (1976) “the greasewood communities are as diverse in species composition as we’ve seen for this vegetation type, and the ponds provide a rare habitat in the area for avocets, ducks, killdeer, willets, and other waterfowl...This

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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whole area is truly unique and should be studied as a possible representative of the alkaline depression – alkaline pond natural history theme” (p. 167).

Recommendations: The Chain Lakes has been proposed as an Area of Critical Environmental Concern, and we recommend that the BLM make this designation.

Threats: There is substantial natural gas drilling activity just to the south of this core. Overgrazing often occurs at the marshy margins of the lakes. A proposal to remove Clean Water Act protection from waters that do not ultimately drain into a major river could remove statutory protection as “Waters of the United States” from these fragile wetlands, leaving them vulnerable to discharges of pollutants from the nearby gas fields and /or uranium mill.



Chain Lakes

BCA

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### 18. Ham’s Fork:

General Description: This 261,934 hectare core area can be found at the western-most point of the Heart of the West lowland study area, squarely over the point where Idaho, Utah and Wyoming come together along the Bear River. This core contains

some of the highest value aquatic habitats in the Heart of the West.

Ecological Values: This core area contributes significantly to the open water and other aquatic and wetland cover types in the lowlands wildlands network, for

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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example contributing over 18% of the meadow / grassy riparian land cover type captured in the entire lowlands network. Conservation populations of Colorado River and Bonneville cutthroat trout are found here...only one of two lowland cores that can boast this occurrence. This area contains important habitat for pygmy rabbit in dense stands of tall sagebrush typically found along intermittent streams and in draw bottoms.

The Ham's Fork core area includes Bear Lake, the largest lake in the Wasatch Mountains. Due to its placement and size, the ecology of the lake unique, and so are the rare endemic fish that live only in the lake. These fish - the Bear Lake sculpin (*Cottus extensus*) and Bear Lake whitefish (*Prosopium abyssicola*) – meet 100% of our target for these rare G1 species.

Other important Natural Heritage elements housed in the Ham's Fork core area include highly significant amounts of the element occurrences in the lowlands

network of three, key G1 and G2 species: Dorn's twinpod (*Physaria dornii*) (G1, 100%), entire-leaved peppergrass (*Lepidium integrifolium* var. *integrifolium*) (G2, 100%), and tufted twinpod (*Physaria condensate*) (G2, over 70%). Ham's fork also houses considerable amounts of other Natural Heritage plants like single stemmed wild buckwheat (*Eriogonum acaule*), starveling milkvetch (*Astragalus jejunus* var. *jejunus*), ternate desert parsley (*Lomatium triternatum*), and tufted cryptanthia (*Cryptantha caespitosa*), as well as element occurrences of rare mammals such as pygmy rabbits and ringtails (*Bassaroscus astutus*).

Recommendations: The Lake Mountain and Raymond Mountain WSAs and neighboring wilderness-quality lands should be granted the full protections of wilderness designation.

Threats: A large-scale seismic oil and gas development project is currently underway in the northeastern part of this core.

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### 19. Upper Bear River:

General Description: 283,898 hectares in size, this core area is situated in extreme southwest Wyoming along the Utah-Wyoming border. Capturing the Bear River as it winds out of its headwater region in the high Uinta Mountains, this core incorporates key transitional habitat between the mountains and deserts of the Heart of the West.

Ecological Values: The Upper Bear River core houses only one of two occurrences of Bonneville cutthroat trout in the lowlands wildlands network, as well as significant numbers of other Natural Heritage aquatic species (and Heart of the West focal species) like bluehead sucker (*Catostomus*

*discobolus*) and leatherside chub (*Gila copei*). This core helps meet other Natural Heritage representation goals, capturing 100% of the narrowleaf goldenweed (*Haplopappus macronema* var. *linearis*) occurrences in the lowlands network, 50% of the prostrate bladderpods (*Lesquerella prostrate*), and between 20 and 25% of all echo spring parsley (*Cymopterus lapidosus*), opal phlox (*Phlox opalensis*) and starveling milkvetch occurrences in the wildlands network. Important vertebrate species found in the Upper Bear River core include pygmy rabbits and Wyoming ground squirrels (*Spermophilus elegans*).

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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Recommendations: We recommend that no new permanent roads are built in this core, that use of motorized/mechanized equipment and vehicles are prohibited or substantially limited, and commercial logging is curtailed. We also recommend

that certain exotic species be controlled and/or eliminated in the Upper Bear River core area. Species such as exotic trout are especially detrimental to the rare native fish in this region.

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### 20. Flaming Gorge:

General Description: This 269,594 hectare core area marks an important transition zone between the Wyoming Basins Ecoregion and the Utah-Wyoming Mountain Ecoregion, and is located along the Utah-Wyoming border near the Colorado line. The arid, alkaline deserts at the north end of this core give way to the high grasslands and ponderosa pine woodlands of the Teepee Mountains along the Wyoming-Utah border. The thousand-foot red walls of Firehole Canyon incised into the flanks of Flattop Mountain have been nominated as a National Natural Landmark, as has the Henry's Fork Fault.

Ecological Values: Thirteen different Natural Heritage plants are captured in highly significant amounts in this core area, including six species in which 100% of the species occurrence in the lowlands core can be found in the Flaming Gorge core. These include the Moab milkvetch (*Astragalus coltonii* var. *moabensis*), precious milkvetch (*Astragalus proimanthus*) (G2), Rollins cateye, stemless beardtongue (*Penstemon acaulis* var. *acaulis*), Uinta draba (*Draba juniperina*), and Uinta greenthread (*Thelesperma pubescens*). Important vertebrate occurrences in this core include bonytail (*Gila elegans*), 50% of the northern tree lizard occurrences in the lowlands



Devils Playground, Flaming Gorge

Erik Molvar

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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network, and 75% of the Wyoming ground squirrel occurrences in the lowlands network. This core holds the stronghold of the midget faded rattlesnake (*Crotalus viridis concolor*), and also healthy populations of spotted bat (*Euderma maculatum*).

Recommendations: A Citizens' Proposed Wilderness Unit (Devil's Playground) exists within this core area. We recommend that the BLM conduct the necessary inventory work and/or research to determine whether additional lands adjacent to the current WSA qualify for WSA status.

Threats: Flaming Gorge Dam has already had a devastating effect on the Colorado River Endangered fishes (the razorback sucker (*Xyrauchen texanus*), Colorado Pikeminnow (*Ptychocheilus lucius*), bonytail, and humpback chub (*Gila cypha*) by drastically lowering the temperature of the Green River below the dam, effectively eliminating the native fish fauna. Seismic exploration has been pursued in the Devil's Playground WSA, indicating that industry is interested in pursuing gas development in this area.

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### 21. Adobe Town/Vermillion Basin:

General Description: 362,954 hectares in size and situated in the proximity of the Colorado-Utah-Wyoming border, this impressive wilderness country encompasses the three largest roadless areas within the Wyoming portion of the lowland study area (Kinney Rim North - 128,597 acres, Kinney Rim South - 125,562 acres, and Adobe Town - 180,910 acres). At

the heart of the core area, the massive monocline of the Kinney Rim rises above a sea of sagebrush. Farther east, the spectacular badlands, monoliths, and grottoes of the Adobe Town and Skull Creek Rim wind for 25 miles from north to south. This area possesses outstanding primitive qualities and exemplifies the wide open spaces for which Wyoming is known, but which are fast disappearing in the state.



Adobetown

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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Between the major rims are plains where sagebrush grows on small stabilized dunes and saltbush communities are found in the blowouts between them, while to the west of Kinney Rim are vast tracts of sagebrush steppe draining into Vermillion Creek. Much of the eastern part of this core lies within the proposed Washakie Basin National Natural Landmark, with its world-class Eocene fossils and spectacular erosional landforms such as the Haystacks, Adobe Town Rim, and Skull Creek Rim.

**Ecological Values:** This core area comprises an important habitat connection between the Great Divide Basin and the high deserts of western Colorado. It is also home to active ferruginous hawk, burrowing owl and golden eagle nest sites, and includes pronghorn crucial winter range. The midget faded rattlesnake has been documented along the Adobe Town Rim, at the northeastern limit of its range. The northern plateau lizard (*Sceloporus undulatus elongatus*) and eastern short-horned lizard are among the other rare and sensitive reptile species that are known to inhabit this area. The Pine Butte area was once proposed as an ACEC because of its unique geological and wildlife habitat attributes. The Adobe Town WSA and greater Adobe Town area are of great importance as one of the last large remnants of the Red Desert ecosystem that remains in a pristine state.

**Recommendations:** The BLM has already given interim protection to 85,710 acres of the Adobe Town roadless area and has acknowledged that an additional 40,000 acres deserves wilderness status. All 180,910 acres of Adobe Town that qualify as wilderness should be protected from oil and gas leasing. In addition, the BLM has failed to recognize a large portion of the

Kinney Rim area for roadless or wilderness qualities. As such, we recommend that the BLM take heed of the Wyoming Citizens' roadless area inventory and wilderness proposal, and elevate the many roadless areas in this core area (i.e. Kinney Rim North, Kinney Rim South, and Vermillion Basin) to WSA status. The Vermillion Basin Natural Gas Project was predicated on a defective Environmental Assessment (EA) that violated NEPA, and routes constructed under the aegis of this illegal document might well be required to be decommissioned and obliterated as a result of ongoing legal actions.

**Threats:** The Deoslation Flats Natural Gas project, entailing 385 gas wells, would impact 50,000 acres of wilderness-quality lands in the Adobe Town portion of this core if approved, including important mountain plover nesting habitat. Several routes constructed recently as part of the Vermillion Basin Natural Gas Project have been included within the boundaries of the Vermillion Basin Citizen's Proposed Wilderness Unit. Although these routes meet BLM's definition of a "road," they will be required to be obliterated upon abandonment, and are analogous to similar roads determined to be temporary intrusions and included within existing WSAs such as Adobe Town. In addition to the Vermillion Basin Natural Gas Project which is already underway, formations bearing potential reserves of natural gas at shallow to moderate depth include the Wasatch, Ft. Union, Lance, and Lewis formations, and the Mesa Verde group of the Almond formation. Adobe Town WSA and the surrounding wildlands are under direct threat from expanding oil, gas, and coalbed methane drilling in the Washakie Basin.

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

### 22. Medicine Bow:

General Description: 1,367,680 hectares in size, this core area encompasses the northern extent of the Southern Rockies Ecoregion within the Heart of the West lowlands study area, including the coniferous forests of the Medicine Bow and Sierra Madre ranges plus some areas of adjacent rims and benchlands and lower elevation shrubland habitat and shortgrass basins. The western part of the core includes the Atlantic Rim country, an area of high rims robed in sagebrush steppe and mountain shrub communities and managed by the BLM. This area includes the important Muddy Creek and Little Snake drainages, which not only harbor important populations of rare native fishes but are critically important to maintaining the natural flows and sediment levels of the Yampa and Green River systems, home to four species of endangered fish. To the east of the range, the core encompasses the Big Hollow, a massive natural blowout that has been nominated as a National Natural Landmark.

Ecological Values: Three of Wyoming's seven sharp-tailed grouse leks on public lands can be found in this core area. This core also contains important elk calving and wintering areas. This area contains southeast Wyoming's best habitat for the recovery of carnivores, such as lynx, wolves, and grizzly bears. A great deal of crucial winter range for elk and mule deer is found along the foothills of the Sierra Madres and the Atlantic Rim country. This area also has Wyoming's only known occurrence of ringtail. Important conservation populations of Colorado River cutthroat trout are found in several branches of the Little Snake River. The Medicine Bow core area also contains the northernmost extension of Gambel oak woodlands in southeastern Wyoming. The core contains parts of the Laramie Basin where freshwater and brackish lakes are clustered, including the Hutton Lake National Wildlife Refuge. This lake district is a magnet for waterfowl and shorebirds including the



**Snowy Range, Medicine Bow**

**Erik Molvar**

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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white-faced ibis (*Plegadis chihi*), and provides the world's last remaining habitat for the Wyoming toad (*Bufo baxteri*[*Bufo hemiophrys baxteri*]), one of the rarest animals on the Endangered Species List. Alpine areas in the Snowy Range are habitat for the brown-capped rosy finch (*Leucosticte australis*) and a population of white-tailed ptarmigan (*Lagopus leucurus*) that is barely hanging on, as well as eight species of rare native wildflowers that inhabit the fragile alpine tundra.

Recommendations: Based on recommendations made in the Citizens' Conservation Alternative for the Medicine Bow National Forest Management Plan, we recommend for this core area 1) a moratorium on new roads, 2) accelerated rates of road decommissioning, and 3) that logging never exceed more than 25% of the area of any watershed of any order. We also recommend that previous logging practices be replaced with selective harvest as a method of timber removal in the core. The Medicine Bow National Forest's reliance on clearcutting as a timber harvest method is inconsistent with longstanding Forest Service policy to move away from clearcutting. Rivers recommended for Wild and Scenic River status include the Roaring Fork of the Little Snake River, Big Sandstone Creek, the North Fork of the Little Snake River, Solomon Creek, Rose Creek, Encampment River, and the North Platte River; these areas should be recommended for this protection. Seasonal closures to snowmobile use should occur in National Forest roadless areas, and where there are conflicts with wildlife and their winter needs, and at times and places where snow depth is not sufficient to prevent damage to the underlying soils and vegetation. A moratorium should be

placed on future water diversion projects that rob one watershed to provide additional water to another.

Threats: A 3,880-well coal bed methane drilling project has been proposed in the Atlantic Rim part of the core area. If implemented, this project would industrialize hundreds of thousands of acres of crucial winter range, and the operation's wastewater would threaten the survival of sensitive native fish. These include (bluehead sucker, roundtail chub (*Gila robusta*), and flannelmouth sucker (*Catostomus latipinnis*) in the Muddy Creek watershed as well as four species of endangered fish in the Yampa/Green River system downstream. In addition, the oil and gas industry has proposed seismic exploration for oil and gas in the Rock Creek Roadless area, portending industry's interest in future development.

Water diversion projects also are raiding flow from streams in the Little Snake watershed, home to conservation populations of Colorado River cutthroat trout, to feed water demands in Cheyenne and the North Platte basin. Additional water diversions may be built in the future, further stressing the Colorado River system.

Decades of mismanagement have left the Forest Service in charge of a Medicine Bow Forest that is in grave trouble. Forest fragmentation is rampant; the patchwork of roads and logged areas that characterize the forest today is far beyond the range of natural variability for this forest ecosystem. Wildfires that occur naturally throughout the Forest are suppressed as soon as they start. Beetle epidemics are viewed as forest diseases and are actively fought. The response to endemic dwarf mistletoe (*Arceuthobium abietinum*) has



## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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been to clearcut the forest. Stands of lodgepole pine have been artificially maintained in an early seral state through clearcutting and replanting with more lodgepole, instead of allowing these stands to naturally convert to spruce-fir forest. The disappearance of species such as lynx and wolverine (*Gulo gulo*) are likely to be directly related to the increased road building and logging that began in the

1950's. Currently, many parts of the Medicine Bow core area are traversed by numerous four-wheel drive routes, and illegal off-trail ATV use in the fragile snowglade area causes significant resource damage in June and early July. Private lands in this core are at risk for subdivision and second home development.

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### 23. Rawah Mountains:

**General Description:** This core area, along with the Medicine Bow core, comprises the northern-most extent of the Southern Rockies Ecoregion. Practically abutting Fort Collins, CO., it is one of our few core areas that is in very close proximity to a fairly large city. The Rawah Mountain core area is 363,667 hectares in size.

**Ecological Values:** This core area adds significantly to the upper elevation habitat types captured in the wildlands network – notably including almost 20% of the limber pine vegetation type and 28% of the ponderosa pine type found in the Heart of the West Network. There are a number of G2 Natural Heritage species element occurrences captured in this core, including Gray's peak whitlow grass (*Draba grayana*) (100% of occurrences in overall lowlands network), Larimer aletes (*Aletes humilis*) (85% of occurrences), pale moonwort (*Botrychium pallidum*) (100% of occurrences), and reflected moonwort (*Botrychium echo*) (50% of occurrences). The Rawah mountains contain a number of species that are endemic to the southern Rocky Mountains and which are captured in this core area, like the Rocky Mountain cinquefoil (*Potentilla effuse* var *rupincola*), the Rocky Mountain columbine (*Aquilegia saximontana*), and the southern Rocky

Mountain cinquefoil (*Potentilla ambigens*). Additionally, the Rawah Mountains core captures 50% of all pygmy shrew (*Sorex hoyi*) occurrences in the lowlands network.

Since the Rawah Mountain core is the furthest east of any core area in the Southern Rocky Mountain Ecoregion portion of the lowland study area, it serves as an important "transitional zone" between the Southern Rockies and the short and midgrass prairie systems of the Northern Great Plains Ecoregion. The fact that many species of plants and animals reach the edge of their range in this transitional zone is significant because individuals at the edge of their range often possess slight genetic variation, or are more susceptible to conditions that can induce slight variation, in comparison to those at the core of the species' distribution (Frey 1993, Lesica and Allendorf 1995, Garcia-Ramos and Kirkpatrick 1997). This makes these out-reaching segments of these populations a dynamic focus of evolutionary change, in which those individuals may be more likely to survive and adapt to regional perturbations, or climate shifts. From both an evolutionary perspective, and from the perspective of conservation of all species in the southern Rockies, populations at their distributional limits are extremely important.

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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**Recommendations:** Since the northern third of this core area was extensively logged in the late 1800's for railroad ties, this area (especially in the vicinity of the Old Roach townsite), is still recovering from this extensive logging. As such, we recommend that no more logging be carried out in the Rawah Mountain core area.

**Threats:** Since the majority of this core area is included in wilderness areas, threats are comparatively few to this core. However, part of the area not included in wilderness is logged to some extent (see above), and the recreation pressure inside the wilderness areas is currently intense.

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### 24. Flat Tops:

**General Description:** This core area comprises the northwest most extent of the Southern Rockies Ecoregion, and is located in the southeast part of the lowland study area. 492,378 hectares in size, this core includes both the forested Flat Tops region and the lower-elevation Roan Plateau region.

**Ecological Values:** The Roan Plateau towers more than 3,000 feet above I-70 along the southern edge of this region. The massive cliffs at its rim are formed from the sandstone and shale of the Green River Formation. A dark brown line is apparent in the cliffs, even from I-70, and denotes the presence of an oil bearing stratum called the Mahogany Ledge. The oil-bearing layers of the Green River Formation thicken as one moves north and west into the Piceance Basin core area. Consequently, most commercial oil shale development efforts took place farther north, and left the Roan Plateau relatively unscathed.

The Roan Plateau's gentle valleys and rolling hills end abruptly in the 1,500-foot deep canyons carved by the East Fork and East Middle Fork of Parachute Creek on the Plateau's western edge. This unique geology, with high waterfalls plunging off the edge of the Plateau, creates perfect isolated conditions for native Colorado River cutthroat trout to thrive. The geo-

logic isolation protects the native cutthroat's genetic purity by eliminating the possibility of hybridization by rainbow trout invading from downstream. The Roan Plateau also provides ideal habitat for large herds of mule deer and elk. The Roan Plateau hosts an abundance of rare and imperiled native plant communities, including cliff seeps containing rare hanging gardens. The Green River Formation, through which the Plateau's valleys are cut, contains abundant fossils.

On the northern edge of the Flat Tops core area, the Colorado Plateau's least altered river - the Yampa - courses through the rangelands of northwest Colorado. Large herds of elk and deer winter along the Yampa River. Because the Yampa is essentially free-flowing from its source to confluence with the Green River in Dinosaur National Monument, it provides the best remaining habitat for imperiled native Colorado River fishes, most particularly the Colorado pikeminnow. Most of the Yampa is designated critical habitat for the pikeminnow.

**Recommendations:** Three Citizens' Proposed Wilderness Units (Grand Hogback, Yampa River, Roan Plateau) exist within this core area. We recommend that the BLM conduct the necessary inventory research to determine whether these units qualify for WSA status.

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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Threats: Most of the Roan Plateau is free of oil and gas leases, but the BLM is currently completing a management plan for the Roan Plateau that could throw the area wide open to oil and gas exploration. Open-pit coal mines flank the Yampa River

and threaten to invade the proposed wilderness. A large reservoir was once proposed for this segment of the Yampa at Juniper Mountain, but is now defunct because of economics.

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### 25. Piceance Basin:

General Description: 235,386 hectares in size, this core area captures the heart of the Piceance Basin in northwest Colorado.

Ecological Values: The Piceance Basin is characterized by high ridge tops and steep slopes, where Douglas fir clings to the rugged walls of narrow canyons. The Piceance Basin has long harbored one of the premier mule deer herds in North America, sustaining the largest migratory herd in Colorado. The White River courses through the heart of the basin and provides abundant habitat for wintering bald eagles and numerous golden eagles. The Piceance Basin's unique shale outcrops and soils support an abundance of endemic and globally rare plant species.

Recommendations: Four Citizens' Proposed Wilderness Units (Pinyon Ridge, Big Ridge, Black Mountain WSA, Windy Gulch WSA) exist within this core area. We recommend that the BLM conduct the necessary inventory work and/or research

to make the determination as to whether Pinyon Ridge and Big Ridge qualify for WSA status.

Threats: Extensive mineral exploration and development has occurred in recent years in this region of Colorado. The resulting maze of roads, power lines, and pipelines has severely diminished the available solitude for wildlife, putting ever-increasing pressure on them as the unroaded area shrinks. If oil shale is ever developed in a major fashion, Black Mountain, Windy Gulch and the other proposed wilderness units will remain the only untracked area in oil shale country.

The Pinyon Ridge proposed wilderness area in this core is facing a dozen separate proposed oil and gas lease parcel sales. Industry has proposed drilling a half dozen wells in the Big Ridge proposed wilderness area. Farther east in the basin, no oil and gas leases occur within Black Mountain and Windy Gulch proposed wilderness units.

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### 26. Duschene:

General Description: This 313,511 hectare core area is in the extreme southwest corner of the lowland study area, and provides a critical link between the lower elevation habitats of the Book Cliffs in Utah to both the Wasatch Plateau and Uinta Mountains.

Ecological Values: Important fish habitat exists along the Strawberry River and its tributaries, and winter range for elk and deer are found in the Argyle Ridge area. First American rock art sites, particularly along Nine Mile Canyon, offer some of the highest density and most remarkable displays in Utah, and the particular style of the rock art are unique to this region.

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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This core area contributes significantly to upland habitat types in the lowlands wildlands network, containing 10% of the pinon-juniper land cover type present in the network, and fully 44% of the mountain fir vegetation type. This is a particularly important core area in terms of capturing habitat for a few, very rare (G1 and G2) NHP species; the Duschene core includes 100% of the Barneby pepper grass (*Lepidium barnebyanum*) (G1), 100% of the Green river greenthread (*Thelesperma caespitosum*) (G1), and 28% of the federally threatened Ute ladies' tresses orchid (*Spiranthes diluvialis*) (G2) in the lowlands network. Rare vertebrates known to occur in the Duschene core area include the plateau-striped whiptail (*Cnemidophorus velox*), thirteen-lined ground squirrel, and ringtails.

**Recommendations:** Several Citizens' Proposed Wilderness Units on both National Forest and BLM lands exist within this core area. These include Willow Creek, Bad Lands (Argyle Canyon), Lion Hollow, and Long Ridge. We recommend that the Forest Service and BLM conduct the necessary inventory work and/or research to determine whether these units qualify for WSA status. We also recommend that new vehicle routes for ORVs be curtailed.

**Threats:** This area, close to a number of communities in the Uinta Basin, is seeing increased ORV use. Oil and gas development increasingly has made inroads into remote areas. Such production, opposed for parts of Nine Mile Canyon, threaten not only wildlife habitat but also cultural sites.

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### 27. Book Cliffs:

**General Description:** 783,571 hectares in size, the 2,000 foot-high escarpment of the Book Cliffs and Roan Cliffs mark the southern perimeter of our study area in Utah, and is part of a roadless area that is over a million acres in size. The thousand-foot-high wall of the Book Cliffs that run for 250 miles along I-70 across Utah and Colorado is the longest continuous escarpment in the world (UWC 1990). These cliffs, together with the Roan Cliffs and the Tavaputs Plateau, comprise this ecologically important core area. The Tavaputs Plateau, topped with spruce, aspen, and fir, is a monument to the battle between uplift and erosion. This two-mile thick block of sedimentary strata was uplifted directly in the path of the Green River; as the land rose the Green scoured its channel deeper, eventually cutting the Tavaputs Plateau in half. Between those two halves, the Green winds for 80 miles in a gorge – Desolation Canyon - nearly as deep as the Grand Canyon.

**Ecological Values:** In the Book Cliffs, high elevation (8,000 ft) sandstone canyons drain to the north through lush meadows. These stone canyon walls are capped with Douglas fir forests. The region between I-70 on the south and the White River to the north harbors an estimated 375 vertebrate species of wildlife - half of the number found in Utah (UDWR 1977). The Tavaputs Plateau offers ideal summer habitat for elk, deer, cougar, and bear, and harbors perhaps the largest and most well-studied black bear population in Utah. The Green River in Desolation Canyon is a major migration route for waterfowl and a favorite winter roosting site for bald eagles. Bighorn sheep have been successfully reintroduced to this region, where they were formerly extirpated.

Importantly, some of the highest scoring suitable wolf habitat in the Heart of the West lowlands study area was captured in this core area. The Book Cliffs core, if

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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properly protected and managed, could offer critical wolf migration routes linking source populations of wolves in the Utah-Wyoming Mountain Ecoregion to excellent wolf habitat in the Southern Rocky Mountains.

**Recommendations:** The majority of acreage within this core area is comprised of a most impressive number of inventoried roadless areas, all of which are currently proposed for wilderness designation under America's RedRock Wilderness Act (proposed legislation in Congress). This wilderness proposal would protect this region's important wildlife resources in perpetuity.

**Threats:** Current BLM wilderness proposals would leave fully half of the roadless areas in this region open for development of coal, petroleum and natural gas. While geologic exploration has shown a low likelihood for major fossil resources, BLM has a history of allowing exploratory wells to be developed in WSAs in this core area. Today, many unprotected areas are already being hit hard by energy exploration and development proposals. The state has a long history of managing a 60,000 acre portion of this region primarily for wildlife. Currently this policy has been reversed and new roads and logging are entering this critical wildlife habitat.

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### 28. Little Book Cliffs:

**General Description:** 100,464 hectares in size, the Little Book Cliffs core encompasses the cliffs and canyons of the east end of the Book Cliffs. Thousand-foot canyon walls rise from the entrance to Main Canyon at its confluence with the Colorado River, and portions of the 2,000-foot vertical face of the Book Cliffs, visible from throughout the Grand Valley, are incorporated into the area. The sheer enormity of these unscalable walls, combined with the views from the mesas above them, provide incomparable wilderness values. Evidence of the Fremont Culture can be found throughout the area, lending it archaeological as well as ecological and scenic value.

**Ecological Values:** This core area includes the Little Book Cliffs Wild Horse Range, one of only three such designated Wild Horse Ranges in America, and the only one in the Colorado Plateau Province. More than 100 wild horses roam the area, providing unique opportunities for ob-

serving and photographing them while hiking, backpacking, or horseback riding. Portions of Little Book Cliffs also provide critical winter range for mule deer. Little Book Cliffs is one of very few remaining roadless areas in the Book Cliffs region of west central Colorado. Major canyons cut through the area - Main, Cottonwood, Spring and Coal - and these twisting canyons contain trickling desert streams graced by cottonwoods and Douglas firs in their upper reaches. Plunge pools and waterfalls dot the canyons. Several natural bridges and numerous hoodoos line the tan and gray canyon walls.

**Recommendations:** Four Citizens' Proposed Wilderness Units (Cow Ridge, Hunter Canyon, Shale Ridge, Little Bookcliffs) exist within this core area. We recommend that the BLM conduct the necessary inventory work and/or research necessary to make the determination as to whether these units qualify for WSA status.

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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Threats: The entire region is under siege from accelerating oil and gas development. Gas wells are planned or pending for three of the four proposed wilderness units. Nearly the entire region is presently leased

for oil and gas exploration with few restrictions. Modest coal reserves also underlie Little Book Cliffs, but the only producing underground mines closed during the 1990s.

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### 4.3.1 Highlighting Key Linkages in the Lowlands Heart of the West Wildlands Network

Conservation biologists have found that our current system of protected “islands of habitat” are not sufficient by themselves to sustain biodiversity over the long term. These areas do not provide for all the needs of wildlife and so they must be connected to one another by safe passage and by smaller areas of habitat. While there are many important landscape

linkages that have been identified in the Heart of the West Wildlands Network (Figure 4.1), we focus below on two that are particularly crucial to identify for immediate protection: the Powder Rim Linkage and the Green River Corridor Linkage.

#### 4.3.1 The Powder Rim Linkage

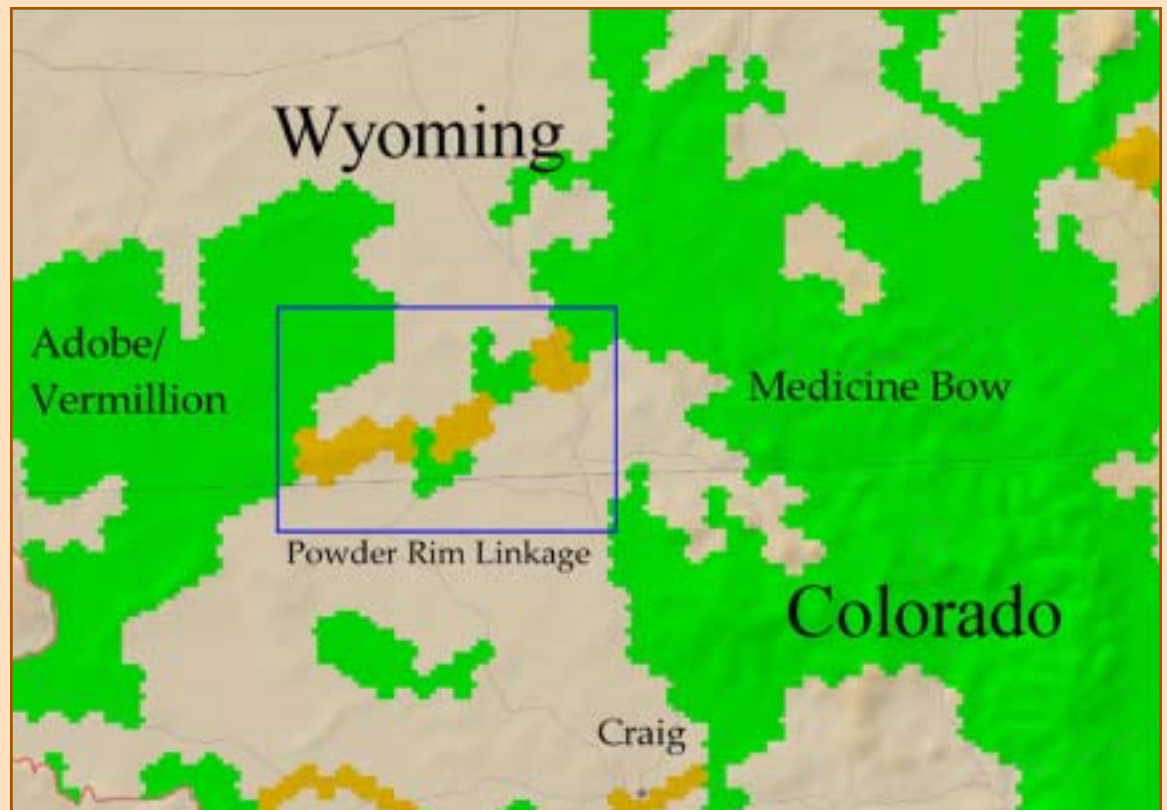
The Powder Rim Linkage (Figure 4.3) is a broad swell of high country that rises at the south end of the Washakie Basin and includes both the area known as the Powder Rim and the adjoining Atlantic Rim. If protected, this area will serve as a critical landscape corridor of habitat between the Adobe Town/Vermillion core area and the large Medicine Bow core area. As such, it will contribute to ensuring connectivity between the Uinta Mountains in the Utah Wyoming Mountain Ecoregion (via the Adobe Town/Vermillion core) and the Southern Rocky Mountains Ecoregion.

The Powder Rim Linkage is robed in a mix of juniper woodland and sagebrush steppe/grasslands. The northern side of the rim slopes down into the Skull Creek basin, where it is dissected into clay badlands. There are a number of permanent springs in the area, important in such a dry region. The area within and around the Powder Rim Linkage provides perhaps the finest opportunities for primitive recreation in a juniper woodland setting available in Wyoming.

In terms of important plant and animal species in the Powder Rim Linkage, this linkage boasts its own desert elk herd, seven species of rare native plants, critical winter habitat for mule deer, and sage grouse, a species of particular concern. Muddy Creek, one of the few permanent waterways in the area, is home to three types of fish rated as sensitive species by the BLM. This area also includes cottonwood riparian communities rated “highest priority” by the Wyoming GAP Analysis. It is also home to rare raptors such as golden eagle and ferruginous hawk; juniper-obligate birds like gray flycatcher (*Empidonax wrightii*), western scrub jay (*Aphelocoma californica*), plain titmouse (*Parus inornatus*), gray vireo (*Vireo vicinior*), black-throated gray warbler (*Dendroica nigrescens*), and other passerines that are rare in Wyoming such as Scott’s oriole (*Icterus parisorum*).

The Powder Rim Linkage serves as a critical wildlife linkage between the Adobe Town/Vermillion core area and the Medicine Bow National Forest. The Adobe Town area is of

## Chapter 4 - Introduction to the Heart of the West Wildlands Network



**Figure 4.3 The Powder Rim Linkage, which connects the Adobe Town/Vermillion Core Area to the Medicine Bow Core Area in the lowland Wildlands Network**

great importance as one of the last large remnants of the Red Desert ecosystem that remains in a pristine state, and the Medicine Bow is a 1.37 million hectare important core area of habitat for elk as well as many other species and home to several rivers that have been recommended for Wild and Scenic protection status. Even within the Powder Rim Linkage there are two small core areas identified by the SITES model: the Reed Creek roadless area and Flattop Mountain. These areas provide excellent habitat for the rare Gibben's beardtongue (*Penstemon gibbensii*). The Powder Rim Linkage provides an important corridor for migrating elk and

mule deer, is perhaps the last east-west linkage joining sage grouse populations in the southern Red Desert, and also has some of the last lightly impacted lands in the midst of a rash of oil and gas development.

Specific management recommendations for the Powder Rim Linkage include preservation as an Area of Critical Environmental Concern as suggested in the Citizens' Alternative for the Great Divide Management Plan. The BLM is currently revising this management plan for the BLM's Great Divide Resource Area in southern Wyoming.

### 4.3.2 The Green River Corridor Linkage

The Green River Corridor Linkage (Figure 4.4) links the Upper Green River core area to both the Upper Red Desert core and the Flaming Gorge core area. As described

below, it is a critical component of connecting wildlife winter use areas to summer use areas in southwest Wyoming.

## Chapter 4 - Introduction to the Heart of the West Wildlands Network



**Figure 4.4 The Green River Corridor Linkage connecting Upper Green, Upper Red Desert, and the Flaming Gorge Core Areas.**

Between Greater Yellowstone's mountain highlands and the sagebrush steppe of Wyoming's high deserts lie ancient animal trails well worn by thousands of years of seasonal migrations. Each fall and spring, great waves of pronghorn antelope, mule deer, elk and moose - numbering in the tens of thousands - follow these trails (especially along the Green River corridor) from the animals' lush summer ranges to their snow-free winter range in the Wind River Basin, Green River Valley, and the Red Desert. These trails are critical to the survival of these species, but they are at risk of being blocked by human activities.

In response to the threats to these crucial wildlife migration corridors, a coalition of Wyoming Environmental groups came together to found the Restoring Wild

Patterns conservation effort (Box 4.1). The map in Box 4.1 conveys the importance of the Green River Corridor Linkage to seasonal migrations of Wyoming's ungulate wildlife.



## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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### Box 4.1 Restoring Wild Patterns

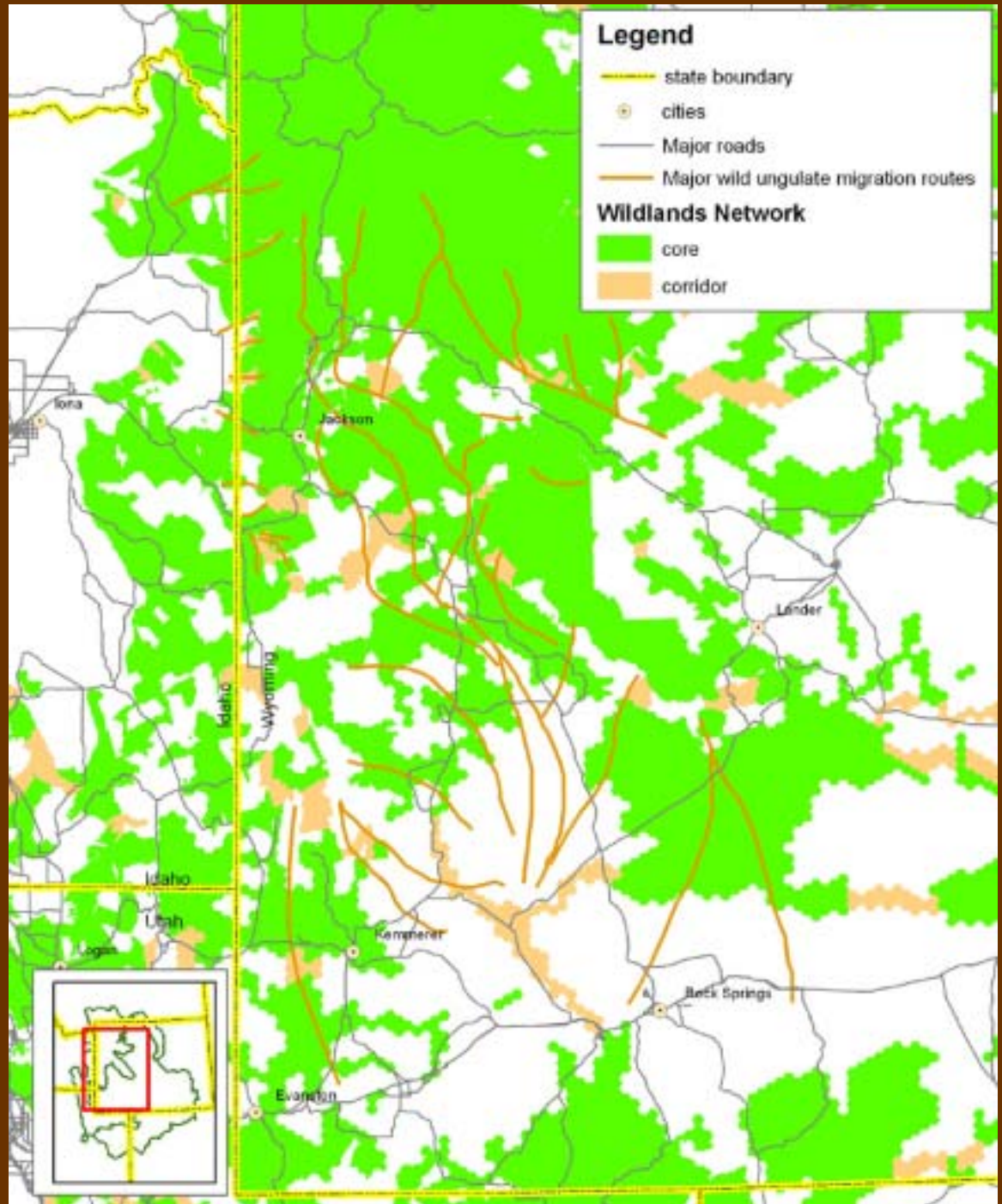
Since the last Ice Age, an array of wildlife species have followed ancient migration patterns each year from the heart of Yellowstone south through the Gros Ventre, Snake, Hoback, and Green River drainages to their wintering grounds in the Wyoming Basins. Natural bottlenecks have long funneled wildlife into narrow ways along their route. But today those bottlenecks are being choked by development that is threatening to completely block the migration corridors altogether. Booming oil and gas fields, livestock overgrazing, sprawling subdivisions and other human developments are fragmenting habitat, encroaching on critical winter range and blocking historic wildlife travel routes that link the Greater Yellowstone to the lowlands of the Heart of the West. Safeguarding vital links between summer and winter ranges is critical to ensure the survival of abundant, healthy, genetically diverse wildlife populations in the future. The Restoring Wild Patterns (RWP) program envisions restoration of healthy, sustainable, free-ranging wildlife populations to the diverse, native habitat in the southern Greater Yellowstone and Green River Valley.

Protecting and restoring wildlife migration corridors requires the conservation of large landscapes rather than the piecemeal, politically expedient land partitioning we have seen in the past. To ensure the long-term survival of our wildlife populations, RWP challenges wildlife and public land managers to re-evaluate their priorities by working to safeguard existing migration corridors and restore missing links in those corridors. The choice to protect and restore historic migration paths is ours now, but as the last great corridors are being fragmented, this may be the last chance we get to make that choice. RWP recommends the following actions that are necessary if we are to protect and restore historic migration routes through Yellowstone and Grand Teton Parks, Buffalo Valley, Jackson Hole, Gros Ventre Valley and Green River Basin:

- Create incentives to private landowners to protect open space and migration corridors through the voluntary sale of conservation easements
- Tax mineral production on public lands to create a wildlife trust fund to finance habitat acquisition and conservation easements
- Adopt an aggressive noxious weed campaign to eradicate non-native invasive plants that are compromising native habitat and reducing available forage
- Manage livestock grazing operations to minimize competition with wildlife on available habitat
- Provide access to and make available public land winter habitat for wintering wildlife
- Implement proactive travel plans where motorized vehicles and snowmobiles impact or displace wildlife. Road density should be reduced and road conflicts eliminated in important wildlife habitat
- Modify or remove fences to allow large-scale wildlife migrations to proceed without impediments
- Implement county land-use plans that reduce future subdivision sprawl and, where development has already occurred, help private landowners avoid conflicts with migratory wildlife
- Place a moratorium on new oil and gas leasing in migration corridors until federal agencies can complete cumulative-effects analyses of the impacts of this unprecedented pace of energy development
- Phase out elk feedgrounds where possible and allow supplemental feeding only on an emergency basis. Manage wildlife at carrying capacity on native range in order to reduce wildlife concentration and the risk of disease which impacts free-ranging wildlife herds

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

- Improve and restore habitat to assure healthy flora and fauna and increase vegetative health by fire treatment, native seed planting, etc. as habitat improvement projects to provide alternative winter range.



**Overlay of RWP ungulate migration routes with Heart of the West Wildlands Network. The serious threats facing these migrating animals is evidenced by the fact that the destination of many migrations is into a matrix of private lands, ranches and oil and gas activities (and thus not included in core areas).**

## Chapter 4 - Introduction to the Heart of the West Wildlands Network

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In the Greater Yellowstone, there remains one of the last intact ecosystems in the temperate zones of the earth. Protecting and restoring traditional wildlife migration corridors between the vast landscapes of Yellowstone and the Wyoming Basins is a daunting challenge. RWP's habitat restoration plan would maintain human social values as well as the benefits resulting from viable big game herds. RWP has the vision to make the correct choice at this crossroads to promote free-ranging, healthy wildlife, rather than domesticated and diseased elk and bison sustained on artificial feedlots and cutoff from their historic wintering grounds.



# Heart of the West Conservation Plan

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Adobetown

Erik Molvar

## Chapter 5 - Implementation of the Heart of the West Wildlands Network

### 5.1 Introduction

In this chapter, we describe how the Heart of the West Wildlands Network is used to effect change on the ground and achieve the basic conservation goals of this plan (Table 5.1). Implementation involves designing and applying land use prescriptions specific to different parts of the wildlands network. Drawing from specific

land management practices and protective designations commonly used today, this conservation plan applies a step-by-step decision procedure for guiding land use in the Heart of the West.

## Chapter 5

# Implementation of the Heart of the West Wildlands Network

**Table 5.1 Goals of the Heart of the West Wildlands Network and Conservation Plan**

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|                |   |
|----------------|---|
| <b>Goal 1:</b> | <b>Protect and restore viable populations of all native plants and animals (including some that have been extirpated) within the Heart of the West.</b> |
| <b>Goal 2:</b> | <b>Protect sufficient amounts of all habitat types from further degradation and loss.</b>   |
| <b>Goal 3:</b> | <b>Maintain and restore all ecological and evolutionary processes.</b>  |
| <b>Goal 4:</b> | <b>Protect land from further fragmentation. Protect and restore functional connectivity for wide-ranging species native to the region.</b>              |
| <b>Goal 5:</b> | <b>Prevent the spread of exotic species. Reduce the distribution and abundance of exotics, with the ultimate goal of elimination.</b>                   |
| <b>Goal 6:</b> | <b>Prevent or reduce further introduction of ecologically destructive pollutants into the region.</b>   |

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Our implementation model employs several fundamental principles, including management for ecologically functional habitat for populations of focal species, the principle of adaptive ecosystem management, and the precautionary principle:

*Managing for healthy populations of focal species* - While focal species habitat modeling was key in designing the wildlands network, the focal species concept continues to be critical in the implementation stage as well. For example, many of the Heart of the West focal species were chosen because they can serve as indicators of habitat health. The decline of these indicator species may be a signal that the health of the land has also diminished. Part of implementation involves putting in place management prescriptions that will ensure healthy and viable populations of focal species and functional focal species habitat.

*Adaptive management* - Biologically based adaptive management allows for adjustments based on ecological indicators. The appropriate use of adaptive management

involves testing management changes for the desired result, making changes based on monitoring of key ecological indicators, and independent peer review.

*The precautionary principle* - The urgency for increased habitat protection requires us to make scientifically informed decisions in the face of imperfect knowledge. In these instances we must apply the precautionary principle. The precautionary principle prescribes erring on the side of caution in the face of uncertainty. It suggests that the better the monitoring is, the more certain a manager can be that management practices do not put ecological health at risk, while the less adequate monitoring is, the greater the uncertainty and the greater the risk. For example, if we are to ensure viable populations of sage grouse, we cannot afford to allow further loss of function of sagebrush steppe, which means that we cannot afford continuing to use unproven management prescriptions. The burden of proof in cases of doubt necessarily falls on the proponents of a particular land use to show that it will not impair the land, not on the proponents of conservation to show that it will.

## Chapter 5

### Implementation of the Heart of the West Wildlands Network

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In the implementation process, each of the above three principles will be differentially applied to the various components of the wildlands network (core areas, core recovery areas, linkages, and compatible use areas) in order that human activities occur in deference to the needs of the land.

The remainder of this chapter elaborates on the concepts just mentioned. Section 5.2 describes a systematic approach for implementation (with flowchart), which includes developing site-specific management prescriptions, evaluating management actions against the conservation plan, developing remedies for management, implementing the remedies, evaluating the results against the goals of the conservation plan, and updating the conservation

plan with new information. Next, Section 5.3 describes management prescriptions that are consistent with this conservation plan. These prescriptions are derived from a number of sources and reflect the best knowledge on monitoring, managing human activities, and evaluating impacts on wildlife and habitat. Section 5.4 discusses various tools that can ensure protective designations for linkages and/or core areas or parts of cores. Section 5.5 gives an example of how a land use planning process can be made congruent with the conservation plan in a specific part of the Heart of the West (in this case, managing oil and gas development within Heart of the West core areas in the Uinta Basin in eastern Utah).

#### 5.2 General Implementation Approach: Affecting Management Change for Wildland Network Units

This section of the Heart of the West Conservation Plan describes a wildlands network implementation approach that in stepwise fashion translates the plan's prescriptions into actions on the land. The Heart of the West Wildlands Network Design features core areas, linkages, and compatible use areas. The network components each come with implementation prescriptions that describe the types of human activities compatible with those protective designations, as well as the habitat indicators for measuring the compatibility of these activities with biological goals. Prescriptions described in this conservation plan

are standards for managing human activities in a manner that is consistent with habitat needs. These prescriptions are developed from information in the focal species accounts, past management practices, and other scientific analyses.

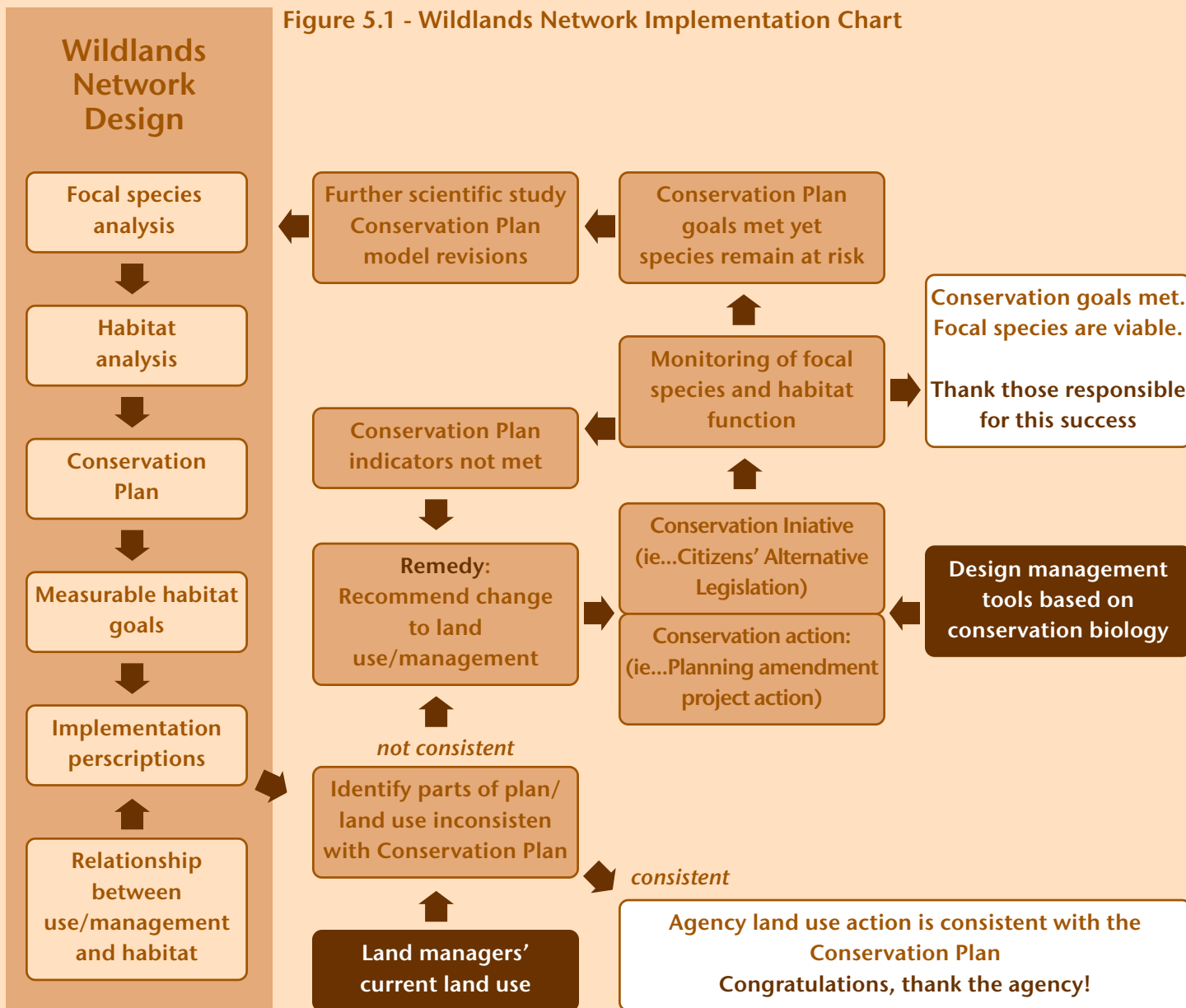
We recommend that implementation occur in the steps of the flow path shown in Figure 5.1. These steps aid land users, managers, and conservationists (referred to in this plan as "reviewers") as they make this conservation plan a basis for land use decisions. Below we develop the concepts represented by each box in the flow chart in Figure 5.1.

##### 5.2.1 Recommended Changes in Land Use or Management

Once the reviewer has identified those land uses that are inconsistent with the conservation plan, the next step is to design a remedy. Based on the biological

prescriptions in the conservation plan, the reviewer designs the type of treatment needed to meet the plan's goals, including the kind and intensity of

## Chapter 5 Implementation of the Heart of the West Wildlands Network



human use acceptable in specific places, and necessary monitoring.

The remedy required to achieve the conservation plan's goals will likely include the following components:

1. Inventory of focal species habitat — prior to continued or new habitat disturbance, an inventory of focal species habitat use, and habitat function for that species, should be conducted.

2. The location and degree of impacts from human activities — identify those activities that potentially affect the focal species and its habitat, and begin monitoring on the site in question. Attempt to quantify or otherwise describe the relationship between human activity and degradation of habitat function.

3. Land use stipulations — suggest management stipulations that are designed to maintain and/or restore habitat function for focal species.



## Chapter 5

### Implementation of the Heart of the West Wildlands Network

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4. Peer review — solicit expert peer review from scientists that have no conflict of interest with either land users or the land manager.

5. Ensure adequate funding – as a part of any action, funding should maintain the monitoring and evaluation necessary to implement the management remedy.

Timing on when best for the reviewer to affect land management decisions is also important. In most cases this requires the reviewer to be involved in the decision process at the earliest possible stage.

#### 5.2.2 Design Management Tools Based on Conservation Biology

Land and wildlife managers have collected extensive data over long periods of time. These data can sometimes be used to support the biology-based decisions called for in the Heart of the West Conservation Plan. However, in some cases the necessary data have either not been collected or the agency decision process excludes key biological considerations. BLM's range monitoring offers a good example. Historically, rangeland monitoring has emphasized forage for

livestock and browse for big game over other land health considerations, such as stream and riparian health. Thus, where crucial information concerning over-all land health is lacking it is imperative that reviewers augment monitoring and ecosystem health assessment methods – especially in cores and linkages. Box 5.1 gives a good example of a case where independent scientists and conservationists developed an alternative procedure for assessing stream and riparian health.

#### 5.2.3 Conservation Action: Planning Amendment or Project Action

Opportunities to implement the wildlands network will often coincide with an agency decision process. The revision of a Forest Plan, the renewal of a grazing permit, the approval of a gas field development Environmental Impact Statement (EIS), or the updating of a travel plan are examples of opportunities to use the conservation plan to guide land uses. The reviewer can use these decision processes as opportunities to promote remedies for management problems identified in the previous step of the implementation flowchart.

The best time to affect a land use decision is early on. For example, by the time a Draft EIS is released, the possibility of modifying the preferred alternative may

be remote. The reason for this is that the range of possible outcomes is often determined long before the public becomes aware of the environmental analysis process. In order to justify the expense for a land manager to write an EIS, the agency needs to have a clear idea of the nature of the problem and how to fix it. When the agency begins to write the EIS, the money the agency has budgeted for the task already defines the kind of information that will be gathered, what scope of analysis the agency can afford, and a narrowed range of possible preferred alternatives. The decisions that shape an EIS or land use plan are often in place prior to the agency filing a notice of intent to prepare an EIS in the Federal Register.

## Chapter 5 Implementation of the Heart of the West Wildlands Network

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### Box 5.1 Riparian Health Assessment Example.

In the mid 1990s, the BLM established Rangeland Health standards that advocated for the proper ecological functioning of rangelands. To implement this policy for riparian/wetland areas, BLM developed a rapid assessment method to determine the hydrological and geomorphic function of streams. BLM's assessment method has been more broadly used by BLM to determine whether an area is in Properly Functioning Condition (PFC), and thereby meeting the Rangeland Health standards. As is the case with some agency monitoring and assessment methods, BLM omitted key biological considerations required by the rangeland health standards in their PFC assessments and omitted instructions on exactly how to reach a final PFC determination. As a result, many BLM PFC assessments underreport deteriorated riparian areas. In response to this, the conservation community in Utah assembled a team of scientists to design an alternative PFC assessment method for riparian areas that more fully implements BLM's rangeland health standards. The resulting revised PFC assessment method gives the conservation community a stronger tool to use in promoting a conservation remedy in riparian areas impacted by overgrazing. Importantly, the BLM actually implemented part of the revised PFC procedure in the Grand Staircase-Escalante National Monument in Utah.



Deer Creek in the Grand Staircase Escalante National Monument

Jim Catlin

## Chapter 5

### Implementation of the Heart of the West Wildlands Network

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In order to have maximum influence on the land use plan, the conservation plan reviewer should be involved in shaping the land manager's request for the planning budget well in advance of any public notice. This will usually involve personal contact with key agency staff, often more than a year in advance of the start of an EIS. Early and ongoing personal involvement will usually be required if it is to have a meaningful effect on the decision process.

In addition, to be part of an existing land use decision process, the conservation plan remedy must have a logical place in current institutional structure. For a remedy to have a place in a land man-

agement institution's way of thinking, those advocating a remedy must design the recommended action to comply with the regulatory structure and culture of the institution. The reviewer needs to know how an agency makes decisions. Recruiting the support of decision makers for a conservation remedy is also of critical importance. This can be achieved by creating long-term relationships with those in the managing agency that share our conservation goals. Approaching key decision makers early to understand their needs and concerns may help the reviewer find a way to make the conservation remedy have more of an impact.

#### 5.2.4 Conservation Initiatives

At times, a conservation remedy is most effective when initiated external to the land management agency. A conservation initiative may take the form of a wilderness or wildlife habitat inventory, proposed legislation that promotes habitat protection, or a "Citizens' Alternative" for a land use plan. Effective conservation initiatives often include cooperative partnerships and a well-organized campaign.

Citizen wilderness proposals are a good example of a citizen initiative. While wilderness management is not perfect, much of the protective management required for core areas can be achieved by wilderness designation. Citizen wilderness proposals and designated wilderness (the result of past campaigns) for the Heart of the West region are shown in Figure 5.2.

While designation of wilderness is the ultimate goal for a wilderness proposal, citizen wilderness proposals also provide more immediate benefits. They can serve

as useful alternatives to wilderness proposals developed by federal agencies or legislators. They may also serve to identify species habitats that land managers should give higher priority for protection. Almost without exception, agency wilderness recommendations are much smaller than what is eventually designated wilderness by Congress.

The Citizens' Wilderness Proposal is just one example of an independent alternative for land management. As with any suggested remedy, these independent alternatives are suggestions that are more likely to succeed when they resonate with the values of the community and have broad political support.

Chapter 5  
Implementation of the Heart of the West Wildlands Network

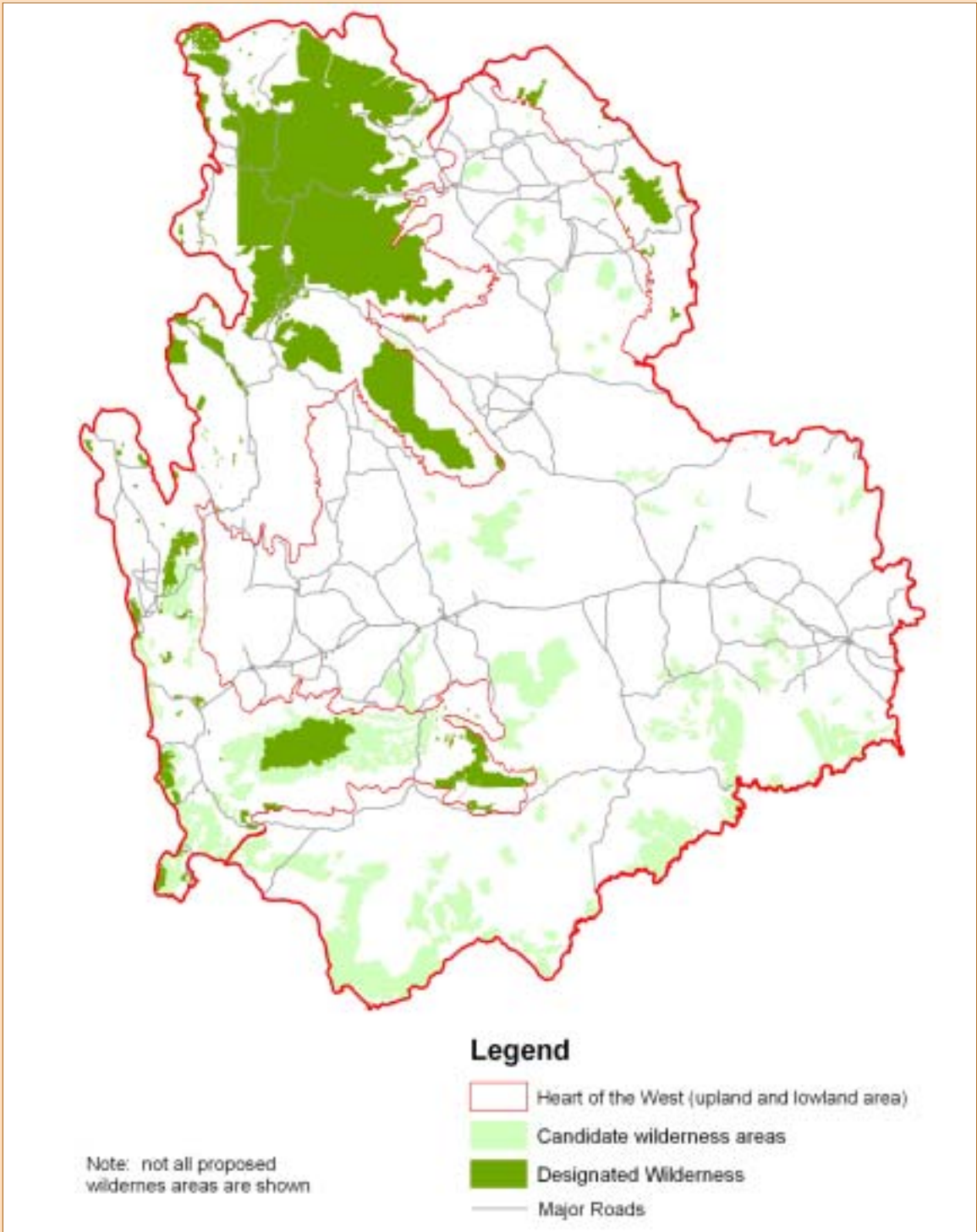


Figure 5.2 - Current citizen wilderness proposals, candidate wilderness, and existing wilderness within the greater Heart of the West region.

## Chapter 5

### Implementation of the Heart of the West Wildlands Network

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#### 5.2.5 Monitoring of Focal Species and their Habitat

Assume that the conservation plan remedy has been applied and enough time has passed for change to occur. Monitoring of the key indicators for focal species and their habitat will help determine whether the remedy was successful. Depending on the results of this evaluation, one of two implementation paths in Figure 5.1 will be chosen. If the remedy did not achieve the

result desired, a feedback loop directs the reviewer to reassess and, if necessary, change the remedy. The remedy, once adjusted, is again applied as described earlier. The second path assumes that the remedy was applied and the prescription goals were met, but for some reason the focal species remains in trouble. The second path is described below.

#### 5.2.6 Further Scientific Study and Conservation Plan Revision

This conservation plan incorporates the evolution of scientific knowledge. Like species, plans also can evolve over time. Indeed, they must. The Heart of the West Conservation Plan will someday need to be updated. The accumulation of data and understanding of ecosystems grows at a rapid rate. What we know today will be revised as science improves our knowledge of ecosystem processes. This conservation plan should be revisited to make certain that it incorporates this new information.

Another reason for additional analysis occurs in the case where our implementa-

tion of the plan appears successful, yet key ecological problems persist. For example, if the key implementation prescriptions are conducted and monitoring shows that target goals have been met, then one would expect that key focal species (for example, bighorn sheep) should have viable populations in the core areas of the wildlands network. But in the case that bighorns have not recovered as successful implementation would predict, we then need to revisit our methods and plan. New prescriptions should be developed based on new scientific studies and data.

#### 5.2.7 Using the Implementation Flowchart - Sage Grouse Example

The following example looks at how the conservation plan prescriptions can be implemented for one of our focal species. Sage grouse populations can be negatively influenced by increased raptor predation. Developments that provide new places for raptors to perch (such as a powerline pole) allow for greater hunting success for raptors. As a result, sage grouse are likely to face abnormally high losses in areas where raptors have access to these artificial perches.

Oil and gas development is frequently accompanied by power lines, fences, towers, tanks, buildings, and drill head stems that provide an elevated place for a raptor to perch. Land managers can protect sage grouse from excessive predation by raptors by putting stipulations on oil and gas development that can prevent new raptor perches. In core areas that are known to have sage grouse, the stipulations on development can require that above-ground structures be no higher than one meter. Or the structures might be designed so that raptors cannot perch on them.

## Chapter 5

### Implementation of the Heart of the West Wildlands Network

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In summary, when using the flowchart (Figure 5.1) to implement the conservation plan's goals for sage grouse, the reviewer should check the land use plan to see if the plan authorizes oil and gas development (or other land uses) inconsistent with the function of sagebrush communities for sage grouse. What sort of guidance does the land use plan give in terms of the negative impacts of certain oil and gas development activities? If the land use plan calls for activities that are incompatible with functioning sage grouse habitat, then a remedy must be devised that implements the needed changes. This remedy could be implemented either in the land use planning process, or through individual projects on the ground, or with some sort of Citizens' conservation initiative. Once the remedy is in place, careful monitoring of sage grouse populations and sagebrush habitat must be conducted to ensure that the prescriptions were car-

ried out; and ultimately, that the goals of the Heart of the West conservation plan (in this example, regarding sage grouse) have been met.

In addition to this implementation example with sage grouse in core areas and linkages, there are other implementation examples that are already underway in the Heart of the West. Box 5.2 illustrates one such example, regarding restoration of key migration routes of ungulates in Heart of the West core areas and linkages.



Elk

Scott Smith

## Chapter 5

# Implementation of the Heart of the West Wildlands Network

### Box 5.2. An Implementation Example: Restoring Wild Patterns

When most Americans think of Wyoming, they envision roving herds of antelope, elk, deer, and bison in seasonal migration across open expanses of forests and shrub deserts. Today, much of that natural migration is restricted, and in many places is blocked by fences. This causes a serious problem that is growing over time. The continued viability of these historic herds and their habitat is inexorably linked to these recurring migration events.

The Wyoming Wildlife Federation, along with other regional groups like the Wyoming Outdoor Council, has initiated a campaign to restore wild patterns of migrating native ungulates. Part of this campaign has identified fences as one of the key obstacles to wildlife movement. Fences are one of the main tools that range managers, land owners, and highway departments use to control livestock. Fences also influence wildlife - particularly the migration of larger ungulates. With the help of the University of Wyoming, the Restoring Wild Patterns Coalition assembled maps of fences on public lands in Wyoming. These maps describe the location and kind of fence that are found in key migration routes. The figure here presents the results of this fence inventory in parts of Wyoming.



Results of the Wyoming Wildlife Federation's fence inventory in parts of Wyoming.

The Restoring Wild Patterns effort has direct relevance to Heart of the West Wildlands Network implementation. Knowing where the fences are that block Heart of the West linkages and impair core areas is the first step to restoring wild patterns. The next step involves a management prescription that uses this fence inventory and traditional native ungulate migration routes to identify those fences which are causing migration problems – especially in linkages between core areas. Management recommendations will then be developed to correct the problem. For example, this may involve replacing one strand of barbed wire fence with unbarbed wire and changing the spacing so that antelope may pass under. In other cases, fences may be removed or turned into “seasonal fences” which are let down during migration periods. It is critical that implementers insert this prescribed management remedy into the appropriate place in a decision process, such as a land use plan revision, an updated travel plan, or other planning process for the Wyoming Department of Transportation. Depending on the location of certain fences, it may be appropriate to work directly with private landowners.

## Chapter 5

# Implementation of the Heart of the West Wildlands Network

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### 5.3 Conservation Plan Prescriptions

The prescriptions described in this conservation plan give priority to the maintenance and, where needed, restoration of populations of Heart of the West focal species. The prescriptions are organized by wildlands network component type, with the more conservative prescriptions pertaining to cores and linkages. Prescriptions are designed to apply the precautionary principle in all cases.

Sources used to assemble these prescriptions include scientific studies, agency standards and guidelines, past land use plans, best management practices regarding wildlife habitat, recovery plans for federally listed species, and management recommendations of conservation groups. The focal species

accounts that were assembled to help design the Heart of the West Wildlands Network also provide relevant information.

Prescriptions are built upon four key elements: baseline information, measurable ecological goals, monitoring of ecological indicators and human activities, and the actual stipulations that guide the location and degree of human activities. Below, we further describe these basic elements of a conservation plan prescription. We also include a short discussion on certain management elements, laws and regulations that pertain to all lands in the Heart of the West. We conclude this section with a discussion of prescriptions for private lands within cores and linkages.

#### 5.3.1 Baseline Information

With the conservation plan's ecological goals in mind, the reviewer needs to determine baseline conditions in terms of the needs of focal species. Some analysis of the existing baseline data, even if incomplete, is needed to shape the prescriptions that will follow. The baseline information should map the area historically and

currently occupied by focal species. The reviewer should assemble any records on focal species use of the habitat in the area of interest. Habitat needs for each part of the life cycle of the focal species must be described and the current function of habitat for the focal species determined.

#### 5.3.2 Measurable Ecological Goals

Restoring and maintaining viable populations of focal species requires achieving measurable population goals for each focal species in a core area. Measurable goals for viable populations of sage grouse, for example, include achieving population sizes and demographics that represent the habitat's historic potential and that indicate proper habitat function for the species.

Again drawing on our sage grouse example, secondary goals for the sage grouse in core areas offer indirect indicators of habitat

function necessary for this species. For example, habitat condition for sage grouse in each core area can be measured by current vegetation inventory techniques. Measures of ground cover, exotic species, plant community composition, and herbaceous and shrub productivity, are a few such measures. The measurable plant community goal compares a site in question against a standard. Relict sites are commonly used as standards to assess the potential condition of a plant community. In this example, if both plant community productivity and composi-



## Chapter 5

### Implementation of the Heart of the West Wildlands Network

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tion are at or near reference site conditions, then habitat is assumed to function adequately for sage grouse. This is one of many indicators that managers can use to assess habitat function for focal species.

Yet another habitat goal could be presence or relative abundance of indicator species. For example, amphibians are an excellent indicator of healthy wetland areas, and thus could be used as a proxy to determine that habitat is properly functioning for various aquatic and wetland Heart of the West focal species.

Often, a federal agency will have already done the groundwork to determine whether habitat function goals are being met. For example, a habitat goal may be the proper function of riparian zones and

other surface waters. Agency-conducted properly functioning condition assessments are an example of one type of ecosystem health assessment tool for riparian areas developed by the Department of the Interior and Department of Agriculture (Barrett et al. 1998). Many focal species, such as river otters and beavers, require riparian habitats that are properly functioning.

Goals pertaining to focal species include restoration of required habitat. For example, sage grouse are strongly associated with big sagebrush (*Artemisia tridentata*). Since as much as half of original sagebrush habitat in the intermountain West has been eliminated (Call 1975), restoring large sagebrush tracts is one example of a measurable goal for a core area.

#### 5.3.3 Monitoring

Monitoring of focal species populations and their habitats is a key feature of implementing this conservation plan. Where practicable, focal species should be directly monitored. For example, in the case of sage grouse, annual bird counts at leks during mating season offer a good measure of population changes over time. There are a number of proven methods for direct monitoring of Heart of the West focal species. Because many focal species are highly mobile, monitoring of habitat function is often more practical than direct monitoring of the species. There are a number of techniques, some which we have already described, to assess habitat function for focal species as represented by, for example, the health of riparian areas, or plant community composition.

The monitoring required for this conservation plan is a departure from that commonly conducted for, say, livestock graz-

ing management. While some of the same field monitoring methods may still be used, the monitoring needed here directly relates to the indicators of habitat function for key focal species. Much of the monitoring conducted for livestock grazing management, on the other hand, is conducted for a different purpose. Monitoring for livestock grazing commonly focuses on changes in the utilization and frequency of the most prevalent forage grasses. As a result, major losses of herbaceous productivity may not be caught.

One important component of all monitoring activities and habitat health assessments entails comparing monitoring data to some sort of “benchmark,” or relict, site conditions. Few satisfactory ecological reference sites exist today, yet they are critically important for effective land management. For this reason, one of the top priorities in managing a wildlands

## Chapter 5

### Implementation of the Heart of the West Wildlands Network

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network is to establish ecological reference sites to represent each habitat type (including riparian areas) in each core area.

#### 5.3.4 Prescription Stipulations for Activities in Cores and Linkages

In Chapter 4 we outline the generic stipulations we recommend for core areas, linkages, core recovery areas and compatible use areas in the Heart of the West Wildlands Network. Here is a quick summary:

*Core Areas* - Core areas are wilderness, or wilderness-like areas, managed so as to maintain ecological processes and biodiversity within them. This prescription requires that no new permanent roads are built, use of motorized/mechanized equipment and vehicles is prohibited or substantially limited, logging and other tree removal activities are curtailed, new oil and gas development use directional drilling from existing well pads, and new surface mineral extraction activities are avoided. To reduce the impacts of seismic oil and gas exploration, we recommend shothole exploration only, hand-laying of lines in particularly sensitive areas, and banning the use of motorized vehicles off of main roads for seismic exploration. Predator control and trapping should be prohibited. Livestock grazing should be limited to a timeframe when plant communities are near or at their potential, and intensity of grazing should be limited to protect the forage base. Special attention should be given to ensure that riparian areas function at their potential for wildlife. Exotic species that significantly affect habitat should be controlled in core areas.

*Core Recovery Areas* - For the lowland Heart of the West study area, oil and gas well density was used to identify those lands in need of recovery. Recovery areas have more than 5 oil and gas wells per wildlands

network hexagon (or more than one well per 250 hectares). Today, these recovery areas normally fail to function in the manner needed to support focal species. Yet these areas are ecologically important and are incorporated in our core areas. Recovery for a producing oil field would require that future wells be drilled from existing well pads, and that nonproducing well sites and associated roads and pipelines be reclaimed and habitat restored. Recreational vehicle use should be limited to principal roads. Power lines should be moved underground in areas where raptor predation may affect a focal species. Additionally, livestock grazing should be limited to a level that ensures that rangelands adequately function for focal species in the area.

*Linkages* - Linkages should be managed for movement by both terrestrial and aquatic species known to use those areas, based on the needs of those particular species. In general, we recommend that when linkages intersect well-used highways, structures allowing the passage of wildlife be constructed. Fences in linkage areas should be modified to allow traditional migration patterns for native ungulates. We also recommend that human development, such as mineral activities, occur in deference to the habitat needs of dispersing and migrating focal species. Public vehicle use must be limited to designated routes in linkages.

*Compatible Use Areas* - Areas outside core areas and linkages are identified in the plan as compatible use areas. These areas allow for a higher level of human activity than is allowed in cores and linkages. However,

## Chapter 5

### Implementation of the Heart of the West Wildlands Network

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these human activities, must still be managed in order to meet basic environmental requirements. By law, federal lands managed for multiple use must be managed in a manner that provides adequate habitat for wildlife and which prevents significant impairment of habitat. A number of human activities, with appropriate stipulations, are suitable in compatible use areas. Some of these include motorized recreation on designated routes, camping, fishing and hunting, wood-cutting, habitat manipulation needed to restore the function of wildlife habitat, and ecologically sound livestock grazing. Oil and gas development should emphasize continued production from existing oil fields. In important wildlife

habitat, directional drilling should be practiced from existing pads. Spacing between well pads should be at least 3 miles (6.6 km) in such habitat. Human activities associated with oil and gas production should cease between November 15 and April 15 on big game winter ranges.

In summary, the above generic stipulations are a good starting point for management within network components. Individual prescriptions unique to specific situations will have to be developed for each core area and linkage. Box 5.3 (page 150) illustrates a good example of how livestock grazing should be managed in core areas known to contain sage grouse.

#### 5.3.5 Stipulations that Apply Throughout the Network

Defined by law, certain basic land management practices apply to all federal lands. These basic practices present standards for management that reflect basic land stewardship important for the productivity of the land. This conservation plan argues that these common standards should be applied regardless of whether the area is inside or outside a core area or linkage.

There is a long list of existing laws and policies that, if applied, would help us make significant progress in protecting important ecological sites everywhere. Here, we will present a few of these laws and regulations that are potentially be most important. A few of the basic environmental standards are:

- The Secretary of the Interior, by law, manages public lands for the purpose of preserving, protecting, and maintaining resource values of said lands. Federal agencies are required to manage uses in order to prevent the permanent impairment of the productivity of the land.
- Federal agencies must inventory and restore riparian areas and wetlands, and surface waters must meet Clean Water Act standards.
- Motor vehicle use on public lands must be managed to prevent significant impact to those lands.
- There are a number of pieces of legislation that offer strong protection for species at risk, especially threatened and endangered species.
- Both the BLM and the Forest Service are required to protect and provide adequate habitat for wildlife. The Fish and Wildlife Service and state wildlife agencies have management practices designed to protect wildlife.
- Rangeland Health Standards and Guidelines apply ecological standards to manage livestock grazing on BLM lands.
- Organic acts for the BLM and the Forest Service call for mineral development that minimizes its impacts to the land.

## Chapter 5

# Implementation of the Heart of the West Wildlands Network

### Box 5.3 An Example of Prescription Stipulations in a Core Area: Sage Grouse and Livestock Grazing Stipulations.

Sage grouse, a Heart of the West focal species, require management prescriptions for core areas that will produce habitat functions adequate for the foraging, breeding, migration, rearing, and security needs of grouse (Biodiversity Conservation Alliance 2003). Livestock grazing is often the most impactful activity affecting sage grouse. Here, we use a prescription for livestock grazing within core areas as an example of how land use can be modified for the benefit of a focal species.

The prescription for livestock grazing in sage grouse habitat focuses on a goal of ensuring plant community function and riparian area health. Sage grouse need sagebrush communities that include adequate litter and herbaceous plant cover for foraging, rearing and security needs (Gregg et al 1994, Sveum et al 1998). To function adequately for sage grouse, sagebrush communities should contain shrubs, perennial grasses, and other herbaceous plants. (Sharon and Paige 2000). Stocking levels and periods of grazing should be determined by the need to restore and maintain plant community structure, composition, and productivity in deference to the needs of sage grouse. For a number of reasons, livestock grazing use, especially by sheep, should be avoided during the growing season and sage grouse breeding season (Call 1975, Ritter and Paige 2000, Holloran 1999, Klebenow 1982 ).

The Heart of the West grazing prescription in core areas known to contain sage grouse includes these steps:

- Determine whether the habitat meets rangeland health standards and habitat structure and function necessary for sage grouse.
- Determine the kind and magnitude of livestock grazing that may have led to an area meeting or not meeting the standards.
- For areas failing to meet the standards, change season of use and/or reduce livestock grazing to seasons and/or levels that will ensure the recovery of upland and riparian areas.
- Give priority to the recovery of riparian areas.
- Establish best management practices that include thresholds that trigger necessary management changes.
- Monitor the relationship between livestock grazing, habitat condition, and sage grouse populations.
- Ensure that adequate funding to implement this prescription is in place before livestock grazing continues.



Cattle in Sagebrush

George Wuerthner

We are developing similar prescriptions based on focal species needs for each human activity that agencies manage within the Heart of the West. These prescriptions fit into the implementation flow chart found at the beginning of this chapter (Figure 5.1).

## Chapter 5

### Implementation of the Heart of the West Wildlands Network

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This list mentions only a few of the laws that favor management in deference to the needs of the land. The environmental practices

discussed above apply to all lands both inside and outside of cores and linkages.

#### 5.3.6 Private Lands Within the Wildlands Network

The Heart of the West wildlands Conservation Plan considers the habitat needs of focal species without regard to land ownership. After all, animals can't read lines on a map and many populations of focal species, as well as rare and threatened "special element" species, currently dwell on private land. Hence, some ecologically important private lands are included in the Heart of the West Wildlands Network.

This conservation plan respects the rights of private landowners and does not advocate that these private lands become federal or state lands. It provides the private landowner with information on the ecological importance of these lands and offers a number of management options that they may choose from to promote the needs of wildlife while continuing to use their lands.

Stewardship for wildlife can be improved with a number of management actions on private lands:

- Private landowners can work with state wildlife agencies to survey and monitor key focal species and habitat on their land, and can preserve existing natural habitat important to wildlife.
- Farmers can schedule cultivation activities before or after nesting season, can attach bird flush chains to mowing machines, and apply integrated pest management practices to preserve native pollinators and the food supply for insect-eating birds (Gillihan et al. 2001).

- Landowners can ask electrical utilities to configure power poles in order to prevent raptor electrocution (Ligouri and Burrus 2001).
- Ranchers can take a number of steps to manage grazing to help wildlife. Forage utilization can be managed to leave abundant residual cover that will benefit birds, small mammals, and other native herbivores. Escape ladders can be put in watering troughs for birds and small animals (Gillihan et al. 2001). Also, ranchers can make their operations "predator friendly" by using guard dogs and llamas, various non-lethal scare tactics, and employing many tested strategies such as calving in the spring when predators have plenty of natural prey.
- Private land holders can take steps to control the spread of non-native species on their property.
- Landowners can reseed with native species.
- Landowners can also enroll their property in a conservation reserve program, or work with land trusts<sup>1</sup> and other conservation interests to develop conservation easements on their property.

There are a large number of tools available to landowners to increase protection of wildlife habitat on their lands. *Options for Landowners* (Vint 1998) lists 23 land protection tools for achieving various landowner goals. Table 5.2 illustrates some of these options, all of which are described in detail by Vint (1998).

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<sup>1</sup>Land Trusts are private, nonprofit organizations that work with landowners who want to voluntarily protect land with important natural, scenic, archeological, recreational, agricultural, or historic value for the public benefit. Land trusts acquire land directly through donation and purchase, hold conservation easements, and often provide stewardship management of protected lands.

## Chapter 5 Implementation of the Heart of the West Wildlands Network

Table 5.2 Examples of land protection tools available to private landowners (reprinted from Vint 1998)

|                                |  |
|--------------------------------|--|
| Bargain Sale                   | Donating a Remainder Interest            |
| Charitable Gift Annuity Trust  | Donations of Undivided Partial Interests |
| Conservation Buyer             | Installment Sale                         |
| Conservation Easement Donation | Leasing Your Land                        |
| Conservation Easement Sale     | Like-Kind Exchange                       |
| Deed Restrictions              | Limited Development                      |
| Donating Conservation Land     | Management Agreement                     |
| Donating Trade Land            | Mutual Covenant                          |
| Donating Land by Will          | Purchase Option                          |

The decision on how to manage private lands remains with the landowner. With each property right comes a responsibility to the land and its occupants. All private land exists within a larger setting that has interrelated biological, economic, and social connections. This conservation plan

identifies those lands, including private lands, that contain key wildlife habitat in a larger ecosystem. The Heart of the West Conservation Plan offers the private landowner an opportunity to be part of a larger regional effort to preserve the future of wildlife.

### 5.4 Protective Land Designations

Conservationists have available to them a diverse set of tools for establishing special protective designations in core areas and linkages. Some of these are:

- Legislative designation of new Wilderness Areas, National Monuments and Wild and Scenic Rivers.
- Conservation easements on private lands (discussed above).
- Facilitate ecologically beneficial land exchanges between public and private lands. Land exchanges that reduce habitat fragmentation can be useful where the underlying goal of the land swap is to improve management of linkages and core areas.
- Promote open space protection through local governments and private land owners.
- Work with First Americans to identify lands they regard as important for preservation and restoration, in terms of

their regional context, local biological values, or as sacred sites.

- Establish land trusts that promote the conservation plan goals.

The above list is not comprehensive, but offers a great place to start. In addition, there are also a number of federal programs, already in place, that can create special protective designation:

*Forest Legacy Program*, administered by the Forest Service, protects private forest lands from being converted to non-forest uses through the purchase of conservation easements or direct acquisition

*Forest Resource Management Program (or Rural Forestry Assistance Program)*, administered by the Forest Service, provides matching funds to state agencies for technical assistance to private landowners who protect habitat.

## Chapter 5

### Implementation of the Heart of the West Wildlands Network

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*Forestry Incentives Program*, a Forest Service and Natural Resources Conservation Service program, provides technical, educational, and financial assistance to help landowners defray the costs of making long-term investments in forests, including promoting natural regeneration.

*Conservation Reserve Program*, promoted by the federal Farm Service Agency, provides farm income support and promotes environmental protection by taking important wildlife habitat out of crop production. This is the nation's largest private lands long-term retirement program.

*Environmental Quality Incentives Program*, administered by the Natural Resources Conservation Service, provides up to 75% cost share of locally approved conservation practices.

*Wetlands Reserve Program*, administered by the Natural Resources Conservation Service, pays for the restoration of wetlands on non-federal lands.

*Wildlife Habitat Incentive Program*, a Natural Resources Conservation Service program, helps landowners improve wildlife habitat on private lands.

*Partners for Wildlife Program*, administered by the U.S. Fish and Wildlife Service, provides cost share and technical assistance for a variety of projects focused on wildlife.

*Roadless lands protection*. Both BLM and the Forest Service have programs to designate and protect roadless areas.

*Additional Protective designations on federal lands* also include such designations as Areas of Critical Environmental Concern (BLM) and Research Natural Areas (USFS).

These approaches offer a number of opportunities that fit with the implementation steps (in Figure 5.1) used to achieve the conservation plan's ecological goals.

#### 5.5 An Implementation Example: BLM's Vernal Field Office Resource Management Plan

Implementation opportunities often come as part of some scheduled activity or decision process. This example describes such an opportunity. In 2002, the BLM began to revise its Resource Management Plan (RMP) for the Vernal Field Office in northeastern Utah. In this example we show how the Heart of the West Conservation Plan and its biology-based prescriptions can be used to guide the part of the Vernal RMP dealing with oil and gas development.

BLM land use plans are designed to provide approximately ten years of guidance for a number of land uses. For the Vernal Field Office, BLM's planning process will

revise a past RMP based on new issues, changes in policy, and changing conditions. The RMP establishes various BLM programs, management zones, and management prescriptions for a particular BLM planning area. The plan addresses wild and scenic river designation recommendations, oil and gas leasing and development, wildlife and habitat, livestock grazing, surface water and riparian areas, transportation (which includes off-road vehicle use), protection of scenery, utility corridors, and more.

Located in the southwestern part of the Heart of the West study area, the Vernal Field Office manages an area that totals

## Chapter 5 Implementation of the Heart of the West Wildlands Network

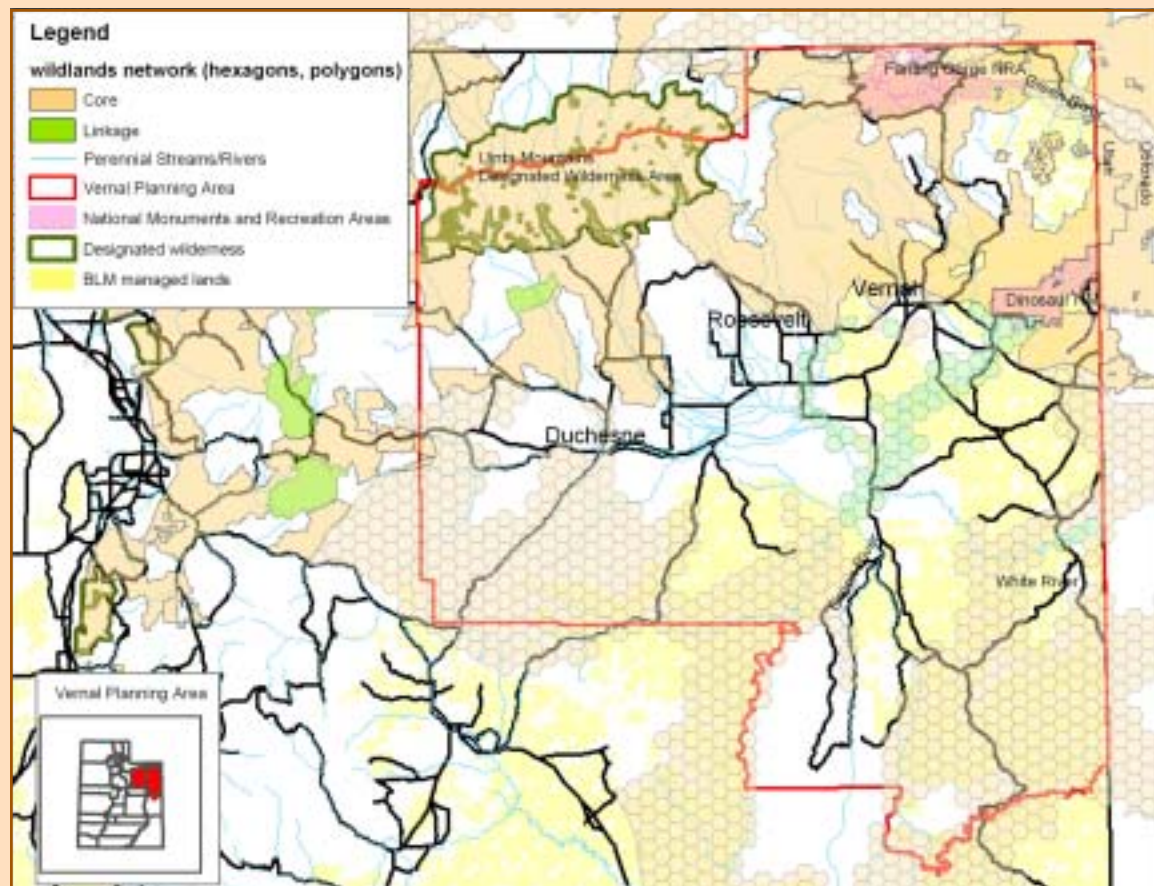


Figure 5.3. The BLM Vernal Field Office Planning Area in northeast Utah.

nearly 2.2 million acres of lands (Figure 5.3). This region of Utah includes some of the most remote and wild places in the continental United States, such as the Book Cliffs roadless area with over one million acres of contiguous undeveloped candidate wilderness lands. The Green, Yampa and White Rivers pass through this wild and largely undeveloped region, providing critical wildlife habitat. In the northern Uinta Basin, Dinosaur National Monument and Flaming Gorge National Recreation area carve out a corner of the eastern slopes of the Uinta Mountains.

For decades the Vernal planning area has been the center of oil and gas development in Utah, and fossil fuel production is central to the economic interests of communities and land managers in this region.

More than 7,000 wells have been drilled and thousands more are planned. Figure 5.4 shows both active, and abandoned, oil and gas wells in the area. The oil and gas deposits are not uniformly distributed in this area. The geology of the hydrocarbon deposits is complex and commercial viable deposits are generally found only in pockets and fractures of uplifted domes. This means that a majority of this region has a low likelihood of economically viable deposits of oil and gas outside of developed fields. Superimposed over this activity is the fact that much of the planning area is critical for wildlife. The challenge is to manage the land so that oil and gas development adequately respects critical wildlife habitat by employing least impactful methods and favoring development in biologically less important areas.



## Chapter 5 Implementation of the Heart of the West Wildlands Network

The Vernal RMP revision builds on two existing plans, the Diamond Mountain RMP and the Book Cliffs RMP. Driven by the current administration's policy to accelerate development of fossil fuels, BLM saw a need to revise these older plans in order to expedite the development of oil, gas, and coal bed methane.

Based on guidance from the Heart of the West Conservation Plan, a conservation alternative for the Vernal RMP revision was recently developed with a number of partners that live and work in the Uinta Basin, including conservation organizations, scientists, and a number of interested people working with different government agencies. This group assembled a biology-based planning ap-

proach which we call the "Responsible Use Alternative."

The first step in developing a conservation alternative for the Vernal RMP involved reviewing past planning decisions, reviewing the condition of the land today, and assessing whether past planning decisions were/are consistent with the wildlands network. Prescriptions that BLM applied were reviewed in order to identify those management decisions that have worked well, and those that have not met ecological goals.

This example focuses on just one of the most impactful activities in this planning area - oil and gas development. Extensive scientific studies have confirmed the

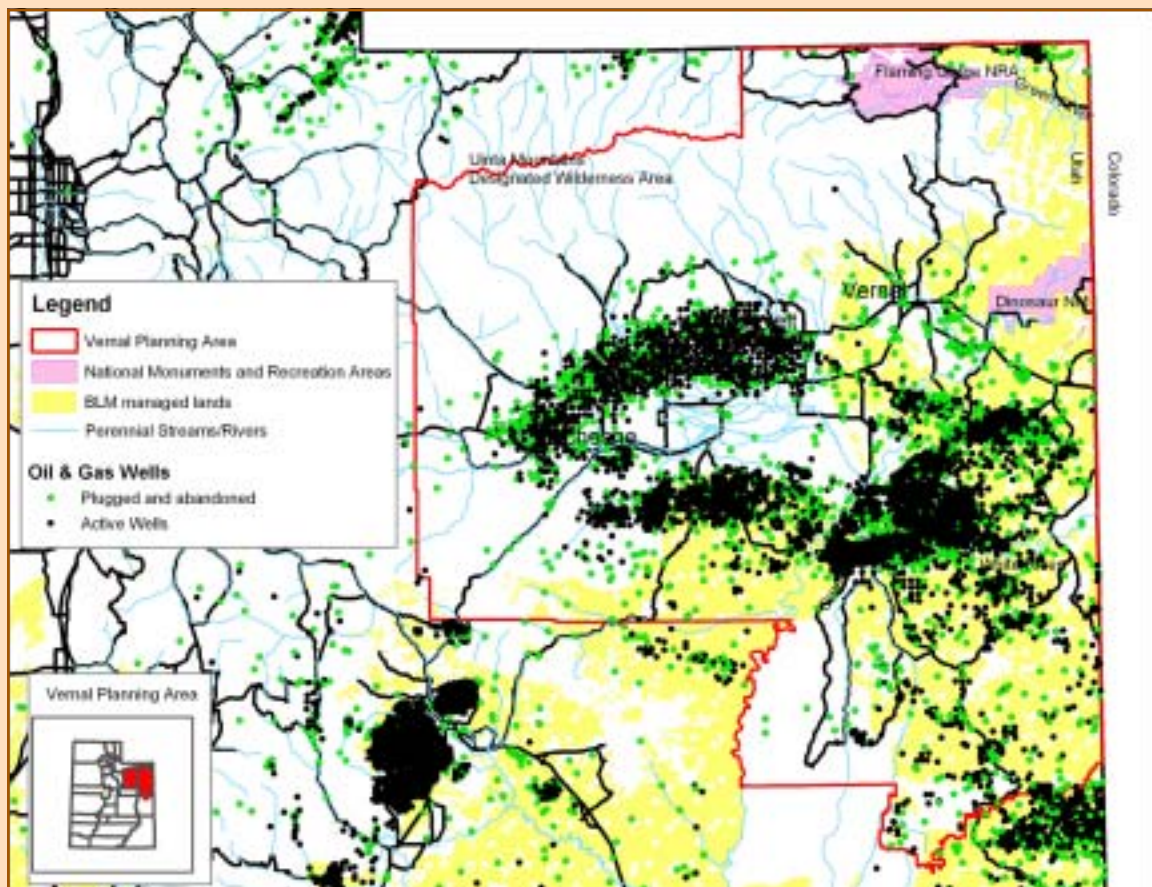


Figure 5.4. Active, and abandoned, oil and gas wells in BLM Vernal Planning Area. BLM managed lands are shown in yellow.

## Chapter 5 Implementation of the Heart of the West Wildlands Network

detrimental effect that well pads, roads, and pipelines have on the survival of wildlife (e.g. Bradshaw et al. 1997, Gese et al. 1989). Land use plans manage oil and gas activities by zones, with each zone describing an area with a particular oil and gas management prescription. Divided into four categories, the zones are defined by oil and gas land categorization. These categories are (BLM 1994):

- Category I - This category identifies areas that are open to exploration and development, subject to the terms and conditions that accompany a standard lease.
- Category II – These areas are open for leasing but subject to seasonal or other minor constraints. These stipulations apply where conflicts with “resource values” require specific protection, but the development activity is not of sufficient magnitude to preclude surface occupancy.
- Category III – These areas are open for leasing but subject to No Surface Occupancy. They possess special resource values or land use opportunities, such as camping or picnic areas, scenic areas, recreation sites, significant historical and/or archaeological areas. They may also contain buffer zones along the boundaries of special areas such as wild and scenic river corridors.
- Category IV – These areas are closed to leasing either through discretionary or nondiscretionary decisions. These areas have other land uses or resource values that cannot be adequately protected, even with the most restrictive lease stipulations, if they are drilled. Appropriate protection of these areas can only be ensured by closing the lands to leasing.

The current land use plans for the Vernal Planning Area (the Diamond Mountain and Book Cliffs RMPs) designate different



Gas Pipeline in the Uinta Basin

Jim Catlin

## Chapter 5 Implementation of the Heart of the West Wildlands Network

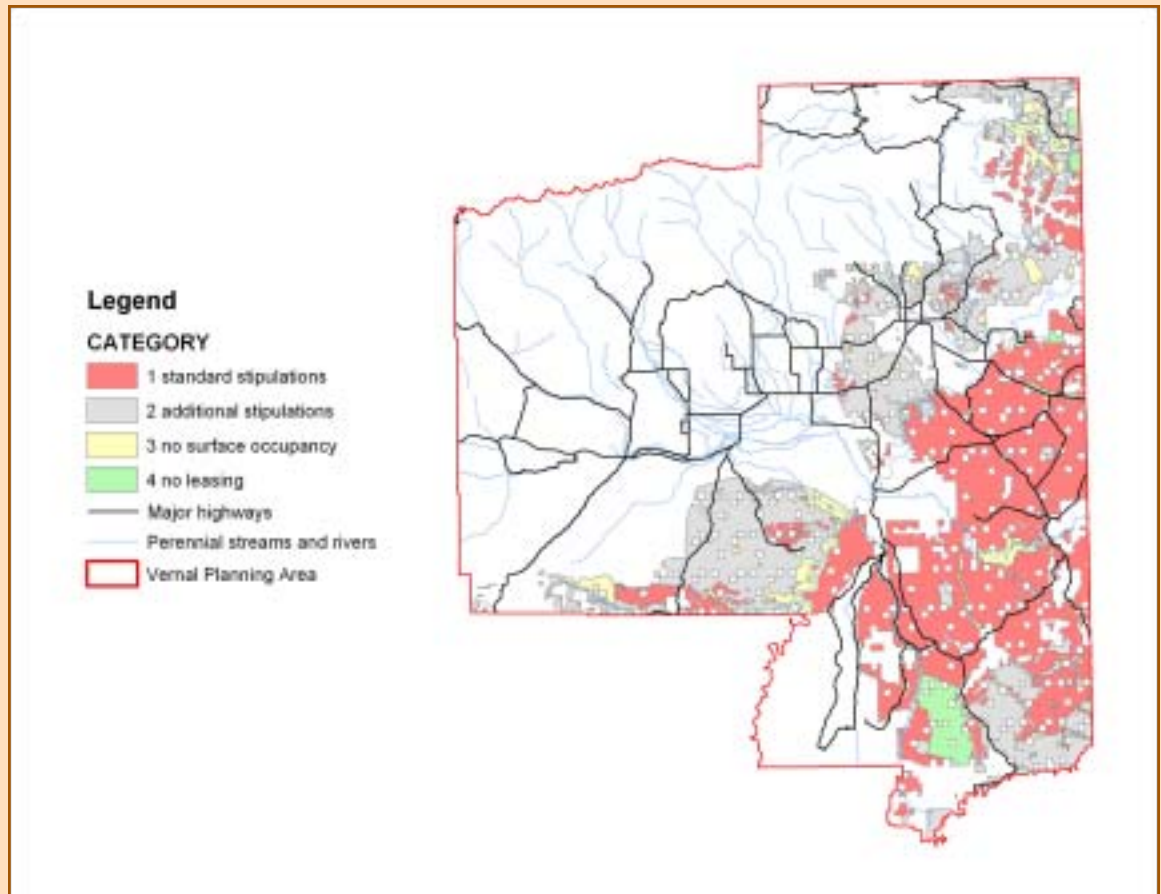


Figure 5.5. Current oil and gas zoning categories in the Vernal Planning Area, as designated in the Diamond Mountain and Book Cliffs RMPs.

parts of the Planning Area into one of these four categories (Figure 5.5). Category I areas are subject to standard stipulations that focus on administrative practices, best development practices common to all drilling and production, and reclamation once production ends. Category II has a number of stipulations that are often specific to certain wildlife species and critical habitat locations. For example, drilling activity is not allowed within a specified distance of sage grouse leks during part of the year. Category I and II stipulations generally do not prevent habitat fragmentation and lead to habitat degradation over time.

The next step in implementing the Heart of the West Conservation plan requires comparing the wildlands network with its prescriptions to the existing management. Most of the core areas include important wildlife habitat. Figure 5.6 depicts a close-up view of a section of the wildlands network along the White River in the Uinta Basin, showing core areas and linkages, as well as oil and gas wells and associated roads. Some of the core areas have existing producing gas wells,<sup>2</sup> and many contain roads or ways. The conservation plan recognizes and respects these current uses as long as they were created legally. The conservation plan identifies these important cores, linkages and core

<sup>2</sup>For the lowlands study area, the Heart of the West Wildlands Network identifies both short-term and long-term core recovery areas based on the number of oil and gas wells in those places.

## Chapter 5 Implementation of the Heart of the West Wildlands Network

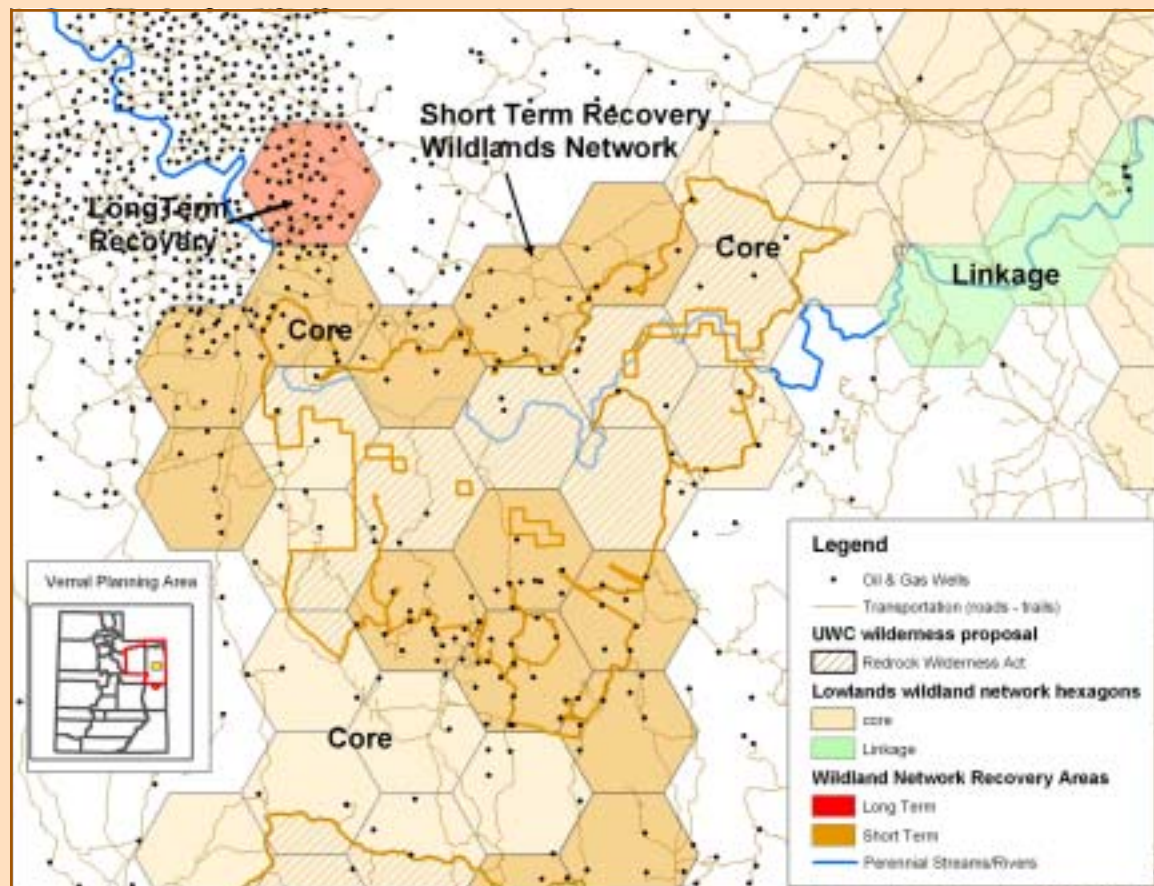


Figure 5.6. A section of the wildlands network along the White River in the Vernal Planning Area, depicting the relationship between rivers and proposed wilderness; roads, trails, and oil and gas wells; and Heart of the West core areas, linkages, and recovery areas.

recovery areas in order to guide future developments and, in some cases, prioritize restoration activities.

The conservation plan makes recommendations for how oil and gas activities should be conducted in core areas and linkages. Note that new wells and continued production are supported in the plan with certain stipulations. In core and linkage wildlands network units, existing producing wells may continue operation. However, directional drilling should be used to create new wells from either existing well pads or from locations outside core areas and linkages. Based on these prescriptions in the conservation plan, the working group for the Vernal Responsible Use Alternative recommended that

candidate wilderness areas (all of which are captured in Heart of the West core areas) be classified as Category IV (no leasing). We recommend Category III management for linkages, which in this case will ensure that new roads and wells are not put into sensitive riparian areas. The final Responsible Use Alternative included a map of our proposed oil and gas zoning (Figure 5.7).

Hexagons lying within core recovery areas have a slightly different prescription. Practical measures will need to be taken to reduce the density of wells and roads to a level consistent with the habitat needs for the focal species found in the area. For recovery areas, new wells must be drilled from outside the core/linkage area. Some existing wells,

## Chapter 5 Implementation of the Heart of the West Wildlands Network

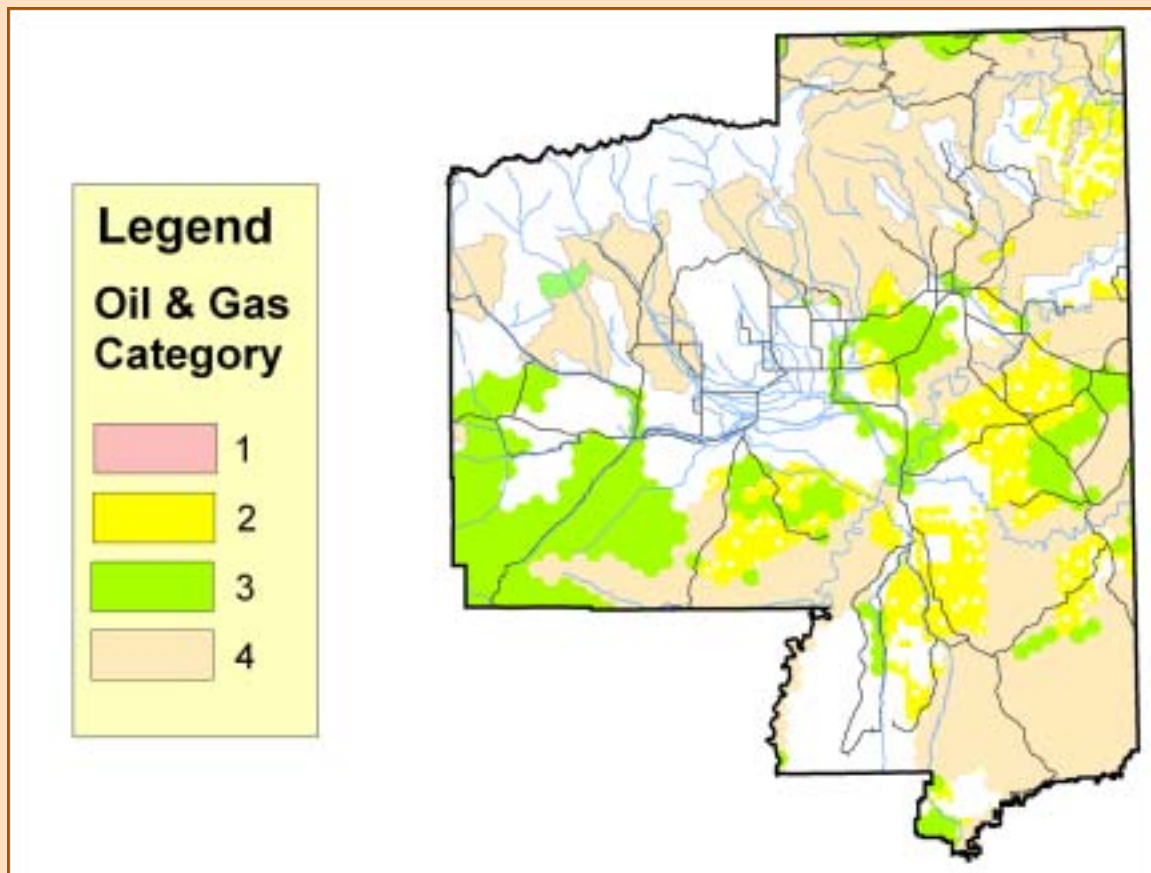


Figure 5.7. Recommended oil and gas stipulation categories featured in the final Responsible Use Alternative for the BLM's RMP for the Vernal Field Office in Utah.

roads, and pipelines will need to be removed in order to meet wildlife habitat requirements. The detailed map for the White River area demonstrates the relationship of these recovery hexagons to other core and linkage hexagons (Figure 5.6).

Next, the working group for the Vernal Responsible Use Alternative created a new map (Figure 5.8) that shows those areas where past oil and gas classifications are compatible with the conservation plan (in green) and other classified areas where change is needed (in red). The next step on the implementation flow chart directs us to use this remedy to help the BLM develop the revised Vernal RMP.

In this example we showed how the Heart of the West Conservation Plan could be used to affect oil and gas development and management in the Vernal planning area in northeast Utah. This example demonstrates the need to integrate the scientific results in the wildlands network into the regulatory and decision-making process that land managers follow (in this case – for oil and gas development). Similar efforts are needed for other land uses, including management of transportation, off-road vehicles, livestock grazing, wildlife, and other mineral extraction.

Another good example of Heart of the West Wildlands Network implementation is Biodiversity Conservation Alliance's conservation biology-based Citizens' Alternative

## Chapter 5 Implementation of the Heart of the West Wildlands Network

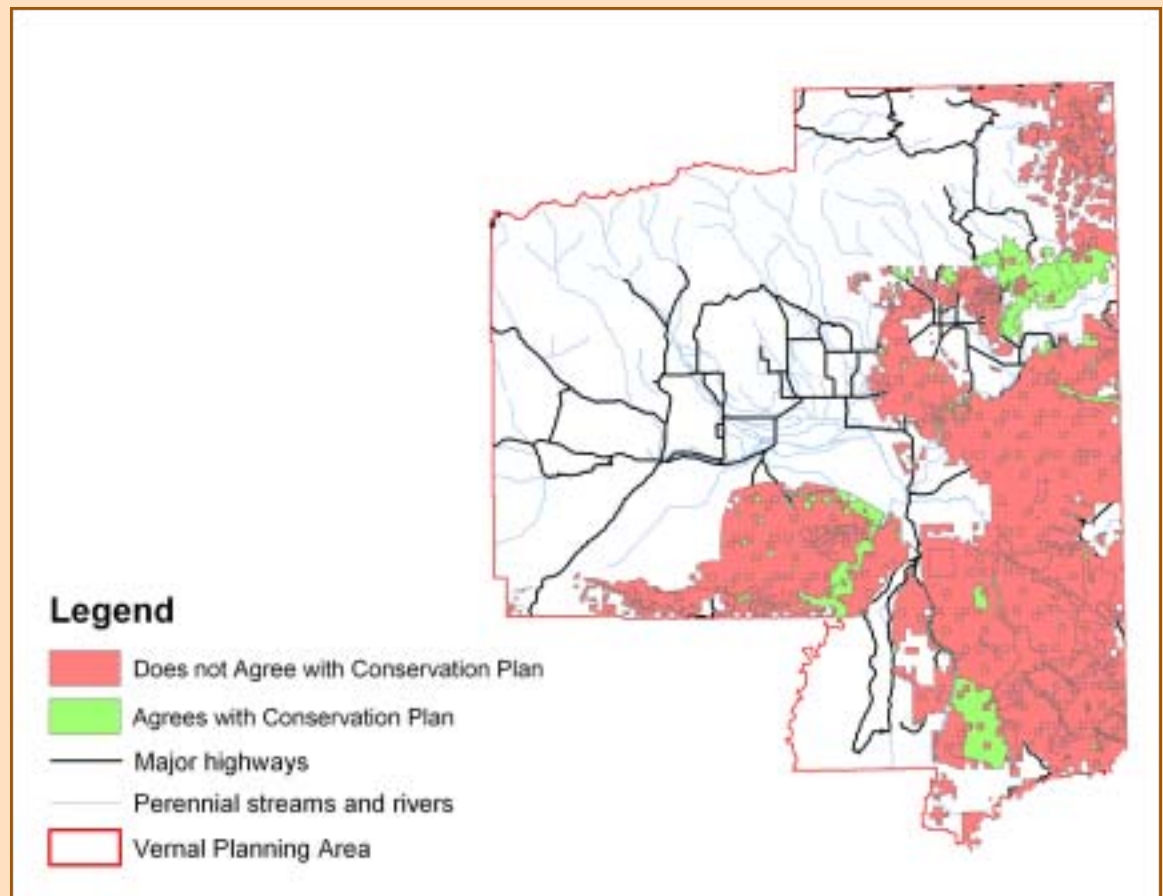


Figure 5.8. Oil and gas activity areas that is compatible with Heart of the West ecological goals (in green) and those areas where management change is needed (in red).

for the BLM's Great Divide Basin RMP revision in southern Wyoming (<http://www.voiceforthewild.org/greatdivide/index.html>).

### 5.6 A Note on Implementation Strategies

In the Heart of the West, other organizations, agencies, landowners, and scientists have ongoing programs that complement and help implement the wildlands network. These programs are not necessarily associated with the Heart of the West Wildlands Network and many predate it. Those who developed the Heart of the West Conservation Plan recognize these independent efforts as important in achieving our common ecological goals.

Implementation of the Heart of the West Wildlands Network does not require a single campaign. There will be a diversity of approaches that vary by local organization and focus. However, the more coordination that can occur, the more likely we will see success.

Building political support plays a significant role in promoting a conservation remedy. Facts alone, no matter how scientifically

## Chapter 5

### Implementation of the Heart of the West Wildlands Network

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sound, carry little weight in the decision-making process when they stand alone. Detailed science-based comments are rarely important unless accompanied by broad local support. This political support can come in a number of forms. It can take the form of a positive letter from an elected official, a good story in the press, large numbers of letters from the public, or the support from respected community organizations. This may come as a surprise to some. Land managers often describe their decision process as one of professional judgment based on the best science. However, in practice, it often only takes a single phone call from a protesting elected official to stop a conservation remedy. Land managers rarely change practices without positive political support and often give in to the lightest of political opposition.

Those advocating the conservation plan will need to understand the structure of political power that influences land managers. Marshaling these political influences in the name of conservation requires developing direct and indirect connections with key people. It can take a long time to gain these peoples' trust, respect, understanding of our concerns, and support for our recommendations. To persuade the land manager to implement sage grouse prescriptions, for example, in grazing management, it makes good sense to identify the right messenger to help approach local government, develop an ongoing relationship with the local media, and develop positive relationships with people in the grazing community.

We normally call for help from those who advocate for wildlife, and those who hunt, fish and manage wildlife. However, in many cases, people in the conservation movement may not be the best messengers

to people outside the conservation community. For example, to speak to the grazing community we may want to ask help from those who ranch. Ideally, this would be a rancher who understands the relationship between range productivity and wildlife and can advocate for the recovery of sagebrush habitat. Similarly, there may be people in the mineral industry who want to help out with part of an implementation process. Introducing the press to a willing rancher and supportive mineral companies can lead to positive articles in local papers that influence elected officials and land managers.

In general, the normal reaction of a land manager to controversy is to continue doing what they did in the past. In order to do something new, and this conservation plan calls for exactly this, the conservation plan reviewer needs to lay the groundwork to either gain support for the conservation remedy or, where that isn't possible, act to reduce opposition. The collective influence of the press, supportive land users, the general public, and elected officials shapes the land manager's actions. In addition, there are a number of opportunities to shape land manager's budgets to promote implementation of the conservation plan. Land managers are more like to welcome conservation measures that come with funding. In some cases legal action may be a major part of a larger campaign to implement the conservation plan. Such legal action may be required to restore or protect wildlife habitat. The eventual success of such legal action benefits from implementation of the conservation plan using the methods just described.

## Chapter 5 Implementation of the Heart of the West Wildlands Network

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### 5.7 Conclusions

This chapter presented a strategy to implement the Heart of the West Conservation Plan. While much is yet to be learned about the complexities of ecosystem composition, structure, and processes, both science and management experience have given us some proven tools for responsible ecosystem management with predictable outcomes. This chapter emphasized the importance of various social, political, and legal tools for making land management decisions in deference to ecosystem health. Part of our job in implementing this plan must include understanding and working with communities, land users, and land management agencies. It is not enough to seek the support of the environmental community. For example, we need to join with and help city councils as they work for the health of their community's water supply. We need to work with land managers and help them apply the science of conservation biology to shaping good land use decisions.

This conservation plan emphasizes several key concepts. Land management should follow the precautionary principle rather than traditional risk analysis. Population trends of many focal species are an indicator of ecosystem health and must be carefully studied and monitored. We need to move past traditional monitoring practices in order to properly assess ecosystem health.

This chapter did not comprehensively cover all that is needed to implement the Heart of the West conservation plan. Above all, the core areas need to be carefully scrutinized individually, or in small groups, and specific remedies and recommendations should be made for these

areas based on our implementation model. A number of land use plan revisions are now underway in the Heart of the West, presenting good opportunities for doing this. Implementation of the conservation plan is, and will continue to be, a very complex but rewarding challenge.

We hope this document will prove to be a useful tool for all who share the Heart of the West vision. We hope that it will inform, inspire, and support individual conservation work. While the task of preserving biodiversity can seem overwhelming, it can be accomplished one step at a time, as success stories from other wildlands network projects have shown.<sup>3</sup> In regions across North America, and beyond, conservationists are assembling similar wildlands networks, each one another piece in a larger ecological mosaic. Our combined efforts enhance our collective power.

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<sup>3</sup>Be sure to check out other Wildlands Project conservation plans that describe some of these implementation success stories (i.e. Foreman et al. 2003, Miller et al. 2003).



# Heart of the West Conservation Plan

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Upper Wind Rivers

Erik Molvar

## Chapter 6 - Discussion and Conclusions

Change is underway in the Heart of the West at an unprecedented pace and scale. For example, this region—which includes most of Wyoming, northeastern Utah, northwestern Colorado, and part of Idaho—faces the most significant fossil fuel development of any region in the United States. These same lands also possess significant remnants of our natural heritage and are the very essence of the American West. Great sagebrush basins, wild rivers, and remote mountain forests are home to one of the most remarkable assemblages of wildlife in North America. Elk and antelope still make several-hundred-mile seasonal migrations. America's largest hawk, the ferruginous hawk, still nests in a sea of sagebrush. Native trout spawn in some of our last remaining world-class streams and rivers. The romance of wild places and wild animals—this is the West as it once was and,

to a significant extent, still is. It needs our vigilant protection against the efforts of those who, wittingly or not, would degrade it in the pursuit of economic or other short-term goals.

The Heart of the West Conservation Plan attempts something not yet undertaken by most land management efforts: production of a land use plan based on the ecological needs of the land. This conservation plan describes a wildlands network of core areas and linkages that offers a proactive framework for planning and managing land uses.

The three tracks of conservation planning pursued in this study are designed to assess the biological needs of the region in order to provide conservation priorities within it. The results will provide a basis for a variety of land protection strategies

## Chapter 5 - Discussion and Conclusions

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and improved land management, including congressional and administrative designations of new wilderness and wild and scenic rivers, designation of special conservation management areas, management direction for mineral extraction, best management practices for wildlife, recreational vehicle management and range management, stewardship assistance to landowners, and conservation easements. Land users, land trusts, conservation organizations, local communities, state and federal agencies, industry, and community groups all stand to benefit greatly from using this plan.

Because this conservation plan is based on rigorous scientific principles, data and methods, we are confident that the result-

ing wildlands network represents the minimum amount of land requiring protection to ensure the viability of focal species and the maintenance of ecological processes across the Heart of the West. By identifying those areas where human development can be compatible with ecological goals (compatible use areas) and those that should be more conservation oriented (cores and linkages), this plan can help minimize the socio-economic and ideological biases inherent in large scale conservation planning. We also intend for this plan to clarify the various consequences and trade-offs involved in regional land use decisions. When trade-offs involved in such choices are explicit and transparent, conflicts between competing values can be minimized.

### 6.1 The Benefits of a Wildlands Network to Local Communities

Wildlands networks are just as important to local and rural communities as they are to the ecosystems they contain. The wild heritage of the West is particularly important to those who live in rural communities. They, perhaps more than anyone else, value the wild country they were raised in. And they want their grandchildren to be able to enjoy it too. Economic, cultural, and social dimensions of communities are strongly linked to local ecosystems—thus, future evolution of the local community (i.e. planning for growth) should benefit considerably from a comprehensive ecological analysis such as the one provided in the Heart of the West Conservation Plan. A wildlands network proposal that is closely suited to the local history of communities provides a way for people to continue to make a living from the land, which is their lifeblood, while maintaining biodiversity and healthy ecosystems. In fact, local people may realize certain

economic incentives to support implementation of a wildlands network in their community. For example: income from hunting permits on their land, lower taxes through conservation easements, job opportunities with ecological restoration efforts, new state and federal parks and preserves, and multifarious income streams derived from tourism and recreation. All of this is over and above the numerous “ecological services” that healthy ecosystems provide—such as effective water storage, filtration and purification, soil maintenance and fresh air—amenities that we seldom acknowledge because we have not had to pay for them so far.

A necessary first step to realizing the benefits and opportunities of wildlands conservation networks is for every individual, family, and community to rethink its relationship to the land and the ap-

## Chapter 5 - Discussion and Conclusions

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proaches taken to land use and land management. In many instances, the historical approach has been exclusively one of opportunistic resource extraction in the way of hunting, logging of old growth trees, mining of valuable minerals, and (often) removal of these resources to outside the region, with little thought to how it is done or what the long term effects will be. Even farming and ranching have often caused erosion and topsoil loss or permanent loss of desirable vegetative cover through overgrazing or inappropriate methods of plowing. Enlightened change is desirable—change that will allow for traditional practices, but only in so far as they are compatible with the health of the whole system, which in turn is essential to a continuation of suitable traditional practices.

This new approach is fostered by viewing our entire landscape and natural world as a living organism, of which we are a part. This systemic whole is not something to be thoughtlessly dismembered and consumed, but something to be nourished, cultivated and carefully exploited with an eye to the future and the health of the

whole. This means that both private and public land management will need to shift orientation toward restoration and sustainable, holistic landscape health. The ongoing social and economic health of individuals and communities depends upon it.

Quality of life issues are of concern to every segment of society, particularly in rural areas where economic pressures and impending residential development may lead to major lifestyle changes. Thousands of families in the Heart of the West are affected by uncertainty due to “boom and bust” economic cycles, subdivision encroachment on open space, air and water pollution, and fears that the natural world bequeathed to future generations will soon be largely degraded. Wildlands conservation is an effective, ethical response to many of the conditions that threaten to reduce the quality of life we enjoy in the Heart of the West. For many years, protecting native ecosystems has been a recognized tool for improving the well being of sensitive species, but it is a proven method for ensuring the quality of life of current and future generations of humans as well.

### 6.2 The Future of the Heart of the West

This visionary plan for long term conservation in the middle Rockies we call the Heart of the West represents a starting point. Whether it is implemented is up to industry, conservation groups, land managers, land trusts, local communities, and private land holders who live and work in the Heart of the West.

Not only will certain key areas and habitats need to remain ecologically functional, but degraded habitats currently within cores and linkages will need to be restored. Habitat restoration can take many forms,

including removal (or better management) of exotic species along streams and in sensitive or degraded habitats, changes in livestock grazing practices to ensure habitat recovery, return of riparian trees and shrubs to degraded stream segments, restoration of natural fire regimes to forested regions, erosion-control projects, return of natural patterns of forest patches, and so on.

Yet another form of restoration is re-introduction (or facilitation of natural recovery) of extirpated focal species to

## Chapter 5 - Discussion and Conclusions

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parts of the Heart of the West from which they have been extirpated. The chief candidates for restoration are the bison, sage grouse, native trout, wolverine, lynx, gray wolf, and grizzly bear. The recovery of some of these species—bison for example—will require an incremental approach, with local communities, conserva-

tion groups, and management agencies working together over the course of decades to restore the species to suitable parts of its historic range. Other species, such as the sage grouse, which are still present but in diminished populations, can achieve recovery to unoccupied parts of their natural ranges in shorter time frames, assuming that existing and impending threats are mitigated. A full recovery plan for any one of these species will require extensive planning beyond what is described in this conservation plan. Restoring extirpated species will require separate modeling efforts, planning documents, maps of proposed reintroduction (or recovery) zones, and coordination with state and federal land management agencies and wildlife management agencies.

It will be a challenge to conserve carnivores in the Heart of the West, let alone restore populations and seek to expand current ranges. Many of the carnivore populations in the Greater Yellowstone Ecoregion of the Heart of the West are now on the periphery of their ranges due to climate change or anthropogenic factors or both. The capacity of protected areas to serve as refuges for these species as they recolonize vacant historical habitat will depend upon a combination of factors: area size, degree of isolation, degree of connectivity, habitat quality and reprieve from human persecution. The evidence indicates that some focal species, such as wolves and grizzly bears, are now in a phase of population expansion beyond the limiting confines of the Greater Yellowstone Ecoregion. Unfortunately, as these carnivore populations rebound from historical eradication efforts, they may find their most desirable habitat options—primarily in the southern part of the Utah-Wyoming Mountain Ecoregion—generally foreclosed by the rapid rate of landscape



Lynx

Howie Garber

## Chapter 5 - Discussion and Conclusions

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alteration. Reducing habitat fragmentation caused by roads and other human activities may be necessary to provide them security. Linkages may need special modifications. For example, wildlife underpasses and other highway modifications in strategic places will be helpful in allowing carnivores safe travel between core areas (Noss and Cooperrider 1994).

Noss et al. (2002), through both static and dynamic habitat models for grizzly bear, wolf, lynx and wolverine, depict different scenarios for future viability and range of these carnivores based on both an “optimistic future” outlook and a predicted outlook that assumes a continuation of current trends (Appendix A). Building a comprehensive conservation strategy for the greater Heart of the West region that combines core areas for the entire carnivore guild will be challenging. In general, areas of high value for

multiple species of carnivore must combine both biological productivity and security from human impacts (Carrol et al. 2001). Unfortunately, such areas in the Heart of the West tend to be threatened by development (Hansen and Rotella 1999). However, we are confident that they are captured in either the core areas identified in our lowland SITES model, or in the adjacent portfolio sites identified in TNC’s Utah-Wyoming Rocky Mountains Ecoregional Plan (Noss et al. 2002, Appendix A).

Regional habitat prioritization for conservation management, as outlined in this conservation plan, along with specific prescriptions for core areas, linkages and compatible use areas, can serve as a valuable guide for detailed planning of land uses that will ensure the long-term survival of native species, as well as focal species in the Heart of the West.



White River

Steve Mulligan

## Chapter 5 - Discussion and Conclusions

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### 6.3 Data Gaps, and Research/Inventory/Monitoring Needs

Throughout this project, our science team documented data gaps, monitoring and inventory needs, and future research necessary to verify and build on the Conservation Plan for the Heart of the West:

*Conservation goals and viability analysis:*

The various assumptions made regarding focal species viability in this document need further validation from empirical research. Such research would involve studies of focal species population demographics, habitat function, and the spatial assemblage of functioning habitat on a landscape scale. Research results would then allow us to determine whether the proposed wildlands network will adequately ensure long term viability of those species.

*Inventory needs:* Inventory efforts should be directed toward targets that did not meet conservation goals, particularly those not represented or documented in our wildlands network. Additionally, inventory efforts should be a priority in those cores and linkages with low levels of field verification for target elements, but with high levels of threats and/or other human activities.

*More detailed threats analysis:* The threats analysis completed for our lowland Heart of the West study area GIS model was necessarily limited to existing GIS data. We must acquire additional digital data regarding fires and fire recovery, grazing practices, the ecological impact of exotic species, and motorized vehicle use. This data should be analyzed at the level of individual core areas.

*Monitoring focal species and habitat:* Monitoring needed to implement the conservation plan requires a shift in methods to capture those indicators that assess focal

species habitat function for both core areas and linkages. For linkages, such monitoring would ascertain whether ungulates and carnivores, for example, are adequately supported by core areas and are using the linkages as travel routes for dispersal and migration. Similarly, core areas should be monitored regularly for abundance of focal indicator species, and habitat function for those species should be comprehensively assessed. In the future, conservation measures and prescriptions for these focal species and habitats within cores and linkages should be based on this monitoring.

*Consideration of regional climate change:*

Regional climate change could accelerate a number of the threats to conservation targets within the wildlands network by causing, for example, the spread of invasive species and an increased risk of unnatural wildfires. However, it was beyond the scope of this conservation plan to address the specific impacts of regional climate change to the Heart of the West. Further work is needed to guide conservation efforts under different climate change scenarios. For example, it would be useful to predict the future level of risk that certain species and their ecological systems face under different future climatic scenarios.

## Chapter 5 - Discussion and Conclusions

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### 6.4 Conclusions and Recommendations

Our study indicates that continued and improved biological and ecological health of the Heart of the West demands a conservation plan that integrates criteria based on conservation biology into current management plans. Because of competing goals, current management does not ensure the necessary habitat for all focal species at a landscape level. Most areas where habitat protection is emphasized (i.e. National Parks and wilderness) were protected mainly for their scenery or lack of development potential, and so poorly represent the range of habitats that exist in the region. From an ecological standpoint they are important but inadequate. The primary product of our conservation assessment is a prescribed set of core areas and linkages, based on the best available data, representing an optimal strategy for achieving ecological targets throughout the Heart of the West. The resulting wildlands network for the lowlands study area, combined with the existing ecoregional plan for the Utah-Wyoming Mountains, consists of 71 core areas/portfolio sites and connecting linkages, together comprising 15,462,702 hectares, or 53.5% of the ecoregion. More than 75% of the land area within the wildlands network is federal or state-managed land and nearly 25% is in private ownership. Therefore, a diverse combination of players will need to undertake a diverse combination of actions for this conservation plan to succeed—from on-the-ground protection of specific cores to multiple core/compatible use area strategies designed to abate threats to targets across the region.

In closing, we make the following recommendations in accordance with the scientific results of this conservation assessment and the implementation recommendations of the previous chapter:

1. Ensure that the conservation plan is part of any land use decision in the Heart of the West.
2. Prioritize data gaps, inventory and research needs, and develop a plan to address these issues.
3. Identify specific threats to the wildlands network and management changes required to insure proper functioning habitat within cores and linkages. Work with partners within agencies and other conservation groups to develop strategies to address pervasive threats (both specific strategies for individual cores and multi-area strategies to improve habitat management across the study area).
4. Develop monitoring methods for core areas and linkages that assess the proper function of habitat for focal indicator species. Make future management actions contingent upon adequate biologically-based monitoring.
5. View the conservation wildlands network design as an iterative process, allowing for continued evolution based on improved knowledge, better data, and new analysis. Update and revise this wildlands network and conservation plan periodically.
6. Work with our partners to educate the public about the opportunity the Heart of the West Conservation Plan offers for slowing and reversing the current decline in landscape quality in many parts of the Heart of the West.

Even the best plan comes to naught if it is not implemented. The world is on the verge of a global extinction crisis. If we fail

## Chapter 5 - Discussion and Conclusions

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to mitigate this crisis in our own part of the world the result will be the loss of our wild heritage and a drastic deterioration in the productivity of our land. This in turn will mean an impoverished future for the current generation and for our descendants. We must tackle this problem on the local level. For this reason, it is imperative that the Wildlands Network Design for the Heart of the West be integrated into land use policies, plans and actions for our region of the middle Rockies. It is our best hope for responsible land stewardship in the Heart of the West. We urge First American nations, conservation groups, local communities, mineral extraction companies, and government land management agencies to unite in working toward its implementation.





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