Wildlife: Range and Condition

The Historic and Current State of Wildlife in the Rockies

By Julia Head

The 2009 Colorado College State of the Rockies Report Card

Key Findings

74 36 40 150 50 83

- In the last 150 years, elk have lost 74 percent of their range and cougar have lost 36 percent of their range.

- Coyote range has increased 40 percent over the last 150 years.

- Animal-vehicle collisions increased 50 percent between 1990 and 2004.

- A 5.4 °F increase in average July air temperatures could eliminate 50 percent of currently viable trout stream habitat in the Rockies.

- Habitat loss and fragmentation have led to population decreases in approximately 83% of U.S. species.

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Introduction

The Rockies region has a rich and complex natural heritage. From the alpine tundra of Colorado's high peaks to the Sonoran Desert of southern Arizona, the eight-state region supports a diverse range of ecosystems and species. However, for many of these species and their habitats the past has been turbulent and the future remains uncertain. As more people move to the Rockies, how can the region manage both rapid growth and fragile natural systems to maintain healthy wildlife, one of its defining characteristics?

Wildlife plays a crucial role in natural ecosystems, which in turn provide free environmental services such as waste detoxification, pest control, climate stabilization, pollination, and flood protection that would be extremely expensive or impossible to replace if the ecosystems were irreversibly damaged.[1] Wildlife associated with recreation also brings significant economic benefits to communities throughout the Rockies region. Small rural communities in particular benefit from the revenue generated from tourism, hunting and fishing, and other forms of outdoor recreation. In the Rocky Mountain West, 13 percent of the population fish, 6 percent hunt, and 31 percent participate in some form of wildlife watching.[2] Hunting generates 3.2 percent of the income in the Rocky Mountain region as opposed to the national average of 1.8 percent.[3] The numerous individuals and groups that participate in wildlife-related activities in the Rockies region have a large stake in maintaining the open space and functioning ecosystems that directly or indirectly make these activities possible and enjoyable.

The richness of wildlife, beauty of the landscape, and abundance of natural reserves attract visitors, new residents, developers, and industry to the Rockies region at an ever increasing rate. Rapid growth in the Rockies has had and will continue to have significant impacts on its intricate and dynamic ecosystems. Grazing allotments, migration routes, and winter grazing areas once included in the historical ranges of wildlife have been narrowed and broken into disconnected islands of open land. Studies have indicated that in areas of higher human influence, species ranges are more likely to contract and less likely to persist.[4] Within the last 150 years, species iconic to the west, such as elk, bison, pronghorn, grizzly bear, grey wolf, and lynx have lost significant portions of their historical ranges (See Figure 1).[5]

As discussed later in this report, the elk population of northwestern Wyoming provides an informative case study on the habitat fragmentation and the human intervention that has, in places, become necessary for elk survival. Arguments about what an endangered species is and what it should be are major topics in courtrooms today. Predator reintroduction polarizes the public and spurs intensive lobbying and debate over legislation. At the heart of these issues remains the question of how humans and wildlife can most optimally live together on a limited amount of land.

Human activities have reduced wildlife habitat, increased human–wildlife contact and conflict, and decreased populations of both predators and prey. An ongoing example of human–wildlife conflict involves bison carrying brucellosis, a disease introduced to native ungulate populations by cattle in the early 1900's.[6] In the 2007–2008 season alone, fear that the brucellosis would be transferred from bison to cattle led to the slaughter of 1,544 bison moving from Yellowstone National Park into Montana seeking winter grazing.[7] Other conflicts include the introduction of non-native species and the habituation of wild animals to humans.

This Rockies topic report examines the past and present ranges and condition of wildlife in the Rockies region. A comprehensive view of this subject is important for understanding how to protect species, as well as their habitats and migration routes. (See Tables 1A and 1B). By pooling and assessing data over the entire Rockies region and understanding the important issues surrounding wildlife on a scientific basis, we can form a solid platform upon which to make informed decisions about wildlife preservation, wildlife management, and human interests relating to wildlife.

Table 1A: Rockies Focus Species

	Primary Focus Species	Threatened or Endangered	Desireable for Hunting/Fishing
Mammals	Gray wolf (Canis lupus)	Endangered	Yes
	Grizzly bear (Ursus arctos)	Threatened	
	Canadian lynx (Lynx Canadensis)	Threatened	
	North American cougar (Puma concolor cougar)		Yes
	Black footed Ferret (Mustela nigripes)	Endangered	
	Elk (Cervus canadensis)		Yes
	Mule deer (Odocoileus hemionus)		Yes
	Bison (Bison bison)		Yes
	Pronghorn (Antilocapra americana)		Yes
Reptiles/Amphibians	Sagebrush Lizard (Sceloporus graciosus)		
	Tree Lizard (Uta ornata)		
	Red Spotted Toad (Bufo punctatus)		
Birds	Peregrine falcon (Falco peregrinus)		
	Sage grouse (Centrocercus urophasianus)		
Fish	Cutthroat trout (Oncorhynchus clarki)	Threatened	
	*Table 1b lists secondary focus species		

Table 1B: Rockies Focus Species

	Secondary Focus Species	Threatened or Endangered	Desireable for Hunting/Fishing
Mammals	Wolverine (Gulo gulo)		
	Beaver (Castor canadensis)		Yes
	River otter (Lontra canadensis)		
	Snowshoe hare (Lepus americanus)		Yes
	Marmot (Marmota flaviventris)		
	Big brown bat (Eptesicus fuscus)		
	American Pika (Ochotona princes)		
	Black tailed prarie dog (Cynomys ludovicianus)		
	Bighorn sheep (Ovis canadensis)		Yes
Amphibians	Woodhouse's toad (Bufo woodhousii)		
	Boreal toad (Bufo boreas)		
	Wood frog (Rana sylvatica)		
	Northern leopard frog (Rana pipiens)		
	Long-toed salamander (Ambystoma macrodactylum)		
	Tiger salamander (Ambystoma tigrinum)		
	Canyon Tree frog (Hyla arenicola)		
Reptiles	Bull snake (Pituophis cantenifer)		
	Western Rattlesnake (Crotalus viridis)		
	Desert Spiny Lizard (Sceloporus magister)		
	Eastern Fence Lizard (Sceloporus undulatus)		
	Plateau Whiptail (Cnemidophorous neotesselatus)		
	Desert Tortise (Gopherus agassizii)	Threatened	
Birds	Golden eagle (Aquila chrysaetos)		
	Bald eagle (Haliaeetus leucocephalus)		
	Sandhill crane (Grus canadensis)		
	Spotted owl (Strix occidentalis)	Threatened	
	Mountain plover (Charadrius montanus)		
Fish	Colorado pikeminnow (Ptychocheilus lucius)	Endangered	
	Razorback sucker (Xyrauchen texanus)	Endangered	
	Bonytail (Gila elegans)	Endangered	
	Flannelmouth Sucker (Catosomus latipinnis)		
	Desert Sucker (Catostomus clarkii)		
	Speckled Dace (Rhinichthys osculus)		
	Virgin Spinedale (Lepidomeda mollispinus)		

Source: Tables 1A and 1B created by the State of the Rockies Project, 2008

Historical and Current Ranges

In the mid-1800's as many as 30 million bison roamed the plains of North America.[8] The vast grasslands and mountainous areas also supported a suite of other herbivores, including pronghorn, elk, deer, mountain goat, and bighorn sheep. Predator populations of wolves, grizzly bears, cougars, lynx, and coyotes regulated these herbivore populations. Experts estimate that nearly 1.5 million wolves may have lived in North America in the early 1800's.[9] Historical ranges, shown in blue and tan in Figure 1, indicate the extent of several wildlife species in North America.

As early settlers made their way west, North America's wildlife populations plummeted due to market hunting and habitat loss. The ungulates of the region were initially used mainly for food and materials. Later, however, the focus turned to harvesting only the most profitable parts of the animals, such as the hides, and clearing out the competition for grazing cattle. These extreme harvests also contributed to the government's effort to change the Native American's nomadic way of life and force them onto reservation lands.[10] By 1889, there were less than 1,000 bison left in the U.S. Other species fared just as poorly. Between 1850 and 1950, grizzly bears were eliminated from 98 percent of their original range, with extirpation occurring earliest in the Great Plains and later in remote mountainous areas.[11] Wolves were historically distributed throughout the U.S., from the east to the west coast, south of Canada, and north of central Mexico. However, ranchers and farmers perceived wolves as a threat to livestock, and through a concerted eradication effort sponsored by the U.S. government, wolves were confined to northeastern Minnesota and Isle Royale National Park in Lake Superior by 1960.[12]

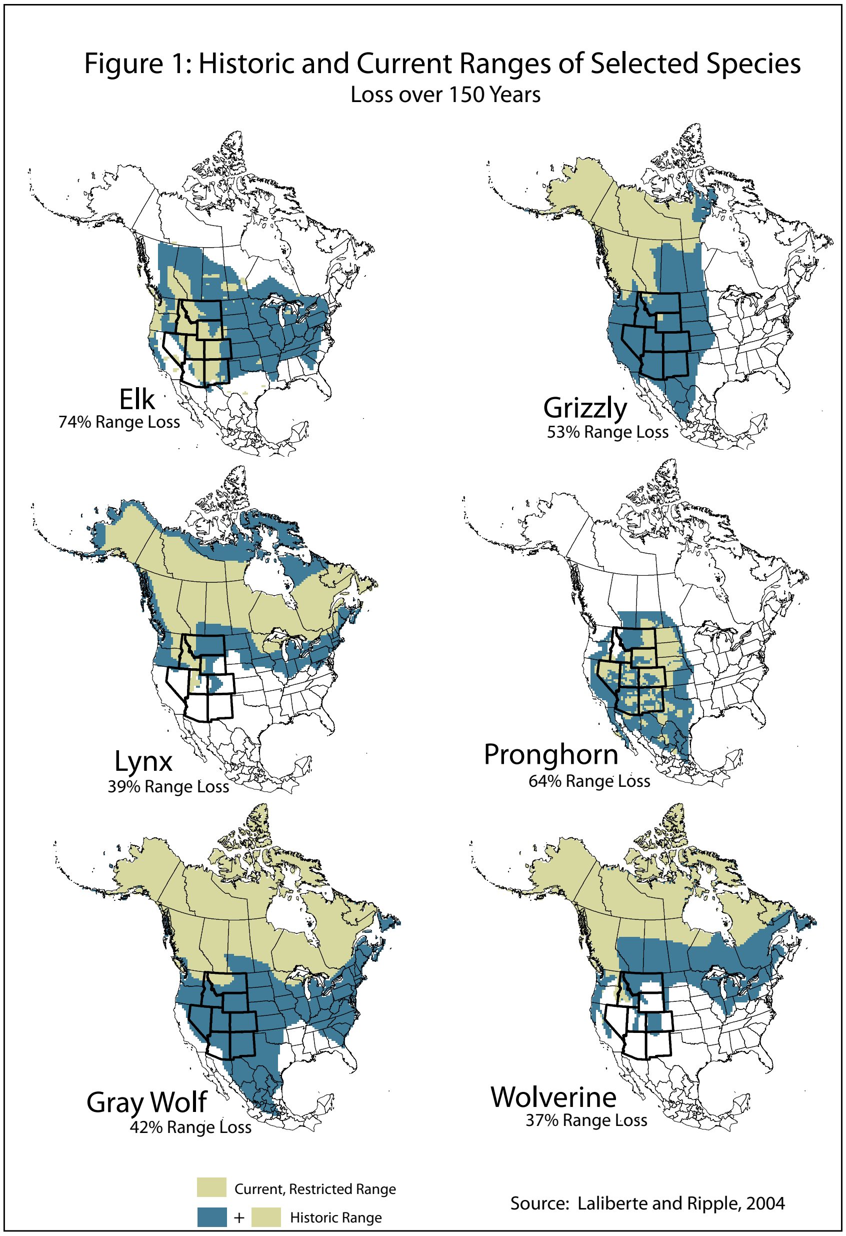
Beginning in the late 1800's, conservation-minded individuals such as Theodore Roosevelt, George Bird Grinnell, and John Muir led efforts to conserve land and manage wildlife.[13] The model that developed out of their efforts has two main principles: our fish and wildlife belong to all North American citizens and should be managed in a way that will sustain their populations indefinitely.[14] Based on this model, wildlife management, especially for game species, was primarily concerned with species restoration and population growth.

Despite these efforts, current ranges of many native species are small fractions of what they once were. Within the last 150 years, elk have lost 74 percent of their range, pronghorn 64 percent, grizzly bear 53 percent, swift fox 60 percent, grey wolf 42 percent, lynx 39 percent, wolverine 37 percent, and cougar 36 percent (See Figure 1: Historic and Current Ranges of Selected Species).[15] Some species that seem quite common no longer occupy the full extent of their historical range. Moose and mule deer have experienced range contractions of 11 percent and 8 percent, respectively.[16] However, the picture is not so bleak for all species, especially generalists that have taken advantage of human changes to the environment. Range increases for some generalists include 10 percent for hooded skunk, 13 percent for red fox, 13 percent for raccoon, and 40 percent for coyote.[17]

In certain areas, restoration and reintroduction of extirpated species has been highly successful. Figure 1 show the current ranges of several species that have been brought back from the brink of extinction. However, in some areas, successful reintroduction and restoration programs have become a double-edged sword. For example, Yellowstone National Park has been very successful at expanding its bison population and fostering the population of reintroduced wolves. In 1995 and 1996 a total of 31 wolves were introduced into Yellowstone National Park. The population has grown to over 400 wolves in the region.[18] Wolves have had positive effects on the ecosystem, such as fostering the regeneration of degraded riparian areas by forcing the elk to regain more natural movement patterns. However, as anticipated at the time of reintroduction, they have also expanded beyond the boundaries of the park, angering humans when they injure or kill livestock and pets.

Bison populations, like wolf populations, have significantly increased within the past 100 years as a direct result of restoration efforts. However, when bison move beyond the boundaries of Yellowstone National Park, where restoration efforts have been particularly successful, bison face stressful herding and possible slaughter because of the risk of their transmitting brucellosis to cattle grazing near the park. For a more complete discussion of the issue of bison and brucellosis, please see the case study. Elk populations in the Rockies, especially in national parks and refuges, has been so successful that some areas now have overpopulation problems. In Rocky Mountain National Park, the current management plan calls for gradual culling (lethal reduction) of the herd using sharpshooters.[19] However, it is important to keep in mind that the overpopulation problems in national parks and refuges do not reflect overall trends in the U.S.

While some areas, such as Yellowstone National Park, have shown success with supporting the natural migration of native wildlife populations, other areas face mounting pressures as human populations grow and encroach on habitat. Fragmentation or the breaking up of habitat is one of the biggest challenges facing wildlife today. In the U.S., fragmentation in the form of development occurs at a rate of about 2 million acres of land per year, or 6,000 acres per day.[20] Higher human densities lead to greater impacts on nature.[21] Habitat loss and fragmentation have led to population decreases in approximately 83 percent of U.S. species that are becoming endangered and over 25 percent of designated at risk-species (553 species) live only in fast-growing U.S.

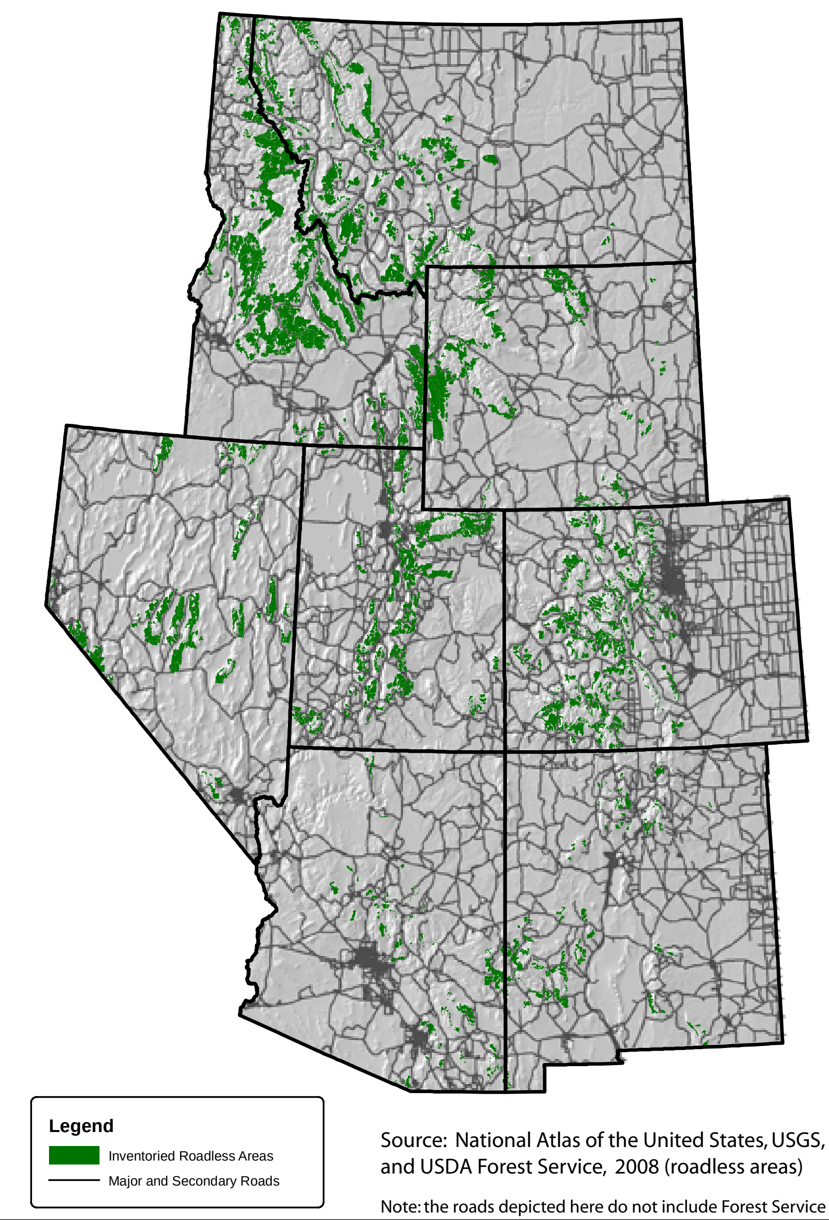


metropolitan areas.[22] While habitat loss is the most evident detrimental effect of fragmentation, other negative effects on ecosystems and species can compound over time,[23] such as impacts associated with roads.

Roads create a significant amount of fragmentation in the U.S. and around the world. When major roads cut through a wildlife range, vehicle collisions with wildlife can be dangerous for animals and humans, as well as damaging to automobiles. An estimate from 1987 indicated that one million vertebrates are killed on U.S. roads every day.[24] More recent research suggests that while the total number of crashes per year in the U.S. has remained relatively stable, animal–vehicle collisions steadily increased by about 50 percent between 1990 and 2004.[25] Furthermore, scientists have estimated that the effects of a road extend over a band approximately 600 meters wide.[26] Studies on National Parks have found that wildlife mortality associated with the boundaries of these protected areas is extremely common among all large carnivore species for which data are available and that mortality is particularly high when conservation areas are surrounded by high densities of people.[27] Even large tracts of protected land do not cover sufficient land to allow for the natural movements of many species, especially large herbivores which require vast areas of forage and large carnivores that need large areas to roam and capture prey (See Figure 2).

Such threats to wildlife habitats and populations have raised concerns about conserving biodiversity, particularly in sensitive areas. Scientific studies have shown that contiguous range is crucial in maintaining healthy levels of diversity, which provides plant and animal populations with more resilience to stresses such as drought, floods, pest infestations, disease outbreaks, and changes in climatic conditions.[28] Thus, in directing conservation efforts, the focus is beginning to shift towards an approach that considers the contiguity or fragmentation of the landscape and the levels of biodiversity present in the area.

Figure 2: Roadless Areas and the Major Road Network of the Rockies



Source: National Atlas of the United States, USGS, 2004 (roads) and USDA Forest Service, 2008 (roadless areas)

Note: the roads depicted here do not include Forest Service or private roads.

When considering the current and future ranges for wildlife in the Rockies region, it is important to note that wildlife does not observe political borders or land ownership boundaries. The West is made up of a patchwork of federal, state, tribal, and local government lands as well as private lands. These lands are currently home to rapid development and ecologically intact landscapes, both of which are essential to economic strength and quality of life in the West. Change is occurring at a pace that is difficult for decision makers to monitor and control.[29]

Migration patterns

As knowledge about wildlife biology increases, an understanding of wildlife migration plays an ever increasing role in implementing conservation and management techniques. Animals migrate when seasonal conditions reduce food availability, limit movement or prove unsuitable for bearing or raising young.[30] The scientific definition of a migration is a seasonal roundtrip movement between discrete areas not used at other times of the year.[31] Migration corridors are essential to these seasonal movements and serve as an important intermediate range that

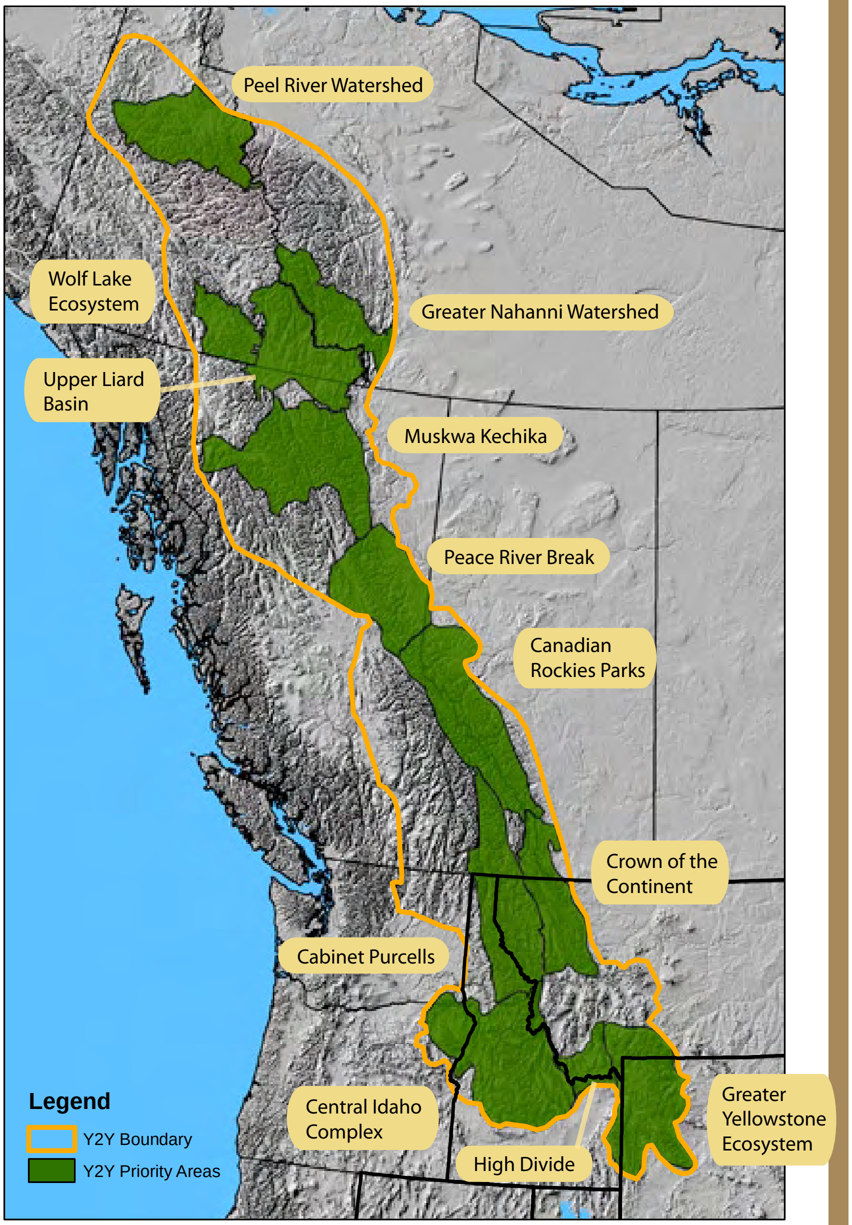
Case Study: Yellowstone to Yukon Conservation Initiative

Yellowstone to Yukon, or Y2Y, is a conservation initiative working to protect the natural heritage of the mountain region from Yellowstone National Park to the Mackenzie Mountains in Canada. Y2Y envisions a connected, functioning ecosystem in which wildlife and humans can coexist and thrive. To reach these goals, Y2Y staff members and researchers collaborate with diverse groups involved in the Rocky Mountain region, including environmental nongovernment organizations (ENGOs), government agencies, First Nations/Native American communities, hunters, anglers, ranchers, researchers, foundations, and businesses.

In the lower 48 states, the Y2Y region is one of the few remaining places where a full suite of carnivores and ungulates can be found. Much of the research associated with Y2Y initiative focuses on the needs of grizzly bears, birds, and fish. In conserving key habitat areas and habitat connectivity for grizzlies, the Y2Y strategy also protects many other animals including wolverine, lynx, and moose. The Y2Y bird conservation strategy focuses on 20 sensitive species chosen from the region's 275 bird species, including golden eagle, long-billed curlew, and ruffed grouse. The aquatic conservation strategy prioritizes watershed health and uses the native cutthroat and bull trout as indicator species. While the overall approach of Y2Y may seem ambitious or even idealistic, ecosystem and connectivity approaches are gaining momentum in the field of wildland and wildlife conservation.[1]

[1] Yellowstone to Yukon Conservation Initiative. "People Working Together to Maintain and Restore the Unique Natural Heritage of the Yellowstone to Yukon region." http://www.y2y.net/home.aspx (Accessed July 24, 2008).

Figure 3: Yellowstone to Yukon Boundary and Priority Areas



Source: Yellowstone to Yukon Conservation Initiative, accessed 2008

provides food for migrating animals.[32]

Historically, migration corridors were dictated by the confines of topography, forage, weather, and other natural influences. Now, migration corridors are narrowed and often completely cut off by housing developments, industry, resource extraction, roads, fences, and other human-made structures or activities. A study contrasting 29 terrestrial mammals from five continents representing 103 populations reported that the remaining long-distance migrants have poor long-term prospects.[33] The same study found that areas of low human density in the Rockies region continue to experience the longest and largest of the remaining New World long-distance migrations south of central Canada.[34] Many of these long-distance movements occur in or adjacent to the 18 million acre Greater Yellowstone region, where about 75 percent of the migration routes for elk, bison, and pronghorn have already been lost.[35] The main pressures that have contributed to loss of bison, elk, and pronghorn migration routes in the Greater Yellowstone ecosystem are: little tolerance for bison outside of protected areas, the concentration of elk on 23 winter feeding grounds in Wyoming, a 20 percent increase in the human population in the last decade, and the associated loss of habitat, especially in areas crucial to the approximately 100,000 wintering ungulates in the southern part of the ecosystem.[36] Thus, the unprotected lands within and adjacent to the Greater Yellowstone region are highly valuable to conservation efforts. Unfortunately, accelerated leasing of public lands for energy development in the area will likely reduce and perhaps truncate such migrations.[37]

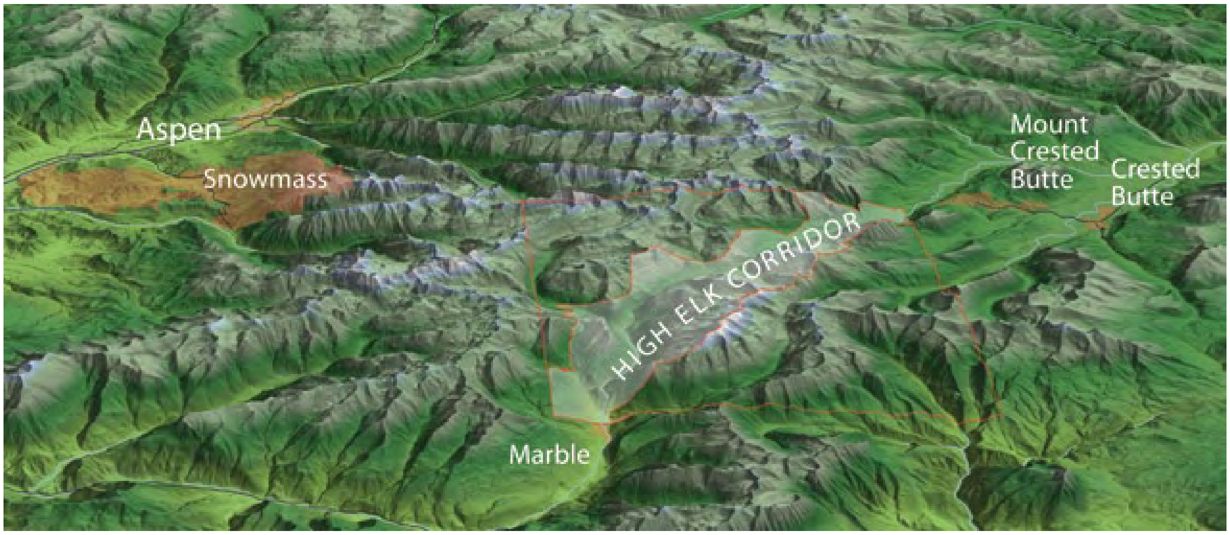
Case Study: Crested Butte High Elk Corridor

The High Elk corridor is a valley system that connects the mountainous Maroon Bells and Ragged wilderness areas. North of Crested Butte, a rugged, seasonal road traverses the valley, connecting the former mining towns of Gothic, Crystal, and Marble. The area includes the Rocky Mountain Biological Lab, as well as two watersheds providing drinking water for downstream communities, numerous recreational opportunities in the beautiful and wild landscape, and important cultural heritage in its historical mining areas. As its name implies, the area is also an important wildlife migration corridor and a hotspot for ecological diversity. Although the High Elk corridor is sandwiched between two wilderness areas, much of the 6,000 acre land area is privately owned. Many of these private lands are old mining claims which still fall under the jurisdiction of the outdated 1872 mining laws. Due to the nature of these laws as well as the other private in-holdings in the area, the High Elk Corridor has very incomplete protection.

Until now, the remote location, limited accessibility, severe winters, and avalanches have hindered development. But current interests in off-the-grid homes and trophy vacation homes, as well as the capabilities offered by the Internet, are putting this pristine area at risk. Friends of High Elk, a coalition that has created a fund to purchase land and conservation easements in the corridor, has protected 1,100 acres of the 2,500 acres of vulnerable areas within the corridor. However, the estimated total value of these vulnerable lands is $6.5 million, and the coalition faces increasing pressure from developers and land speculators. By finding solutions with property owners, the Friends of High Elk coalition hopes to secure this important area and create a contiguous wilderness area for the benefit of the ecosystem and future generations.[1]

[1] Friends of the High Elk. "Preserving the High Elk Corridor." A publication from The Trust for Public Land. 2006.

Figure 4: High Elk Conservation Corridor



Source: Trust for Public Land, 2001

Traditionally, conservation efforts have focused on individual species and crucial habitat for particular species. As conservation efforts shift towards a more holistic approach, migration corridors have received heightened attention from conservation groups. However, some researchers argue that animals need habitat rather than specific corridors and that corridors are too expensive relative to the amount of wildlife use. Furthermore, they contend that connecting isolated habitats with protected corridors would slow evolution by genetic drift and facilitate the spread of catastrophes such as fires, diseases, or introduced species.[38] However, the recommendations of studies critical of corridor preservation have not completely ruled out the potential benefits of protecting migration corridors, but have rather encouraged policymakers to consider the costs and benefits of the corridors and investigate other conservation options.

Although there are arguments against the focus on migration corridors as conservation tools, legitimate corridors that multiple species use for migration and habitat can produce economic gain in the long run. The economic benefits derived from the survival and health of big game herds and migratory birds rely heavily on the effective management of seasonal ranges and the migration corridors.[39] Wildlife corridors help support the hunting and wildlife watching industries, while also protecting biodiversity and wildlife migration paths. They thus contribute to healthy, functioning, and resilient ecosystems which provide humans with important nutrient cycling services, pollination, and pest and disease control.

Trophic Cascades

Recent scientific studies have researched the role of predators in trophic cascades to investigate how interactions within ecosystems impact species. A trophic cascade occurs when a top predator in a food chain suppresses the abundance of prey species, which in turn reduces pressure on the next trophic level, or species in the food chain. If the prey is an herbivore, then the top predator would decrease pressure on producers (plants). While any change in the trophic structure will cause a change in the ecosystem, there is debate as to the relative strength of top-down forces (removing the top predator) vs. the strength of bottom-up controls (changing plant productivity) (See Figure 5 and Table 2 in the Zion National Park Case Study).[40]

Large carnivores, many pushed to the brink of extinction during the 19th century, are rebounding in some areas, often as a result of reintroduction. This has created a unique scientific opportunity to understand the role of large predators in an ecosystem. Berger et al. studied the effect of grizzly bears and gray wolves in the southern greater Yellowstone ecosystem. In areas where grizzlies and wolves were locally extinct, there was an increase of moose, a riparian-dependent herbivore. The subsequent alteration of riparian vegetation structure and density caused the consequent reduction of avian neotropical migrants that rely on riparian willow communities.[41] This study supports the hypothesis that large carnivores play a crucial role in regulating terrestrial ecosystems, or the "top-down effect." The findings of this study have wide-reaching implications for our understanding of ecosystems impacted by predator removal or reintroduction.[42]

Climate Change

(See Figures 6 and 7)

Climate change is now a ubiquitous term that generates frequent conversation and debate and extensive media coverage (including more than 60 million "hits" on a Google Internet search). The Intergovernmental Panel on Climate Change stated in the 2007 report that "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice rising global average sea level."[43] Trends in increasing temperatures are occurring at levels well above background variation, and many studies have shown a strong link between human activities and temperature

Case Study: Trophic Cascade in Zion National Park, Utah

In a 2006 study, Ripple and Beschta examined the dynamic interactions between human use, cougar presence, deer presence, cottonwood growth, stream channel morphology, and populations of wildflowers, amphibians, lizards, and butterflies.[1] They found that areas with high numbers of human visitors to Zion Canyon within Zion National Park reduced cougar densities, which in turn allowed for higher mule deer densities, subsequent increased browsing intensities, decreased growth of cottonwood seedlings into mature trees, increased bank erosion, and reduction in both terrestrial and aquatic species abundance. Thus, the presence or absence of a large predator, in this case the cougar, appears to have significant effects on lower trophic levels as well as abiotic factors and native species abundance.

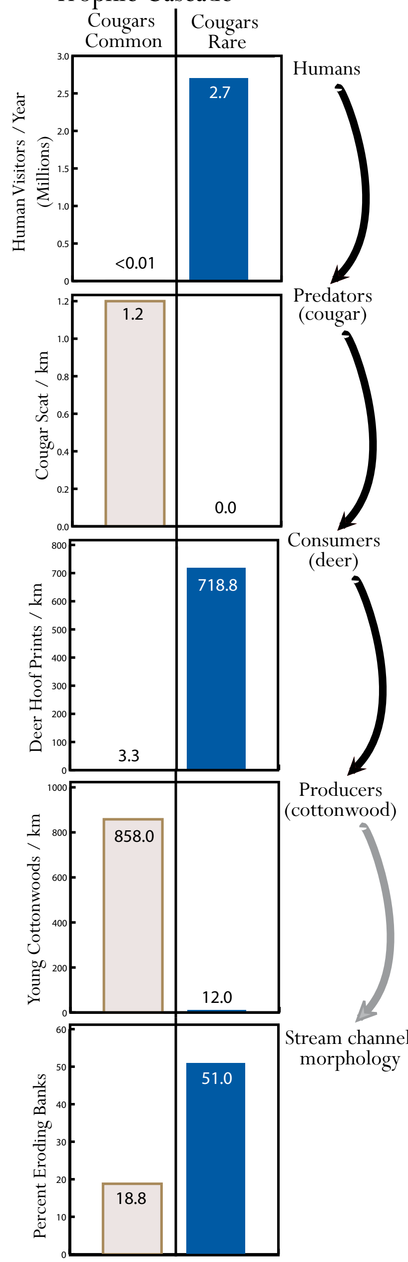
[1] Ripple, William J. and Robert L. Beschta. "Linking a Cougar Decline, Trophic Cascade, and Catastrophic Regime Shift in Zion National Park." *Biological Conservation* 133 (2006): 397-408.

Table 2: Species Abundance

	Hydroponic Plants % of observations (rushes, cattails, scouring rush)	Wildflowers No. / km (Asters, Cardinal flowers)	Amphibians No. / km (frogs, toads)	Lizards No. / km	Butterflies No. / km
Cougar Common	63.8	808.3	358.4	16.7	58.3
Cougar Rare	14.3	0	1.4	6.3	13.3

Source: Ripple and Beschta, 2006

Figure 5:
Trophic Cascade



Source: Ripple and Beschta, 2006

changes.[44] Warming has had significant impacts on wildlife in the last 100 years, and various studies and models predict that warming will continue to put escalating pressure on species and their habitat (See Table 3).

Research by the U.S. Geological Survey indicates that given the current trends in carbon dioxide emissions, expansive sagebrush habitats throughout the western U.S. could decline by 59 percent before the end of this century.[45] Sage grouse, mule deer, pronghorn, and many other species that rely on these areas are likely to decline in the face of shrinking habitat.

Sage brush habitat is not the only land type that is predicted to face significant impacts due to climate change. The Great Basin of western North America is a region of interior drainages between the Rocky Mountains and the Sierra Nevada. A modeling study of the effects of climate change on biodiversity predicted that a 3°C increase in average temperature will cause boreal habitat to recede 500 meters upslope and cause the extinction of 44 percent of the mammals that live in the area.[46]

High-elevation species are especially vulnerable to global warming as there is only a limited amount of space for retreat to higher elevation habitat. The American pika, which lives in high-elevation talus fields, is acutely sensitive to high temperatures and may die in one hour if exposed to temperatures above 75ºF. Beever *et al*. reported that 28 percent of populations in study areas in the mountain ranges of Nevada had experienced recent extirpations, likely due to habitat loss and warming.[47]

Changes in water temperature and streamflow will have drastic impacts on salmonids (a family of fish that includes salmon and trout). Scientists at the University of Wyoming estimate that a 5.4ºF increase in average July air temperatures could eliminate 50 percent of currently viable trout stream habitat in the Rocky Mountain region.[48]

These examples are by no means exhaustive of the implications climate change has for wildlife; however, they do illustrate some of the challenges that wildlife will face in combination with other human influences. Overall, research on climate change indicates that temperature rise and its associated effects will have profound effects on wildlife.

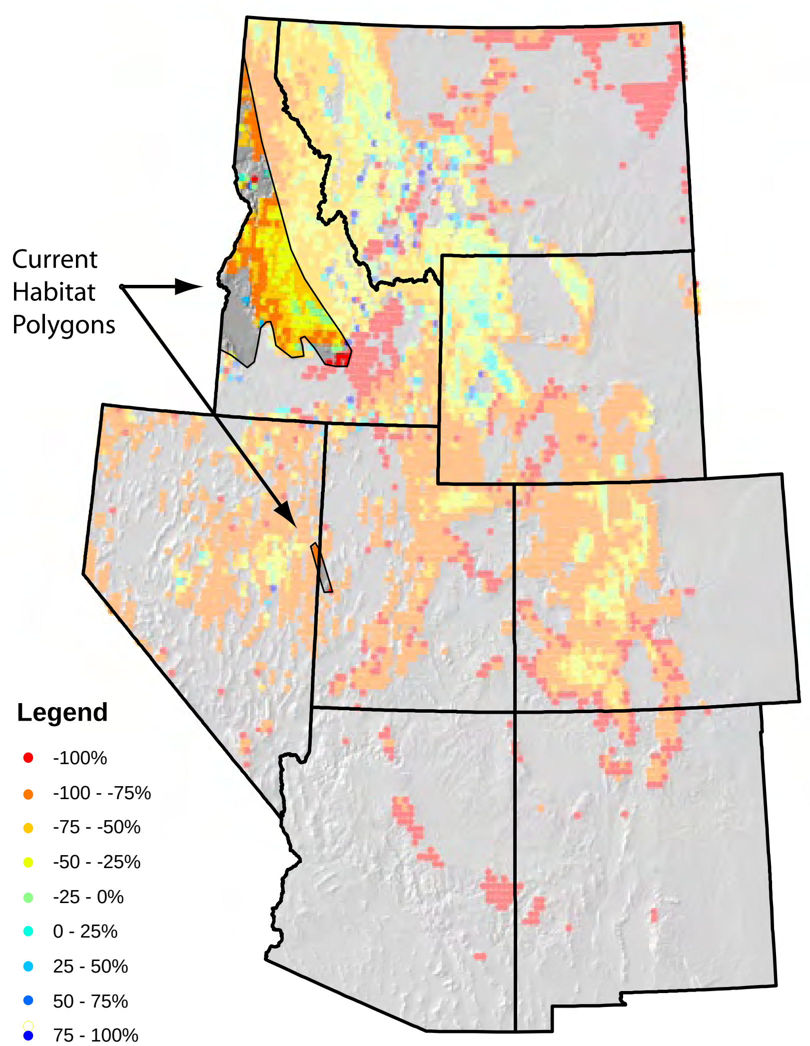
Diseases in Wildlife

Wildlife has evolved alongside many endemic diseases that play an important part of natural population dynamics and evolution. However, introduced diseases can be catastrophic for wildlife conditions and populations, especially when species are already at risk due to other pressures. Often, human-caused conditions create dangerous disease situations for wildlife.

Disease emergence almost invariably results from a change in the ecology of the host, the pathogen, or both. Expanding human populations can put pressure on wildlife habitats, increasing wildlife population densities. Higher population densities can lead to the emergence or higher prevalence of infectious diseases in wildlife.[49] For example, the Jackson National Elk Refuge was created in 1910 to feed wintering elk and keep them off private lands (see case study on page 96). Elk gather in the thousands to feed on the refuge. In this situation of unnatural crowding, diseases which are normally of low prevalence in the population can run out of control. An estimated 35 percent of the elk that winter at the feedgrounds have been exposed to brucellosis; in contrast, only 2 to 3 percent of those wintering on native range without supplemental feed have been exposed.[50]

Brucellosis in bison and elk is a controversial

Figure 6: Current Wolverine Habitat and Projected Snowpack Change, 1976 to 2085



Note: values here reflect the percent change in snowpack from the 1961-1990 baseline for the time period 2070-2099, using the IPCC A1 carbon emission scenario (business-as-usual) and the HADCM3 climate model. The year1976 is the 1961-1990 midpoint; 2085 is the 2070-2099 midpoint.

Sources: Laliberte and Ripple, 2004; ATMOS Consulting, 2004 topic in the Rockies. Scientists have argued that brucellosis in bison in Grand Teton National Park is related to the presence of the disease in managed elk herds that share grazing areas.[51] Brucellosis is an infectious contagious disease caused by the bacteria *brucella abortus*.[52] In cattle and ungulates, including bison and elk, infection with the bacteria results in third trimester abortion in 80 percent of animals. Retained placenta and other complications such as inflammation of the uterus are also common.[53] After an initial abortive event, cattle are usually unaffected by the disease, but continue to have circulating antibodies and may be carriers of the bacteria.[54]

Once the animals have the disease, it is untreatable. However, vaccines are available that range from 65 percent effective for both cattle and bison (Strain 19),[55] to 80 percent effective in cattle (Strain RB51).[56] Brucellosis is a zoonotic disease, which means that it can be transmitted from animals to humans. Humans can contract the disease by ingesting unpasteurized dairy products, handling the tissues of infected animals, or inhaling infectious particles. Rarely, transmission is caused by eating undercooked meat.[57] Human-to-human transmission is infrequent. The disease manifests itself in humans with an irregular or "undulating" fever, headache, sweats, back and joint pain, fatigue and weakness. Severe infections may affect the central nervous system or the lining of the heart and can result in death.[58] At-risk populations include butchers, veterinarians, lab workers, hunters, and travelers. Diagnosis involves culturing the bacteria from body fluids or testing for *brucella* antibodies. Treatment for humans involves taking a combination of antibiotics for an extended period.[59]

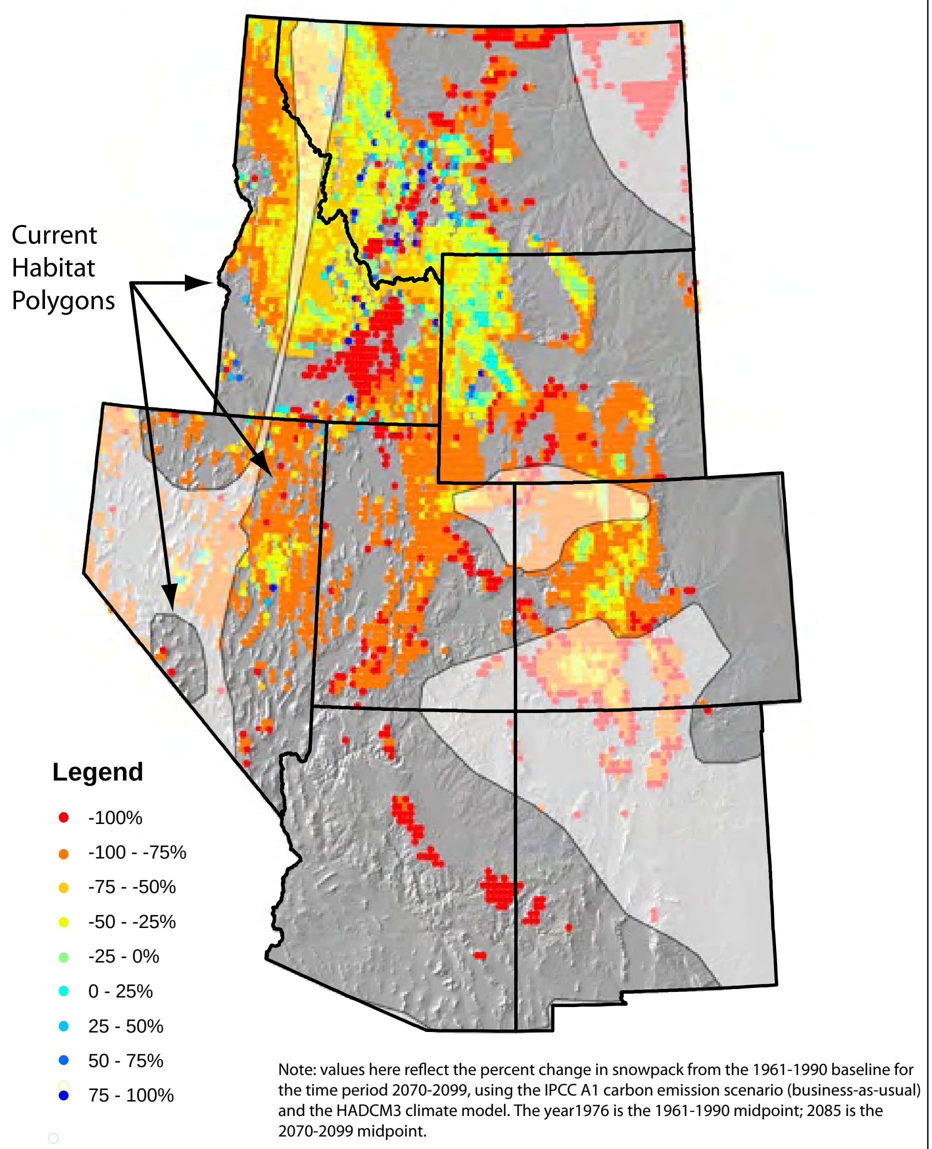
Before antibiotics became easily available, the disease was highly problematic in the U.S. In 1934, The Animal and Plant Health Inspection Service (APHIS) set out to eradicate brucellosis from the U.S.[60] The approach with cattle has been to test, slaughter infected animals, trace back the source of the infection, investigate the case, and vaccinate. However, pasteurization has made the disease uncommon, with only approximately 100 to 200 cases per year in the U.S.[61] Now, most infections in the U.S. are the result of returning travelers who have eaten soft, unpasteurized cheeses in foreign countries.

Although the disease status in the U.S. has changed significantly since 1934, APHIS is still legally bound by the 1934 guidelines. While the test and slaughter program has been highly effective in domesticated animals, the disease persists in wildlife. The brucellosis-free status that many states enjoy has recently been revoked in Montana due to the presence of infected herds. The blame has been primarily focused on wild ungulates that carry the bacteria. For a detailed discussion of the brucellosis issue in the Greater Yellowstone ecosystem please see the Bison in Yellowstone Case Study.

The large number of bison held on private ranches around the U.S. will buffer the species from extinction by brucellosis. The Yellowstone bison herd, however, is among the last with pure bison genetics, most others have been mixed with cattle. However, diseases in endangered species, especially introduced diseases, can have compounding and dangerous consequences.

Human influence on ecosystems, such as the widespread introduction of nonnative flora and fauna into new areas is increasing biogeographical homogeneity. Disease introduction, termed "pathogen pollution," can have similar and compounding effects. Pathogen pollution can cause catastrophic depopulation of native,

Figure 7: Current Bighorn Sheep Habitat and Projected Snowpack Change, 1976 to 2085



Note: values here reflect the percent change in snowpack from the 1961-1990 baseline for the time period 2070-2099, using the IPCC A1 carbon emission scenario (business-as-usual) and the HADCM3 climate model. The year1976 is the 1961-1990 midpoint; 2085 is the 2070-2099 midpoint.

Sources: Laliberte and Ripple, 2004; ATMOS Consulting, 2004

Table 3: Observed And Projected Changes In Western U.S. Climate Change And Impacts To Wildlife

	20th Century Changes (+1°C)	Future Projections (2020-2029, 1-1.5°C)	Implications for Wildlife
Warmer stream temperature		+0.6-1.2°C	-Reduced survival and reproduction of salmonids. -Impacts on cold water fisheries.
Warmer winters and spring	0.1°C per decade through 20th century – greatest warming in spring and winter.	+1-1.5 °C; greater magnitude of warming in spring and winter	-Shifting geographic range. Increased pest and pathogen outbreaks. -Impacts for animals with temperature dependent sex determination. -Accelerated parasite life cycles and improved pathogen survival.
Earlier spring arrival	Advancement of spring by 5 days per decade. Longer growing season by 2 days per decade.	Continued earlier spring arrival.	-Earlier migrations, nesting, breeding, budburst, flowering. -Changes in synchrony and inter-species interactions.
Streamflow	Peak streamflow 3 weeks earlier than average in existing historical record.	Earlier peak streamflow. Higher winter and early spring flows. Lower summer flows.	-Higher flood frequency. -Earlier peak flow. -Reduced natural summer and autumn flows. -Reduced frequency of reservoir refill. -Increase in the duration of summer dry period. -Floodplain habitat increasingly isolated from the active river environment. -Reduced habitat and survival for terrestrial and aquatic species. -Increased scouring of fish nests, aborting development.
Snowpack	April 1 snow water equivalent declining 15-30%. Earlier snowmelt timing.	Generally decreasing snowpack. Decreased length of snow season.	-Reduced habitat for bighorn sheep, wolverine and other snow-dependent species. -Reduced water availability. -Shrinking alpine habitat.
Glaciers	Declines in glacier volume and area across the west.	Glaciers in Glacier National Park disappearing by approximately 2030.	-Impacts on wildlife that relies on glacier fed streams and lakes.
Fire	Longer fire season. Increased fire frequency and intensity largely due to spring and summer warming and earlier spring snowmelt.	Even longer fire seasons. Increased fire frequency and intensity.	-Six times more acres burned over the last 15 years vs. previous 15 years. -Changes in forest species composition. -Changes in physical forest structure. -Increases in invasive species.
Invasive Species	Spreading worldwide. Outcompeting native Wildlife.	Spreading throughout the west.	-Habitat under climate change more hospitable for invasive species than native species.

Source: Western Governor's Association, 2008

naïve populations and if the pathogen persists it can result in chronic population depression. Ultimately, if the disease evolves in such a way that fewer infected animals can propagate the disease, local extinction can occur.[62] Reintroductions intended to bolster small populations create another disease threat for endangered species. The goal of captive breeding programs is to maintain genetically viable, healthy populations for subsequent release into the wild. The potential to introduce infectious agents into unexposed wild populations in sensitive, protected areas constitutes a serious hurdle for restorative conservation efforts.[63]

Conclusions

The Rocky Mountain West is home to thriving dynamic ecosystems, diverse wildlife, and expansive landscapes. Currently, the eight-state region also supports rapid population growth and booming development. From 2000 to 2006, the population in the Rockies grew 15 percent, while the rest of the U.S. grew 6 percent.[64] Prime wildlife habitat is often sought after as areas for housing developments, fossil fuel and mineral extraction, and agriculture.

Undoubtedly, human land uses directly and indirectly impact wildlife. The question is not whether urban areas will grow or not, but rather how and where they will grow. Pre-meditated, careful planning and effective strategies in community building can significantly reduce the impacts of habitat fragmentation. By balancing development with protecting crucial habitat and maintaining ecological permeability of the landscape, wildlife can effectively move between habitat areas.[65] Careful planning decisions will also affect the quality of life of people living in these communities and will determine whether the wildlife so emblematic to the West will persist in the future. Ultimately, by planning ahead and making informed decisions, development will be less expensive and more compatible with wildlife.[66]

The long-term impact of human influence on wildlife and wildlife habitat, whether positive or negative, benign or catastrophic, depends on our willingness to be responsible stewards.[67] Wildlife is being constricted into smaller habitat areas and populations face non-endemic diseases, climate change, introduced species, and other human impacts. Careful and effective management will become increasingly important in maintaining the wildlife populations that are so crucial to the functioning ecosystems of the West. As wildlife protection and management moves into the future, government legislation, conservation initiatives, and public voices will be essential in lobbying for wildlife that cannot speak for itself.

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Case Study: Craighead Beringia South Research and Educational Center

Pulling up to the research center in Kelly, Wyoming, on a hot July day the Rockies research team was immediately greeted by the squawking of adolescent ravens. These orphaned birds are a part of the institute's ongoing raven ecology project. Craighead Beringia South Research Center was established in 1998 by Derek J. Craighead as a nonprofit educational and scientific institute. Currently, Derek and his team of researchers are conducting research in the ecologically rich area of Grand Teton National Park, the Gros Ventre River, and the Jackson Hole valley. Overall, the mission of Craighead Beringia South is "to better understand the dynamics of environmental change so that man may be better prepared for his future."[1]

Current projects at the research center include studies of the ecology of the common raven, red-tailed hawk migration, dynamics of the cougar population in Grand Teton National Park, northern Yellowstone large carnivores, and the demographics of sage grouse in the Jackson Hole area. Many of these projects focus on indicator species, which can reveal much about the general health of the ecosystem. Because ravens occupy a top tier in the food chain, the birds serve as an indicator species in the Jackson Hole ecosystem.[2]

In Jackson Hole, the raven population has increased by at least 600 percent over the past 55 years. During the same period, red-tailed hawks, which compete with ravens for prey and nest sites, have declined in number at the same rate. Derek Craighead and Bryan Bedrosian are the lead researchers for the raven ecology project at the institute. By studying nest site competition, reproductive success, roosting ecology, feeding habits, and the impact of West Nile Virus, Craighead and Bedrosian hope to better understand these population changes. Similarly, as large predators have been reintroduced into the Rockies and their numbers expand, the Craighead family has been conducting long-term research on grizzly bears, wolves, cougars, and black bears. Habitat use and interactions among these predators have been important aspects of the studies. The research center is also actively pooling data from researchers working on these specific animals to formulate trends on the effect of carnivore groups on their environment.


Meeting a friend of Beringia South

Researchers from the institute have also been investigating sage grouse, which have been declining in many parts of the West, particularly Wyoming. As energy development rapidly expands in the Pinedale area and sage grouse populations decline, Craighead Beringia South researchers have worked to establish baseline data for Jackson, where energy development has not threatened grouse habitat. Sage grouse are a particularly important part of the ecosystem as they are the main protein fixers in the food chain and therefore are an important food source for predators. Sage grouse numbers thus have a large impact on other wildlife. After the results of the research are reported, Derek sees the real question as what will society be willing to sacrifice for wildlife?[3] In the case of sage grouse, the sacrifice might be slowed or halted gas drilling. For a more complete discussion of the impact of energy development on wildlife, please see its section in the *2009 Report Card*. The detailed research by the Craighead Research Center and other researchers in the region is crucial for understanding the dynamics of wildlife range and population and recognizing the human impacts on these systems.


Rockies Researchers at Beringia South

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Case Study: Yellowstone Bison-Cattle Brucellosis Controversy: Pointing fingers over the spread of brucellosis

A Brief History of Bison in Yellowstone:

Yellowstone National Park is the only area in the lower 48 states where bison have existed in a wild state since the Pliocene Epoch.[1] However, Yellowstone was not immune to the effects of drastic market hunting and habitat destruction in the 19th century. Although the National Park was established in 1872, the bison population continued to dwindle due to poaching and was composed of only 23 animals in 1902.[2] In the same year, the park purchased 21 bison from private herds in Texas to bolster the population.[3] Brucellosis was first detected in Yellowstone bison in 1917. It is likely that the disease was transferred to bison from domestic cattle raised in the park in the early 1900's to provide dairy products and meat for the visitors.[4] From 1907 to 1930, the Yellowstone herd was fostered at the Buffalo Ranch in the Lamar Valley of the Park.[5] As the herd grew, it became increasingly evident that the bison, which as adults weigh between 900 and 2,100 pounds, are not particularly respectful to fences. After many years of rounding up the bison each time they broke free to of the fences, the Park Service decided to let the bison roam freely in the park.[6]

Eventually, the bison regained their natural migration pattern from the high elevations in the central areas of the park in the summer to the lower elevation areas to the north and to the west of the park in the winter. While the bison were allowed some room to roam, they were still heavily managed by park officials. Between 1934 and 1967, Yellowstone National Park operated under a plan of culling ungulate populations for achieving predetermined stocking levels.[7] In 1968, this management strategy changed to a regime of ecological management in which populations of bison and all other wildlife in the park were allowed to fluctuate without human intervention.[8] Growing bison herds caused contention about the transmission of brucellosis from bison moving beyond park boundaries, concern about the effects of snowmobile use on bison movements and controversy over expanding bison ranges.[9] Now, bison are protected and managed by the National Park Service within the park, but once they step foot outside the boundaries, they fall under the jurisdiction of the state. Management techniques have evolved over time, but with an estimated population of 3,000 animals, the same issues of brucellosis and bison moving beyond park boundaries continue to make the future and extent of the Yellowstone bison herds uncertain.

Bison in corral, Yellowstone National Park, 18991-1936.
© American Environmental Photographs Collection, [AEP Image Number, e.g., AEP-MIN73], Department of Special Collections, University of Chicago Library.

Bison in Yellowstone Today:

During a cool July morning the Rockies research team met with Rick Wallen, Yellowstone's head bison biologist. From the picnic table at the Buffalo Ranch, where the Yellowstone herd was contained in the early 1900's, we could see a few dozen bison grazing near the banks of the Lamar River. Wallen started off by giving a short background of bison in the West and the genetic background of the Yellowstone herd, which is one of the few remaining pure herds. He stressed that 100 years ago many wildlife populations were at all time lows due to hunting and habitat pressures and that Yellowstone bison are a success story in that the herd has grown from just 44 animals in 1902 to 4,694 animals in the summer of 2007.[10] Despite this bright statistic, Wallen is well aware of the challenges that face Yellowstone bison and other wild herds in the west.

Currently, the Park Service is one of five agencies in a management plan which dictates when and where bison can be outside the park.[11] As temperatures drop and snow falls on the high elevation plateaus of Yellowstone, the animals seek better grazing in the lower elevation areas north and west of the Park boundaries. It is during this time that bison are hazed back into the park, captured, quarantined or slaughtered. Hazing involves attempting to move the bison back into the park using horses, ATVs, snowmobiles and helicopters. The stated rationale for this intensive management and attempted containment is to prevent bison from transmitting brucellosis to cattle.

Wallen is straightforward about the prevalence of brucellosis in the Yellowstone herd – he is constantly working in the field to gather accurate and up to date data on population, genetics and disease occurrence. While finding exact prevalence rates for brucellosis is logistically unfeasible, extensive testing reveals that about 50 percent of Yellowstone bison have antibodies to brucellosis and about 25 percent are actively infected during late winter.[12] The presence of antibodies indicates that the animal has been exposed to the bacteria, however, antibodies alone do not indicate if the animal has an active infection nor do they indicate whether the individual is contagious or not. A much more expensive and time consuming test, live culture of the bacterium, is necessary to indicate an active infection that could be transmitted. A Texas A&M University study carried out in 1990 demonstrated that bison infected with *Brucella abortus* could transfer the disease to cattle in a confined, controlled setting.[13] Environmental groups, such as the Buffalo Field Campaign, are quick to point out that there has never been a documented case of transmission in the wild.[14] In any case, it is the high brucellosis infection rates of the Yellowstone bison which have incited large scale management techniques by a variety of agencies, mainly the National Park Service and the Montana Department of Livestock.

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The proportion of Yellowstone bison that move out of the park into unprotected winter range varies from 3 to 30 percent annually. The mortalities that result from management techniques, which include hazing, capture and removal, can be high. For example, in the 2007 to 2008 season, 1,728 bison were removed through a variety of management techniques including slaughter, quarantine, and hunting.[15] However, the Yellowstone bison have a high reproductive capability and following high herd reductions, approximately 75 percent of reproductive age females conceive during the next breeding season.[16] The population recovered quickly from high mortality rates from the severe winter that occurred during the 1996 to 1997 season. From 1997 to 2005, the annual population growth rate was 11.5 percent.[17] Presently, the culling practices aim to prevent bison-cattle interaction and maintain a minimum population of 2,500 at the end of the winter. Although Wallen's research team is currently doing genetics testing on the bison, preservation of the Yellowstone herd's genetic diversity has not yet been a consideration in the containment and slaughtering practices. However, Wallen hopes that the management plan will change in order to incorporate this and other important biological considerations into the management activities.

Wallen sees the current management practices of hazing, quarantine and slaughter as far from the ideal situation. Yet the legalities of APHIS and the Montana Department of Livestock hold precedence over the biological aspects of the situation and the protesters who detest such treatment of wildlife. In 2000, the critical habitat for bison was extended slightly beyond the boundaries of Yellowstone, however, these protected areas still do not encompass the whole of bison habitat and there are strict limitations as to how and when the habitat is available to bison.

Wallen is optimistic and hopes that the future will bring a new management plan that will allow the Yellowstone ecosystem to function as naturally as possible and that will foster good relationships between the Park and its neighbors.

Moving Towards Solutions:

Yellowstone National Park is not a self contained ecosystem. It comprises only 11%, or 2.2 million acres, of the Greater Yellowstone Ecosystem which is nearly 20 million acres.[18] In Yellowstone Park, the deep snow of the harsh winter covers the forage. Bison migrate out of the park to lower elevations where snowpack is not as dense and forage can be reached underneath. Because bison leave the park, they face harassment and possible death because of current management practices that are closely tied with brucellosis management.

The Greater Yellowstone Coalition (GYC) asserts that practical solutions exist to manage bison as wildlife while at the same time managing the risk of disease transmission from bison to cattle. GYC operates under the fundamental conclusion that bison are wildlife and need more habitat and tolerance outside the park's boundaries, and the assumption that disease transmission between bison and cattle can occur. The GYC challenges agencies to think about policies based on this assumption to ensure reasonable

Yellowstone Bison Case Study Continued

separation between bison and cattle. To ensure this separation, GYC recommends grazing buyouts on some private and public lands, effective fencing between bison and cattle supplemented by some subsidies, and fundamental changes to the Interagency Bison Management Plan (IMBP).[19] Amy McNamara of the GYC also points out that the regulations regarding brucellosis management were established in the 1930's - when milk was not routinely pasteurized – and that the policies need to change with the times, removing the requirement that cattle herds testing positive for brucellosis be slaughtered.[20] While APHIS has been highly successful with the test and slaughter technique for eradicating brucellosis from cattle, that method is logistically and financially unfeasible in wildlife. GYC would like to see funds directed at developing a better vaccine for cattle that is more effective against brucellosis as well as focusing on a population management program similar to that used in managing elk, deer and other ungulate populations. GYC is in support of regulated and responsible hunting outside the boundaries of Yellowstone National Park.

Hunters and other advocacy groups argue that a legitimate hunt to regulate the bison population, coupled with protected winter range outside the park is part of a sustainable solution to the question of bison management. A limited bison hunt has been allowed in the area surrounding Yellowstone, however, the bison numbers taken during the hunt are very low compared with those taken to slaughter.[21] The best time to hunt bison is in the fall, yet during this time they are still within the park boundaries where hunting is not allowed. The hunting season in Montana stretches from November 15 to February 15, after which female bison are in the late stages of pregnancy and hunting presents an ethical issue.[22] Also, some hunters who believe in the fair chase principle, do not like to hunt bison because when threatened, bison circle up to protect their young and become easier targets, unlike elk that will almost always run to escape.[23] We have yet to see whether a full scale bison hunt will be implemented and if it will be effective in the scheme of bison management. For a more detailed discussion of hunting as a wildlife management tool, please see the Wildlife Management section in the *2009 Report Card*.

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Case Study: The National Elk Refuge

Driving south on highway 151 towards Jackson, WY, the expanse of the National Elk Refuge extends to the east transected by the Gros Ventre River. In mid-July, one might wonder why it is called an "Elk Refuge". Almost no elk graze the lush pasture in the summer. However, in the winter 5,000 to 10,000 elk migrate from the high country in and around Grand Teton National Park to winter at the lower elevation of the refuge. To understand why the refuge has become the focal point of several high profile lawsuits and has faced intense criticism from environmental groups, it is helpful to understand the history of the land.

The history of the National Elk Refuge began in the winter of 1910-1911 when citizens of Jackson Hole began feeding elk due to severe winter conditions. Even at that time, accessibility to traditional winter ranges in the Southern part of Jackson Hole as well as the Green River, Snake River and Wind River basins was restricted. The problem was apparently solved with the supplemental feeding – elk were no longer dying on the doorsteps of Jackson Hole residents. In 1912, 1,760 acres of private lands were set aside by Congress as winter range for elk. A later series of executive orders expanded the refuge and broadened the purpose of the area to conserve habitat for birds and other big game besides elk. Currently, the vertebrate fauna that the refuge supports includes 48 mammal species, 175 bird species, 3 reptile species, 4 amphibian species and 11 fish species.[1] Today, the refuge covers 23,754 acres in Teton County.

Although much has changed since 1912, supplemental feeding of elk has continued and the elk population has ballooned. Prior to the feedgrounds, periodic severe winter mortality undoubtedly served as a natural population control on the elk herds, which enjoyed vast summer range and high reproductive capacity.[2] Now, thousands of elk that have become habituated to the refuge congregate at the feed lines every winter. Due to both wildlife management concerns and financial concerns, the refuge is actively trying to reduce reliance on supplemental feeding. In 2008, alfalfa pellets alone cost the refuge $989,000. Half of this cost is covered by the Wyoming Department of Game and Fish. The refuge is trying to decrease the dependence on winter feeding by increasing the production and utilization of natural standing forage.[3] When the State of the Rockies team toured the refuge in July, significant irrigation efforts were quite apparent. Approximately 1,300 acres of the refuge are seeded with non-native species and maintained to enhance grass production.[4]

Besides the enormous costs of supplemental feeding and irrigation, the refuge faces numerous management challenges. Due to extensive development in Jackson and the surrounding areas, the refuge is the best undeveloped winter range that remains. In addition to the elk, a growing population of bison has become habituated to the feeding and herd knowledge of natural migration routes has been lost. Diseases also present significant challenges to the refuge. The unnatural crowding of elk that occurs because of the supplemental feeding provides the perfect breeding ground for a variety of diseases that are normally maintained at low levels in the wild. Diseases of concern include: brucellosis, hemorrhagic septicemia, necrotic stomatitis, gastrointestinal viruses, respiratory viruses (P13, RSV), scabies and gastrointestinal parasites.

Managers of the refuge are particularly concerned about the future threat of chronic wasting disease and tuberculosis. Chronic wasting disease is a prion disease that infects deer, moose, and elk and has symptoms similar to mad cow disease. A prion is not a virus nor a bacterium, but rather an infectious protein. Chronic wasting disease is ultimately always fatal; however, infected animals will not show signs of infection for 18 months, during which they continuously shed infectious prions. The refuge managers are particularly worried that the National Elk Refuge could become a long-term source of infection because the prions can remain viable in the soil for an undetermined number of years. As such, the area could become unsuitable habitat for healthy elk populations into the future. At present, based on testing from samples hunters voluntarily provide, chronic wasting disease is mostly concentrated on the east side of Wyoming; nonetheless, concern for the spread of the disease is great – and has heightened since an infected moose was found approximately 45 miles away from the refuge.[5] Limited scientific investigations have not demonstrated that the disease is transmittable to humans from the soil. However, the evidence is not conclusive as to ungulate to human transmission.[6]

On June 3, 2008, Earthjustice filed a lawsuit against the National Elk Refuge on behalf of Defenders

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Jackson National Elk Refuge Case Study Continued

National Elk Refuge © Mark Gocke

of Wildlife, the Jackson Hole Conservation Alliance, the National Wildlife Refuge Association, the Greater Yellowstone Coalition and the Wyoming Outdoor Council.[7] These environmental groups argue that the Final Bison and Elk Management Plan and Environmental Impact Statement for the National Elk Refuge, released January 2007, violates the National Environmental Policy Act and the National Wildlife Refuge System Improvement Act, especially with regard to disease control.[8] Under the January 2007 management plan, the refuge plans to reduce the wintering elk population from 7,500 to 5,000 and the bison population from 1,200 to 500 through hunting over a 15-year period with a goal to maintain minimum genetic diversity levels. The plan will also attempt to reduce the need for supplemental feeding by improving habitat, but does not predict an end to supplemental feeding.[9] Therefore the environmental groups argue that the unnatural crowding at the feed lines will continue, producing hot beds for disease and reducing biological and environmental health.

To reduce the unnaturally high elk populations on the National Elk Refuge, supplemental feeding will need to be reduced over time and hunting pressure increased until a herd objective is reached that can be sustained on natural forage in the valley. Legislation, executive orders and administrative action determine the mission and goals of the refuge, which require laborious processes to amend and improve.

Hunting is an important tool for managing the size of the elk and bison herds in Jackson Hole. Hunting of elk occurs on the National Elk Refuge, in Grand Teton National Park and on other public and private lands throughout the valley. Some herds, which have been very successful at increasing in population size, have become adept at avoiding hunters and congregating in no hunting areas where they damage landscaping and natural forage. The hunting industry has a large sway in the future of the refuge and is in favor of options that aim to maintain high numbers of elk – and thus in favor of continued feeding. Tourism is also a factor for the elk refuge, and decreasing the size of the elk herd would likely be unpopular with the visitors. Phasing out supplemental feeding would likely result in significant population decreases. Other impacts involved with reducing supplemental feeding include increased elk grazing on rancher's pastures and increased elk depredation on haystacks. Jackson residents could experience property damage by foraging elk and bison.

Ultimately, the problem is that natural elk and bison migration routes have been lost due to development and reliance on supplemental feeding. Land in the Gros Ventre Valley may offer part of the solution in terms of encouraging the elk to regain a more natural migration pattern, but cannot be the only solution. The refuge has also considered the future option of providing incentives to ranchers to allow bison to winter on their lands. Most likely, a combination of management changes will be necessary to effectively address the issue of supplemental feeding on the refuge.

Though the most prominent, the National Elk Refuge is not the only feedground in Wyoming where unnaturally high populations of elk are being sustained. There are 22 additional feedgrounds managed by the State of Wyoming that face similar challenges involving elk populations, the cost of feeding and the threat of uncontrolled diseases.

[1] Smith, Bruce, Eric Cole and David Dobkin. *Imperfect Pasture*. Moose: Grand Teton Natural History Association, 2004.
[2] *Ibid.*
[3] Kallin, Steve and Dan Huckle, interview by Julia Head, Jackson Hole National Elk Refuge, WY, July 14, 2008.
[4] Smith, et al., 2004.
[5] Kallin, Steve and Dan Huckle, July 14, 2008; and Amy McNamara, Personal Correspondence, 3/1/2009.
[6] Belay, Ermias D, *et al*. "Chronic Wasting Disease and Potential Transmission to Humans." Emerging Infectious Diseases. 10 (6) (2004): 977-984.
[7] Earthjustice. "Our Cases: Protecting Healthy Elk and Bison in Wyoming." 2008. http://www.earthjustice.org/our_work/cases/ (accessed August 11, 2008).
[8] Kallin, Steve and Dan Huckle, July 14, 2008.
[9] U.S. Fish and Wildlife Service, National Park Service. *Final Bison and Elk Management Plan and Environmental Impact Statement: National Elk Refuge Grand Teton National Park.* January 2007.