



ECOLOGICAL FUTURE OF BISON IN NORTH AMERICA: A Report from a Multi-Stakeholder, Transboundary Meeting



Edited by Kent H. Redford and Eva Fearn



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ECOLOGICAL FUTURE OF BISON IN NORTH AMERICA: A REPORT FROM A MULTI-STAKEHOLDER, TRANSBOUNDARY MEETING

Edited by Kent H. Redford and Eva Fearn

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The Wildlife Conservation Society saves wildlife and wild places worldwide. We do so through science, global conservation, education and the management of the world's largest system of urban wildlife parks, led by the flagship Bronx Zoo. Together these activities change attitudes towards nature and help people imagine wildlife and humans living in harmony. WCS is committed to this mission because it is essential to the integrity of life on Earth.

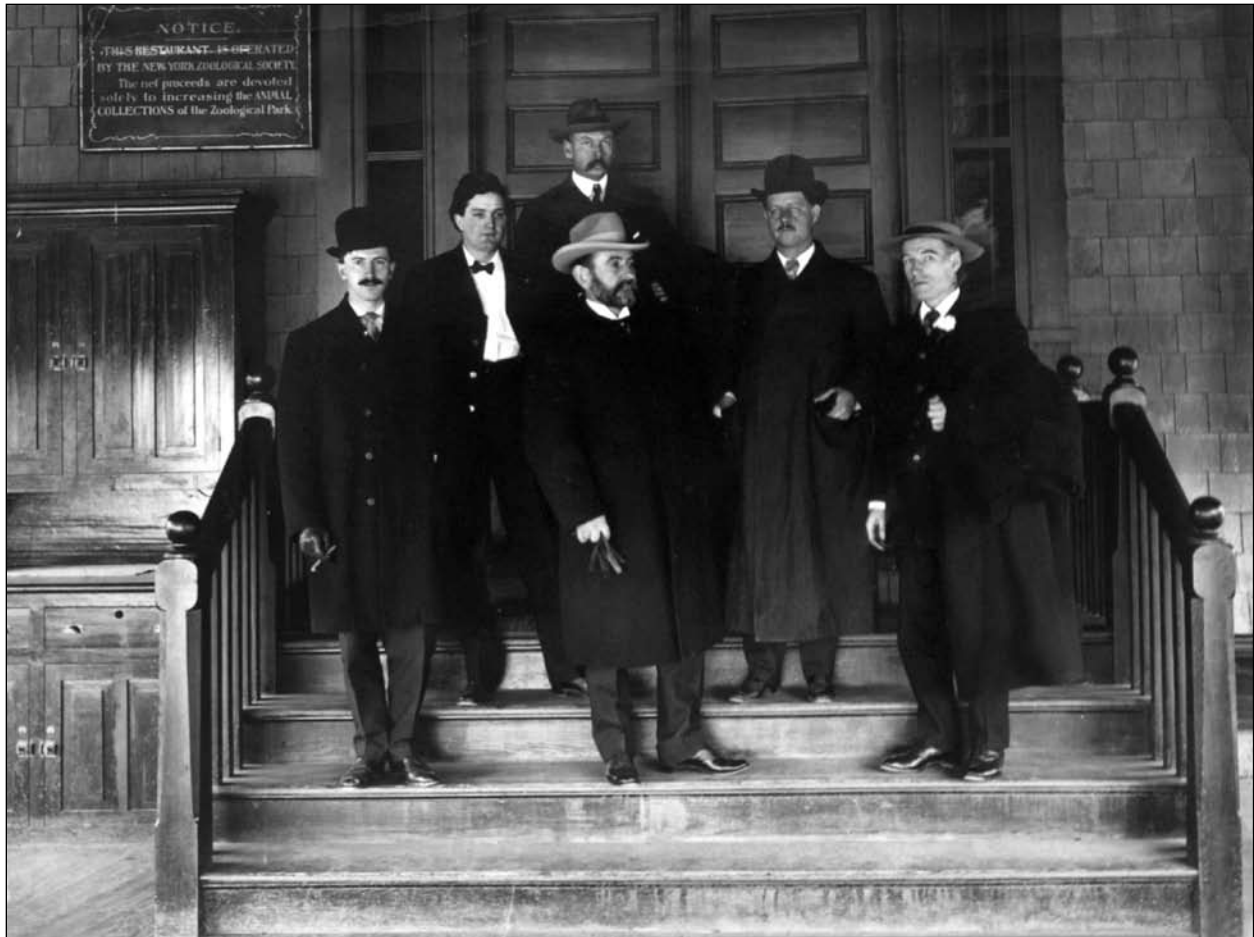
Over the past century, WCS has grown and diversified to include four zoos, an aquarium, over 100 field conservation projects, local and international education programs, and a wildlife health program. To amplify this diverse conservation knowledge, the WCS Institute was established as an internal "think-tank" to coordinate WCS expertise for specific conservation opportunities and to analyze conservation and academic trends that provide opportunities to further conservation effectiveness. The Institute disseminates WCS' conservation work via papers and workshops, adding value to WCS' discoveries and experience by sharing them with partner organizations, policy-makers, and the public. Each year, the Institute identifies a set of emerging issues that potentially challenge WCS' mission and holds both internal and external meetings on the subjects to produce reports and guidelines for the institution.

The American Bison Society (ABS), managed by the WCS Institute, works with a broad range of stakeholders to build the scientific and social bases for the long term ecological restoration of bison in North America. ABS and partners address information gaps by initiating research and papers on issues that require further exploration or synthesis, or where policy and guidelines are needed.

The ABS Working Paper Series, produced through the WCS Institute, is designed to share information with the conservation and bison stakeholder communities in a timely fashion. Working Papers address issues that are of immediate importance to helping restore bison and either offer new data or analyses, or offer new methods, approaches, or perspectives on rapidly evolving issues. The findings, interpretations, and conclusions expressed in this Paper are those of the author and do not necessarily reflect the views of the American Bison Society or the Wildlife Conservation Society.

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Elwin R. Sanborn/WCS

The American Bison Society was established on December 8, 1905. Founding members included Frederick H. Kennard, member, Board of Trustees; Harry V. Radford, editor, Woods and Waters; Charles H. Stonebridge, manufacturer; Edward Cave, editor, Field and Stream; William T. Hornaday, director, New York Zoological Park; and Ernest H. Baynes, writer.

PART 1

INTRODUCTION

Kent H. Redford

Vice President and Director, Wildlife Conservation Society Institute

Eva Fearn

Assistant Director, Wildlife Conservation Society Institute

*The North
American bison
experienced an
ecological loss at a
scale unparalleled
in our modern
history.*

In North America, many wide-ranging mammals have experienced significant declines within the last 200 years: Now, elk are found in only 26% of their historic range and grizzly bear are found in only 47% of theirs (Laliberte and Ripple 2004). This loss has resulted in fewer landscapes rich with large mammals and lower densities of mammals in many of the rest of these landscapes. Nowhere is this more dramatic than is the case with the North American bison, which experienced an ecological loss at a scale unparalleled in our modern history. Only 200 years ago, 30-50 million plains bison (*Bison bison bison*) roamed the grasslands and shrub steppes from Mexico to central Canada. To the north, wood bison (*Bison bison athabascae*) ranged from boreal forests to the Arctic plain. In herds that numbered up to 10,000 animals, bison were an ecological keystone species on the Great Plains and montane grasslands. Their migrations, grazing patterns, and behavior shaped the physical environment and they had myriad ecological interactions with other native species. Bison were also integrally linked with the spiritual and economic lives of original American cultures, and embodied the frontier for many Americans. Due to massive overhunting and land-use change, bison were pushed to the brink of extinction. By the 1870s bison were decimated by the onset of the railroad and the robe trade. By 1889 only about 1,091 bison were left.

Today, the bison remains a unique icon of North American culture and natural history. The numerical restoration of bison, which now number approximately 450,000, could be considered a conservation success story. However, the bison's important ecological roles in the landscape have not been restored, as over 95% of these animals are being raised in confined circumstances for meat. In fact, today bison exist in vastly differing management circumstances, herd dynamics, states of genetic integrity, and ecological settings than in the past. Bison are absent from most of their former range, their grazing does not influence the grassland-fire or nutrient-cycling regimes, and they rarely create habitat or provide food for other native species.

In order to restore the ecological role of bison across their original range, the Wildlife Conservation Society (WCS) has set up a multi-stakeholder, trans-boundary initiative. The Wildlife Conservation Society is an international science-based organization committed to conserving wildlife and wildlands. WCS has a long history with bison: William Hornaday, WCS' first director, conducted the 1889 survey that revealed how alarmingly close bison were to extinction. He, Theodore Roosevelt, and others formed the American Bison Society (ABS) in 1905. The ABS launched a national campaign to create wild bison reserves, stock them with bison from WCS' Bronx Zoo and elsewhere, and educate the public about the bison's endangered status. The ABS helped reestablish bison by pulling bison from captive and private herds, raising funds, and lobbying for reserve establishment. In 1907, WCS shipped 15 bison to the Wichita Reserve Bison Refuge in Oklahoma by cart and rail car. The ABS also helped buy a

nucleus herd for the Montana Bison Reserve. In 2005, on the 100th anniversary of the ABS, WCS revitalized the American Bison Society with the objective of working with partners to achieve the ecological restoration of bison.

The complex modern identity of the bison – as icon, wildlife, and livestock – produces several challenges to its ecological future. Climate change, potential intensification of biofuel production, and a growing cultural separation of people from wildlife add to that complexity. The current conservation situation of bison is rife with local disputes. Controversial situations include brucellosis management; stalled efforts to reintroduce wood bison in Alaska; the domestication and selective breeding of bison for market; and the dichotomous legal status of bison as livestock or wildlife in different states and provinces. Any one issue could thwart the interdisciplinary collaboration necessary for large-scale bison restoration. The ecological restoration of bison comes at a critical time for the species and for North American grasslands and provides an excellent opportunity for working across a full range of land -ownership types.

Rebuilding the American Bison Society

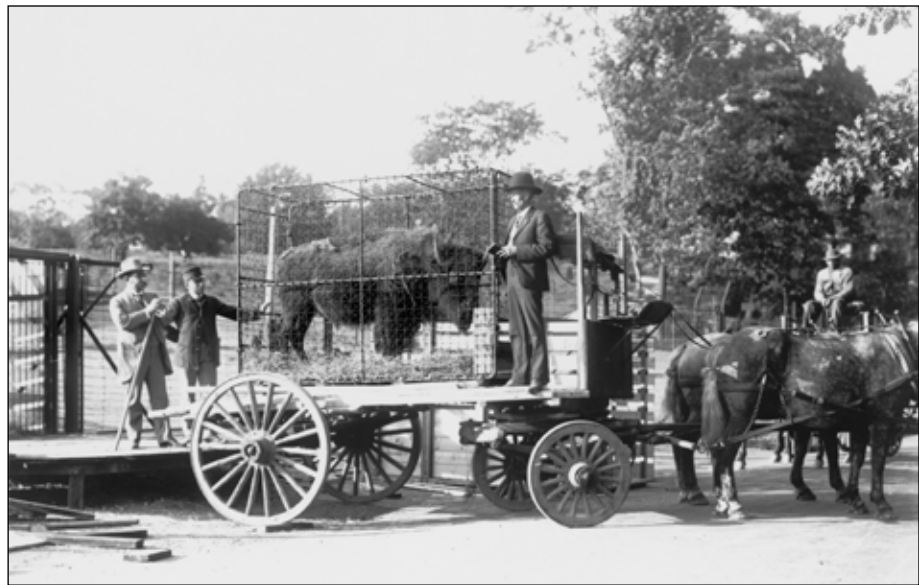
As a part of reestablishing the American Bison Society, in 2006 WCS organized two meetings to bring together diverse perspectives to assess the needs for bison restoration. A WCS workshop for 28 bison experts at Ted Turner's Vermejo Park Ranch produced: 1) a statement of ecological restoration for bison over the next 100 years crafted as a consensus document by 29 people representing producer groups, American Indians, governments, NGOs, and academic scientists (Appendix 1); 2) a GIS database of the distribution of bison herds today; 3) revised historical range maps and maps of potential ecological recovery areas; and 4) a matrix of ecological characteristics to assess how herds (private production, public, and private conservation) can contribute to overall ecological restoration at varying scales (Appendix 2). The characteristics analyzed include herd size and age dynamics; regulatory implications related to disease; genetics; and ecological interaction with other native species.

Discussions at these two meetings fed into a larger conference in Denver, Colorado, on the ecological future of bison in North America co-hosted by The Nature Conservancy and World Wildlife Fund-US. The Denver conference was groundbreaking in facilitating bridge-building between groups that have not worked together before. It included perspectives from leading institutions dealing with bison and featured informative presentations on bison genetics, the potential role of zoos, the role of private producers, the economic situation of grassland states, the IUCN-World Conservation Union bison action plan, bison ecological interactions with other species, disease, and wood bison conservation. The meeting featured talks on how to restore bison as an ecologically sound food source and on the history of the destruction of the great bison herds. Discussions and working-group sessions reinforced the fact that a wide range of stakeholders want to collaborate on bison conservation.

The Wildlife Conservation Society sponsored this meeting in an effort to start a truly international initiative with a breadth of representation and expertise. Realizing that ecological restoration is not a straightforward proposition, and that it can vary by herd size, ecosystem, land use, human futures, genetics of animals in the wild and in captivity, and politics, WCS wanted to create an

In 2005, WCS revitalized the American Bison Society with the objective of working with partners to achieve the ecological restoration of bison.

In 1907, WCS shipped 15 of the Bronx Zoo's bison to the Wichita Reserve Bison Refuge in Oklahoma.



WCS

opportunity for open dialogue on the many facets of bison conservation that are outlined in this working paper.

The American Bison Society's conservation initiative is long-term, large-scale, international, multi-purpose, and inclusive of many stakeholder groups: ABS works with bison ranchers, Native American managers, federal and state agencies, conservation NGOs, and natural and social scientists from the US, Canada, and Mexico. ABS will engage in high-leverage activities and facilitate work with a broad range of partners to build the scientific and social bases to achieve the ecological restoration of the North American bison.

Bison are back, but with multiple perspectives on the meaning of bison conservation and the value of bison now and in the future. These include the cultural role of bison for Native Americans; the cultural value of bison for Americans as a symbol of the Western past; the economic value of bison for private producers; the economic value of herds for rural communities; the ecological value of bison and bison behavior for biological communities; and the existence value of the species itself. The complexity and subtlety of the issues, and the diversity of perspectives, must be respected going forward. Most importantly, just as the American Bison Society in 1905 acted at a critical time for bison, so in 2007 we are in a strong position to set a course for the next 100 years so that our successors look back and consider this initiative as having been pivotal for the ecological conservation of this majestic species.

This working paper is a summary of presentations and discussions at the Denver meeting. It provides snapshots of the plenary presentations and the results of the five breakout groups. We hope it will be valuable in sharing the meeting with those who were unable to attend and in reminding all of us of the vital nature, and substantial challenges, of achieving the ecological restoration of North American bison.

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PART 2
FACETS OF BISON
MANAGEMENT AND
CONSERVATION AFFECTING
LONG-TERM ECOLOGICAL
RESTORATION

2.1 Genetic Considerations: American Bison – the Ultimate Genetic Survivor

Jim Derr

Associate Professor of Veterinary Pathobiology, Texas A&M University

Natalie Halbert

Assistant Research Scientist, Department of Veterinary Pathobiology, Texas A&M University

The recent discovery that most bison populations contain evidence of domestic cattle genetics has led to an increased concern for the long-term conservation of this species.

Conservation biology is sometimes viewed as a “crisis discipline” because most species of interest are critically threatened in some way. However, the recovery of North American bison (*Bison bison*) is one of the best documented success stories in conservation biology. Bison suffered an infamous population bottleneck that lasted from the early-to mid-1800s to about 1905 when animal numbers were reduced from millions to less than a few hundred distributed across North America in small and severely fragmented populations. The disappearance of bison is often blamed on “buffalo” hunters, but a more complex series of events devastated the bison herds. For example, extreme and unusually harsh weather conditions for nearly a decade in the 1870s, exotic livestock diseases imported from Europe and Africa, and competition for resources with increasing numbers of imported domestic grazers clearly had a major impact on the great bison herds.

Regardless of these issues, most modern bison populations appear to be relatively free of fitness-related problems usually associated with severe population bottlenecks and, for the last 50 years, their recovery has seemed assured. However, the recent discovery that most bison populations contain evidence of domestic cattle genetics has led to an increased concern for the long-term conservation of this species. In fact, a second recovery of bison appears to be underway that is centered on the genetic history and lineage of specific populations.

We have recently completed a series of comprehensive studies examining genetic diversity and evaluating the genetic integrity of major bison populations across North America. These studies focused on the genetic recovery and long-term conservation of bison germplasm. Some of the significant findings from these studies include:

Overall Genetic Diversity. Despite the historic bottleneck, bison have similar levels of genetic variation compared with other mammals and clear differences in genetic variation and diversity exist among the US-federal and some state and private populations. These genetic relationships, as defined by molecular genetic markers, are generally consistent with known population histories. In most populations examined, levels of genetic diversity revealed no significant issues with inbreeding; however, at least one exception has been identified. Unfortunately, this level of population genetic investigation has not been completed for many Canadian and Mexican bison, whether federal, state, or private herds, and these indices are generally unknown for these populations.

Introgression with Domestic Cattle. The hybridization experiments conducted by some of the owners of the five foundation herds of the late 1800s

have left a legacy of a small amount of cattle genetics in many of our existing bison herds. Domestic cattle introgression is widespread, but at low levels in US-federal herds and in US-state and private populations. These studies were based on mitochondrial DNA and nuclear microsatellite analyses. Exceptions include the bison herds at Yellowstone National Park and Wind Cave National Park where no evidence of cattle genetics has been detected. In addition, we did not have enough samples from Grand Teton National Park and there are not enough total animals in the Sully's Hill National Game Preserve herd to have a reasonable statistical chance of finding cattle markers. Nevertheless, the lineage history of both of these herds includes animals from hybrid herds. All private and state bison herds we have investigated (over 100) have evidence of nuclear and/or mitochondrial introgression from domestic cattle with the exception of the private Castle Rock herd on the Vermejo Park Ranch in New Mexico. Additionally, the Henry Mountains bison herd in Utah may be free of cattle introgression based on its reported unbranched lineage to Yellowstone NP and a limited number of DNA samples tested (> 50 animals). This finding should be confirmed. Finally, a number of recent efforts are underway to establish new herds using genetically defined animals that were culled from these private and public populations.

Important Genetic Considerations for the Second Recovery of North American Bison. Clearly, the ability to identify bison populations with hybrid ancestry provides information to make responsible conservation decisions regarding the introduction of animals into bison populations that have no evidence of past hybridization. A bison population with domestic cattle introgression requires that it be handled differently in long-term conservation and ecological efforts. However, this does not dismiss important contributions such as unique genetic attributes and diversity represented by those herds. The second bison recovery, over the next decade, will primarily involve establishment of new populations from populations with high and/or unique levels of genetic diversity and a relatively small chance of contamination with domestic cattle genetics.

North American bison represent an ultimate genetic survivor given the fact that they have endured multiple insults, including:

- multiple historic climatic periods with extreme temperature, moisture, and ecological changes;
- exposure to exotic parasitic, bacterial, and viral diseases from Europe and Africa that were introduced by imported species of domestic livestock;
- widespread habitat destruction, population fragmentation, and competition with imported grazers;
- one of the most dramatic population crashes and one of the best-documented population recoveries of any wildlife species;
- forced hybridization with another species.

Given all of this, for bison or any other species, one major consideration for their long-term conservation must be the preservation of their germplasm. If this germplasm is lost through extinction or genetic drift, or diluted and contaminated through extensive hybridization, it can never be fully recovered. Our understanding of the genetic bases of this “ultimate survivor” should serve as a model in the rescue of other threatened wildlife species.

2.2 Captive Populations: American Bison and Zoos

Sharon Joseph

Taxonomic Advisory Group for Bison, Buffalo and Cattle, Association of Zoos and Aquariums (AZA), and Director of Animal Programs, Houston Zoo

Zoos can contribute to a cooperative recovery and restoration effort for the American bison.

There is a long and rich history of American bison in zoos, dating back to 1887 when famed naturalist William Hornaday was instrumental in obtaining a few animals for what later became Smithsonian's National Zoo. Hornaday went on to become the first director of the Bronx Zoo and bison were first displayed there in 1899. Bison have continued to be important collection elements at both zoos. Today, there are approximately 500 bison displayed in more than 80 zoos in the United States.

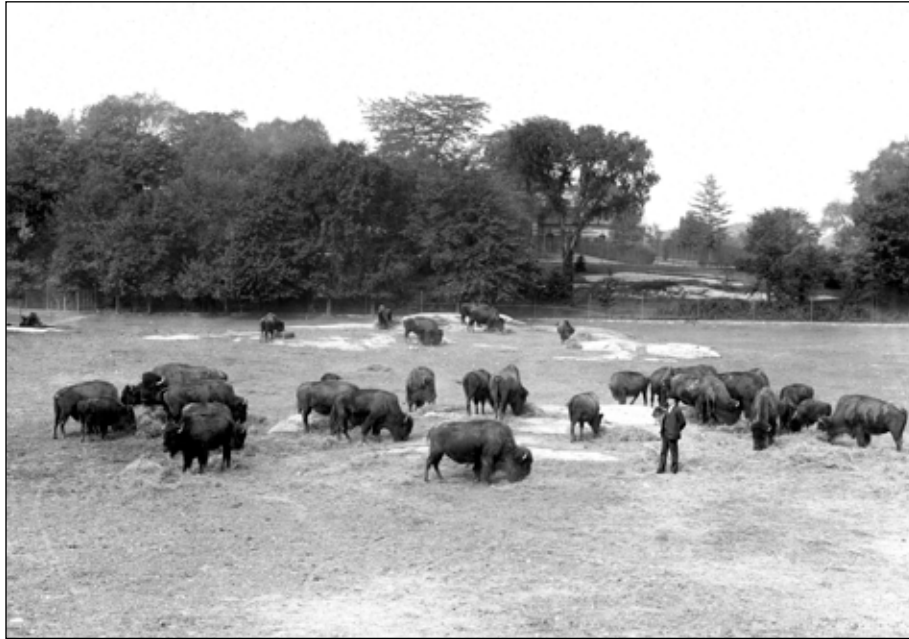
The Association of Zoos and Aquariums (AZA) was founded in 1924 as a non-profit organization dedicated to the advancement of animal care, wildlife conservation, education, and science in zoos. The AZA oversees many cooperative management programs, including Species Survival Plans (SSPs) and Taxon Advisory Groups (TAGs).

The Species Survival Plan program began in 1981 to manage breeding of selected high-profile species in order to maintain healthy, self-sustaining populations with genetic and demographic diversity. There are currently 107 SSPs covering 161 species. Established in 1990, Taxon Advisory Groups examine the conservation needs of entire taxa, or groups of related species. There are currently 46 TAGs that cover groups of invertebrates, fish, birds, mammals, reptiles, and amphibians.

The AZA Bison, Buffalo, and Cattle Taxon Advisory Group was formed in 1992 to address captive management issues for wild cattle species and to support both *in situ* and *ex situ* conservation efforts. Thirteen species of wild cattle are covered under this TAG. The goals of the TAG are to:

- support programs for wild cattle;
- maintain genetic and demographic reservoirs in the captive populations that may eventually provide animals or gametes to bolster wild populations;
- increase knowledge of natural history, husbandry, and behavior of wild cattle;
- serve as a resource for information on the status, management, and conservation of wild cattle species in nature and in zoological institutions;
- promote research that will enhance the well-being of captive wild cattle;
- foster links and provide logistical and/or financial support for *in situ* efforts;
- coordinate TAG efforts with other applicable conservation groups;
- promote public education programs that highlight wild cattle species and habitat conservation. More than 143 million people visit AZA zoos annually. There is a tremendous opportunity here to educate the public about bison and bison habitat recovery efforts.

A project to ensure the ecological future of the American bison is consistent with the core goals of this TAG. The future of bison is by no means assured and it will certainly never return to its original status as a prominent landscape feature on this continent. But zoos can contribute to a cooperative recovery and restoration effort for the American bison as outlined above and would welcome the opportunity to do so.



WCS

**The Bronx Zoo's bison herd,
October 1907.**

2.3 Disease Status of Bison in North America

Keith Aune

Research and Technical Services Section Supervisor, Montana Department of Fish, Wildlife and Parks

Successful restoration projects must embrace regulatory steps necessary to establish healthy conservation herds.

Early in the history of bison restoration disease issues were not considered important and bison translocations proceeded with limited concern for pathogen transfer. As a consequence of these failures to guard against the translocation of diseased bison, modern restoration projects must overcome historical baggage of “disease fear.” With the development of an extensive and aggressive domestic animal disease control program in North America during the mid- to late 1900s, the implication of disease to wildlife restoration has increased. Globalization and a highly mobile society are also increasing the likelihood of pathogen transfer across continents, thereby intensifying the vigilance of animal disease control programs. Efforts to conduct bison restoration in the future will have to consider the significance of disease. Unfortunately, disease issues often trump conservation interests, especially when the conservation actions are likely to come in direct conflict with powerful agricultural industries. This will likely mean careful selection of source stocks, extensive testing and screening of source herds, health monitoring of herds, and regulatory involvement in the process of translocation and restoration. Successful restoration projects must navigate around disease issues and embrace regulatory steps necessary to establish healthy conservation herds.

The key disease categories that need to be considered (see table below) in bison restoration are: foreign animal diseases, regulatory diseases, and diseases significant to livestock but not regulated. A foreign animal disease will cause significant impact to restoration and agricultural activities in any jurisdiction. A government response network is already available to address these diseases. This response network typically involves agriculture, wildlife, and public health agencies. Any such event would halt restoration efforts and stop movement of individuals from infected source stock. Regulatory diseases, on the other hand, are more manageable. Although they are significant, tests, management protocols, and effective control measures exist for many of these diseases. However, each disease presents unique characteristics and challenges. There have been many historic efforts, some successful and some not, to control and eliminate these types of diseases in bison.

The science behind wildlife disease issues is improving but more work is needed. Considerable research is needed to establish or improve quarantine and testing protocols for movement of animals to assure that healthy bison are used for restoration. It is also important to accurately and reliably establish the health background of source herds and of wild and domestic animals within restoration areas to be certain that reintroduction will not introduce disease or exacerbate existing diseases. Agricultural interests will be closely examining bison restoration efforts and utmost attention should be given to communicating disease prevention and health protection measures to these sectors. Real or perceived impacts of diseases to agriculture will be major impediments to res-

toration. To mitigate this, modern approaches to monitor bison health should be used and advanced and regulatory health officials should be integrated into restoration efforts. Communications should be established with key animal health organizations such as the U.S. Animal Health Association or Wildlife Disease Association to ensure that the best health information is openly discussed and shared with affected groups and individuals as it relates to restoration of bison.

Some diseases that may have implications for bison restoration:

Disease	Restoration is Prevented	Significant Impediment to Restoration	Medium Impediment to Restoration	Manageable
Any foreign animal disease	√			
Anthrax	√			
Tuberculosis	√			
Brucellosis		√		
Malignant catarrhal fever (MCF)			√	
Johnes			√	
Respiratory Diseases (e.g. BVD, IBR, BRSV, PI3, Bacterial)			√	√
Endoparasites				√
Ectoparasites				√
Other bacterial/viral infections				√

2.4 Ecological Role of Bison in Grasslands: Managing Bison and Fire Together at Increasingly Larger Scales

James H. Shaw

Professor in Conservation Biology and Wildlife Ecology, Oklahoma State University

Although historical estimates of bison abundance likely contain serious errors, the Great Plains once supported nomadic populations of bison numbering somewhere in the millions. Anthropogenic fires were common, and no doubt influenced bison movements and improved forage quality. By combining our knowledge of pre-settlement bison populations with modern field studies, we can make reasonable inferences regarding the capacity of the Great Plains to support restored bison populations at higher scales in the future. Prescribed fires, applied under the patch-burn model, improve grazing conditions for bison and can restore overall biodiversity in grassland areas. Together, bison-grazing behavior and prescribed fires create shifting mosaics of grasses at the landscape level. Invasion of woody vegetation is hampered and species like deer mice (*Peromyscus maniculatus*) and black-tailed prairie dogs (*Cynomys ludovicianus*) are favored. As prairie dog populations expand, other species, including the endangered black-footed ferret (*Mustela nigripes*), and, to varying degrees, burrowing owl (*Athene cunicularia*) and the swift fox (*Vulpes velox*) will have new opportunities. It is possible that the bison's effect on the land results in an overall richness and diversity of tall-grass species, which would benefit endangered grassland birds. Studies have shown that bison grazing and enhanced grass diversity have resulted in an increase in grasshopper diversity. Historically, bison interacted with other native species as prey for predators, scavengers, and decomposers. Although more studies need to be done, there is evidence that bison were important ecological keystones.

As the scale of bison operations increases, the species' gregariousness will cause shifts in its spatial impact on other biota. The most likely outcome of this shift will be the creation of further habitat patchiness over larger scales. At truly large scales, seasonal prescribed burns can be done to trigger bison migration, enhancing opportunities for nature tourism.



Prescribed fires restore grassland biodiversity and improve grazing conditions for bison.

Terry Bidwell/Oklahoma State University

2.5 Cultural Role of Bison

Dick Baldes

Founder and Board Member of the Wind River Alliance, Wyoming; Member of the Eastern Shoshone

Whether they're the *tatonka* of the Lakota, the *bozheena* of the Shoshone or *hii3einoon* of the Arapaho, bison have played a tremendously important cultural role for many Native Americans, First Nations peoples in Canada, and native peoples in Alaska. A recent South Dakota newspaper reported that a rare white buffalo was born on a farm in Wisconsin. The white buffalo is "big medicine" and brings good fortune and peace to native people. It means a tremendous amount to native peoples. In the native prophecy, it is said that the white buffalo will reunite the races of man and restore balance to the world. In its lifetime, its coat will turn from white to black to red and yellow; the colors of the various races of man. It then turns brown. The changes signify a circle, which native people often use in their emblems.

The bison was the most numerous and important animal in the Great Plains at the start of the 19th century. For Native Americans and First Nations bands, their economy, lifestyle, social ceremonies, and religious rituals – their entire culture – was buffalo-oriented. To imagine the impact of the destruction of the bison on native people, consider this modern analogy: Today, if we told everyone in a U.S. city that there was no more fuel to get them from place to place and provide their resources, it would be impossible for them to cope or provide for themselves.

In 1872, President Ulysses S. Grant appointed General Francis Walker as commissioner of Indian Affairs, and he summed up what was happening: "Each year's advance of our frontier takes in a territory the size of some of the kingdoms of Europe. We are made richer by millions of acres of land and the Indian poorer by the loss of a large portion of what he had. This growth is bringing imperial greatness to our nation: to the Indian it brings wretchedness, destitution, starvation." With this movement came the deliberate destruction of the buffalo.

But that is the past. Most of us want to see more bison in Mexico, the U.S., and Canada, and wood buffalo in the Yukon. At Wind River, there are large expanses of habitat where bison could be introduced. There are several hundred thousand acres in the Wind River Mountains and several hundred thousand acres in the Owl Creek Mountains where herds of bison could roam. The Wind River Reservation could conceivably harbor more bison than there are currently in Yellowstone National Park. We have started negotiations toward such a reintroduction.

School children at Wind River celebrate "buffalo week" every year. They honor the buffalo for his role in the preservation of native people in the past, present, and future. At the end of the five buffalo days a parade involving the kids, teachers, elders, councilmen, and the community is held. Nutritional aspects of bison meat are important, too. Historically, native people did not suffer from diabetes, but now it is rampant on most reservations. Buffalo meat is a healthy substitute for foods that cause diabetes.

For Native Americans and First Nations bands, their entire culture was buffalo-oriented.

Free-ranging wild herds of buffalo could be managed similarly to other wildlife for the benefit of the public on some of the millions of acres of federal lands. At Wind River, we want to reintroduce wild, free-ranging buffalo: No ear tags, no corrals, no round ups. They should not be treated as livestock because they are wild animals and should be treated like other wildlife. Our goal is to establish herds that are as genetically pure as possible and disease-free. We can bring back respect for the buffalo.



Julie Larsen Maher/WCS

2.6 Role of Ranchers and Private Lands

Tom Olson

Senior Partner of the law firm of Olson Lemons LLP, and bison rancher in four environmentally sensitive areas: Bragg Creek, Waterton, Milk River Ridge, and the Cypress Hills, Canada

The ecological future of bison will necessarily entail private ranchers and land owners. Following are three major areas of intersection between private ranch lands and the ecological restoration of bison where private land owners can play a stronger role.

The first is the fact that government agencies and NGOs, by the natures of their organizations, are limited in their ability to achieve large-scale ecological recovery of bison. Ecological restoration requires large landscapes. That is a challenge to government agencies because, while they may have control of large plots of land, they do not manage enough parcels within all regions of the bison's historical range to make it truly meaningful. Much of the land between national parks and wildlife refuges is allocated to economic and political interests that are not easy to dislodge. Working with private land owners would help build a mosaic of public and private land that would cumulatively support bison.

Beyond the land issue is funding: Government funding is fickle and reliant on the next budget. Government agencies, by their design, are slower bureaucracies. NGOs are more flexible in their funding, but are challenged by fundraising for ongoing operations and have a limited land base. Further, there is clear political risk if NGOs acquire too much land.

What can bison ranchers bring to the initiative? We bring millions of acres of habitat that are already paid for, and, of course, hundreds of thousands of bison. We have expertise in keeping costs lean and operations under control. We can act quickly and decisively.

To give you one ecological rancher's perspective, my family started with one bison ranch. Over time, we bought four ranches in ecologically sensitive areas. One in Milk River Ridge was native fescue grasslands that had been highly damaged over a century of cattle grazing. We replanted it with native grasses and, over time, several hundred acres have been restored. We then expanded to another ranch in Cypress Hills, Saskatchewan. About half of that ranch was in grain production. We took it out of production and replanted native grasses. We also purchased land adjacent to Waterton National Park that had been damaged by excessive grazing and much of the area had been contaminated with invasive species. By managing free-ranging herds, we try to mimic historic bison grazing patterns and the health of that range has been restored quite dramatically. We have seen that bison are a restoration tool for native prairie. Our greatest success has been in fescue ecosystems where bison winter grazing can arrest and reverse the spread of invasive grasses.

Our story is just one, but there are potentially thousands of ranchers who take the health of bison ecosystem seriously. Alberta has five million acres of private bison ranch lands – potentially restorable land. To put that into perspective, Elk Island National Park is 45,000 acres and Old Man on His Back is 13,000

Working with private land owners would help build a mosaic of public and private land that would cumulatively support bison.

acres. In addition, there are about five million more acres in lease available for bison grazing to private landholders in Alberta. As we encourage ranchers and First Nations to ranch ecologically, we have the potential to engage millions of bordering acres for bison restoration without raising additional money.

Some challenges for ranchers in contributing to overall ecological restoration are getting stock and remaining economically sustainable. My family tried to get stock that originated from the National Bison Reserve or Yellowstone. As the herd grows, we hope we can learn more about better lineages. To be economically sustainable, my family started a meat company for free-range grass-fed bison. This small market grew and the meat is served in restaurants and sold in natural food markets.

We can reintroduce bison into our agricultural economy. Bison herbivory on native grasslands is more practical and economical than beef herbivory. Bison do well feeding themselves in winter, they require low-protein native grasses, and they require no help in calving. By supporting the sale of bison, we support private bison conservation by providing economic sustainability. As we find more economic incentives for meat sales, we can encourage other ranchers who currently may not be able to manage at ecological standards to do so. There are several trends that will help sell bison as a viable food and viable agricultural option: 1) bison is a healthy meat; 2) we are riding an organic trend and bison qualify as organic; 3) there is a trend to consume locally-produced food; and 4) bison can be environmentally sustainable. We have chefs tour our ranch twice a year and they are pleased with the environmental picture they see, and, in turn, promote the use of free-range grass-fed bison in their work.

Among some NGOs and agencies, there is a fear that ranchers and the private sector cannot be trusted in the long term and will abandon conservation for profits. But there are many cattle ranches that have been held in certain families for generations with economic losses, so profit is not necessarily the only motive in the ranching community. With this in mind, we could establish a great ecological tradition among private bison ranchers that is economically sustainable (and even potentially profitable).

To get more ranchers thinking along ecological lines, we need to collaborate on education and training. Government agencies and NGOs could help bison ranchers by promoting bison consumption and incentives for bison ranching. Finally, agencies can help by sharing advice on land management and NGOs can be more collaborative, particularly in the political scene. Together, we can encourage ranchers, including cattle ranchers, to ranch in an ecologically sustainable manner.

2.7 Economics of Grasslands States: A Bison Economy?

Ray Rasker

Executive Director, Headwaters Economics, Montana

It is well known that the Northern Great Plains is in economic trouble. Could the restoration of bison to the prairies, with all the attendant wildlife and open space protection that it entails, offer some hope for the restoration of the economy as well? Recent lessons from the West offer some insight.

The economy of the American West has undergone a remarkable transformation in the last three decades: A once-popular bumper sticker said, “True Wealth comes from the Ground,” but the economy seems to have shifted to nature-loving “footloose entrepreneurs.” In this reincarnation, the West is driven by mobile professionals and retirees who value the land not as a repository of raw materials to extract, but as a place to live and enjoy. The new hope (in this over-simplified view) is that the protection of open spaces and wildlife will create a setting attractive to people and their businesses. It is an optimistic view where conservation and development are complements, not competitors.

To understand whether such a transformation could take place in the Northern Great Plains of Montana, it is useful to follow the economic changes that have taken place in the West and in the nation. There are two important, nationwide economic and demographic trends that affect how conservation and economics may intersect. The first is the changing nature of goods production, where the factory may be in India, the management of the company in New Jersey, and employees and sub-contractors scattered throughout the world. In this new global economy, where the “assembly line” is no longer in one place, people with the skills can now live where they want. This means an engineer selling services to a French auto maker may live in Moab, Utah. The sales department of a Boston shoe company (with the shoes made in Brazil) can be located in Bozeman, Montana so that the employees can enjoy fly-fishing and skiing. As one owner of a former East Coast engineering firm put it, “We looked all over the West for places that were within an hour’s drive of good hunting, hiking and fishing.” In this view of the West, the environment is a setting that attracts and retains entrepreneurs.

The second important trend is the aging of the population, with an expected 22% of the population over the age of 65 by the year 2050. We are no longer a young country and, just as many workers and companies are able to locate almost anywhere, so have retirees become more mobile. One of the fastest sources of population growth for small towns in the West is the “equity refugee.” These are retirement-age people who have built up equity in their homes in the cities, sell those assets, and move to the country to enjoy its beauty.

Theoretically, it could be argued that the restoration of the prairies and herds of viewable bison would create the types of amenities that entrepreneurs, knowledge workers, and retirees seek. While this is appealing at first blush, further investigation of the conservation-economy in the West reveals that although environmental amenities are a necessary condition for economic development, they are not sufficient. Also necessary is ready access to markets,

For bison restoration to play an economic role, we need to think of solutions that are unique to the economy of the prairies.

primarily via air travel. In other words, although the engineer may be able to live in a picturesque rural town surrounded by wild country, she still needs to board a plane from time to time to visit with clients, her employer, and suppliers. An analysis of the commercial airports in the Northern Great Plains, as well as the travel time to those airports, shows that the prospects of attracting amenity migrants are limited to just a handful of places.

For bison restoration to play an economic role, we need to look beyond what has recently transformed the economy of the West, and think of solutions that are unique to the economy of the prairies. Although the amenity-business-migration model will work in selected instances, a bison economy will have to be a multi-pronged approach that also consists of: attracting retirement and investment income (currently 40% of the economy of the Northern Great Plains); converting subsidies for food production into subsidies for wildlife production; tourism (likely limited to places with transportation facilities); bison production as agricultural commodity; purchase and management of large ranches by conservation organization and fish and game departments; restoration of bison to tribal lands; attraction for artists, writers, and movie makers; and growth in bison-related employment in federal and state land management agencies. In the end, the cumulative effect of all of these economic activities could translate into a bison economy.

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2.8 Bison as a Food Source: Linking the Recovery of Free-Ranging Bison to Habitat Restoration and Diversified Food Production in Bison Nation

Gary Nabhan

Director of the Center for Sustainable Environments, Northern Arizona University, and co-founder of Native Seeds/SEARCH and the Renewing America's Food Traditions consortium

Bison have not only been an ecological keystone in the grassland biome of North America, they have also been a cultural keystone for many indigenous communities in the region. By recovering free-ranging bison on large landscapes, they will again influence the patch dynamics and plant diversity of the region. Bison will not be the only harvestable product from this wild ecosystem; a number of historically important food plants will also increase in abundance should buffalo wallows, browsing pressures, and historic fire regimes reestablish themselves. At least two dozen plants of historic and economic significance would no doubt increase in abundance. Among them could be prairie turnip, American groundnut (*Apios Americana*), and purple poppy mallow (*Callirhoe involucrata*). A wild game species that would benefit from prairie restoration is the prairie chicken (*Tympanuchus cupido pinnatus*). Bison meat and several of the wild food plants associated with bison browsing and wallowing have the added value of helping to control and prevent adult-onset diabetes now afflicting the peoples of Bison Nation. The Renewing America's Food Traditions (RAFT) Consortium is now working to envision a diversified regional food system based on bison and its ecological associates. This mirrors similar refocusing of native food sources in other ecosystems, or nations, such as the Salmon Nation in the Pacific Northwest. The prospects for viable food resources based on native game and plants are better in Bison Nation than any other North American landscape. This is possible if conservation biologists, tribal activists, restorationists, chefs, marketers, and economists can find ways to collaborate that build on their shared values and collectively elaborated goals. For further information on the Slow Food Movement, which promotes locally-produced goods, visit: www.slowfoodusa.org. For further information on sustainability science, please visit www.environment.nau.edu.

The Renewing America's Food Traditions (RAFT) Consortium is working to envision a diversified regional food system based on bison and its ecological associates.

PART 3

MULTIPLE PERSPECTIVES ON CURRENT AND FUTURE BISON RESTORATION

3.1 InterTribal Bison Cooperative

Mike Fox

Manager of Fort Belknap herd, Council Member for InterTribal Bison Cooperative (ITBC), and former Interim Director of ITBC

ITBC is working on a health initiative to emphasize the healthy aspects of bison meat for native people whose communities suffer from diabetes.

The InterTribal Bison Cooperative (ITBC) was formed in 1992 by 11 tribes who had buffalo herds, with the idea of increasing the number of herds on tribal lands. Now we have 58 member tribes in 19 states. The ITBC membership is diverse and ranges across the country, which is one of our greatest strengths: the political impact that we can bring to the stage to deal with buffalo and related issues. Indian tribes are in a unique position to increase the land base available for buffalo. The tribes represented by ITBC represent 20 million acres. Even if one took just a quarter of that, it adds up to large amounts of acreage that could potentially be used for bison grazing. One example is Fort Belknap, where we have a relatively small reservation of about 700,000 acres. We have about 600 bison on 14,000 acres. And there are an additional 400,000 acres of grazeable land that are currently leased to cattle ranchers.

ITBC provides a variety of technical services to member tribes. The staff includes a wildlife biologist and will include a rangeland ecologist. ITBC is working on guidelines to overcome herd management lapses and retain lessons learned.

ITBC works on marketing buffalo meat. Originally, ITBC started bringing bison back for use in pow wows and other traditional uses, but as the herds grew, the cost of keeping them needed to be offset by selling them. Due to cultural considerations and varying viewpoints among tribes regarding bison, the marketing aspect of ITBC is slightly contentious within the cooperative.

ITBC is working on a health initiative to emphasize the healthy aspects of bison meat for native people whose communities suffer from diabetes. Buffalo meat is low fat and high protein. The health initiative will get buffalo meat back into the communities. So far, 45 tribes have signed up.

ITBC works on outreach and education. We have been generations without buffalo so we actually have to work on cultural education for some of the younger generations. We sponsor cooking demonstrations because some tribal members are not familiar with the varying meat qualities and want to hunt the large bull, when actually the meat is much better from a two- to three-year-old animal.

ITBC funnels federal funding to tribes and also distributes surplus bison from Wind Cave and Badlands National Parks: We take competitive proposals from our tribes and whoever needs the animals the most gets them. In 2006, 300 buffalo went all over the country – to the Kalispell Tribe in Washington, the Mesa Grande tribe in California, and the Modoc tribe in Oklahoma.

I am interested in the potential of the ITBC to help tribes find funding to support a transition from cattle leases, which provide a lot of income, to managing buffalo. It is really great to see the cultural impact of buffalo. When people are able to use the skulls in the Sundance ceremony, the hides in the singings, and the robes in the fasting and Vision-seeking – after 150 years of not having access

to that – it is moving. I’ve seen people’s lives changed by working with bison. People that you thought would never have a real connection to anything change once they start working with the buffalo. Once we get more animals back on the ground, we believe it will bring back the physical health of the people, and also the cultural and spiritual health.



Julie Larsen Mather/WCS

3.2 IUCN-The World Conservation Union: Status and Action Plan for Bison

John Gross
National Park Service, Ft. Collins, Colorado

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Faculty of Environmental Design, University of Calgary, Canada

The IUCN Status and Action Plan for North American Bison emphasizes the importance of maintaining the wild nature of bison.

The IUCN-World Conservation Union is the world's largest conservation network, bringing together 82 states, 111 government agencies, and more than 800 non-governmental organizations (NGOs). The Union's mission is to influence, encourage, and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. The IUCN oversees the production of conservation plans for species or groups of species, and it is responsible for creating and maintaining the well-known Red List of Threatened Species.

The North American Bison Specialist Group (NABSG) is charged with drafting the IUCN Status and Action Plan for North American Bison. The NABSG consists of more than 60 registered members and numerous collaborators (www.notitia.com/bison/). The Status and Action Plan will be a strategic document on the status and conservation of bison in North America. It will provide a concise, authoritative review of the history, biology, and ecology of the two modern North American bison subspecies, plains bison and wood bison, and their current numerical and geographic status in Canada, Mexico, and the United States. It offers science and practice-based guidelines for management and restoration of populations and conservation of the genetic integrity of these subspecies. The document emphasizes the importance of maintaining the wild nature of bison and restoring populations, where feasible, where bison are an integral element of intact ecosystems, interacting with other native species, filling other ecological roles, and behaving as bison would under natural conditions. Local community support is an important component as well.

Recommendations and guidelines in the Plan specifically target managers of herds that will contribute to bison conservation. Guidelines apply equally well to public and private herds. The Plan acknowledges the special historical and cultural ties between native peoples and bison and encourages the support of aboriginal and other local and rural communities in contributing to bison conservation and to ecosystem restoration and sustainability.

Contributing authors have produced drafts of all major sections of the Plan. Remaining phases are to conduct a comprehensive internal review of individual chapters and the entire Plan, and a final external review of the Plan under auspices of the IUCN office. The Plan will be available for review in 2007.

3.3 Perspective from Mexico

Rodrigo A. Medellín

Professor of Ecology, Instituto de Ecología, Universidad Nacional Autónoma de México, and Adjunct Professor, Columbia University

Mexico faces severe economic and social challenges that compound its already serious environmental threats, especially those to biological diversity. The country has made two types of major investments on land tenure for conservation: the protected areas system, managed by the federal government, and the units of wildlife management and conservation (UMA) system, managed by land owners.

The protected areas system: Although Mexico's protected areas have a long history (its first national park was created in 1917), the nation did not have a specific policy to protect large land tracts until about 1978. At that time the Mexican model of biosphere reserves was established. The biosphere reserve model involves large land areas, with identified high biodiversity conservation values or defined ecosystem services, and zoned with a core and a buffer area. In 1995 several other categories of protected areas (less restrictive) were established. Twenty-eight years later, Mexico has about 150 protected areas for a total of about 19 million hectares (47 million acres): 35 biosphere reserves with 11 million ha, and 28 areas of protection of wildlife with 6 million ha, for a grand total covering 10% of Mexico.

The UMA system: In 1995 the federal government decided to make a radical modification to the policies regulating land management and access to wildlife. Land owners became partners with the national government for conservation and wildlife management by establishing a management and recovery plan for their land. They also become entitled to a harvest quota of specific species. This system grew and today there are 5,000 UMAs that represent 25 million hectares (61.7 million acres), or about 13% of Mexico.

The distribution of the bison is marginal in Mexico, and a single population exists in northern Chihuahua, where it has been known for the past 10 years. The transboundary Janos-Hidalgo bison herd in Mexico migrates between Chihuahua, Mexico (where it is considered an endangered species), and Hidalgo County, New Mexico (where it is considered livestock). These bison are a top priority for conservation according to the IUCN because they represent a fourth separate North American herd and the southernmost distribution of the species. This herd is within the limits of a new 200,000 hectare biosphere reserve that is currently in proposal before the new federal government, and the presence of bison is one of the key points in support of the creation of the biosphere reserve. Private lands adjoin this reserve, several of which are registered as UMAs, so additional conservation efforts can be launched in collaboration.

Much remains to be known of bison in Mexico: their original historic distribution, the genetic profile of the Chihuahua population, its movements, threats, and conservation needs. An international team is collaborating to address these needs. Although the bison is currently under the lowest protection level of the Mexican legislation and no recovery team has been established in Mexico, there are many alternate ways to promote its conservation at the continental level. Foremost of these are the Trilateral Committee for Wildlife and Ecosystem Conservation and Management, and the Commission for Environmental Conservation (CEC).

The transboundary Janos-Hidalgo bison are a top priority for conservation because they represent a fourth separate North American herd and the southernmost distribution of the species.

3.4 National Bison Association

Dave Carter
Executive Director, National Bison Association

The National Bison Association is a producers' group, and an incredibly diverse group. Members of the National Bison Association are perceived to be mostly private landholders, but there are other interests represented in the organization, like the Intertribal Bison Cooperative, some of The Nature Conservancy properties, Custer State Park, and Antelope Island.

From the landholder perspective, bison ranching and production is an incredibly diverse business. At one end of the spectrum there is one particularly well-known individual with 42,000 bison. At the other end of the spectrum there are hundreds of members who have taken their life savings, bought a couple hundred acres and 20 or 30 animals, and sell meat at local farmers markets or via the Internet. But the one thing that connects all of those folks is the majesty of this animal. For example, throughout the 25 years that I worked for the general farm organization, I never thought of starting a cattle herd. But now I do have a few bison heifers. Anyone who has spent time with bison knows there is just something about being with this animal that speaks to our spirit, speaks to our heritage and independence. So even though we have some lively discussions within the NBA, a love of the animal is something we have in common.

*Long-term
bison conservation is an
opportunity for
collaboration.*

Long-term bison conservation is not just about the critically important conservation herds. It is also an opportunity for collaboration with private landowners and ranchers. The private landowners played an important historical role in the restoration of bison numbers – although, of course, it has not been perfect. At the turn of the century, it was private landowners that helped save the bison. Since then, bison numbers have gone from a couple thousand to approximately 500,000 across North America.

Bison are playing a strong role in reconnecting consumers with their food sources: People are rediscovering that bison is part of a healthy diet. One of the catch phrases in the agricultural world is “sustainable agriculture.” The root of that word is sustenance – bison were sustenance for the original Americans and can become sustenance for people wrestling with obesity or diabetes. In 2005 we processed under federal inspection 35,000 bison. That was an increase of 19% from the previous year. By October 2006, the number is already 23% above that. To put that in perspective, the cattle industry processes 125,000 individuals on a typical day. But we do not want bison to become just another commodity, like most beef cattle.

In the American food supply system today, people are disconnected from their food sources and we have developed an attitude that food should be fast, cheap, and convenient. Through bison production, the slow food movement, and the chef's collaborative, Americans are rediscovering that food is fuel not just for the body but also the soul. It helps us connect to the bigger picture of how land is used. As we go forward, there is a great opportunity for those ranchers to raise bison as food, but manage them ecologically.

Several years ago, there was a controversy in the western communities caused by the Poppers and their idea of the Buffalo Commons. Interestingly, a group of landowners across the High Plains have formed the Oglala Commons to look at whether agriculture of the High Plains is sustainable. Here you have to dig hundreds of feet in the ground to get up water to irrigate corn that needs to be subsidized in a food system where the average ounce of food travels 1600 miles from where it is grown to where it is consumed. More and more ranchers are looking at how to break out of the mold of unsustainable and subsidized agriculture and get back to something better. Bison play a role in that.

There will be a lot of political discussions coming up regarding public lands, particularly the Farm Bill. Creating incentives for conservation programs, land management, and local food systems is something we'd like to see gain ground over subsidies for corn and soy. NBA has drafted the Bison Restoration Incentive Act, which would provide some incentives to promote sustainable bison production.

The NBA is a patchwork of perspectives on how to raise bison. There will always be producers who are raising bison as food to take into the marketplace, for which they actively manage their herds for consistent good taste and economic sustainability. But even those types of ranchers recognize that the bison and the land go together.

3.5 U.S. National Park Service

Michael Soukup

Associate Director for Natural Resources Science and Stewardship, National Park Service

The National Park Service will continue to support restoration of bison as a keystone species in North American ecosystems and as an important part of the heritage of North American cultures.

The American bison is crucially associated with our national parks. Bison grazing amidst the geysers at Yellowstone inspired the creation of the first national park in 1872. Bison now inhabit six national parks, and our management goals are not only to provide bison herds for the public to view and appreciate, but to keep our population of the nation's bison wild and subject to all the processes of natural selection.

The National Park Service is addressing the challenges of bison management with improved understanding on three fronts: bison genetics, disease, and behavior. All NPS herds have been subjected to DNA analysis. The results indicate that NPS bison herds contain important intra-specific variation and that some herds also show evidence of inter-specific hybridization. With this information we can better manage herds to retain important genetic variation, while ensuring the genetic integrity of bison not known to contain cattle genes. We can make surplus bison with valuable genetic variation available to others to supplement or establish herds that contribute to ecological recovery of bison. To do that with Yellowstone bison, we will need to make further progress in preventing transmission of brucellosis. In order to achieve this goal, NPS sponsored an international meeting on brucellosis, and we are collaborating with the USDA and with states to develop vaccines for the eventual elimination of brucellosis from Greater Yellowstone Area bison and elk. Restoring the selection pressures that favor breeding and survival of the hardiest animals is another way we insure the future of American bison. One of the many positive aspects of wolf restoration to Yellowstone and Grand Teton National Parks is their effects on ungulates, and in recent winters we have documented increasing predation by wolves on bison.

We support the collective vision of a future in which great herds of bison roam across vast expanses, without detecting agency boundaries. Accomplishing this will take better cooperation on public lands and strong partnerships with private land owners. The National Park Service will continue to support restoration of bison as a keystone species in North American ecosystems and also as an important part of the heritage of North American cultures. Our part is to insure that bison have not just survived, but remain an authentic part of the American heritage.

3.6 Parks Canada

Stephen Woodley
Chief Scientist, Ecological Integrity Branch, Parks Canada

Parks Canada has a long interest in bison conservation. One of the earliest efforts to conserve bison in Canada was the establishment of the National Buffalo Park in Wainwright, Alberta in 1909. This reserve held some of the last remaining wild bison rounded up from the Flathead area of Montana. The only remaining wild bison in Canada were in Northern Alberta. Wood Buffalo National Park was established in 1922 to protect the habitat of a small herd of wood bison whose population had dropped to less than 1,000 by 1900. Today, the 44,807 square kilometers of northern boreal interior plains landscape, located in the extreme north of Alberta and overlapping into the Northwest Territories, encompasses the largest free-roaming and self-regulated bison herd in the world. Now a UNESCO World Heritage Site, as well as Canada's largest park, Wood Buffalo National Park has the longest-standing tradition of native subsistence use by the people who continue to live, hunt, trap, and fish within the park's boundaries.

Elk Island has also played a historical role in bison conservation and has been the source of many re-introductions of both the plains bison and wood bison types. Bison from the Pablo herd were first transferred here in 1907 to what became Elk Island National Park. In 1965, a separate enclosure was established for the wood bison type, brought from the Narlying River areas of Wood Buffalo.

In Wainwright's National Buffalo Park, the population expanded beyond carrying capacity by the 1920s, so 6,673 plains bison were transported north to Wood Buffalo National Park. Unfortunately the introduced plains bison carried with them bovine tuberculosis (TB) and brucellosis. These diseases still remain at high levels in Wood Buffalo National Park and it is an ongoing issue for this herd, with calls to eliminate the disease through a program of depopulation followed by repopulation with disease-free animals. Because the herd ranges across boundaries, any resolution to this complex issue will require the coordinated action by federal, provincial, and territorial governments as well as the First Nations communities in the region. The Wood Buffalo herd has grown to almost 6,000 animals. The Government of Canada has decided to manage these diseases under the Canadian Wildlife Disease Strategy (www.cwsscfc.gc.ca/cnwds/index_e.cfm).

Parks Canada is committed to restoring bison populations to their former range in national parks wherever possible. In 2006, bison were successfully restored to Grasslands National Park in south Saskatchewan. Currently, Waterton Lakes and Banff National Parks are reviewing options for reintroductions.

Wood Buffalo National Park encompasses the largest free-roaming and self-regulated bison herd in the world.

3.7 Canadian Wood Bison Recovery

Nicholas Larter

Regional biologist working with the Dehcho First Nation within the Government of the Northwest Territories Department of Environment and Natural Resources in Canada

The key issue affecting the ecological restoration of wood bison (*Bison bison athabascae*) in Northern Canada is a lack of suitable re-introduction sites. Potential re-introduction sites are limited by: 1) the presence of diseased bison populations (bovine tuberculosis and brucellosis); 2) a cultural disconnection of local residents from bison; 3) co-management; and 4) costs associated with re-introductions and monitoring.

A huge area of the North falls under the historic/pre-historic range of wood bison. Currently much of this area is under – or soon to become under – land claim agreements with First Nations. Few parts of this range have had any detailed habitat assessments although critical wood bison habitat has been identified. Throughout much of the range wood bison have not been physically present for a number of generations and the initial re-introductions of wood bison were carried out with limited consultation between wildlife agencies and local residents. This contributed to a view that the government, not the Creator, put bison on the land and it creates issues for future re-introductions. Suitable habitat, located within the historic range of wood bison, far from diseased wood bison, can be found, but the question remains as to whether or not re-introductions are acceptable to local residents, and if there are adequate resources to cover the costs associated with the release.

Local residents have concerns about the impact of wood bison on moose and woodland caribou, their preferred food sources. Will bison create disturbances, compete for food and habitat, introduce disease, and/or change the predator-prey relationships, negatively affecting moose and woodland caribou populations? There is limited study on the impact of bison on other ungulate populations. Work has documented bison habitat and diet selection in “typical” bison and woodland caribou habitats, but some re-introduced bison populations have moved into less “typical” bison habitats, limiting the applicability of these studies. Wood bison frequent northern communities, creating local concerns such as fear of encounter, safety around residences, airports, schools/playgrounds, motor vehicle accidents, damage to heritage sites/graves, wetlands, and property. This is the dilemma of this locally overabundant yet endangered species.

Unfortunately, the lack of local consultation surrounding the first wood bison re-introductions is the root of many concerns. Today, working with current co-management principles, local people are becoming more involved in the process of wildlife management and in day-to-day management activities. Consultation is required to ensure conservation. Much effort has gone into developing conservation harvesting (or hunting) programs at the local level. Such programs have allowed for cultural reconnection with bison and the land and reinforced that bison are a part of the northern landscape. Conservation

harvesting has provided tools for managing bison populations and has provided economic opportunities. Most importantly, it has increased local support for bison re-introductions.

We need to shift the management of threatened/endangered species to include sustainable hunting or harvesting. The status quo of ca. 5,500 diseased bison in and around Wood Buffalo National Park, combined with the outdated game regulations prohibiting bison hunting in the park, have only reinforced the cultural disconnect between bison and aboriginal peoples. If done properly, harvesting bison is not a threat, but an aid to ecological recovery because it is consistent with modern co-management principles, with cultural values of aboriginal/First Nations people, and with maintaining ecosystem integrity.

3.8 The Nature Conservancy

Bruce Runnels

Managing Director for the Rocky Mountain Region, The Nature Conservancy

The Nature Conservancy (TNC) places a high priority on preserving and restoring grassland ecosystems, which serve as habitat for bison as well as many other important grassland species. TNC's mission is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters that they need to survive. As such, we are oriented to the long-term viability of the systems that plants and animals rely on. The Nature Conservancy has been active in conservation for over 50 years and has had a measurable impact on 117 million acres worldwide. The two TNC regions most involved in the conservation of bison and grasslands are the Rocky Mountain and the Midwest regions.

TNC has roughly 3,800 bison on 53,000 acres in nine reserves. The largest herd is on the Tallgrass Prairie Preserve in Oklahoma and the second is at the Medano-Zapata Ranch in Colorado. TNC's system and landscape conservation view is considered a fundamental component in which to frame conservation, restoration, and the long term viability of species including bison. It also incorporates human well-being into conservation strategies. TNC's framework for all of our work is Conservation by Design. It is a science-based approach to ensure the long-term survival of all viable native species and ecological communities through the design and conservation of portfolios of functional conservation areas within the world's ecoregions. By using ecoregions as the unit of analysis, adequate representation of species and ecological systems is assured.

At the scale of a single ecoregion, for example, the Central Shortgrass Prairie Ecoregion, the goal is to conserve the range of biodiversity that occurs within this ecoregion. An assessment of the ecoregion translates into a portfolio of areas of conservation importance that are of adequate size, distribution, and context to conserve "enough" of the species and habitats in that region. Ecoregions have proven to be a suitable framework for conservation planning because they are science-based (rather than political) units of evaluation, i.e., they are defined by topography, climate, vegetation, and geology. We identify focal conservation targets within each ecoregion. Shortgrass prairie is a focal target in many ecoregions, particularly in the western Great Plains. Other focal conservation targets include prairie dogs, mountain plover, swift fox, and bison. But in all cases, from TNC's perspective, the restoration of bison is about restoring the grassland ecosystem and the bigger picture of the wildlife assemblages in that area.

Today, the map of remaining untilled landscapes in the Great Plains offers opportunity for achieving a big vision for restoring grasslands and ensuring the lasting viability of the creatures in these landscapes. TNC has learned that working at the landscape-scale is very important. Small and separate reserves alone will not adequately protect a region's biodiversity. We have also learned that when working in larger areas, the link between biodiversity and human

well-being is critical, and we incorporate the range of human actors – conservation NGOs, landowners, ranchers, and citizens – into our conservation measures.

Three dynamic and interwoven processes have shaped the grasslands of North America: fire, bison grazing, and climate. Historically, natural fires burned patches of grasslands, and through the patch dynamics of new grass growth and bison grazing, grasslands evolved into what they are today. The nature and size of current ownerships of bison do not allow for these processes to express themselves, and they are only seen under managed scenarios. On TNC's Ordway Prairie Reserve, in South Dakota, we foster a patch-burn grazing technique to burn and rotate grazing systematically with bison and cattle. Through this research, we have found that in this controlled experiment, there is little difference between how free-ranging cattle and bison impact pastures in the prairie. We are hopefully mimicking natural processes, but perhaps not at the historical scale. We are also looking into which grazer is better at halting invasive grass species.

Looking out 10 years, temperate grasslands, savannahs, and shrublands are among the most altered and least conserved habitat types and are therefore in need of immediate conservation focus. TNC's goal is to work with partners to assure that at least 10% of that habitat type is conserved in the next decade. In the U.S. much of this will need to be done in "working landscapes." The idea is to protect and steward grasslands at the scale of the Western High Plains to restore the landscapes with people who work on the land and rely on it. On some properties, we can move closer to having large, free-roaming herds of bison managed in a natural way. For example, at Medano-Zapata Ranch in southern Colorado, roughly 300,000 acres of a national park, a wildlife refuge, a TNC working ranch, and other neighboring public lands offer some promise for the natural growth of the current bison herd. TNC priorities for all grassland sites going forward will be genetic research and assessment of existing bison herds, maintaining and restoring grasslands, engaging partners to protect additional grassland areas, and engaging local communities and landowners in working landscapes to effectively conserve grassland biodiversity.

3.9 World Wildlife Fund-US

Lawrence H. Linden

Member of the Executive Committee for the World Wildlife Fund-US and
Advisory Director at Goldman Sachs and Co.

The Great Plains stand at a crossroads, ecologically and economically. For more than a century, restoration of this storied and iconic landscape was a dream that seemed beyond our reach. Indeed, Aldo Leopold, lamenting the demise of prairie ecosystems, wrote in *A Sand County Almanac* that, “what a thousand acres of silphiums looked like when they tickled the bellies of the buffalo is a question never again to be answered, and perhaps not even asked.” But Leopold was an ecologist, not an economist. And more than 60 years ago, when he wrote those lines, it was impossible to foresee the socio-economic changes that would later take place – changes that now present us with a historic opportunity for conservation.

The Northern Great Plains, a grassland ecosystem WWF has identified as being of global importance for biodiversity conservation, has particularly outstanding restoration potential. Much of it remains unplowed, which, combined with low human population density and areas with extensive public lands, offers the opportunity to construct large conservation areas. WWF’s vision for the Northern Great Plains is for a restored, healthy ecosystem, eventually spanning millions of acres that can support a full complement of species, including bison, pronghorn, prairie dogs, and black-footed ferrets. At present, only 1.5% of the Northern Great Plains is in conservation areas. Our goal is to increase that to 10%. Our vision is for a system of reserves large enough for roaming bison and other wildlife that will also help revive a stagnant regional economy through tourism and recreational opportunities.

Along with our land trust partner, the American Prairie Foundation, we have made an ambitious start in the glaciated plains of eastern Montana where, in the last three years, we have acquired more than 60,000 acres of deeded and leased land, with negotiations underway for additional properties. In 2005, we introduced the first genetically pure bison to the American Prairie Reserve and we’re working now with state officials and other conservation partners to reintroduce prairie dogs and black-footed ferrets.

The American Prairie Reserve is WWF’s flagship project, but we recognize that the restoration of just one place will not by itself restore the bison’s key-stone role across the array of prairie ecosystems found in the Great Plains. Doing that requires a cooperative public and private sector effort involving all of us. The North American bison conservation strategy, which WWF is working on in partnership with IUCN, Texas A&M, WCS, and TNC, among others, will serve as the roadmap for this larger effort. It’s a big challenge, to be sure, but one that’s achievable. Today, we pose the question that Aldo Leopold thought would never again be asked. Tomorrow, by working together, we will answer it.

PART 4

FINAL THOUGHTS AND NEXT STEPS

4.1

Florence M. Gardipee
Doctoral student, University of Montana

Conservation of bison (*Bison bison*) is crucial to conservation of North American tribal cultures and the biodiversity of the plains ecosystem. Bison are an ecological and cultural keystone species (McHugh 1972; Erdoes and Ortiz 1984; Knapp et al. 1999). Conservation status reviews reveal that bison are ecologically extinct from over 90% of their former habitats, generating concern for their persistence. Of the estimated 450,000 bison that reside on private ranches, most have been subjected to hybridization with cattle and domestication (Boyd 2003). In addition, seven of ten public bison herds show evidence of hybridization (Halbert 2003).

The Greater Yellowstone Area (GYA) bison herds represent an evolutionary legacy for bison because they are the only surviving naturally occurring wild bison population. Prior genetic studies with microsatellite loci, limited to opportunistic sampling of bison that exited Yellowstone National Park (YNP), suggested the presence of three subpopulations (or breeding groups) within the park (Halbert 2003).

We have developed and implemented a novel, non-invasive approach for sampling feces from wild bison in the field for use in genetics and parasite studies, and have collected over 500 fecal samples from the GYA bison, during both summer and winter seasons. The use of non-invasive fecal sampling in bison allows for widespread sampling of free-ranging bison populations with minimal human interference. We can monitor genetic diversity and introgression in current and reintroduced bison populations. The combination of non-invasive sampling and new developments in technologies for genetic studies (i.e., rapid sequencing, single nucleotide polymorphisms (SNPs) and gene micro-arrays) may allow us to address crucial issues for their conservation.

An expanded assessment of population structure and gene flow between GYA bison populations through non-invasive fecal sampling, and the addition of mitochondrial DNA (mtDNA) sequencing could provide further insight. We have screened over 40 microsatellite loci with DNA from bison blood and fecal samples, and identified a subset of at least 18 of these loci that work well with fecal DNA samples on the ABI 3130xl sequencer. We will use these to assess population structure and gene flow in GYA bison and management implications, the prevalence and intensity of parasites in bison, and genetics and disease relationships. The mtDNA haplotypes in historic bone samples excavated within the GYA will allow us to assess the relationships between modern and historic bison and gain insight into historic bison ecology in the GYA.

Though bison have made a remarkable demographic recovery since the late 1800s, bison continue to face two major issues with respect to their ecological restoration. The first is the loss of continuous habitat to exercise their innate life history characteristics evolved over centuries of existence upon the North American continent. The second, and perhaps most critical issue, is that of genomic extinction, whereby wild bison alleles that are co-adapted to North

American ecosystems are lost through bottlenecks, domestication, selective breeding, and replacement with hybrid alleles from cattle. If we consider that 95% of bison exist within private herds where there is widespread evidence of introgression of cattle alleles, and only three federal bison herds currently considered free of hybridization, there are few bison populations that can provide a genetic wellspring for future bison restoration efforts (Boyd 2003). These issues can be addressed through the application of genetic techniques to identify bison populations for use in ecological recovery and conservation of the bison genome.

This research project provided the opportunity to mentor Native American undergraduate students. The invaluable experience gained from working on this project enabled students to develop greater self-confidence and a sense of cultural repatriation through working with bison. Many Native American tribes and First Nations people are eager to play a significant role in bison conservation. Cultural and spiritual restoration may be accomplished through bison conservation within their respective communities. Several reservations in Canada and the United States can provide ample range to support the restoration of large bison herds. However, tribes face many issues in becoming more involved in bison restoration such as economic development and funding shortfalls. Bison restoration efforts should incorporate Traditional Ecological Knowledge (TEK). Tribal members at this conference were concerned about bison hybridization and prefer genetically pure bison for tribal herds.

Where some may see obstinacy as typical of bison, I see self-determination. If we provide the right set of circumstances and sufficient habitat, bison can continue to survive many generations into the future. It will require the concerted efforts of ranchers, First Nations people, Native American tribes, government agencies, and conservation organizations to achieve the goal of the ecological restoration of bison.

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4.2

Ron Hiebert

Research Coordinator, Colorado Plateau, U.S. National Park Service

In 1997, The Secretary of the Interior became concerned with the appearance of inconsistency in how bison were managed in U.S. national parks (especially as it related to vaccinations/testing for brucellosis). As Associate Director for Natural Resources for the Midwest region, I organized a workshop of all parks that manage bison to address this issue. This group not only discussed brucellosis issues but issues related to disposition of excess animals, animal handling techniques, and research needs. The group also decided they got so much out of the interaction with other bison managers that we should meet each year and include bison managers from the USFWS. Since then, three subcommittees have formed to address policy issues and Native American relations, animal health (disease), and genetics and demography.

A top priority research need identified was the genetic status of the herds. We needed to know what were the present levels and patterns of genetic variation in Department of the Interior-managed herds, whether DOI herds should be managed as separate populations or as a meta-population, and what effects our culling practices had on maintenance of genetic variation.

We invited James Derr and Joe Templeton of Texas A&M University to the workshop and got their advice on current technology. Funding from the USGS-administered Natural Resource Preservation Program and FWS allowed for testing. To summarize, the 11 DOI populations have moderate levels of genetic variation. There are unique alleles in some populations. All but two populations have low levels of introgression of cattle genes (no introgression was noted in Yellowstone or Wind Cave). Simulations by Wang and Gross, using the data from the Texas A&M studies, determined a population size of at least 500 is needed to maintain 90% of the heterozygosity for 200 years. A much larger population – 1,000 or more – would be needed to maintain 90% of the alleles for 200 years. Population numbers in DOI herds range from approximately 4,500 at Yellowstone to 35 at Neil Smith. Simulations showed that culling practices that help maintain an even sex ratio and that lengthen generation time (culling young of the year) should help maintain genetic diversity.

The DOI bison herds have high genetic integrity compared to almost all private- and state-managed herds. If genetic purity is an important component of conservation of plains bison, then the DOI herds are of utmost importance. DOI herds provide the best available animals for creation of large herds.

DOI bison managers need to work cooperatively with common conservation goals. The DOI bison conservation working group needs to be officially recognized. Agencies need to work with tribes, NGOs, private land owners, and ranchers to identify areas that are large enough and culturally and socially feasible for establishment of 1,000+ size herds that are free roaming and subject to natural ecological control factors such as predation. Goals should be set similar to those that were set for the black-footed ferret: 10 populations that are sustainable without active management.

The genetic information we have in hand has completely changed the complexion of bison conservation. Bison were rescued from extinction once. Now is the time to take the needed steps to save the majestic North American bison again. I believe that the U.S. and Canadian federal, provincial, and state agencies need to play a major role in this effort. The NPS and FWS plan on working closely with the IUCN Bison Specialist Group to determine how we can best contribute to this effort. Let us move from fencing bison in to fencing bison out.

4.3

Justina Ray

Director, Wildlife Conservation Society Canada

The ecological restoration of bison has involved big picture, visionary thinking on the scale of the North American continent. While that is laudable, we cannot lose sight of the local level activities – the building blocks – that will be where ecological recovery starts to take place. These proceedings have mostly considered the largest scales relevant to bison, but implementing the vision will require getting down to the scale of individual properties. Keeping that big picture in mind as well as considering the more local building blocks is not necessarily easy. At that fine grain, the opportunities and pitfalls become more apparent. For example, in southern Saskatchewan, at The Nature Conservancy Canada property Old Man on His Back, bison were recently reintroduced. In this area, a mosaic of public land provides some future possibilities for bison, but large swathes of cultivated land in between remain a challenge.

In discussing ecological recovery, we have outlined the ecological contribution and value of individual herds to that overall goal. However, ecological contribution is not the only measure by which herds should be valued. Individual herds can carry a great weight of importance in other ways; by carrying a particular allele or serving a cultural purpose – there are myriad other valuable functions aside from ecological function.

In fact, by concentrating on ecological restoration, we hinge a great deal on the bison's functional role. It also implies that we already know with certainty the details of that functional role and that we will recognize when it has been restored. Actually, we do not necessarily fully understand the bison's ecological functional role across its range because it does not always express itself. From a background in carnivore ecological role studies, I would argue that there is a danger in relying too heavily on the functional argument of bison because it may be difficult to translate into effective conservation. Therefore, we have to include all the other values that bison represent. For example, this initiative could be viewed simply as promoting the recovery of landscapes by using bison as an icon. And it is an impressive icon considering bison are the last link to the Pleistocene mega-herbivores.

How do wood bison fit into the framework that we're mapping for ecological recovery of bison? There is a huge difference between the ecological and political contexts for wood and plains bison. A default reaction is to assess whether or not they are a different species or subspecies, but in this case, the genetic considerations are not necessarily relevant. Instead, we need to assess whether the overarching goals for ecological recovery for wood and plains bison are similar, and how to achieve restoration in different contexts. There is a precedent in thinking of species restoration in two contexts from caribou conservation: Woodland caribou and barren ground caribou are the same species but they exist in different cultural connection, sociopolitical and environmental contexts. Ecological recovery will look different for wood bison than for plains

bison. Where plains bison numbered in the millions, wood bison numbered in the hundreds of thousands at most, so their overall effect on the landscape was likely quite different.

There are already several lessons to be learned from wood bison recovery in Canada. We have a lot of land for wood bison recovery and we have some ecosystems where predation is actually an important force.

Going forward, some major areas to acknowledge are:

- The variability within commercial herds and how human selective pressure on commercial herds will express itself behaviorally and ecologically in the bison population over time;
- The underlying wish for bison to replace beef to some degree on the landscape and in our diets. There are ecological tradeoffs if this were to happen: Creating greater demand for bison meat could lead to a departure from managing herds in an ecological sustainability framework and commercialize the animal;
- Climate change will affect grasslands and prairies in ways that might compromise some goals of restoration in the future;
- Education has been identified as a priority, but the target is not clear.

Generation X-ers may be a target, as they are detached from nature and how it works. We also need to consider how to get the right information to the policy table, and to do this, non-traditional partnerships may be key.

The immediate priority is to target research so that it is designed to be applied immediately and with an existing need for the research results. This requires a strategic division of roles and responsibilities and careful prioritization. The opportunities for policy action include livestock versus wildlife classification and addressing grazing on public land. There is a tremendous amount of work ahead and the broadness and diversity of the stakeholders could lead to conflicts of interest. We have to concentrate on our diverse strengths.

PART 5

STAKEHOLDER BREAKOUT

GROUP REPORTS

At the meeting on The Ecological Future of North American Bison in 2006 in Denver, Colorado, the 161 participants broke into five stakeholder groups for a three-hour working session. The purpose of the stakeholder working group session was to have participants share perspectives in a more focused way. Groups were asked to comment on the Vermejo Statement on the Ecological Restoration of Bison, and, using its approaches, the plenary presentations, and the matrix of herd characteristics, consider how each group could contribute. Each stakeholder group shared their priority opportunities and constraints for ecological restoration and drafted short-and long-term goals.

The groups considered a range of qualitative and quantitative characteristics regarding the future ecological restoration of bison (e.g., biological, ecological, and management) and answered the following questions:

1. What would “bison ecological restoration” look like to your stakeholder group?
2. Which of the approaches following the Vermejo Statement would be most useful for your stakeholder group toward the ecological restoration of bison?
3. What stakeholder-specific priorities would your group suggest be initiated/continued/expanded in: a) the next one to five years, and, b) in 20-50 years?
4. What are the major opportunities currently available to allow this work to begin? (organizations working on similar goals, legislative or economic trends, capacity and interest within stakeholder group)
5. What are the most significant constraints and what are the potential means of alleviating these constraints? (political, ecological, cultural and economic situations, stakeholder group interests, and potential partnerships)

5.1 Agencies (Federal, State, Provincial)

Co-leaders: John Gross, National Park Service, and Randall Rogers, Alaska Dept. of Fish and Game

The Agencies stakeholder breakout group generally agreed with the existing Vermejo Statement. Points added:

1. Population size of greater than 1,000 is critical, as is local acceptance and international collaboration.
2. The Agencies stakeholder group recommended an additional statement: “Ecological restoration of bison will occur when self-sustaining, ecologically viable populations of bison exist that are representative of the historical, geographical, morphological, taxonomic and behavioral variation.”

Whatever agencies do for bison restoration, it will have to be in collaboration with other groups: ranchers, NGOs, private conservationists. Agencies could be well-positioned to be honest information brokers of known-origin animals and could draft protocol for herd and individual exchange.

One- to five-year goals:

- *Genetics*: Establish an agency agreement regarding genetic conservation rule (90% rule) and effectively limit cattle introgression.
- *Disease*: Exercise due diligence in preventing spread of disease and maintain compliance with state and federal policies.
- *Land management*: Identify high-priority sites for bison conservation/recovery on existing public lands; facilitate use of agency lands for bison recovery – change grazing policy.
- *Policy*:
 - o Ensure bison are on the agenda at Association of Fish Wildlife Agencies and other meetings.
 - o Bring bison recovery issues to international trilateral commission.
 - o Promote introduction of herds in Mexico. Promote UMAS for conservation of bison in Mexico.
 - o Promote conservation easements for bison habitat.
 - o Investigate how Migratory Act applies to bison that migrate to and from Mexico.

Medium priorities:

- Consider promoting a consistent re-classification of bison in states and nations.
- To address lack of source bison that are genetically suitable and disease-free, agencies can become suppliers of known animals and establish and maintain a centralized database on movements of animals between herds.
- Interagency coordination to establish a third-party bison certification (e.g., grass-fed, free-ranging); create interagency bison recovery information materials and working group; use bison as vehicle to educate the public about history, benefits, and future of bison; increase awareness and understanding of bison recovery among key agency leaders.

20- to 50-year goals:

- *Habitat:* Grow large protected areas and/or connected landscapes that will support core herd. Investigate reclamation of areas used for coal mining/energy development
- *Incentives:* Establish economic incentives that permit private land owners to sustainably keep conservation/recovery bison herds. Encourage sale of grazing permits for bison.
- *Management:* Allow harvest management that mimics natural predation on bison.
- *Develop* education programs that address actual population demographics.



Julie Larsen Maher/WCS

5.2 Native Americans and First Nations

Co-leaders: Dick Baldes, Wind River Alliance, and Craig Fleener, Council of Athabascan Tribal Governments

A top priority should be the emphasis on the cultural significance of bison. Toward a vision of ecological recovery with emphasis on cultural connection, bison should cease to be considered livestock. Restoring natural behavior and social systems within herds is important. Bison restoration should not occur at the expense of other native species (e.g., caribou and moose). Spiritual reconnection is part of restoration, including connections to bison ancestors, to sacred sites, to white buffalo, and to matriarchy.

The current Vermejo Statement should include traditional ecological knowledge regarding bison and aboriginal cultural relationship with bison. A broader tribal constituency should be approached to set tribal priorities for bison recovery. There is great potential for tribal involvement and a culturally and spiritually oriented future for bison and people.

One- to five-year goals:

- Gather aboriginal thoughts and create a collaborative direction on ecological recovery. Prioritize traditional knowledge regarding bison.
- Educate tribal members on the importance of bison; communicate the spiritual connection through education.
- Assess status (genetic and other) of bison currently on tribal lands.
- Identify funding for tribes that wish to put genetically pure bison on their land.
- Identify major land masses that are connected and talk with landowners and communities; Create refugia for bison far from people.
- Promote the idea that bison are more than just meat and justify the care of them outside economic interests.

20- to 50-year goals:

- Get as close as possible to elimination of cattle genes in buffalo.
- Restore traditional buffalo stories and human health.
- At least 10 populations of migrating bison herds.
- Tribes across North America work together to restore bison.
- Minimize and eliminate transfer of disease between cattle and bison.

The major opportunities currently available to allow this work to begin are:

- The energy and cooperative spirit of represented communities and their wish for restoration of bison.
- Alaska has three opportunities for restoration (6-7,000 square miles potentially supporting 3-5,000 animals).
- Banff reintroduction area and Waterton National Park.
- Wind River opportunity up to 700,000 acres.
- South Unit Badlands/Pine Ridge; Wichita Mtns; big ranches in Texas available.

- Many native organizations, councils, and foundations are already supportive of bison restoration; some tribes taking over Wildlife Refuge management of bison.

The major constraints to the ecological future of bison are:

- Lack of funds: pool resources and communicate need for bison on public and tribal land.
- Interagency bickering.
- People disenfranchised and disconnected; lack of communication among diverse interests.
- Disease issues.
- Bison viewed as livestock.



Kent H. Redford/WCS

The bison remains a cultural icon in North America to this day.

5.3 Non-governmental Organizations (Conservation, Zoos, Science)

Co-leaders: Steve Forrest, World Wildlife Fund-US, and Chris Pague, The Nature Conservancy

The NGO group supported the visionary aspects of the Vermejo Statement. This group valued factors such as predation, population size, natural selection, habitat scale to allow natural movements, ecological role maintained, and representation in major habitat types. Additional factors not sufficiently addressed were grasslands-mosaic of vegetation in successional states, natural bison behavior maintained (eg., wallowing), co-occurring habitats and species, and human aesthetic desire.

The NGO group prioritized the following three approaches:

1. Building financial, organizational, distributional capacity (share information among stakeholders via popular publications, speakers, web-based venues, education, inspire the public).
2. Work across all borders (including fences).
3. Private land incentives seem to be a good way to move forward immediately. By the same token, there are public lands that could have bison but do not. Federal managers could and should do more to fulfill their wildlife mandate.

One- to five-year goals:

Each NGO should concentrate on the three approaches above and work together to lead the process of creating an overarching strategic plan.

20- to 50-year goals:

- Restore native ecosystems at a large spatial scale, and support government partnership on this. Promote something inspiring (National Bison Conservation Act).
- Subject conservation herds (TNC, WWF-US) to natural selection and encourage public herds to be managed this way.
- Create the circumstances necessary to allow large-scale movement between herds or landscapes to preserve migratory instincts of bison.
- Conduct reassessment of how we are conserving bison.
- Promote a conducive, fair, and scientifically based regulatory environment.
- Improve testing and veterinary tools to address disease and genetic issues.

The major opportunities currently available to allow this work to begin are:

Large-scale land conservation and bison expansion on private and public lands in the following areas: American Prairie Foundation project, MT; U.S./Mexico herd (Janos) and in grassland tracts in the Chihuahuan desert; Crow, Cheyenne River, Pine Ridge, Wind River, and Fort Belknap Reservations; Yukon Flats, AK; Turner, TNC, other supportive conservation lands; Charles M. Russell National Wildlife Refuge; Great Sand Hills, Old Man on His Back, and Grasslands National Park, SK; Kiowa National Grassland, NM.

Other opportunities:

- A conducive mood amongst NGOs to bring diverse stakeholders together.
- Advancing technology for genetic conservation.
- Rising public support for more environmentally sound agricultural policies.

NGOs can work to introduce policy and legislation at state and federal scale, using recent publicity and information as basis. NGOs can continue to improve the growing institutional capacity (tribes, ABS, TNC) for ecological management of bison.

The major constraints to the ecological future of bison are:

- Bison are not defined as wildlife (a third definition may be necessary).
- Lack of public understanding of conservation needs of bison and of large scale landscapes.
- Perceptions about diseases and current economics favor cattle on public lands, constraining bison expansion.
- NGO financial capacity.
- Land-use trends (fragmentation) threaten all wildlife conservation.



5.4 Producers, Ranchers, Private Lands, and Sportsmen

Co-leaders: Mark Silzer, Canadian Bison Association, and Dave Carter, National Bison Association

Bison ecological recovery would generally mirror the Vermejo Statement on Ecological Future of Bison. Certain aspects of the bison production business would support the Vermejo Statement. Herds of bison should ideally be appreciated as viewable wildlife, but also as huntable wildlife and economically important wildlife. For sportsmen, more representative herds throughout the historic range could provide a fair chase hunt. To create larger land bases for herds, smaller herds and lands should be aggregated and drafting such cooperative agreements would be a valuable pilot project.

Natural predation could play a role in herd management. Allowing predation on herds has an ecological benefit in maintaining the natural selection pressures on the herd. This is innovative in terms of wildlife-friendly livestock management policy.

It is important to have state and federal public policies and tax incentives that recognize the ecological uniqueness of bison, particularly if studies on the bison's ecological role are favorable to long-term natural resource management (their positive effect on grasses, riparian areas, fire management).

In order to bolster the business of ecologically sound bison production, consumer appreciation for bison meat should be promoted. Investigations into marketing could provide ideas for incentivizing ecological management of production herds. (Ecological management means striving for greater ecological value of herds as suggested by the “matrix” of herd characteristics.)

This stakeholder group prioritized three interdependent approaches:

1. Providing conservation incentives for bison producers, managers, and other stakeholders.
2. Maintaining herds that meet the criteria for ecological recovery, as well as herds that contribute in some significant way to the overall vision, regardless of size.
3. Creating education, awareness, and outreach programs to public and policy-making constituencies (based on good science).

One- to five-year goals:

Sportsmen's groups could identify demand among sportsmen for fair-chase bison hunts. They could also support the adoption of previously successful strategies used for the restoration of other huntable wildlife (antelope, elk).

Producers, ranchers, their cooperatives, and legislative constituencies could:

- Identify and reach out to new sources of demand for sustainable food (hospitals, doctors, American Heart Association, diabetes organizations).
- Encourage producers to monitor herd genetics as a potential source for conservation herds.
- Develop animal health strategies to avoid barriers to animal movement across boundaries (state/federal/international), dovetailing with initiatives aimed at protecting food security.

- Design certification programs to verify ecologically managed bison meat.
- Share educational materials internally among producers and sportsmen regarding the overall value/rewards of ecological restoration.
- Expand ecotourism opportunities for private landholders (this could include engaging the support of sportsmen’s groups for hunting trips).
- Draft rationale and incentives for bison on public allotments and remove market-distorting subsidies (agricultural and trade) that disadvantage bison.

20- to 50-year goals:

- Genetic testing and adopt further strategies that encourage genetic diversity among private herds.
- Establish two to three “beachhead” projects of a large scale on or adjacent to private ranches, working with public agencies to recognize the compatibility of bison with landscape.
- Aggregated public/private/tribal tracts in cooperative venture.
- A collaborative program of aggressive education/outreach to expand the general public’s appreciation of bison.
- Assess ways in which ecologically managed bison herds help mitigate climate variation and work with public agencies on general wildlands policies to mitigate climate drying/variation in the Great Plains.

The major opportunities currently available to allow this work to begin are:

- Emerging public recognition of the benefits of sustainable food sources/systems.
- Emerging techniques to pursue market differentiation and collaborative stewardship/conservation marketing.
- Growing network of people and organizations interested in bison.
- Legislative opportunities to enhance conservation, e.g., Farm Bill.

The major constraints to the ecological future of bison are:

- Lack of legal framework to support bison ranching and marketing. This could be mitigated by an increase in public policy action by NBA members and other bison ranchers.
- Lack of public awareness and support for bison. This could be mitigated by targeted educational programs and by building partnerships with parties interested in sustainable, healthy meat.
- Fundamental distrust that NGOs/agencies have for private landholders. This can be addressed by continued building of networks and dialogue.
- “Commodity/cattle” bias in public policy, agricultural departments, and rural communities. This requires targeting USDA for above educational program, working with and learning from groups that have developed public policy reform proposals (Organic Trade Association), and using science/research to support public policy reform.

5.5 Social and Natural Sciences

Co-leaders: James Derr, Texas A&M, and John Duffield, University of Montana

The Social and Natural Sciences group affirmed the Vermejo Statement and suggested some additions:

1. Define ecological restoration by the major factors listed on the matrix of herd characteristics, e.g., herd size, interaction with natural ecosystem processes.
2. Socio-economic impacts: Conservation will be more successful if supported through social and economic benefits to the people in the local region.
3. Ecological restoration provides great opportunity for and with First Nations and Native Americans. Bison coevolved among humans (e.g., hunting pressure) and cooperation among humans is essential for their future.

The approaches prioritized for bison work were:

1. Manage herds so they are subject to natural selection and with attention to maintaining the health, genetic diversity, and integrity of the species.
2. Restore native ecosystems, ecological interactions, and species.
3. Create education, awareness and outreach programs to public and policy-making constituencies.
4. Conduct research and monitoring that lead to improved bison recovery and management.

One- to five-year goals:

- Create education, awareness, and outreach programs to public and policy-making constituencies.
- Resolve disease regulation issues. Identify what veterinary and policy progress needs to be made so that bison can be available to repopulate.
- Promote recognition of bison as a species of common concern at the North American level by the trilateral committee and Commission for Environmental Cooperation of NAFTA.
- Make progress on gaps in knowledge base – genetic, ecological impacts – prior to start of reintroduction efforts; develop socioeconomic baseline for regions of potential re-introduction.
- Identify priorities by population/geographical area. Have a model site in each area that displays a majority of exemplary ecological attributes; Major bison reintroduction in at least three eco-geographical areas (currently only one in Northern Great Plains).
- Communicate contribution of individual herds.
- Ask for Executive Order or legislation directing federal agencies to “seamlessly manage their lands for the coordinated ecological restoration of bison on federal lands.”
- Try to redirect federal incentives in Farm Bill and research incentives for private landowners.



Steve Zack/WCS

Burrowing owls nest in burrows dug out by other grassland species, such as prairie dogs.

20- to 50-year goals:

- Resolve disease issues.
- Transboundary Peace Parks US-Mexico, US-Canada set aside for restoration of grassland ecosystems.
- Reduce threats to grassland birds and other grassland species.

The major opportunities currently available to allow this work to begin are:

- Rural people in Western states are looking for new economic development ideas (biofuels, Indian grass). Investigate feasible development of sustainable energy compatible with objectives of bison recovery (wind power on bison land).
- Conference on future of grasslands in North America to bring in more policy stakeholders
- Work with Native American lands, TNC, Audubon, American Prairie Foundation. Create visions for other 11 landscapes in the Northern Plains Conservation Network.
- State lands as a potential land base for bison recovery, but also bison as a potential best revenue source for school trust lands.
- Work with federally-listed species recovery efforts – black-footed ferret, mountain plover, swift fox, ferruginous hawk – where their habitat restoration could tie to bison.

The most significant constraints are:

- Funding:
 - Identify successful conservation incentive programs that could be adapted and implemented for bison (e.g., Mexican experience, NRCS, easements).
 - Compensation strategies (e.g., pay directly for impacts not covered through other wildlife infrastructure, such as bison damage to fences; like Defenders of Wildlife livestock compensation for wolves).
- Need to work on public relations on behalf of the bison. Bison have a rich historical, artistic and cultural significance. No one in Congress has delved into this issue, which is necessary. Need to work on our political connections to get the message across.
- Uncertain impacts on other valued species, e.g. Canada moose, caribou.
- Currently few economic methods for evaluating pros and cons of bison restoration, and benefits are difficult to quantify.
- Some government policies are contrary to ecosystem restoration, e.g. poisoning of prairie dogs. Need to promote stronger scientific leadership for conservation.
- Overall coordination of all these elements is currently lacking.
- Difficulty of restoring populations of large carnivores along with bison.
- Conservation groups traditionally have poor public relations skills.

PART 6

CLOSING POEM

Herd of Buffalo Crossing the Missouri on Ice

If dragonflies can mate atop the surface tension of water, surely these tons of bison can mince across the river, their fur peeling in strips like old wallpaper, their huge eyes adjusting to how far they can see when there's no big or little bluestem, no Indian grass nor prairie cord grass to plod through.

Maybe because it's bright in the blown snow and swirling grit, their vast heads are lowered to the gray ice: nothing to eat, little to smell.

They have their own currents. You could watch a herd of running pronghorn swerve like a river rounding a meander and see better what I mean. But

bison are a deeper, deliberate water, and there will never be enough water for any West but the one into which we watch these bison carefully disappear.

–William Matthews



Kent H. Redford/WCS

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APPENDIX 1: VERMEJO STATEMENT ON ECOLOGICAL RESTORATION



Ecological Restoration of Bison in North America over the Next Century

Vermejo Statement – May 2006

Ecological restoration of the North American bison will occur when multiple large herds of plains and wood bison move freely across extensive landscapes within all major habitats of their historic ranges, interacting in ecologically significant ways with the fullest possible set of other native species, and inspiring, sustaining, and connecting human cultures.

This will be realized through a collaborative process engaging a broad range of public, private, and indigenous partners who contribute to bison restoration by:

- Maintaining herds that meet the criteria for ecological restoration, as well as herds that contribute in some significant way to the overall vision, regardless of size
- Managing herds so they are subject to natural selection and with attention to maintaining the health, genetic diversity, and integrity of the species
- Restoring native ecosystems, ecological interactions, and species
- Providing conservation incentives for bison producers, managers, and other stakeholders
- Creating education, awareness, and outreach programs to public and policy-making constituencies
- Conducting research and monitoring that lead to improved bison restoration and management
- Building capacity and sharing information among key stakeholder groups
- Working across international borders, where necessary

APPENDIX 2: MATRIX OF ECOLOGICAL CHARACTERISTICS TO ASSESS HOW BISON HERDS CAN CONTRIBUTE TO OVERALL ECOLOGICAL RESTORATION AT VARYING SCALES

Major Factor	Subfactor	No Contribution	Small Contribution	Modest Contribution	Large Contribution	Exceptional Contribution	Notes
Herd Size and Composition	<i>herd size</i>	<2	2 - 400	400 - 1000	1000 - 5000	> 5000	Cutoffs based on models of population sustainability and maintenance of long term genetic diversity, assuming a natural population structure. Population sizes assumes sufficient habitat area is available to support herd at natural densities
	<i>population structure</i>	age structure, sex ratio, social units and population size managed for goals inconsistent with recovery	at least one aspect of pop. structure (age structure, sex ratio, social units, pop density) managed to match natural reference conditions	two or more aspects of population structure managed to match natural reference conditions	all aspects of population structure managed to match natural reference conditions	no manipulation of population structure	For details of natural age structure, sex ratio, social units, and other demographic parameters at reference sites, refer to Gates et al. (1995) and upcoming IUCN action plan
Landscape Size and Use	<i>landscape available to bison</i>	< 10 acres	10 - 5,000 acres	5,000 - 50,000 acres	50,000 - 500,000 acres	>500,000 acres	
	<i>human footprint</i>	>20% landscape converted to human uses incompatible with bison	15 - 20% landscape converted to human uses incompatible with bison	5 - 15% landscape converted to human uses incompatible with bison	1 - 5% landscape converted to human uses incompatible with bison	< 1% landscape converted to human uses incompatible with bison	

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Major Factor	Subfactor	No Contribution	Small Contribution	Modest Contribution	Large Contribution	Exceptional Contribution	Notes
Landscape Size and Use (continued)	management of movements	movements are tightly controlled within small, fenced lots	movements are confined by perimeter barrier and limited by some internal barriers	animals free to move within managed landscape, but limited at perimeter	animals are free to move on their own, with rare exceptions	animals are free to move on their own, with no exceptions	
	natural selection	all selection by humans for production or purpose other than ecological recovery	some limited natural selection or management to mimic natural selection (at least 1 of the 5 selection pressures active)	some limited natural selection or management to mimic natural selection (at least 3 of the 5 selection pressures active)	most natural selection processes operational (4 of 5 selection pressures); others managed to mimic nature	all natural selection processes are present without active human intervention	Natural selection pressures include (1) mortality from native predators, (2) native diseases, (3) drought, (4) climatically induced food limitation (including interannual variation in forage quality), and (5) unmanipulated mate competition
	interaction with suite of native vertebrate species	no native vertebrate species and no plans for restoration of species	no or few (<10%) other native vertebrate species present, but restoration is planned	some (10 - 50%) native vertebrate species present (e.g. some native herbivores, few predators, some dependent species) or restoration underway	most (50 - 90%) native vertebrate species present (e.g. all native herbivores, some predators, most dependent species)	all native vertebrate species are represented in the system and there is no known impairment to intra-specific interactions	
	interaction with ecosystem processes	herd does not exist at ecologically functional density	herd exists at ecologically functional densities, varying within natural ranges, <10% of landscape	herd exists at ecologically functional densities, varying within natural ranges, over 10-50% of landscape	herd exists at ecologically functional densities, varying within natural ranges, over 50-90% of landscape	herd exists at ecologically functional densities, varying within natural ranges, over the entire landscape	Bison interactions with ecosystem processes include differential grazing, disturbance through wallowing, and nutrient redistribution from excretion/ carcasses

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Major Factor	Subfactor	No Contribution	Small Contribution	Modest Contribution	Large Contribution	Exceptional Contribution	Notes
Human Cultural Interactions	public access	no access	public access limited to perimeter	public access limited to selected locales/times on the landscape	public access across most landscape (>50%) at most times (>50%)	full public access across landscape at all times	
	indigenous cultural use	no use allowed	no herds near tribal traditional territory. Private and/or agricultural bison near trad'l territory but access not allowed	bison within tribal traditional territory some access allowed for interaction. No hunting	bison within traditional territory some access allowed for interaction and hunting	bison within traditional territory unlimited access for hunting and interaction	
Geography	representation	herds live in a habitat that was not in the historical range of the species	in a major habitat type	one of top 10 representatives of a major habitat type in terms of ecological recovery within the historical range of the species	one of top 3 representatives of a major habitat type in terms of ecological recovery and within the historical range of the appropriate subspecies	best representative of a major habitat type within the historical range of the appropriate subspecies	Each herd is located within its potential major habitat type. Scores are compared only between populations within each major habitat type

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Major Factor	Subfactor	No Contribution	Small Contribution	Modest Contribution	Large Contribution	Exceptional Contribution	Notes
Health and Genetics	presence and management of disease	presence of reportable disease prevents recovery	presence of reportable disease constrains recovery, but management is planned	presence of reportable disease constrains recovery, but disease is managed	no "reportable" diseases	no "reportable" disease and herd is not mixing with or adjacent to any sources of disease	
	genetic diversity	low genetic diversity and no unique genetic traits	some genetic diversity or some unique traits	moderate genetic diversity or unique genetic traits or lineage history unknown	high genetic diversity and some unique genetic traits and known lineage	high genetic diversity and many unique genetic traits and fully documented lineage	
	genetic integrity	strong phylogenetic resemblance to domestic cattle, indicating significant hybridization	>5% detected cattle markers or hybridization status is unknown, but phylogenetically similar to bison	less than 5% detected nuclear cattle genes and/or cattle mitochondrial DNA but phylogenetically similar to bison	less than 1% detected nuclear cattle genes with no or limited cattle mitochondrial DNA	no detected cattle genes and no known genetic history with hybrid populations	
Sociopolitical Environment and Capacity	supportive legal and policy environment for ecological recovery	legal or policy constraints bar some aspect ecological recovery with no attempt to change law or policy (including intl. disputes)	significant or multiple legal or policy constraints exist to ecological recovery; active attempts are being made to change law or policy	minor legal or policy constraints exist to ecological recovery; active attempts are being made to change law or policy	minor legal or policy constraints exist to ecological recovery are under review with a commitment for change; intl. coop. exists	ecological recovery is legal within jurisdiction and supported by public policy, including international agreements as necessary	

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Major Factor	Subfactor	No Contribution	Small Contribution	Modest Contribution	Large Contribution	Exceptional Contribution	Notes
Sociopolitical Environment and Capacity (continued)	long-term security of recovery objectives	current land manager is not supportive of ecological recovery	current land manager supportive of ecological recovery, but no explicit statement about management objectives for ecological recovery	current land manager is supportive of ecological recovery, with explicit management objectives related to ecological recovery	current land manager is supportive and future of ecological recovery is guaranteed through legal mechanisms over >50% of landscape	current land manager is supportive and future of ecological recovery is guaranteed through legal mechanisms over >90% of landscape	legal mechanism to guarantee ecological recovery, as defined in Vermejo statement; include conservation easements, legal mandates for public agencies, etc.
	capacity to manage	no capacity to manage bison ecologically	management models for ecological recovery of bison exist that are appropriate for site, but have not been applied because of lack of capacity	modest capacity to manage bison exists, but further capacity-building is required to achieve scientific management	substantive capacity to manage bison for ecological recovery, with some capacity-building programs in place	substantive scientific capacity to manage bison for ecological recovery, with on-going capacity-building programs in place	Modest capacity consists of professional managers informed about the ecological requirements of bison as relates to particular landscape; substantive capacity consists of knowledgeable and experienced managers, with scientific support, for management.
	market incentives	there are no market incentives or models for ecological recovery of bison	market incentives for managing bison for ecological recovery exist and are appropriate for site, but have not been applied	market incentives for managing bison for ecological recovery are contributing to the economic sustainability of the site in some way (>10% of income)	market incentives for managing bison for ecological recovery are contributing to the economic sustainability of the site in a significant way (>50% of income)	a fully sustainable economic model based on market incentives is in place and has operated successfully for > 5 years	

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