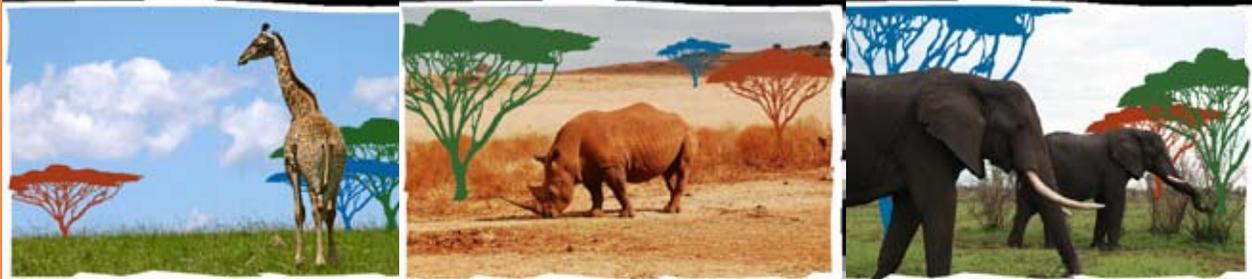


# IV<sup>th</sup> International Wildlife Management Congress



## PROCEEDINGS

James W. Cain III and  
Jason P. Marshal, Editors



9-12 July 2012

Durban, South Africa



# **Proceedings of the IV<sup>th</sup> International Wildlife Management Congress**

**Cooperative Wildlife Management Across Borders:  
Learning in the Face of Change**

**Editors**

**James W. Cain III  
Jason P. Marshal**

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## WHAT IS THE FUTURE OF BISON CONSERVATION?

**MICHEL T. KOHL**, *Boone and Crockett Wildlife Conservation Program, University of Montana, 32 Campus Drive, Missoula, MT 59812 USA*

**JEROD A. MERKLE**, *Département de Biologie, Université Laval, Pavillon Alexandre-Vachon, 1045 Avenue de la Médecine, Québec, QC, G1V 0A6 Canada*

**PAUL R. KRAUSMAN**, *Boone and Crockett Wildlife Conservation Program, University of Montana, 32 Campus Drive, Missoula, MT 59812, USA*

**KYRAN KUNKEL**, *Wildlife Biology Program, University of Montana, 32 Campus Drive, Missoula, MT 59812, USA*

**KEITH AUNE**, *Wildlife Conservation Society North American Program, 301 North Willson Avenue, Bozeman, MT 59714, USA*

**C. CORMACK GATES**, *Faculty of Environmental Design, University of Calgary, 2500 University Drive NW, Calgary, AB T2N 1N4, Canada*

**SAM. D. FUHLENDORF**, *Department of Natural Resource Ecology and Management, Oklahoma State University, 008C Agricultural Hall, Stillwater, OK 74078, USA*

**ABSTRACT:** The conservation of the plains bison (*Bison bison*) is considered one of the greatest conservation success stories in North America. Although the historic distribution of bison (plains and wood bison [*B.b. athabasca*]) was larger than any other indigenous large herbivore in North America, market hunting and competition with the livestock industry reduced the plains bison to  $\leq 1,000$ , with only 25 free-ranging animals left in the world by 1902. Through the cooperation of private individuals, non-profit organizations, and the federal governments of the U.S. and Canada, bison were saved from extinction and are now scattered throughout much of their historical range, numbering  $> 500,000$  individuals. Despite the numerical recovery of the species, recent questions have surfaced regarding the true success of this effort as  $< 21,000$  plains bison ( $< 5\%$  of all bison) are managed within conservation herds ( $n = 62$ ). Thirteen percent ( $n = 8$ ) of herds are outside of their historical range, 92%

( $n = 57$ ) have  $< 1,000$  individuals, and 8% ( $n = 5$ ) are managed on areas of  $> 2,000$  km<sup>2</sup>. Based on these data, new questions have been posed regarding the direction of bison restoration at the continental scale. Taking into account challenges associated with bison management (e.g., disease transmission, genetic introgression of domestic cattle, legal designation of bison, availability of restoration sites), we examine whether the current model of numerous small, confined bison populations represents ecological recovery of bison. We then outline recent conservation initiatives to demonstrate that a decision on the future objectives of bison conservation needs to be addressed.

**KEY WORDS:** bison, Bison bison, conservation challenges, conservation, management, restoration

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Plains bison (*Bison bison*; hereafter referred to as bison) historically ranged across North America from the Rocky Mountains to the eastern seaboard and the plains of Canada to the northern reaches of Mexico (Reynolds et al. 1982, Danz 1997). In total, bison resided in 4 Canadian provinces, 42 U.S. states, and 5 Mexican states, an area of  $> 9,000,000$  km<sup>2</sup>, thus encompassing the largest distribution of any indigenous large herbivore in North America (Figure 1; Gates et al. 2010b). Throughout the Great Plains, bison interacted with a host of species including pronghorn (*Antilocapra americana*), elk (*Cervus canadensis*), deer (*Odocoileus* spp.), prairie dogs (*Cynomys* spp.), wolves (*Canis lupus*), grizzly bears (*Ursus arctos*) and grassland bird species through ecosystem alterations (Coppock et al. 1983, Krueger 1986, Knopf 1996, Freese et al. 2007). Bison also play critical roles in grassland ecology through the facilitation of vegetative heterogeneity (Knapp et al. 1999, Fuhlendorf et al. 2008). Wallowing activities can lead to standing water (Knapp et al. 1999), which in turn supports numerous plant species (Collins and Uno 1983, Polley and Wallace 1986) and provides habitat for prairie amphibians (Bragg 1940, Corn and Peterson 1996). Vegetation communities are affected by bison through grazing, physical disturbance, nutrient cycling, and seed dispersal (McHugh 1958, Knapp et al. 1999). These activities influence grassland heterogeneity, supporting prairie obligate species in the tall, mixed, and short-grass prairies (Powell 2006, Fuhlendorf et al. 2008, Gates et al. 2010a).

Prior to the arrival of Europeans in North America, the estimates of bison numbers ranged from 15 to 100 million individuals (Dary 1989, Shaw 1995),

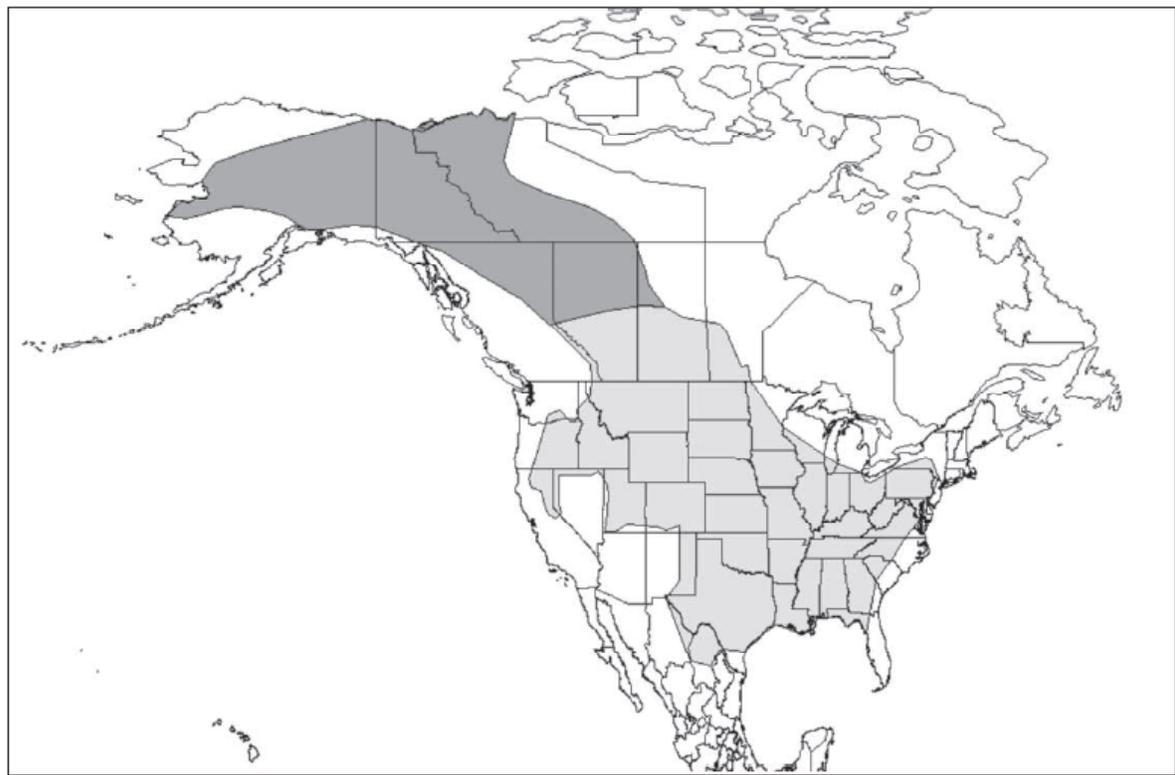


Figure 1. Original ranges of plains bison (light gray area) and wood bison (dark gray area). Permission granted by Potter et al. 2010. History of bison in North America. Page 7 in Gates et al. 2010a)

however most estimates range from 30 to 60 million bison (Seton 1929, McHugh 1972, Lott 2002). Following European settlement, bison numbers declined rapidly as a result market hunting by European settlers (Hornaday 1887, Isenberg 2000) in addition to competition with domestic livestock (McHugh 1972, Dary 1989, Danz 1997, Isenberg 2000). As a result, <1,000 bison were in North America by 1890 (Hornaday 1887, Seton 1929) and wild, free-ranging bison were extirpated from Canada (Freese et al. 2007) and nearly extirpated from the U.S. (Meagher 1973).

In the U.S., the loss of large bison herds led to the first major conservation movement to preserve a species on the brink of extinction (Coder 1975). These efforts were led by private individuals who established small herds throughout the Great Plains (Boyd 2003). Private herds would later form the foundation for most of the public herds (Boyd 2003). The second conservation effort was led by the American Bison Society (formed 1905) who influenced the U.S. Congress to establish public conservation herds throughout the U.S.

(Coder 1975, Danz 1997). In Canada, federal conservation began in 1907 with the purchase of the privately owned Pablo-Allard herd from Montana, U.S. (Freese et al. 2007).

These conservation efforts increased the bison population, which doubled between 1888 and 1902 (Coder 1975) and increased steadily to approximately 30,000 by the 1970s (McHugh 1972). Of the 30,000 bison, half resided in conservation herds (Freese et al. 2007), defined as bison populations managed primarily for conservation rather than commercial production (Boyd 2003). In the 1980s, commercial bison production increased, resulting in >500,000 bison in North America today; yet, <5% of bison reside in conservation herds (Boyd 2003). In fact, the number of individuals in conservation herds has remained relatively stagnant since the 1930s, and today only 20,504 individuals are located in 62 conservation herds (Boyd et al. 2010). In other words, despite the dramatic increase in bison during the past 120 years, the number of free-ranging wild bison has lagged far behind.

A further examination of these conservation herds provokes questions regarding the ecological effectiveness of bison restoration at a landscape scale. Of the 62 conservation herds, 13% ( $n = 8$ ) are located outside the historical range of bison and 92% ( $n = 57$ ) consist of < 1,000 individuals, a population size considered to be genetically viable over the long term (Gates and Ellison 2010). Furthermore, only 8% ( $n = 5$ ) of herds are located on landscapes > 2,000 km<sup>2</sup> (Gates and Ellison 2010) and 16% do not contain breeding age males. Ecologically, wolves are the only effective predator of adult bison, yet they are associated with only 10% of conservation herds (Gates and Ellison 2010).

As a result, conservationists are questioning whether bison are facing an ecological extinction event (Freese et al. 2007). To reverse this trend, the Wildlife Conservation Society designed a foundation for bison restoration through the Vermejo Statement (Redford and Fearn 2007) which states, “Over the next century, the ecological recovery of the North American bison will occur when multiple large herds move freely across extensive landscapes within all major habitats of their historical range, interacting in ecologically significant ways with the fullest possible set of other native species, and inspiring, sustaining and connecting human cultures.”

Expanding on this work, Sanderson et al. (2008) established a scoring matrix to quantifying the conservation value of these herds. Exceptional contributors to ecological restoration included naturally structured herds of > 5,000 individuals. Herds should consist of genetically pure and disease free animals which are impacted by all natural ecological interactions including predation. Lastly, herds located on landscapes > 2,000 km<sup>2</sup> are considered excellent contributors to bison recovery (Sanderson et al. 2008). Similarly, Lott (2002) hypothesized that > 13,000 km<sup>2</sup> is necessary for an ecologically functional prairie landscape. More recently, Kohl (2012) examined single foraging patch sizes of bison that when multiplied by historical spatial and temporal scales equates to landscape scales similar in size to these previous estimates.

Given the current status of bison (Boyd 2003, Gates et al. 2010a) and restoration guidelines (Redford and Fearn 2007, Sanderson et al. 2008, Gates et al. 2010b), we outline the important conservation challenges facing the ecological restoration of bison today, and then discuss these challenges in light of the current model for bison conservation (i.e., numerous small, confined bison populations). In conclusion, we outline contemporary steps that are being taken to conserve bison, and provide a comment on how things need to change to prevent the ecological extinction of bison.

## CONSERVATION CHALLENGES

### Domestication

Domestication may permanently alter the bison genetic pool while producing significant changes to morphology, physiology, and behavior as a result of anthropogenic selection and the loss of natural selection (Freese et al. 2007). Within the commercial herds, cattle husbandry practices are common resulting in non-random selection of traits leading to docility, reduced agility, and growth performance while also altering sex ratio and age structure (Gates et al. 2010a). The elimination of mature males further influences mate competition and natural selection (Gates et al. 2010a). Domesticated bison may also pose significant issues to bison conservation if commercial animals establish cattle introgression within conservation herds when intentionally or accidentally mixed with conservation herds (Boyd et al. 2010). Furthermore, increased commercial herds may lead to the misconception that bison are no longer vulnerable to conservation issues because of demographic recovery (Gates and Gogan 2010).

### Hybridization

A concerted effort to create “beefalo” through the cross-breeding of bison and domestic cattle occurred during the late 1800s and early 1900s to create a more resilient winter species while maintaining the meat production qualities of cattle (Dary 1989, Oglivie 1979). The concept dates back to the 16th century (Dary 1989) and was actively pursued by the Canadian government as late as the early 1960s (Ogilvie 1979). These efforts have resulted in widespread domestic cattle gene introgression in the mitochondrial and nuclear DNA of bison (Halbert and Derr 2007). Today, only 8 conservation herds are free of genetic introgression (Boyd et al. 2010) and only the Yellowstone National Park (YNP) and Wind Cave National Park (WCNP) herds have had large enough samples to confidently evaluate introgression levels (Boyd et al. 2010). Of these 2, recent work has demonstrated minimal introgression in bison in WCNP (K. Kunkel, unpublished data).

Further complicating the conservation of the bison genome are questions related to historical and geographic differences. Despite low levels of cattle introgression, some public herds may contribute to bison conservation due to unique historical and geographic lineages (Halbert 2003, Halbert and Derr 2007). As a result, these lineages are important in the long-term conservation of the bison genome regardless of introgression levels and should be preserved (Boyd et al. 2010). Similarly, herds considered free of cattle introgression should be managed in isolation from hybridized herds (Boyd et al. 2010).

### Disease

Nine diseases are recognized by the International Union for the Conservation of Nature (IUCN)- Bison Specialist Group as diseases of concern for bison conservation; however, only the YNP and Grand Teton National Park/National Elk Refuge (Jackson herd) herds (24% of the bison conservation population) are significantly impacted by chronic disease issues (Aune and Gates 2010).

**Brucellosis.**—Brucellosis (*Brucella abortus*) is primarily found in bovine species; however, elk play a transmission role in the Greater Yellowstone Ecosystem (Davis 1990). Primarily transmitted through oral contact with aborted fetuses, contaminated placentas, and uterine discharges (Reynolds et al. 1982, Tessaro 1989), brucellosis leads to first pregnancy abortion in > 90% of infected female bison (Davis 1990, Davis et al. 1990). Natural immunity reduces the abortion rate to 20% and ~ 0% by the second and third pregnancy, respectively (Davis 1990, Davis et al. 1990). Due to similar symptoms in domestic cattle, infected bison populations are heavily managed to minimize transmission from bison to domestic livestock (Keiter 1997), despite no confirmed cases of transmission in the wild (Bienen 2002, Chevillat et al. 1998, Shaw and Meagher 2000). No highly effective vaccine is available; however, quarantine protocols and test and slaughter protocols may effectively eliminate all animals within an exposed population (Aune and Gates 2010).

In YNP, the Interagency Bison Management Program (IBMP) was adopted as a cooperative, multi-agency plan to guide bison and brucellosis management to maintain wild, free-ranging bison, while reducing the transmission risk of brucellosis to domestic cattle (USDOI and USDA 2000). Management has incorporated multiple strategies including spatial and temporal separation of bison and cattle, capture-test-slaughter actions, quarantine and translocation actions, hazing of bison back into YNP, and vaccination (USDOI and USDA 2000). In the Jackson herd, intense management actions based on spatial and temporal separation are not as prominent as in YNP, rather management aims to reduce elk and bison dependency upon the winter feeding grounds while utilizing brucellosis vaccination program for both species while simultaneously using hunting to reduce and later maintain the population at 500 individuals (Aune and Gates 2010).

### Legal Status

Bison do not typically have equal legal or policy status when compared to other wildlife species because of early conservation practices that classified and managed bison as a form of livestock (Aune and Wallen 2010). Today, bison management and conservation is

highly complicated because of this conservation legacy, particularly in cases of threatened species listing (see below).

**Listing.**—From a global perspective, the IUCN lists the bison (wood and plains bison) as “Near Threatened” (IUCN 2012). According to federal designation, bison are a “Red-Listed” species in Mexico; however, bison are currently not listed in Canada under the Species at Risk Act because of potential economic implications for the Canadian bison industry (Aune and Wallen 2010). Bison are classified as “Threatened” by the Committee on the Status of Endangered Wildlife in Canada. Similarly, bison are not listed under Endangered Species legislation in the U.S. A primary difficulty for listing in the U.S. and Canada is complication caused by the classification of hybridized animals (Boyd and Gates 2006) and the role of commercial bison producers in the numerical status of bison.

**Classification.**—The classification of bison as wildlife, livestock or both, is jurisdictionally dependent. Within their historical range, bison are classified as wildlife in 4 Canadian provinces, 10 U.S. states, and 1 Mexican state; however, free-ranging populations do not exist in all these areas. Where bison do exist as “wildlife”, they are typically managed within fence preserves (Aune and Wallen 2010). Outside of these areas, bison are typically classified and managed as livestock by private ownership, thus are governed by animal health and trade regulations.

**Ownership.**—Bison conservation within the private sector is largely a secondary objective behind commercial production. However, conservation groups such as The Nature Conservancy, American Prairie Reserve, and World Wildlife Fund have established privately owned herds focused on bison conservation. In addition, North American indigenous peoples are playing a key role in conservation because of the bison’s cultural importance and role in restoring cultural connections in addition to dietary and economic benefits. Despite these efforts, bison managed by these groups face difficult challenges such as management restrictions, insufficient funding, and litigation.

### Availability of Restoration Sites

The identification of bison restoration sites has been particularly problematic because landscapes large enough to support ecologically interactive bison populations are limited. In particular, human development and habitat conversion has expanded into many areas capable of supporting large bison populations. For example, private agricultural operations can be found in almost all areas suitable for bison restoration, even on public land. Besides direct forage competition between bison and livestock, potential conflicts may include hu-

man safety issues and property damage (e.g., fencing, crop depredation). As a result, the social difficulties of translocation have increased, particularly when considering the restoration of bison to mixed-ownership and mixed-management landscapes. These areas require detailed restoration plans which provide guidelines for dealing with management issues and conflicts. In these areas, coordination among private individuals, local, state, federal, and tribal governments, wildlife agencies, conservation organizations and other concerned parties has been difficult but successful and is a necessity for long-term success.

## DISCUSSION AND REVIEW OF CURRENT INITIATIVES

Throughout the last century it has been easier to start and maintain multiple small herds due to challenges listed above, however this trend raises questions about the efficacy of this model in the future of bison conservation. Have bison been restored ecologically? Are conservation initiatives actually meeting the restoration criteria set forth by Freese et al. (2007), Sanderson et al. (2008), and Gates et al. (2010b)? The following review of recent bison initiatives provides insight into these questions.

### Grasslands National Park

Grasslands National Park is located on the U.S. – Canada border in southern Saskatchewan. The park was formally established in 1981 by the Canadian federal government and is currently managed by Parks Canada. Seventy-one bison were translocated from Elk Island National Park in 2005 and have since grown to approximately 350 individuals. Disease-free and genetically pure, these animals are maintained within 182 km<sup>2</sup> fenced region of the park. Current management plans will maintain the herd at approximately 800 animals; however, a range expansion may occur in coming years providing availability for a larger population. Although large predators are not found in the area, future expansion of wolves into the area may lead to overlap with the park.

### American Prairie Reserve

American Prairie Reserve (APR) is a non-profit organization established in 2001 with the goal of acquiring and managing private land and public grazing leases to establish a fully-functioning prairie-based wildlife reserve in north-central Montana, USA. Since establishment, APR has purchased and leased 498 km<sup>2</sup> of prairie, of which 57 km<sup>2</sup> currently support bison. Approximately 325 disease-free animals currently graze the reserve. All animals have been genetically tested and all animals acquired from WCNP which contained

levels of cattle introgression were removed from the population in 2011. Genetically pure animals from Elk Island National Park were used to augment the population in 2010 ( $n = 94$ ) and 2012 ( $n = 70$ ). The bison pasture will double in the coming years and will be further expanded as land purchases allow. No large predators currently exist in the region; however, grizzly bears have ventured within 200 km of the reserve (Robbins 2011). Future reserve plans include a landscape of > 14,000 km<sup>2</sup> that support a full suite of native wildlife including 10,000 bison and large predators.

### El Uno Ecological Reserve

The El Uno Ecological Reserve (EUE), located in Chihuahua, Mexico, is owned and managed by The Nature Conservancy. The EUE is a part of the larger Janos Biosphere Reserve which consists of a mix of private owners and ejidos (communal agriculture lands). Bison were translocated from WCNP in 2009 with 38 animals currently occupying approximately 20 km<sup>2</sup> of the EUE. The EUE has been registered as a Wildlife Management Area with the Mexican Federal Government which will permit an increase in the bison pasture and herd size. As a result, future management will maintain a sustainable herd size of 157 animals and a maximum of 210 (Laura Paulson, The Nature Conservancy, personnel communication). No sustainable populations of large predators are currently located in the region.

These examples illustrate the range of recent restoration efforts for bison. From government-based herds on public land (i.e., Grasslands National Park) to completely private conservation herds (i.e., EUE), the conservation of bison comes in multiple forms. However, when considering the criteria for the ecological restoration of bison, many programs fall short. Are these bison herds able to move freely across the landscape? Are the effort's goals > 5,000 individuals? Will these herds face historical predation? These questions seem easy to answer, but is this the model of bison conservation that will actually restore bison, ecologically, in North America?

## CONCLUSION

As bison conservation continues forward, we as managers and conservationists understand the challenges associated with bison restoration. Additionally, we have been provided with guidelines for the successful restoration of bison (Redford and Fearn 2007, Sanderson et al. 2008, Gates et al. 2010b). After reviewing the projects above in light of ecologically restored bison populations, it leads us to speculate on the feasibility and intentions of bison restoration efforts. If we understand the challenges and issues associated with

bison restoration, shouldn't conservation target the restoration of the species in landscapes large enough to support ecologically restored bison herds, not small bison herds maintained behind wire? If so, then we as managers and conservationists, along with the general public, and all interested and affected parties must join in the discussion on how we proceed.

If we as society desire an ecologically restored bison population, we must then initiate a shift in bison conservation which takes us away from small, isolated conservation herds and toward ecological recovery. Naturally, there will be social, political, and biological ramifications to deal with; however, these issues are not new to wildlife conservation. To proceed, we must shift our focus toward expanding existing herds that have the potential for a large ecological footprint. In regions currently lacking bison, we must focus our efforts on the translocation of bison to areas that can meet the aforementioned conservation criteria. Never again will bison roam North America by the millions, but it is ecologically, culturally, and historically important to continue the conservation of this North American icon. Thus, it is time we shift our model of bison conservation toward ecologically functional populations rather than livestock and fenced wildlife.

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