When people describe what's happening here as a national tragedy, I don't disagree with them . . . We are participating in something that is totally unpalatable to the American people, and it's something we are not convinced that science justifies.

Yellowstone National Park Superintendent Mike Finley following
the slaughter of over 1,000 migrating wild bison
the winter of 1996-97.

We have our own mandate just like the park has theirs, and ours is to eliminate brucellosis . . . If we drop our guard and let the diseased bison roam freely out in the countryside, we're inviting trouble.

Animal and Plant Health Inspection Service (APHIS)
Veterinarian Mike Gifford. (Brunner, 2011, p. 2).

Greater Yellowstone is absolutely irreplaceable. If we, as a society, cannot protect this spectacular, iconic place that inspires people worldwide with its breathtaking beauty, incredible wildlife, vast landscapes and vision for the best that this country can be in protecting our natural heritage – if we cannot leave this place wild and intact as a legacy for the future – where can we?

Sierra Club: Resilient Habitats, 2014

The buffalo is more than an animal. It is the sun's shadow.
Our lives are bound to it. If it lives, we live.
If it dies, we die. It is our life and our living shield.

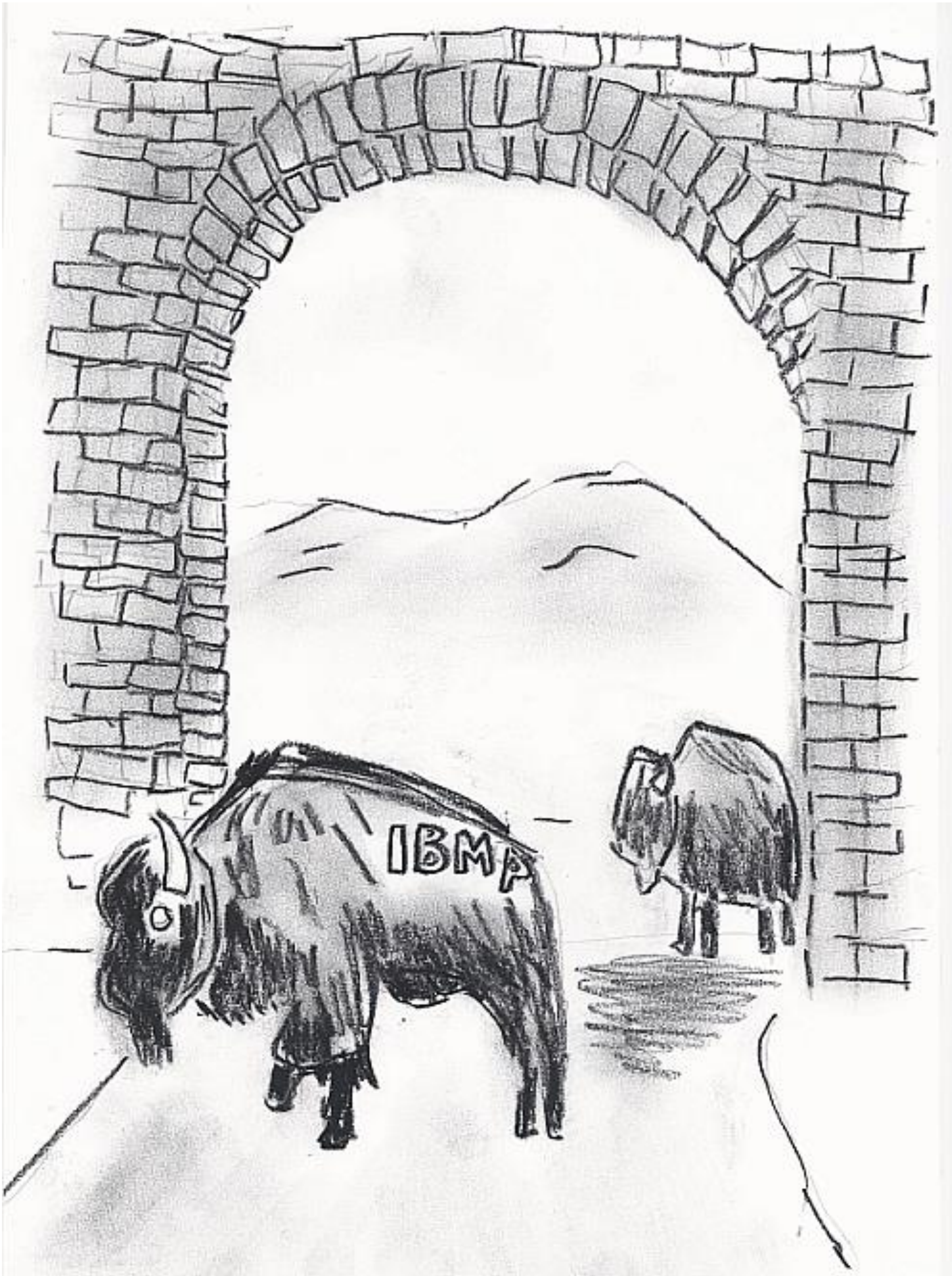
Words spoken to N. Scott Momaday by an old Kiowa man
at Medicine Park, Oklahoma (Momaday, 2014).

Who's afraid of the big bad wolf,
The big bad wolf, the big bad wolf;
Who's afraid of the big bad wolf,
Tra la la la la

Popular song written by Frank Churchill

Before the Secretary of the Interior:

A Petition to Protect Yellowstone's Wild Bison from Extinction



ENTERING THE KILLING ZONE. **See Figure 96.**

Before the Secretary of the Interior:

A Petition to Protect Yellowstone's Wild Bison from Extinction

James Horsley

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To the glory of God,
and to my wife Karen,
the American Indian nations,
conservationists
and hunters

Preface

One winter afternoon I lay on my bed reading a copy of the *Fargo Forum*. I read how over 1,000 wild bison trying to migrate out of Yellowstone National Park had been killed by agents of the Montana Department of Livestock during the brutal winter of 1996-1997. For reasons I am not sure of, I was filled with a mixture of horror, grief and anger. I suppose, if I were to examine that feeling, it was shock that the park was being turned into a wildlife extermination center. But there was something deeper. These wild beasts once had sustained the American Indians, especially the Plains Indians and Columbia Basin Indians, and were sacred to those nations. An old Kiowa man at Medicine Park, Oklahoma, talking with novelist N. Scott Momaday, summed up the Indian's relationship to the buffalo. He said:

> The buffalo is more than an animal. It is the sun's shadow. Our lives are bound to it. If it lives, we live. If it dies, we die. It is our life and our living shield (Momaday, 2014).

American Indians are also the living shield of the buffalo. But now wild bison, so intertwined with the tribal cultures, are treated by our government as pests. I decided to do something about it.

I started reading about the bison native to the park. I learned that they are the only wild unextirpated herd left in America following the great slaughter of the late 1800s that almost reduced them to extinction. Now they are being killed because when they migrate they might infect cattle grazing on the park's borders with brucellosis, a disease that makes animals abort. This rare wild ungulate is being sacrificed in favor of a few domestic cattle that should not be in this wildlife ecosystem in the first place, for their presence here promotes the transmission of this disease out of the park and is a biohazard to other cattle herds in the nation.

I was especially impressed by the work of park biologist Mary Meagher. I began to think that one way to save these iconic animals would be to have them listed as endangered. But how? I learned that I would have a logical toe-hold if I could find them to be a distinct population segment, essentially a subspecies. I went about preparing a petition and wrote a brief eight-page document, submitting it to the Secretary of the Interior in 1999. It was written by hand as I had no access to a computer at that time (see Appendix A).

Eight years later I was notified that my petition had been accepted and that a finding had been published in the Federal Register August 17, 2007. The finding's summary said:

> We, the U.S. Fish and Wildlife Service (Service), announce a 90-day finding on a petition to list the Yellowstone National Park (YNP) bison herd as endangered under the Endangered Species Act of 1973, as amended (Act). On the basis of our review of the petition and information readily available in our files, we have determined that there is substantial information indicating that the YNP bison herd may meet the criteria of discreteness and significance as defined by our policy on distinct vertebrate population segments (DPS). However, we have also determined that there is not substantial information indicating that listing the YNP bison herd under the Act may be warranted throughout all or a significant part of its range.

In essence, I had come close to having them listed, but no banana.

In the fall of 2014 I read an announcement by the National Park System that stated the Interagency Bison Management Plan (IBMP), a coalition of government agencies formed in 2000 that now has jurisdiction over wild bison management, was going to cull 900 wild bison migrating out of the park in the winter to prevent a "mass migration" into Montana. The need to make large-scale reductions of the herd was not based on good science and the claim of a mass migration into the state misrepresented the facts at hand. I decided to write another petition, submitting it March 2, 2015. This one was over 300 pages.

Shortly thereafter, I read that the State of Montana and the National Park Service were jointly revising the Interagency Bison Management Plan and were going to prepare an Environmental Impact Statement (EIS). Its purpose was to develop a new, long-term decision about how to manage bison in the park and on adjacent lands outside of the park in Montana, with the objective stated "to conserve a wild and migratory population of Yellowstone-area bison, while minimizing the risk of brucellosis transmission between these wild bison and livestock to the extent practicable" (Updating the Interagency Bison Management Plan, 2015). It provide a number of alternatives, none of which included removing cattle from the perimeters of the park. By excluding that alternative, the revision effort was a farce.

Comments by the public were requested for the EIS. I submitted one on the deadline date of June 15, 2015. In preparing that comment I became even more convinced that the IBMP was engaging in duplicity.

I decided to self-publish the petition so that it would be publicly available while it was being evaluated by the Fish and Wildlife Service (FWS). The photographs and charts in the petition submitted in 2015 were in color. To keep down the price of the book, I decided to publish the petition in black and white. Some of the government's color-coded maps were in hard-to-decipher pastels. In converting them to gray scales, I came to understand better some of the ungulate population aspects, including distribution of cattle, bison and elk. For instance, on the map showing Hebgen Basin were two black fly specks. These black dots represented the area of allotments occupied by cattle relative to the land space available, only a few in number in that basin west of Yellowstone. What began to emerge more clearly were two points:

1. That the government is spending $3 million annually to protect a relatively few cattle from the spread of brucellosis by bison, but spends almost nothing to prevent the spread of that disease to cattle by elk, which are an even greater threat, allowing elk to migrate freely out of the park, but not bison;

2. That Gardiner Basin, where most of the culling is being done, is a critical "dispersal sink," a vital link in the preservation of this wild species, yet cattle, a domestic species, is given preference here over bison for the use of this ecosystem habitat. Killing bison that enter Gardiner Basin eventually will drive them to extinction.

It also became increasingly clear that by the government holding wild bison hostage in the park and by slaughtering all those that try to escape from the park—migrating for self-preservation of their species—the government was making a frontal assault against the Plains Indians' way of life, one that traditionally was dependent on wild bison. This assault is so systematic it has a high potential of driving wild bison into extinction. Yellowstone is the last stand in the complete annihilation of America's wild bison—a public animal—and a way of life that is characterized by subsistence on wildlife, as opposed to domestic animals. That way of life was an involvement with wild bison that preserved their existence, as opposed to the European way of life that years ago exterminated the European bison.

I thought I had time to self-publish the petition before a finding was made because of the duration it normally takes for the FWS to reach a decision—often over two years and for my first petition eight years. But such was not the case. On January 12, 2016, the FWS denied two petitions requesting Yellowstone bison be listed as endangered or threatened—one jointly submitted November 14, 2014, by the Western Watersheds Project and Buffalo Field Campaign and my separate petition submitted March 2, 2015 (Endangered and Threatened Wildlife and Plants; 90-Day Findings on 17 Petitions, 2016).

Armed with new information, I have extensively rewritten and reorganized my second petition and am submitting this third petition of about 700 pages to list wild bison It includes not only new information (including new research), but also my public comment on the proposal to update the Interagency Bison Management Plan. It is my hope and prayer that this petition results in the protection of wild bison from extinction.

James Horsley
November 2016

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Petition Under the Endangered Species Act for the Listing of the Wild Herds of Bison in Yellowstone National Park as Endangered or Threatened with Extinction in a Significant Portion of Their Range

Figure 1. DOOR TO EXTINCTION for America's last wild bison: The North Gateway of Yellowstone National Park. At its top is inscribed "For the benefit and enjoyment of the people." ***Photo released by author James Horsley to public domain.***

Notice of Petition

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Petitioner

I, James Horsley, hereafter referred to as the Petitioner, am a resident of Fargo, North Dakota, and am the author of a petition submitted February 11, 1999 (see Appendix A), as well as a second petition submitted March 2, 2015, both to list the Yellowstone National Park (YNP) bison herd as threatened or endangered under the Endangered Species Act (ESA). Both petitions have been denied (see Appendix C and D). This petition is my third submission.

My work experience includes: publisher of the *Prairie Journal*, a regional newspaper; instructor in English composition at College of the Desert, Palm Desert, California; speech writer for the California Medical Association and the State Bar of California; and account executive with the public relations firm Daniel J. Edelman, San Francisco, California.

I am a graduate of the University of California at Berkeley with a BA in English and did graduate studies in English at California State University, San Bernardino and at North Dakota State University, Fargo.

Emergency listing sought

The wild bison of Yellowstone are a tribal trust resource and merit immediate protection by the Fish and Wildlife Service. An emergency listing (or a candidate for listing) for Yellowstone's wild bison is requested, based on the Interagency Bison Management Plan's scheduled culling of up to 1,400 animals for the winter of 2016-2017. This is large-scale culling and exposes the herds to loss of genetic diversity necessary for survival. The Fish and Wildlife Service denied my first and second petitions based on its claim that total abundance of wild bison is sufficient to prevent extinction. However, total population is not the only issue, but rather abundance of a sub-population, the migratory herd, which has been repeatedly reduced over decades by the government's selective culling and is being put in further danger of extinction by the IBMP's planned level of lethal removals for the future. The continued existence of this migratory herd subpopulation is necessary for the long-term survival of Yellowstone's wild bison. This would be recognized under a more inclusive definition of species than the biological species concept now being used by the FWS in its evaluation—such as the phylogenetic or ecological species concept. This petition should be evaluated under one or more of these more useful species concepts. Emergency listing should be granted because massive slaughter is imminent and has the potential of driving this wild species into extinction.

Capture operations at Yellowstone's Stephens Creek bison trap began Saturday, January 7, 2017. As of the submission of this petition, Buffalo Field Campaign field patrols in the Gardiner Basin report that 84 wild buffalo are currently captive in the trap, awaiting shipment to slaughter.

Figure 1a. WILD BISON AWAITING SLAUGHTER in the Stephens Creek capture facility. ***Photo courtesy Buffalo Field Campaign.***

Overview of 90-day finding of 2007

The U.S. Fish and Wildlife Service concluded August 15, 2007 that the YNP bison herd satisfied the two essential requirements to be listed as either endangered or threatened, that it was both "discrete" and "significant." The FWS found that while there are 500,000 bison in North America, including 50 herds (containing approximately 19,200 head) managed with conservation objectives, "YNP is the only area in the United States where bison have existed in the wild state since prehistoric times." "Conservation herds" refer to those herds managed by federal, state, municipal or private entities without commercial intent (see Appendix C).

The FWS found that the YNP bison may be discrete from other members of the taxon Bison bison because of physical distance and barriers. The herd was considered significant because it is the only wild herd that has remained in an unfenced setting since prehistoric times and because it was uniquely genetically pure and diverse, one of two populations "which at this time do not have any evidence of domestic cattle introgression and also have high levels of unique genetic variation in relation to other federal populations," noting that, "All other bison in the United States are reconstituted herds and are confined with fencing, or otherwise range restricted."

However, it also concluded that the petition did not provide substantial information to indicate listing may be warranted. It held that the YNP bison herd is not in danger of going extinct because there are sufficient numbers and because the current government management practice of lethal control of bison crossing the park borders has not reduced the population of the herd to a point of being in danger of extinction. Further, it found that the herd's ability and instinct to migrate were not being compromised by killing only migratory bison because so far some bison were still migrating, that is, attempting to leave the park. (Endangered and threatened wildlife and plants; 90-day finding on a petition to list the Yellowstone National Park bison herd as endangered, 2007).

In a press release August 17, 2007 following the listing denial, headed "Yellowstone National Park Bison Do Not Meet Criteria for Listing Under the ESA: Management Plan Now Provides Substantial Protection for Herd," the FWS stated:

> The Service finds that the YNP bison herd is not in danger of going extinct. Since the petition was filed, a multi-agency Joint Bison Management Plan was finalized in 2000. The plan provides substantial protection for the YNP bison herd and therefore there is not a current credible threat to the herd's existence, which would be necessary to list the herd under the ESA (Davis, 2007).

Overview of 90-day finding of 2016

The 90-day finding on my second petition filed March 2, 2015 was denied January 12, 2016 essentially on the same grounds as the denial of my first petition (see Appendix D).

In the second petition, the Petitioner contended that the Joint Bison Management Plan, now called the Interagency Bison Management Plan (IBMP), itself posed a current credible threat to the herd's existence, making it necessary to list the herd under the ESA.

Summary

The iconic wild bison, the last of which now inhabit the Greater Yellowstone Ecosystem, sustained for millennia the Native American tribes and for over a century the European settlers. Buffalo roamed the Great Plains in multiple millions. However, as a strategy instituted by the federal government following the Civil War to subjugate the tribes so as to make way for cattle and the construction of the transcontinental railroad, the herds were reduced by buffalo hunters to a few dozen animals that hid out in the region that is now Yellowstone National Park. Today, this strategy would be termed genocide, for it was aimed specifically at a race of people and used starvation as a weapon.

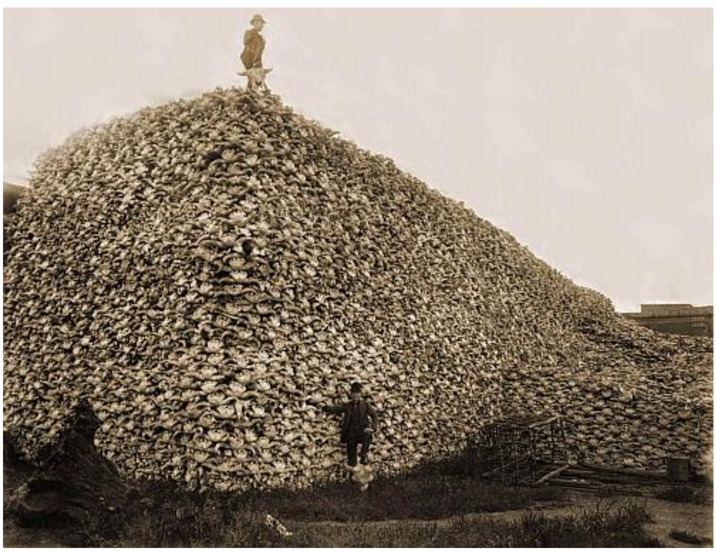


Figure 2. BISON SKULLS from the slaughter of the 1870s, stockpiled for grinding into fertilizer. The pile represents a fraction of the millions killed.

This same policy is being continued by a coalition of state and federal agencies called the Interagency Bison Management Plan (IBMP), which confines the last wild ancestors of the survivors of the great bison slaughter to the interior of Yellowstone National Park. Any bison that attempts to migrate out of the park when the herd exceeds its maximum population allowed under the interagency plan—3,000 animals—is subject to lethal removal, that is, slaughter. Limiting the availability for hunting of wild bison, a publicly-owned ungulate, to numbers insufficient to sustain tribal members has caused great harm to the American Indians as well as wild bison. Bison are evolutionarily essential to the health of these tribal people, who have depended on bison for over 10,000 years for sustenance. An epidemic of diabetes among the tribes is just one result of being deprived of access to this animal.

This petition argues for the restoration of the historical pre-settlement relationship between the tribes and the bison herds, a relationship that was beneficially symbiotic. Today, the relationship between wild bison and the state and federal agencies that have jurisdiction over them is parasitic. The present management of wild bison by the IBMP will lead to the extinction of that animal.

Wild bison occupy off-reservation land. Under provisions of various treaties (such as the Treaty of Fort Laramie of 1851 and the Blackfeet Treaty of 1855), they are subject to governance as tribal trust resources. To prevent the extinction of this rare herd of wild bison found only in the Yellowstone region, wild bison must be listed as endangered under the provisions of the Endangered Species Act. If listed, the federal government has self-acknowledged it would be obligated to work with Indian tribes in the conservation of an endangered species that is a tribal trust resource, in this case wild bison.

State and federal agencies have singled out wild bison for massive culling because about 50 percent of the herds are infected with brucellosis, a disease that causes ungulates to abort their young. However, this targeting is discriminatory and biased, nullifying effective disease control. Both wild bison and elk can carry the disease. When cattle ingest infected birthing materials, the disease can be transmitted to them. Since the implementation of the IBMP, multiple thousands of wild bison have been killed attempting to migrate out of the park to survive the severe winters characteristic of the mountainous, high-altitude regions of the interior. They are killed, so the rationale goes, to protect cattle grazing on the borders of the park from the spread of brucellosis. It is a bogus justification because epidemiologically such slaughter has no disease-control value. While both elk and bison have the disease, only bison are prohibited from migrating out of the park. Elk, on the other hand, are allowed to migrate and mingle with unfenced cattle herds in the Greater Yellowstone Ecosystem. Since elk are a major vector for brucellosis, allowing elk in the proximity of cattle utterly defeats containment of the disease and killing bison to prevent their contact with cattle serves no useful purpose.

As park biologists admit themselves, "Many of the approximately 450,000 cattle in the Greater Yellowstone Area are fed on private land holdings during winter and released on public grazing allotments during summer—

but throughout the year they are allowed to mingle with wild elk. Thus, the risks of brucellosis transmission to cattle are primarily from wild elk, and management to suppress brucellosis in bison will not substantially reduce the far greater transmission risk from elk" (White, P.J. et al., 2015).

Since the inception of the IBMP, elk have been exempt from a comprehensive brucellosis management plan. However, hazing of elk between January 15 and June 15 to prevent comingling with cattle in the regions north and west of the park, called the Brucellosis Designated Surveillance Area (DSA), was proposed August 11, 2016 by Montana Fish, Wildlife and Parks as a means of mitigating the transmission of brucellosis. But, as the proposal notes about the use of hazing:

> Given the wide and nearly continuous distribution of elk throughout much of Montana to include the areas in and around the DSA, this tool has high potential to fail if only because all elk interactions cannot possibly be monitored, identified, or influenced (Elk Management in Areas with Brucellosis: 2017 Proposed Work Plan, 2016) (Brucellosis Designated Surveillance Area, 2016).

What goes for elk goes for wild bison. Hazing is essentially useless. The proposal is grandstanding. Only killing great droves of either animal will limit their migration out of the park and influence interactions with cattle. What will be the outcome of this proposal vis-a-vis elk? Most likely, nothing of substance will change. Typical of the thinking that goes into the management of brucellosis in the GYE is admission after admission that the way it is being done really makes no sense, but regardless, it is going to be continued anyway. The various governmental agencies operate as if by their admissions of the plan's failures, they have not merely identified its deficiencies, but somehow rectified them. That, of course, is delusional. But that appears not to matter to members of the IBMP. Reason just gets in their way—kill all the wild bison they can and give elk a free pass. They engage in meaningless talk designed to draw attention away from what is actually happening,. Their words are hocus-pocus.

Two types of bison exist in the park—migratory and non-migratory. Since only migratory bison are killed, the IBMP is artificially selecting for survival the non-migratory, resident bison. They alone are left to breed and propagate the herd. The primary method of killing wild bison is by means of a bison trap called the Stephens Creek capture facility. It is a stockade which has on one end a system of fencing shaped like a funnel that feeds stampeded bison into it. At the end of the facility is a ramp up which the trapped bison are prodded into livestock trailers. They are then shipped in a caravan of trailers to slaughterhouses for meat processing. Year after year the waste bins of the slaughterhouses are filled with guts that contain rare genes that carry the traits governing the survival instinct of migratory behavior. Because of this continued selection favoring the non-migratory, at some point only non-migratory bison will compose the herd and when this happens, that herd will not possess the instinct to migrate. This has the potential to produce genomic extinction, that is, the loss of these migratory genes in this subspecies. This is harmful to wild bison for in effect they will no longer be wild. Without the ability to survive an especially harsh winter because they remain in the park's higher elevations, the potential is significantly increased for a collapse of the entire herd. Genomic extinction can produce complete extinction.

However, the FWS evaluators of the several petitions to protect wild bison have denied listing wild bison in part because they do not believe traits or behavior are important to conserve as long as what looks like a species remains abundant. It does not matter if the migratory bison may be wiped out by the culling of the IBMP of thousands of wild bison that possess this trait because, as they have noted, bison still attempt to migrate. Logically speaking, because of this perspective by the FWS, the only evidence that such present-day large-scale herd reductions harm genetic diversity would be the extinction of wild bison—which is what the authors of the petitions are trying to prevent.

Two ways exist to prevent the spread of brucellosis out of the park: either prohibit *both* elk and bison from leaving the park or prohibit livestock from grazing on the perimeters, that is, exclude cattle from the Greater Yellowstone Ecosystem. However, laws and legal agreements—such as the Multiple-Use and Sustained-Yield Act and the Interagency Bison Management Plan—provide support for the continued presence of cattle on these biohazardous public lands.

However, examination of laws and policies favoring the livestock industry show that their application often have been in error or the law itself unconstitutional. Ranchers claim they have a right to graze their cattle on national forest and public lands because of the multiple-use mandate, but disregard that such use must also provide sustained yield. According to the Multiple-Use Sustained-Yield Act, sustained yield is defined as "the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land."

The overarching goal of the IBMP is to reduce the productivity of wild bison by killing large segments of the population, especially mothers and calves. Killing wildlife, including bison and predators, in great numbers to protect cattle diminishes the productivity of the land by means of reducing the reproductivity of wild species and by the associated high cost of lethal removals, and puts in jeopardy the sustained yield in perpetuity of these resources by exposing targeted animals to decreased birth-rates and the potential for extinction. Instead, cattle are assured a high-level of output at the expense of wild bison.

Further, while grazing permits convey no right, title or interest held by the United States in any national forest or public lands, permittees holding expiring grazing permits are given first priority for new permits, according to the Code of Federal Regulations on grazing permits. This makes ranchers that were granted permits in the past heirs of the publicly-owned land of the ecosystem, which is fundamentally unconstitutional, prohibited under the constitution's title of nobility clause.

The mission of the IBMP is supposed to be guided by the Department of the Interior's *Adaptive Management Technical Guide*. It states:

> Adaptive management focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable resource systems.

Increasing wild bison culling goals, yet publicly claiming its goal is to decrease culling to the point of no human interference, and grazing cattle in the Greater Yellowstone Ecosystem that ends up costing millions of dollars in public funds to protect them, threatening to drive wild bison into extinction, is not learning from experience or adapting. It is in fact doing just the opposite of its stated mission to "create and maintain sustainable resource systems." It is instead wasting them.

The execution of such laws and policies defeats the mitigation of brucellosis in the ecosystem. By not allowing bison to migrate and by feeding elk on the perimeters of the park, the prevalence of the disease is increased, since both acts promote crowding of animals. Close proximity of diseased animals to healthy ones is the hallmark cause of disease transmission. Further, the presence of predators has been shown to reduce the incidence of disease in an ecosystem, especially in ungulates, because predators prey on animals weakened by disease, thereby reducing the prevalence of disease among a population.

An ignorant public and legislatures dominated by special interests that are anti-wildlife have enabled the cattle industry to benefit from public funding protecting ranchers' domestic animals from the hazards of the ecosystem. For just brucellosis protection alone, the public provides the IBMP $3 million annually. Not only do such public dollars fund the potential extinction of wild bison, they fail to serve the intended purpose: disease control.

The major portion of these funds goes toward the operation of the Stevens Creek capture facility, which is located on park land in the Gardiner Basin, a grassland that straddles the northern boundary of the park. Roughly half of the basin is on park land and the other in the Gallatin National Forest just outside the park. This region is known as a "dispersal sink," essential for the survival of migratory species such as wild bison because it is the lowest region in the northern sector of the ecosystem, providing a refuge from the harsh winter climate of the park's higher elevations.

Placing in effect a wild bison slaughterhouse in the middle of a wildlife refuge's most critical region for winter survival is egregious. Funding its operation with public dollars should be unthinkable. That the FWS defends its operation and winks at its destructive capabilities is alarming.

Further, the claim by the National Park Service, one of the member agencies of the IBMP, that culling wild bison is necessary to prevent migration onto private grasslands comprising Paradise Valley within the ecosystem is false. A natural bottleneck at the northern portion of Gardiner Basin called Yankee Jim Canyon, consisting of steep cliffs and a whitewater portion of the Yellowstone River, and barricaded with fencing and a cattle guard, prevents their movement beyond. Knowing this, yet advocating continued lethal removal, is troubling.

The IBMP claimed in its 2014 annual report that it hazed bison back into the park that had gone beyond Yankee Jim Canyon north into Tom Miner Basin, which adjoins Paradise Valley. That claim is also false. The bison hazed only went as far as the cattle guard in Yankee Jim Canyon. The agency proffered its claim by means of tricky language involving where Gardiner Basin ends and Tom Miner Basin begins. However one looks at it, bison never went beyond the cattle guard. The canyon is several miles long and separates the two basin grasslands. The cattle guard is in the middle of the length of the canyon. The IBMP made the claim apparently to look as though it were saving Montana from bison migrating out of Gardiner Basin. The claim is misleading and braggadocio.

The government is presently proposing to rewrite the outdated Interagency Bison Management Plan, but in keeping with its hoodwinking of the public, it is only considering adjustments to the maximum number of bison allowed in the park. Removing livestock from the ecosystem is not an alternative in the proposed environmental impact statement.

For the winter of 2016-2017, the IBMP is proposing to lethally remove up to 1,500 bison from the park to protect up to 1,500 cattle that graze in Gardiner Basin and Hegben Basin, wildlife habitat owned by the public. Here is the deal: a bison for each cow plus $3 million and possible extinction of a wild species.

Unlike hunting, government mass slaughter destroys not only more bison, but also entire familiy units, eliminating that genetic line permanently.

The IBMP is genetically managing wild bison by artificially selecting for culling only migratory bison and sometimes those testing positive for brucellosis, even those immune to the disease. IBMP biologists claim that such managment will nevertheless retain 95 percent of the existing genetic diversity of the park's bison, yet have no idea what valuable genes are being lost in the culling process. As biochemical geneticist Thomas Pringle notes, this has nothing whatsoever to do with proper management of the YNP bison herd. He states:

> I challenge the whole concept that bison or any other native species needs genetic or any other kind of 'management' (unless it be halting trophy rack hunting). No one proposes a cull of a native species in a national park for the species' benefit — this is all about two cowardly controversy-avoiding agencies kowtowing to the local cattle industry, even though almost all of the adjacent FS [Forest Service] allotments were retired by NWF [National

Wildlife Federation] years ago. (Thomas Pringle, personal communication, October 22, 2016).

At the center of this controversy is the Stephens Creek capture facility, where bison on park property are trapped and shipped to slaughter. What it is like can be seen on a video produced by the National Park Service. Here are two stills from the video:

Figures 2a and 2b. STEPHENS CREEK CAPTURE FACILITY. See https://www.nps.gov/yell/learn/photosmultimedia/vl_stephenscreek.htm (Bison - Stephens Creek Capture Facility, 2016).

Other videos of the hazing and capture process can be seen at:

- BFC: Hazing Operations & the Stephens Creek Capture Facility
https://www.youtube.com/watch?v=hbuRAraRkOU

- Shame on Yellowstone, 2015
https://www.youtube.com/watch?v=hwVwvK7dK3c

- Bison Helicopter Haze, 2013
https://www.youtube.com/watch?v=68VfwlDnVL8

It is either delusion or dissembling that continues the practice of allowing cattle to graze in the ecosystem. Because cattle, an invasive species, promote the spreading of disease outside the park and because their so-called protection from this biohazardous environment by the valueless culling of wild bison has the potential of driving this species to extinction, the Fish and Wildlife Service under the provisions of the Endangered Species Act, should list this rare herd as endangered or threatened, working with American Indians, local inhabitants of the ecosystem, conservationists and hunters to restore their original habitat and cease their government slaughter. As part of the listing process, cattle and other livestock should be removed from the ecosystem, as opposed to removing wild bison, with wolves, bears and mountain lions also protected.

What follows amounts to a collection of essays by the Petitioner in support of listing wild bison as endangered or threatened with extinction, each with a different perspective. The Petitioner can be reached at jahorsley@yahoo.com.

Declaration

Release the buffalo from Yellowstone National Park. Let them migrate. They are a tribal trust resource, obligating the federal government to protect them and preserve their wild state. Restore to the Indian nations, and to hunters, wild bison in sufficient numbers to sustain them, for what is valued will be protected. Killing only the migratory, as is now government policy, will drive them into extinction.

I, James Horsley, a private citizen, petition the Secretary of the Department of the Interior through the US Fish and Wildlife Service pursuant to the Endangered Species Act to list for protection from extinction the Yellowstone wild bison as an endangered or threatened subspecies, namely, as a distinct population segment (DPS) of plains bison (*Bison bison bison*), and as an endangered or threatened species of mountain bison or buffalo, also called wood bison (*Bison bison athabascae*), in a significant portion of their range in and near Yellowstone National Park, namely, the Greater Yellowstone Ecosystem.

This means allowing wild bison to migrate out of the park, just as do elk and other wild ungulates. At present, the park functions as a wild bison stockade. Captivity promotes disease. The wild bison's range includes their winter and spring habitats, such as Gardiner Basin north of the park and the Hebgen Lake region to the west, as well as portions historically occupied by bison beyond these regions—those extending along both the Yellowstone River into Paradise Valley and along the Madison River into Madison Valley. It also includes the Mirror Plateau and Pelican Valley, where sightings have been made of mountain bison.

The Petitioner claims that the park contains remnants of the only bison herd in the United States that has not been extirpated. It is also the only bison herd in the nation that has remained in its wild, unfenced state since prehistoric times. These characteristics make the herd distinct, discrete and significant population segments. Further, the petition claims that because of the genetic traits of the herd and because it is being managed by scientifically unsound principles—namely, large-scale herd reductions via lethal control by government agencies—the herd is being subjected to selective breeding practices that have the potential of reducing the herd to population compositions and levels that will put it in danger of extinction.

At present, it is private, commercial interests, namely the cattle industry, under the sanction of state and federal government agencies, that exercise exclusive control over those animals that reside in and migrate out of Yellowstone National Park, trapping them inside the park, killing those that try to escape. To protect the future existence of wild bison, the common man, instead of private industry, should have governance over these unique and wild ungulates. This means that the present massive culling of wild bison now being carried out by the government in behalf of commercial interests should be prohibited. Instead, all herd reductions by humans should be carried out by hunting only.

In behalf of the common man, I claim the right to hunt wild bison as a public animal in numbers capable of sustaining us as they did the original inhabitants of this continent for 10,000 years, the American Indians. By being hunted for need, not wanton slaughter, bison flourished for millennia. The dependence by the common man on wild bison preserved them. Now they are being subjected to systematic mass governmental destruction to preserve the cattle industry. For this reason, wild bison are in danger of extinction and need the protection of being listed pursuant to the Endangered Species Act. It is the commoner (those who live off the commons), the hunter (those who for thousands of years have co-existed with bison), who can protect this creature from extinction, instead of current government management, which kills wild bison execution-style in droves annually.

The common man includes members of the American Indian tribes, conservationists and all those who hunt wild animals. I claim the right to hunt them in the same manner as elk are hunted today, in particular with regard to the region comprising the Greater Yellowstone Ecosystem. Here elk are allowed to migrate out of Yellowstone National Park, while the majority of wild bison are not, severely limiting the expansion of the herd and consequently hunting opportunities of this wild animal. Critical habitat includes the bison's historical migratory routes along the Yellowstone and Madison Rivers.

By the industrialized slaughter of wild bison in the late 1800s, the herds of millions of animals were brought to near extinction. The last of these wild bison now exist in Yellowstone. Here they have lived continuously since they migrated from Asia millennia ago. Their wild existence is being put in jeopardy by a coalition of government agencies that continues this nation's past policy of large-scale bison killing. Culling ostensibly is carried out today by this governmental partnership to prevent bison from spreading the disease brucellosis to cattle that graze just outside the park. Brucellosis causes ungulates to abort.

This purported mission is a sham because the greatest vector of *Brucella abortus* is elk, yet elk are free to come in contact with the very cattle bison are not allowed to mingle with. Such epidemiology is no epidemiology at all. The only effective solution to preventing the spread of brucellosis out of the ecosystem is to ban cattle from the ecosystem.

The coalition is called the Interagency Bison Management Plan (IBMP). It consists of eight federal, state and tribal entities. Five agencies were originally responsible for implementing the plan: the National Park Service, Animal and Plant Health Inspection Service, U.S. Forest Service, Montana Department of Livestock, and Montana Fish, Wildlife & Parks. Since 2009 three tribal groups have been added: the Confederated Salish & Kootenai Tribes, the Inter Tribal Buffalo Council, and the Nez Perce Tribe.

The IBMP is overseeing what amounts to a pest extermination program mounted against the Yellowstone bison, favoring the economic interests of the cattle industry in direct violation of the act founding the park, which states that the Secretary of the Interior "shall provide against the wanton destruction of the fish and game found within said park, and against their capture or destruction for the purposes of merchandise or profit" (Yellowstone Act, 1872; 2014).

As demonstrated by its present actions, this interagency is out of control. The potential for the absence of appropriate checks and balances for this coalition is evident when one considers that the National Park Service (a member agency of the IBMP that oversees bison culling in the park), the Bureau of Indian Affairs (which provides protection of trust natural resources such as wild bison) and the Fish and Wildlife Service (responsible for the administration of the Endangered Species Act and for making listing decisions protecting wildlife from extinction), are all under the authority of the same department, the Department of the Interior.

The IBMP was formed in 2000 not only to control the spread of brucellosis from wildlife in the park to cattle on the park's perimeter, but also to mitigate large-scale culling and to preserve wild bison's migratory habits. None of these objectives have been achieved. The pace of culling has continued and at times increased. Under the plan, bison may be culled when the herd inside the park reaches a population greater than 3,000 animals. This magic number was established by the IBMP as a population limit, claiming that above that number bison tended to migrate out of the park, putting them in contact with cattle. Experience has shown, however, bison will migrate out at almost any number, given a harsh-enough winter.

Bison qualify for lethal removal from the park when they enter either of two lower-altitude grasslands on the park's borders in search of forage, namely Gardiner Basin, the northern migration route, and Hebgen Basin, the western migration route. Both basins straddle the park's borders and both are killing fields. On reaching these grasslands, bison first enter a meadow designated Zone 1 inside the park, where they may be culled (yes, bison may be culled *inside* the park, and thousands upon thousands have been shipped to slaughter from there). As they travel on and cross the park's border they enter Zone 2, where they also may be culled. If they reach Zone 3, which is anywhere outside the first two zones, they are automatically subject to being killed. In other words, wild bison are only safe in the interior of the park, not on its borders, for that is where cattle graze. In essence, domestic animals have priority over wildlife in major wildlife habitats in the Greater Yellowstone Ecosystem.

In an attempt to open up critical habitats outside the park to wildlife, in particular for wild bison in Gardiner Basin, millions of dollars have been spent by the government and by wildlife organizations to purchase land and easements so that bison could have a place to go when winter becomes severe and when it comes time for bison to calve in the spring.

But what one hand of the government attempts to give, the other hand takes away. Because of the 3,000 limit imposed by the IBMP on the number of bison allowed to occupy the park, even though public and private land has been set aside for wild bison to access outside the park, if the herd grows larger than 3,000 animals, any bison that approaches the park border may be culled. Under the provisions of the IBMP, such an animal may be lethally removed on park land before it can get to the habitats set aside for it outside the park.

Montana Governor Steve Bullock on December 30, 2015 issued a decision that allows bison year-round in limited numbers in some localities in Montana on the perimeter of Yellowstone National Park. This decision has allowed bison to calve in some portions of Hebgen Basin without being hazed back in the spring. But such an order still allows cattle on the perimeter and culling of bison if the herd gets too large. Bullock commented with regard to the order:

> . . . I am confident our livestock industry is protected. I remain committed to continuing to pressure the Park Service to reduce the bison population in the Park, and keep those numbers to manageable levels (Governor Bullock Issues Decision on Year-round Habitat for Yellowstone Bison, 2015).

Following that order, the IBMP announced January 5, 2016 it planned to cull up to 900 bison (IBMP Partners Agree on Bison Management Operations, 2016). In the end, it is still the same old numbers game—off with their heads if the population is above 3,000 animals.

The most important winter migration route out of Yellowstone National Park empties into Gardiner Basin. Surrounded by the high mountain peaks of the Absaroka and Gallatin ranges, Gardiner Basin is of special importance as a critical habitat for wild bison. It is called a "dispersal sink," a place for a species to go to survive when the environment in its home region turns hostile, such as an unusually severe winter. Historically, wild bison would migrate here, calve and then return to the interior of the park where the forage was richer in nutrients. But now, few wild bison return once they enter here. For bison, Gardiner Basin is a death trap.

Incomprehensibly, here in the middle of this critical habitat essential for the long-term survival of wild bison is located on park property the Stephens Creek capture facility. Here, on the banks of Stephens Creek, migrating bison have been destroyed by the multiple thousands by means of this facility, a meat-processing field station operated under the auspices of the IBMP.

Lethal removal of bison that wander into such places as Gardiner Basin is accomplished by government agents riding on horseback, in ATVs, pickups and squad cars and piloting helicopters. Operating together, they drive herds of wild bison into the capture facility, trapping them inside. From here they are loaded onto livestock trucks and shipped to slaughterhouses.

For treating wild bison like domestic beef cows the IBMP is paid $3 million annually in public funds. Such lethal removals are claimed to be necessary to protect, according to government estimates, about 2,000 head of cattle grazing on the perimeters of the park. However, this is a gross overstatement of the number of cattle actually exposed to bison near the park. Most of the activities of the IBMP are focused on protecting cattle both on private land and on government allotments in Gardiner Basin. In 2014, as shown in this petition, Gardiner Basin was occupied by 273 head of cattle. This means the nation is spending annually about $10,000 to protect each cow in Gardiner Basin from the spread of disease of brucellosis from bison, but nothing on its spread from elk, which is the greater vector of that disease.

This obviously is not disease management. This is a boondoggle. But the price is more than financial.

Such human intrusion defeats the natural functioning of the Greater Yellowstone Ecosystem, one of the world's largest interconnected networks of wild plants and animals, and brings to bear the forces of artificial selection, for only migratory bison are targeted. Weeding that trait out has the high potential of diminishing this wild species' chances for survival over the long term, for it operates against natural selection and favors not the survival of the fittest, but the survival of those chosen to survive by humans. In Yellowstone, the favored are those bison that stay behind in the park.

Since 1985 over 9,000 bison have been killed attempting to migrate out of Yellowstone. This culling is limited to the migratory subpopulation of wild bison, while the non-migratory or resident bison are spared, thereby creating an imbalance in the breeding population. Such an imbalance could lead to extinction, as this petition shows.

Deep snow and ice conditions in 1997 contributed to an attempted large-scale migration of bison out of the park, seeking accessible forage at lower elevations. About 1,100 bison were shot or captured and sent to slaughter by government agents as the bison approached the park's border. Other bison died of starvation or other natural causes inside the park, decreasing population size from approximately 3,500 bison in autumn 1996 to 2,000 animals by spring 1997 (White, 2011). That is a reduction of 43 percent in one year.

In the winter of 2005-2006, out of a herd of 4,900 animals a total of 1,016 bison were culled, reducing the populations by 21 percent (History of bison management in Yellowstone National Park, 2016; Yellowstone Buffalo Slaughtered, 2016).

In 2008, 1,087 bison were captured and shipped to slaughter from the Stephens Creek and Horse Butte capture facilities as they attempted to migrate. Another 166 bison were lethally removed by state-licensed and tribal hunters. Total herd population went from 4,700 to 3,000, winter die-off accounting for the mortality of another 500 animals (National Park Service, 2008). This totals 1,753 wild bison killed, a reduction of 47 percent in one year.

In mid-2014 when the herd population was 4,900, IBMP established a goal of removing 900 wild bison during the winter of 2015 and another 900 animals in 2016. However, out of the 900 targeted removals, only 740 were culled. In 2015, the IBMP proposed lethally removing 1,000 bison the winter of 2015-2016 to make up for the previous shortfall. Total Yellowstone bison killed during the winter of 2015-2016 numbered 593.

As successive years pass and culling goals are not met, the probability of the herds needing greater and greater reductions increases. Sooner or later a hard winter will hit and high numbers of bison will attempt to migrate out of the park. With the Interagency Bison Management Plan’s limit of 3,000 park bison, the rationale for massive and genetically-destructive large-scale reductions is in place. To meet IBMP’s goals, thousands of bison could become candidates for culling in one year as catch-up.

Such management objectives fly in the face of statements by wildlife biologists, some even members of agencies comprising the IBMP, warning that large-scale culling of Yellowstone’s bison will harm biodiversity. Biologists have variously said:

- The continued practice of culling bison without regard to possible subpopulation structure has the potentially negative longterm consequences of reducing genetic diversity and permanently changing the genetic constitution within subpopulations and across the Yellowstone metapopulation (Halbert, 2012).

- Frequent large-scale, non-random culls could have unintended effects on the long-term conservation of bison, similar to demographic side effects detected in other ungulate populations around the world.

- However, our analyses suggest the continuation of erratic, large-scale culls over the coming decades could have unintended consequences on the demography of Yellowstone bison (White, et al., 2011).

While massive culling is horrible science, it is legal under the terms of the IBMP that now exist. What is permissible is usually done.

If reductions are to occur, they should be small and frequent, according to guidelines developed for genetic management of federal bison herds as reported in “Bison conservation genetics workshop: Report and recommendations” by Peter A.

Dratch, National Park Service Natural Resource Program Center and Peter J. P. Gogan, U.S. Geological Survey Northern Rocky Mountain Science Center. The authors state:

> Based on well-established genetic population theory, fluctuations in population size increase the rate of genetic loss. Any necessary population reductions should be small and frequent to create minor adjustments as opposed to large and infrequent adjustments (Dratch, 2010, p. 11).

Small and more frequent reductions are best achieved by hunting and wolf predation, yet, inexplicably, the government insists on continuing its policy of large-scale reductions, paying no attention to the somber words of biologists raising numerous red flags. Such large-scale culling practices are setting up the present Yellowstone bison herd for a potential catastrophe.

When it appears that genetic diversity is being harmed by the IBMP, corrective action is provided for in the *Record of Decision for Final Environmental Impact Statement and Bison Management Plan for the State of Montana and Yellowstone National Park,* the document that established the Interagency Bison Management Plan in 2000. It states:

> If the additional information suggests the management practices of the Joint Management Plan adversely affect genetic diversity, the NPS will review management actions and recommend adjustments. Considering the information currently available, the agencies believe they are providing for the conservation of Yellowstone bison genetics by balancing a spring bison population limit of about 3,000 animals with other management objectives *(p. 51).*

However, given such information, member agencies of the IBMP prefer to blind themselves to it. Meaningful adjustments to preserve the genetic diversity of Yellowstone's wild bison herd are not taken. By persisting in carrying out large-scale bison reductions and by not following its plan for revision when evidence shows it is needed, the government is not getting its own message or following its own advice. That "the agencies believe they are providing for the conservation of Yellowstone bison genetics" is today and always has been a belief only. No relevant scientific study demonstrates that the genetics of Yellowstone's wild bison are being conserved by the lethal removal actions of the IBMP. Based on poorly applied simulation studies, the IBMP has a persistent mindset that the best way to mitigate the spread of brucellosis is to limit the size of the wild bison populations to 3,000. Such a limitation is bogus and has no disease control value as applied by the IBMP, for it fails to control the spread of brucellosis out of the park by elk.

The petition evaluators with the Fish and Wildlife Service know this, but are silent when this is brought to their attention. My 2015 petition discussed at length the epidemiological foolhardiness of this hypocritical stance. However, such exposition fell on deaf ears. The finding was silent on this issue. This 2016 petition discusses the differential in treatment between bison and elk as well. When someone is logically trapped by evidence presented to them, avoiding an answer or failing to adopt corrective action is often a strategy employed. But that is not good science. That is simply being evasive and does not solve the problem.

Because each member agency of the IBMP gets one vote, and because the state and federal agencies are in the majority and can thereby outvote the tribal groups, and because the IBMP has been granted exclusive and broad control of the wild bison inside and outside the park, in practice it functions as a government wild bison extermination program operating primarily in behalf of the Montana Department of Livestock.

Tribal trust resources

Wild bison are a tribal trust resource. According to the Fish and Wildlife Service, the term "tribal trust resources" means "those natural resources, either on or off Indian lands, retained by, or reserved by or for Indian tribes through treaties, statutes, judicial decisions, and executive orders, which are protected by a fiduciary obligation on the part of the United States" (Working with Tribes: American Indian Tribal Rights, 2016).

The imbalance of power that now exists in the IBMP has led to an abuse of bison as a tribal trust resource. This is contrary to the provisions of various treaties that protect these resources, such as the Blackfeet Treaty of 1855, as well as to the federal policy of promoting tribal self-government.

Although the Fish and Wildlife Service acknowledges that the relationship between Indian tribes and the United States is a unique government-to-government relationship and states that it respects the exercise of tribal sovereignty over the management of tribal trust resources (Working with Tribes: American Indian Tribal Rights, 2016), as it stands now, the majority of power in practice resides in the United States and its member states concerning the management of Yellowstone's bison.

Because of this, the relationship between the United States and the tribal nations, as represented by the composition of the governing members of the Interagency Bison Management Plan, is not government-to-government, but instead guardian-to-ward, with the Indian nations being treated as wards.

This nowhere is more glaringly seen than by the way Yellowstone's bison are harvested. A few hundred each year are killed by members of the public and Indian tribes via hunting, while the rest, sometimes above a thousand animals, are killed by federal and state agencies under the umbrella of the IBMP. These slaughtered animals are then given to the tribes under the authority of the federal government. Instead of the Indian nations being treated as equal and self-sufficient sovereigns, in this case they are treated as wards, with bison being distributed as hand-outs, the very bison that sustained these tribes for millennia.

Culling so many bison inside the park leaves fewer to hunt the next year, a point the Indian members of the IBMP have argued. Their plea for killing park bison only by hunting has been in practice disregarded by the other members, for higher numbers of bison can be killed by capture and ship-to-slaughter methods.

This is not just. This is not ethical. This does not promote Indian self-government nor the conservation of wild bison, yet this is all happening on land comprising the Greater Yellowstone Ecosystem and its environs, land containing tribal trust resources, such as wild bison, resources both on and off tribal lands, resources subject to treaty agreements between the United States government and Indian nations.

An overview of the importance of these resources and the threats they face is given by Mary Christina Wood, professor and director, Environmental and Natural Resources Law Program, University of Oregon School of Law, writing in the *Tulsa Law Review*. She states in "Indian Trust Responsibility: Protecting Tribal Lands and resources through Claims of Injunctive Relief against Federal Agencies":

> In the treaty era, the government promised homelands that could sustain tribal lifeways, governments, and economies. But much of the natural web that supports tribal life and culture occurs beyond the boundaries of Indian country. These lands contain species that tribes hunt and fish for, roots and berries that they gather, headwaters and tributaries that flow into their reservation streams, and sacred sites. These are being destroyed at an unprecedented pace, and the pressure from industrial America is both unyielding and unbounded, coming from corporations that feed on growth. While environmental disease may sooner or later affect everyone in the United States, the impacts on Indian country are magnified, because the land base is the linchpin for tribal survival.

Wood argues the following. The government's trust responsibility is critical in protecting tribal lands and resources. Historically, it arises from the relinquishment of land by Native Americans in reliance on federal assurances that retained lands and resources would be protected for future generations. Protection by the federal government for tribal resources has often been viewed as a principle derived from a paternalistic relationship—one of a guardian to his ward. This is a mistaken view. In actuality, the relationship should be between sovereign nations: the United States and the tribes.

Wood notes:

> A sovereign trust duty of protection should not at all depend on a guardian-ward relationship. The public trust doctrine in environmental law involves a sovereign trust model, but with no guardian-ward aspect.

She explains:

> Chief Justice Marshall recognized the autonomy of tribes within a sovereign trust framework in *Worcester v. Georgia*, when he commented: “This relation [between the Cherokee Nation and the United States] was that of a nation claiming and receiving the protection of one more powerful: not that of individuals abandoning their national character, and submitting as subjects to the laws of a master. This language in *Worcester*, rather than the guardian-ward description in *Cherokee Nation*, provides an appropriate wellspring for the common law trust duty towards tribes (Wood, 2003).

This perspective is mirrored in an order titled “Working with Tribes: American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act,” issued by the secretaries of the departments of the Interior and of Commerce concerning the administration of the Endangered Species Act and corresponding management responsibilities to promote healthy ecosystems and conserve tribal trust resources. According to the Fish and Wildlife Service, the order in part states:

> The Departments acknowledge that Indian tribes value, and exercise responsibilities for, management of Indian lands and tribal trust resources. In keeping with the federal policy of promoting tribal self-government, the Departments shall respect the exercise of tribal sovereignty over the management of Indian lands, and tribal trust resources. Accordingly, the Departments shall give deference to tribal conservation and management plans for tribal trust resources that: (a) govern activities on Indian lands, including, for the purposes of this section, tribally-owned fee lands, and (b) address the conservation needs of listed species. The Departments shall conduct government-to-government consultations to discuss the extent to which tribal resource management plans for tribal trust resources outside Indian lands can be incorporated into actions to address the conservation needs of listed species (Working with Tribes: American Indian Tribal Rights, 2016).

In “Working with Tribes: Overview,” the Fish and Wildlife Service states that the FWS and Indian tribes have a common goal of conserving natural resources:

> As a representative of the Federal government and a steward of our country's natural resources, the U.S. Fish and Wildlife Service has a responsibility to manage these natural resources in a way that:
>
> - reflects our Federal trust responsibility toward Indian tribes
> - respects tribal rights
> - acknowledges the treaty obligations of the United States toward tribes
> - uses the government-to-government relationship in dealing with tribes

- protects natural resources that the Federal government holds in trust for tribes (Working with tribes: Overview, 2016).

The most important animal to the tribes, especially the Columbia Basin and Plains tribes, is the wild bison. It has held that status for thousands of years. As discussed, at present its management is largely in the hands of the IBMP under the sway of the Montana Department of Livestock, with tribal membership in the IBMP essentially a token one. This could all be changed from the guardian-ward relationship that now exists in that interagency to one of a sovereign nation-to-nation character by listing wild Yellowstone bison as endangered or threatened. Listing would open the door for cooperative action.

But so far, the listing of this species has been repeatedly denied. My first petition to list Yellowstone's wild bison as endangered was submitted in 1999, almost two decades ago, and denied in 2007. My second petition was denied in 2015. In those intervening years two other petitions have also been denied. It is the opinion of this Petitioner that much of this denial is based on a political bias favoring the livestock industry.

In a letter to me in 2016 explaining the denial of my second petition (see chapter "Protection Hinges on Species Concept"), the FWS states that the Interagency Bison Management Plan effectively controls the spread of brucellosis out of the park. It said:

> The intention of the Management Plan is not to eradicate brucellosis in Yellowstone wildlife, but to control its spread to livestock, which it has done (Personal communication, April 19, 2016).

This statement's conclusion is wrong. The IBMP has not controlled the spread of brucellosis to livestock. As mentioned, elk are a greater vector of the disease, yet they are allowed to mingle with cattle and indeed have infected cattle with brucellosis within the Greater Yellowstone Ecosystem. Allowing one diseased species of animal to associate with livestock, but not another species has no epidemiological value over time in controlling the transmission of brucellosis to the affected livestock. Disregarding good science, which repeatedly implicates Yellowstone's elk as an important source of *Brucella abortus*, in favor of the cattle industry's claim that its culling of only bison somehow controls the total spread of brucellosis out of the park, reveals a bias by the Fish and Wildlife Service toward that industry and against the conservation of wild bison, a bias so strong that it will wink at data that does not support the actions of the IBMP.

Almost two decades ago this bias against wild bison, "the unwelcome precedent of livestock officials taking jurisdiction over wildlife," was noted by Robert B. Keiter, director of the Wallace Stegner Center for Land, Resources and the Environment. He wrote in "Greater Yellowstone's bison: Unraveling of an early American wildlife conservation achievement.," *Journal of Wildlife Management*:

> The Greater Yellowstone region's bison-brucellosis controversy has triggered troublesome proposals giving federal and state agriculture agencies jurisdiction over wildlife to eradicate a domestic livestock disease. Many of the region's bison (Bos bison) and elk (Cervus elaphus) carry the bacterium *Brucella abortus*, which can cause brucellosis. Local livestock officials fear bison and elk could transmit brucellosis to domestic livestock, jeopardizing state brucellosis class-free status. However, no cases of such transmission in an open range setting have been verified scientifically. Various federal and state agencies have jurisdiction over the region's wildlife and livestock; these agencies are having real difficulty reaching consensus on how to address brucellosis in the wildlife populations. Montana and Idaho recently vested state livestock officials with jurisdiction over bison leaving Yellowstone National Park (YNP), and the U.S. Department of Agriculture's Animal, Plant, and Health Inspection Service (APHIS) has indicated it may propose regulations asserting jurisdiction over bison. An interim bison management plan, the result of a recent court settlement, provides for the National Park Service (NPS) to participate in capturing, testing, and slaughtering Yellowstone's bison, but makes no provision for addressing brucellosis in elk. The region's brucellosis problem could be adequately addressed through a risk management disease control policy rather than a costly and perhaps fruitless eradication effort. Such an approach can be implemented without the unwelcome precedent of livestock officials taking jurisdiction over wildlife (Keiter, 1997).

In the Greater Yellowstone Ecosystem, livestock officials have wrested control of wildlife away from wildlife agencies and thereby from much of the American public, in particular those interested in the conservation of wild species. These officials are imposing animal breeding practices on the park’s wild bison via culling, the process of removing or segregating animals from a breeding stock based on specific criteria. In animal husbandry, this is done either to reinforce or exaggerate desirable characteristics, or to remove undesirable characteristics from the group. In the GYE, the desirable characteristic for bison (as evidenced by the selective breeding practices of the IBMP employed against the Yellowstone herd) is the non-migratory trait, for the non-migratory subpopulation is the one left behind to breed. The undesirable trait is the migratory trait, for only migratory bison are lethally removed from the breeding stock.

Who will protect us from political favoritism and its consequences, in this case the management of wildlife like domestic animals—management that tilts the scales toward extinction? One agency should be the Fish and Wildlife Service, but it often appears paralyzed in the face of political pressure, afraid to carry out its mandate to protect endangered species.

For instance, conservation groups, including the Center for Biological Diversity, for years have tried to get wolverines listed, arguing climate change, population size and genetic isolation threaten the wolverine's survival in the lower-48 states—but to no avail. Finally, in 2013 the FWS issued a proposed rule to list the wolverine as threatened, but aborted that decision the next year. However, on April 4, 2016, a federal district court overturned FWS's reversal.

In rejecting the FWS's determination, U.S. District Court Judge Dana Christensen, Montana, addressed the question of why the FWS flip-flopped on this conservation issue, stating:

> [T]he Court suspects that a possible answer to this question can be found in the immense political pressure that was brought to bear on this issue, particularly by a handful of western states. The listing decision in this case involves climate science, and climate science evokes strong reactions.

The judge directed the FWS to correct its erroneous findings:

> It has taken us twenty years to get to this point. It is the undersigned's view that if there is one thing required of the Service under the ESA, it is to take action at the earliest possible, defensible point in time to protect against the loss of biodiversity within our reach as a nation. For the wolverine, that time is now (Sanerib, 2016).

The time is now

That time is also now for the wild bison of Yellowstone. Now is the time "to take action at the earliest possible, defensible point in time to protect against the loss of biodiversity within our reach as a nation." This species is in danger of extinction because its present management for all intents and purposes is under the livestock industry. Wild bison are wildlife, not livestock, and should be managed by people that know how to manage wild ungulates. Historically, that has been the American Indian.

To bring about the restoration of the appropriate relationship between the federal government and the tribes concerning the tribes' most important trust resource, wild bison should be listed as threatened or endangered. This does not have to be a formal listing—a candidate or proposed listing is sufficient to open the door to the conservation of that species via cooperation as sovereign-to-sovereign nations.

According to the order issued by the Secretary of the Interior and the Secretary of Commerce discussed in "Working with Tribes, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act":

> Because of the unique government-to-government relationship between Indian tribes and the United States, the Departments and affected Indian tribes need to establish and maintain effective working relationships and mutual partnerships to promote the conservation of sensitive species (including

candidate, proposed and listed species) and the health of ecosystems upon which they depend. Such relationships should focus on cooperative assistance, consultation, the sharing of information, and the creation of government-to-government partnerships to promote healthy ecosystems (Working with Tribes, American Indian Tribal Rights, 2016).

The best way to promote a healthy ecosystem and to assure a sufficiently abundant and genetically diverse wild bison population that is not subject to extinction is for the federal and state governments to work with the tribes in the management of bison through regulated hunting, wolf predation and the absence of present-day government trapping and extermination of park bison.

The Petitioner recommends the creation of a cattle-free zone around Yellowstone National Park, especially in the regions of Gardiner Basin and Hebgen Basin, to preserve wild bison's historic range, to mitigate the interspecies transmission of the disease *Brucella abortus* between wildlife and livestock, to protect the interests of national security by eliminating a biohazard threat to and from cattle exposed in this region, to reduce costs related to disease-control and to prevent the extinction of Yellowstone's wild bison. Cattle are domestic animals raised for commercial purposes that originally spread brucellosis to bison in the park. They have no business in the Greater Yellowstone Ecosystem, especially since at its heart is the Yellowstone National Park, the incomplete habitat of the rare and iconic wild bison.

Because brucellosis can not be eliminated in wildlife, cattle that inhabit this ecosystem promote biohazardous conditions. Their presence here increases the probability of the risk of disease transmission out of the park to domestic animals. It puts in jeopardy Montana's brucellosis-free status and for this reason is a threat to national security. Without cattle in these regions no transmission from park wildlife can occur. Such separation would eliminate the cost of IBMP's bison culling and hazing. How wide that separation should be around the park depends on the range not only of bison, but of elk also in the ecosystem. Where bison and elk are, cattle should not be. There is simply no other way to realistically and effectively control the spread of the bacterium *Brucella abortus* out of the ecosystem without destroying the ecosystem itself.

Of paramount importance in helping to assure that Yellowstone's bison continue to exist as a wild species is the restoration of their historic habitats, especially Gardiner Basin, a vital dispersal sink and the Hebgen Lake region, a calving habitat for bison. Allowing wild bison to disperse to these locations also has the potential of reducing the incidence of brucellosis in bison comparable to the lower incidence of the disease seen in some migratory elk populations, since crowding promotes the spread of this disease.

To restore the habitat of these areas means not issuing government allotment grazing permits for cattle, as well as banning private cattle grazing here. It means stopping the practice of capturing and shipping to slaughter bison in these critical habitats, as well as limiting new housing development here. In regions in the ecosystem where cattle and other livestock are phased out, compensation could be provided to ranchers for allowing wild bison on their allotments or land.

While this would pose many difficulties and a change in culture, to continue not to do so over time will result in a stagnated and disease-ridden ecosystem. The question is not if this should be done, but when—before it is too late.

If the present large-scale lethal removals are allowed to continue, at some point either the entire bison herds residing in the park will collapse, dying because of slaughter and winter kill, or only the non-migratory will be left, meaning valuable genetics related to the migratory trait of wild bison will be lost forever, significantly damaging the genetic diversity of Yellowstone's wild bison and their ability to survive as a wild species. Large-scale removals are contrary to the scientific findings that oppose such massive herd reductions.

The artificial limitation of the park bison population to 3,000 is not based on scientific findings concerning the preservation of genetic diversity among the herd but instead is a formula employed only to justify lethal control measures of migratory bison based on density pressures.

The root cause of the problems arising in the Greater Yellowstone Ecosystem relative to bison is the failure to let nature alone, interrupting natural control mechanisms such as the predator-prey relationship and hunting. Instead massive culling is used.

With the absence of all lethal control, hazing or capturing wild bison within the Greater Yellowstone Ecosystem, and with agencies instead working together with the tribes, scientific studies can be made regarding the outcome of such non-intervention strategies. This would allow the inter-relationship among bison, elk and wolves to play out. A particularly valuable focus would be to study whether wolves show signs of "prey switching" from elk to bison as a response to fewer elk and/or larger wolf pack sizes. This would provide valuable data for holistic research studies that do not now exist.

Controlling the population size of wild bison should be limited to such factors as wolf predation, the natural toll of disease, range capacity, climate, age, accidents (such as vehicular) and hunting.

Concurrent with listing should be the launching of a study concerning the possibility of a species of bison separate from *Bison bison* called mountain buffalo that may still exist in remote regions of the park. This study has never been done, and claims by park officials that no such species now exist are not based on any scientific study, but rather opinion. Historically, this species has been documented to exist in the Yellowstone area and was named "mountain buffalo" because they inhabited the mountains of this region. Their migrations were altitudinal, as opposed to the essentially horizontal migrations of plains bison. If its present existence can be established (and there have been claimed recent sightings—one by a former park ranger in the Pelican Valley region), it is in need of special protection via an additional listing and habitat protection. In my original 1999 petition to list

Yellowstone's wild bison I presented information substantiating the existence of at least a hybrid of plains and mountain bison existing in the park. This has never been disproved, nor has the existence of pure mountain bison here in the park.

Taxonomic reasons supporting listing wild bison as threatened or endangered are several. First, on August 15, 2007 the FWS concluded in its finding of my petition that the YNP bison herd satisfied the two essential requirements to be listed as either endangered or threatened, namely, that it was both "discrete" and "significant." That position was also upheld in the finding of my March 2015 petition.

Secondly, the Petitioner asserts that the finding of the multi-agency Joint Bison Management Plan finalized in 2000 that purportedly "provides substantial protection for the YNP bison herd and therefore there is not a current credible threat to the herd's existence," is in fact in error. Instead of providing protection, the Petitioner contends that it is the very actions of the members of that interagency plan that are now causing the threat to the herd's continued existence as discrete and significant.

The Petitioner contends that the failure to designate the migratory regions immediately outside the park historically used by wild Yellowstone bison as critical habitat will result in their extinction as a distinct, undomesticated, unfenced and wild species.

It would stand to reason that the alternative recommended here, namely, allowing bison to move into their traditional migratory grounds, banning cattle from regions around the park, allowing the bison population to grow and provide for regulated hunting, would not only save the money now being spent on separating wild bison from cattle bi-annually, that is, about $3 million annually in combined state and federal funds, but would also be profitable to the local economy through bison hunting-related revenues.

The money saved could be used to purchase wild bison migratory habitat as a reserve. Further, funds generated by the license fees currently being collected for bison hunting could be used to compensate any displaced cattle operations now in the region.

Thus, listing the wild bison as endangered or threatened and designating its migratory regions and calving grounds immediately outside the park as critical habitat has a good probability of saving money and generating income in comparison to the plan now in operation, further warranting their listing as endangered or threatened.

Moreover, because it has the most potential in comparison to all other alternatives to promote the national security—that is, safety from an outbreak of brucellosis among cattle in the contiguous states—the listing concurrent with habitat designation should be granted.

If allowing wild bison to migrate to these regions proves problematic due to property damage and safety reasons, then funds from hunting permits and from the tax dollars currently going to lethal management and hazing activities by the IBMP could be diverted to building fences around communities such as Gardiner and around vulnerable private properties.

However, such actions require compromise on the part of both those in favor of allowing bison to roam and those against it. With a philosophy of valuing the Yellowstone bison, its heritage and its wildness as a priority, then humans and wild bison can co-exist, avoiding the tragedy of the extirpated European bison, the wisent. Further, the war against the wolf should also stop, for it should be viewed as an ally in controlling the bison population and keeping the herds healthy.

But it does not stop there. Combined actions, instead of targeting the destruction of wild bison, could result in the restoration of the ecosystem and a cascade of ecological benefits. To accomplish this, we need to listen to the experts in conservation. That includes the American Indian people, those who were able to not only co-exist with wildlife, but to prosper in doing so. If one views wildlife merely scientifically, one ends up relating to it in a heartless way, and that is what is happening now. Heartlessness eventually ends up in exploitation and conflict.

Such a viewpoint—namely, working with nature instead of against it—would lead to greater prosperity.

The Petitioner supports the petition filed Sept. 15, 2014, by the Friends of Animals and the Buffalo Field Campaign asking the National Park Service (NPS) and the U.S. Forest Service (USFS) to undertake a population study of the Yellowstone bison herd, revise the Interagency Bison Management Plan (IBMP) to correct scientific deficiencies, and make the plan consistent with the best available science. The Petitioner supports the groups' request that the capture, removal or killing of bison at the Stephens Creek area of Yellowstone National Park and the Horse Butte area of the Gallatin National Forest be prohibited, as well as at any other capture facility in the GYE.

The position that it is cattle that should be managed, not bison—as argued recently by the Western Watersheds Project and the Buffalo Field Campaign in a recently submitted petition to list the park's wild bison—is also supported by this Petitioner. That petition states:

> Current Yellowstone bison management outside the Park is governed by the IBMP. However, the IBMP was not designed to protect bison and their habitat but rather to keep bison out of their habitat outside of the Park. Although the threat of brucellosis transmission could be more easily pacified through management of domesticated cattle rather than bison, the agencies have chosen the wrong ungulate to manage (Connor, 2014).

Listing wild bison as an endangered or threatened species would open the door to its continued preservation and close the door on its present wanton slaughter. Working with American Indian tribes for the protection of wild bison would be the key. Bring back the lives of tribal members by restoring the abundance of wild bison in sufficient numbers to sustain them. Conservation of wild bison's genetic diversity then will be assured because of their importance for the survival of those who co-evolved with them. What is valued is protected.

Introduction

I. The problem

The Greater Yellowstone Ecosystem is sick. It is sick because of an invasive species. That species is cattle, native to Europe and Asia. Cattle were brought years ago to Yellowstone National Park by early park employees, who used the cows for milk. These cattle are believed to have carried brucellosis, a zoonotic disease that makes ungulates abort and humans contract undulant fever. Over the years it spread to the park's wild bison and elk. A majority of wild Yellowstone bison, as well as a high percentage of elk, now test positive to having once had that disease or presently have it. Bison were once thought to pose the highest risk of transmitting the disease, but now it is elk that have proven to be the greatest vector, their range, more than the bison's, overlapping with cattle in the ecosystem.

The ecosystem is sick because of the continued presence of cattle and other livestock in it, because of laws that permit domestic animals on land set aside for wildlife (such as national forests and public lands), because of laws that allow the killing of wild animals that come near livestock in this ecosystem (an ecosystem valued for the protection of wildlife), because of laws that mandate the protection of livestock in the ecosystem at government expense and because of laws and their biased interpretations that in effect make the holders of existing grazing permits barons of the ecosystem.

The ecosystem is feared by ranchers because of the wildlife here. It is a double fear. One fear is that its wild inhabitants might transmit brucellosis to their cattle, which are shipped here every spring to graze in the ecosystem's meadows just outside the park to fatten up for a few months before going to market. The other fear is that their domestic animals will be prey for the wolves, bears and mountains lions here. Both are real fears. Cattle have contracted brucellosis from the elk here and cattle and sheep have been killed by the predators here. But instead of avoiding the ecosystem, ranchers insist on using it because they can make a profit off cheap federal grazing fees and because they can rely on the government to absorb the cost to protect the livestock that they have placed at risk in a wilderness.

As mentioned, the cost of separating cattle grazing on the perimeters of the park from bison trying to migrate out of the park by means of hazing and lethal removal is $3 million annually. That bill is paid by the government, both state and federal. Add to that the total costs of predator damage control, such as compensation for livestock killed and the shooting, trapping and removal from the ecosystem of predators by state and federal agencies. Ask this question: if a livestock owner places livestock in a region that puts his livestock at risk, should not the owner bear the costs related to that business venture and do so without damaging the wilderness in which he is doing business, a wilderness publicly held? To rely on the government to make a profit is welfare ranching, a business venture underwritten by the public. It makes grazing in the national forest adjacent to the park operate at a loss for the owners of that land, the public.

Such destructive governmental intrusion in the natural operation of an ecosystem comes not only at a monetary cost, but also an environmental one. The disease caused by the bacterium *Brucella abortus* now endemic in the region is a symptom of a debilitated ecosystem. By keeping both the wild ungulates and predators away from their domestic animals by means of stopping migration and shooting predators, ranchers have stagnated the ecosystem.

How can it be healed? Simply listing its animals, such as wild bison, grizzly bears and wolves, as endangered or threatened is not a permanent solution for the health of the ecosystem nor the protection of its wildlife. It is a start, but most important is the protection of the ecosystem on which they all mutually depend. This means protection of the habitat. The use of habitat for commercial purposes destroys that habitat for wildlife. A destroyed habitat is like a wound that festers. If it does not heal, it kills. Brucellosis is only a sign that the ecosystem is unhealthy. When large predators are not allowed to operate at an effective level by diminishing their numbers, diseased animals proliferate and in the end smaller and smaller predators take over, eventually down to the lowest predatory level in size—parasites, bacteria, viruses and infectious prions. When animals are not allowed to migrate, especially animals such as ungulates, crowding occurs. Crowding promotes proximity and proximity promotes disease transmission. The government kills and allows hunters to kill the predatory species that clean the environment of diseased animals. It coops up and concentrates those diseased animals behind the boundaries of the park, on elk feed-grounds at its borders and in capture and quarantine facilities, making the park and its environs a disease incubator. And a hoodwinked public pays millions of dollars for these ecologically destructive actions—boondoggles with a price.

The protection of Yellowstone’s endangered species must be an ecosystem-wide solution. Nothing else will work. This means that a culture-change, a value-change must occur before it is too late. Epidemiologically, that entails removing domestic animals from the ecosystem like one removes a tumor. Harsh words, but do nothing and the patient will die, and in this case the patient is the ecosystem and its wild flora and fauna.

Someday this disease will explode out of the park if not controlled, plunging Montana and other surrounding states such as Wyoming and Idaho into a brucellosis outbreak among its cattle herds. This would mean millions of dollars lost to the cattle industry and the mandatory depopulation of infected cattle herds. In fact, that outbreak is already beginning. We see it in the ever-rising seroprevalence of brucellosis in elk and its ever-increasing interspecies transmission to cattle.

On top of this, chronic wasting disease has now broken out in states bordering the Greater Yellowstone Ecosystem and is inching toward it (McQuillan, 2015). The prion disease, limited to animals of the deer family such as mule deer and elk, is progressive and always fatal. The risk, if any, of transmission of CWD to humans is low. However, "provided sufficient exposure, the species barrier may not completely protect humans from animal prion diseases," according to an investigation of individual case-patients by Ermias D. Belay et al., reported in "Chronic Wasting Disease and Potential Transmission to Humans." If CWD is not controlled, it could jump into the park, further exacerbating wildlife diseases in the region (Belay, 20040).

The Greater Yellowstone Ecosystem is sick because it is out of balance—the imbalance being caused by humans trying to maintain domestic animals in a wilderness and doing so by using domestic animal management practices on wildlife. Instead of wolves, which selectively target unhealthy animals, and instead of hunters keeping in check the abundance of the park's bison, it is a coalition of government agencies that has banded together to kill all the migratory bison they can get their hands on. These migratory bison are often the most healthy and aggressive—those containing the most valuable genetics. Many are pregnant. Some years over a thousand wild bison are herded like cattle into capture facilities—steel-barred stockades against which the animals bash their heads, break their horns, but can not break out. Here park rangers put hooks in their noses, draw blood and ship them like cattle to meat-processing plants. Ah, the glory of being America's official mammal.

The habitat outside the park toward which wild bison migrate is off-limits to this species of wildlife. In practice such national forests as the Gallatin National Forest and the Bridger-Teton National Forest are first and foremost cattle land where wildlife is treated as pests. Over 9,000 wild bison have been killed since 1985 simply because they attempted to migrate out of Yellowstone National Park into the Gallatin National Forest, potentially placing themselves near cattlemen's cows and calves grazing on a grassland that is habitat critical for the survival of wild bison. In fact, wild bison can not even come near this national forest without being subjected to lethal removal. As described, droves annually are captured on land inside Yellowstone National Park and shipped to slaughter, trapped in the Stephens Creek capture facility as they migrate into Gardiner Basin, a grassland that extends from the northern portion of the park into Gallatin National Forest. They are captured and sent to slaughterhouses even before they leave the park. Is anyone listening? They are culled on park land by the thousands and slaughtered. Wild animals that are supposed to be protected from capture and wanton slaughter by the Congressional act that established the park are captured by the park's very own rangers inside the boundaries of the park and slaughtered by the thousands by our government. And it has all been determined to be legal, supported by court decisions. The outcome? A wildlife refuge has become a wildlife slaughterhouse. Is anyone listening? Such environmental abuse will have enormous consequences.

One looming possibility is extinction of wild bison. The systematic destruction of only the migratory members of the herd is drastically tilting the wild bison populations to a herd composed of non-migratory bison, animals without the instinct to escape an especially severe winter. Staying behind inside the park, they may all die when a unusually harsh winter hits. Every year, almost all the migratory bison that descend from the high altitudes of the park are killed. With migratory bison wiped out by the government agents and with non-migratory bison wiped out by an especially severe winter, what wild bison would be left? The answer is none. No wild bison means extinction, extinction at the hands of the very government that is supposed to protect these iconic animals. And despite petition after petition pointing out these facts, the Fish and Wildlife Service—the agency responsible for protecting such endangered wildlife as bison—looks the other way with a "What? Me worry?" attitude.

The Greater Yellowstone Ecosystem is sick because this government coalition, called the Interagency Bison Management Plan, refuses to practice sound epidemiology. It claims killing migrating bison is necessary to keep bison away from the cattle—cattle they insist must be allowed to graze along the borders of the park—because these wild bison may spread brucellosis back to the cattle. But such culling is pseudo-epidemiology because elk, which also have the disease, are allowed to migrate and mingle with the very same cattle. Effective epidemiology is practiced when infected animals are separated from non-infected animals. Separating cattle from one diseased species but not another is futile disease control. Thinking otherwise is delusional. Claiming otherwise is dissembling.

The plain fact is that the interagency has not reduced the prevalence of brucellosis in the park among bison during its 16-years of existence and that concurrently it has witnessed a dramatic increase in the prevalence of the disease in elk.

As noted, brucellosis is spread by crowding animals together. Bison are not allowed to escape the harsh winters in the park, crowding them inside the park on limited winter forage, many around thermal pools, the warm water environment perfect incubators for brucellosis. Wild bison are captured en masse by the IBMP and kept in quarantine, increasing the potential for brucellosis transmission among the crowded animals. Elk are artificially fed on feed grounds on the perimeters of the park to keep them off cattle allotments in the ecosystem, promoting crowding. Elk that graze on irrigated pastures for cattle just outside the park are thereby encouraged not to migrate back into the park. Here some elk stay year-around. More crowding.

In the meantime, the solution to this wildlife disease epidemic is being stopped by anti-wildlife policies and statutes. Predators of bison and elk, such as wolves, grizzly bears and mountain lions, are essential to the health of the ecosystem, for they selectively prey on the sick, vulnerable and old, reducing the density of the herds directly and through the fear they create in ungulates. But because predators prey on livestock, cattlemen routinely seek the removal of these animals, further collapsing the health of the ecosystem.

The Greater Yellowstone Ecosystem has been reduced to a stockyard with stockyard diseases.

However, instead of facing facts, the IBMP and its member agencies pat themselves on the back. For instance, in “Bison Management: A Brief History,” the National Park Service claims:

> The conservation of bison has been relatively successful under the IBMP, with overall abundance during summer ranging between approximately 2,400 and 5,000 (average ~ 4,000) during 2001 through 2015. Yellowstone bison are managed as wildlife in multiple, large herds that migrate and disperse across an extensive landscape and are subject to a full suite of native ungulates and predators, other natural selection factors, and substantial environmental variability.

Fact: Bison are managed like cows, not wildlife, subject to roundup, hazing, capture, slaughter, vaccination and quarantine.

Fact: Wild bison are not abundant but rare, with only 5,000 in existence, 1 percent of the total number of bison in the United States, most of which are raised for commercial purposes behind fences.

Fact: Bison are not allowed to migrate, not even within the Yellowstone National Park, without being subjected to lethal removal by the government, culling only those animals that attempt to migrate, which is artificial selection, not natural selection.

The NPS continues:

> Yellowstone bison have a relatively high degree of genetic variation, which should be maintained for centuries with a fluctuating population size that averages 3,000 to 3,500 bison. Also, adaptive management adjustments during 2005 to 2012 increased the tolerance for bison on habitat in Montana.

Fact: Biologists, including those employed by member agencies of the IBMP, assert repeatedly that the large-scale culling now being exercised against wild bison could expose the species to irreversible genetic damage.
Fact: While claiming increased tolerance on habitat in Montana for wild bison, the IBMP still maintains lethal removal goals of up to a 1,000 animals annually on wild bison that attempt to access that very habitat. Inaccessible habitat is equivalent to no habitat at all. The NPS further claims:

> Likewise, mitigation of the risk of brucellosis transmission from bison to cattle has occurred under the IBMP. To date, no documented transmission of brucellosis from Yellowstone bison to cattle has occurred, due in part, to successful efforts by the agencies to maintain separation between them. Conversely, numerous transmissions from elk to cattle have occurred since 2000. Currently, the risk of brucellosis transmission from bison to cattle is low during winter and spring because few cattle are in the areas where bison are tolerated north and west of the park. By the time more cattle are released onto public and private lands north and west of the park during mid-June and July, the bison calving season has ended and bison are usually following the progressive green-up of new grasses back into the park interior as snow melts at higher elevations. Brucellosis transmission risk is limited due to the combined effects of management to maintain separation between cattle and bison, the synchrony of most bison parturition events into a short period and in areas separate from cattle summer ranges, the cleaning of birth sites by female bison and the relatively quick environmental degradation of *Brucella* in late spring weather, and scavenger removal of potentially infectious birth tissues that makes it unlikely that viable *Brucella abortus* bacteria would remain for cattle to encounter (Bison Management: A Brief History, 2016).

Fact: Despite claiming a low transmission risk of brucellosis from bison to cattle, the IBMP continues its large-scale culling of wild bison to prevent them from migrating and mingling with cattle outside the park.

Fact: Despite claiming that the opposite case holds for elk, that is, that numerous transmissions of brucellosis from elk to cattle have occurred since 2000, elk are allowed to migrate and mingle with cattle outside the park. Here elk shed *Brucella abortus* concurrently with the occupancy of the land with cattle.

Fact: The National Park Service is not practicing sound wildlife conservation nor sound epidemiology. Instead it is engaging in a massive public relations snow job.

Let's look more closely at the facts.

In the northern Greater Yellowstone Ecosystem, wild bison and elk populations are equal in size. Aerial surveys of the northern Yellowstone elk population on January 20, 2015 by the Montana Department of Fish, Wildlife & Parks and the National Park Service counted 4,844 elk, including 1,130 elk (23 percent) inside Yellowstone National Park and 3,714 elk (77 percent) north of the park (2014-2015 Winter Count of Northern Yellowstone Elk, 2015). The estimated number of wild bison in the park was 4,900 in July 2015, including two sub-populations, the northern herd (3,600) and the central herd (1,300) (Yellowstone Bison, 2016).

Wild bison culling is initiated in the winter months with zero tolerance for any outside the park, as well as those near the border inside the park in Gardiner Basin, the primary winter migration route. Elk are free to come and go from the park at all times of the year.

Most cattle are shipped to grassland ranges bordering the park in the spring and shipped out in the fall. In 2009, 266 cattle were grazed in the winter and 1363 in the spring on public and private lands adjacent to YNP and within habitat occupied by bison and elk during the winter (Kilpatrick, 2009). This figure for cattle numbers does not include herds that are in the northern Greater Yellowstone Ecosystem but not immediately adjacent to the park. Numerous cattle herds are beyond the migration range of bison that travel mostly river bottom routes, while elk are wider ranging and come in contact with cattle in the outlying allotments. Because of the diffuse migratory habits of elk, this species is much more likely than bison to mingle with cattle within the ecosystem.

As mentioned, the Interagency Bison Management Plan mandates that the maximum number of bison allowed in the park is 3,000. Above that number they are subject to lethal removal. Because the wild bison population was 4,900 in the park in 2015, the IBMP decided in January 2016 to cull between 600 to 900 animals that winter to begin its reduction to the number allowed. The IBMP did not quite make its minimum goal for wild bison herd reduction. All told, it culled by both hunting and ship-to-slaughter methods 593 animals for the winter of 2015-2016.

"It's a numbers game: how many can we accommodate?" Montana State University wildlife researcher Robert Garrott told the Associated Press. "The source population every year will produce 6 to 10 percent (more bison) that will need a new home . . . Despite the fact that bison are an iconic symbol of the United States and North America once had 30 to 60 million of them, our society has said there is no place we're willing to accept them" (Brown, 2016).

This statement is a curious mixture of fact and fiction. Ostensibly, the reason for the culling is brucellosis. The real reason for the culling as Garrott states is simply lack of tolerance. But saying that an increasing percentage will need a new home if not culled has not been documented—in fact just the opposite. Bison return in the spring to the higher altitudes. Carrying capacity of the park is above 6,000 animals. If there is not enough forage to support a given population, the excess will die, for at present, the only way out to the north is Yankee Jim Canyon, which is a bottleneck barricaded by cattle guards and fencing, essentially impassible to bison.

Since the forage in Gardiner Basin is sub-optimal and since they are herd animals, bison will return as a herd to the more nutritious forage in the interior of the park, as it has been their habit for millennia.

Mumbo-Jumbo

What is going on in the Greater Yellowstone Ecosystem is voodoo epidemiology. When it comes to disease control in Yellowstone, bison are being treated as effigies of the disease caused by *Brucella abortus*. It is as though members of the IBMP believe they can break the spell of brucellosis in the ecosystem by separating bison from cattle only in the winter, when it is not spread, but not in the spring, when it is spread, and by separating only wild bison from cattle, thinking somehow by doing so it will control the spread of the disease also posed by elk. The IBMP by its bison culling practices is performing a ritual, not science.

Follow this line of reasoning. It is mumbo-jumbo:

Bison migrate out of the park in response to environmental changes, dispersing in the winter to seek forage at lower elevations and in the spring to calve. This movement away from the park's interior may put disease-carrying bison in close proximity to cattle munching grass along the park's border. As one can see from the diagrams below, *Brucella abortus* is shed throughout the northern and western portion of the ecosystem where cattle, elk and bison graze. This region is called by the Montana Department of Livestock the "Brucellosis Designated Surveillance Area" (DSA). The number of potentially infectious births or abortions from both bison and elk is highest in April, May and June. This is calving season when the ungulates shed brucellosis on the ground in birthing materials, such as placenta. Livestock owners do not want bison present in the spring outside the park, for that is when they ship their cattle into allotments bordering the park. What triggers migration in the spring is the green-up, which begins earlier on the border of the park than in the interior due to its lower elevations.

The Brucellosis Designated Surveillance Area (DSA) is administered by the Montana Department of Livestock. It encompasses a huge area bound by a line roughly running east from Dillon, Three Forks, Bozeman and Livingston south to the latitude of West Yellowstone. While much of this area is inhabited not only by cattle, but by elk also, only a small portion of the surveillance area is entered by wild bison—regions around West Yellowstone and Gardiner. However, only these two relatively small areas are subjected to large-scale lethal control of ungulates entering the area and that ungulate is wild bison only.

One would think that surveillance would lead to control of *all* animals with brucellosis or those exposed to it. Under present disease management protocols, it does not. Gardiner Basin is zoned for lethal control of bison, but not for elk and while the surveillance area coincides with the shedding events of both bison and elk, only bison are culled. Figures 3, 4 and 5 illustrate this disparity. This is mumbo-jumbo wildlife management of the disease of brucellosis in the ecosystem.

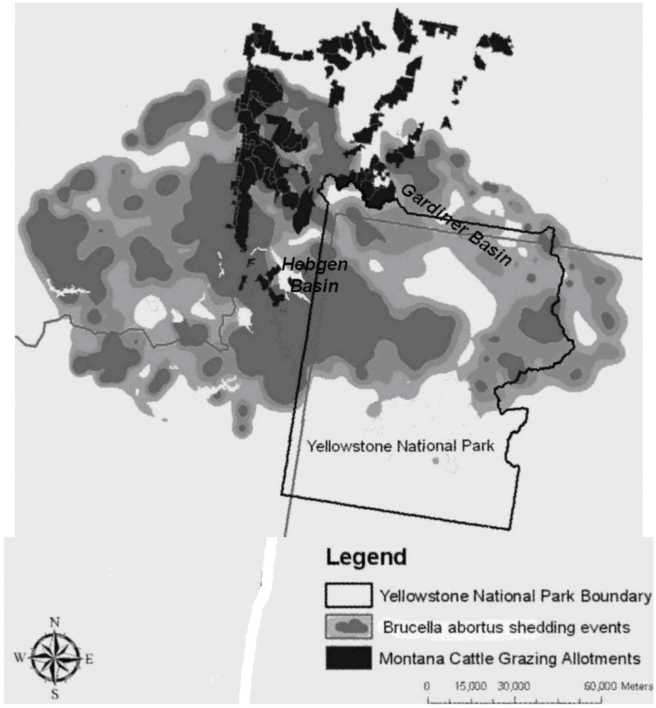


Figure 3. MAP OF TOTAL B. ABORTUS SHEDDING EVENTS from bison and elk populations during June in the northern portion of the greater Yellowstone area based on an average winter. Montana cattle grazing allotments are in black. Darker gray areas indicate higher levels of shedding while lighter gray areas indicate lower levels of shedding. ***Adapted from Schumaker, 2010, p. 69.***

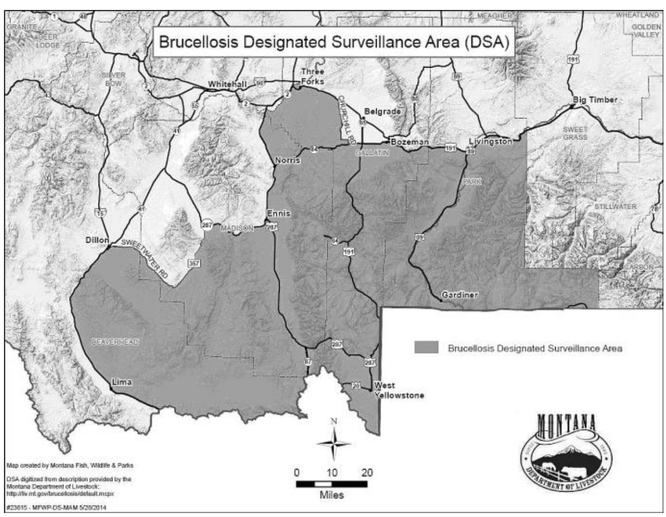


Figure 4. BRUCELLOSIS DESIGNATED SURVEILLANCE AREA north and west of Yellowstone National Park as defined by the Montana Department of Livestock (Brucellosis designated surveillance area, 2016).

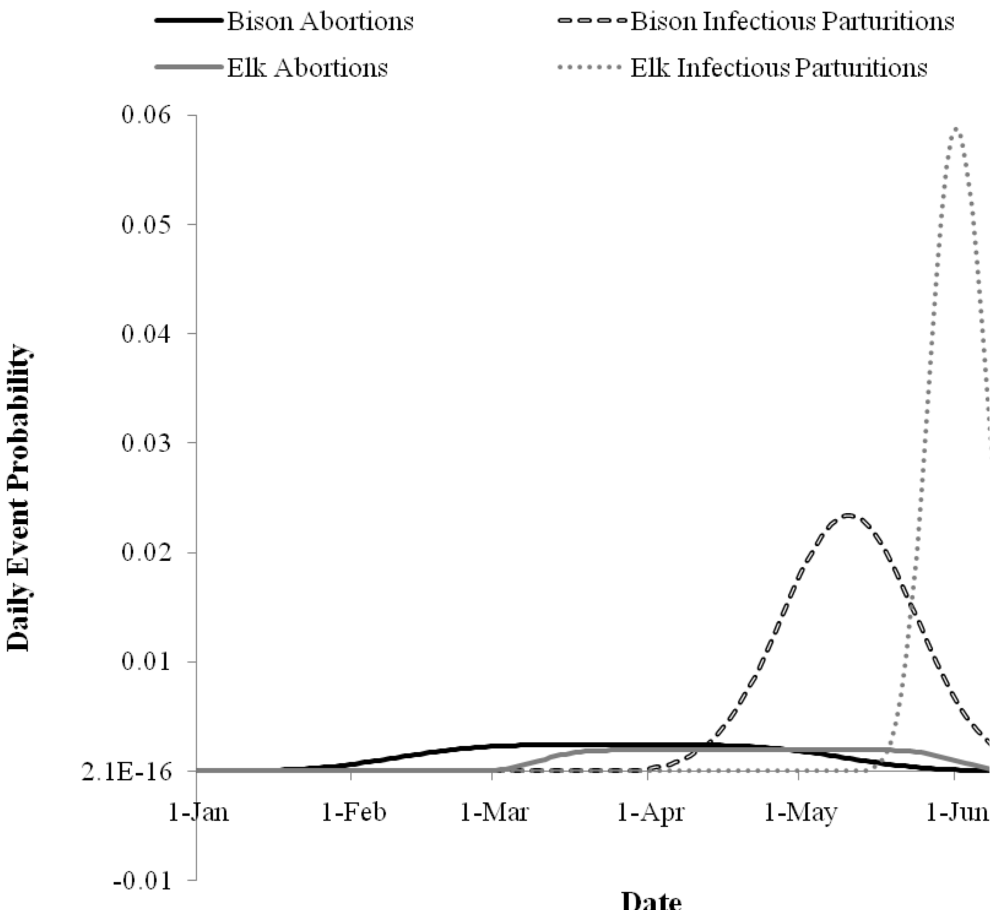


Figure 5. BRUCELLOSIS EXPOSURE GREATEST IN SPRING. Probability distributions for infectious parturitions **(births) and abortions by bison and elk in the northern portion of the greater Yellowstone area (Schumaker, 2010, p. 68).**

While the risk of brucellosis transmission is highest in the spring, bison are allowed in Gardiner Basin and Hebgen Basin during calving season each spring. To separate bison from cattle, bison have been annually hazed back into the park before cattle are shipped into the regions. Bison leave behind on the landscape potentially infectious placentas.

But elk are not hazed back into the park and are present when cattle are shipped in. As the chart above demonstrates, this is at the peak of the "daily event probability" of shedding "elk infectious parturitions."

Most bison are culled in the winter months as they migrate north into Gardiner Basin when the risk of brucellosis transmission is close to nil. Bison usually do not migrate to Hebgen Basin in the winter because its elevation is higher than Gardiner Basin and often covered by deep snow. Bison are culled in the winter for one reason: to reduce the population inside the park to 3,000 animals, the theoretical population density that triggers migration out of the park in the winter, especially severe winters.

But winter is not the problem. Brucellosis is not spread then and most cattle are not present in the region then. Spring is the problem. So the only reason bison are culled in the winter is to keep them from migrating, but come spring, they do migrate and are allowed to do so. Yes, folks, they are allowed to migrate onto land later occupied by cattle, where they shed brucellosis before they return on their own to the park or are hazed back, while elk are allowed to remain and mingle with cattle when the incidence of shedding brucellosis by elk is highest. Go figure. Jumbo mumbo-jumbo.

But killing bison in the winter does have its effect. As mentioned, bison not only come to Gardiner Basin to survive the harsh environment in the park's interior, but to calve also. Eliminating most of the bison herd that accesses Gardiner Basin in the winter reduces the number of bison that would have remained into spring to calve here, for most of the females are pregnant when they reach this destination. (As park biologists point out, this is efficient herd reduction, for slaughter often eliminates two bison (mother and calf) for the price of one removal—the pregnant female.) But beyond just killing bison for the sake of killing, what is its purpose? In the end, nothing is achieved beyond killing bison for the sake of having less bison on the land. Separating diseased animals from non-diseased animals is not effective disease control if it is not consistent both temporally and spatially, and for all disease-carrying species. Further, what is the point? Gardiner Basin has fewer than 300 cattle there. Does it make any sense to spend millions for a few head of cattle? Should not that question be answered with all due consideration?

In 2016, tolerance of bison outside the western border of the park was increased. Montana Governor Steve Bullock and the IBMP agreed early that year to allow bison year-round in portions of Hebgen Basin, namely, Horse Butte, a peninsula that extends into Hebgen Lake, because cattle no longer graze here. While cattle are present across the lake on private land, most bison stay on the peninsula. Now in portions of Hebgen Basin bison will be allowed to return to the park without being hazed back. However, bison that wander near cattle outside Horse Butte in Hebgen Basin are still hazed back.

For Gardiner Basin, under the new rules, bulls may occupy the region year-round, but nothing has changed for female bison. Those few that have escaped the winter slaughter in Gardiner Basin may remain there to calve for limited portions of the spring as in the past. And as in the past, they are hazed back later to make room for cattle that are moved in.

Come winter, bison will still be subject to lethal removal due to the IBMP's 3,000 bison population cap. Bullock stated in a letter to Montana's Department of Livestock and Fish, Wildlife and Parks announcing the greater tolerance for bison:

> I remain fully committed to pushing for a reduction of the bison population in the Park, and keeping those numbers to manageable levels.

He added:

> I believe that with this decision, hunting outside the Park by state licensed and tribal hunters will become a more vigorous tool for population management (Bullock, 2016).

As encouraging as this new tolerance is, why is population reduction in the park a goal for bison but not elk when both carry the disease? Instead of wild bison being viewed on equal footing as a valuable resource like cattle and elk, hunting is employed merely as population control.

Bullock's letter mentioned no population limits or management of elk in the ecosystem, despite his acknowledgement in that same letter that "Elk are now recognized as the primary transmission route of brucellosis infection to livestock" and despite the fact that brucellosis is brucellosis regardless of the species that transmits it.

In the winter the probability of the shedding of brucellosis is near zero, while in the spring months the probability shoots up. It is highest between late-April to late-May for bison and from mid-May to mid-June for elk, which coincides with the respective species' calving seasons.

But here comes more mumbo jumbo. As discussed in this petition, bison are hazed off of Gardiner Basin May 1 and off Hebgen Basin May 15, with the recently increased tolerance allowing bison year-round on Horse Butte in Hebgen Basin. Cattle come onto Gardiner Basin historically between May 21 and July 15, while some graze year around, and onto Hebgen Basin between June 15 and July 5. So in Gardiner Basin a separation of 20 to 45 days is maintained between bison and cattle, while at Hebgen Basin a separation of 30 to 51 days.

According to studies, birthing materials shed on the ground by either bison or elk containing *Brucella abortus* bacteria are unlikely to survive after 45 days due to heat, ultraviolet light and their removal by scavengers such as vultures, coyotes, bears, and wolves.

This means that after *Brucella abortus* is shed in the environment by bison, some cattle have been placed on ranges while the disease is still viable, that is, during the month-and-a-half life span of disease. The scenario is even worse for the risk exposure of the disease to cattle by elk. Cattle are trucked onto land when some elk have just given birth, for their calving season is later, ending mid-June.

Considering all this, what then has been gained by killing bison in the winter in Gardiner Basin? Yes, the number of bison come spring is reduced in Gardiner Basin. But bison nevertheless are allowed on land in the spring both north and west when the possibility of transmission is highest, with only a few weeks of separation and with that separation not being consistently maintained temporally or spatially.

What has been gained epidemiologically if cattle are moved onto lands containing viable, infectious birthing materials from *both* bison and elk—especially elk that routinely give birth at the same time cattle occupy the land? If the idea of culling large numbers of bison in the winter is done to inhibit migration out of the park, but come spring, when brucellosis is shed, bison and elk are allowed to migrate out of the park anyway onto land that will be occupied by cattle, what is the point? Can anyone answer this?

There is no good answer. What is going on amounts to a cult practice, the waving of hands to banish brucellosis, but not science-based disease control. It is all show. It is all mumbo-jumbo.

This irrational and biased disease management is unrealistic and utterly ineffective. It is one thing only: mismanagement and the abuse of the trust the public has put in its officials. Bison are treated as members of the lowest caste, the "untouchables" of Yellowstone, where contact with them is held to defile members of the higher caste—cattle. But if cattle associate with either brucellosis-infected bison or brucellosis-infected elk, cattle will contract brucellosis. Forbidding the mingling with just one diseased species but not the other is meaningless. Not wanting to face that is misology, the hatred of reason. Misology now rules in the Greater Yellowstone Ecosystem. This mixture of reason and unreason is typical governmentese. It is called doubletalk.

Double talk is often used when one does not want to disclose one's real objective. By default, the real issue is range competition. Brucellosis is being used as a smoke screen. Cattlemen want to keep bison off the river-bottom lands grazed by their privately-owned cattle, so they find a rationale to kill the competitors. If you follow the money you will find the objective. "Brucellosis is a convenient excuse to kill bison," noted Daniel M. Brister, writing in "In the presence of buffalo: Working to stop the Yellowstone slaughter." He quoted an official with the Wyoming Department of Game and Fish, who explained:

> If the public gets used to the idea that bison, like elk and deer, should be free to roam on federal lands, then it may lead to a reduction in the amount of public lands forage allotted to livestock. That's what the ranchers really fear (Brister, 2002).

But, after all is said and done, while brucellosis is being used as a ruse, brucellosis remains the critical problem, a problem that must be addressed. The cattlemen are on the right track by wanting to contain brucellosis in the ecosystem, but they have the wrong motives and therefore the wrong methods.

In its attempt to mitigate brucellosis in the Yellowstone area by attacking wild bison only, the IBMP is engaging in showmanship—a display of dominance, a bluff—not science. And those who carry out this ritualistic culling activity and provide its rationale *know this*, but continue on anyway. P.J. White, chief of wildlife and aquatic resources at Yellowstone National Park, Rick L. Wallen, the bison project leader at the park, and David E. Hallac, division chief of the Yellowstone Center for Resources at the park between 2011-2014, admit that culling wild bison does not adequately address the spread of brucellosis. They state in *Yellowstone Bison: Conserving an American Icon in Modern Society* (citations omitted):

> However, surveillance during the past decade indicates brucellosis prevalence has increased from less than 5 percent to 8 to 25 percent in several elk populations in the northern portion of the Greater Yellowstone Area. These increases coincided with increasing elk numbers and/ or aggregations of elk on lower-elevation winter ranges, including a greater proportion of private land than 20 years ago. Many of these elk populations appear to support the disease independently of wild bison or feed-ground elk. Also, in recent years the distribution of elk testing positive for brucellosis exposure has expanded beyond the periphery of the Greater Yellowstone Area and now encompasses more than 20 million acres (8 million hectares). The estimated risk of brucellosis exposure to cattle from Yellowstone bison is insignificant (less than 1 percent) compared to elk (more than 99 percent of total risk) because elk have a larger overlap with cattle and are more tolerated by managers and livestock producers. Many of the approximately 450,000 cattle in the Greater Yellowstone Area are fed on private land holdings during winter and released on public grazing allotments during summer—but throughout the year they are allowed to mingle with wild elk. Thus, the risks of brucellosis transmission to cattle are primarily from wild elk, and management to suppress brucellosis in bison will not substantially reduce the far greater transmission risk from elk (White, P.J. et al., 2015).

This statement is by the very biologists who advise the IBMP. Why is the IBMP not listening? Wallen restates these conclusions, saying:

> Any attempt to control the rate of spread in wildlife must be evaluated at the ecosystem scale and include an effective strategy to address infection in elk across the greater Yellowstone area. Focus on bison alone, as was suggested in the past, will not meet the disease eradication objective and conserve wildlife (Study Shows Pathways of Disease Transmission Between Elk, Bison and Cattle in the Greater Yellowstone Area, 2016).

What do Yellowstone biologists perceive to be the solution? Manage elk by controlling the size of their population. The authors *of Yellowstone Bison: Conserving an American Icon* state (citations omitted):

> Therefore, numerous independent evaluations have recommended that management actions for brucellosis focus on maintaining separation between bison and cattle, while attempting to decrease elk density and group sizes in areas where mingling with cattle occurs (White et al., 2015).

How does one reduce the density of a herd and its size? Theoretically, there are two ways: by reducing the total population size, as wild bison are now being managed, or by selectively decreasing the number of animals in a herd and by increasing the number of smaller herds. Both ways would reduce crowding, a leading cause of the spread of disease in wildlife. But simply reducing total population size has not diminished brucellosis in wild bison.

The lack of efficacy in disease mitigation via non-selective herd reductions has been observed in the dynamics of chronic wasting disease in deer. In a study led by Margaret A. Wild, National Park Service, Biological Resource Management Division, the following was noted (citations omitted):

> Thus far, control strategies relying on hunting or culling by humans to lower deer numbers and subsequently CWD prevalence have not yielded demonstrable effects. However, these results are not surprising given the limited duration of such management actions and because theory suggests that randomly removing individuals from an infected population should have less effect on epidemic dynamics than selectively removing infected individuals (Wild, 2011).

This leaves us with the second option, a more targeted one—removing only diseased animals from a population. This can be achieved by increased predation. Wolves thin out a herd, preying on the young, aged and diseased, plus make herds smaller. Elk herds fragment and disperse in the presence of wolves due to fear. Smaller herds are less dense, less crowded, less disease-transmission prone.

In Wild's study, wolves and other large carnivores were shown to be essential to the health of an ecosystem. Wolves are capable of reducing or eliminating the spread of such disease as chronic wasting disease, in part by reducing density and group sizes of elk and deer. In the investigation by Wild and her team, simulation studies demonstrated that wolf predation could control a wildlife disease more effectively than human culling. The study, published in the *Journal of Wildlife Diseases* titled "The Role of Predation in Disease Control: A Comparison of Selective and Nonselective Removal on Prion Disease Dynamics in Deer," noted:

> Results from these simulations suggest that predation could markedly decrease prevalence of CWD under certain conditions. Nonselective predation, as might occur with hunting or culling by humans, may decrease disease prevalence over time but the disease was not eliminated under modeled conditions. Alternatively, selective predation by wolves at the same rate would result in a

> more precipitous drop in CWD prevalence that would culminate in disease elimination in a closed system . . . It appears that prevalence could be halved within a decade and eliminated within the century through sustained predation by a pack of wolves that removed 15% of deer per year in a closed population.

What is the theoretical basis for these results? The authors argued:

> Reductions in transmission rates and disease prevalence can be particularly large if mortality rates are disproportionately higher in the infected portion of the population than in the susceptible portion . . . For example, if predators prey selectively on diseased individuals, it is reasonable to expect that they might reduce disease prevalence much more rapidly than would occur if mortality were nonselective.

Evidence that predators prey more heavily on diseased prey has been widely observed, the study noted. The authors reported that researchers found parasitized voles in buzzards' diets in a greater proportion than they occurred in the population. Birds with high blood parasite loads and birds with weakened immune systems were preyed upon at higher rates than uncompromised birds. Increased predation was seen on snowshoe hares with heavy burdens of stomach worms. The authors concluded:

> It is logical to assume that predators' high success with diseased prey may be due to poorer body condition of the prey and consequently prey's slower avoidance behavior, decreased awareness, or reduced stamina. Studies have suggested that predators may also use visual pattern, scent, or behavioral cues to select compromised prey (Wild, 2011).

This all makes good sense and is evidence for encouraging increased involvement of predators in the ecosystem. But when push comes to shove, good sense is not operative in the Yellowstone ecosystem. Instead, what dominates this wilderness is the economics of private industry, namely, the cattle industry.

Not only do cattle ranchers not want wild bison and elk in the presence of their cattle grazing in the ecosystem because of disease risks, they also do not want predators due to the risk of losing livestock to them. The present solution now being employed for both wild ungulates and predators in the Greater Yellowstone Ecosystem is to keep wildlife away from cattle, instead of cattle away from wildlife, and doing so at government expense—a solution biased toward the commercial interests of cattlemen. It is simply not fair. Nor is it good wildlife management. Wild bison are either hazed back into the park or killed to keep them away from cattle, and predators that are deemed a threat to cattle herds, such as wolves, grizzly bears and mountain lions, are tranquilized and relocated or hunted and shot.

It is a lose-lose situation for wildlife and a win-win for ranchers, who can put their cattle in an environment where their herds are exposed to a high risk of disease and predation and have the government pay for their protection and compensate them for their losses.

The bias toward the ranchers' interests is so strong it even applies to threatened species such as the grizzly bear. The Bridger-Teton National Forest is touted by the U.S. Forest Service as containing "some of the most pristine areas within the Greater Yellowstone Ecosystem," and this "wild expanse provides habitat for grizzly bears and wolves, along with moose, elk, deer, antelope, and eagles" (Bridger-Teton National Forest Visitors Guide, 2016). Yet, we read headlines about this region such as this: "Grizzly bears, wolves killing cattle in western Wyoming." This is worthy of a headline? Then so should this: "Dog eats hamburger out of master's bowl in back yard." Why do we read stories like this? Because in the heart of this wilderness is a huge cattle allotment. As a Missoulian July 13, 2015 article states:

> The 323-square-mile public lands rangeland complex in the Upper Green, located about 40 miles east of Jackson, is the largest grazing allotment in the U.S. Forest Service system. In places it spans the entire Bridger-Teton National Forest from north to south.

A rancher told the *Jackson Hole News & Guide* that a neighbor who grazes cattle along the Green River bottom had a "bear kill and a wolf kill before we even got there," and he added, "and I think between then and now—this is a guess—there's been about six to eight bear kills and two wolf kills on us."

Predators are programmed by nature to eat ungulates. Why should this be news? A better headline would be: "Ranchers are surprised that their cows are getting killed by grizzly bears and wolves in the heart of a grizzly bear and wolf wilderness."

According to Forest Service documents, the region is the most concentrated portion of the Greater Yellowstone Ecosystem for grizzly bear conflict. The allotments are the site of about 40 bear-livestock conflicts a year. When bears kill livestock, they either are relocated from the Upper Green or killed. The Fish and Wildlife Service, which is managing grizzly bears while they're being protected by the Endangered Species Act, allows up to 11 grizzly bears to be killed over any three-year period. The July 13, 2015 article noted that ten grizzly bears had been killed by wildlife managers since 2012 for depredations in the rangeland (Grizzly bears, wolves killing cattle in western Wyoming, 2015).

Mountains lions are also second-rate denizens of the ecosystem. Government attitudes toward predatory wildlife are typified by those held by the state of Wyoming. Mountain lions that cause livestock damage "normally result in the lethal removal of the offending mountain lion" according to Wyoming's "Mountain Lion Management Plan." In Wyoming, to reduce mountain lion damage either the "offending mountain lion" is removed by the state or their take is increased by sport hunting. However, just how many mountain lions should be removed from the landscape to decrease predation of cattle is not known. The Wyoming Game and Fish Department states:

> We currently do not know the harvest level or length of time required to reduce lion populations to the point that livestock reductions would be reduced, but the adaptive management approach outlined in this plan will allow evaluation of this issue in the future (Mountain Lion Management Plan, 2006).

Demographically, in wildlife management regions where mountain lion conflicts with livestock are elevated, the limit on the number of mountain lions that may be killed by hunting is raised, even though the state of Wyoming does not know if killing more mountain lions works to reduce depredations. For instance, a 2010-2012 Wyoming Game and Fish Department study of a hunt area, where the distribution of mountain lions and domestic sheep overlapped, reported that:

> The southern Bighorn Mountains continue to have the highest precedent of mountain lion livestock depredation (sheep), and subsequently, mountain lion mortality limits have been adaptively increased in order to reduce the lion population sympatrically with sheep grazing allotments.

This area comprises the Northcentral Mountain Lion Management Unit (NCMLMU) and the Northeastern Mountain Lion Management Unit (NEMLMU), located east of the Greater Yellowstone Ecosystem and roughly bordering it. The study noted:

> Despite elevated levels of harvest in both the NCMLMU and NEMLMU, we did not document a corresponding decrease in livestock depredation, rather there was a positive correlation with increased mountain lion harvest and increased amount of damage monies paid for compensation in relation to sheep depredation. It has been hypothesized that sustained high harvest density of mountain lions may in turn create more problems related to conflict based on mountain lion home range turnover and younger age structure (Thompson, 2013).

In other words, killing more mountain lions does not appear to reduce the degree of conflict between predators and livestock. Yet each year, more and more lions are being killed, the number rising from a little over 200 animals in 2007 to about 300 in 2012. What impact this level of harvest is having on the total population of mountain lions in Wyoming is not known, for as the Wyoming Game and Fish Department says itself, the “WGFD does not estimate mountain lion numbers to manage populations,” although some day it might, stating:

> Despite the fact WGFD does not currently use mountain lion abundance to manage lions in Wyoming, separate ongoing research projects are attempting to develop multiple monitoring methods to estimate abundance and movements of these animals for possible future use.

All told, between 1974 and 2011, humans have killed at least 4,372 mountainlions in Wyoming (Summary: Mountain Lions in the State of Wyoming, 2016). If the mortality rate due to harvesting continued at the rate of 300 animals a year, by 2015 more than 5,500 mountain lions would have been removed from the ecosystem lethally since 1974. Conservationists estimate that 30 percent of the female mountain lions have kittens which die of starvation, having been orphaned by the death of their mothers, as reported June 1, 2016 by the *Jackson Hole News & Guide* in “Critics say: Kill fewer lions—Hunters, researchers join forces to ask for lower quotas around Jackson Hole.”

One comment was posted in response to the article. The writer stated:

> Other than providing some income to WF&G and outfitters and hunters, what is the need to kill any cougars? If folks are concerned about the safety of their pets or themselves, they need to be vigilant in taking measures such as having bear spray while in the wild and make sure their pets are not allowed to roam without supervision. Cougars play an instrumental role in maintaining a healthy landscape and they are very territorial and will kill other cougars, thus maintaining a balance if left alone. Please enlighten me (Critics say: Kill fewer lions, 2016).

You want enlightenment? Follow the money. It is livestock in our national forests that creates the need to kill cougars. It is a range war over grazing rights in wildlife habitats and the domestic animals are winning. In our national forests, it is a mad, mad world. But it gets even madder.

After years of a multi-million dollar wolf recovery program, in 2011 federal protection for the gray wolf under the endangered species act was lifted. Wolf management was placed under state authority in Montana and Idaho. Wolves were delisted in Wyoming in 2012, but a federal court relisted Wyoming wolves because of the state’s shoot-on-sight policy and returned them to federal authority in 2014. As of December 31, 2011, the Northern Rockies contained at least 1,774 wolves in at least 287 packs.

The delisting of the gray wolf was greeted with a hunting frenzy. In 2013, the second year after delisting, more than 550 gray wolves were reported killed by hunters and trappers in Montana, Idaho and Wyoming, the states bordering the Greater Yellowstone Ecosystem, according to NBC News. Add to this number 216 wolves killed by federal agents of Wildlife Services (responsible for controlling damage or threats to livestock posed by wildlife), because they were attacking livestock (Protected no longer, more than 550 gray wolves killed this season by hunters and trappers, 2013).

In 2015, the Northern Rocky Mountain wolf population (Montana, Idaho and Wyoming only), was estimated to be 1,704 wolves in 282 packs, including 95 breeding pairs. Human-caused mortality, including wolf-control and hunting, for the three-state region totaled 684 wolves—about 28 percent, almost a third of the total population (Jimenez, et al., 2016). This level of harvesting continues annually.

Killing wolves has a number of unintended consequences. Marc Cooke of the Wolves of the Rockies conservation group, told NBC News:

> These animals can't take this much more persecution. When you go and kill these wolves, a lot of times you're killing the teachers, and when you kill the teachers of the pack you get the youngsters who haven't absorbed the skills that would've been passed down over time to them from the elders in the pack. Now you have youngsters who don't know how to kill things going after the easiest thing to kill, lambs and cattle, which leaves them open to being killed by control hunts by the federal government.

A reader of the NBC News article commented that the reason for killing wolves and other predators in a wilderness is that livestock are allowed to graze without fencing or daily supervision. Putting unprotected livestock on public land inhabited by predators leads to predation. He said March 7, 2013 that behind the killing of predators is economics:

> I think one of the most important things this article is saying is ranchers are lazy and cheap. Why?
>
> The article [implies that] . . . much of the reasoning to kill off wolves and other big game predators in nature is that they kill livestock. What isn't said is they kill unattended livestock being left on vast stretches of property—property which frequently is leased from the federal government (BLM) or state governments. We aren't talking about small meadows with barbed wire around them. We're talking thousands of acres with limited barriers, where ranchers use RFID [radio-frequency identification] tags to track their herds. Where are the ranchers when the cattle and sheep are out? They sure as hell aren't sitting in the fields watching them. The animals free roam. This is the modern west.
>
> Predators were killed off to safeguard the animals. Sometime in the past, it was determined to be cheaper to kill off the predators such as wolves, bears and cougars; than it was to maintain cowboys and shepherds in the fields to watch over the stock. It's commonly known that when there's someone guarding the flock or herd, wolves and other predators stay away.

> It's naive to think that in the modern era, with access to radios, RFID, vehicles and such; that ranchers in the west (where I lived for nearly 15 years) can not be responsible for their stock full time. It's far easier and cheaper to blame the wolf—dollars to put someone in the field to be responsible, pennies to shoot an animal that earned its place in nature (Protected no longer, more than 550 gray wolves killed this season by hunters and trappers, 2013).

But here is the rub. Intuitively, the more wolves one kills on a landscape on which cattle and sheep graze, the more those domestic animals are protected. Wrong. Just the opposite is often true, according to a 2014 study, "Effects of Wolf Mortality on Livestock Depredations" published in the open access scientific journal PLOS ONE by researchers Robert B. Wielgus and Kaylie A. Peebles in the Large Carnivore Conservation Laboratory, School of Environment, Washington State University. The authors wrote:

> However, contrary to the "remedial control" hypothesis, each additional wolf killed increased the expected mean number of livestock depredated by 5–6% for cattle and 4% for sheep. It appears that lethal wolf control to reduce the number of livestock depredated is associated with increased, not decreased, depredations the following year, on a large scale – at least until wolf mortality exceeds 25%. Why 25%? The observed mean intrinsic growth rate of wolves in Idaho, Wyoming, and Montana is about 25%. Therefore, once anthropogenic mortality exceeds 25%, the numbers of breeding pairs and wolves must decline – resulting in fewer livestock depredations.

Killing off up to a quarter of the population paradoxically results in more livestock depredations the next year. The authors explain:

> Below 25% mortality, lethal control may increase breeding pairs and wolves through social disruption and compensatory, density dependent effects. For example, wolf control efforts occur year round and often peak during grazing season in areas with livestock depredations. However, if control takes place during the breeding season and a member of the breeding pair is removed it may lead to pack instability and increased breeding pairs. Furthermore, loss of a breeder in a pack during or near breeding season can result in dissolution of territorial social groups, smaller pack sizes and compensatory density dependent effects – such as increased per-capita reproduction. Culling of wolves may also cause frequent breeder turnover and related social disruption – which can result in reduced effective prey use (through loss of knowledge of prey sources and ability to subdue prey) which may also result in increased livestock depredations. All of these effects could potentially result in increased livestock depredations.

So, if killing wolves at a rate beyond 25 percent reduces livestock depredations, why not opt for that level or above? The authors explained:

> Annual mortality in excess of 25% will reduce future depredations, but that mortality rate is unsustainable and cannot be carried out indefinitely if federal relisting of wolves is to be avoided. Furthermore, a 5% (sheep) and 5% (cattle) kill rate of wolves yields the same number of cattle and sheep depredations as a 35% (cattle) and 30% (sheep) kill rate, but the 30% or 35% rate is unsustainable for wolf population persistence and the 5% rate is not. The worst possible case appears to be a high mortality rate at about 20–25%, since this corresponds to a "standing wave" of the highest livestock depredations (Wielgus, 2014).

Right now in the Greater Yellowstone Ecosystem, the region is experiencing a 28 percent mortality rate for wolves via hunting and trapping. We are on a teeter-totter between wolf-kill that either promotes the highest livestock depredations or extirpation once again from the region of the gray wolf.

The wildlife management philosophy operative in these ecosystems gets even more puzzling. The onus of disease mitigation in the ecosystem falls on wildlife, instead of the intrusive domestic animals. For instance, domestic sheep can transmit a highly contagious disease called *Pasteurella haemolytica*, a respiratory pathogen that leads to pneumonia and death in bighorn sheep. In wild situations, domestic sheep and bighorn sheep association almost always results in deaths of bighorns without affecting the domestic sheep. Because game agencies cannot force private landowners to relocate domestic sheep, the agencies often will capture or kill bighorn sheep known to have been in contact with domestic sheep to prevent the spread of disease (Prevost, 2014).

In Gardiner Basin in the Gallatin National Forest, the observed mortality of bighorn sheep over the past several years has been greater than normal. It is speculated that this die-off is because of their mingling with domestic sheep recently brought into that valley. The government's solution, as shown in this petition, was not to remove the domestic sheep, but to kill those bighorns that were known to have been in direct contact with domestic sheep (Pneumonia Detected in Gardiner Area Bighorn Sheep, 2014).

So a logical question is why, under these circumstances, are bighorn sheep that come in contact with these domestic sheep killed instead of removing the domestic sheep so as to prevent further outbreaks? Indeed, why kill wolves, bears and mountain lions that can keep an ecosystem healthy, instead of removing cattle and sheep from the ecosystem? Why are bison killed that try to enter the national forests outside Yellowstone National Park during migration, instead of removing the cattle, and why are elk allowed to migrate and feed on the park's borders when it promotes disease? But of course, we have to remember that logic does not necessarily prevail in our national forests or near them. The answer is simple:

instead of wildlife having precedence here, cows and sheep rule. It is the preservation of domestic animals, not wildlife, that counts in our national forest and on our public lands.

How did we get into this pickle? Much of the blame can be attributed to the Multiple-Use Sustained-Yield Act of 1960, its faulty interpretation and the legislation it inspired. But first a little history.

With the major grazing ungulate of the North American continent wiped off the face of this nation by the late 1800s, that is, with the extirpation of wild bison through their relentless government-supported slaughter so as to gain military dominance over the Plains tribes, huge tracts of public land were left open, which the public began to use for grazing domestic animals such as cattle and sheep. In 1890, the US Supreme Court in *Buford v. Houtz* recognized the right of the public to use these lands. It stated:

> We are of the opinion that there is an implied license, growing out of the custom of nearly one hundred years, that the public lands of the United States, especially those in which the native grasses are adapted to the growth and fattening of domestic animals, shall be free to the people who seek to use them where they are left open and unenclosed, and no act of government forbids this use.

The Court further commented:

> [I]t became a custom for persons to make a business or pursuit of gathering herds of cattle or sheep, and raising them and fattening them for market upon these unenclosed lands of the government of the United States . . . Everybody used the open unenclosed country, which produced nutritious grasses, as a public common on which their horses, cattle, hogs and sheep could run and graze.

Congress later closed the public lands to grazing without permit (Aldrich, 1980). The Taylor Grazing Act of 1934 placed controls on public land grazing and established specific grazing allotments or areas of use. But over time, ranching interests in the public lands increasingly came in conflict with public interests in the land, interests that entailed environmental protection and conservation of natural resources. The exploitative private use of public lands for grazing livestock began to compete with its public uses for the purpose of recreation and hunting. The public became increasingly interested in the protection of wilderness, wildlife habitat, endangered species, cultural resources and water resources (History Of Public Land Livestock Grazing, 2015).

In an attempt to mediate the conflicting private and public uses of these public lands, in 1960 Congress passed the Multiple-Use Sustained-Yield Act, which sought to strike a balance in land use planning among the competing values of recreation, grazing, timber, watershed protection, wildlife and fish.

Today, administration of the public lands is divided between two federal agencies. The 191-million-acre National Forest System is administered by the Forest Service, an agency of the Department of Agriculture, under the National Forest Management Act and the 265 million acres of public lands is managed by the Bureau of Land Management (BLM), an agency of the Department of the Interior, under the Federal Land Policy and Management Act. Both statutes borrow from the Multiple-Use Sustained-Yield Act in their emphasis on balancing the use of the resources of the public lands (Multiple Use Lands, 2016).

The act directed that "the national forests be managed under principles of multiple use and to produce a sustained yield of products and services . . ." The act stated that "it is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes." It stated that "In the administration of the national forests due consideration shall be given to the relative values of the various resources in particular areas. The establishment and maintenance of areas of wilderness are consistent with the purposes and provisions of this Act."

In other words, wilderness was just one of many uses. By authorizing the division of the national forests into "areas of wilderness" the act authorized the fragmentation of the wilderness into areas of wilderness *and* non-wilderness. Multiple use was defined as the management of the various resources so that they are utilized "in the combination that will best meet the needs of the American people." Sustained yield was defined as "the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land." The act provided for the "harmonious and coordinated management of the various resources, each with the other," and stated again that this was to be done "without impairment of the productivity of the land . . ." (Multiple-Use Sustained-Yield Act, 1960).

The language of the act, such as "relative values of the various resources," "sustained yield of products and services," and "high-level annual or regular periodic output" are economic terms. The national forests by this act were being put to work for the nation. While the value of wilderness was a consideration, it was just one competing value and had to compete with the production of value by domestic grazing animals and timber.

"They thus, as famously observed, 'are not parks,'" the Department of Justice noted, commenting on the resultant character of the public lands following the passage of the Multiple-Use Sustained-Yield and related statutes. The Department of Justice stated:

> For historical reasons, the statutorily sanctioned timber and grazing uses of these lands have resulted not only in the expectation by ranchers and the

timber industry that these uses will continue unabated, but similar expectations in communities whose livelihood depends on the persistence of these uses. At the same time, the National Forests and the Public Lands represent significant, and in some cases, the only large scale refuges for certain wildlife, and have nationally recognized ecological significance. Recreational uses may conflict with both of the above interests, and there may be conflict within the neighboring community between the economic value of consumptive and recreational uses and preservation values.

As can be expected, the use allocations made by the agencies often do not sit well with one or the other of these constituents (Multiple Use Lands, 2016).

In 1979 George Cameron Coggins, professor of law at the University of Kansas, was invited to serve on a National Academy of Sciences committee to study and recommend reform of public rangeland management. After two years of study, the committee was disbanded by its sponsor, the Bureau of Land Management. "Perhaps coincidentally, the BLM Director knew the recommendations would be unfavorable to the agency's way of doing things," Goggins mused in an article on what he learned from the study. His perspective sheds light on the status of public land use in ecosystems. In his remarks published in the *Gonzaga Law Review* titled "Livestock grazing on the public lands: Lessons from the failure of official conservation," Coggins stated:

> The permittees and the present BLM leadership argue that the current course of management best represents and advances the public interest because their livestock feed the huddled masses of the world, and because the livestock industry is of crucial importance to the gross national product. These arguments can be dismissed fairly easily. The public lands do not feed the world, and, in their present condition, their contribution to the national economy, and even to national beef production, is insignificant. Some would also argue that these ranchers have acquired de facto rights to these lands by virtue of their long use of them, even if they do not hold record title, and thus they are entitled to priority of use over any granola-chomping, johnny-come-lately making a big deal out of the rights of jackrabbits, coyotes, or dirt bikers.

However, he reflected:

> A more persuasive rancher argument is that the public interest cannot be divorced from history. These stockraising families have had the benefit of this way of doing things as a central element of their way of life since the beginning of western settlement, and it would be grossly unfair to suddenly defeat their legitimate expectations. The western ranchers do have a long-standing stake in the use of these lands, so the picture is not one-sided.

But there is another way of looking at the issue. Coggins said:

> When we look at the other side of the coin, however, we see that the public interest dictates complete and radical reform of the entire present system. Of the dozens of reasons why this system is bad public policy, two prominent ones are human discrimination and resource ravishment.

With regard to discrimination, he noted:

> It is contrary to the public interest, as expressed in virtually every public policy from the beginning of the Republic, to limit one kind of public benefit to one class when the class is not defined by any present status related to the benefit but is instead defined by inheritance, stemming from the accident of proximity a half century ago. Ask yourself whether the nation would tolerate a policy that limited access to Yellowstone National Park to descendants of the early explorers. It is even more pernicious when the least needy receive the most benefits.

With regard to the despoliation of the ecosystem, he said:

> It is contrary to the public interest to perpetuate the ravishment of a public resource. The present system insures that the non-economic resources receive little real administration consideration.

Coggins concluded that:

> So long as the public lands are devoted primarily to raising livestock, wildlife, recreation, scenic beauty, air and water quality, and the land itself will all suffer. Present management tries to kill every beast, bug, and plant that might inconvenience the livestock permittees (Coggins, 1985).

The system of public land management now being carried out in the Greater Yellowstone Ecosystem contravenes the public interest and directly operates against the tenants established in the Multiple-Use Sustained-Yield Act. Are the resources in the national forests comprising this ecosystem being utilized "in the combination that will best meet the needs of the American people"? How can this be answered in the affirmative when those who benefit most from the extraction of value (forage) and government protection of assets (livestock) are the relatively few owners of livestock that dominate the grasslands? Are the resources being maintained at "a high-level annual or regular periodic output"? How can this be answered in the affirmative when the federal and states governments spend millions upon millions of dollars to protect cattle and other livestock from disease and predation in the ecosystem? What is transpiring in the ecosystem is not sustained yield, but sustained loss year after year after year in the form of costs related to protective federal and state services paid for by the public in tax dollars. Are the "various renewable resources of the national forests" being utilized "without impairment of the productivity of the land"? How can this be answered in the affirmative when hundreds of wild bison, wolves, bears and mountain lions are killed each year for no other reason than to make it possible for cattle to graze on these public lands?

This is not production, this is not output by the national forest and public lands but instead ecological ravishment that involves discrimination, financial loss, and wildlife decimation. And because these practices are causing the ecosystem to collapse under the burden of endemic diseases due to the stagnation of the system to make it work in behalf of the ranches, the result is ultimately the promotion of an increasingly biohazardous environment—an environment that will cause great harm to this nation's productivity and health.

How can an ecosystem maintain a sustained yield? Certainly not by becoming diseased. Certainly not by killing off one species after another to suit temporary economic needs.

In the proceedings of a workshop convened March 5 and 6, 1992 by the US House of Representatives' Committee on Interior and Insular Affairs titled "Multiple Use and Sustained Yield: Changing Philosophies for Federal Land Management?" Chris Maser wrote on the concept of managing an ecosystem to maintain a sustainable environment in perpetuity without impairing the productivity of the land. Key is the preservation of biodiversity so it can adapt to change. In a report "Do We Owe Anything to the Future?" he said:

> . . . the only sustainability for which we can manage is that which ensures an ecosystem's ability to adapt to evolutionary change (such as warming of the global climate) in a way that may be favorable for us. In other words, we need to manage for choice, which is synonymous with biodiversity, which, in turn, is an ecological insurance policy for the flexibility of future choice.

Destroy the diversity of species and biodiversity is destroyed—nature's repair kit:

> Every ecosystem adapts in some way, with or without the human hand. Our heavy-handedness precludes our ability to guess, much less to know, what kind of adaptations will emerge. Thus, we must pay particular attention to ecological redundancy, of which biodiversity is the 'nuts and bolts.'

He explained the role of ecological redundancy:

> Each ecosystem contains built-in redundancies, which means it contains more than one species that can perform similar functions. Such redundancies give an ecosystem the resilience either to resist change or to bounce back after

disturbance. But we have little knowledge about which species do what and how. So when we tinker willy nilly with an ecosystem's structure to suit our short term, economic desires, we lose species to extinction, and thus reduce the ecosystem's biodiversity. With decreased biodiversity, we lose choices for management, which directly affects the Earth's cultural capacity and therefore our lifestyles. The loss of biodiversity may so alter the ecosystem that it no longer can produce that for which we valued it in the first place—a desired lifestyle (Maser, 1993, pp. 205, 206).

Kill with a heavy hand migratory animals and predators and one kills biodiversity. A root cause of this willy-nilly heavy-handedness is the domination of the ecosystem by the livestock industry. Domination, especially one that degrades the wilderness and promotes disease, does not provide for the "harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land," as mandated in the Multiple-Use Sustained-Yield Act of 1960.

The national forests surrounding Yellowstone National Park for all intents and purposes are royal forests, the domain of livestock permittees that have been granted the right to hold these properties as an inheritance. In most cases, as long as they follow the legal requirements of their leases, they can keep their leases for decades, if not forever.

Holders of term grazing permits have become the barons of the national forests and other public lands, which is unconstitutional at a fundamental level. Article 1, Section 9, clause 8 of the US Constitution states: "No Title of Nobility shall be granted by the United States." Titles grant entitlement and the title of livestock permittee bestows on the recipient control over vast tracts of land that is inheritable and can last for generations. Are these permit holders not then functioning as the lords of the ecosystem with their status of nobility bestowed by the federal government?

"Nobility" is defined as the group of people belonging to the noble class in a country, especially those with a hereditary or honorary title. "Noble" is defined as belonging to a hereditary class with high social or political status, aristocratic. A defining element of the terms "nobility" and "noble" is heredity. Position in government or privileges bestowed by government because of heredity is fundamentally contrary to the principles that founded this nation.

The nobility identify themselves by coats-of-arms. A brand on livestock is equivalent to a coat-of-arms, a unique heraldic design stamped on the hides of cattle to signify that these animals are not public property, but instead private property. Historically, Mexican dons, that is, the nobility, branded their herds with a configuration of their family coat-of-arms. As the cattle industry moved northward into Texas, this method of indicating ownership gradually became accepted by American ranchers (Cattle Brands, 2016). Brands on cattle in the ecosystem, a network of publicly held lands, are stamps of nobility.

How a governmental permit may be acquired today for long-term grazing (called a “Term Grazing Permit”) reveals the system’s roots in the privilege of nobility. To begin with, one must own “base property,” that is, private range outside the boundary of a national forest or public land holding, as well as cattle. This, in essence, means one has to be landed gentry and have capital (livestock). Those without property, the common man, can not use the open lands, the public lands, for his or her livestock. How does one get property to be a rancher in the national forests? According to the US Forest Service’s “Rangelands, How do I get a grazing permit?” the most common way is:

> . . . through the purchase of existing base property that is recognized under an existing Term Grazing Permit. Occasionally individuals or businesses may inherit, obtain through foreclosures, or through other means become owners of base property. They are considered qualified applicants once all legal matters are settled.

The base property can not be any old rangeland, but has to have been previously recognized under an existing Term Grazing Permit—that is, property that includes in its value the right by permit to graze in a national forest off the base property, a right that is inheritable, a right that increases the value of the base property and can increase its taxes.

While “Grazing permits or leases convey no right, title, or interest held by the United States in any lands or resources,” incomprehensibly, “Permittees or lessees holding expiring grazing permits or leases shall be given first priority for new permits . . .”, according to the Code of Federal Regulations on grazing permits or leases 43 CFR 4130.2.

By this latter stipulation the United States conveys inheritable value to a private citizen, which is unconstitutional, just as it has been argued that giving first priority for admission to public schools for children of alumni is unconstitutional. Carlton F.W. Larson, acting professor of law, University of California at Davis, in “Titles of Nobility, Hereditary Privilege, and the Unconstitutionality of Legacy Preferences in Public School Admissions,” explained:

> Such preferences, far from being constitutionally benign, are in fact an egregious violation of the constitutional prohibition of titles of nobility.

What, Larson asked, does the “history of the Nobility Clauses and the long struggle against entrenched hereditary privilege . . . ” tell us? He wrote:

> . . . we do know what the Revolutionary generation thought about hereditary privilege. They denounced it in every form it might potentially appear. Equality was thus a fundamental theme, not just of the amended Constitution

> of 1868, but of the Constitution of 1787. And it is in the Nobility Clauses that this command of equality speaks most loudly (Larson, 2006).

One of our founding fathers, Alexander Hamilton, in the *Federalist Papers*, wrote:

> Nothing need be said to illustrate the importance of the prohibition of titles of nobility. This may truly be denominated the corner-stone of republican government; for so long as they are excluded, there can never be serious danger that the government will be any other than that of the people (Hamilton, 1787-1788).

Despite the Constitutional barricades erected against a state granting a class of citizens assets of value that are inheritable, the federal government has done so for that special class comprising the permittees, those holding permits to graze livestock of publicly held allotments. They have become a privileged group.

The average increase in value of base property was calculated by Bill Steven Stern in his 1998 thesis titled “Permit value: A hidden key to the public land grazing dispute.” His research disclosed that per AUM (the amount of forage needed by an “animal unit” grazing for one month), the average increase to the base property was $50 AUM in 1993. This is significant when one considers that the federal grazing fee for 2016 was $2.11 per AUM, as compared to the 2015 fee of $1.69 and the 2014 fee of $1.35 (Gorey, 2016). Stern wrote:

> In 1993 there were 13,303,068 BLM AUMs and 8,765,829 Forest Service AUMs for a combined total of 22,068,897 AUMs (USDI BLM). Using $150/AUM, one of the highest permit values found for year-round allotments, the total permit value for all allotments would be $3.31 billion. Using the 11 state average permit value level of $68, the combined permit value would be a bit over $1.5 billion. Since this figure comes from one of the years with the highest permit values, the current average is probably closer to $50/AUM, which would give a total national permit value of $1.1 billion.

Regardless of the number of months grazed, Stern found that permits conferred significant value to base property (Stern, 1998), value that could be inherited.

Without having base property, what can a poor boy do to graze cattle on public land? In essence, go back to square one:

> Without purchasing or acquiring base property the only other way of acquiring a Term Grazing Permit is to purchase permitted livestock and then providing a parcel of land that meets base property requirements. In either case, the current holder of the Term Grazing Permit who sold either base property or permitted

livestock must waive their permit to the Forest Service in favor of the purchaser (applicant).

Either way, this keeps control of the permit in the hands of the holder of the permit. In sum, the open land is closed to the common man and can only be accessed by a privileged class, the permittee, those who were there first. As the Forest Service notes:

> Acquiring a permit to graze livestock on National Forest land is not a simple process since most Forest Service lands eligible to be grazed by livestock are already obligated under existing permits.

But let us say that a grazing permit applicant jumps through all the hoops required and decides not to use the acquired allotment for grazing—say the applicant is an environmentalist or a wildlife conservation organization. That door has been legally shut. The permit can be relinquished but it cannot be sold. If a permit holder gives up their permit, then the BLM or Forest Service can take it and reissue it to another livestock operator. According to the Code of Federal Regulations governing the issuance of grazing and livestock use permits (36 CFR 222.3):

> If the permittee chooses to dispose of all or part of his base property or permitted livestock (not under approved nonuse) but does not choose to waive his term permit, the Forest Supervisor will give written notice that he no longer is qualified to hold a permit, provided he is given up to one year to reestablish his qualifications before cancellation action is final.

In other words, public grazing allotments must be grazed. Nevertheless, some grazing allotments have been bought out by such organizations as the National Wildlife Federation, but the buyout, where ranchers are paid not to graze their allotments, are not permanent solutions and can be revoked. For instance, as reported in this petition, the Slip & Slide allotment at the northern end of Gardiner Basin, listed as being "retired" by the National Wildlife Federation as of 2011 (Retired Wildlife Acre Allotments, 2016), was again listed as active by the Forest Service in 2015, that is, cattle were grazing there (see Table 4). To remedy this, Congressional legislation has been introduced that would allow ranchers to voluntarily end their grazing allotments in exchange for private compensation. Called the Rural Economic Vitalization Act, it would allow private parties to pay willing ranchers to relinquish their grazing permits on public lands. Allotments would then be permanently closed to livestock grazing (Maughan, 2013).

Those who have been granted grazing permits may use the forage resources of the public lands for their livestock without paying the economic price for exposing their domestic animals to a biohazardous environment such as the Greater

Yellowstone Ecosystem. They can expect the IBMP to separate their cattle from wild bison that carry brucellosis and wink at the fact that the IBMP does not separate their cattle from elk which also carry brucellosis—winking to placate the elk hunting industry. In an ecosystem that is kept healthy by predators such as wolves, bears and mountain lions, they can expect Wildlife Services to exterminate any predator that is deemed a threat to their livestock. They can expect that the very institutions we depend on to protect our wildlife, including the National Park Service and the Yellowstone National Park, will remove, haze and kill wildlife that is found objectionable by the permit holders. And the public will pick up the tab.

II. The non-solution: the IBMP

The Interagency Bison Management Plan is the armed guard of the grazing allotments. It functions as a wall or lethal fence around Yellowstone National Park. Any bison that gets near it or tries to go beyond to escape may be killed. Its purported purpose is to keep wild bison separate from cattle to prevent the spread of brucellosis. Its actual purpose is to keep wild bison from entering the national forests and repopulating the wild portions of the Rocky Mountains and Great Plains so that people must remain dependent on livestock—livestock they must purchase instead of wild bison that the public can hunt. The need for the wall rests on a foundation of lies.

The IBMP was bestowed its authority in 2000 by agreement between the various agencies involved, agreement obtained by a court-ordered mediation concerning a management plan for Yellowstone's wild bison. The plan was formulated after conducting an environmental impact statement, its summary published in *Record of Decision for Final Environment Impact Statement and Bison Management Plan for the State of Montana and Yellowstone National Park.* An environmental impact statement is a report required by the National Environmental Policy Act of 1969 for actions by the federal government "significantly affecting the quality of the human environment." It describes the positive and negative environmental effects of a proposed action and of alternatives to the proposed action.

As set forth in the *Record of Decision:*

> The requirement to prepare an environmental impact statement is designed to serve two major functions: to provide decision-makers with a detailed accounting of the likely environmental effects of a proposed action prior to its adoption; and to inform the public of, and allow it to comment on, such action.

During a 120-day period in 1998, the public made extensive comments on the Draft Environmental Impact Statement (DEIS), made available through its publication and by means of public meetings. According to the *Record of Decision:*

> The agencies received 67,520 comment documents containing 212,249 individual comments on the DEIS. The agencies responded to each of the substantive points raised in these comments, and those responses were included in a 433-page appendix to the Final EIS (Record of Decision, 2000).

According to the Final Environmental Impact Statement for the Interagency Bison Management Plan that contributed to the establishment of the IBMP:

> The purpose of the proposed interagency action is to maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana.

As mentioned in the Declaration, the IBMP was originally composed of both federal and state agencies:

> The U.S. Department of the Interior, National Park Service, and the U.S. Department of Agriculture, Forest Service, are the federal lead agencies. The state of Montana is the state lead. The U.S. Department of Agriculture, Animal and Plant Health Inspection Service, is a cooperating agency.

The FEIS stated:

> This environmental impact statement examines seven alternative means of minimizing the risk of transmitting the disease brucellosis from bison to domestic cattle on public and private lands adjacent to Yellowstone National Park. These alternatives each include a full range of management techniques . . .

The seven alternatives examined by the FEIS for managing bison were:

> *Alternative 1*, a no-action plan that continued the present plan of capture and slaughter of bison crossing the north and west boundaries of the park;
>
> *Alternative 2,* involved changes in cattle operations and would allowed bison to range over the largest portion of their historic range;
>
> *Alternative 3* managed bison through hunting and quarantine;
>
> *Alternative 4* added quarantine to Alternative 1, so that bison testing negative for brucellosis would not be slaughtered;

Alternative 5 involved an extensive capture, test, and slaughter of bison that test positive for brucellosis;

Alternative 6 was similar to alternative 5 but required 10 years of vaccination before the test and slaughter phase began;

Alternative 7, the agencies' preferred alternative, focused on maintaining the bison population below about 2,500 animals to minimize migration into Montana.

Alternatives 2, 3, and 7 also included plans for the acquisition of land outside the park for use by bison, especially use as winter range (Final Environmental Impact Statement, Vol. One, 2000).

The National Environmental Policy Act specified that "the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act . . ."

In the analysis performed in the preparation of the environmental impact statement, one of the public laws with which it should be in accord is the Multiple-Use Sustained-Yield Act. As mentioned, it specified that the national forests were to be used by various interests in a balanced way. A particular concern was that the use of the national forests results in "sustained yield of the several products and services," defined as meaning:

> . . . the achievement and maintenance in perpetuity of a high level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land.

The act stated the national forests were to be managed:

> with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

In other words, the national forests were to be managed not necessarily for their greatest profit, but instead for their relative value, that is, the use of the resources "in the combination that will best meet the needs of the American people" (Multiple-Use Sustained-Yield, 1960).

Assessment of needs can be determined by investigating what the public wants and what its interests are. The *Record of Decision* reported that:

> As a summary, the public was overwhelmingly in favor of more natural management of the bison herd, with minimal use of actions they felt more appropriate for livestock such as capture, test, slaughter, vaccinating, shooting,

corralling, hazing, etc. They also indicated extremely strong support for the management and/or restriction of cattle rather than bison given a choice between the two. The public also supported the acquisition of additional land for bison winter range and/or the use of all public lands in the analysis area for a wild and free-roaming herd of bison. A large number of commentors also expressed opposition to lethal controls, and in particular the slaughter of bison.

The alternatives that received most of the public support were 2 (identified as the environmentally preferred alternative), and 3 (the hunting alternative):

> Alternative 2 would minimize human intervention, discontinue the use of capture, test and slaughter, focus on managing cattle rather than bison, and result in the largest area of acquired land for winter range. It also would offer the largest benefits to most environmental resources analyzed in the EIS, with alternative 3 offering some benefits to many of these same resources as well. The management emphasis and environmental advantages of alternative 2 are most consistent with the overwhelming majority of public comment.

The least preferred alternative was number 7. It ironically was called by the drafters of the EIS the "preferred alternative," a name which only a governmental group think tank could come up with under the circumstances. A more accurately descriptive name for Alternative 7 would have been the "ranchers' preferred alternative." It was this plan, the least preferred, that was adopted. One must ask, why?

Alternative 2 sought to restore conditions to a near natural state for bison, including a portion of their historic migration patterns outside the park over which bison would be able to range without interference from governmental agencies. The primary means to minimize the risk of disease transmission would be changes in cattle operations in regions immediately outside the park. This alternative would provide for lethal control of bison only in cases where human safety was in immediate danger, on private property at the request of the landowner, or for bison moving beyond the management areas just outside the park. Bison would not be captured or slaughtered by agencies.

Alternative 3 would rely on hunting of bison to regulate population numbers and distribution of bison outside the park, as well as to separate bison from cattle. Where hunting was not feasible, capture and shipment of seropositive bison to slaughter and seronegative bison to quarantine would be used to maintain separation and manage the risk of disease transmission (Final Environmental Impact Statement, Vol. One, 2000).

Both of these alternatives at face value appear to be reasonable. If what the public thinks counts, why was one of these alternatives, or a combination, not chosen? In the second volume of the FEIS, "Responses to Substantive Comments on the Draft Environmental Statement," numerous public comments were recorded, as well as the government's response, casting light on the public's thinking as well as the government's in the crafting of a management plan for Yellowstone's wild bison. Here are some representative comments and responses:

> Comment: The herd should not just be free-roaming, but wild. The agencies should address reestablishing wildness.
>
> Response: Maintaining the wild nature of the Yellowstone bison herd is one of the primary objectives of the long-term bison management plan. Each of the alternatives analyzed in the EIS process addresses the need to maintain a wild and free-ranging population of bison while also addressing the risk of brucellosis transmission. The interagency team has defined a "wild and free-ranging population" of bison as one that is not routinely handled by humans and can move without restrictions within specific geographic areas. The operation of a capture facility would not affect the wild, free-ranging character of the herd, since bison would be handled for only a short period of time.

The last sentence of the above paragraph is disingenuous. It is magical thinking. Handled for only a short period of time? How true. It only takes a short period of time to trap and kill a wild bison. But how does destroying an animal, quickly or not, preserve its wildness? It of course does not. This kind of thinking is typical of those who have crafted the environmental impact statement for the management of Yellowstone's wild bison. Claiming devotion to maintaining a wild and free-ranging population of bison and then claiming that no harm is done to the wild, free-ranging character of bison by the operation of a capture facility that kills multiple hundreds annually, sometimes over 1,000 animals, establishes that those drafting the EIS are crafting a document imbued with deceit. Deliberate deceptiveness—especially by pretending one set of feelings and acting under the influence of another—is Janus-faced.

The response continues:

> Conversely, the placement of bison in a quarantine facility would affect the wild, free-ranging nature of those individuals, since each would be required to complete a lengthy protocol before their release. Because they would lose an element of wildness, these animals would not be returned to Yellowstone National Park, but would be made available to requesting organizations to establish or augment populations elsewhere.

Conversely? Not really. Either lethally or physically removing wild bison from the park excerpts them from the park's wild bison genetic pool, affecting the wildness of the general herd population. Why? Because both those that are slaughtered and those that are quarantined are members of the migratory herd. They are the ones that attempt to leave the park to survive. They are the only ones that are killed or removed from the park. As pointed out extensively in this petition, it is this trait, the trait of migration, that is a primary characteristic of wild bison. Eliminate that trait by its annual and systematic destruction by the IBMP protocols and their wild instinct is destroyed, setting up the population for extinction.

Another comment and response:

> Comment: Why was the cost-effectiveness of the plan not fully measured in terms of costs to the taxpayer; e.g., the average cost of trapping, testing, transporting a bison is $850. These actions are being taken to protect less than 2,000 cattle, whose owners pay the U.S. Forest Service a total of $5,000 per year to graze on public lands. Commenters felt there was inequity in costs vs. benefits.
>
> Response: The costs and benefits of the various actions and alternatives are now more fully evaluated in the final environmental impact statement. The comment is correct in noting that in general the bison management costs proposed far exceed the annual return to the U.S. Treasury from the nearby public grazing allotments. Implicitly, a solution to the problem is to simply end these grazing allotments. A complication is that there are also cattle on private grazing lands in the area. Considerations of ranchers' rights and a desire to protect the ranching industry would seem to prevent eliminating all livestock grazing in the area.

A purpose of the environmental impact assessment is to develop a plan that would protect ranchers throughout the state from the threat of brucellosis. If the best way to do this would be to eliminate cattle from the vicinity of the park where brucellosis-infected animals live, then that should be on the table. Instead, it was taken off the agenda arbitrarily. The response continues with a rationalization for controlling the numbers of bison in the park:

> Additionally, in the absence of a plan, the 1998 NAS study concludes that bison populations would continue to grow and could range in ever-increasing distances from Yellowstone National Park. Given that ranching will likely retain a presence in the Greater Yellowstone Area, the real costs of not controlling the risk of brucellosis is not only the damage to local herds, but that the state of Montana could lose its class-free status (Final Environmental Impact Statement, Vol. Two, 2000).

Alternatives 2 and 3 are plans, so the comment about the absence of one does not apply in this instance. Further, because the Yellowstone bison herd migrates altitudinally, seasonally descending in the winter and returning to the higher elevations in the park in the spring, the fear that bison will be an ever-increasing presence beyond the park throughout the year is not supported by the history of the herd, as argued more fully in this petition.

Recall that the Multi-Use Sustained-Yield Act specifies that "The establishment and maintenance of areas of wilderness are consistent with the purposes and provisions of this Act," that "the resources of the national forests" are to be utilized "in the combination that will best meet the needs of the American people," that the "harmonious and coordinated management of the various resources, each with the other," be exercised and that this all be directed to produce a sustained yield, that is, ''the achievement and maintenance in perpetuity of a high level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land."

Keeping cattle and other domestic animals in an ecosystem that contains wild animals that have the contagious disease brucellosis, and maintaining separation of cattle from those diseased animals by killing those wild animals that come near cattle, does not promote harmony and impairs the productivity of the land. In pre-settlement days, members of the American Indian tribes thrived off the wilderness, achieving a high level of output from the resources. For instance, wild bison were allowed to be wild, had no brucellosis, and sustained the tribes. Wild bison did not have to be protected from predators and if allowed to migrate survived severe winters. Without intervention, wild bison can produce a high level of sustained yield.

Substituting cattle for bison in an ecosystem is against the American Indian culture that values wildlife for their ability to provide sustenance to the tribes. The culture of many of the tribes traditionally has centered around the wild bison and its ability to feed and shelter them. But with a rough hand the members of the IBMP disregard this cultural perspective and systematically remove lethally large segments of this wild herd, ever increasing the probability that such wildness will be rooted out, bringing wild bison annually closer to extinction.

A comment and the government's response addresses this factor:

> Comment: The Draft Environmental Impact Statement did not assess the impact to minority and low income populations (particularly Native Americans) from the continued lethal means to address brucellosis in bison. The use of lethal force is a significant impact to the tribes' cultural well-being.
>
> Response: During 1999 both visitors to Yellowstone National Park and regional and national populations were surveyed as to their attitudes on various issues associated with bison and brucellosis management. An examination of the responses to surveys of winter and summer park visitors, and a national random phone survey, indicate that Native Americans do indeed have differing attitudes towards the issue of bison management than do the average park visitor or national survey respondent. On the key question of lethal control of bison, survey respondents were asked whether they agreed or

disagreed with the following statement: "It is appropriate to kill bison at park boundaries, as necessary, to protect domestic livestock." A significantly greater number of the Native American respondents (60% to 70%) disagreed with this statement compared with the average nonresident respondent in both the summer visitor survey (35%) and the national phone survey (33%). The difference in attitudes towards lethal control of bison between the Native American and nonnative populations indicates that continued use of lethal control methods could have a greater negative impact on the well-being of tribes than the non-tribal population (Final Environmental Impact Statement, Vol. Two, 2000).

What caused the Native American people to be classed as "low income"? It can be simply put with regard to the Plains tribes: the annihilation by the United States of their herds of wild bison on which they depended for their livelihoods. That annihilation is still ongoing—its target now the last surviving remnant of those wild herds, the Yellowstone bison. Instead of recognizing the value of bison to tribal cultures, that this animal was the underpinning of their prosperity, the United States government with the implementation of the Interagency Bison Management Plan—which centers on lethal control and mass slaughter of wild bison, keeping bison captive in the park and not allowing the herd to grow beyond 3,500 head—has utterly disregarded its negative impact on Native Americans and a tradition that utilized wildlife for its sustained yield so important for their survival, a tradition that stretches back 10,000 years, a tradition that incorporated many of the aspects of Alternative 3, hunting, and Alternative 2, minimal human intervention and allowing bison to be wild instead of treating them as livestock.

Given its benefits and public support, why was Alternative 2, or a combination with Alternative 3, not adopted? According to the *Draft Environmental Impact Statement*, Alternative 2 was discarded from consideration because it had the greatest potential for transmitting disease in wildlife to cattle:

> Alternative 2 would have significant beneficial impacts associated with the nonmarket values attributed to the well-being of bison, while this alternative would also present the greatest potential for the transmission of brucellosis from bison to cattle. Were that to occur, there would be major negative economic effects on Montana's livestock industry (Draft Environmental Impact Statement, 1998).

Now how, just how, is this possible if one of the elements of Alternative 2 was the removal of cattle from the allotments, that is the "management and/or restriction of cattle rather than bison"? How can bison or elk or any wildlife transmit brucellosis to cattle that are not there?

According to the *Record of Decision*, of those commenters expressing a preference for an alternative analyzed in the EIS, most chose alternative 2, indicating a preference because this alternative focused on cattle management, instead of the management of bison, and the removal of livestock from the allotments in the national forest. But according to the *Record of Decision* this was not possible, to wit:

> To summarize generally, Gallatin National Forest does not believe its multiple-use mandate is best fulfilled by closing or modifying allotments unless a replacement allotment is available, and replacements are not available (Record of Decision, 2000, p. 47).

But the so-called multiple-use mandate is based on the Multiple-Use Sustained-Yield Act, which provides not only for multiple-use of the resources, but sustained yield. Cattle in the ecosystem promote a sustained *loss* in profit, tax dollars, and wildlife health and numbers. In other words, Alternative 2, which emphasizes managing cattle by closing allotments, was not considered a viable alternative because the drafters of the environmental impact statement simply refused to consider closing those allotments, misapplying and misinterpreting the act upon which their decision was based. This is trickery. This is misrepresentation. This is a biased manipulation of statutes. By limiting the investigation of the environmental impact of bison management to only choices the drafters wanted to consider, the *Record of Decision* which established the IBMP is the record of a fraud perpetuated in behalf of the cattle industry against the American public and in particular the Indian nations.

Biologists recognize that the threat of brucellosis and predators to cattle just outside Yellowstone National Park needs to be an ecosystem-wide solution. However, in the EIS, this ecosystem-wide perspective was also taken off the table. Following is a representative comment and response:

> <u>Comment</u>: The presence of ranching activity within a “significant portion” of the Greater Yellowstone Area constitutes a major disruption to the ecosystem, preventing the area from being a truly intact ecosystem.
>
> <u>Response</u>: The agencies recognize that the Greater Yellowstone Area is one of the “largest and most nearly intact” ecosystems in the continental U.S. (DEIS, p. 137). It is also recognized that a variety of human activities have had impacts on the ecosystem, and increasing levels of some activities pose threats to various aspects of ecosystem integrity. These issues, however, are beyond the scope of this environmental impact statement (Final Environmental Impact Statement, Vol. Two, 2000).

In an evaluation such as conducted to make an EIS, if elements critical to formulating an informed decision are exempted from consideration, how can a workable solution be achieved? Cherry-picking only benefits the picker of the cherries, and in this case it is the government in behalf of the livestock industry that is doing the picking of alternative bison management plans.

This spirit of cherry-picking continues. After 15 years of operating the IBMP, a proposal to revise the plan was announced. On March 16, 2015 the National Park Service and the State of Montana issued a notice of intent that they were serving as joint lead agencies "in the preparation of an Environmental Impact Statement (EIS) for a plan to manage a wild and migratory population of Yellowstone-area bison, while minimizing brucellosis transmission between these wild bison and livestock to the extent practicable." They were asking, once again, for the public to comment on various alternatives. The alternatives essentially provided a choice of the number of bison to be allowed in the park. My comment submitted for the EIS, an extensive analysis of the alternatives, is provided toward the end of this petition in the chapter 32 titled "Comment on alternatives for revision of the IBMP." The alternatives (which should all be called the Cherry-Picked Alternatives) are as follows:

> *Alternative 1* would continue implementation of the 2000 IBMP, using lethal removal and hazing, to maintain a population of wild bison allowed in the park at 3,000 animals.
>
> *Alternative 2* would limit bison abundance through hunting, with the maximum population limited to the carrying capacity of the park, that is up to 7,500 animals. "The risk of brucellosis transmission from bison to cattle would be managed through physical separation and limited hazing of bison back into the park."
>
> *Alternative 3* would focus on maintaining bison numbers below 3,000 animals, "the level at which large migrations would likely occur during winter months, thus limiting the number of bison that migrate out of the park . . ." "Brucellosis transmission would be minimized through population control, separation of bison and cattle and hazing of bison back into the park."
>
> *Alternative 4* would prioritize the prevention of brucellosis transmission between bison and livestock. "Suppression tools may include capturing bison at facilities inside or outside Yellowstone National Park, culling of likely infectious bison, vaccination of bison at capture facilities, sterilization of bison before shipment to terminal pastures and adjusting land use by cattle." Bison population would be limited to 3,000 animals.
>
> *Alternative 5* would seek to expand bison tolerance north and west of the park year-round within specific geographic boundaries, such as into Gardiner Basin. Bison population would be limited to 3,000 animals.

Alternative 6 would allow for the total bison population to vary between 2,500 and 4,500 animals. “Tools such as hazing, public and treaty hunting and culling near the park boundary would be used to regulate population size and distribution, minimize brucellosis transmission from bison to cattle and protect property and human safety.”

Notice that the choices of alternatives were selected so that the alternative of removing cattle from the perimeters was not available. As demonstrated by this petition, bison numbers have nothing to do with controlling the spread of brucellosis from wildlife in the park to cattle just outside the park, yet numbers of bison is all that the EIS asks the public to comment on. What does matter is proximity of diseased animals to non-diseased animals. If a cow comes in contact with brucellosis-infected birthing material from either bison or elk, the probability is increased that the cow will become infected with *Brucella abortus.* The proposed EIS is silent on the issue of elk spreading the disease. The proposed EIS is more of the same non-solution vis-à-vis disease control as was the original interagency plan. All the alternatives seek to manage the disease through separation of bison from cattle. Whether the number of bison in the park is 2,500 or 7,500, the only way to keep bison from coming near cattle is either to remove bison through culling or hazing or to remove cattle from the allotments and private land in the region. Regardless of the presence of bison, if elk that have brucellosis are going to mingle with cattle anyway, does it not make good epidemiological sense to close the ecosystem to cattle? Any answer other than “yes” is tantamount to sticking pins in bison, hoping that by attacking the problem only in bison the disease in multiple species will go away. It won’t.

III. The solution: Remove cattle from the ecosystem

This petition is an effort to protect Yellowstone’s wild bison from extinction. This entails an ecosystem-wide approach. Not only should wild bison be listed, but also access to their critical habitats should be restored, as well as the health of those habitats on which they depend. This means the protection of predators in the ecosystem, the removal of cattle from the wildlife habitats surrounding Yellowstone National park and the dissolution of the IBMP, an anti-wildlife coalition. Of paramount importance is the prohibition of shipping cattle into or out of the ecosystem, for their presence here exposes them to the disease of brucellosis, endemic among the native wildlife population, thereby promoting the spread of brucellosis out of the park state-wide and nationally, resulting in economic loss and a threat to national security.

Ranchers, where appropriate, should be provided compensation for the removal of livestock from private land in the ecosystem and for the closing of grazing allotments. Cattle and domestic animals have no business being in the

Greater Yellowstone Ecosystem because it is a biohazardous environment. Cattle here put at risk the brucellosis-free status of the nation. The disease can be controlled in only two ways. Either eliminate almost all elk and bison from the park, or all cattle near its borders. Since eradicating elk and bison would destroy the function of the park as a wildlife reserve, this leaves banning cattle from the environs of the park as the only reasonable alternative.

To restore the health of the ecosystem—in particular elk and bison—the killing of wolves, bears and mountain lions within the ecosystem should be prohibited, for predators selectively kill weak and diseased animals.

Without cattle in the ecosystem, there is no need for lethal removal or capture facilities and therefore no need for the IBMP. Wild bison would then be free to migrate. Excessive wild bison population would be controlled by hunting, predation and the availability of forage.

If the IBMP's claim was true that the need to lethally remove wild bison from the park, and to haze those that survive back into the ;park, was because wild bison are a disease threat to cattle grazing just outside the park, then elk also would be subject to the same treatment, for they too are brucellosis disease vectors. But the movements of elk are not controlled, thereby putting the lie to that claim by the IBMP.

One of the nation's major food sources is large ungulates. Historically, for those of European descent, that ungulate is cattle. For the American Indian, it is bison, wild bison. The difference between the two is that cattle are privately owned, while wild bison are publicly owned. The real, unspoken reason for not allowing wild bison out of Yellowstone National Park is to prevent a return to availability to the public of this once-prevalent food source, wild bison, and instead retain access to the nation's relatively new ungulate—cattle—in private hands.

It is a war between public and private control, a war fought in our national forests. Access to the pastures of the national forests is controlled by the federal government in the form of grazing permits. According to the Code of Federal Regulations 36 CFR 222.3 "all grazing and livestock use on National Forest System lands and on other lands under Forest Service control must be authorized by a grazing or livestock use permit" (Section 222.3 Issuance of grazing and livestock use permits, 2016). Livestock is defined as animals kept or raised for use or pleasure. According to this section, "term permits will be issued to persons who own livestock to be grazed and such base property as may be required." Wild bison are unique for wildlife in that they are under the jurisdiction of the IBMP and the State of Montana, Department of Livestock. In practice, wild bison are recognized and treated as livestock by the state. It would seem reasonable that term permits could be issued to tribes, whose tribal lands would serve as base property for the purpose of grazing wild bison, traditionally the livestock on which tribal members subsist and a tribal trust resource. Further, tribal use of these lands for grazing could have preference over other non-tribal entities. According to Section 51.11 on the nature of treaty rights in the Forest Service's *Grazing Permit Administration Handbook*:

> Where expressly reserved by treaty, tribal grazing shall be recognized as a reserved right on National Forest System land held in perpetuity by the Indian tribe (Weldon, 2010).

Moreover, "Section 2: Treaty Rights and Forest Service Responsibilities" states that Forest Service Manual 2235.1 directs the agency to:

> Give Indian Tribes fair and reasonable opportunity to enjoy any treaty grazing rights reserved to them by treaty on ceded lands. Grazing rights reserved by treaty are a continuing privilege beyond that enjoyed by other citizens. The Forest Service shall not deprive Indians of treaty rights (Section 2: Treaty Rights and Forest Service Responsibilities, 2016).

An application of this directive may stem from Article 3 of the Blackfeet Treaty of Fort Benton, 1855, which reserved hunting and grazing rights for the region comprising the Gallatin National Forest for a number of tribes. It states that the area:

> . . . shall be a common hunting-ground for ninety-nine years, where all the nations, tribes and bands of Indians, parties to this treaty, may enjoy equal and uninterrupted privileges of hunting, fishing and gathering fruit, grazing animals, curing meat and dressing robes (Blackfeet Treaty of Fort Benton, 2016).

This passage does not mean that the Blackfoot Tribe gave up its rights at the end of 99 years but instead, at the end of that period of time, while its agreement to allow its land to be a common hunting ground may terminate at some distant time, it still retained the same privileges as it had in the past with regard to such now off-reservation activities as hunting and grazing. Provisions like this are also in treaties affecting the Columbia Indian tribes and give the signatories access to that buffalo commons today. Although the Blackfeet were moved north following the treaty of 1855, the Blackfeet Treaty as well as the Columbia Basin tribal treaties all set aside these lands as tribal trust resources, and because of the treaties' interdependent legal language, guarantee the right to access those resources today located on what was termed the buffalo commons.

Working with the Indian nations and with wildlife conservation and hunting groups could heal the ecosystem and prevent the extinction of wild bison. The need to restore the health of the ecosystem is not limited to its wild inhabitants, but to its human residents also and those who depend on this environment today and historically.

Brucellosis is a zoonotic disease, a disease that can be transmitted between animals and humans. In humans it is called undulant fever and can cause recurrent fever, night sweats, joint and back pain, other influenza-like symptoms and arthritis. A person, such as those engaged in hunting activities, can become sick if blood, fluid, or tissue from an infected animal comes in contact with eyes, nose, mouth or a skin cut. This can happen during field dressing, butchering or eating undercooked meat. It is therefore important to reduce the prevalence of brucellosis among elk and bison in the ecosystem, for by lowering the percent of infected animals comes a corresponding lower probability of contracting the disease (Hunters: Protect Yourself from Brucellosis, 2016).

Brucellosis is not the only disease linked to the unhealthy status of the ecosystem. By the IBMP's policy of limiting the size of the wild herd in the park to 3,000, the herd is not allowed to increase to a level that could sustain the surrounding American Indian tribes. Depriving tribes of bison has caused physiological and psychological harm. Taking away in a relatively few years their primary source for food, shelter and clothing—as did the great buffalo slaughter of the late 1800s—had devastating effects. This genocidal policy is being continued by the IBMP today through its systematic limitation of the expansion of the herd and access to these animals in numbers sufficient to sustain members of the tribes.

Type 2 diabetes was probably uncommon in American Indian populations before the 1940s. During 2010–2012, American Indian adults were 2.1 times as likely to have diabetes diagnosed as non-Hispanic white adults. From 1994 to 2004, Indian youth experienced a 68 percent increase in this disease. According to the Center for Disease Control, biologic explanations for disproportionate incidences of chronic illness often focus on the behaviors of individuals. However, another factor is the social conditions that contributed to their development in the first place. For diseases such as diabetes, attention to the social history is as important. Physiologic stress responses have been associated with historical trauma, namely the cumulative emotional and psychological wounding across generations emanating from massive group trauma. As the CDC explained:

> Disruption of indigenous persons' relationships with their homelands, including land, language, culture, and religious beliefs, has been suggested to be "at the root of health disparities." Certain public health leaders have noted that this connection to health disparities, including the diabetes epidemic in Native populations, has received little attention. Indigenous persons had traditionally gathered and cultivated plants and hunted and fished on their lands. Even with the restricted access to their fertile lands through policy changes, including the reservation era, many tribes maintained a high-fiber diet based on traditional foods that fueled a physically active life. However, industrial developments beginning in the mid-1900s on some tribal lands have further limited tribes' ability to harvest their traditional foods and curtailed the associated physical activity.

How can these disparities be redressed? The CDC states:

> A first step in creating systemic, long-term changes to redress imbalances and promote health in AI/AN [American Indian and Alaska Native] communities is to build awareness of the complexities regarding the historic and contemporary context of policy, poverty, historical trauma, and food systems related to health disparities, including diabetes disparities.

To help solve this problem, the CDC, in cooperation with tribal leaders, launched the "Traditional Foods Project" in 2008. Its purpose is to increase access to traditional foods, reclaim physical activity and revive and create stories of healthy traditional ways (Satterfield, 2016).

One of the stories that could be told is a myth by the Apache and Comanche on how the buffalo was released on earth to feed the Indian people. In the first days, so the story goes, a powerful being named Humpback owned all the buffalo. He kept them in a corral in the mountains north of San Juan. Not one buffalo would Humpback release for the people on earth. Coyote decided to do something about it. He pretended to be a dog and became a pet of Hunchback's son. One night he got into the corral and ran barking and nipping at the buffalo's heels, stampeding the buffalo out. Watching the bison escape, he told his son: "That was Coyote the Trickster. He has turned loose all our buffalo." And that is how the buffalo were released to scatter over all the earth (Shadow Walker, 2003).

Humpback today is the IBMP and the corral in the mountains is Yellowstone National Park. For the health of wild bison and the Indian people, the wild bison herds—the American Indians' basic and traditional food source, central to their culture and wellbeing—must be released. This would also be in the best interest of the non-native public, including hunters and conservationists.

The importance of restoring the availability of bison to the American Indian, in particular, is underscored by steps being taken by the small Stillaguamish Tribe in northwest Washington state. Tribal leaders are bringing wild bison onto the land of the 200-member reservation to combat diabetes. Like other Indian tribes, Stillaguamish tribal members have a much higher rate of the disease than their white neighbors.

As reported by the *Seattle Times*, a steady diet of bison meat—which has less fat and more antioxidants, vitamins and minerals than beef or chicken—has been shown to stop diabetes, according to Jim Stone, executive director of the Intertribal Bison Cooperative, a collection of about 57 tribes. If each person ate eight ounces of bison a day, a single bison could feed two people for a year, Stone said. On the other hand, no tribe has a herd so large that it could feed all its members. Before white settlers arrived, the Stillaguamish often traveled over the Cascades, sometimes as far as Montana, to trade for goods including bison. By bringing bison back to the tribe, they are getting back their cultural and traditional dietary ties to their ancestors. "Every tribe has had a history of interaction with the buffalo," Stone said. “You need something to spark that history for oral history to work” (Flint, 2008).

With the recent decision by Montana Governor Bullock to allow bison to return to the high country of Yellowstone in the spring after calving without the herds being hazed back by government agents, we are beginning to see for the first time in a hundred years the healing of the Greater Yellowstone Ecosystem. According to Stephany Seay, writing for the Buffalo Field Campaign June 30, 2016:

> West of Yellowstone, in Montana’s Hebgen Basin, buffalo have been making their own migratory choices for the first time in over a century. The buffalo who have been inhabiting Horse Butte have had the opportunity to give birth in peace and raise their calves in their gentle way, without threat of abusive government hazing. They have been able to take their time, waiting until their calves are strong enough to make the slow journey east into Yellowstone, to soon join other buffalo families in the reunions we call the rut. Just a small number of buffalo remain around Horse Butte, and they will likely join the others soon. Impatient and abusive Department of Livestock agents were always so anxious to bully buffalo out of these areas, but we have always known that buffalo know best where to roam and when it is time to move on (Seay, 2016).

Why not open up Gardiner Basin for wild bison also? Migration helps to assure the survival of species. In Yellowstone, elk, mule deer, pronghorns, moose and bighorn sheep are allowed to migrate. The disallowance of migration for wild bison has no scientific justification and will lead to extinction for that subspecies. In a “90-Day Finding on a Petition to List the Yellowstone National Park Bison Herd as Endangered” made in 2007 in response to my original petition in 1999 to list the wild bison herd, the FWS stated:

> The petitioner’s assertion that hazing and killing of bison outside the Park will affect the “quasi-migratory” behavior of the herd, and will result in a restriction of the range is not supported by information available in our files. Bison in YNP attempt to compensate for declining per capita food resources by range expansion . . . In other words, bison move out of the Park in the winter in search of food, and this pattern has continued since implementation of the Joint Bison Management Plan . . . in 2000 . . . Therefore, the available information indicates that control actions have not affected the “quasi-migratory” ranging behavior of the YNP herd.

Since the beginning of the IBMP in 2000, wild bison have not been permitted to migrate out of the park, their movements controlled by hazing and lethal control. Stating that the IBMP’s present practice of killing thousands as they attempt to migrate across the park's border is not a restriction of the range is empirically a false claim. Stating that no harm is being done to the migratory behavior of wild bison by the control actions of the IBMP to date because bison are still attempting to migrate leads to only one possible proof that the FWS's position is wrong: the future cessation of migration by wild bison, the very eventuality that this petition is trying to prevent.

In a letter to this Petitioner concerning my query as to why my second petition submitted in 2015 was rejected, the Fish and Wildlife Service stated that, among other things, my examples of the harm done by hindering migration in other species were "inappropriate surrogate comparisons that this will happen in Yellowstone bison." Once again it appears that the only proof acceptable to the FWS would be this: what actually happens to the migratory behavior of wild bison subjected to a harmful effect, such as by the IBMP's lethal removals. To demonstrate that, migration would have to cease in wild bison. With the extinction of that trait, wild bison cease to exist genetically. With that trait gone, the net result is either gnomic extinction of the migratory herd due to lethal removals or extinction of both the migratory and non-migratory herd (due to that herd's inability to adapt to seasonal climate change), resulting in the wild bison population's complete collapse. Given the parameters of the FWS evaluators, only extinction will be accepted as proof that they are wrong, defeating the very mission of the Endangered Species Act.

New information has been provided in this petition that will show among other things that the risk of extinction for wild bison is increased by the large-scale culling activities now practiced by the IBMP. This claim is supported by a recent simulation model by Stephen P. Ellner, Department of Ecology and Evolutionary Biology, Cornell University (see chapter 26 in this petition titled "Keeping out of the emergency room"). Just because bison are now attempting to migrate does not mean that if culling large numbers continues, wild bison migration will continue. The purpose of protecting wild bison is to make sure the species continues as a wild species into the future and that this is done in a timely manner before it is too late. By not listing wild bison, the Fish and Wildlife Service is allowing the IBMP to play a version of Russian roulette with the genes of wild bison as the target.

1

The greatest threat: Human interference

The single largest threat to the conservation of the bison species is human interference, according to the findings of Natalie D. Halbert and James N. Derr, writing in "Patterns of genetic variation in US federal bison herds," citing artificial selection, domestication, introgression of domestic cattle DNA into bison, and issues related to disease, such as in Yellowstone National Park:

> Despite the clearly successful demographic recovery of bison, the long-term preservation of bison germplasm and, thus, conservation of the species, remain threatened. First, fewer than 5% of bison are maintained in conservation herds (Boyd 2003); the remaining 95% exists in private herds subjected to various levels of artificial selection (primarily used for meat production). Second, introgression of domestic cattle DNA into both the mitochondrial (Polziehn *et al*. 1995; Ward *et al*. 1999) and nuclear (Halbert *et al*. 2005; Halbert & Derr 2007) genomes of many bison herds has greatly complicated species conservation efforts. Additionally, infectious diseases prohibit the transfer of bison out of the two oldest and largest free-ranging herds in North America—brucellosis in Yellowstone National Park and both brucellosis and tuberculosis in Wood Buffalo National Park (Boyd 2003). Therefore, the protection of the native bison genome from selection, domestication, introgression, and disease is paramount to the conservation of this species. Human interference has led to similar threats in other wildlife species worldwide, such as the preferential poaching of male saiga antelopes and consequent reproductive collapse in Russia (Milner-Gulland *et al*. 2003), the rapid domestication of wild banteng in southeast Asia (Bradshaw *et al*. 2005), hybridization between domestic dogs and the endangered Ethiopian wolf (Gottelli *et al*. 1994), and canine

distempter in the black-footed ferret in the USA (Primack 1993). The main source of bison germ plasm exists in a handful of publicly managed Canadian and US federal herds, from which the majority of extant bison are derived (Soper 1941; Coder 1975) (Halbert, 2008).

The IBMP is practicing selective breeding at the borders of the park by killing only migratory bison. Dead animals with valuable genetics cannot reproduce or pass on protective genetic traits. However, conservation of this germ plasm has been denied by the Fish and Wildlife's repetitive rejection of petition after petition requesting that Yellowstone's wild bison be listed as endangered or threatened. While finding that these particular bison inhabiting Yellowstone are indeed an important subspecies, a distinct population segment and a discrete population segment, the FWS found them not in need of protection because these wild bison were sufficiently abundant and were still migrating, despite often intense culling practices.

While this may indeed be true, that is, that bison numbers in the park are increasing after years of large-scale lethal removals by the IBMP, the FWS is whistling in the dark.

Its whistling is in tune with the propaganda by the National Park Service, which stated in 2015:

> At the current population level, there could be a mass migration of many hundreds of bison out of the park this winter if there is deep snow pack at higher elevations. Also, without harvests or culls, we predict the population will increase to nearly 6,000 bison by the end of winter in 2016 (Frequently Asked Questions: Bison Management, 2016).

That fear-mongering concerning migration into Montana is deceptive has been amply shown in this petition. However, the prediction that the population will increase is substantially correct, since the bison population was estimated August 17, 2016 near 5,500, an 11 percent increase since summer 2015 (Geremia, 2016). And this increase is in spite of culling (or possibly due to it).

The reason the FWS is whistling in the dark is that it truly is in the dark about why the herd is increasing and what factors, such as genetic traits, are increasing or decreasing. Nor does any other agency have the answers. It could be for a number of reasons:

- If experience with wolf breeding applies, below 25 percent mortality, lethal control may increase breeding pairs and numbers of animals through social disruption and compensatory, density dependent effects (Wielgus, 2014).

- By getting rid of the migratory animals through culling, it may create less competition on the range inside the park, leading to greater fecundity of those left behind.

- By getting rid of the migratory, it may be selecting for removal the more aggressive, altering the breeding behavior, providing increased access to females by other bulls.

- By culling those bison that test positive for brucellosis, both reactors and immune animals may be eliminated, temporarily making a proportionally healthier herd, and thus a more fecund one, but also eliminating those animals with protective immunity, gradually biasing the herd to a less disease-resistant status.

Whatever the mechanisms contributing to this increasing population, one thing is for sure: what is transpiring at the borders of the park by means of the culling actions of the IBMP is not natural selection. It is, instead, artificial selection.

What is being systematically left behind to breed is the non-migratory and potentially the less able to disperse and the less aggressive, in sum, the less fit in terms of genetic traits, immunity, leadership behavior, age and disease status (those too weak to travel due to brucellosis and mitochondrial disease). Wild bison herds are being stagnated.

But, according to the Fish and Wildlife Service, traits do not matter, behavior does not matter, only numbers matter—and all is supposedly well with Yellowstone's bison because those numbers are increasing.

However, the FWS is forgetting one vitally important possibility—what might happen without their intervention. Guarding against what might happen is the essence of its mission, for extinction is an irreversible event. Come a very bad winter, those that have been left behind will be the less able to survive, and those that would have survived are now dead in the slaughtering houses. By its numbers-only view of what counts for defining species, the Fish and Wildlife Service in its denial of protection based on that view has cancelled Mother Nature's insurance policy for wild bison. That insurance policy is its ability to exercise its migratory behavior and occupy a safe haven, the Gardiner Basin. Instead of an insurance policy, Yellowstone's bison get a death certificate when attempting to escape to survive, turning Mother Nature against herself.

Deleterious genetic effect

Selection involving large-scale lethal removal of bison from the breeding population due to such factors as animal movement (migration), time of movement (winter), place of dispersal (Gardiner Basin), disease status (brucellosis) and maximum size of the herd (3,000) is artificial selection. Such selection has the potential of a deleterious genetic effect. Bison are subject to management not only at Yellowstone but, as Dale F. Lott noted in *American bison: A natural history*, on other public bison ranges as well, not to mention in private herds, where selection is for such traits as rump size for the best meat cuts.

Public bison ranges are often more like cattle ranges than wilderness, introducing an artificial, controlled environment. For instance, according to Lott, the National Bison Range, "like other overgrazed bison refuges, was divided into several parts by fences. The bison are moved around to ensure that each of those parts goes ungrazed for a whole growing season every two or three years."

Through such management techniques "The other public herds also grew; they eventually stabilized or were reduced, as the range required, managed by the same generation of managers with the same goals. With sizeable herds in the public's hands, the short-term future of wild bison seemed assured," Lott said. But what about the long-term genetic effect? he asked.

> But what of the bison's long-term future? In the long run a species adapts by tapping its ultimate resource—its gene pool. The gene pool contains not just the species' reality but also its future possibilities. It limits not just what challenges a species can handle today, but its range of possible adjustment to future changes.
>
> Many genes are in only some individuals. Therefore, the more individuals, the bigger the gene pool. Several million bison would have a very large gene pool, but reduce that population to several hundred and it's become very likely that a lot of genes have fallen by the wayside on the road to extinction . . .
>
> . . . the surviving populations have been divided into even smaller populations in parks and refuges. The size of a species gene pool sets a limit on future adaptation. But very small populations raise another specter: inbreeding. Today's plains bison—Bison bison—mingled with millions of their own kind drifting across a wide and unbroken sea of grass. Suddenly they were reduced to scattered handfuls confined to tiny islands a few miles across that more or less matched their original habitat. It's a scenario sure to chill the blood of a genetically-oriented conservation biologist. Deleterious genes that would have been diluted to near-insignificance in a gene pool contributed to and drawn from by millions could suddenly be concentrated and vigorously expressed in a gene pool drawn from fewer than a dozen animals.
>
> From widely outbred to severely inbred in one or two generations—the worst possible case of the infamous genetic bottleneck. It all adds up to a gloomy forecast for the American bison . . .
>
> Given that at present only Yellowstone Park has a significantly larger population, an acceptably effective breeding population can be achieved only by relocating females from herd to herd, thus managing the several federal herds as a single meta-population . . .

Perhaps someday we'll create at least one more island large enough to accommodate a population large enough to be viable over the long term (Lott, 2002, pp. 192-194).

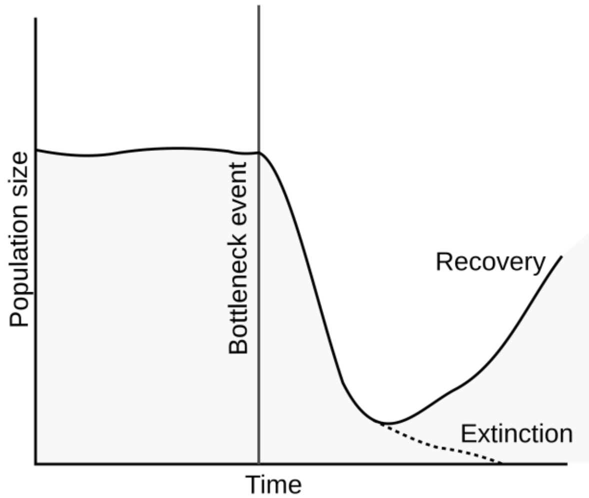


Figure 6. POPULATION BOTTLENECK (or genetic bottleneck) followed by recovery or extinction. As the population plummets, unique genes important for survival may be lost and are not recoverable (Population bottleneck, 2016).

But is Yellowstone National Park really that island? It could be, but at present it is not. In fact, just the opposite is happening. The YNP is becoming an island of extinction. What is happening at the borders of Yellowstone National Park is domestication of wild buffalo, for what is being selected out is their wildness. We are treating them like cattle. Those that stay behind the imaginary fence of the park boundary are allowed to live. Those that stray beyond in search of forage are shot, shipped to slaughter or hazed back into the park by helicopters and cowboys and trucks, or relocated into holding pens on the grounds of the park and fed hay just like cattle. This is wilderness?

The cattle of today came from the wild aurochs. It was a massively powerful creature standing almost six to seven feet at its shoulder, slightly smaller than an elephant, fierce and capable of great speed. But where is that species today? Captured and put behind fences, they were selectively bred for prime cuts and tame behavior—and in doing so, bred into extinction. And the few wild aurochs left were hunted to extinction. All we have now are some bones and cave paintings. The last recorded auroch, a female, died in 1627 in the Jaktorów Forest, Poland. Her skull is now exhibited at the Royal Armory (Livrustkammaren) Museum in Stockholm, Sweden (Aurochs, 2011).

Lott noted:

> Cattle look a good deal like the wild aurochs, but even though we have no direct information about aurochs' behaviour, we can be sure it was radically

> different. Wildness, competitiveness, and self-protectiveness are vital to an animal living on its own, but they're a big nuisance to a rancher.

Over 90 percent of the bison in the United States are being domesticated, that is, being bred for such qualities as meat production. The other bison are in conservation herds, but they, too are either behind fences or have their range restricted. As Lott pointed out:

> So, the needs of the rancher and the nature of wild bison clash head on. The rancher's goal has to be to take the wild out of the bison he or she is domesticating. The conservationist's goal has to be to preserve the wild in the remaining wildness . . .
>
> A better bison, from a stockman's point of view, would be less feisty and less restless.

According to Lott, the great enemy of wildness is selective breeding:

> Sometimes when I talk about wild bison someone points out that all of today's plains bison descend from animals that spent at least some time enclosed in a fence. Therefore, some argue, all of today's bison are domestic and there are no wild bison to preserve. That claim reflects a misunderstanding of what domestication is. It's not being confined—if it were, every animal in most zoos would be domesticated. They're not. Even those that take food from our hands are tamed—habituated to humans—not domesticated. The essence of domestication is selective breeding: humans deciding which individuals will produce the next generation, and choosing them to produce a next generation that will better serve human goals (Lott, 2002, p. 197-200).

One of the traits not wanted by the Montana Department of Livestock is the wild bison's migratory behavior. The wild herd crossing Yellowstone National Park's border is deemed a nuisance and the rationale for lethal control.

Ecological disruption of Yellowstone bison

After passing through a bottleneck event and after beginning to recover, the behavior of Yellowstone's bison has strangely, and for unknown reasons, changed. As noted, bison have experienced profound perturbations in Yellowstone National Park, going back to their first contact with European settlers, who reduced the herd size from millions to about 25 animals by market hunting and poaching around the turn of the twentieth century. Specifically, a count in 1909 indicated that only 23 bison remained in the park. All of these animals were located in Pelican Valley, which became the core herd of the park. With the establishment of the park and the Lacey Act, aimed at curtailment of poachers, herds rebounded in number, sometimes reaching a total of several thousand animals. A pattern of land use by bison that mimicked the use noted in the first recorded observations began to become apparent.

But that began to change in 1980, especially regarding the core Pelican Valley herd. It began to migrate to different regions of the park, forcing other herds to adopt different migration patterns, creating a chain reaction. Mary Meagher at al in “Recent Changes in Population Distribution: The Pelican Bison and the Domino Effect” noted:

> Bison apparently have wintered for centuries in the Pelican Valley area of Yellowstone National Park. Compared with the other locations where bison winter in the park, Pelican Valley routinely experiences the most severe conditions. Nevertheless, a population has survived there because of the presence of geothermally influenced sites. Until 1980, these bison were isolated in winter by deep snows. Both winter and summer range use showed broadly consistent and predictable patterns, as did seasonal movements between range use areas. In the early 1980s, gradual but escalating changes in the bison population became apparent. Annual winter use of foraging areas by the Pelican bison expanded west from traditionally used, geothermally influenced places near the shore of Yellowstone Lake to sedge areas near the mouth of Pelican Creek, Lake area, and on to Hayden Valley. Because Hayden Valley (part of the Mary Mountain unit) was occupied already by wintering bison, as more shifted from Pelican Valley, more bison moved into the Firehole. They also moved earlier. The process of winter range expansion was coupled with a population increase, and more bison moved further west to Madison Junction and beyond, to spill over the park’s west boundary into Montana (Meagher, 2002).

Domino effect

As population increased, the herd began to spill over into new areas, such as Hayden Valley and Madison Junction. This change in the herd’s traditional seasonal movement has been called the “domino effect.” Meagher noted:

> We term this cascading pattern of population increase *the domino effect.* Concomitantly with the winter westward shift, summer distributions also changed dramatically. The Pelican bison no longer crossed the Mirror Plateau to reach subalpine areas in the upper Lamar country in early summer. Instead, increasing numbers of bison concentrated in Hayden Valley during the breeding season. Some then moved back to the Pelican area before winter set in. With an increased bison population park-wide, numbers also spread across the Lamar Valley in midsummer, and appeared in meadows west and north of Madison Junction where summer use was not recorded previously. Over roughly 20 years, an apparent ecosystem change has occurred involving the bison of the interior of Yellowstone National Park.

What was the push that triggered this cascade of population dispersal and increase? Meagher theorized it might be winter grooming of the park's trails, noting that in recent decades, recreational use by people of the park's interior road system in winter resulted in compacted snow surfaces that, in certain locations and times, provided readymade travel linkages between locations that bison preferred (Meagher, 2002).

This idea was taken up by a team consisting of Montana State University researchers M.L. Taper, C.L. Jerde, and Meagher. They speculated that one of the reasons for the movement is quite simple: bison like to stay together. Initially, some larger herd units will fragment and scatter when facing a threat, but when allowed to roam freely, will clump together as a family unit. Finding groomed roads easy to travel, they theorized that the clans headed off together on these roads. In "The Phenology of Space: Spatial Aspects of Bison Density Dependence in Yellowstone National Park" they wrote:

> It is apparent that bison could survive by breaking social bonds and scattering into small sites where a few animals could survive. However, the gregariousness of bison is the stuff of legend—the huge aggregations reported for the Great Plains (Roe 1970). Over time, it has become apparent that when bison are free-ranging and can move, they will move to stay together and maintain their social bonds, rather than scatter. This factor is fundamental to the ease with which bison began to use sections of road. When bison did this in the Pelican area, more of the population survived, and more bison moved to Hayden Valley. But, Hayden Valley was occupied, so more bison moved west, and developed habitual usage of road section usage, foraging sites, and attractive destinations. The population increased greatly, and shifted westward (Taper et al, 2000).

However, the groomed road theory did not hold up. After making over 28,000 observations of individual bison during the winter and spring months of 1997 to 1999 in the Madison-Gibbon-Firehole (MGF) area, researchers at Montana State University found that "grooming roads during winter does not have a major influence on bison ecology." Writing in the *Journal of Wildlife Management* (2001), D.D. Bjornlie and R.A. Garrott noted in "Effects of winter road grooming on bison in Yellowstone National Park" that:

> Most travel took place off roads ($P<0.001$). Bison utilized geothermal features, a network of trails they established, and river and stream banks for travel. Bison road use was negatively correlated with road grooming, with peak use in April and lowest use during the road-grooming period. Bison in the MGF [Madison-Gibbon-Firehole] area of YNP neither seek out nor avoid groomed roads. The minimal use of roads compared to off-road areas, the short distances travelled on the roads, the decreased use of roads during the over-

snow vehicle (OSV) season, and the increased costs of negative interactions with OSVs suggest that grooming roads during winter does not have a major influence on bison ecology (Bjornlie at al, 2001).

A similar finding was reported by Montana State University researchers, Department of Ecology, in *Ecological Applications*, August 2006, based on data collected during the winters from 1997 to 2005 on bison road use. A team led by JE Bruggeman wrote in "Temporal variability in winter travel patterns of Yellowstone bison: the effects of road grooming":

> Road travel was negatively correlated with road grooming, and we found no evidence that bison preferentially used groomed roads during winter. Snow water equivalent, bison density, and the springtime melt period were positively correlated with both bison road and off-road travel…
>
> We suggest that the changes in bison spatial dynamics during the past three decades have likely been the result of the natural phenomenon of density-dependent range expansion, rather than having been caused by the anthropogenic influence of road grooming.

The researchers concluded:

> To summarize this section, bison numbers and distributions have shifted westward overall. This is especially striking in the central herd. When the Pelican bison began to move westward, they had a "domino" effect. Hayden Valley was already occupied by the numbers of bison that were "comfortable" at a given time. When more bison arrived, this bumped the system up, and for bison, the solution was to move westward to the Firehole, which was the traditional shift as winter progressed. In turn, these increased numbers on the Firehole led to the shift westward and northward from Madison Junction. But, more bison survived within the park, so the whole process developed a positive feedback leading to the recorded high count of 4,114 in 1994 (Bruggeman et al, 2006).

What a number of researchers point out is the gregarious nature of bison and the instinct to stay together. Meagher stated in her study:

> Key to this is the long-observed determination of bison to maintain group social bonds if at all possible. Although they can survive by breaking social bonds and scattering into geothermal sites, if presented with a choice they will move preferentially to maintain a higher level of aggregation. They will also shift toward less harsh winter conditions, as is usual with ungulates in mountain habitat. Over time, as this has occurred, many more bison have exited the park in an apparent effort to maintain social aggregations that the

within-park habitat would not permit. In so doing, they have come into conflict with different land-use objectives outside the park. Although attempts have been made to force them back into the park, this has been a short-term solution at best, and most have been removed from the population under state legal authority. This situation can be expected to continue (Meagher, 2003).

It is unmistakable that some unusual force is operating within the park. It could be the echo of forces operating on the borders of the park, that is, the ongoing lethal removals of whole bison clans. Among gregarious animals this has to have an effect one way or the other, especially with regard to social trauma. Smaller herds may be joining large herds for protection, creating greater breeding opportunities. Over 9,000 have been killed since 1985, occasionally in large-scale slaughters of over 1,000 animals. Where the herd instinct is implanted evolutionarily for survival, having large numbers of the herd not coming back has to have significant repercussions among those surviving back in the park.

Greatest influence on bison: park management

Historically, bison have experienced increased mortality rates within the park during severe winters and due to culling practices by park personnel. Population increases and attempted range expansion by bison has proven fatal to the Yellowstone herd. Park managers periodically culled the central herd during 1954 to 1968 to limit bison numbers within the park (Meagher, 1973). A major reason for the herd reductions was an attempt to control brucellosis among these wild ungulates.

Years prior to the establishment of the IBMP, the National Park Service, in cooperation with the Department of Agriculture, began a brucellosis control program consisting of vaccination of calves and removal of "reactors during reductions," that is, shipping bison off for slaughter or shooting those that tested positive for brucellosis.

"This cooperation resulted in reductions of animal numbers below the park's management objective at Lamar in 1964-65," Meagher noted (Meagher, 1973, p. 71). Herd numbers fell from 1,477 in 1954 to a low of 226 in 1966, an 85 percent reduction. This practice of reductions within the park was discontinued in 1968.

However, as herd numbers began to climb again, park managers again initiated lethal control of bison that moved outside the park to prevent entry by bison into territory where cattle grazed, such as near Gardiner, Montana. According to serological standards for cattle, the prevalence of brucellosis in the Yellowstone bison has been approximately 40 percent, but correlation with culture results was approximately 25 percent (Meyer & Meagher 1995). According to these data the true prevalence would be closer to 10 percent. Effects of brucellosis on the bison population appear to be minimal (Meagher, 1973; Meagher and Meyer, 1994).

Herd size has fluctuated, going from 25 animals in the late 1800s to an actual count of 44 in 1902, 501 in 1920, 1192 in 1931, 747 in 1944, 1477 in 1954, 975 in

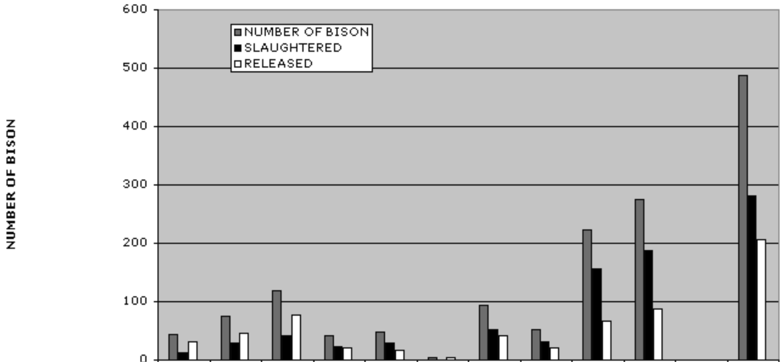
1962, 388 in 1965, 226 in 1966 and 418 in 1968 (Meagher, 1973). In 1988, there were approximately 2,800 bison in Yellowstone. In the winter of 1988-89, 569 bison were killed. As noted, during the harsh winter of 1996-97, 1,084 bison were subjected to lethal control. In addition to the buffalo that were shot by the government or shipped to slaughter that winter, many starved to death, putting the death toll at more than 1,300.

In 2000, the herd population was down to about 3,000 bison, due in large part to actions by National Park Service and the State of Montana to control the bison when they roamed outside the park and due to winterkill inside the park. For several years following the plan, culling removed several hundred bison each year. However, culling numbers began to mount as bison attempted to migrate out of the park to escape harsh winter conditions. During the severe winter of 2005-06, 1,106 bison were killed. In 2006 there were 5,000 bison. That winter, 1,016 were killed. In 2007-08, the largest number of buffalo since the great extermination of 1872 to 1874 were killed by government agents stationed at the borders—a total of 1,631. From 1985 to February 19, 2015, a total of 8,528 wild bison native to Yellowstone National Park have been lethally removed (How many buffalo have been slaughtered?, 2015).

Table 1. Bison killed at Yellowstone National Park: 1985 to 2015

Winter	**Number**	**Winter**	**Number**	**Winter**	**Number**
2014-15	**739**	2004-05	**101**	1994-95	**427**
2013-14	**653**	2003-04	**281**	1993-94	**5**
2012-13	**254**	2002-03	**246**	1992-93	**79**
2011-12	**33**	2001-02	**202**	1991-92	**271**
2010-11	**230**	2000-01	**6**	1990-91	**14**
2009-10	**7**	1999-2000	**0**	1989-90	**4**
2008-09	**22**	1998-99	**94**	1988-89	**569**
2007-08	**1631**	1997-98	**11**	1987-88	**35**
2006-07	**67**	1996-97	**1084**	1986-87	**6**
2005-06	**1016**	1995-96	**433**	1985-86	**57**
				Total	**8,577**

With regard to the number captured and killed according to age and sex, the following graph for 11/03 to 7/04 is representative. As one can see in the example below, a disproportionate number of calves and females are slaughtered. The culling for the winter of 2015 that officially commenced January 15 has been described by the NPS as being the lethal removal of bison "without regard for sex, age or disease status." However, culling historically has resulted in disproportionate outcomes.



	CALF M	CALF F	CALF TOTAL	YRLNG M	YRLNG F	YRLNG NO SEX DATA	YRLNG TOTAL	ADULT M	ADULT F	ADULT TOTAL		TOTAL BISON
NUMBER OF BISON	44	75	119	42	47	5	94	52	223	275		488
SLAUGHTERED	12	30	42	22	30	0	52	31	156	187		281
RELEASED	32	45	77	20	17	5	42	21	67	88		207

AGE AND SEX

Figure 7. CAPTURED AND KILLED BISON by age and sex from 11/2003 to 7/2004. ***Courtesy of Buffalo Field Campaign.***

As mentioned, the interagency plan established killing fields, divided into three zones, at the northern and western exits of the park for bison moving outside the park. In addition, it set a cap on the number of bison allowed within the park, stating that "if the late-winter/early-spring bison population is above the 3,000 target, specific management actions may be undertaken at the Stephens Creek capture facility or outside the park in the western boundary area to reduce its size." Management action included hazing them back into the park or slaughtering. A few bison were allowed to roam in certain zones outside the park, but had to be back in the park by May 1 (Gardiner Basin) or May 15 (Hebgen Basin) or be subject to hazing or lethal removal (Lancaster, 2005 p. 439, 400).

Exploitative selection

Killing animals that exhibit certain characteristics or behaviors is called "exploitative selection." It has been defined as selection as a result of human harvest analogous to Darwin's use of the term "artificial selection" for the intentional breeding of certain traits, or combinations of traits, over others in domestic animals and plants.

Fred W. Allendorf, regents professor of biology at the University of Montana and professorial research fellow at Victoria University of Wellington, New Zealand, in collaboration with other researchers, studied the outcome of exploitative selection in "Genetic effects of harvest on wild animal populations." (Allendorf is the author of a genetics text that Wallen suggested Davis reference in his 2007 finding regarding various points made in my original 1999 petition). Allendorf noted:

> Virtually all species have separate local breeding groups (subpopulations) that are somewhat reproductively isolated. Harvest of wild populations can perturb genetic subdivision among populations within a species and reduce overall productivity. The primary problem is that harvesting a group of individuals that is a mixture of several subpopulations can result in the extirpation of one or more subpopulations. This will not be recognized unless the subpopulations are identified separately and individuals from population mixtures are assigned to subpopulations.

Subpopulations of bison, namely migratory bison, are removed in large numbers annually from the park. This can reduce genetic variation, fitness and the ability to adapt.

The reasons that subpopulations are important is that they may include a proportion of animals that are more genetically varied for the same trait or phenotype, such as coat color, eye color, behaviors (migratory or non-migratory), etc, and thus have the potential of being more adaptive to changes in the environment. Genes for the same trait come in pairs called alleles. Pairs that have different alleles linked together—say an allele for blue eye color linked with an allele for brown eye color—are called heterozygous, while pairs that have the same alleles linked together, say an allele for blue eye color linked with an allele for blue eye color, are called homozygous. Prior to fertilization, the gene pairs first split to produce each parent's sex cells (sperm or egg), then are recombined upon mating. In the throw of the genetic dice that occurs in mating, heterozygous animals are more capable of producing genetically varied offspring—and potentially more fit—than homozygous ones simply because there are more allelic combinations. Allendorf explains how this relates to population size:

> Reduced population size due to harvesting can also reduce the number of migrants and cause the loss of genetic variation within subpopulations. Genetic variation is measured in two primary ways: heterozygosity and allelic diversity. Loss of genetic variation can reduce productivity of exploited populations both by reducing individual fitness in the short term (primarily affected by heterozygosity) and by reducing the ability of subpopulations to evolve in the future (primarily affected by loss of allelic diversity).

This can cascade into a further decline of fitness. According to Allendorf:

> Exploitation can also increase gene flow or hybridization among subpopulations and potentially swamp local adaptations. Overexploitation could reduce the density of local subpopulations and allow for more immigration from nearby subpopulations less affected by exploitation. This could bring about the genetic swamping of the remnants of exploited subpopulations and thereby reduce fitness.

A phenotype is any observable characteristic or trait of an organism, such as its morphology, development, biochemical or physiological properties, behavior and products of behavior (like a bird's nest). Phenotypes result from the expression of an organism's genes as well as the influence of environmental factors and the interactions between the two. The researchers noted that a population's genetics should be monitored in order to devise recovery programs that would minimize phenotypic changes detrimental to survival. Allendorf noted:

> There is ample evidence that exploitative selection is at least partially responsible for phenotypic changes over time observed in exploited populations. However, determining the role such changes have played in the decline in harvested populations is much more difficult. This issue is analogous to the controversy in conservation biology about the causal role of genetics in extinction. Extinction, or population decline, is always the result of a variety of interacting biological and environmental factors. Attempts to identify a single cause (e.g. loss of genetic variation or genetic change brought about by exploitative selection) in the decline of wild populations are doomed to fail. A more prudent course is to assume that harvest will result in exploitative selection, develop management and recovery programs that will minimize potential harmful effects of genetic changes due to harvest and then to monitor for molecular genetic changes as well as key life-history traits (Allendorf, 2008).

Phenotypic plasticity is the ability to change a phenotype in response to a change in the environment. This can be critical for survival. Migration is a phenotype. Aggressive behavior is a phenotype. When by artificial or exploitative selection, as opposed to natural selection, one kills bison that are genetically programmed to migrate and that have the sufficiently aggressive behavior to seek out better winter habitat, then there is the potential to select out the very traits necessary for survival in the wild, namely, the ability to change habitat under stress.

Could the governmental culling programs be doing this by exploiting the migratory herd, reducing that subgroup's population?

Older experienced females are often the leaders (Meagher, 1989). It is these bison that lead other members of their herd to forage areas outside the park, primarily the Gardiner Basin. When they are culled at the border, their knowledge is destroyed and thus this migratory instinct, coupled with learned behavior, is selected out and abolished from the gene pool.

Ken Cole, writing for *The Wildlife News*, made the following observation in "Greater Yellowstone Bison show signs of inbreeding: Government slaughter could irreparably harm bison species":

> In recent years, while conducting repeated culling—where greater than half of the Yellowstone herd could be killed either by slaughter or winter kill—

> government managers never studied how their actions affected the genetics of the bison. For example, prior to the winter of 2007/2008 the population was estimated to be 5,500. That winter 1,631 buffalo were killed by the government and hunting but an additional 1,500 died from starvation due to the harsh winter that they were unable to escape because their habitat has been so curtailed by the policy of Montana and its greedy livestock industry. This left only 2,300 bison, or less than half of the bison herd, the following spring and possibly irreparably harmed the remaining genetic diversity of the herd.

A prime reason for the potential for irreparable genetic harm is that the culling process developed by the government does not take into account the genetic composition of the various herds. Removal is based only on one initiating factor: migration.

Genetics not known of bison lethally removed

Scientists do not know what members of what herds are being killed by park removals at the borders, according to a study published in the *Journal of Wildlife Management* and funded by the National Park Service and National Science Foundation, involving investigators Julie A. Fuller and Robert A. Garrott, both from the Department of Ecology, Montana State University, and P. J. White, supervisory wildlife biologist, Yellowstone National Park. It appears scientists are not even sure in what direction the bison "dominos" are falling. They speculate that:

> Density-related emigration from the central herd to the northern range may be fueling bison emigration onto private and public lands where large-scale removals occur, exacerbating the brucellosis controversy for natural resource managers.

However, they point out that "removals at the northwestern boundary can no longer be reliably assigned to the northern herd. Long-term studies of marked animals from both herds should be initiated to elucidate the extent and factors influencing these movements" (Fuller et al, 2007).

Park managers therefore do not know what genetic traits they are increasing or decreasing—including genetic strengths and genetic weaknesses—by these bison removals. Playing with bison genetics like dice, park managers under the interagency leadership are running a crapshoot. It is a gamble that responsible wildlife managers cannot afford to take.

Herd management requires knowledge of the genetic composition of each herd. Differences in genetic makeup are assessed by means of DNA analysis. One way to do this is through obtaining blood samples. However, the traditional invasive methods of obtaining blood or tissue samples by capturing free-ranging bison are difficult, costly and dangerous for both the bison and research personnel.

For bison, traditional sampling entails a high risk of physiological stress and potential mortality associated with immobilizing agents.

There is a non-invasive way, however. Lott, who grew up on the National Bison Range and spent most of his adult life studying bison behavior and ecology, in *American Bison: A Natural History*, suggested a novel method of studying a herd's genetic identity—buffalo chip analysis. He touted in chapter five, "Digestion: Grass to Gas and Chips," the usefulness of fecal studies in wildlife, and for bison in particular:

> In their passage chips also pick up bison cells that contain the individual's complete genome. It is possible that they could reveal not only the individual's identity but perhaps the identity of its parents as well. So science will just keep chipping away at the secrets in the belly of the beast . . . but few other ways are as humane and efficient as chip analysis. No need to subdue the buffalo with a tranquilizing dart—and no worries that hormone levels in the blood sample reflect short-term peaks or bottoms caused by the trauma of the sampling. Little wonder, then, that when the chips are down, the biologist's spirits are up. The investigator that at first seems a figure of fun, a dedicated pooperscooper, is really the very model of a modern-day mammalogist (pp. 52-52).

"Dale was right!" wrote Florence Marie Gardipee in her thesis "Development of fecal DNA sampling methods to assess genetic population structure of Greater Yellowstone bison." She noted:

> The non-invasive fecal DNA sampling protocols I have developed for population genetic studies of free-ranging bison, has just begun to reveal "the secrets in the belly of the beast." I have become the dedicated "pooper-scooper," and hope to continue the use of non-invasive fecal sampling to learn as much as I can about the wild bison of Greater Yellowstone. And, who knows how much we will continue to learn about these amazing animals through just sampling of their feces? Hopefully, we will gain the information and insights we need in order to conserve them for future generations (Gardipee, 2007, p. ix).

Such a study is necessary, she explained, because "the loss of genetic diversity due to multiple bottlenecks, founder effects, hybridization, and domestication pose the risk of genomic extinction, and reduced evolutionary potential." Genomic extinction is what happened to aurochs.

Gardipee analyzed 179 fecal samples collected over two consecutive seasons to evaluate population structure among Yellowstone National Park bison breeding groups and between Grand Teton National Park and YNP bison populations. She noted:

> I found significant genetic distinction between YNP and GTNP bison populations," she said. "The differences in haplotype frequencies between Hayden Valley and Lamar Valley breeding groups were highly significant ($FST = 0.367$, $p < 0.001$), and nearly two times greater than between GTNP and YNP thus providing evidence for at least two genetically distinct breeding groups within YNP (Gardipee, 2007).

Factor of mitochondrial disease

The government's naive and genetically-uninformed lethal control program has implications for the herds' survival. Thomas Pringle, a biochemist on the genomic team for the University of California at Santa Cruz where he annotated dozens of mammalian genomes, said a hereditary weakness in the various bison herds could be amplified by the culling program.

In a study posted Feb. 7, 2011 in *Nature Precedings,* Pringle found that many Yellowstone bison whose DNA was tested carried a genetic mutation that affects cellular metabolism. Called mitochondrial disease, which affects the powerhouse units of cells, the defect makes bison lethargic, rendering them less capable of foraging in deep snow, fending off predators and competing for mates. In his paper, Pringle noted that:

> Recovery of a species from a severe bottleneck requires consideration of both nuclear and mitochondrial genomics because inbred reduced populations may have lost much of their former genetic diversity and harbor unnaturally high frequencies of deleterious alleles. Inbreeding depression in Florida panthers, collapse of the pygmy rabbit captive breeding program, facial tumors in Tasmanian devil and required rescue of the Texas State Bison Herd have put such concerns on center stage.

Pringle, whose work on other genomes has appeared in professional journals such as *Science* and *Nature*, said his bison research demonstrates that culling of the wild herd based on brucellosis, rather than on the health of their genes, may push the species over the edge into a form of extinction.

"They're taking a really high risk of killing bison with healthy genes and getting into a situation where they can't go back; the good DNA will be lost," Pringle said. His paper relies on published genetic data, analyses of bison fossils and samples from herds at national parks like Yellowstone (Zuckerman, 2011). In his paper, Pringle stated:

> Mitochondrial disease is common in humans so it comes as no great surprise to find another species affected by it. The alarming frequency of occurrence in bison can be attributed to the severe bison bottleneck of the nineteenth century followed by decades of inbreeding and suppression of natural selection. Mitochondrial disease in dog breeds has a similar history.

> Based on the available evidence, the disease haplotype was uncommon in pre-contact bison but widespread today, affecting bison in numerous discrete herds including Yellowstone and Grand Tetons national parks. Ironically, Yellowstone bison are used to found new herds and improve genetics of existing herds.
>
> While symptoms of mitochondrial disease vary somewhat according to the specific mutation, the common denominator is inadequate ATP production from loss of oxidative phosphorylation capacity. Exercise intolerance, lactic acid buildup in blood, and ragged red muscle fiber can be expected in affected bison. While not lethal at birth, these bison may be significantly impaired in escape from predators, winter cold tolerance, brushing snow aside for feeding, combat for breeding opportunities and similar aerobic activities (Pringle, February 7, 2011).

Yellowstone bison are affected to different extents in distinct Yellowstone National Park herds, Pringle noted in a press release Feb. 8, 2011, "Widespread Mitochondrial Disease in North American Bison: Genetics study findings: Implications for saving America's last wild bison." Pringle tested 179 bison in Yellowstone National Park and Grand Teton National Park for mitochondrial disease. The press release stated:

> With the National Park Service estimating 1,000 bison or more migrating through deep snows this winter from the Northern Range of Yellowstone National Park, a high proportion of bison with healthy genetics are likely to be slaughtered.
>
> The northern range subpopulation or breeding group are some of the last remaining bison free of mitochondrial disease based on its geographical distribution. The deleterious mitochondria appears more frequently among bison in the central interior herd.

"Bison mitochondrial disease could also be managed away with retention of nuclear genetic diversity since only the latter is passed on by bulls," Pringle noted. "However, this is not occurring with the present system of quasi-random culls of animals of unknown genetic status." To help obviate this disease, he recommended "genetic testing prior to culls" along with other procedures (Pringle, February 8, 2011).

Based on a genetic disease trait, it appears that the bison herds in Lamar Valley and the Mirror Plateau are dramatically less-affected than the Hayden Valley herd. This means that genetically, the herds are distinct, yet the government's culling program treats them as homogeneous.

Table 2. WILDTYPE MITOCHONDRIAL DNA sequence data for Yellowstone and Grand Tetons National Parks.

Park	Herd	V98A I60N	V98V I60I	%
YNP	Hayden Valley	88	6	6%
YNP	Lamar Valley	19	22	54%
YNP	Mirror Plateau	10	6	38%
GTNP	Antelope Flats	20	0	0%
GTNP	Wolf Creek	8	0	0%

Note: **First and second columns provide herd locations. The third column shows number of bison carrying the disease haplotype; the fourth the numbers of bison with wildtype mitochondrial DNA. The final column shows the percentage of healthy bison varies with geographic location of the herds (which have little observed mixing) (Pringle, February 7, 2011).**

Pringle summed up his findings by noting the following:

North American bison have rebounded from near-extinction in the nineteenth century but from such small inbred founding populations that once-rare deleterious nuclear gene alleles and mitochondrial haplotypes are now at high frequencies. The initial bottleneck was compounded by decades of unnatural selection affecting bison conservation genomics and undercutting restoration initiatives. The genomics era began in late 2010 for bison and sister species yak with the release of 102 whole mitochondrial genomes, displacing earlier control region and microsatellite data not extending to coding regions. This allows detection of both sporadic and sub-clade level mutations in mitochondrially encoded proteins and tRNAs by comparative genomics methods: deleterious mutations in both cytochrome b (V98A) and ATP6 (I60N) occur within a single common bison haplotype. Since similar mutations in human and dog cause clinical impairment of mitochondrial oxidative phosphorylation, these bison are predicted significantly impaired in aerobic capacity, disrupting highly evolved cold tolerance, winter feeding behaviors, escape from predators and competition for breeding. Because Yellowstone National Park bison are subjected to genetically uninformed culls and surplus animals used to seed new conservation herds, mutational status has significant implications. Continuing take of the remaining bison with wildtype mitochondria may recapitulate errors of nineteenth century bison stewardship bringing bison conservation to the point of no return (Pringle, March 7, 2011).

Yellowstone biologist Rick Wallen concurs in part with Pringle. He states in "Summary of recent publications and monitoring of Yellowstone bison genetics (Pringle 2011, Pérez-Figueroa et al. 2012, Halbert et al. 2012) and NPS response Wallen et al. draft manuscript," that:

> Pringle's reference to the double mutation in haplotype 6 bison is a fact to consider. Our work with UM shows that there are more bison in the central herd that exhibit the haplotype 6 genotype.

But Wallen takes issue with Pringle's conclusion:

> Pringle's conclusion that oxidative phosphorylation functions are impaired in haplotype 6 bison and thus they are less likely to survive hard winters and the effects of predation are not substantiated.

The reason Pringle's conclusion is not substantiated, according to Wallen, is because:

> Genetic mutation does not automatically equal genetic disease. If the mutations were as deleterious as claimed, they would have been eliminated by natural selection (Wallen, 2015).

However, Pringle notes, the whole point is that natural selection has *not* been able to operate:

> In the case of bison, natural selection has not been fully operative on deleterious alleles for decades, having been largely displaced by predator control, genetically uninformed culls, trophy bull hunts, winter hay feeding, and selection for docility. Recovery of large herds of animals outwardly resembling bison serves no authentic conservation purpose if these bison are hobbled by inherited disease and no longer function as they had evolved up to the era of human interference (Pringle, March 7, 2011).

Wallen, continuing his summary of publications on recent Yellowstone bison genetics, comments on the study "Genetic Population Substructure in Bison at Yellowstone National Park," its findings critical of culling practices without regard to the structure of subpopulations. The study published in the *Journal of Heredity* is by Natalie D. Halbert, Jacquelyn M. Wahl, and James N. Derr, Department of Veterinary Pathobiology, Texas A&M University; Peter J. P. Gogan, Northern Rocky Mountain Science Center, US Geological Survey and Philip W. Hedrick, the School of Life Sciences, Arizona State University. The authors state:

> The continued practice of culling bison without regard to possible subpopulation structure has the potentially negative longterm consequences of reducing genetic diversity and permanently changing the genetic constitution within subpopulations and across the Yellowstone metapopulation (Halbert, 2012).

Wallen sums up the study with this statement:

> Hypothesis: level of divergence is expected to continue to increase in the future.
>
> Conclusion: The identification of genetic subpopulations in this study raises serious concerns for the management and long-term conservation of Yellowstone bison. The continued practice of culling bison without regard to possible subpopulation structure has the potentially negative long-term consequences of reducing genetic diversity and permanently changing the genetic constitution within subpopulations and across the Yellowstone metapopulation.

After giving these summaries, Wallen comes up with his own conclusion, commenting via a "draft manuscript near submission" titled "Population substructure in Yellowstone bison" authored by himself, with co-authors F. Gardipee, G. Luikart and P.J. White.

> Conclusion: Yellowstone bison can be characterized as a single population with genetically similar, yet distinguishable, breeding groups on the northern and central ranges. Effective emigration among the two breeding groups is occurring.
>
> Recommendations:
>
> - Preserve a near equal sex ratio.
> - Manage for breeding groups of about 1500 bison on the northern and central ranges.
> - Monitor diversity indices every one to two generations.

It should be no surprise to anyone reading this petition that the good ol' boys club of Yellowstone biologists would recommend that the park's wild bison should be "managed," i.e., reduced by culling, for a total bison population of 3,000.

Wallen and the boy's recommendations about the Halbert et al. study amounts to saying, "Forget it. We will continue to disregard subpopulation structures, such as the migratory population, and continue large-scale culling."

While not specifically identified, Wallen's summary document is from the library of the IBMP. So many of the scientific studies are orchestrated by persons affiliated with the IBMP and its member agencies in one form or another. They make high-sounding claims of wanting to preserve the genetic wild diversity of Yellowstone's bison population, yet at the very moment they are making these claims, they are in the process of violating them. And they are very skillful at doing so and have deluded the public effectively for years.

In a way, it is a form of what is called in Islamic jurisprudence "kitman" (Arabic for secrecy or concealment). It consists of the art of making ambiguous statements, paying lip-service to authority, while reserving personal opposition as a kind of political or strategic camouflage.

Halbert's study is rebutted in "Yellowstone Bison—Should We Preserve Artificial Population Substructure or Rely on Ecological Processes?" by Patrick J. White and Rick L. Wallen, published August 23, 2012, in the *Journal of Heredity*. It begins by saying:

> Halbert et al. (2012) analyzed microsatellite genotypes collected from 661 Yellowstone bison sampled during winters from 1999 to 2003 and identified 2 genetically distinct subpopulations (central, northern) based on genotypic diversity and allelic distributions. On the basis of these findings, they raised concerns about the management and long-term conservation of Yellowstone bison because of disproportionate culling of the 2 subpopulations in some winters. The data and findings of Halbert et al. (2012) are significant and useful for managers charged with conserving these iconic wildlife. However, their article provides information regarding the behavior and management of Yellowstone bison that does not accurately portray historic or current conditions. This response clarifies those conditions and challenges some of their apparent deductions and recommendations.

White and Wallen explain their position:

> Halbert et al. (2012, p. 9) deduce that ". . . the identification of genetic subpopulations in this study raises serious concerns for the management and long-term conservation of Yellowstone bison" which ". . . have long been treated as a single metapopulation whereby the total number of bison is assumed to be the most important factor in determining appropriate winter cull levels." It is correct that the Interagency Bison Management Plan (USDI and USDA 2000) provides guidelines for managing toward an end-of-winter abundance for the entire population around 3000 bison. However, management plans and monitoring/research to inform and adjust actions, including culling activities, have considered the two breeding herds (Angliss 2003, Clarke et al. 2005, Gates et al. 2005, Gardipee 2007, Fuller et al. 2009, Geremia et al. 2012). Although the 2 subpopulations have been

disproportionately culled in some years, biologists have clearly warned of possible demographic effects if large culls were continued over time (White et al. 2011b). Biologists have also acknowledged that it is not clear how large-scale culling might influence the genotype diversity and allelic distributions of the subpopulations over time (White et al. 2011b).

White and Wallen acknowledge that culls have disproportionately affected the two herds and recognize the adverse effects of large culls. This resulted in the following action:

> These analyses and uncertainties led to the implementation of several adaptive management adjustments to the Interagency Bison Management Plan designed to minimize future large-scale culls of bison, evaluate how the genetic integrity of bison may be affected by management removals (all sources combined), and assess the genetic diversity necessary to maintain a robust, wild, free-ranging population that is able to adapt to future conditions (USDI et al. 2008).

The reference citation "(USDI et al. 2008)" is "USDI, USDA, Montana, Department of Fish, Wildlife, and Parks, Department of Livestock. 2008. Adaptive adjustments to the interagency bison management plan. Mammoth (WY): National Park Service, Yellowstone National Park."

The portion on maintaining genetic diversity in the 2008 document titled "Adaptive adjustments to the interagency bison management plan" is provided below:

> **Management action 2.1a**—Increase the understanding of bison population dynamics to inform adaptive management and reduce sharp increases and decreases in bison abundance.
>
> *Monitoring metrics:*
>
> - Conduct aerial and ground surveys to estimate the annual abundance of Yellowstone bison each summer (Lead = NPS).
> - Document and evaluate relationships between bison migration to the boundary of YNP and bison abundance, population (or subpopulation) growth rates, and snow pack in the central and northern herds (Lead = NPS).
> - Continue to obtain estimates of population abundance through the remainder of the year based on surveys, knowledge of management removals, and survival probabilities (Lead = NPS).
> - Conduct an assessment of population range for Yellowstone bison that successfully addresses the goals of the IBMP by retaining genetic diversity and the ecological function and role of bison, while lessening the likelihood of

large-scale migrations to the park boundary and remaining below the estimated carrying capacity of the park's forage base (Lead = NPS).

Management responses:

- If abundance estimates decrease to ≤2,300 bison, then the agencies will increase the implementation of non-lethal management measures.
- If abundance estimates decrease to ≤2,100 bison, then the agencies will cease lethal brucellosis risk management and hunting of bison and shift to non-lethal management measures.

Management action 2.1.b—Increase the understanding of genetics of Yellowstone bison to inform adaptive management.

Monitoring metric:

- Complete an assessment of the existing genetic diversity in Yellowstone bison and how the genetic integrity of Yellowstone bison may be affected by management removals (all sources combined) by October 2010 to estimate existing genetic diversity of substructure in the population (Lead = NPS).
- Conduct an assessment of the genetic diversity necessary to maintain a robust, wild, free-ranging population that is able to adapt to future conditions (Lead = NPS). (Memorandum, 2008, pp. 4, 5).

As can be seen, the "adaptive adjustments" are not adjustments, but instead plans for adjustments, including monitoring, protocol for adjusting cull size and assessments. To date these intentions have not resulted in actions to maintain the genetic diversity of "a robust, wild, free-ranging population that is able to adapt to future conditions." Culling based on herd size only is not protective and culling based on the phenotype of the migratory trait is genetically destructive. But it continues under the management of the IBMP.

Halbert et al. expand on the negative effects of culling without regard to herd composition:

> Our study has also revealed longitudinal differences in migration patterns among Yellowstone bison, as it appears that bison moving to the park boundary in the vicinity of West Yellowstone are consistently from the Central subpopulation, whereas those moving to the park boundary in the vicinity of Gardiner may originate from either the Central or Northern subpopulation. These observations warrant serious reconsideration of current management practices. The continued practice of culling bison without regard to possible subpopulation structure has the potentially negative longterm consequences of reducing genetic diversity and permanently changing the genetic constitution within subpopulations and across the Yellowstone metapopulation (Halbert et al., 2012, p. 368)

Commenting on this passage and subsequent ones, White and Wallen state:

> The authors further suggest that current management will ". . . erode the genetic distinctiveness between the 2 groups" (Halbert et al. 2012, p. 9). We agree that bison removals should be carefully managed to prevent unintended consequences and have referenced documents in this response that indicate such management is occurring with frequent assessments of progress toward desired conditions. However, we question whether the National Park Service should actively manage to preserve the genetic distinctiveness of each herd because history indicates humans likely facilitated the creation and maintenance of this population substructure. Rather, we recommend that the National Park Service continue to allow ecological processes such as natural selection, migration, and dispersal to prevail and influence how population and genetic substructure is maintained in the future rather than actively managing to perpetuate an artificially created substructure. The existing population and genetic substructure may be sustained over time through natural selection or it may not. Regardless, we submit that it is the conservation of the ecological processes that is important, not the preservation of a population or genetic substructure that may or may not have been created and/or facilitated by humans.

If this passage were not to be taken seriously, it would make great satire. How can they say with a straight face that "We . . . have referenced documents in this response that indicate such management is occurring with frequent assessments of progress toward desired conditions," knowing that is all that has happened, that is, just "assessments"?

How can they say with a straight face that "we recommend that the National Park Service continue to allow ecological processes such as natural selection, migration, and dispersal to prevail and influence how population and genetic substructure is maintained in the future . . ." when they are systematically stopping natural selection, migration and dispersal?

How can they say with a straight face that Halbert et al. are recommending "actively managing to perpetuate an artificially-created substructure," when in fact they are questioning artificially altering the composition of herds, stating that the "continued practice of culling bison without regard to possible subpopulation structure has the potentially negative longterm consequences of reducing genetic diversity and permanently changing the genetic constitution within subpopulations and across the Yellowstone metapopulation"?

White and Wallen's paper is only one thing: a rather bad attempt to pull the wool over the eyes of the public. But the charade does not stop here. As though they were cheerleaders on death row, they extol the very population they are seeking to put to death. White and Wallen warble:

> Yellowstone bison are a valuable conservation population because they represent the largest wild population of plains bison and are one of only a few populations to continuously occupy portions of their current distribution and show no evidence of hybridization with cattle in their genomic ancestry (Meagher 1973, Halbert and Derr 2007). Perhaps more importantly, Yellowstone bison are part of an intact predator–prey–scavenger community and move, migrate, and disperse across a vast, heterogeneous landscape where the expression of their genes is subject to a full suite of natural selection factors including competition (for food, space, and mates), disease, predation, and substantial environmental variability. As a result, Yellowstone bison likely have unique adaptive capabilities compared to most bison populations across North America that are managed like livestock in fenced pastures with forced seasonal movements among pastures, few predators, selective culling for age and sex classifications that facilitate easier management (e.g., fewer adult bulls), and selection for the retention of rare alleles—the importance of which has not been identified.

With lip service White and Wallen belittle "most bison populations across North America that are managed like livestock in fenced pastures with forced seasonal movements among pastures," yet that is what they are actually advocating by participating in having the Department of Livestock manage wild bison, by taking part in restricting their movements across the border, thus fencing them, and by supporting indiscriminate, excessive and needless culling, demonstrating a gross disregard for the "retention of rare alleles," the importance of which they have no clue, seeking to destroy these wild animals mid-migration by a factor of 900 for 2015, 900 for 2016 and 1,500 for 2017.

New York Times staffer Jim Robins, in "Anger Over Culling of Yellowstone's Bison," reported March 23, 2008 the opinion expressed by Derr regarding the effects of killing bison that attempt to migrate. In his bibliography, Derr is described as having interests in molecular genetics of mammals, including characterization of genetic traits and disease, population and conservation genetics, and the evolution of genes and genomes at the nucleotide level in domestic and wild populations. Robins wrote:

> James Derr, a professor of genetics at Texas A&M who is studying the Yellowstone bison, said he feared that some behaviors or traits, including the propensity to migrate, could be lost with the killed bison. "The great-grandmother, grandmother, mother and daughter often travel together," he said. Killing them "is like going to a family reunion and killing off all of the Smiths. You are affecting the genetic architecture of the herd" (Robins, 2008).

Derr noted May 21, 1998 at a meeting of the Greater Yellowstone Interagency Brucellosis Committee that the Yellowstone bison have a naturally-occurring resistance to brucellosis. Because of this, he said, “it is important to not reduce the bison population levels any further and risk the elimination of these disease resistant genes” and that “we should know the genetic makeup of bison before management decisions are made which may compromise the future of bison genetic health.”

At the same meeting Joe Templeton, Texas A&M University, Department of Veterinary Pathobiology, made these remarks:

> The so-called random shooting at the Montana borders is actually eliminating or depleting entire maternal lineages, therefore this action will cause an irreversible crippling of the gene pool. Continued removal of genetic lineages will change the genetic makeup of the herd, thus it will not represent the animal of 1910 or earlier. It would be a travesty to have people look back and say we were “idiots” for not understanding the gene pool.
>
> Bison have developed a natural resistance genetically as long as they have enough to eat, limited stress and are not consumed by other disease. There is no magic bullet in wildlife disease, therefore management is important. Vaccines are one management tool and one component, but genetic structure is necessary for future management. Every animal which is removed from the breeding population can no longer contribute to the genetic variability of the herd (Geist, 2008).

Apparently, the members of the IBMP and the biologists who provide support for their culling practices are not listening. The apostles of obfuscation have turned a deaf ear.

How does the Fish and Wildlife Service look at all this? In evaluating two recent petitions on the subject, my petition submitted in 2015 and the other submitted in 2014 by the Western Watersheds Project and the Buffalo Field Campaign, it had this to say in its 90-day finding rejecting protection of Yellowstone’s wild bison:

> The petitions claim genetic viability may be degraded by a loss of unique genetic qualities (particularly the ability to migrate) through disproportionate culling of migratory animals. The first petition states “culling migratory bison could reduce the overall health and resilience of the Yellowstone bison by favoring less migratory bison, which may also select for a mitochondrial gene defect that decreases their fitness…” Both petitions cite Pringle’s (2011, entire, both petitions) findings, which suggest bison are predicted “significantly impaired in aerobic capacity, disrupting highly evolved cold tolerance, winter feeding behaviors, escape from predators and competition for breeding” (Pringle 2011, p. 1, both petitions). However, these impairments have not been connected to specific defects in the bison mitochondrial genome and Pringle’s assertions are predicated on assumptions that bison

mitochondrial defects are caused by not the same, but similar mutations observed in humans and dogs (Pringle 2011, p. 1, both petitions). Only one bison from YNP analyzed in Pringle's study had haplotypes that contain the possibly deleterious mutations (Pringle 2011, p. 14, both petitions). Further, these defects are thought to have arisen from the initial population bottleneck that reduced the North American bison population to 25 animals in YNP (Boyd and Gates 2006, p. 1, first petition). Therefore, any deleterious genetic effects of the bottleneck would have occurred at that time and would not necessarily be exacerbated by present culling management regimes. Lastly, the second petition posits that "the genetic diversity of wild bison is not being maintained by the IBMP's actions of lethally removing migratory bison, but instead the herds' genetic composition is being altered by the artificial selection of bison with non-migratory and domestic animal traits." However, the second petition does not cite sources to support these claims and there is no evidence at this time that indicates culling animals migrating from YNP will eliminate a genetic basis for the migratory behavior. In addition, continual migration each year suggests this behavior persists. Plumb et al. (2009, p. 2383, both petitions) suggests movement of YNP bison beyond YNP boundaries began when the Central/Western herd surpassed a population size of 1,500 and the Northern herd surpassed 550. These numbers are 7 well below mean estimates of herd population sizes limited by food resources (~ 2,400 and ~3,800 for Northern and Central/Western herds, respectively). In addition, permanent movement out of YNP (i.e. dispersal) is thought to have naturally occurred in the absence of management regimes (Plumb et al. 2009, p. 2383, both petitions). Therefore, winter culling may actually be serving as a surrogate for a dispersal sink (permanent movement out of the population) that would occur as a natural part of the ecosystem process.

To clarify what was being said by the FWS, I wrote Pringle, noting that I had quoted his study "Widespread Mitochondrial Disease in North American Bison" in a petition I submitted in 2015 to the FWS to list Yellowstone's wild bison, providing a copy of the above finding. Pringle is an expert on vertebrate comparative genomics. He received his undergraduate degree in 1966 from Harvard, completed graduate work in molecular biology at the University of California San Diego, and received a Ph.D. in mathematics at the University of Oregon. He was a college professor at Gettysburg College in Pennsylvania, taught biochemical genetics at the University of Texas Medical School and currently directs the Sperling Biomedical Foundation based in Eugene, Oregon (Declaration of Dr. Tomas Pringle, 2011).

I asked him two questions, which are embedded in his reply below and which I have italicized. His October 22, 2016 reply follows:

This sounds like a brief written by a cattleman's lawyer on behalf of FWS, not a geneticist or FWS biologist much less any kind of scientist. The issue here is cattlemen not wanting to share public land grazing allotments with another (vastly more popular) large herbivore and overall racist suppression of Native American culture. It has nothing whatsoever to do with brucellosis, an imported European cattle disease that has gotten into elk and various other North American species. It has nothing to do with MT's status as 'brucellosis-free' state as they imported a diseased cow from TX and nothing of economic consequence happened to EITHER state.

Further, this has nothing whatsoever to do with proper management of the YNP bison herd. I challenge the whole concept that bison or any other native species needs genetic or any other kind of 'management' (unless it be halting trophy rack hunting). No one proposes a cull of a native species in a national park for the species' benefit — this is all about two cowardly controversy-avoiding agencies kowtowing to the local cattle industry, even though almost all of the adjacent FS allotments were retired by NWF years ago.

1. What does the FWS mean by stating "Only one bison from YNP analyzed in Pringle's study had haplotypes that contain the possibly deleterious mutations (Pringle 2011, p. 14, both petitions)"? I thought a number of bison had mitochondrial disease. How many bison were included in the study?

Lots, as I recall. I haven't revisited this paper since it was posted in 2011 but for sure I included ALL data on ALL bison with fully or partially sequenced mitochondrial genomes. I would NEVER make an issue out of a single bison because that could merely be an individual animal with a founder mutation just as we see all the time in human genetic disorders. So if you look at the text, it will clearly state how many bison had the mutation in question. It would be a huge job to update the paper to Oct 2016, lots more data exists now including the whole nuclear genome.

As we all know, dogs, cats, horses, cows, mice, etc. are widely used model species for a great many human genetic disorders, e.g. a mouse with cystic fibrosis or breast cancer etc. So it is no great leap — especially since the protein coding genes of the mitochondria have the same well-studied functions within aerobic electron transport in all VERTEBRATES not just placental mammals — to conclude that an amino acid change that is clearly classified as deleterious by widely applied criteria will be deleterious regardless of what species of VERTEBRATE it occurs in or is transferred to, e.g. lamprey eel or bison. In this case, we know all too well what the role the affected protein has in energy metabolism. We know all too well what happens in humans, mice and other mammals when the primary electron transport chain for producing ATP is disrupted. Yeast would do ok here, they have other options. Mammals do not.

Protein-coding got lost in the lawyer's comments: this is a huge escalation up from a mere genetic marker. I wouldn't have bothered with just a random mitochondrial base pair change as these are near-impossible to evaluate phenotypically. To the contrary, this is an irreplaceable protein with implausible secondary compensation. The protein has been damaged by an inherited mutation in the bison who carry it. If the protein were no longer able to carry out its function at all, it would be lethal. So it is just sub-optimal, very sub-optimal by the same criteria used to classify amino acid changes in the other 6000 mammalian genes having known disease mutation issues.

2. The FWS states: "Further, these defects are thought to have arisen from the initial population bottleneck that reduced the North American bison population to 25 animals in YNP (Boyd and Gates 2006, p. 1, first petition). Therefore, any deleterious genetic effects of the bottleneck would have occurred at that time and would not necessarily be exacerbated by present culling management regimes." Isn't that statement forgetting that the different herds vary widely in disease load? Moreover, by saying something is "not necessarily exacerbated," one can also say that something is not "not necessarily exacerbated" also, so what is the point?

I've read this 3-4 times and concluded it is just word salad, someone with minimal familiarity with population biology throwing out lay speculation (which we call "just-so stories" after Rudyard Kipling). I have no idea what the point is. Just change the disease to cystic fibrosis and two populations of humans, one of which carries a mutant allele.

My profile is now available at ResearchGate, the linked-in for scientists. My peer-reviewed genetics papers have been cited 5,610 times by other researchers in other peer-reviewed journals. This puts me in the 85% percentile of living scientists. [Some editing needed, some misattributions but no substantive changes.] (www.researchgate.net/profile/Thomas_Pringle).

I did a very careful job on this bison paper just as a public service. I was not paid and had no idea in advance that anything of interest would emerge from it. This is a very difficult area in genetics because of numerous bizarre characteristics of mitochondrial inheritance. Based on publication histories, I would say no one employed by either NPS or the USFWS is remotely qualified to either independently research this issue or evaluate academic aspects of my paper. It is an advanced topic requiring decades of prior specialized research experience (Thomas Pringle, personal communication, October 22, 2016).

Word salad

Indeed, the majority of the biologists' defense of the culling and hazing of Yellowstone's wild bison has been "word salad."

One of the most egregious comments by the FWS in its 90-day finding is, "In addition, permanent movement out of YNP (i.e. dispersal) is thought to have naturally occurred in the absence of management regimes (Plumb et al. 2009, p. 2383, both petitions). Therefore, winter culling may actually be serving as a surrogate for a dispersal sink (permanent movement out of the population) that would occur as a natural part of the ecosystem process."

As pointed out in chapters "Protection hinges on the species concept" and "A critical look at wildlife managers' pseudoscientific flimflam," in order for a dispersal sink to be evolutionarily stable, animals *must return* from the source from which they dispersed. If they do not, they will become extinct, for a dispersal sink is a suboptimal habitat where, over the long term, births will not exceed deaths.

Killing all bison that enter Gardiner Basin, a dispersal sink, exposes that species to extinction. Historically, Gardiner Basin has been key to the survival of wild bison, for this is where they migrated in the winter and from which they *returned* after calving in the spring. Bison have experienced "permanent movement out of the population" only by means of the Stephens Creek capture facility and other such facilities, and that permanent movement is in a livestock trailer headed for a slaughterhouse.

Host of questions

In the face of a multitude of studies warning against the practices of the IBMP, this dissembling, evasion and distortion present a host of questions. Why are they touting preservation of wild bison as a good thing when they are devoted to their destruction? Why this poker game with the genetics of the wild bison? Why are irreversible actions via culling of wild bison taken for the sake of grazing a relatively few cattle in an ecosystem? Why are they turning their backs on wild bison?

Another question: historically, did the destruction and extirpation of the vast bison herds in the late 1800s create from the population crash a bottleneck that contributed to the eruption of mitochondrial disease among the surviving remnants? According to Pringle's study, the bison herds in Lamar Valley and the Mirror Plateau are less-affected by mitochrondrial disease than the Hayden Valley herd. The disproporionate culling of the Hayden Valley herd, the central herd, would make that herd more vulnerale to extinction.

And then there were none

Since their discovery as a remnant herd in Yellowstone National Park, in many respects things have not changed much for the wild bison here in Yellowstone. They are still being shot or shipped to slaughter as they cross park boundaries, except it is not by poachers, but by government agents. They are being penned in the Stephens Creek capture facility within the park, in violation of the Congressional act that established the park, which provides "against the wanton destruction of the fish and game found within said park and against their capture or destruction for the purpose of merchandise or profit."

In essence, the government has no clue as to what it is doing, but just keeps killing wild bison because these bison obey the instinct to migrate and cross the invisible borderline of Yellowstone National Park, a line against which the government grants preference to the presence of cattle, culling wild animals that dare to cross. Culling is based on neither genetic health of the herds nor the preservation of genes vital to survival in the wild. Culling is based, in fact, on the opposite—the expression of this genetic strength via migration.

What is happening is that government agencies have taken up the interests of the livestock industry, forgetting their mission to protect wildlife. To do this, they have deluded the public, pretending to have the best interests of the wild bison at heart, when in fact it is all smoke and mirrors. Further, they have tricked the public into thinking their program can work by citing programs that do not pertain and by setting a goal of zero disease transmission, a goal that can only be reached by removing cattle from the ecosystem. Yet, they refuse to do so, putting an entire wild species at risk of extinction.

Further, they have turned their backs on historical and present-day eye-witness accounts that identify mountain buffalo as a species that still may inhabit the park, claiming that this issue has long ago been resolved when, indeed, it has not. No such studies to date have been made to support or detract from that possibility. Moreover, they have established a capture facility at the end of the bison migration route, making the bison captives of the park, yet in a grand example of double-speak claim they want to maintain bison that are "wild and free-ranging."

In a few short years the genetic and learned migratory traits that contributed to the survival of wild bison for millennia is being systematically selected out at the borders of Yellowstone National Park from the last wild herd in the United States. Those that survive now are those that do not migrate. When those bison that stay behind die in droves inside the park during severe winters, the government simply looks the other way. Our national icon, the last and largest remaining member of megafauna that crossed the Bering Land Bridge a decamillennium ago, has been reduced to the status of a pest. The generations that come after us will look at the government agencies in charge of wildlife preservation as populated, at least when it comes to bison, by wildlife antagonists. But that generation will have no ability to bring back the wild bison. It will be too late.

2

Alert: Impending blood bath

Despite intensive culling under the Interagency Bison Management Plan (or because of that culling), the population of Yellowstone's wild bison continues to climb. However, it is the less fit—especially for severe winters—that may be increasing in the park. Managers plan a drastic reduction in an attempt to drive the bison population down to their desired 3,000 level.

For the winter of 2016-2017, the IBMP proposes to reduce both Yellowstone herds by 25 percent, or just the northern herd by 25 percent, in spite of the warning by James N. Derr, Department of Veterinary Pathobiology, Texas A&M University, against such large reductions because of the potential of permanently compromising the herd's immune response to disease (see discussion at end of chapter "Interagency Bison Management Plan").

In "Status Report on the Yellowstone Bison Population, August 2016" Yellowstone biologists Chris Geremia, Rick Wallen, and P.J. White outline the IBMP's lethal removal plan for Yellowstone's wild bison the winter 2016-2017. If this winter is harsh, expect a blood bath. If the winter is mild and not enough bison migrate, not enough bison will be culled. At some point, to push down the herd's population closer to the park's allowed maximum capacity of 3,000 wild bison, large-scale culling will be required. The following excerpt is classic government biologist doubletalk. In sum, they are saying that in order to avoid large-scale culls, which can harm the herds, they are recommending large-scale culls. The report—a plan by wildlife managers who reveal themselves in practice to be anti-wildlife—states:

> **Summary of Removals during Winter 2015-2016**: Known culls and harvests during winter 2015-2016 totaled 552, which excludes up to 30 additional animals that were wounded during hunts and returned into the park. In the northern management area, known removals included 360 harvests, 18

wounded animals that were dispatched by rangers during hunts, 101 animals consigned to tribes for meat processing, and 49 animals held for possible quarantine. Twenty-four bison were harvested in the western management area. Age and sex composition of removals included 175 adult and juvenile males, 227 adult and juvenile females, 146 calves, and 4 unclassified animals.

Forecasts of the Bison Population Under Management: We forecasted the bison population during July 2017 under different management alternatives that removed between 0 and 1,500 bison during winter 2016-2017. In each scenario, we removed 70% adults, 10% yearlings, and 20% calves, including 60% females and 40% males. We chose these removal ratios because they would maintain the age and sex structure of the population within desired conditions.

Forecasts revealed that removal of approximately 900 bison under the assumed removal ratios would be necessary to stabilize population growth . . . Removal of 1,400 bison, which is approximately 25% of the current population size, would result in a smaller population of 4,850 bison (95% range 4,300-5,300) next summer. In contrast, removal of zero individuals would ensure a larger population of 6,500 bison (95% range 5,800-7,200) next summer.

Recommendations for Winter 2016-2017: During 2013-2016, we provided recommendations that specified objectives for annual removals aimed to gradually reduce the bison population. This approach was unsuccessful because numbers of animals migrating outside of the park varied, we were unable to balance hunting and culling to remove targeted numbers of animals and, as a result, the bison population continued to increase. Rather than providing a removal objective, we recommend the following guidelines that balance conservation objectives and conflict resolution constraints for managing bison that exit the park:

Focus population management reductions on the northern herd. Under severe weather conditions, we anticipate a large migration of bison into the northern management area that could exceed 2,000 animals. A mass migration could challenge our ability to meet shared goals of maintaining low transmission risk of brucellosis among bison and livestock. Also, breeding herds larger than 3,000 animals have been associated with high grazing intensities on summer ranges that may not be sustainable over time. There are currently nearly 4,000 animals in the northern herd and we recommend reducing the northern herd towards 3,000 animals.

Maintain approximately 200-450 animals north of Mammoth Hot Springs and within the existing out-of-park conservation area to Yankee Jim Canyon. This approach would support state and tribal harvests – daily harvests rates averaged about 3 bison per day during winters 2013-2015 when 200-450 bison were north of Mammoth Hot Springs. This approach would also limit the number of bison exiting northern Yellowstone and reduce potential conflicts (human safety, property damage) in the local community.

Capture bison at the Stephen's Creek facility throughout winter and during state and tribal hunts. Capture of bison at the Stephens Creek facility can be used to maintain the number of bison north of Mammoth Hot Springs within the range of 200 to 450 animals. Capture-and-slaughter should be implemented throughout the winter with relatively small numbers of animals removed weekly during January through March. If winter is severe, with large numbers of animals rapidly moving into the basin, more animals could be captured weekly.

Remove more animals when winter is severe and large numbers of animals migrate outside the park. Repeated removal of more than 20% of the population as occurred during 2006 and 2008 (Table [similar to Table 1]) may have had negative effects on the bison population, such as altering subpopulation and age and sex structure. Therefore, we recommend removing more bison when large numbers of bison exit the park, but removing less than 25% of the preceding summer population at one time. If bison continue to migrate into the northern management area and more than 25% of the population has been removed, we recommend holding animals for release back into the park during spring.

Track the age and sex composition of removals throughout winter to use capture-and-slaughter to offset demographic effects of preferential harvest. Do not selectively remove bison based on their brucellosis exposure status. Removal of relatively small, entire groups of bison gathered through weekly efforts should mimic random culling, which is a preferable alternative for conservation. Management culling is the dominant source of mortality for Yellowstone bison. Random removal, in contrast to selective removal based on brucellosis exposure, avoids artificially allowing brucellosis to act as a key selective force on the bison population (Geremia, 2016).

In other words, because not enough bison have been killed in the past, the IBMP has to do catch-up culling. But because "Repeated removal of more than 20% of the population as occurred during 2006 and 2008 may have had negative effects on the bison population," biologists recommend these alternatives:

- Reduce the northern herd from 4,000 animals to 3,000 animals, a 25 percent reduction, or

- Lethally remove up to 25 percent of the total population.

This, of course, makes no sense. No matter how one looks at it, 25 percent is more than 20 percent. These recommendations have serious potential repercussions and implications, for the biologists are providing a rationale for lethal actions against the park's wild bison that could put their physical and genetic status in jeopardy, shoving them closer to extinction. This is a betrayal of the public trust, for it serves to continue to con the public through bloviation to spend $3 million annually on a failed project that does not protect cattle from brucellosis and that exposes the Yellowstone bison herd to extinction.

What is being advocated is lethally removing up to 1,500 bison at Gardiner Basin to protect up to 1,500 cattle that graze at Gardiner Basin and Hegben Basin in wildlife habitat owned by the public. Here is the deal: a bison for each cow plus $3 million and possible extinction of a wild species.

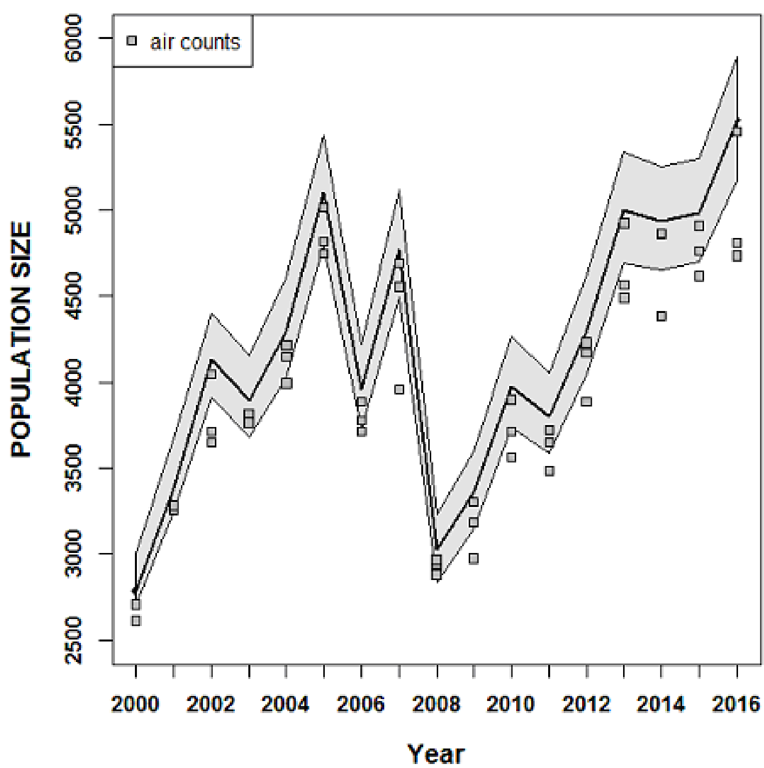


Figure 8. WILD BISON POPULATION. Estimated size of the Yellowstone bison population since the inception of the Interagency Bison Management Plan. Bold lines indicate mean abundance, area between thin lines shows the 95% range of the population, and gray boxes are observed aerial counts. ***From "Status Report on the Yellowstone Bison Population, August 2016" (Geremia et al., 2016).***

The Interagency Bison Management Plan in its *Record of Decision* states:

> The management of bison under this plan will include actions to protect private property; actions to reduce the risk of transmission of brucellosis from bison to cattle; and, actions to maintain a viable, free-ranging population of Yellowstone bison (*Record of Decision*, 2000, p. 22).

How can the IBMP recognize that "Repeated removal of more than 20% of the population as occurred during 2006 and 2008 . . . may have had negative effects on the bison population . . ." yet recommend culling even a greater percentage? Eliminating up to 25 percent of either the northern herd or the total herd is exceeding the large-scale culling it seeks to avoid, and does not maintain a viable herd nor a free-ranging one.

The IBMP is not following its own methodology for protecting wild bison nor adapting to new information, but is instead persisting in large-scale reduction goals. According to the 90-day finding on my first petition, "The plan contains contingency measures to assure that the conservation status of the herd remains secure." This is not being done and is not reflected in IBMP's plans for bison lethal removals for the winter of 2016-2017.

For this reason the FWS pursuant to the Endangered Species Act should intervene and list wild bison, as the IBMP has proven it is unable to abide by the terms to which it agreed in the *Record of Decision.*

3

Protection hinges on the species concept

Part of the reason that the Fish and Wildlife Service has not listed Yellowstone's wild bison as endangered is because the FWS does not consider migration a trait that should be protected. In personal communication to me in response to my questions to clarify this matter, the FWS stated concerning the purpose of the Endangered Species Act, "The Act is not designed to conserve behaviors/traits."

This is absurd, a mere opinion by the FWS, and defeats the intent of the ESA to protect endangered species. According to Anna L. George and Richard L. Mayden, writing in "Species Concepts and the Endangered Species Act," *Natural Resources Journal*, Spring 2005:

> There is no single accepted definition of a "species" in the natural sciences, nor does the Endangered Species Act (ESA) offer one. Instead, prolonged debate over species concepts has allowed various stakeholders to embrace and defend particular definitions based upon personal agendas that may be at odds with the objectives of the ESA.

Further, the authors state:

> Using outdated concepts to identify biodiversity is not only distasteful to conservation biologists and taxonomists, but also contrary to the ESA itself-both substantively and procedurally (George, 2005).

This is the third petition for the protection of the Yellowstone wild bison I have submitted to the Fish and Wildlife Services under the provision of the Endangered Species Act. All told, five have been submitted from various petitioners. Chronologically, I have written the first, fourth and now the fifth petition. My second petition was denied in a 90-day finding by the FWS essentially along the same lines of denial as the first.

When the second petition was denied, to better understand why, I wrote the following email January 27, 2016 to the person listed as a contact, Mark Sattelberg, FWS field supervisor:

> What are my options for corrective action if I object to elements of the finding re my petition to list the Yellowstone bison?

Not hearing back for some time, I wrote again on February 11, asking to confirm receipt of my email. Sattelberg responded that same day:

> I did get your email and forwarded it on to our Regional Office. Right now, the only thing I have gotten back is that we could have a conversation, I am not aware of any option to seek any corrective action on the decision. I will renew my inquiry to our regional office.

On February 15 I replied to Sattelberg:

> I would welcome a conversation by email. I will draft some questions and will be getting back to you shortly.

The next day, February 16, he responded:

> That sounds good. I look forward to seeing your questions.

On March 8, I submitted my letter to Sattelberg (including embedded questions in italics), stating:

> Below please find questions concerning the December 31, 2015 "90-Day Finding on Two Petitions to List a Distinct Population Segment of Bison in its United States Yellowstone National Park Range as Threatened or Endangered under the Endangered Species Act."
>
> The FWS says in its finding that:
>
>> The petitions state concerns regarding the restriction of movement into historical range outside YNP boundaries. However, given the current stable-to-increasing population status of the YNP bison herd, we do not find substantial information that restriction of range is likely a limiting factor for the continued existence of YNP bison.
>
> Abundance of bison in general is not the issue, but instead the abundance of wild bison. The continued existence of YNP bison depends on their

continued existence as wild animals, not merely a “stable-to-increasing population,” which could merely be a stable-to-increasing population of primarily non-migratory bison. A key trait of wildness is the adaptive migratory trait.

Over the long term, how can the FWS conclude that this trait will be preserved by persistently eliminating it annually through its culls of migratory animals only? What studies can the FWS point to that indicate that over the long term destroying only migratory animals will preserve this trait in the YNP herd?

The 90-day finding found that the wild Yellowstone bison are a discrete population segment (DPS). A DPS is defined as markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. One of those behaviors is the trait of migration, which is unique to this subspecies.

The FWS states:

> Lastly, the second petition posits that “the genetic diversity of wild bison is not being maintained by the IBMP’s actions of lethally removing migratory bison, but instead the herds’ genetic composition is being altered by the artificial selection of bison with non-migratory and domestic animal traits.” However, the second petition does not cite sources to support these claims and there is no evidence at this time that indicates culling animals migrating from YNP will eliminate a genetic basis for the migratory behavior. In addition, continual migration each year suggests this behavior persists.

The FWS’s only support that such culling is not harming the Yellowstone bison’s migratory behavior is its observation that “continual migration each year suggests this behavior persists.”

So, will only the cessation of that continual migration prove to the FWS that such large-scale culling of migratory-only bison endangered that trait?

Further, the FWS claims:

> To date, there is no evidence that culling has impacted the long-term genetic viability or persistence of the YNP bison population (White et al. 2011, p. 1328, both petitions).

But the same White et al. study states:

> Thus, sporadic, nonrandom, large-scale culls of bison have the potential to maintain population instability (i.e., large fluctuations) by altering age structure and increasing the variability of associated vital rates. Longterm bison conservation would likely benefit from management practices that maintain more population stability and productivity.

How does the FWS square its summation of the White et al. study with what White et al. also says in that same study about large-scale culls?

Moreover, that study concluded:

> Yellowstone bison provide the wild state and adaptive capabilities needed for restoration but, to date, the brucellosis issue has prevented their use in restoration efforts . . .

Does the FWS believe it is following good wildlife management practices when it is putting wild bison's wild state and adaptive capabilities at risk—qualities valuable for herd restorations—through its denial of protection under the ESA? Can the FWS categorically state that it is not putting those capabilities at risk by allowing the large-scale culls by the IBMP to continue?

To demonstrate that the persistent selection of wild bison for the non-migratory trait via large-scale culls will eventually leave only non-migratory bison in existence—thereby producing a herd lacking a major quality that makes wild bison wild and capable of survival—can only be done by analogy with other species that have had their migratory behavior altered. Absolute proof could only be shown when wild bison stop migrating, which is what the petition is trying to prevent.

Does not the FWS want to act before it is to late? Do not the examples of altered migration for other species—which I have cited throughout the petition extensively—suggest just the opposite, that is, their migration may not persist? For instance, whooping cranes, when isolated in captivity, loose the ability to migrate when released. The lead animals of migrating Arctic caribou are not killed by indigenous hunters for fear it will stop them from migrating in the future. Migration entails learned behavior. Wipe out the leaders that know the migratory route and you wipe out migration.

Does not the example of the whooping crane count? Does not the wisdom of indigenous hunters count? Does the FWS find them not instructive?

Historically, the European bison, the wisent, was exterminated in the wilds, with only a few left in zoos in the early 1900s. The species was later reintroduced to the Caucasus mountains. From the high elevations of the region they annually migrated to the foothill forest where the snow was less abundant. However, poachers using helicopters decimated the herd, which eventually changed its behavior. Now the herd migrates to the wind-blown, snow-free mountain tops for survival.

In my petition of March 2, 2015 I wrote:

> The poachers who brought the restored Caucasian bison to the brink of extermination are equivalent to the interagency collaborators operating under the acronym IBMP. Terrorized (like the Yellowstone bison) by helicopters, driven from their migratory habitat (like the Yellowstone bison), they now survive on the snow-free mountain tops of the Caucasus region. If their migratory habits can be changed by lethal removal means, how can one justify similar actions brought against the migrating Yellowstone bison as harmless, as did the FWS evaluating my first petition?
>
> Hopefully, Georg Wilhelm Friedrich Hegel will be proven wrong when he wrote in *The Philosophy of History* that "What experience and history teaches us is that people and governments have never learned anything from history, or acted on principles deduced from it" (Hegel, 1956, p. 7).

Apparently, Hegel was right, for the FWS in its current 90-day finding states exactly the same defense of the IBMP's lethal removal of wild bison that it made with regard to my first petition, that is, since they are still migrating, no harm is being done. This is incredibly short-sighted.

Unlike the Caucasian bison, Yellowstone's wild bison have no other place to go but Gardiner Basin when winter gets severe. I wrote in my recent petition:

> A habitat that cannot be occupied—such as the Gardiner Basin, because the wild bison seeking to occupy it via migration are killed before they get there—is an arena where those migrating fail to produce offspring. Animals that fail to produce offspring fail to pass on their migratory genes. This has the potential for profound genetic and behavioral consequences.

Associated with the trait of migration is aggressiveness. Domestic animals are less aggressive because that trait has been selected out artificially. Livestock owners want tame animals they can manage. Domestic animals are also less intelligent than their wild ancestors. Not only is the trait of migration being selected out, but concurrently there is a high potential that by IBMP's culling, a cascade of other traits, in particular wild traits, are being lost as well. The effect of the weeding out of these traits only time will tell.

Does the FWS believe that taking such a chance is responsible wildlife management?

Is there such a thing as a migratory gene? A 2011 study of the Blackcap warbler titled "Identification of a gene associated with avian migratory behaviour," headed by Jakob C. Mueller, Department of Behavioral Ecology and Evolutionary Genetics, Max Planck Institute of Ornithology, claims there is.

The evolutionary importance of genes controlling migratory behavior can be seen in drosophila larvae vis-à-vis survival of the fittest. Fruit flies have a particular gene that controls foraging behavior. It governs whether a maggot will be a sitter or a rover, whether it will stay put or migrate to another nutritional source, say another rotten spot on an apple. Depending on the environment, either one or the other will survive better, ensuring the survival of that species. This behavior is also essential for bison and shows the importance of having viable populations of *both* migratory and non-migratory bison.

None of these supporting pieces of evidence provided by my petition were mentioned in FWS's finding.

Do these analogs, studies and observations, all of which are cited in my recently rejected petition, often at some length, not count? That wild bison are still migrating despite the killing of the vast majority of migratory bison suggests to the FWS that their migratory habit will persist. Does FWS's conclusion trump what other findings indicate for other species, that is, that the migratory trait can be eliminated or significantly altered by environmental influences?

The 90-day finding states:

> Thus, maintenance of subpopulation genetic differentiation and overall genetic diversity may not be crucial for preserving genes from the survivors of the historic bottleneck. Lastly, White and Wallen (2012, p. 752, second petition) conclude that the National Park Service should allow ecological processes to "influence how population and genetic substructure is maintained in the future rather than actively managing to perpetuate an artificially created substructure . . . it is the conservation of the ecological processes that is important, not the preservation of a population or genetic substructure that may or may not have been created and /or facilitated by humans."

This passage is all too typical of the doubletalk that emanates from the FWS, as well as the IBMP. Does not the FWS see the hypocrisy of this statement?

Is not the National Park Service, which is a participant in the Interagency Bison Management Plan, by its lethal removal management practices actively creating an artificial substructure within the park's wild bison population by promoting an imbalance between migratory and non-migratory animals through its culling of only migratory bison? Is this not artificially altering ecological processes, instead of conserving them?

But of course, the FWS would have us believe that the IBMP is Mother Nature herself. It would have the public think that the slaughter being directed by this interagency against the park's bison via the Stephens Creek capture facility in Gardiner Basin mimics a natural process called a "dispersal sink."

The FWS states in the 90-day finding:

> In addition, permanent movement out of YNP (i.e. dispersal) is thought to have naturally occurred in the absence of management regimes (Plumb et al. 2009, p. 2383, both petitions). Therefore, winter culling may actually be serving as a surrogate for a dispersal sink (permanent movement out of the population) that would occur as a natural part of the ecosystem process.

This is misrepresentation. Plumb as a co-author never defines a dispersal sink as "permanent movement out of the population." Instead he says in "Carrying capacity, migration, and dispersal in Yellowstone bison" that:

> Dispersal is defined as movement from one spatial unit to another, without return (at least in the short term . . .).

The parenthetical statement "at least in the short term," is critically important. For bison in the Gardiner Basin that "short term" is winter. After that, all would return except for one factor: the Stephens Creek capture facility and other government culling activities. They do not return because they are killed. This is not how an evolutionarily stable dispersal sink functions. As pointed out in my petition, in order for a dispersal sink to be evolutionarily stable, animals *must return* from the source from which they dispersed. If they do not, they will become extinct, for a dispersal sink is a suboptimal habitat where, over the long term, births will not exceed deaths.

Is not the IBMP, by not allowing bison to return to their source from the Gardiner Basin dispersal sink, assuring eventual extinction of wild bison?

The 90-day finding states:

> Our standard for substantial scientific or commercial information within the Code of Federal Regulations (CFR) with regard to a 90-day petition finding is “that amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted” (50 CFR 424.14(b)).

It further states:

> The second petition discusses the ecological impacts of stocking nonnative fish, such as lake trout, in YNP waters, however, the petitioner and sources cited do not provide information regarding the potential impacts of non-native fish stocking on YNP bison. Therefore, we do not find the petitioners present substantial information that non-native species may be a threat to the YNP bison such that listing may be warranted.

This finding is either the result of an incredible misreading of my petition, or critical passages have not been read at all by the FWS evaluators.

Would not a reasonable person evaluate the entire petition, instead of just an isolated part?

Introduction of nonnative trout into Yellowstone Lake was an *example* of how invasive species can harm an ecosystem and in my petition were never directly related to harming wild bison. Instead, I made extensive references to *cattle* as being an invasive species whose presence in bison's critical habitat functions to harm bison because of the lethal removal activities of the IBMP in its attempt to protect domestic livestock grazing on the perimeters of the park.

Why was this information concerning cattle as an invasive species affecting the survival of wild bison not evaluated?

But the lack of evaluation of the information contained in my petition does not stop here.

Bison are culled because of the fear that brucellosis will spread from bison in the park to cattle grazing outside the park.

The FWS states in its finding:

> To avoid contact between YNP bison and cattle, which increases the risk of transmission of brucellosis, the YNP bison are removed from areas used for cattle grazing via hazing back into YNP, followed by, when necessary, capture, testing, and slaughter or release of captured bison,

> depending on brucellosis test results (USDI and USDA 2000, p. 6, first petition).

Later it states:

> The first concern stated in the petitions with regards to culling as disease management is its limitation on YNP bison range and population size. However, the petitions do not provide evidence suggesting IBMP activities may be a threat to the species such that the species may warrant listing. Since the conception of IBMP in 2000, the YNP bison population size has remained within the recommended 2,500-4,500 range, with the exception of 2005 and 2007 years when numbers exceeded 4,500 (Plumb et al. 2009, p. 2385, both petitions; National Park Service 2013, pp. 8, 14, first petition). Disease management is often an important aspect of wildlife management and stable-to-increasing population trends do not indicate IBMP disease management is limiting the YNP bison population.

First, as initially pointed out, a stable-to-increasing population of bison is not the issue. It is the wild quality. Secondly, for disease management to be worth its name it must manage a disease. If it does not, it is not worth carrying out, obviously. As I pointed out in the petition, IBMP's culling activity does not significantly impact the brucellosis threat emanating from the park. In the petition, I provided information that demonstrated that elk, shown recently to be more of a threat as a brucellosis vector than bison, were allowed to migrate and mingle with cattle, while bison were not.

How does this make epidemiological sense? How does allowing one infected species out of the park, but not another, control or manage the disease? Why, given these facts, did not FWS agree with the petition that cattle, instead of bison, should be removed from the ecosystem as the only rational epidemiological solution to containing the spread of brucellosis from the park to domestic animals?

Further, I document numerous times that captivity and close proximity create an environment that promotes brucellosis. Not allowing bison to migrate concentrates bison as well as does feeding elk on feed grounds. Allowing bison to migrate and occupy their historical habitat would promote dispersal and thus has the potential to reduce the prevalence of brucellosis.

Why was this position not evaluated by the FWS in its finding?

And lastly, why was my claim that mountain bison may still inhabit the park and deserve protection under the provisions of the ESA not evaluated? I provided extensive information to support that claim.

Sincerely,

Jim Horsley

I received an answer dated April 19, 2016 from the assistant regional director of the FWS's Mountain-Prairie Region. It stated:

> Thank you for your email inquiry of March 8, 2016, to Mark Sattelberg concerning our December 31, 2015, 90-day finding on bison in Yellowstone National Park. Mark forwarded your email to our Regional Office in Denver for response. This is our reply to your March 8 email. Our 2015 90-day finding was in response to two petitions, including your petition submitted March 2, 2015. We believe our finding adequately addressed concerns raised in the two petitions.
>
> We appreciate your interest regarding the bison population in Yellowstone National Park. The primary concern voiced in your email appears to be the potential impact winter culling may have on the "wildness" of Yellowstone bison as expressed by their migratory behavior. This issue was addressed in detail in our 2015 90-day finding.
>
> One thing we considered at great length is your concern over the preservation of the "wildness" trait (as expressed through migratory behavior) in the context of the purpose of the Endangered Species Act (Act) in conserving species (as defined in the Act). The Act is not designed to conserve behaviors/traits. The Act states that, to the maximum extent practicable, the Service will make a finding as to whether the petition presents substantial information indicating that the petitioned action is warranted. In the case of a petition to list a species, we consider whether there is substantial information that a species may be in danger of extinction throughout all or a significant portion of its range or likely to become endangered within the foreseeable future throughout all or a significant portion of its range; in other words, whether the species may meet the definitions of endangered or threatened. It could indirectly preserve traits if we have evidence that lack of that trait is somehow affecting the species to the point that it meets the definition of threatened or endangered. Then we could list the species based on whatever stressor is causing the lack of that trait that is proven to be crucial to its continued existence. This is where substantive information is lacking. Distribution, abundance, and trends of the bison population in Yellowstone National Park do not support a conclusion that this population is endangered, either now or in the foreseeable future.

We also considered your concern that culling will artificially select for bison that do not migrate, and that Yellowstone bison will somehow be less “wild” because of it. However, as our finding stated, they still do migrate, numbers overall are stable to increasing, and there is evidence that migration is a learned behavior. We agreed that plains bison (Bison bison bison) can best retain their full wildness in large populations experiencing minimal human influences and exposed to the same natural factors that historically impacted bison herds. Unfortunately, today's developed landscapes often limit opportunities to conserve bison under completely natural conditions. Interestingly, winter migration out of Yellowstone National Park by bison did not begin in substantial numbers until the severe winter of 1975/76 (Meagher 1989). Therefore, it may be a learned behavior.

The assumption that culling bison will eventually lead to the proposed migratory trait being artificially selected out of the herd *may* be possible. However, the petition provides only speculation and inappropriate surrogate comparisons that this will happen in Yellowstone bison, tenuously leading to a population decline in Yellowstone bison, which, in turn, will cause the Yellowstone bison to meet the definitions of threatened or endangered. Yellowstone bison are a highly managed population that shows no evidence of trending towards threatened or endangered now or in the future.

In our 2015 finding, we agreed that culling has not eliminated brucellosis in Yellowstone bison. The Interagency Bison Management Plan notes that within the Park, the National Park Service has management jurisdiction; when bison leave the Park, the State of Montana has management authority. Other agencies with roles under the Management Plan include the U.S. Forest Service and Animal and Plant Health Inspection Service. The intention of the Management Plan is not to eradicate brucellosis in Yellowstone wildlife, but to control its spread to livestock, which it has done. Management practices to improve the nutritional condition of Yellowstone bison and thereby improve their immune response to infection and increase the effectiveness of vaccines are underway and may help to address concerns related to brucellosis (see Treanor 2012 and Treanor et al. 2015).

Your email also asserted that mountain bison (aka wood bison; *Bison bison athabascae*) may inhabit the Park. There is contentious debate regarding both genus and subspecies designations for bison. However, if we assume that the subspecies designations for plains and wood bison are correct, the dividing line between historical ranges for the two subspecies is considerably north of Yellowstone National Park, running generally east-west through the central portions of British Columbia, Alberta, and Saskatchewan. We addressed plains bison in our 2015 90-day finding. We recognize that an article by Meagher (1973) spoke of a population of mountain bison originally present in the Park, but we are not aware of additional articles by Meagher or others that support this possibility.

Even though we maintain that a 12-month status review of the Yellowstone bison is not warranted, we believe that understanding and support for bison conservation continues to grow, and with it an improvement in bison management leading to increased conservation of this iconic species. Thank you again for your interest in Yellowstone bison.

Sincerely,

Assistant Regional Director

What I found most astounding was this statement:

> One thing we considered at great length is your concern over the preservation of the "wildness" trait (as expressed through migratory behavior) in the context of the purpose of the Endangered Species Act (Act) in conserving species (as defined in the Act). The Act is not designed to conserve behaviors/traits.

This was an eye opener. A great proportion of my petition was devoted to showing how various traits and behaviors of wild bison were being put into jeopardy by the culling actions of the IBMP. If these traits in and of themselves did not count, and would only count if—and only if—there was an associated decline in numbers of bison, no wonder my petition was rejected.

The rejection of my petition all hinged on the meaning of “species” as defined in the Endangered Species Act. That definition is:

> The term “species” includes any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.

Under the terms of that definition, bison in the park could evolve into creatures that sat on logs, powdered their noses, sipped tea from a cup held by hoof and rocked their calves in a cradle, but as long as they looked like bison, they still would be considered bison despite changes in behavior. Why? Because the only thing that counts regarding existence as a species is if the members of that species are capable of interbreeding.

But is that really so, according to the definition of species as contained in the act? No. That is merely an opinion by the FWS of what species means. Under the section in the act termed “Definitions,” it states numerous words or phrases “mean” this or that. However, with regard to the definition of species, it does not say what their definition “means,” but instead states that it “includes” the definition given. The definition of “species” that is given in the act is just an example of one among many used by scientists and is not limited to that example.

Zoologist Kevin De Queiroz, National Museum of Natural History, Smithsonian Institution, noted there are at least 24 species concepts advocated by different groups of biologists, including the biological, ecological, evolutionary, cohesion, phylogenetic, monophyletic, genealogical and phenetic concepts. The meaning chosen by an investigator or evaluator can dramatically affect a decision reached vis-à-vis a petition for listing or how to conserve a species (De Queiroz, 2007).

The one cited in the act is known as the biological species concept (BSC). It is not *the* definition of “species,” but one among many—an example only. According to evolutionary biologist Leigh Van Valen,

> The usual concept of species can be stated as follows (Mayr, 1970): “Species are groups of interbreeding natural populations that are reproductively isolated from other such groups.” This concept is grandly called “the biological species concept.” But that is an arbitrary appropriation of a term with a more general and earlier meaning. I will instead use the term “reproductive species concept” (Van Valen, 1976).

From this perspective, a biological species is a group of individuals that can breed together, but can not breed with other groups. A new species is formed when an existing species splits due to reproductive isolation. Once a species lives in two different areas, the geographical isolation makes breeding between the groups reduce or stop. Each group develops features which make breeding between them work less well. Eventually, each group becomes a separate biological species, because the two species do not reproduce with each other even when they are together (Biological Species Concept, 2016; Mayr, 1982, p. 273).

But this definition has some difficulties. For instance, how does one define an asexual species? Hydras, a type of freshwater animal related to jellyfish, reproduce asexually by developing small, genetically identical polyps that protrude from the parent. These polyps break off from the parent to form a new organism in a process called "budding." Budding does not involve interbreeding.

Another problem: since field studies are rarely done to confirm that individuals in the wild are mating and producing young, the only tenable verification of interbreeding is numbers of individuals in a group. If the numbers are stable or increasing, all is supposedly well, regardless of evolving behavior or traits. Only when the numbers of the group members are decreasing is a link examined between behavior or traits, for a decline shows the possibility that the species is endangered or threatened by some cause. The biological species concept hinges on the ability to reproduce, making the defining feature for speciation a *process*, instead of a trait or behavior, thereby setting the stage for discounting the importance of conserving a trait or behavior.

And yet another problem: in the context of Yellowstone Park how can the FWS legitimately apply this definition as a reason to not intervene via its power to protect a species when one considers that the IBMP by its lethal removal of migratory bison is by definition doing what will create a new species, that is, physically isolating over time two groups of animals, migratory bison and non-migratory (resident) bison? The IBMP is making the park equivalent to an island. In effect, all those that attempt to get off of it die and can not interbreed, leaving the variant, the non-migratory wild bison, the only type left.

Theoretically, come a very harsh winter, this new species, because they no longer possess members that can migrate, could all perish, trapped in high elevations because of the loss of the genetic trait of migration from the once interbreeding migratory and non-migratory bison herd, bringing to extinction the entire subspecies. This possibility has been termed "speculation" by the FWS. But is it not also speculation by the FWS that this will not happen? Yet the agency responsible for carrying out the Endangered Species Act is comfortable with speculating extinction will not happen and thus does not protect migratory wild bison.

Limiting the definition of a species to the inability of members of two groups to reproduce is not a good taxonomic standard for speciation, especially in terms of conserving species that may look substantially the same, but have subgroups with variant morphologies, such as different beak sizes, viz. Darwin's finches, or that behave differently, such as the Yellowstone bison. Conservation of varieties, rather than just species, is important when that variety can save the entire species from extinction at some evolutionary point in time. What is needed is a more realistic and practical definition. To conserve a species, it may sometimes be necessary to conserve a variety of a species, for the meaning of species is blurred. Charles Darwin noted:

> Hereafter, we shall be compelled to acknowledge that the only distinction between species and well-marked varieties is, that the latter are known, or believed, to be connected at the present day by intermediate gradations, whereas species were formerly thus connected (Darwin 1859, p. 485).

A better candidate than the biological species concept for revaluating the status of the Yellowstone bison would be the ecological species concept. Zoologist Mark Ridley, Oxford University, in the textbook *Evolution* defines the concept:

> The ecological species concept is a concept of species in which a species is a set of organisms adapted to a particular set of resources, called a niche, in the environment. According to this concept, populations form the discrete phenetic clusters that we recognize as species because the ecological and evolutionary processes controlling how resources are divided up tend to produce those clusters. Ecological research, particularly with closely related species living in the same area, has abundantly demonstrated that the

differences between species in form and behavior are often related to differences in the ecological resources the species exploit (Ridley, 2003).

In biology, phenetics (also known as taximetrics) is an attempt to classify organisms based on overall similarity, usually in morphology or other observable traits, regardless of their phylogeny or evolutionary relation. This has particular application to Yellowstone's wild bison because they have a unique relationship with the environment. Unlike most bison, they do not migrate horizontally across the plains, but instead altitudinally. They are dependent for long-term survival as a herd on Gardiner Basin which, as mentioned, functions as a "dispersal sink."

As mentioned, by limiting movement in the ecosystem on which wild bison depend for survival, IBMP, with the sanction of the FWS, is setting the stage for a cascade into extinction by killing in the fall and winter all bison that migrate into the low region of the park, Gardiner Basin, and then in the event of an extraordinary winter, finding in the spring that winter-kill destroyed all those animals that stayed behind in the park. Because the potential genetic saviors—the migratory herd—have been eliminated by the IBMP, the net result is extinction of that entire subspecies at Yellowstone.

But according to the FWS in its 2015 finding, since the bison population is stable and not decreasing, it is no big deal if they destroy the migratory members of the herd. Why does the FWS think this? Because the FWS administrative staff is blind to the need of a diversity of traits and behaviors among wild bison subgroups—in particular the migratory and the non-migratory herds—and does not count as significant the migratory herd, a herd that is forced to decline every year by means of large-scale lethal removals by the IBMP.

Another species definition is called the phylogenetic species concept (PSC), which views a species as an irreducible group whose members are descended from a common ancestor and who all possess a combination of certain defining, or derived, traits. The term phylogenetic comes from "phylogenesis," the evolutionary development and diversification of a species or group of organisms, or of a particular feature of an organism. In phylogenetic terms, a trait is called an apomorphy.

In this definition of species traits and behavior count.

The incapacity for two groups of animals to interbreed may not be the defining attribute of speciation. This may be too simplistic. Not interbreeding could be viewed as an apomorphy, a trait-derived behavior whereby one group of animals becomes unattractive to members of a splinter group, such as a divergence in song among birds that become isolated from one another. This would make distinct species because the two bird groups, when put together after a sufficient period of time, do not recognize the mating call of another, and thus do not mate.

Finches that inhabit the Galapagos Islands, collectively known as Darwin's finches, display a great diversity in beak form and function. They are thought to have evolved from a parent flock that was blown by strong winds from South

America to these islands in the Pacific. Over time these birds came to inhabit island after island in a chain of islands. Field studies have shown that beaks evolve by natural selection in response to variation in local ecological conditions.

For instance, evolutionary change in beak depth in the population of ground finches (*Geospiza fortis*) on the island of Daphne Major were studied by Princeton University biologists Rosemary and Peter Grant. They found:

> Birds with small beaks and small body size suffered selective mortality in 1977, during a severe drought . . . The larger members of the medium ground finch population survived on a diet of large, hard seeds, which increasingly dominated the food supply as a result of an initial preferential consumption of small seeds. Smaller birds, lacking the mechanical power to crack the large seeds of *Tribulus cistoides* [a low-growing flowering plant] and *Opuntia echios* [a prickly pear], died at a higher rate than large birds. An evolutionary response to directional natural selection followed in the next generation . . . because beak size variation is highly heritable.

On the other hand,

> Natural selection in the opposite direction, with small birds surviving disproportionately, occurred 8 years later. The island experienced a major, prolonged El Niño event from November 1982 to August 1983. The abundant rain and high temperatures transformed the vegetation and food supply of the finches, and they bred for 8 months as opposed to the usual 1 or 2 months. Vines and other plants multiplied and spread, smothering the low-growing *Tribulus* plants and *Opuntia* cactus bushes. The seed supply became dominated by small seeds, and seeds of *Tribulus* and *Opuntia* became scarce. When the island entered the next drying-out episode during the drought of 1985, the supply of seeds fell, and so did the numbers of finches from high points in the productive years of 1983 and 1984. Large birds died at the highest rate; hence, the medium ground finches that were small, with relatively pointed beaks, were selectively favored.

What they believed they were observing was the beginning stages of the formation of a separate species. The authors noted:

> Speciation begins with the divergence of a population and is completed when two populations that have diverged on different islands establish coexistence with little or no interbreeding . . . We obtained insight into the initial process of divergence on Daphne Major, thanks to a highly fortuitous circumstance: the founding of a new population (Grant, 2003).

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What could cause the cessation of interbreeding? A 2004 study by biologists Jeffrey Podos, University of Massachusetts, and Stephen Nowicki, Duke University, suggests that as a consequence of beak evolution, changes occurred in the structure of finch vocal signals, since beaks play a functional role in song production in songbirds. Because song plays a significant role in finch mating dynamics, the study hypothesizes that the functional link between beaks and song may have contributed to the process of speciation and adaptive radiation in these birds (Podos, 2004).

The lack of two related groups of animals to interbreed is the end result of evolutionary divergence. In the case of conserving a species, if it gets that far, it may be too late, for the species from which the other diverged may have become extinct.

Variation protects a species from extinction. In the case of the ground finches, variation in beak sizes protected the species from environmental changes in drought and wet seasons. But what would happen if a prolonged drought left only large-beaked finches, and then a prolonged wet season occurred? With no smaller-beaked birds, that finch species would perish.

What would happen if during some exceptionally harsh winter, all the bison remaining in the park—the resident, non-migratory bison—were killed due to the extremely low temperatures and the inability of those animals to break through the ice that sometimes encrusts the landscape, thereby making them unable to forage? What would happen to the wild Yellowstone bison as a species if the only ones that escaped the winter kill and starvation inside the park were the ones that descended to the lower levels of Gardiner Basin—those with migratory behavior—but wait, they were the very ones all killed by the lethal removal actions of the Interagency Bison Management Plan, which had continued its despoliation of wild bison because the Fish and Wildlife Service continued to refuse to protect these animals? Ask the IBMP and the FWS.

If asked prior to such a catastrophic event, most likely they would have said something like what the FWS said in its March 8, 2016 letter regarding my petition:

> The assumption that culling bison will eventually lead to the proposed migratory trait being artificially selected out of the herd *may* be possible. However, the petition provides only speculation and inappropriate surrogate comparisons that this will happen in Yellowstone bison, tenuously leading to a population decline in Yellowstone bison, which, in turn, will cause the Yellowstone bison to meet the definitions of threatened or endangered. Yellowstone bison are a highly managed population that shows no evidence of trending towards threatened or endangered now or in the future.

Most likely they would have said prior to the extinction of that herd that the wild bison in the park were abundant and that they were still migrating (albeit into slaughter houses), so no problem. What would convince the FWS that the IBMP's present culling practices could lead to extinction is hard to know. In my 2015 petition, I had cited a number of instances where migration had ceased in various species due to a variety of factors. To clarify this matter, on May 16, 2016, I asked Sattelberg, with copies to his supervisor and various FWS officials, "Why were the comparisons provided in my petition deemed 'inappropriate surrogate comparisons'"? He did not answer. On June 4, 2016, I wrote again. No answer.

In the FWS's April 19, 2016 letter to me, it discounts the impact of killing only the migratory bison by noting:

> We also considered your concern that culling will artificially select for bison that do not migrate, and that Yellowstone bison will somehow be less "wild" because of it. However, as our finding stated, they still do migrate, numbers overall are stable to increasing, and there is evidence that migration is a learned behavior.

That migration may be a learned behavior *substantiates*, instead of discounts the position held in my second petition, as well as this one. If one kills all those members of a species that know the way out of the park, the knowledge of how to survive an especially severe winter, i.e. migrate, is gone from that species, putting that species' existence in jeopardy.

And incidentally, if behavior does not count to the FWS, why is it mentioning behavior?

Flawed wildlife management decisions by governmental bodies can potentially lead to extinction of the species mismanaged, for they can put that species into an ecological trap from which there may be no escaping. Martin A. Schlaepfer, an ecology and evolutionary biologist at Cornell University, in a 2002 review article co-authored by biologists M.C. Runge and P.W. Sherman titled "Ecological and evolutionary traps" noted:

> Organisms often rely on environmental cues to make behavioral and life-history decisions. However, in environments that have been altered suddenly by humans, formerly reliable cues might no longer be associated with adaptive outcomes. In such cases, organisms can become "trapped" by their evolutionary responses to the cues and experience reduced survival or reproduction. Ecological traps occur when organisms make poor habitat choices based on cues that correlated formerly with habitat quality. Ecological traps are part of a broader phenomenon, evolutionary traps, involving a dissociation between cues that organisms use to make any behavioral or life-history decision and outcomes normally associated with that decision. A trap can lead to extinction if a population falls below a critical size threshold before adaptation to the novel environment occurs. Conservation and management protocols must be designed in light of, rather than in spite of, the behavioral

> mechanisms and evolutionary history of populations and species to avoid "trapping" them (Schlaepfer, 2002).

Examples of ecological traps are asphalt roads that because of the way they reflect light look like lakes to mayflies. The female mayflies because of this reflective quality lay their eggs on the roads, destroying the eggs. Or take a certain beetle. Landfills or roadsides with bottles and broken glass appear to male beetles as female beetles. They attempt to mate with these shards, but of course produce no young. These species have made maladaptive decisions to their environment that reduce the species' productivity (Schlaepfer, 2002).

In the case of wild bison, herds have been migrating down the mountains in Yellowstone for millennia. Such seasonal movement worked for their survival. But now the environment has turned into an ecological trap whereby the cues to leave the high ranges—such as high snow levels, low temperatures and ice that crusts over their forage—no longer serve to protect them but instead doom them. The authors' conclusion that, "In such cases, organisms can become 'trapped' by their evolutionary responses to the cues and experience reduced survival or reproduction" accurately describes what is happening to the park's wild bison except for one element: they do not become figuratively "trapped" by their environment but are, indeed, literally trapped by means of the Stephens Creek capture facility operating on park land by government personnel.

In this case there is an easy fix—stop trapping them. Stop making the Yellowstone bison "a highly managed population." Nature thrives on *not* being managed. Instead, keep human intrusion out. It is human despoliation and the introduction of invasive species such as cattle that should be managed.

What is the FWS's response to my petition concerning the possibility that mountain or wood bison inhabit the park? That only one person, Margaret Meagher, in "an article" says they exist there. The FWS states:

> We addressed plains bison in our 2015 90-day finding. We recognize that an article by Meagher (1973) spoke of a population of mountain bison originally present in the Park, but we are not aware of additional articles by Meagher or others that support this possibility.

FWS's implicit conclusion: forget it and what this Margaret Meagher says does not count. Staff of the Fish and Wildlife Service, let me introduce you to Margaret Meagher. Now retired, she is one of Yellowstone National Park's most renowned naturalists and was a research biologist with the National Park Service. She wrote not "an article" in 1973, but the definitive book on Yellowstone's bison, a doctoral thesis at the University of California at Berkley, called *The Bison of Yellowstone National Park*, published by the National Park Service in its scientific monograph series. Must have some value in establishing the existence of mountain bison in Yellowstone, don't you think?

What about Meagher's statement, as quoted in my 2015 petition that:

> The 1964 skull (Figure [95]) found on the Mirror plateau was identified by Skinner (1965) as "an exceptionally long horned, apparently young Mountain bison = B. (B.) b. athabascae . . ."

Does not the finding of a skull identified as belonging to the species *Bison bison athabascae* help to substantiate the presence of mountain bison in the park?

Figure 8a. MARGARET MARY MEAGHER, Yellowstone research biologist, in the field (McClure, 2016). ***Courtesy National Park Service, Yellowstone National Park, Detail of YELL 180308-1.***

Further, my petition of 2015 includes an extensive email exchange between myself and Bob Jackson, a former Yellowstone National Park ranger, discussing his sightings of mountain bison. Is that not worth considering?

But of course, being that mountain bison are identified as a species in part due to their behavior, namely very wild in nature, fearful of man and travelling in small bands, even if they existed, their existence as a species would not count to the FWS under its concept of a species—the biological species concept—where behavior and traits are not worthy of conservation.

Even though the government by its wildlife management practices is killing sometimes over a thousand wild bison in a year, even though the government only kills migratory bison, even though the government itself recommends against large-sale culling, and even though this culling may include rare mountain bison, there is no need to protect them in their historical range, which includes Gardiner Basin, Paradise Valley and Hebgen Basin, from this slaughter—according to the Fish and Wildlife Service. Wild bison are doing just fine—so they say. It is a lie.

By government edict, wild bison have been banned from the habitat on which they have depended for survival for the last 10,000 years. But wild bison are doing just fine—so they say. It is a lie.

Figure 9. INDIANS HUNTING BISON. Illustration by Karl Bodmer. *Image in the public domain.*

4

The buffalo commons

It was called the “buffalo commons.” It is located in Montana south of the Upper Missouri River, north of the headwaters of the Yellowstone River, east of the Rocky Mountains and west of Crazy Mountains. The region was included in the Treaty of Fort Laramie, 1851, in which it was specified that the Indian nations that were party to the agreement “do not surrender the privilege of hunting, fishing, or passing over any of the tracts of country heretofore described” (Kappler,.1904).

It is a short grass prairie. It was once rich in bison. Indian tribes from the Columbia Basin, the “Western Indians,” as well as those tribes in the Upper Missouri, Musselshell and Yellowstone watersheds would “go to buffalo” here. Those on the western side of the Rocky Mountains would travel 400 to 600 miles to reach this destination. Besides hunting here, they also traded goods with Plains Indian tribes. As Alvin M. Josephy in *Nez Perce Country* points out:

> Nez Perce packed their horses with berries and roots, cakes of camas, dried fish, salmon oil in sealed fish skins, bows of mountain sheep horn, seashells, mountain grass hemp, and other products of he Northwest and traded them on the plains for dressed buffalo robes, rawhide skins, buffalo-hide lodge covers, beads, feathered bonnets, stone pipes, and various goods that had come from farther east in intertribal trades (Josephy, 2007, p. 24).

Gradually, the number of bison dwindled on the plains due to the United States government's genocidal policy of eliminating the Indians' lifeline, the buffalo—a strategy employed to obliterate the tribes' ability to function as sovereign nations. The government wanted the tribes dependent. They wanted them to eat beef. Bison made them free. To do this, they employed genocide.

While the term was not in use at that time, genocide is descriptively appropriate for what was being practiced against the American Indians. The word was originally coined in reference to the Nazi extermination of Jews, meaning literally "killing a tribe," from Greek *genos* "race, kind" and Latin *cidium* act of killing. By the mass destruction of bison, the government was deliberately inflicting on the tribes conditions of life calculated to bring about their physical destruction.

Because of the mingling of the diverse tribes coming to this common hunting ground and because of the ever-decreasing supply of bison, there was intertribal war here. But the government did not want this—it wanted peace here so that settlers could occupy the region, so a survey for a northern route of the transcontinental railroad could be made, and so treaties for land cessions made with the Indians of the Columbia Basin could be fulfilled.

To accomplish this, Isaac I. Stevens, governor of Washington Territory, had been authorized by the United States to make treaties involving huge land cessions with tribes in his region west of the Rocky Mountains. The treaties of cessions had been sweetened with the government's promise to provide protected hunts on the common hunting grounds east of the Rockies.

In exchange for giving up large portions of their land, they were provided reservations. For some of the tribes, such as those signing the Nez Perce Treaty of 1855, the Flathead Treaty of 1855 (signed by the Pend d'Oreille, Flathead and Kootenai) and others, they were given off-reservation hunting privileges, including "the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land" (Treaty with the Nez Perces, 1855; 1904) (Treaty with the Flatheads, etc., 1855; 1904). This "open and unclaimed land" was interpreted as including the common hunting ground controlled by such tribes as the Blackfeet east of the Rockies.

Stevens told Columbia River tribes meeting at Walla Walla in 1855 that:

> We want you to have your roots and to get your berries, and to kill your game. We want you, if you wish, to mount your horses and to go to the Buffalo plains and we want more, we want you to have peace.

But the consent of the Blackfeet and the other tribes to the east had not been secured. Something had to be done and something revolutionary was proposed. Instead of attempting to make the tribes give up land in this plains region, the United States government was trying to broker peace between the tribes east and west of the Rockies to make its past agreement to the Columbia Basin tribes tenable.

In the fall of 1855 Stevens convened a meeting between government officials and tribes consisting of the Piegans, Bloods, Gros Ventres, Blackfeet, Nez Percés and Flathead. Large, leafless trees loomed over the gathering, with a number of tipis and military tents pitched under them (Farr, 2001). The Indians were dressed in their best. As Stevens once noted concerning the Blackfeet:

> The chiefs and warriors were all richly caparisoned. Their dresses of softly prepared skins of deer, elk, or antelope were elegantly ornamented with bead-work. These are made by their women, and some must have occupied many months in making. The other articles of their costume were leggings made of buffalo skins, and moccasins, also embroidered, and a breech-cloth of blue cloth. Their arms were the Northwest guns, and bows and arrows. On all solemn occasions, when I met the Indians on my route, they were arrayed with the utmost care. My duties in the field did not allow the same attention on my part, and the Indians sometimes complained of this, saying, "We dress up to receive you, and why do you not wear the dress of a chief?" (Stevens, 1900, p. 373).

It was two worlds coming together with completely divergent ways of life. One world, those from Europe, was based on domestic animals for substance, in particular cattle, while the other, the Indian nations, was based on wildlife, in particular bison.

They had completely different ways of relating to wild animals. In Asia centuries ago, war lords and sultans would drive herds of European bison, called wisents, and other large ungulates into a funnel of fencing that emptied into a stockade. Sitting on a scaffold in the middle of the captured throng would be the sultan and his consort. Capture was done for amusement. Some of the animals were killed, some let go. Or they would devise game drives. Thousands of peasants formed a human noose several miles in diameter around areas teeming in wildlife and slowly walk toward the center, dispatching the animals as the human circle tightened.

In Europe they dug pits to capture and kill bison. Then with the development of firearms, the large ungulates were further reduced. Over millennia, the population of megafauna diminished until no wild bison or aurochs, a wild form of cattle, were left. In fact aurochs, fierce beasts, the ancestors of all cattle today, became extinct and the wisents were reduced to a few in zoos. They once roamed in large populations over the steppes and through the forests of Europe and Asia. They were replaced by cattle and other livestock.

In America prior to European settlement, the opposite was the case. The native cultures thrived on wildlife. Preeminent for nutrition, clothing and shelter were bison. But that was not to the liking of the newly-arrived Europeans. Many didn't like bison. For that matter, many didn't like wolves. Wildlife for many of the new arrivals was frightening because it could not be controlled and because it threatened their cattle, either through predation or range competition.

The Blackfoot Peace Council, as it came to be called, was held at the confluence of the Judith and Missouri Rivers October 17, 1855. Standing under an impromptu canvas shelter with his staff, Stevens set out the government's vision for the future. He told them:

> We want to establish you in your country on farms. We want you to have cattle and raise crops. We want your children to be taught, and we want you to send word to your Great Father, through us where you want your farms to be . . . This country is your home. It will remain your home. And as I told the Western Indians we hoped . . . the Blackfeet would not live on poor Buffalo Meat but would have domestic Cattle for food. We want them to have Cattle.

He added:

> You know the Buffalo will not continue forever. Get farms and cattle in time (Farr, 2001).

With interpreters for each tribe, the treaty was read. Of particular interest is Article 3. It states:

> The Blackfoot Nation consent and agree that all that portion of the country recognized and defined by the treaty of Laramie as Blackfoot territory, lying within lines drawn from the Hell Gate or Medicine Rock Passes in the main range of the Rocky Mountains, in an easterly direction to the nearest source of the Muscle Shell River, thence to the mouth of Twenty-five Yard Creek, thence up the Yellowstone River to its northern source, and thence along the main range of the Rocky Mountains, in a northerly direction, to the point of beginning, shall be a common hunting-ground for ninety-nine years, where all the nations, tribes and bands of Indians, parties to this treaty, may enjoy equal and uninterrupted privileges of hunting, fishing and

gathering fruit, grazing animals, curing meat and dressing robes (Treaty with the Blackfeet, 1855; 1904).

Figure 10. THE BLACKFEET TREATY COUNCIL held between Isaac Stevens and the Blackfeet Indians. Stevens is standing under a canvas shelter at the center with a group of other Euro-Americans. He has both hands on the lapels of his coat. Rows of Indians are seated on the ground looking toward Stevens. Military tents and tipis are visible in the background. Date October 1855. Drawn by Gustav Sohon. ***Source Wikimedia Commons. Media file in the public domain.***

Essentially, this comprises the Greater Yellowstone Ecosystem’s northwestern region and is roughly bounded by a line running from the Rocky Mountains near Missoula east to the source of the Musselshell River near White Sulphur Springs, south to Livingston (Twenty-five Yard Creek is now Shields River just east of Livingston), then to Yellowstone Lake and back along the Rocky Mountains to the point of starting near Missoula.

The Blackfeet were to allow their country to be a common hunting ground for ninety-nine years, more than the lifetime of any member presumably, and then it would revert back. But ten years later, it was all over. In 1862 gold was discovered on the common hunting ground. Three years later no bison could be found on the buffalo commons. Instead, mining camps dotted the landscape (Making treaties, 2015).

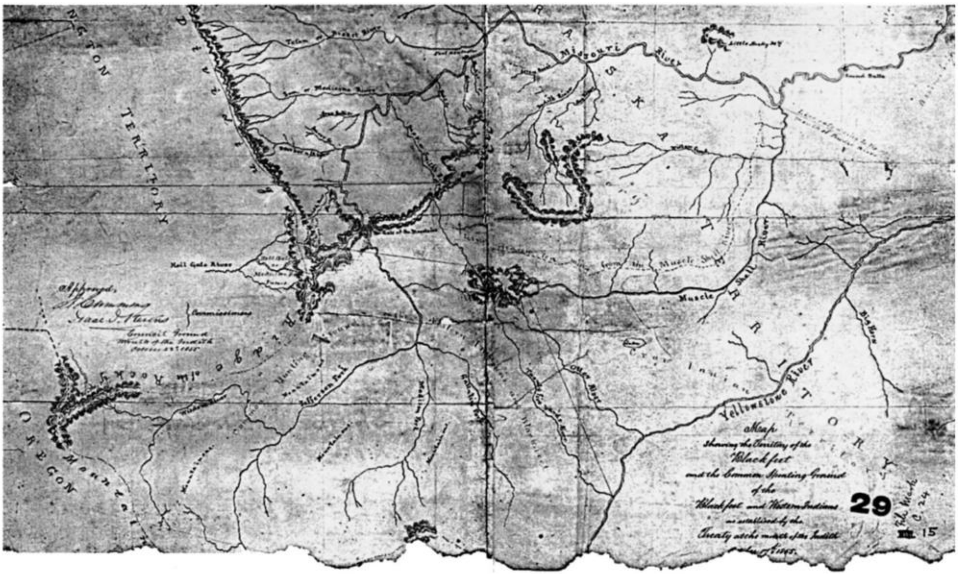

Figure 11. COMMON HUNTING GROUND. Map showing the Territory of the Blackfeet and the common Hunting Ground of the Blackfeet and Western Indians as established by the Treaty at the mouth of the Judith, 17 October 1855. ***Courtesy of National Archives, Records of Bureau of Indian Affairs, RG75, Microcopy T-494, Roll 5, Frame 1093*****.**

In the minds of some, the best way to persuade a hunting culture to "get farms and cattle" is to take away what they hunt. The best way to achieve compliance of a hunting culture is to starve them. The best way to get a hunting culture to give up their hunting grounds is to take away what they hunt. The best way to get land on which to settle is to reduce those who first occupied the land. The best way to get a transcontinental railroad across a given land is to take out its inhabitants that might oppose the takeover. The best way to gain the control you want is to destroy the commissary of those who oppose you.

On the Great Plains the best way to do all these things would be to destroy bison.

And that is just what was done. The US government encouraged the slaughter of bison by hunters. Railroad companies offered rides on the transcontinental railroad to hunters from eastern cities, who shot bison from the windows of the compartments of their train for sport. Millions upon millions were killed. Eventually only a few bison were left—those in the recesses of the headwaters of the Yellowstone River.

Buffalo were wild and thus were publicly-owned animals. You could kill what you wanted. Cattle, on the other hand, were privately owned. When starving Indians killed a cow to survive, the military would attack and wipe out the village harboring the person who killed the cow. This happened again and again, until the Indian Wars swept across the plains. It got so bad that the Sioux chief Sitting Bull once said defiantly that he would never give up. He would protect his people and keep their ways. As I recall, he once said, “When the buffalo are gone, we will eat mice, for we are hunters and must have our freedom.”

Compliance was gained by using what is called the scorched earth policy. It was used by William Tecumseh Sherman during his March to the Sea in the American Civil War. It worked so well he used it again on the American Indian nations following the Civil War.

The strategy of destroying the food and water supply of the civilian population in an area of conflict has been banned under Protocol I of the 1977 Geneva Conventions, Article 54. Specifically, it states that for the “Protection of Objects Indispensable to the Survival of the Civilian Population”:

> 1. Starvation of civilians as a method of warfare is prohibited.
>
> 2. It is prohibited to attack, destroy, remove or render useless objects indispensable to the survival of the civilian population, such as foodstuffs, agricultural areas for the production of foodstuffs, crops, livestock, drinking water installations and supplies and irrigation works, for the specific purpose of denying them for their sustenance value to the civilian population or to the adverse Party, whatever the motive, whether in order to starve out civilians, to cause them to move away, or for any other motive.

The strategy of destroying the natural environment is also prohibited under Article 55. It states that for the “Protection of the Natural Environment:”

> 1. Care shall be taken in warfare to protect the natural environment against widespread, long-term and severe damage. This protection includes a prohibition of the use of methods or means of warfare which are intended or may be expected to cause such damage to the natural environment and thereby to prejudice the health or survival of the population.
>
> 2. Attacks against the natural environment by way of reprisals are prohibited (Clark, 2015).

These strategies were exercised in the past and are on-going against the American Indians today at the headwaters of the Yellowstone River—with the focal point being Gardiner Basin, as mentioned, a low-elevation grassland straddling the northern boundary of Yellowstone National Park. Under the management of the IBMP, the basin has been divided into three zones, a complex maze of killing fields. The portion of the basin on park property is designated Zone 1 in the *Record of Decision*. It is where culling can begin. Zone 1 is from the southern edge of Gardiner Basin inside the park to where Yellowstone River exits the park at Reese Creek. Zone 2 is from Reese Creek to Yankee Jim Canyon outside the park. Zone 3 is anywhere else. Entering any zone can be lethal for wild bison.

As they pass from one zone to another, the bison are attempting to head to the Buffalo Commons and Paradise Valley, their historic wintering grounds.

Gardiner Basin, the portion inside the northwestern corner of YNP, is the first stop. Here grow plants valuable to wild ungulates' winter survival: sagebrush, wheatgrass and fescue. The landscape has relatively mild winter conditions compared to ranges further inside YNP, owing to its lower elevation and windswept slopes (Wambolt, 2005).

Figure 12. WILD BISON GRAZING IN GARDINER BASIN. Bison entering here are slaughtered by the thousands in the heart of the Greater Yellowstone Ecosystem so beef cattle can graze here instead. *Photo courtesy of Buffalo Field Campaign.*

As noted, under the auspices of the Interagency Bison Management Plan (IBMP), a coalition of state and federal governmental agencies, wild bison are prohibited from entering Gardiner Basin, except for a token few, and from leaving the park. This is done by means of hazing and lethal removal, thereby depriving the Indian nations of vital foodstuffs. This violates Article 54, and because bison are part of the natural environment, critical to their health and survival, violates Article 55.

Five agencies were originally responsible for implementing the plan—the National Park Service, Animal and Plant Health Inspection Service, U.S. Forest Service, Montana Department of Livestock, and Montana Fish, Wildlife & Parks.

Gardiner Basin is a microcosm of the Indian and European conflict regarding wild bison. It is the last stand for bison as a wild animal and for any possibility of a return to a way of life dependent on wildlife as opposed to domesticated livestock.

IBMP proposed culling 900 bison in 2015, but killed only 740, and proposed culling 1,000 bison in 2016, but killed 603. It is getting behind in its goal of reducing the herds to a total population of 3,000 animals. It is playing a game of catch-up, a game that has the potential of driving into extinction these wild bison.

By such massive destruction of wild bison, our government via the IBMP is not only at war with wildlife, but continues its war against the American Indian and against their culture—a way of life that depended on wild bison as a staple and that had been sustained over millennia—and now truncated.

Historically and at present, the government has weakened the relationship between bison and the tribal peoples, causing a collapse of their culture. Essential to the Plains Indian's way of life is what Europeans would call the peasant way of life, where one provides all the essentials for living as a family unit and where the "common man" had access to a common, wild region for the purpose of grazing livestock, collecting firewood and hunting.

Enclosure, taking away the commons by the European nobility through legislative actions, stopped all that and is one reason Europeans came to America, for it created a landless working class. Privatization in Europe was accomplished by the erection of walls, fences or hedges around the once common land and the setting of boundaries (Enclosure, 2015).

Now they, the new immigrants, imposed the ways of the nobility from which they had escaped on the native inhabitants of the New World. They gradually took away the commons, which was most of America, after they arrived. Deprived of an active relationship with the environment and forced to specialize (which usually means an indoor job), instead of riding after the buffalo, instead of scraping hides, instead of making bows and arrows, instead of a direct involvement with nature, the Indian people have been forced to be more sedentary, eating beef and white bread and in the end, getting diseases such as diabetes. And this annihilation of a way of life happened less than 150 years ago, requiring a massive readjustment of the Indian society.

Because this relationship has been broken by the industrial-scale killing of wild migratory bison and because privately owned bison are being treated like beef cattle (feedlots, routine antibiotics, castration, selective breeding and artificial insemination) (Williams, 2001), bison are being reduced to domesticated animals, animals that do not have the ability to survive on their own in harsh climates in the wild.

It was the inter-relationship of the Indian people with wild bison on a natural, unfenced, unrestricted habitat that kept both the Indian and the bison healthy. Douglas H. Chadwick summed it up in an InterTribal Buffalo Council blog "Where the Buffalo Now Roam." He said:

> Bison were once a wellspring of sustenance and spiritual strength for the Sioux and other Plains Indians. Today, tribes across the country are working to return herds to their lands. This is far more than an effort to simply re-establish a keystone species and improve habitats for other grassland wildlife. To bring back bison is to regain a primary source of healthy natural food amid the modern epidemic of obesity and diabetes afflicting Native Americans, re-invigorate cultural traditions and provide new economic opportunities (Chadwick, 2015).

In my 1999 petition I called upon the government to follow the Blackfeet Treaty of 1855. I wrote the following excerpted passages:

> A suitable extension of their [bison's] habitat would be the region north of the Yellowstone River, once a common hunting ground designated for the Blackfoot and Flathead nations under a treaty in 1855.
>
> *   *   *
>
> At present several plans are being studied as to how best to manage these animals, from one plan allowing free-ranging to one, a Senate bill, advocating the elimination or forcible return of all Yellowstone buffalo leaving the Park.
>
> No plan involves the Native American, which seems to demonstrate a degree of racial arrogance, especially when you consider that the American Indian has had an 11,000-year association with the buffalo and was responsible for successfully herding the animals, which reached a population on the plains in excess of 30 million.
>
> *   *   *
>
> It would thus make good common sense to include the Native American in any program aimed at stopping the destruction of this endangered distinct population group. As a possible solution to a tenable habitat, the region north of the Yellowstone River, historically set aside for the buffalo and its hunting by Plains and Columbia Basin Indians, should be studied.
>
> *   *   *
>
> Based on the historical use of the region set aside for buffalo hunting for the American Indian tribes, namely the area north of the Yellowstone River, the Petitioner requests that this region be considered as a habitat, a reserve allowing the buffalo the expression of its migrating instinct. Further, the

> Petitioner requests that the Native American be involved in the management of the Yellowstone buffalo to assure their survival (see Appendix A).

Eight years later, the US Fish and Wildlife Service, the agency in charge of the administration of the Endangered Species Act, published in the Federal Register its decision in a document titled "90-Day Finding on a Petition To List the Yellowstone National Park Bison Herd as Endangered." With regard to involvement of Native American tribes in the preservation of wild bison, it stated:

> The petition also asserts that the herd may be a unique hybrid of the wood and plains bison, and the herd has historical and cultural significance to Native Americans.

It continued:

> The Petitioner's assertion that the YNP bison were important to Native Americans also is supported by Gates et al. (2005, p. 77) (e.g., "The Lamar Valley and the Yellowstone River Valley north to Livingstone was an important area for bison and Native peoples throughout the Holocene."). We agree with the Petitioner that the YNP bison herd has substantial cultural and historical value. However, the significance criteria in our DPS Policy are based on biological factors identified in the Act that show that the population is significant to the taxon, and not on human cultural or historical significance. Therefore, we did not evaluate cultural and historical significance in our DPS analysis, but rather relied solely on the scientific criteria in the DPS Policy.

The scientific criteria in the DPS Policy were stated in the finding:

> Under our DPS Policy, in addition to our consideration that a population segment is discrete, we consider its biological and ecological significance to the taxon to which it belongs.

What evidence is to be considered? Several are listed. One of them is particularly relevant to habitat and the involvement of the American Indian ecologically. The finding states:

> This consideration may include, but is not limited to: (1) Evidence of the persistence of the discrete population segment in an ecological setting that is unique or unusual for the taxon.

Of particular interest ecologically is Gardiner Basin. The 2007 FWS finding of my original petition continues:

> Bison move beyond Park boundaries in late winter in response to forage limitation caused by interactions between population density, variable forage production, snow conditions, and grazing competition (Gates et al. 2005). The Gardiner Basin has been considered important winter range for bison since at least the 1940s and is an important component of the Northern winter range; in contrast, the West Yellowstone area does not have unique ecological value as winter range according to Gates et al. (2005). For these reasons we believe there is substantial information that the Gardiner Basin provides resiliency to the herd during harsh winters, and, therefore, may constitute a significant portion of the range for the potential YNP bison herd DPS (Endangered and threatened wildlife and plants; 90-Day finding on a petition to list the Yellowstone National Park bison herd as endangered, 2007).

The Yellowstone River runs north from its headwaters through Gardiner Basin and Paradise Valley. It is the beginning of the historic "buffalo commons," the very habitat preserved by the Blackfeet Treaty of 1855 as "common hunting grounds."

What taxon thrive here? Wild bison. What did this ecological setting historically comprise? Wild bison, Plains Indian tribes and Columbia Basin Indian tribes. It also constitutes what is called a "dispersal sink," a habitat where animals travel to survive for a time, then return to more favorable habitat.

Why is this setting unique or unusual for the taxon in question? Because it is this setting that promoted the survival of wild bison. This low-elevation grassland is vitally important. Here is where varying percentages of bison come to escape harsh winter condition that can be deadly in the high altitudes of the park. As the 2007 FWS finding explains:

> The proportion of Yellowstone bison that move to winter ranges outside YNP varies from 3 to 30 percent per year, depending on conditions.

But what is the major ecological factor now operating in Gardiner Basin? The IBMP and its extermination actions against wild bison. It is` more lethal to wild bison than the worst of winters.

Let us look a little more closely at what is going on here on the park's northern border. Suppose a catastrophic winter hits Yellowstone National Park, one that covers the interior valleys of the park in deep snow, then warms up, melting the top layer of snow, then ices over as a deep freeze sets in again. Historically, thousands of bison have died from this scenario. Bison die not only from the extreme cold, but because they can not crater, that is, sweep back and forth with their heads to reach forage below the snow. They can not crater because in going from melting to freezing again, the snow is covered with a thick crust of ice. Bison can not penetrate it. This can cause massive bison mortality.

With the tribal hunters, most bison survived in the Gardiner Basin and beyond to the north. We know this because wild bison were here in the past. They were able to return in the spring to the high country that is now the park. They did this for thousands upon thousands of years. But now, in the absence of the Indian tribes, European-style wildlife decimation is occurring at the hands of the members of the Interagency Bison Management Plan. Gardiner Basin has become a slaughterhouse. Members of the IBMP collectively are the new anti-wildlife sultans.

Under the traditional practices of the American Indian tribes on this common hunting ground, a certain percentage of bison that occupied Gardiner Basin and beyond would survive in these lower elevations even in a worst-case scenario, that is, a catastrophically severe winter, to repopulate the Yellowstone high-elevation habitat in the spring.

But what is the percentage of bison that return from the Gardiner Basin now under IBMP? With interagency members operating the Stephens Creek capture facility every winter, all migrating bison that enter Gardiner Basin are forced into a funnel of fencing that empties into an entrapping enclosure. From here they are shipped to a slaughterhouse. None survive. If all the bison in Gardiner Basin are killed and if all bison died in the high altitudes of the park during a devastating winter, how many would be left to repopulate the park? Zero.

What would be the status of the wild Yellowstone bison under this worst-case scenario? Extinction.

Over the last 10,000 years, what is the difference that has caused the possibility of such an extinction? The ecological setting has changed in only one way. It is now under the rule of the European philosophy that favors domestication and promotes wildlife decimation, as opposed to the Indian way of treating wildlife—harvest only what you need and not to be afraid of "the big bad wolf."

This conflict has roots reaching back to the settlement of this country. It was summed up by Sagoyewatha, also called "Red Jacket," a Seneca chief. Speaking in the summer of 1805 at a meeting on the banks of Buffalo Creek in New York—a meeting that included an agent of the United States for Indian affairs, a government interpreter and a young missionary named Jacob Cram of the Evangelical Missionary Society of Massachusetts—Red Jacket said:

> Brother, listen to what we say. There was a time when our forefathers owned this great island. Their seats extended from the rising to the setting sun. The Great Spirit had made it for the use of Indians. He had created the buffalo, the deer, and other animals for food. He had made the bear and the beaver. Their skins served us for clothing. He had scattered them over the country, and taught us how to take them. He had caused the earth to produce corn for bread. All this He had done for his red children, because He loved them. If we had some disputes about our hunting ground, they were generally settled without the shedding of much blood. But an evil day came upon us. Your fore-fathers crossed the great water and landed on this island. Their numbers were small. They found friends and not enemies. They told us they had fled from their own

> country for fear of wicked men, and had come here to enjoy their religion. They asked for a small seat. We took pity on them, granted their request; and they sat down amongst us. We gave them corn and meat; they gave us poison in return.
>
> The white people, Brother, had now found our country. Tidings were carried back, and more came amongst us. Yet we did not fear them. We took them to be friends. They called us brothers. We believed them and gave them a larger seat. At length their numbers had greatly increased. They wanted more land; they wanted our country. Our eyes were opened, and our minds became uneasy. Wars took place. Indians were hired to fight against Indians, and many of our people were destroyed. They also brought strong liquor amongst us. It was strong and powerful, and has slain thousands (Stone, 1841, pp. 190, 191).

Here is how things stand now. According to the National Park Service:

> In 2000, the federal government and the State of Montana signed an agreement that established guidelines for cooperatively managing the risk of brucellosis transmission from bison to cattle—primarily by excluding bison from areas used by cattle. This Interagency Bison Management Plan (IBMP) also emphasized preserving the bison population as a natural component of the ecosystem and allowing some bison to occupy winter ranges on public lands in Montana. Five agencies were originally responsible for implementing the plan—the National Park Service, Animal and Plant Health Inspection Service, U.S. Forest Service, Montana Department of Livestock, and Montana Fish, Wildlife & Parks.

Who has jurisdiction over wild, publicly-owned bison? According to the NPS:

> The National Park Service has jurisdiction over all bison management actions inside the park, while the Montana Department of Livestock has lead responsibility outside the park (Bison Management Information Continued, 2015).

By a court-approved inter-government agency agreement the IBMP members in effect enclosed Yellowstone National Park and the buffalo commons beyond the park. Now wild bison are to be treated as livestock, subject to round-up, capture and industrial-scale culling on park property as well as off park property in Montana.

In 2009 several tribes from the Columbia Basin, as well as a group consisting of Plains Indian tribes and others, were added to the IBMP:

> The Confederated Salish and Kootenai Tribes of the Flathead Nation, Nez Perce Tribe, and Inter Tribal Buffalo Council were added as members in 2009

> due to their treaty hunting rights on some unoccupied federal lands in southwestern Montana and their commitment to restoring bison (Bison management information continued, 2015).

In addition to the Confederated Salish and Kootenai Tribes of the Flathead Nation and the Nez Perce Tribe, two other tribes were later given hunting rights. As noted in the *Billings Gazette*:

> The Umatilla and the Shoshone-Bannock, of Fort Hall, Idaho, are the two newest of four American Indian tribes whose treaty rights have been recognized by the state of Montana, thereby allowing them to hunt bison that migrate from Yellowstone National Park into the state. The other two tribes are the Confederated Salish and Kootenai Tribes of Pablo and the Nez Perce Tribe of Lapwai, Idaho.

A total of four tribes have asserted their aboriginal treaty rights to hunt in Montana and therefore are regulated by their own laws related to bison hunting as a sovereign nation (Andrea Jones, personal communication, Montana Fish, Wildlife & Parks, October 10, 2015). These four tribes are now allowed to hunt on the buffalo commons just outside the park in Gardiner Basin. According to Montana Fish, Wildlife and Parks:

> They can hunt "open and unclaimed lands," which are not universally defined by the courts, but are generally considered those federal public lands that are not set aside for uses incompatible with hunting, such as a national park. Many Forest Service and Bureau of Land Management lands constitute open and unclaimed lands (FAQs on Tribal Treaty Hunting Rights and Bison, 2016).

The reaction of the tribal members on returning to buffalo hunting after more than a 100-year hiatus was recorded by the *Gazette*. Carl Scheeler, wildlife program manager for the Umatilla Indian Reservation's Department of Natural Resources in Pendleton, Oregon, said:

> I think it's a pretty special thing, after so many years, to rekindle that tradition of travel to provide food for the long house.

Tom McDonald, Fish and Wildlife Division manager for the Salish-Kootenai Tribes, said it's important to the tribe that the bison are killed through hunting rather than slaughtered by the federal government. He added that the tribe is also interested in seeing the animals restored to Montana as wildlife, because for thousands of years the bison was intimately entwined with the Plains Indian way of life, not only supplying food but also shelter with its hide (French, 2011).

In the past, under a statute created in 2005 by Montana's Senate Bill 91, beside those tribes under treaty hunting rights, eight Montana tribes were allowed to designate individuals from their tribal diabetic programs to receive free wild bison hunting licenses. These tribes are the Assiniboine and Sioux, Blackfeet, Chippewa Cree, Confederated Salish and Kootenai, Crow, Gros Ventre and Assiniboine, Northern Cheyenne and Little Shell band of Chippewa (State Policy with Tribal Impact, 2015).

The statute terminated July 2015. At present, no special hunting is available for any tribes other than those hunting under treaty rights. As explained by Hank Worsech, license bureau chief, Montana Fish, Wildlife & Parks:

> Since the statute terminated in July 2015, the Department contacted each of the eight tribes listed in the statute and provided them an opportunity to get free licenses this year (two per tribe); four of the tribes opted to receive the licenses and four did not. Since that law has sunset the only way any of the eight tribes would receive free licenses would be to reenact this statute and that would require legislation. This would be no earlier than the 2017 session. We still have the tribes that hunt bison based on treaty rights . . . Since the start of SB 91 only about half of the tribes have participated and the statute's intent was to also distribute the meat to the tribes diabetic programs (Hank Worsech, personal communication, November 24, 2015).

To call this hunting, however, is a misnomer. In reality, it is just another method of lethal removal.

Since bison "hunters" have to wait for the bison to leave the park, they wait for their chance in the open Forest Service land near Beattie Gulch. Bison are shot as they step across the line (Lundquist, 2014). Limiting hunting to a small plot of land does not provide "fair chase." Little of the state has been made available for these wild animals, especially for year-round use. "No habitat, no hunt. We're maintaining that position," says Stephaney Seay, spokeswoman for the Buffalo Field Campaign, an advocacy group for the park's bison (McMillion, 2009).

Indeed, as the bison hunt is now practiced, this is hardly hunting. It is merely the first step in culling. Since not more than 300 animals are usually taken by such hunting, the rest are trapped in paddocks such as the Stephens Creek capture facility. They are captured on park land before they can migrate out of the park and be shipped to slaughter. Such government supervised hunting and culling practices are opposed by many tribal members.

One of the strategies of a dominant culture that wants to oppress a certain group for its own gain is to use one segment of that group to suppress another segment of the same group. This is happening now. The Buffalo Field Campaign reported March 7, 2014 the following:

As I write this, two livestock trailers belonging to the Confederated Salish and Kootenai Tribes (CSKT) are heading west on Interstate 90 hauling dozens of live buffalo to a slaughterhouse on the Flathead Indian Reservation. While we don't yet know the exact number of buffalo in these trailers, we do know that in recent weeks the CSKT have slaughtered 37 buffalo and the Intertribal Buffalo Council (ITBC) has slaughtered 146. The majority of these slaughtered buffalo have been adult females, many of which were pregnant with what should have been this spring's calves.

The Buffalo Field Campaign describes the background for these actions and their implications:

> Native American tribes are the buffalo's oldest human kin with relations going back tens of thousands of years. They are sovereign nations whose laws and customs, like their connections to the buffalo, have evolved over millennia. No one knows the buffalo more intimately than the tribes, whose cultures were nearly destroyed when our European ancestors nearly drove the buffalo extinct.
>
> Buffalo Field Campaign has always believed that tribal involvement in buffalo management decisions would be essential to any effort to earn the buffalo the respect and protection they so desperately need. This is reflected in our mission statement, which commits us to "working with people of all Nations to honor the sacredness of wild buffalo."
>
> To the tribes, reengaging in their sacred relationships with wild buffalo is essential to reestablishing hope or, in the words of the ITBC, to "healing the spirit of both the Indian people and the buffalo." We celebrated when the tribes and the ITBC were finally given a voting seat at the table among the state and federal agencies administering the Interagency Bison Management Plan. When the tribes began exercising their treaty rights to hunt buffalo, we respected those rights, even agreeing to turn off our cameras when requested out of respect for the sacred nature of these hunts.
>
> But our job is to share the buffalo's story with the world and when people begin to act irresponsibly or disrespectfully toward the buffalo it is up to us to speak the truth. The events of recent weeks have been especially difficult as we've found it necessary to express our strong opposition to the tribal slaughter agreements. But backing a trailer up to a cage in Yellowstone where buffalo are confined and transporting them to slaughter has nothing to do with tradition or the sacred or sovereign rights of tribes. By participating in such activities the tribes are actively assisting with the destruction of the Yellowstone herds and providing cover to the shameful actions of the livestock industry and the government agencies preventing the buffalo from accessing and re-inhabiting their native habitat.

> Our actions are not motivated by disrespect for the tribes but, rather, by the respect we hold for the buffalo and their right to be wild and free (Weekly Update from the Field, March 7, 2014).

All too often, those who put animals behind fences seek to kill any wild, free-roaming, publicly-owned animal such as the bison or wolf that competes with or preys on domestic, privately-owned animals. However, it is logically odd that this killing arrangement is allowed by society, namely, it is legal to kill a public animal, that is, a wild one, if that animal is a threat to a domestic animal, but it is *not* legal to kill a privately-owned animal, even if that animal is a threat to the life of a public animal, such as cattle that carry brucellosis and originally infected the bison in Yellowstone. This is where the Endangered Species Act comes in. It is a shield to protect the interests of the public from the at times out-of-control interests of the private sector.

But in the case at hand, it is our own government—representing public interests—that is oppressing the interests of the public in the protection of wild animals, in particular wild bison. And ironically, it is a government agency itself, the Fish and Wildlife Service, that is now in the position of potentially ruling against fellow government agencies—those that compose the IBMP coalition—as it administers the Endangered Species Act and evaluates what action is best to promote the public's interests. It will be interesting to see how well it does its job, for it has overtones of asking the fox to guard the hen house.

This petition is a declaration of independence from the tyranny of domestication, a tyranny that both enslaves the Native American and the common man, as well as threatens to drive to extinction bison and other wildlife.

This does not mean that domesticating life is bad, but instead that taming life can overflow to dominate others that depend on common access to wildlife, with the fallout being extinction of species. Fencing, cultivation and control of our environment has its obvious place, but it should not exclusively dominate what is wild, for as Red Jacket maintained, what is wild has been created for the benefit of mankind.

This attitude toward wildlife was also expressed at the August 6, 2015 meeting of the IBMP, a meeting in which the Indian member tribes expressed their desire that only hunting be used to harvest the park's wild bison, while members of the government agencies said 1,000 bison needed to be culled in 2016, violating the very recommendations made at other times by the NPS not to engage in large-scale reductions because of the genetic harm it might do and despite the fact that limiting the size of the herd to 3,000 animals maximum in the park is not supported by good science.

A day prior to the IBMP meeting, the Nez Perce tribe provided a dinner for interagency members, staff and the public. The dinner included ceremonial Chinook salmon caught by Nez Perce fishermen in the Columbia River. At the meeting the next day Josiah Blackeagle Pinkham, a Nez Perce ethnographer, discussed his tribe's oral traditions and their relationship with bison. He told the Nez Perce creation story. A part of it went like this:

> The animal people came together and knowing that man was coming, and that he had few skills and would surely die, had to decide what to do. Starting with the salmon, who said it would every year give up its body to feed humans, one-by-one many of the animal people offered something of themselves or their knowledge so that humans could survive and thrive (Bischke, 2015).

That story, Blackeagle said, helps keep the tribe grounded in the idea that they are at the bottom of the food chain not the top—that they require the "animal people" to survive.

But in a wild setting, that means preserving wild creatures so that people can have the blessings provided by them. Extinct species have no value except as lessons of what people should not do—and then it is too late. They are gone. Forever.

5

Land of monsters

We, the human species, once lived in a land of monsters. We were the hunters, the hunted and often the haunted. We lived in fear of some of these huge creatures. Some claimed our lives. We depended on others for our survival.

We know about these animals, many now vanished from the earth, because of archeological evidence they left behind and because their past has been recorded on the walls of caves and cliffs by our ancestors. Fossils and pictographs have provided us a historical record of our relationship to these large beasts.

On the North American continent most became extinct. The largest in body size and weight of the few species that survived the Late Pleistocene extinction event are today's bison. As a species, they are small compared to some of these giants, such as the mastodons and mammoths. A male woolly mammoth was about the size of a modern African elephant, up to 11 feet tall at the shoulder and weighing about 12,000 pounds. Bison, on the other hand, are 6 feet tall at the shoulder and weigh 1,400 pounds. The only wild, unfenced remnant of this species are the bison in Yellowstone National Park.

Regarding the need for the Endangered Species Act, the act states:

> The Congress finds and declares that—
>
> (1) various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation;
>
> (2) other species of fish, wildlife, and plants have been so depleted in numbers that they are in danger of or threatened with extinction;
>
> (3) these species of fish, wildlife, and plants are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people.

Regarding its purposes, the ESA further states:

> The purposes of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species . . . (Endangered Species Act, 1973).

To rescue a species from the threat of extinction and to meet the objectives of this act, one must know something about that species' past and its relationship to humans. To conserve these species, one must first know what esthetic, ecological, educational, historical, recreational and scientific value that species has to the nation and its people.

An ecosystem is defined as a biological community of interacting organisms and their physical environment. It is important to realize that an ecosystem is not just composed of wild animals, but includes domestic animals and humans as well. It is this interconnectedness that can contribute to the survival or the extinction of any species in that biological community.

Bison belong to a group of animals called megafauna, a term that describes land animals roughly larger than a human that are not domesticated. Our relationship to these large animals has been recorded by humans as far back as 30,000 years ago, first on the Eurasian continent, then here on this continent, beginning 10,000 years ago when people came here across the Bering Land Bridge.

On a wall in the end chamber in the Chauvet Cave, its entrance located high up on a limestone cliff in Southern France, is a drawing of a bison. Its massive hump, its head, horns, body and legs are outlined in charcoal on the smooth surface of the ochre walls. The wall also shows claw marks presumably made by a giant bear that also inhabited the cave. Bear bones are strewn on the floor.

Here paintings abound. There are images on the walls of horses, lions, rhinoceroses, ibex, reindeer, red deer, musk oxen, panthers, owls, hyenas, cave bears (which were much larger than grizzlies) and aurochs (huge, wild cattle, the ancestors of domestic cattle). There are human palm prints, looking like large red dots, and red hand stencils.

The cave was discovered on December 18, 1994 by Jean-Marie Chauvet and his two friends Eliette Brunel and Christian Hillaire, all speleologists. As they were leaving, Brunel looked up and saw on a rocky spur hanging from the ceiling a drawing in red ochre of a mammoth. She exclaimed to her companions on seeing the figure: "They were here!"

And indeed, they were here—both man and animals were here together in this ancient world. These paintings are the first human record of man's encounter with such large creatures. Many of the images are of extinct species, including the mammoth, cave bears and aurochs. The images, according to radiocarbon dating, were drawn up to 30,000 years ago (The Chauvet Cave, 2015), (Chauvet Cave: France's Magical Ice Age Art, 2009).

Nearby, in a cave in Lascaux, France are the silhouettes of four hunters facing a herd of eight deer. Their bows are drawn. They seem to be almost dancing as they shoot. Several arrows are sticking out from the chests of two deer. The drawings were done between 15,000 and 17,000 years ago.

On the canyon walls in Horseshow Canyon, Canyonlands National Park, Utah, is a drawing of what appears to be a huge bison and behind it, two deer. A stick figure with a bow is aiming an arrow at it. It is estimated to have been drawn between 2,000 BC and 500 AD. Pictographs such as these have been found throughout the world.

But there is more than pictographic evidence of megafauna. Frozen mammoths have been found intact on the Arctic coast in Siberia. One can get the sense of the actual presence of megafauna by the vivid descriptions of their discovery. In *The Mammoth and Mammoth-Hunting in North-east Siberia* by Bassett Digby, the finding of one such mammoth was recounted in a letter by a Russian surveyor named Benkendorf, writing in 1846. He and his associate had come across a form in a river at flood stage that they could not quite make out. He wrote:

> At last, however, a huge black horrible mass bobbed up out of the water. We beheld a colossal elephant's head, armed with mighty tusks, its long trunk waving uncannily in the water, as though seeking something it has lost. Breathless with astonishment, I beheld the monster hardly twelve feet away, with the white of his half-open eyes showing.
>
> "A mammoth! A mammoth!" someone shouted…
>
> Picture to yourself an elephant with a body covered with thick fur, about 13 ft. in height and 15 ft. in length, with tusks 8 ft. long, thick and curving outward at their ends. A stout trunk 6 ft. long, colossal legs 1-1/2 ft. thick, and a tail bare up to the tip, which was covered with thick tufty hair.
>
> The beast was fat and well grown. Death had overwhelmed him in the fullness of his powers. His large, parchment-like, naked ears lay turned up over the head. About the shoulders and back he had stiff hair about a foot long, like a mane. The long outer hair was deep brown and coarsely rooted. The top of the head looked so wild and so steeped in mud that it resembled the ragged bark of an old oak. On the sides it was cleaner, and under the outer hair there appeared everywhere a wool, very soft, warm and thick, of a fallow brown tint. The giant was well protected against the cold. The whole appearance of the great beast was fearfully strange and wild . . .

Digby goes on to describe the diet of mammoths:

> In the teeth and stomachs of frozen Siberian mammoths have been found remains of fir cones and branches of fir, larch and pine, sedges, wild thyme,

> Alpine poppy, buttercup, two kinds of moss (*Hypnum fluitan* and *Aula comnium turgidum*), and also the following plants: *Beckmannia cruciformis, Agropyrum cristatum, Horedeum violaceum and Oxytropis sordida*. All these later plants, traces of which were found in the teeth and stomach of the Beresovka mammoth, grow in the region today, indicating that the climate was neither colder nor warmer than it is now (Digby, 1926, pp. 99, 101, 148).

But now, that wild creature is gone. If it had managed to exist to the present, it most likely would be under the control of the Interagency Mammoth Management Plan.

Mammoths inhabited the upper Great Plains. Mammoth bones have been found at a site about 400 miles from Yellowstone National Park in Glendive, Montana.

In July 1966 a farmer was operating a combine along a road near Glendive following a heavy rain. He noticed a whitish substance that had been exposed by road construction. Examining it, it appeared to be a large tusk. A team headed by Lee Davis, a pre-doctoral student in North American archaeology at the University of Calgary, excavated the site, finding beneath the road the fossil skeleton of a mammoth that had died 11,500 years ago. It was a mature bull about 45 years of age at death, towering 14 feet at the top of it skull. The 150-pound right tusk measured nine feet in length along the outside of the curve and eight inches in diameter where it joined the skull.

Some of the bones appeared to be stacked in a pile. Eight sandstone blocks were found beneath the skeleton. Some of the bones had been smashed. But what caused its death could not be determined (Davis, 2012).

At another site near Indian Creek in the Elkhorn Mountains west of Townsend, Montana, about 150 miles from the park, a Clovis point, channel flakes, and numerous cutting and scraping tools were excavated 24 feet below the present ground surface, left there 11,000 years ago.

Near the South Fork of Deer Creek, north of the Yellowstone River, silts containing mammoth remains have been found dating back to 12,300 radio carbon years before the present (about 14,000 years ago) (Hill, 2015).

Along Shields River, a tributary of Yellowstone River, near Wilsall, Montana, about 80 miles north of the Gardiner Basin and just outside Paradise Valley, is a Clovis burial site called the Wilsall-Anzick site. Here, ocher-covered bones and the cranium of a child, along with other artifacts, were discovered (Davis, 2012).

Artifacts included large bifacial flake cores, smaller bifaces, Clovis points, Clovis point blanks, flaked stone items, and polished and beveled cylindrical bone tools or tool parts. The assemblage was located at the base of an escarpment in what appeared to be a collapsed rock shelter at the end of a long hogback. Overlying deposits contained many bison bones and apparently document use of the escarpment as a bison jump in late prehistoric times (Wilke, 1991).

The human bones of the male infant recovered from the Anzick burial were found to be about 12,500 years old and were directly associated with Clovis tools. The infant's genome was sequenced by a team led by Morten Rasmussen of the Centre for GeoGenetics, Natural History Museum of Denmark, University of Copenhagen. As reported in *Nature* in "The genome of a Late Pleistocene human from a Clovis burial site in western Montana," the study showed that the gene flow from the Siberian Upper Palaeolithic Mal'ta population into Native American ancestors is also shared by the infant. It also showed that the infant is more closely related to all indigenous American populations than to any other group and most probably belonged to a population directly ancestral to many contemporary Native Americans (Rasmussen, 2014).

Figure 13. BONES OF A CLOVIS INFANT were discovered buried at the base of this escarpment near Wilsall, Montana by the Shields River, a tributary of the Yellowstone River. Bones of bison were also found at the base, indicating this was an ancient bison jump over which Clovis people stampeded bison so as to trap and kill them. Man with horse at top for perspective. *Release to public domain by author James Horsley.*

Throughout North America the fossil record tells an intriguing, yet disturbing story. At the La Brea Tar Pits in Los Angeles the fossilized bones of a wide array of now extinct large herbivores have been recovered, such as the Imperial mammoth, Columbian mammoth, American mastodon, three species of ground sloth, Giant bison (bison latifrons), Ancient bison (bison antiquus), American camel, stilt-legged llama, Western horse, Mexican horse and California tapir. There were also carnivores such as the American lion, scimitar cat, sabre-toothed cat, jaguar, American cheetah and dire wolf. (La Brea Tar Pits, 2015).

We have drawings of them. We have their frozen bodies. We have their fossilized remains. But we do not have them. They had lived for millions of years as species larger than most life—and then for reasons as yet not fully understood, all went extinct about 10,000 years ago, coincidentally at the same time people came onto the North American continent for the first time.

We know these people were here and that they preyed on much of the megafauna because of the numerous sites that contain their artifacts and the remnants of species they killed. But what caused the extinction of the largest of the animals they preyed upon, all except bison? Even the largest species of bison went extinct at that time, the Giant bison and the Ancient bison. Theories abound.

In the time around the last ice age, a number of catastrophic events occurred. The glaciers melted that had barred travel between Asia and North America. With the opening of an ice corridor, humans as well as other animals began to mix with the animal population already in North America. Then the sea waters began to rise, cutting off further animal and human travel between the two continents.

The warm period that melted the glaciers is referred to as the Allerød period, running from about 14,700 to 12,700 years before the present. It ended abruptly with the onset of the Younger Dryas, a cold period that reduced temperatures back to near-glacial levels within a decade. Referred to as the Big Freeze, it lasted about 1,300 years, characterized by periods of cold climatic conditions and drought. It occurred about 12,800 to 11,500 years ago.

The Younger Dryas period is thought to have occurred when the North American ice sheets that had dammed Lake Agassiz collapsed, flooding the North Atlantic with fresh water and shutting down the oceanic circulation of warm tropical water northward (Younger Dryas, 2015; Bølling-Allerød, 2015).

Vance Haynes, Jr., Departments of Anthropology and Geosciences, University of Arizona, speculated on what possibly caused this massive extinction. He noted that the sole survivor among the largest animals was the bison:

> The fact remains that the existence of mammoths, mastodons, horses, camels, dire wolves, American lions, short-faced bears, sloths, and tapirs terminated abruptly at the Allerød-Younger Dryas boundary . . . Only bison survived to the Younger Dryas, probably because they vastly outnumbered other species.

He reviewed the various theories related to the megafaunal extinctions (citation numbers omitted):

> Martin's overkill hypothesis posits humans as the sole cause, but could they do it everywhere in the same instant? Lundelius and Graham invoke climate change, but this, like overkill, would seem to require more time than the evidence for stratigraphic abruptness allows. MacPhee and Marx believe hyper disease caused extinction of the megafauna, but natural selection would have left survivors. Perhaps the incredible coincidence of drought, rise of the Clovis population, and extinction at the onset of the glacial cold of the YD indicates multiple causes of extinction. In the San Pedro Valley of Arizona animals under stress gathered at dwindling water sources only to be annihilated by Clovis hunters. However, many relatively young, tender mammoths in the San Pedro Valley died without Clovis impact. Did a long-lasting deep freeze deny

> water to them? Considering the abruptness and magnitude of the termination, a major environmental and biotic disturbance took place at 10,900 B.P. that requires interpretation.

Or possibly an ET did it. He states:

> Should an extraterrestrial (ET) cause be considered? Brakenridge and Berger suggest there may be an ET explanation for YD in the form of a supernova. Brakenridge points out that supernova Vela occurred sometime between 11,300 and 8,400 years ago. Firestone et al. proposed that a comet impact 12,900 years ago (˜10.9 radiocarbon years ago) caused the megafauna extinction and triggered the onset of YD cooling.

He noted that the Clovis culture is the first well-defined culture that employed a specific technology, namely, fluted projectile points. These people occupied North America from 11,500 to 10,900 years ago. At Clovis sites people interacted with the last of the megafauna at spring heads, along spring-fed streams, or around ponds as the Pleistocene climate became drier and warmer (Haynes, Jr, 2008).

But just how cold was this "Big Freeze"? David J. Meltzer and Vance T. Holliday co-authored a paper asking "Would North American Paleoindians have Noticed Younger Dryas Age Climate Changes?"

That assessment of the nature, severity and abruptness of Younger Dryas changes is largely based on ice core records from the Greenland ice sheet where changes were indeed dramatic. Recorded there is a mean annual Younger Dryas air temperature about 15–16 °C colder than present, they noted.

Today, some weather stations in the center of Greenland's ice cap record mean annual temperatures below -27 °C (-16.6 °F). This would mean that mean temperatures at Greenland during the Younger Dryas could be as low as -43 °C or -45 °F. That is the mean temperature. That is cold. The coldest day in Greenland ever recorded during this present time was –66 °C or –87 °F in Northice, Greenland on Jan. 9, 1954 (Lowest Recorded Temperatures, 2015).

However, while there was cooling across northeastern North America during this period, it was far less than in Greenland, the authors found. Estimates of Younger Dryas mean annual temperature based on data from a variety of proxies (e.g., chronomids, pollen, oxygen isotopes) indicate that mean annual temperatures were no more than 5 °C cooler than at present, and often of the order of just 3–4 °C cooler, the authors noted. In passing, they said (citations omitted):

> Physical conditions during Younger Dryas times were thus, arguably, unique, unlike what occurred even in previous deglaciations. Although beyond the scope of this paper, we would note that this putative uniqueness could be relevant to the question of why a suite of mammals that had previously survived multiple glacial-interglacial cycles failed to survive this one.

What was characteristic of the Big Freeze was its abrupt changes. Given large swings in temperature, anything could happen, including mass extinctions. Anthony Watts concluded in “The Intriguing Problem Of The Younger Dryas—What Does It Mean And What Caused It?”:

> The climatic fluctuations before and after the Younger Dryas, as well as the fluctuations within it, and the duration of these changes are not consistent with a single event cause of the YD. Neither cosmic impact or volcanic eruptions could produce the abrupt, multiple climatic changes that occurred during the late Pleistocene (Watts, 2012).

Meltzer and Holliday concluded:

> Even were they in regions where YDC climatic and ecological changes were occurring on a scale of multiple decades or centuries, they still might not have noticed, since people respond more directly to daily, weekly, and seasonal conditions. Besides, adapting to changing climatic and environmental conditions was nothing new to them. It was what they did (Meltzer, 2010).

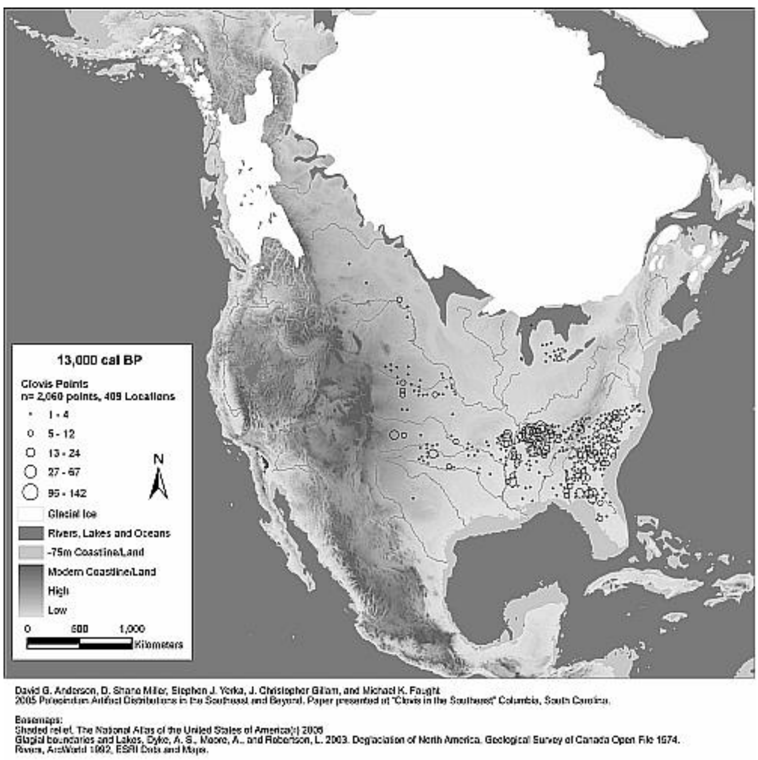

Figure 14. SITES OF FLUTED PROJECTILE POINTS characteristic of Clovis man dating 13,000 years ago are represented by circles. All are assumed to be of late-Pleistocene age. White regions represent glacial ice.

As the Clovis people came on the scene in North America, they came in contact with megafauna. Their camp sites and unique fluted projectile points that they used to kill game, often megafauna, are a record of where they hunted, for that is what they did to survive.

These people encountered monsters in real life that modern man only has nightmares about. Take, for instance, the saber-tooth cat with its huge fangs. Recent studies suggest it used its canines and lower jaw to open its prey with a leverage action like one would open a can with a pocket knife can opener, administering a downward thrust while holding its prey to the ground (Zielinski, 2014).

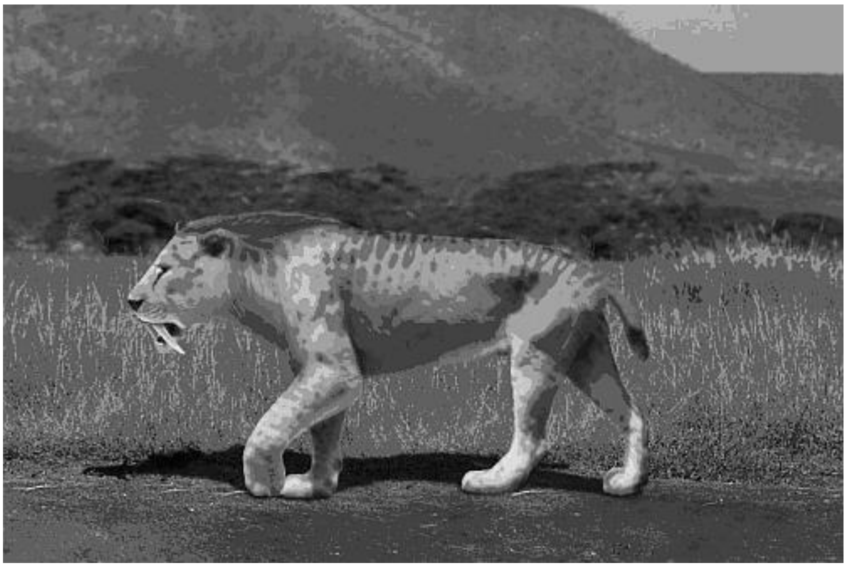

Figure 15. SABER-TOOTHED CATS roamed the North American continent and were encountered by early man (Smilodon, 2015). ***Author: Rom-diz. Used under the Creative Commons Attribution-Share Alike license.***

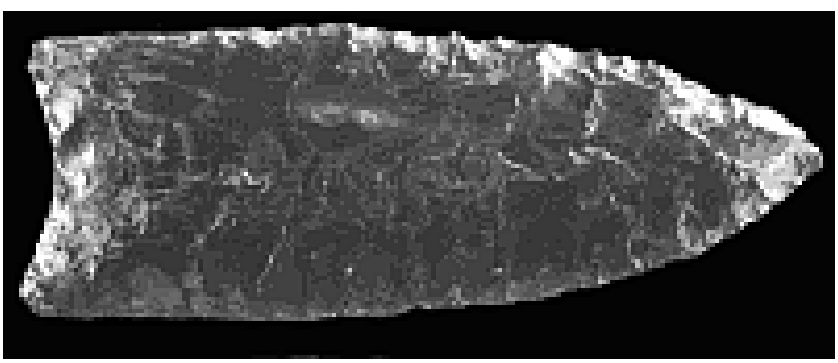

Figure 16. FOUND AT GARDINER, Montana, during the construction of a post office in the 1950s is this obsidian projectile point dating from approximately 11,000 years ago, made by Paleo-Indians of the Clovis culture.

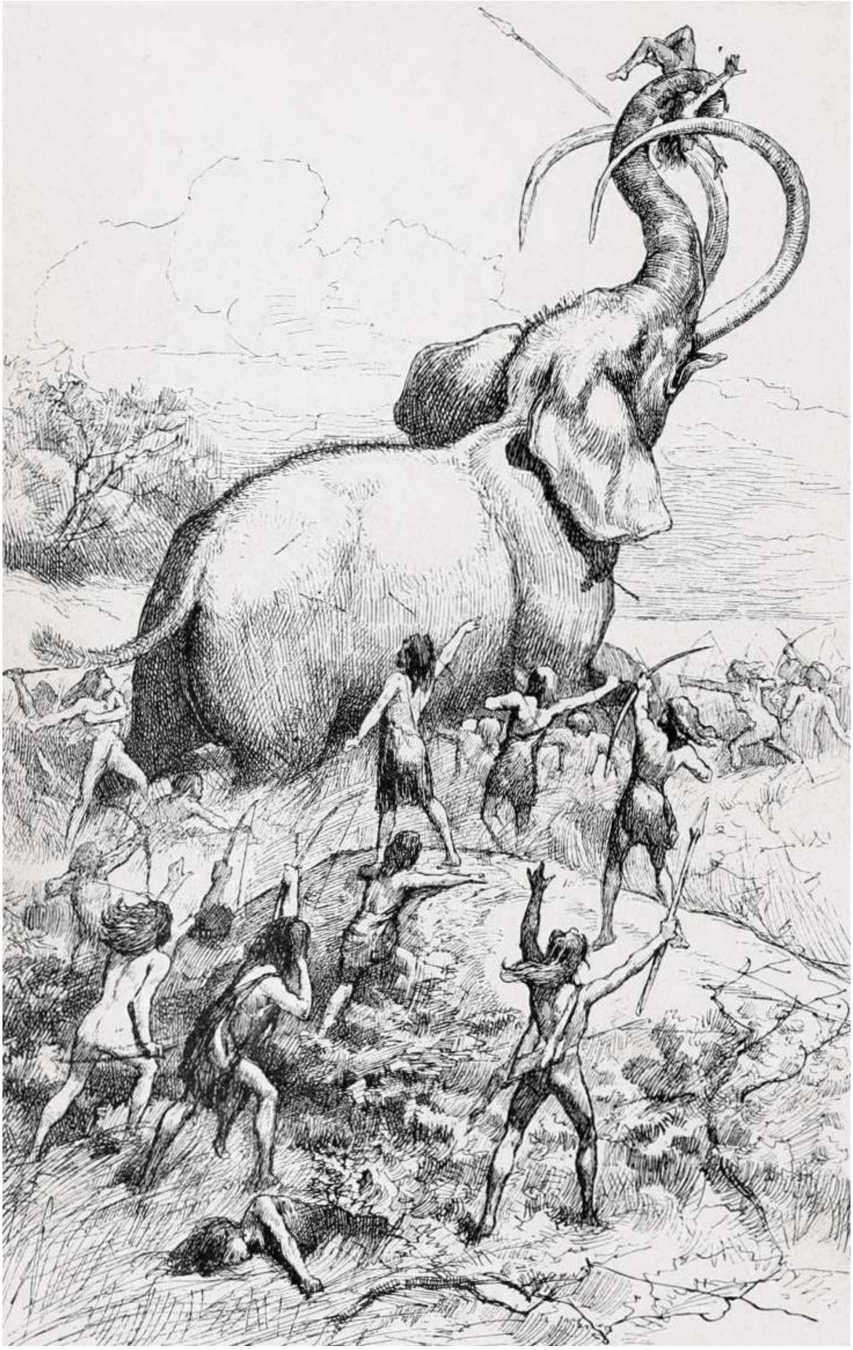

Figure 17. A MAMMOTH WRAPS ITS TRUNK around an early hunter to dash him to the ground. After living on earth millions of years, they became extinct at about the same time as early man arrived on this continent. ***Frontispiece of the book "Children's Stories in American History," by Henrietta Christian Wright. Pub. Charles Scribner's Sons., New York, NY, 1885. Illustrated by J. Steeple Davis. From Project Gutenberg.***

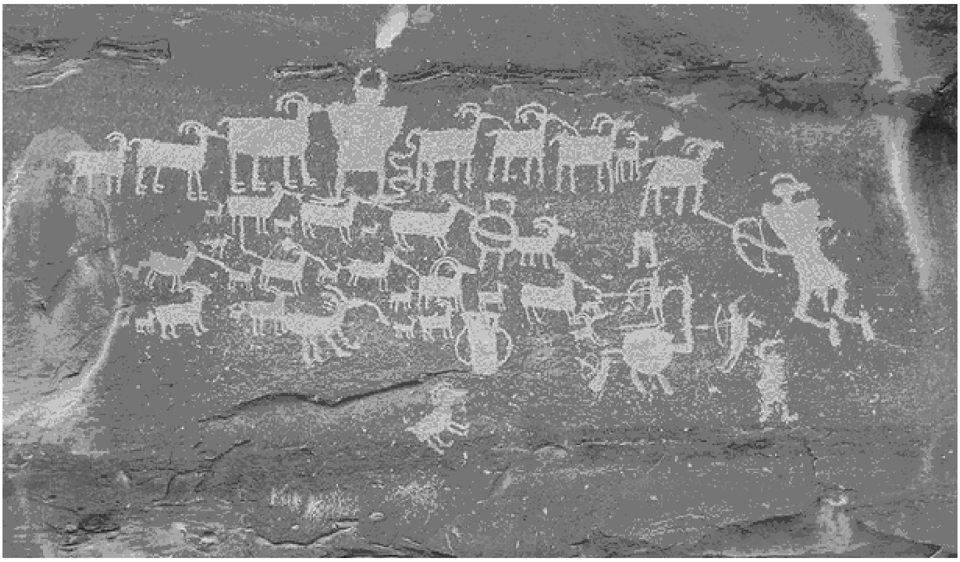

Figure 18. HUNT SCENE OF POSSIBLY MIGRATING UNGULATES drawn on a rock wall in Nine-Mile Canyon National Backcountry Byway, near Price, Utah. Tongues appear to connect one animal to another. Could that connection symbolically represent herd unity or migration? *By Scott Catron via Wikimedia Commons.*

Figure 19. BISON'S IMPORTANCE to early man is evident in this petroglyph of a hunter with a bow aiming at a bison, followed by two deer, drawn on a canyon wall in the Horseshoe Canyon Unit, Maze District, Canyonlands National Park, Utah *(Photo by permission from Todd Martin, Todd's Desert Hiking Guide, 2015)*.

William J. Ripple, writing in "Linking Top-down Forces to the Pleistocene Megafaunal Extinctions," makes an interesting observation, namely that the extinctions were caused by the addition of human hunters to the predator-prey relationship, a relationship in which the predators, being much more abundant than the humans, most likely killed the vast majority of the megafauna. He argues in his paper, co-authored by Blaire Van Valkenburgh, that:

> Humans, in conjunction with natural top-down processes and through a sequence of cascading trophic interactions, may have contributed to the Pleistocene megafaunal extinctions. The arrival of the first humans, as hunters and scavengers, through top-down forcing, could have triggered a population collapse of large herbivores and their predators. We present evidence that the large mammalian herbivores of the North American Pleistocene were primarily predator limited and at low densities, and therefore highly susceptible to extinction when humans were added to the predator guild. Our empirical evidence comes from data on carnivore dental attrition, proboscidean age structure, life history, tusk growth rates, and stable isotopes from the fossil record. We suggest a research agenda for further testing of this hypothesis that will provide a more detailed comprehension of late Pleistocene megafaunal ecology, and thereby allow us to better understand and manage remaining megafauna.

That last sentence is key: how to "manage remaining megafauna." The authors elaborate later on:

> In the terrestrial realm, it is important that we have a better understanding of how Pleistocene ecosystems were structured as we proceed in maintaining and restoring today's ecosystems.

One of the restorative elements to consider is bringing back migration among ungulates. The authors make this observation (citations omitted):

> Current ecological literature contains compelling empirical support for the limiting effect of large carnivores on their prey. Numerous studies have found that predation by large mammalian carnivores, especially by sympatric wolves and bears (*Ursus arctos, Ursus americanus*), limits the densities of large mammalian herbivores in the Northern Hemisphere, thus demonstrating widespread and strong top-down forcing by large carnivores on large herbivores. When predators are removed, herbivore populations irrupt and these dense herbivore populations most likely become limited by resources or human hunting.
>
> An exception to the above pattern is that some migrating ungulates are not limited by predation and can cycle over a wide range of abundance.

> Migration creates an advantage for prey species because it significantly reduces predation, as most predators are confined to a specific area for at least part of the year, usually when denning or caring for dependent offspring. Evidence exists that Pleistocene megafauna, such as equids and mastodons (*Mammut americanum*), may have undertaken migrations of at least 120 to 300 kilometers, whereas mammoths (*Mammuthus* spp.) appear to have ranged more locally. Nevertheless, all three of these species became extinct, suggesting migratory habits (or the lack thereof) did not guarantee survival (Ripple, 2010).

While migration may not guarantee survival for all species, in the case of bison it nevertheless may have been the key to its survival, especially the Yellowstone wild bison's trait of altitudinal migration. Yellowstone National Park may contain one of the most unique survivalist regions on earth: geothermal pools high in the mountains. Possibly it was here that bison gathered to escape extreme downswings in the earth's temperature characterized by the Younger Dryas, as well as later on. And here is where they gathered to escape destruction out on the plains in the 1870s. If the habitat around the thermal pools became too crowded, or the pressure of wolf predation too heavy, bison could migrate down to the Gardiner Basin or near Hebgen Lake. And if that became too crowded, to decrease density bison could migrate down the Yellowstone or Madison rivers to the Madison Valley or Paradise Valley. If wolf predation became too intense in the lowlands, they could go back up into the mountains in the spring where there was nutritionally higher forage. It was a system of movement key to their evolutionary survival.

In short, Gardiner Basin and other lowland regions contiguous to YNP were "dispersal sinks," essential habitat for the survival of this wild species.

But all this is being prohibited by the IBMP's slaughter of migrating wild bison. Not only are we destroying wild bison, but we as a nation are severing our link with early man and the last and biggest remaining wild ancestor of these large mammal species. Particularly tragic is the loss of this wild megafauna species that is so closely related to the life history of Native American tribes stemming back to the Clovis people over a span of 10 millenniums. Along with this nation's ecological and historical legacy, our connection with wildness is being lost.

6

Yellowstone’s bison

The present-day American bison is a descendent of *Bison antiquus*, sometimes called the "ancient bison,” once the most common large herbivore of the North American continent. It was taller and had larger bones and horns than modern bison. It stood about 7.5 feet tall and had a horn span of 3 feet from point to point. Bison today stand at 5 to 6.5 feet.

During the later Pleistocene epoch, between 240,000 and 220,000 years ago, steppe wisent (*Bison priscus*) migrated from Siberia into Alaska. This species inhabited parts of North America throughout the remainder of the Pleistocene. In midcontinent North America, however, *Bison priscus* was replaced by the long-horned bison, *Bison latifrons*, and somewhat later by *Bison antiquus*. The larger *Bison latifrons* appears to have died out by about 20,000 years ago. In contrast, *Bison antiquus* became increasingly abundant in parts of midcontinent North America from 18,000 years ago until about 10,000 years ago, after which the species appears to have given rise to the living species, *Bison bison*. Bison *antiquus* is the most commonly recovered large mammalian herbivore from the La Brea tar pits (Bison antiquus, 2015).

These animals, as well as other megafauna, evolved in North America without the presence of humans. As mentioned, about 13,000 years ago the ice sheets that had covered the Bering Land Bridge located between Asia and North America began to melt, creating an ice-free corridor between glaciers. The terminus of the corridor emptied into the plains and Rocky Mountain region. Travelling through this corridor came tribes of ancient people.

Excavators in the 1920s at a site near Folsom, New Mexico, discovered a stone projectile point along with the bones of the extinct *B. antiquus*, indicating that bison were trapped and killed there. In the 1930s excavations near Clovis, New Mexico uncovered projectile points at what appeared to be an ancient campsite. Fluted points, spearheads and other stone and bone weapons, as well as tools and processing implements were found. These artifacts were in association with the remains of extinct Late Pleistocene megafauna, including Columbian mammoths, camels, horses, bison, saber-tooth cats, sloths and dire wolves.

Radiocarbon dating indicated the sites were over 10,000 years old, with the earliest sites being those containing the Clovis points. (Folsom Site, 2015; Clovis culture, 2015; Blackwater Draw, 2015). Clovis culture existed contemporaneous with this megafauna.

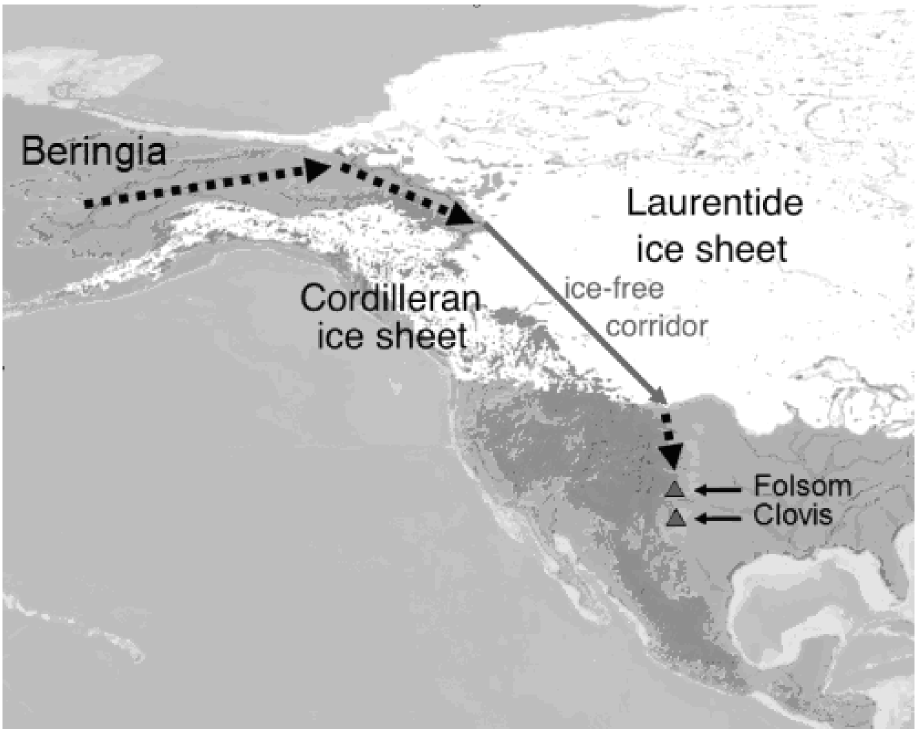

Figure 20. FROM THE OLD WORLD TO THE NEW. Map showing the location of the ice-free corridor and specific Paleoindian sites, such as Clovis and Folsom, New Mexico. Early man migrated over the Bering Land Bridge when the ice sheet began to melt, encountering such megafauna as bison and mammoths. About this time, a mass extinction of megafauna species began. ***Map used under the Creative Commons attribution license. Author: Roblespepe***

As mentioned, as the ice age ended, fresh water from the glaciers melted and the level of the ocean began to rise, eventually cutting off further passage between the two continents. At about the same time, numerous large animal species went extinct. No one knows exactly why. Some think it was due to indigenous hunters. Others believe predators, climate change or disease were the cause. The largest megafaunal species to survive that extinction was bison, from which the present species evolved. (Elias, 2014; Anderson, 2014). }

On Osprey Beach on the shore of Lake Yellowstone in Yellowstone National Park is an archaeological site, a campsite occupied about 10,000 years ago. Hunters and gatherers of the region were once thought to inhabit only the plains and foothills as bison hunters. However, following excavation of the site, analysis revealed that they were also present in this mountainous lake area on a seasonal basis. Chert or obsidian knives found in the excavation had various types of blood residue on their blades, such as bison, deer, rabbit and Rocky Mountain bighorn sheep. Some of the artifacts came from Obsidian Cliff, a major source of obsidian throughout prehistory, located about 20 miles to the northwest of Yellowstone Lake. Some believe that the Yellowstone region may have served for early man as a kind of summer resort and as a place to procure flint and process hides (Shortt, 2003).

Paleo-Indians were efficient hunters. Before the introduction of horses by the Spanish conquistadors in the 16th century, they hunted on foot using spears. Analysis of archaeological excavations of kill sites across the United States reveal that such hunters often stampeded bison into gulches or over cliffs, killing hundreds in a few minutes. They were butchered on the spot and the various cuts taken back to camp (Shortt, 2003).

Clovis people hunted mammoths, but the mammoth may have been hunted out by 8,000 BC. It was replaced as a big game animal by the now extinct *Bison antiquus*. A millennium later this species was supplanted by the somewhat smaller *Bison occidentalis*, also now extinct (Wheat, 1972).

There are two recognized subspecies of bison extant today, wood (*Bison bison athabascae*) and plains (*Bison bison bison*) bison.

As reported by William T. Hornaday in *The Extermination of the American Bison*, the first sighting of the American bison by Europeans in the Americas was in the menagerie of Montezuma in 1521. He quoted historian Antonio de Solís:

> In the second Square of the same House were the Wild Beasts, which were either presents to Montezuma, or taken by his Hunters, in strong Cages of Timber, rang'd in good Order, and under Cover: Lions, Tygers, Bears, and all others of the savage Kind which New-Spain produces; among which the great Rarity was the Mexican Bull; a wonderful composition of divers Animals. It has crooked Shoulders, with a Bunch on its Back like a Camel; its Flanks dry, its tail large, and its Neck cover'd with Hair like a Lion. It is cloven footed, its Head armed like that of a Bull, which it resembles in Fierceness, with no less strength and Agility (Hornaday, 1887).

Indians coexisted with bison on the Great Plains for millennia. Massive herds of buffalo roamed the Great Plains. Bison were the most numerous single species of large wild mammals on earth, numbering in the multiple millions.

With the settlement of the United States by European immigrants, the killing of bison increased exponentially. During the “great slaughter” of bison during the years 1872 to 1874, according to records provided by Col. Richard Irving Dodge, based on statistics furnished by the Atchison, Topeka and Santa Fé railroad, 3.2 million buffalo were killed "by whites" (Hornaday, 1887).

This was done in part as a military strategy to clear the Great Plains of Indians to make way for settlement by European immigrants, to ensure safe passage of the transcontinental railroad—as well as encourage investment in this enterprise—and to enable the introduction of domestic cattle.

As a pastime, tourists were invited to shoot bison from the trains of the newly built transcontinental railroad. Passengers shot their rifles from on top of the train, through the windows of the compartments and got off the train and fired by the tracks into the herds of bison.

Figure 21. "SLAUGHTERED FOR A PASTIME," the caption read from "Shall the Buffalo Go? Reminiscences of an Old Buffalo Hunter," published in *Frank Leslie's Popular Monthly*, Vol. XV, May 1883, New York. Wood engraving.

The December 12, 1874 issue of *Harper's Magazine* recounted the slaughter:

> The vast plains west of the Missouri River are covered with the decaying bones of thousands of slain buffaloes. Most of them have been slaughtered for the hide by professional hunters, while many have fallen victims to the sportsmen's rage for killing merely for the sake of killing. These people take

> neither hide nor flesh, but leave the whole carcass to decay and furnish food for the natural scavengers of the plains.
>
> Our front-page illustration represents a party of professional hunters, numbering six or eight, who have come upon a large herd of buffaloes. The first shot brings down a splendid animal, wounded purposely in a manner not to kill but to make him "pump blood," that is to say, to bleed profusely. Others of the herd gather around their wounded comrade, and appear to be too much stupefied to avoid danger by flight. The hunters kill as many as they can, until the survivors at last take fright and gallop off.
>
> Then the "stripping" begins. The hides are taken off with great skill and wonderful quickness, loaded on a wagon, as shown in the background of the picture, and carried to the hunters' camp. Our artists spoke with the hunters on the plains who boasted of having killed two thousand head of buffalo apiece in one season. At this rate of slaughter, the buffalo must soon become extinct. Already there is a sensible diminution of the great herds on the plains, and from many places where they were once numerous they have disappeared altogether. Some of the railroads running far out into the prairies have regular trains for parties of amateur hunters, who fire upon their victims from the car windows. Thousands of buffalo were killed in this manner, besides other kinds of wild game, and their carcasses left to decay on the ground along the line of the railroad.

Such killing had massive consequences to the ecological stability of the region, for with the bison's extirpation, the destruction of the Indian tribes also followed, resulting in war on the plains. As the *Harper's Magazine* article continues:

> The indiscriminate slaughter of the buffalo has brought many evils in its train. Among other bad consequences it has been the direct occasion of many Indian wars. Deprived of one of their chief means of subsistence through the agency of white men, the tribes naturally take revenge by making raids on white settlements and carrying off stock, if they do not murder the settlers.

The end result was the re-location of Indian tribes to reservations where they were forced to live sedentary lives, deprived of the bison stock on which they had subsisted. Because bison were not viewed as valuable to the settlers, but instead a hindrance to the cattle they brought with them, they were allowed to perish. The bison's protectors, the Indian tribes, were no longer an effective part of the ecosystem. Bison were reduced to a few hundred animals on the verge of extinction.

As the buffalo disappeared from the plains, the shattered and starving tribes were forced to subsist on reservations that were small compared to the vast tracts of land on which they had formerly hunted bison and other game. Generally, they were not allowed to leave these reservations and even when they did, the buffalo were gone. They began to take part in a movement called the Ghost Dance, which was an attempt to bring back their lost world and the bison upon which they depended by dancing slowly in a circle, chanting song after song. Here are the lyrics of one song by the Sioux, documented and translated by ethnologist James Mooney in *The Ghost Dance Religion and the Sioux Outbreak of 1890*:

> The whole world is coming,
> A nation is coming, a nation is coming,
> The Eagle has brought the message to the tribe.
> The father says so, the father says so.
> Over the whole earth they are coming.
> The buffalo are coming, the buffalo are coming,
> The Crow has brought the message to the tribe,
> The father says so, the father says so.

Mooney wrote:

> This fine song summarizes the whole hope of the Ghost dance—the return of the buffalo and the departed dead, the message being brought to the people by the sacred birds, the Eagle and the Crow (Mooney, 1896, p. 1072).

The dancers joined hands to form a large circle, moving to their left with a side-shuffle step, dancing to a drumbeat, bending their knees to emphasize the beat. Their chant was a prayer for the return of their old life.

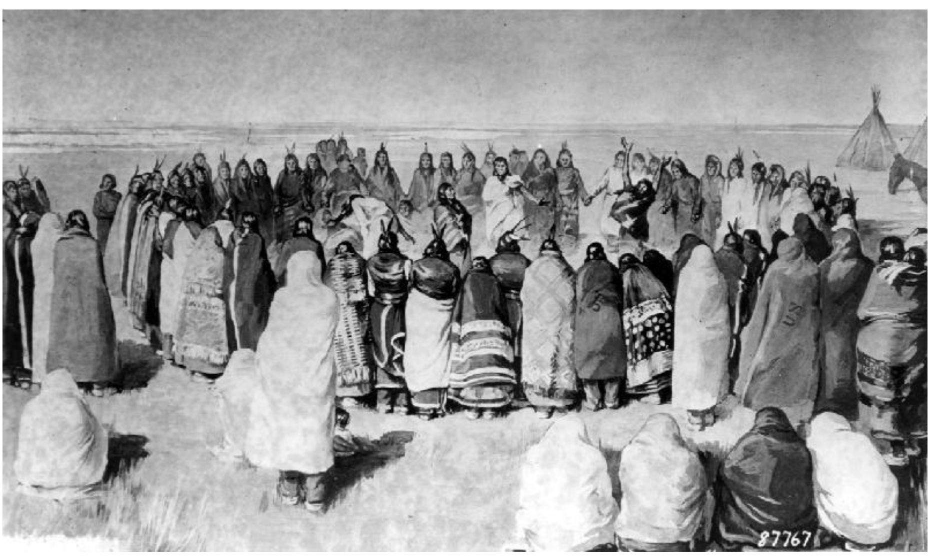

Figure 22. ARAPAHO GHOST DANCE. Artwork based on photographs from James Mooney. *Courtesy of the National Archives and Records Administration.*

The word ecology is derived from the Greek “oikos,” meaning house, and “logia,” meaning “study of.” With the isolation of the American Indian from the environment through their imprisonment upon reservations, the tribes ceased to be a working force in the ecology of this nation. They had been taken from their house. Accompanying this relocation, bison had been extirpated. Only a few surviving wild bison existed in this nation and they were now barred from leaving a tiny portion of the nation they once inhabited, now called Yellowstone National Park. They were under house arrest, vulnerable to extinction because of limited habitat. If they went in search of food beyond the gate, they risked being shot or executed. And their protectors, the American Indian, were also under house arrest. The two species, human and ungulate, no longer had an effective relationship. Their interconnectedness had been broken.

Species survive by adapting through evolution. Michael Novacek observed in *Terra: our 100-million-year-old ecosystem—and the threats that now put it at risk:*

> The twenty-first century may mark the evolutionary dead end of large vertebrates. As we have seen, much of the devastation that humans have wrought over the past forty thousand years has been unusually focused on big animals. The survivors of this onslaught now hang on in confined, degraded habitats, with small, isolated populations that maintain only a meager portion of their once enriched gene variation. We may have already deprived them of the genetic potentials for evolutionary change and adjustments they accumulated over millions of years. Despite recent conservation efforts, even some of the largest protected areas might be too small to provide a matrix for such evolutionary change (Novacek, 2007).

Deprived of the ability to adapt, such as by killing only the migratory of a species, makes that species vulnerable to extinction. Extinction is irreversible. Species that die out will never come back.

Following the decimation of the American bison, a few were found huddled in Yellowstone National Park. According to Hornaday,

> South of the Northern Pacific Railway, a band of about three hundred settled permanently in and around the Yellowstone National Park, but in a very short time every animal outside of the protected limits of the park was killed, and whenever any of the park buffaloes strayed beyond the boundary they too were promptly killed for their heads and hides. At present the number remaining in the park is believed by Captain Harris, the superintendent, to be about two hundred; about one-third of which is due to breeding in the protected territory (Hornaday, 1887).

Yellowstone National Park was founded in 1872 in part for the protection of bison and other wildlife. Ongoing poaching continued there until the U.S. Army arrived at Mammoth Hot Springs in 1886 and built Camp Sheridan. By 1902 a total of 23 bison were counted in Pelican Valley, located at the east end of Yellowstone Lake outlet.

The bison most likely survived here because of the thermal pools, which provided a year-around refuge. Because of the warm thermal ground, forage was available even during the winter because of less snow cover. Some of these bison stayed within the park all winter, thereby not exposing themselves to buffalo hunters and poachers.

In 1905, 21 bison were introduced into the park to improve genetics. Beginning in 1940, bison that reproduced beyond what was considered the carrying capacity of the range either starved or were killed by park rangers. By 1954 there were 1,477 bison in the park. In 1966, park managers adopted a policy of "natural management," ceasing to kill bison within park boundaries. Hunting licenses were sold by Montana for bison that migrated across park boundaries. In 1984, in response to ranchers' complaints in the Gardiner Basin, Montana game wardens slaughtered 88 buffalo that wandered outside the park.

In 1985 the Montana state legislature passed a law "reaffirming buffalo as a legitimate game animal." By 1988, due to a number of preceding mild winters, the bison numbered 3,500.

7

Interagency Bison Management Plan

In the winter of 1988-89, snow depth and cold temperatures forced the bison to lower elevations, resulting in a large migration (Gutkoski, 2006). During that winter cattlemen complained that if migrating bison got near their cattle grazing adjacent to the park they could be infected with brucellosis. To address that problem, the Montana Fish, Wildlife and Parks agency announced a special hunt.

Reporters from the national news media travelled to the Gardiner Basin and the West Yellowstone area to film the event. They described how park rangers led hunters directly to bison they had located. Animals either standing or lying down were shot at point-blank range. A total of 569 buffalo were killed. One reporter noted ironically that the rangers' badges were inscribed with the Interior Department's symbol, the American bison. The resulting footage caused a national uproar and criticism of "unfair chase" and "slaughter."

In 1990 the National Park Service, the U.S. Forest Service, and the Montana Department of Fish, Wildlife, and Parks collaborated to prepare an environmental impact statement examining options for a "long-range bison management plan." In 1992, those agencies joined with the Montana Department of Livestock and U.S. Department of Agriculture, Animal and Plant Health Inspection Service and signed a "Memorandum of Understanding" to develop such a plan.

Between 1990 and 1995, various plans provided for agency personnel from Montana and the National Park Service to shoot bison moving from Yellowstone National Park into Montana in order to "achieve the objectives of protecting private property, providing for human safety, and maintaining Montana's brucellosis class-free status."

In 1995 the State of Montana sued the National Park Service and APHIS, complaining of both NPS management of bison and the possibility that APHIS would change the state's brucellosis class-free status. In 1996, shooting was suspended and instead, migrating wild bison were herded into the Stephens Creek capture facility within the park and near its north boundary, loaded onto livestock trailers and shipped to a slaughtering facility. The plan also provided for the capture of bison outside Yellowstone in the West Yellowstone area and the shipment to slaughter of all pregnant bison as well as any others that tested positive for brucellosis.

Two lawsuits challenged the legal basis for the implementation of this plan because it included the capture and testing of bison in capture facilities within the park and in the Gallatin National Forest, and subsequent slaughter of seropositive and pregnant bison. The U.S. District Court for the District of Montana held that the actions of the National Park Service were within the authority and discretion of the agency. The Ninth Circuit Court of Appeals affirmed that decision (*Record of Decision,* 2000, pp. 3-4).

During the severe winter of 1996-1997, nearly 1,100 bison were sent to slaughter, reducing the population to about 2,200 in 1997-1998. The carcasses were sold at public auction or given to Native Americans (Bison, 2015).

While the various plans provided the legal authority to lethally remove bison attempting to leave the park for forage, no management plan was in place limiting the mortality or providing guidelines to maintain a genetically viable population. The need for such a bison management plan was summarized in the *Jackson Hole News & Guide*. The story, headed "Feds deny petition for bison ESA listing," concerned the Fish and Wildlife Service's 2007 denial of my petition to list the Yellowstone bison as an endangered species. Reporter Cory Hatch wrote:

> The U.S. Fish and Wildlife Service has denied a private citizen's request to list the Yellowstone bison as an endangered species after eight years of deliberation.
>
> Minnesota resident James Horsley filed the petition in 1999, concerned that there were no limitations on killing bison that left the park. Horsley's petition came after the winter of 1996-97 when severe weather led to the deaths of over 1,000 bison as they tried to move into winter range outside the park.
>
> According to Chuck Davis, endangered species litigation coordinator for the Fish and Wildlife Service, Yellowstone and other management agencies that oversee bison populations in Montana have since formulated a management plan that provides guidelines for killing bison meant to keep numbers high enough to maintain a viable population.
>
> Davis said that, though the petition was unsuccessful, Horsley's concerns raised some key issues. "His main concern was there was no control over mortality," said Davis. "Because we didn't have a plan, his petition had some merit."
>
> Also, Horsley suggested that the Yellowstone bison be considered a distinct population segment, a position that the agency ultimately agreed with.

"If you look at the Yellowstone bison herd, it is both discreet and important," said Davis. "It doesn't interbreed with other populations and it's significant because it's the only bison herd that has always been there. It never disappeared and it is not reconstituted from other herds."

Davis acknowledged that there are still some problems with Yellowstone bison, most notably a disease called brucellosis that bison might be able to transmit to cattle. "Clearly there were some issues here with management of the park's herd," he said. "Quite frankly our herd continues to grow and it doesn't show any problems with breeding and things like that. In fact, the herd is doing pretty darn well."

Horsley and representatives of the Buffalo Field Campaign could not be reached for comment (Hatch, 2007).

Beginning of the Interagency Bison Management Plan (IBMP)

Trying to achieve the various goals of the agencies created conflicts between them and resulted in the filing of the suit mentioned above. Following an environmental impact statement, the parties signed a settlement agreement that provided for a bison management plan. That plan eventually resulted in a court-approved agreement that entailed the shipment to slaughter of bison captured in the park near the north boundary in the Stephens Creek as well as Hebgen Lake regions near the West Yellowstone area.

This agreement established the Interagency Bison Management Plan (IBMP). In essence, the plan gives legal authority to haze or lethally remove wild bison coming into these wildlife habitats where cattle, a domestic and invasive species, graze. The plan was made law in 2000 and since November 2009 includes three tribal entities: the Confederated Salish & Kootenai Tribes, the Inter Tribal Buffalo Council, and the Nez Perce Tribe.

According to the Preamble of the *Record of Decision for Final Environmental Impact Statement and Bison Management Plan for the State of Montana and Yellowstone National Park*:

> Bison are an essential component of Yellowstone National Park because they contribute to the biological, ecological, cultural, and aesthetic purposes of the Park. However, Yellowstone National Park is not a self-contained ecosystem for bison, and periodic migrations into Montana are natural events. Some bison have brucellosis and may transmit it to cattle outside the Park boundaries in Montana if bison migrating from the Park are allowed outside the Park without appropriate management measures. Transmission of brucellosis from Yellowstone bison to cattle in Montana could have not only direct effects on local livestock operators, but also on the cattle industry statewide. Because bison that leave YNP are under the management jurisdiction of the State of Montana, the cooperation of several agencies is required to fully manage the

herd and the risk of transmission of brucellosis from bison to Montana domestic cattle. Is line below indented correctly?

The parties recognize that the cooperation to address the existence of brucellosis in the bison herd involves the management of wild bison on both private and public lands, which requires different approaches to risk and disease management than standard situations involving brucellosis in domestic cattle or bison . . .

The management of bison under this plan will include actions to protect private property; actions to reduce the risk of transmission of brucellosis from bison to cattle; and, actions to maintain a viable, free-ranging population of Yellowstone bison (*Record of Decision*, 2000, p. 21, 22).

As a risk management measure and as a bison mortality cap, the *Record of Decision* states "the agencies would maintain a population target for the whole herd of 3,000 bison." Why this maximum allowable bison population in the park? According to the *Record of Decision*, this is the number above which "bison are most likely to respond to heavy snow or ice by attempting to migrate to the lower elevation lands outside the park in the western and northern boundary areas" (*Record of Decision,* 2000, p. 20).

This is an amazing collection of double talk. On the one hand, it outlines the importance of wild bison and that the park is not large enough to provide all the habitat essential for their survival, necessitating their migration out of the park. In recognition of this, the IBMP states it intends to "maintain a viable, free-ranging population of Yellowstone bison." But when are bison most likely to become migratory or "free ranging"? It is, according to the IBMP, at the 3,000 population level and it is at this level the IBMP member agencies will cull them. These two statements (protect the free-ranging and kill them) are of course contradictory, and thus double talk. But what else can one expect when one considers that the IBMP was specifically formed to stop the free-ranging behavior of bison, that is, their migration out of the park, yet need cover to do so? That cover is the claim its goal is to "maintain a viable, free-ranging population of Yellowstone bison"—which is just talk.

In order to proceed when mission statements contain opposing goals, one has to choose one or the other goal. One can not have his cake and eat it, too. The IBMP chose to target bison instead of cattle to achieve separation of the two species. The simplest, most effective and most economical choice would have been to remove cattle from the park boundary areas such as Gardiner Basin and Hebgen Lake region near West Yellowstone. Instead, the IBMP chose to allow cattle in these park perimeter habitats and disallow bison, favoring domestic cattle that predominantly graze these regions during warm-weather months over wild bison that historically have used these habitats for winter migration for millennia for survival. This is an ecological travesty.

Wild bison managed by law like livestock

Giving legal cover for this range war is title 81 of the Montana Code Annotated on livestock. It states that the Department of Livestock "shall exercise general supervision over and, so far as possible, protect the livestock interests of the state from theft and disease . . ." Included in the department's responsibilities under statute 81-2-120 is "Management of wild buffalo or wild bison for disease control." The 2015 code states:

> (1) Whenever a publicly owned wild buffalo or wild bison from a herd that is infected with a dangerous disease enters the state of Montana on public or private land and the disease may spread to persons or livestock or whenever the presence of wild buffalo or wild bison may jeopardize Montana's compliance with other state-administered or federally administered livestock disease control programs, the department may, under a plan approved by the governor, use any feasible method in taking one or more of the following actions:
>
> > (a) The live wild buffalo or wild bison may be physically removed by the safest and most expeditious means from within the state boundaries, including but not limited to hazing and aversion tactics or capture, transportation, quarantine, or delivery to a department-approved slaughterhouse.
> >
> > (b) The live wild buffalo or wild bison may be destroyed by the use of firearms. If a firearm cannot be used for reasons of public safety or regard for public or private property, the animal may be relocated to a place that is free from public or private hazards and destroyed by firearms or by a humane means of euthanasia.
> >
> > (c) The live wild buffalo or wild bison may be taken through limited public hunts pursuant to 87-2-730 when authorized by the state veterinarian and the department.
> >
> > (d) The live wild buffalo or wild bison may be captured, tested, quarantined, and vaccinated. Wild buffalo or wild bison that are certified by the state veterinarian as brucellosis-free may be:
> >
> > > (i) sold to help defray the costs that the department incurs in building, maintaining, and operating necessary facilities related to the capture, testing, quarantine, or vaccination of the wild buffalo or wild bison; or
> > >
> > > (ii) transferred to qualified tribal entities that participate in the

disease control program provided for in this subsection (1)(d). Acquisition of wild buffalo or wild bison by a qualified tribal entity must be done in a manner that does not jeopardize compliance with a state-administered or federally administered livestock disease control program. The department may adopt rules consistent with this section governing tribal participation in the program or enter into cooperative agreements with tribal organizations for the purposes of carrying out the disease control program.

(e) Proceeds from the sale of live, brucellosis-free, vaccinated wild buffalo or wild bison must be deposited in the state special revenue fund to the credit of the department.

(f) Any revenue generated in excess of the costs referred to in subsection (1)(d)(i) must be deposited in the state special revenue fund provided for in 87-1-513(2).

(2) Whenever the department is responsible for the death of a wild buffalo or wild bison, either purposefully or unintentionally, the carcass of the animal must be disposed of by the most economical means, including but not limited to burying, incineration, rendering, or field dressing for donation or delivery to a department-approved slaughterhouse or slaughter destination.

(3) In disposing of the carcass, the department:

(a) as first priority, may donate a wild buffalo or wild bison carcass to a charity or to an Indian tribal organization; or

(b) may sell a wild buffalo or wild bison carcass to help defray expenses of the department. If the carcass is sold in this manner, the department shall deposit any revenue derived from the sale of the wild buffalo or wild bison carcass to the state special revenue fund to the credit of the department.

(4) The department may adopt rules with regard to management of publicly owned wild buffalo or wild bison that enter Montana on private or public land and that are from a herd that is infected with a contagious disease that may spread to persons or livestock and may jeopardize compliance with other state-administered or federally administered livestock disease control programs. (Montana Code Annotated, 2015).

In sum, this states that whenever wild bison from Yellowstone National Park (which are recognized by law as being publicly owned) come onto public or private property within Montana, the Department of Livestock may either haze them back into the park, capture and ship them to a slaughterhouse, shoot them or have them taken by public hunting.

Brucellosis-free bison may be sold or transferred to those tribes that have taken part in the "disease control program," thereby providing bison as a handout to these tribes. This is an insult when you consider that bison were originally destroyed by the millions during the great buffalo slaughter following the Civil War as a means to subdue the Plains Indian nations' ability to be self-reliant.

It is relevant to note that this statute is under the heading of "Title 81: Livestock, Chapter 2: Disease Control." Bison are being managed as livestock for disease control in the state of Montana by the Department of Livestock.

The statute is biased. It does not address disease-control issues with regard to the removal of either elk or cattle that enter the state of Montana "from a herd that is infected with a dangerous disease."

Possibly Native Americans and conservationists can offer to manage Montana cows for disease control. The cattle that graze along the perimeters of the park have been exposed to brucellosis from elk because the cattle herd and the elk herd mingle, thereby making both elk and cattle "from a herd that in infected with a dangerous disease." Why not manage Yellowstone's border cattle like bison are managed now? It would be an instance of "tit for tat," a logical strategy used in the game Prisoner's Dilemma. This strategy, which has been applied successfully in many real life situations, recommends a like-for-like retaliation as the most rewarding response to duplicity by one's opponent (Tit for tat, 2015). Hypothetically, in the name of disease control, Native Americans could go onto cattle ranches near the park and slaughter cattle that have come in contact with elk from brucellosis-infected elk herds—which is most of the cattle herds in the Greater Yellowstone Ecosystem—and give the slain cattle to the cattlemen, charging them $3 million for their services. It would be, indeed, tit for tat. But of course it would be unlawful. Legally, it is the profits from cattle, regardless of whether or not cattle have been exposed to brucellosis, that now count.

Let us look more closely at what is happening on the borders of the park. As noted, prior to the formation of the IBMP, thousands of wild bison had been culled attempting to leave the park for winter forage or to give birth outside the park's boundaries. Since IBMP's inception, thousands more have been shot or shipped to slaughter because they were headed toward the park boundaries, with the largest single herd reduction totaling 1,729 in the winter 2007-2008. Between 1985 and 2014, nearly 7,200 wild bison have been eliminated from America's last wild population by artificial means (Brister, 2014). By 2015 that figure rose to 8,640 (Yellowstone Bison Slaughtered, 2015). In 2016 the tally climbed to 9,183 bison killed.

The major destinations of the bison migrations are two areas just outside the park. One is the Gardiner Basin just north of the park near the city of Gardiner and the other the Hebgen Lake region west of the park near West Yellowstone. These grasslands straddle the boundaries of the park and occupy a relatively small percentage of the GYE.

Of particular importance is the Gardiner Basin. It has become the "Achilles Heal" of the Greater Yellowstone Ecosystem, for it is here that both the northern and central herds attempt to migrate during winter. It is also the gateway via Yankee Jim Canyon to Paradise Valley, home of Hollywood actors and actresses, producers, directors, publishers and song writers (Paradise Valley, Montana, 2014), as well as the site of a number of multi-million-dollar "executive ranches." The valley is a swath of spectacularly beautiful private property that cuts into the heart of the Greater Yellowstone Ecosystem and through which flows the Yellowstone River.

In hindsight, both the Gardiner and Hebgen Lake basins, as well as Paradise Valley and regions along the Madison River, should have been included in the park boundaries to enable proper function of this wildlife ecosystem. However, they were not.

Instead of being the exclusive habitat for wildlife, these regions are the site of a number of cattle operations. Being that Yankee Jim Canyon is a bottleneck through which passes the highway connecting Yellowstone National Park's northern entrance with such towns as Livingston, Montana, bison are stopped from entering Paradise Valley by the cattle guards and fencing there.

Bison headed toward this valley to escape the winter snow levels in the park must first pass through the Gardiner Basin to the north. To get here, they follow the Yellowstone River and the Gardiner River. The Hebgen Lake region to the west does not pose a winter bison migration problem. Situated at a higher elevation than Gardiner Basin, it is often covered in four feet of snow during winter months. Such depths prohibit foraging, so it is not a significant winter migration destination. However, in the spring the Hebgen Lake region is a favorite calving spot for wild bison. To get here, they follow the Madison River through Madison Valley, which is bisected by the park's west boundary.

When the IBMP was formed in 2000, about 2,000 cattle were trucked to the Gardiner and Hebgen Lake basins to graze every spring. They represented a fraction of the 2.5 million beef cattle in Montana. The two ranges where bison grazing overlaps with cattle are designated Special Management Areas.

Seasonally, some bison are found in the Gardiner Basin and the Hebgen Lake regions. Some are escaped from capture facilities, that is, those who did not migrate during the winter into these bison traps, which in effect automatically destroy hundreds, sometimes thousands of bison annually, functioning as wild bison disposal units. Others are those that come to these regions to calve in the spring. Until recently, all were hazed back into the park while still in the process of nursing their young. Bison entering both regions sooner or later were either hazed out of these critical habitats or slaughtered. Now hazing has been more limited in the

Hebgen Lake region, allowing those entering Horse Butte to return to the high country of the park on their own.

These are unique animals. At a molecular level, 75 percent of the genetic diversity that occurs in the entire species of bison is found in Yellowstone National Park. It is the only major herd in the US that is free of cattle genes. "The bison in Yellowstone National Park are pivotal to the long-term conservation of the species," according to Jim Derr, speaking at a gathering of a panel in Washington, D. C., formed by the National Academy of Sciences.

Two genetically distinct populations inhabit the park, the northern herd and the central herd. He explained:

> When we compared the genetics of these two herds, these two populations are similar to the differences between other US federal herd populations. For example, these two populations are as dissimilar as either are to Wind Cave National Park bison.

The dissimilarities are enough to influence mating behavior. He notes:

> They do interact together in the summertime in the Lamar Valley. When it comes time to do breeding most of the breeding is done separately. The animals know what herd they belong to. I don't know how they know it, but they know it.

He spoke against the culling that is done without sufficient knowledge of its effects. He said:

> I think when we go and manipulate populations—however we do it—and we are changing the genetics architecture of the population from a genetics point of view, I think it is always better to have more knowledge than less knowledge.

He spoke in particular about the genetic perils of culling that was excessive, non-random and uninformed:

> What I am opposed to is making drastic changes and drastic culling from a population in a non-random way when we really don't know what the implications for that will be. We don't know how we are changing the genetic architecture of that population.

There are rare alleles or genes in a few bison. Culling without knowing which genes are in which animals has the potential of removing those genes from the park. Derr stated:

> We do know that in Yellowstone National Park there are about a half dozen alleles that occur in Yellowstone National Park in low frequencies that don't occur in any other bison herd. O.K.? I am not saying those alleles are good and I am not saying those alleles are bad. I am saying they are a private alleles that occur in Yellowstone National Park. They are rare. And we could remove those alleles out of the park if we chose those animals that had those genes. We should know what we are doing when we decide to go in and make those non-random decisions.

And how do we do that? Derr had some suggestions:

> I think understand, at least for those genes here, understand what is going on with these genes, as far as susceptibility or resistance, and how those immune response genes are acting so we know what to focus on—what genes to focus on—realizing that there are two populations there and if we heavily take animals out of the northern population and we hit that really hard and we take a lot of animals out of that population and we make the argument there are 3,500 animals in this population and we take out 500 from this northern herd it is not going to matter. The fact of the matter is there is not 3,500 in this population, there are two populations there that [together] have 3,500, so if we make our calculations wrong, then we can have an effect and I don't know exactly what number would start having a detrimental effect on the genetics, but it is undeterminable.

Yet, in spite of this warning, in the event of a harsh winter, when there is a large out-migration, one of the proposals of the IBMP is to hit the northern herd hard, reducing it from a population of 4,000 to a population of 3,000, a reduction of 25 percent. Derr summed up part of his talk by noting the unique position of wild Yellowstone bison as a species:

> And finally, think about this. Yellowstone bison have existed on their present landscape since pre-Columbian times. Do you know of any other bison herd in the US that has existed on that landscape forever? All other US federal herds (the US Fish and Wildlife, the National Park Service herds), except Yellowstone, those animals have been moved onto those locations. Yellowstone bison have been there—they have never been completely exterminated—because in 1902 the census revealed there were 22 animals remaining in the park that were native and endemic animals (Derr, 2015).

And now this one-of-a-kind herd—America's last wild bison—is being subjected to federal, state and tribal initiated slaughter by the thousands for no reason other than intolerance, primarily by members of the cattle industry that appear to hate and fear wild bison—all done under the legal cover of the IBMP.

8

Migration to extinction: The bison horror picture show

When wild bison descend from the high plateaus and valleys of the interior of the park, they enter what is technically called a “dispersal sink,” in this case, a low-altitude refuge from the deep snowpack they have left behind. This refuge is called Gardiner Basin, the only place bison can go when ice and snow cover their forage in a severe winter. They walk into a death trap.

Wild bison movements into Gardiner Basin during winter range from a few percent to sometimes 30 percent to almost an entire herd in a catastrophically severe winter. These movements are routinely tracked, as well as weather and landscape conditions such as snowpack, to enable park managers to better understand the dynamics influencing the wild bison’s migratory habits. They need to know when the bison are coming and how many they will have to handle for meat processing, employing highly-sophisticated methods to do this.

Data from NASA's Landsat satellite generates daily maps of snowpack depth and density throughout the park, as well as how the snowpack is being influenced by patterns of vegetation, geothermal features and wind. Precipitation and temperature are measured daily by the United States Department of Agriculture Snowpack Telemetry system. The satellite map below shows the “migration routes” of bison during the winter into the “bison capture facility,” at Stephens Creek (Cook-Anderson, 2006).

As the wild bison enter the basin, they are intercepted by a posse of park rangers who drive them into the capture facility located inside the park. Shown photographically is the herding of these wild bison into the capture and ship-to-slaughter facility, an aerial view of the facility itself, various views of its interior, the result of bison entering that facility and the effects hazing can have. These are pictures of industrialized wildlife slaughter.

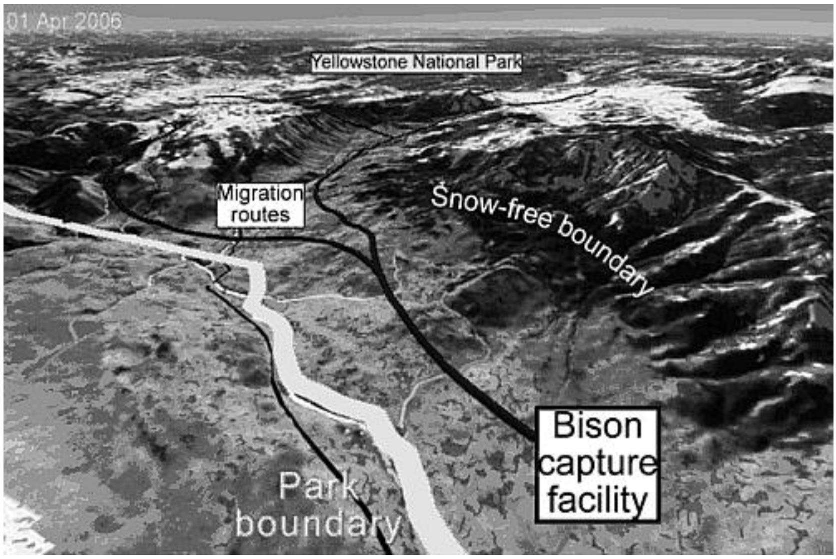

Figure 23. BISON MIGRATION ENDS in a capture facility, then slaughter. This image was created from NASA Landsat satellite data and shows the "snow-free boundary" and the migratory path of the bison herd in Yellowstone National Park. ***Credit: NASA (Cook-Anderson, 2006).***

Figure 24. DRIVING WILD BISON into the Stephens Creek capture facility for purposes of "ship and slaughter" to carry out the mandates of the IBMP. ***National Park Service photo.***

Figure 25. RANGERS on horseback and in vehicles pushing bison into the Stephens Creek capture facility January 1997. That severe winter 1,100 bison were either shot or captured and sent to slaughter. (Yellowstone's Photo Collection, 2015). ***Photo by Jim Peaco.***

Figure 26. AERIAL VIEW OF STEPHENS CREEK CAPTURE FACILITY on the north side of Yellowstone National Park near Gardiner, Montana. Here on park property thousands of bison have been captured mid-migration and shipped to slaughter houses. ***Photo courtesy of Buffalo Field Campaign.***

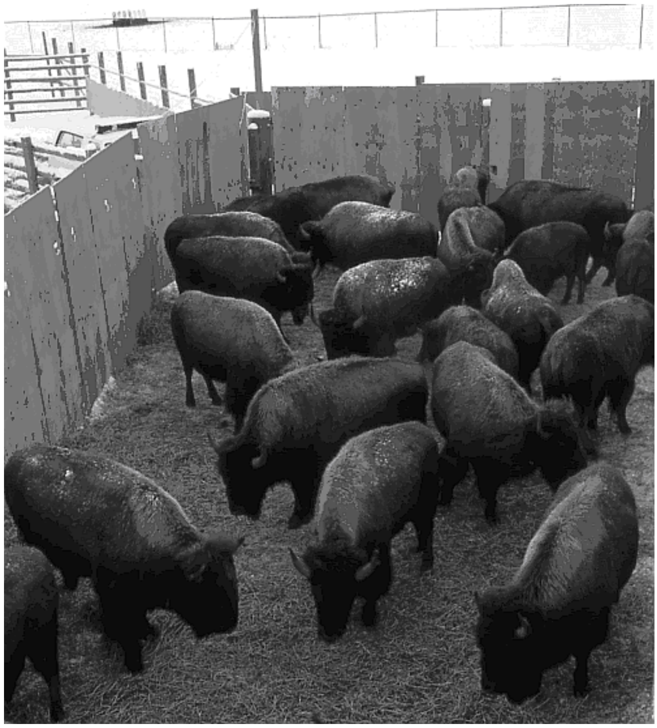

Figure 27. BRUCELLOSIS IS PROMOTED BY CROWDING (White, 2011), yet captured bison are forced into pens and fed hay. Under one plan, bison that test negative for brucellosis and are *not* pregnant are ear-tagged, marked with a peroxide dye and hauled to nearby public land and released. The rest are hauled to slaughterhouses (McMillion, 1996). ***Photo by Jim Peaco (Yellowstone's Photo Collection).***

Figure 28. INTO THE MAW OF THE CAPTURE FACILITY. Wild bison travel increasingly narrow chutes and are finally secured by a rope and hook through the nose. ***Photos courtesy of Buffalo Field Campaign.***

Figure 29. WORKING BISON CHUTES AT STEPHENS CREEK in 1997 are Ranger Lloyd Kortge, managing the park's $100,000 capture facility, and Jerry Ryder (bottom) (McMillion, 1996). Bison are loaded onto waiting livestock trailers and hauled to a slaughter house. ***January 1997 photo by Jim Peaco (Yellowstone's Photo Collection).***

Figure 30. ON THE ROAD TO EXTINCTION. A convoy loaded with bison from the Stephens Creek capture facility heading to a slaughter house. *Courtesy Buffalo Field Campaign.*

Figure 31. OUTSIDE A SLAUGHTERING FACILITY, bison heads are stacked in the snow. The decapitated heads are from butchered wild bison initially trapped in a Yellowstone National Park capture facility. *Photo courtesy of Buffalo Field Campaign.*

West of the park, buffalo grazing on the shore of Hebgen Lake in early January 2006 were chased by the Montana Department of Livestock onto thin ice. Several broke through the ice and drowned in the frigid water. Rangers pulled their bodies out by rope and snowmobiles. The 33 remaining survivors of the herd were captured and slaughtered. All told, that winter 1,016 bison were culled.

Figure 32. RANGERS HAZED THESE WILD BISON out onto the thin ice of Hebgen Lake, drowning several. ***Photo courtesy of Buffalo Field Campaign.***

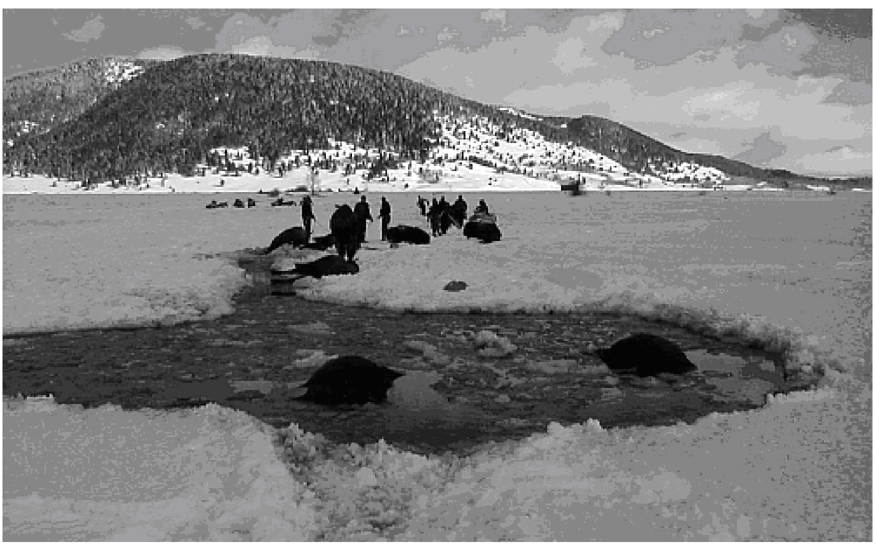

Figure 33. RANGERS PULLING OUT CARCASSES of drowned bison that fell through the ice during hazing operations. ***Photo courtesy of Buffalo Field Campaign.***

What is going on here the IBMP calls Adaptive Management (AM). By this "adaptive management," the IBMP artificially selects for survival only those bison with the potentially non-adaptive traits of the non-migratory. Migration is a necessary component of a herd to assure survival and is linked to aggressive and leadership behaviors. By culling the migratory, IBMP is selecting toward a breeding stock of non-migratory bison, eliminating the wild trait of migration.

9

The brucellosis controversy

Violent acts need a rationale to justify them. The rationale for the lethal removal of wild bison in the park is the bacteria called *Brucella abortus*. Testing indicates about half the bison population either has immunity to it or is infected by it. According to *Yellowstone Bison: Conserving an American Icon in Modern Society* by White et al.,

> The prevalence of brucellosis in Yellowstone bison is relatively high with about 60 percent of adult females testing seropositive for antibodies in their blood indicating previous exposure to *Brucella* bacteria. However, only about 10 to 15 percent of all adult female bison, and 20 to 30 percent of seropositive female bison, are infectious and could potentially shed live bacteria (White, 2015, p. 24).

The IBMP's stated mission is to 1. maintain a wild, free-ranging bison population, 2. reduce the risk of brucellosis transmission from bison to cattle, 3. manage bison that leave Yellowstone National Park and enter the State of Montana, and 4. maintain Montana's brucellosis-free status for domestic livestock (Interagency News Release, 2015).

IBMP states that its lethal removal of bison migrating out of the park is necessary because "the risk of transmission is not zero" between bison and cattle (*Record of Decision*, 2000, p. 50).

The chief agency justifying the lethal control of wild bison is APHIS. It claims that brucellosis can be eradicated from Yellowstone wildlife and that this can be done by maintaining separation between species susceptible to brucellosis, such as cattle and park bison, through hazing and culling (Brucellosis and Yellowstone Bison, 2012). But elk are also susceptible to brucellosis and that fact is just winked at by APHIS in its brucellosis eradication program.

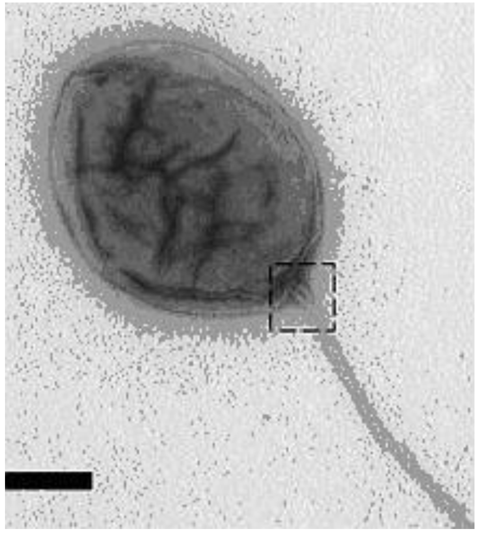

Figure 34. *BRUCELLA* is a genus of Gram-negative bacteria named after David Bruce (1855-1931). As shown under an electron microscope, the body contains genetic information, while the tail of the organism, the flagellum, has been indicated as significant in bacterial adhesion to host cells and invasion into them. The tail spins to provide motility via a rotary motor at the site of the dashed boxed area (Haiko, 2013; Ferooz, 2010). *Image courtesy of BioMed Central.*

The Greater Yellowstone Ecosystem is the last significant reservoir of brucellosis in the United States. To eradicate brucellosis in cattle, diseased animals must be separated from healthy animals by spatial or temporal separation, such as by killing infected herds and keeping uninfected herds isolated from possible contamination through fencing, distance or absence from a once-diseased environment for an interval of time.

But brucellosis is present in multiple wildlife vectors. In addition to bison and elk, susceptibility to brucellosis has also been documented in rats, rabbits, hares, mink, foxes, coyotes, dogs, guinea pigs, sparrows, magpies, crows, pigeons, pheasants, chickens, turkeys, geese, fleas, house flies, mosquitoes, bedbugs and ticks (Hayes, 1977).

To eradicate this disease in the ecosystem (to reduce the risk of transmission to zero), one would have to eradicate wildlife. To maintain a free-roaming bison population and to control the spread of *Brucella abortus* from bison and elk (and potentially other wildlife) to cattle within the same system is self-contradictory, that is, impossible.

Brucellosis: characteristics of the disease

The stated reason for culling bison attempting to exit the park is to prevent the spread of brucellosis from infected wild bison to the cattle grazing adjacent to the park. Brucellosis is transmissible interspecies and is a zoonotic disease that can be passed between vertebrate animals and humans.

According to a fact sheet prepared by APHIS, brucellosis:

- is a contagious, costly disease of ruminant animals such as cattle, bison and elk that also affects humans. It is also called contagious abortion or Bang's disease. In humans it is known as undulant fever because of the severe intermittent fever accompanying infection.

- in animals causes decreased milk production, weight loss, loss of young, infertility and lameness.

- is commonly transmitted to animals by direct contact with infected animals or with an environment that has been contaminated with discharges from infected animals. Aborted fetuses, placental membranes or fluids may be contaminated with the disease. It is transmitted by cows licking those materials or the genital area of other cows or ingesting feed or water contaminated with the disease-causing organisms. Brucellosis is carried from one herd to another when a herd owner buys replacement cattle that have been infected with the disease. The disease may also be spread when wild animals or animals from an affected herd mingle with brucellosis-free herds.

- may be avoided by using proper sanitation methods. Proper herd management strategies, such as maintaining closed herds, can aid in the avoidance of the disease.

- can be eradicated. In 1954 congressional funds were approved for a cooperative state-federal brucellosis eradication program to eliminate the disease from the country. The basic approach is to vaccinate calves, test cattle and domestic bison for infection and send infected animals to slaughter. Depopulation of herds, if funds are available, may be used if herds are severely affected. States are designated brucellosis-free when none of their cattle or bison is found to be infected for 12 consecutive months under an active surveillance program (Facts About Brucellosis, 2015).

Of particular interest is the method APHIS recommends to control the spread of brucellosis, namely, closed herds. Closed herd management restricts the introduction of animals and vehicles from livestock sources as well as contact with other herds and animals, according to the *Merck Veterinary Manual*. Open herds have a higher risk of introducing pathogens through such practices as introduction of purchased replacements, mingling of animals of different backgrounds or poor herd biosecurity (Hilton, 2014). Maintaining a closed beef herd includes eliminating fence line contact with other herds (Dahlen, 2015).

By insisting on grazing cattle, whether open range or fenced, adjacent to a biohazardous area such as the GYE where wildlife is infected with brucellosis, is not practicing the protocols recommended by APHIS, which include closed herd management.

No transmission of brucellosis from wild bison to cattle has been recorded in the wild. Nevertheless, because cattle are allowed to graze adjacent to the park within the GYE in opposition to the very brucellosis-control methods APHIS recommends, the IBMP nevertheless has acquired the legal authority to kill any bison coming out of the park when the population of bison within the park exceeds 3,000 head because the IBMP has determined the risk of transmission from bison to cattle is "not zero," as stated in the *Record of Decision*.

Any reasonable man would say, given these facts, that the only way to maintain zero risk transmission is to permanently separate all animals with brucellosis from those animals that are disease-free and that the only way to do this would be to control what one can control, namely, separate cattle from the contagious environment.

The history of the brucellosis controversy involving the Yellowstone bison herd and cattle near YNP is documented by the Animal Plant and Health Inspection Service:

> During the winter of 1996-97, with the herd population at record levels, the limited forage in YNP was covered with record levels of ice and snow. As a result, larger numbers of bison moved to areas outside the park looking for food; 1,079 bison that exited the Park were shot or sent to slaughter. An additional 1,300 or more bison starved to death inside the park. The involved Federal agencies—APHIS, USDA's Forest Service, and the Interior Department's National Park Service—then proposed a series of contingency measures to address the problems caused by that year's severe winter weather in YNP. The short-term objective was to limit as much as possible additional killing of bison during the balance of the winter season, while also preventing transmission of brucellosis to livestock outside the park.
>
> The long-term objective was to develop a long-range plan for management of the Yellowstone bison herd to prevent the transmission of brucellosis from bison to cattle and maintain a viable bison herd.
>
> While USDA is charged with eradicating brucellosis from the United States, it also remains committed to maintaining a viable and free-roaming bison herd in YNP. The goals of the eventual elimination of brucellosis from the GYA and maintaining a free roaming bison herd have been jointly agreed to in a Memorandum of Understanding between the U.S. Department of Interior, the States of Montana, Idaho, and Wyoming, and USDA. Eliminating brucellosis and managing a free-roaming bison herd at YNP are not

> incompatible goals, and achieving them will require a cooperative effort by all involved agencies. The *Record of Decision* for Final Environmental Impact Statement and Bison Management Plan for the State of Montana and Yellowstone National Park was signed December 20, 2000. The goal of the bison management plan is to maintain a wild, free ranging bison population while minimizing the risk of transmitting brucellosis from bison to domestic cattle on public and private lands in Montana adjacent to YNP. This plan is a bison management plan, not a brucellosis elimination plan.

In "Brucellosis and Yellowstone Bison" APHIS states the bison threat it perceives:

> More than 50 percent of the bison in YNP test positive for brucellosis. A positive test indicates that animals have been exposed and are most likely infected. The concern is that when these bison leave YNP, they may transmit brucellosis to cattle in the surrounding States. All three States surrounding YNP are officially free of brucellosis.

But how probable is the transmission of *Brucella abortus* from wild bison to cattle? Interspecies transmission is rare due to the "species barrier." APHIS continues:

> In 1990, researchers at Texas A&M demonstrated that bison infected with *Brucella abortus could* spread the disease to cattle through contact. Although this was proven under controlled conditions, it is difficult to document transmission of a disease in the wild. In order to document this, a researcher would need to be present when the transmission occurred and collect samples for tissue culturing. In addition, the animals would have to have been previously tested before the transmission had occurred to verify that the event was caused by the bacterial transmission at the observed time. Therefore, it was necessary to conduct this research under controlled conditions. Even though transmission in the wild is difficult to document, results of epidemiological investigations point to domestic bison as the likely source of the disease in infected cattle herds found in Wyoming and North Dakota (Brucellosis and Yellowstone Bison, 2012).

The 1990 study referenced above by APHIS is titled "*Brucella abortus* in captive bison: serology, bacteriology, pathogenesis and transmission to cattle." Donald S. Davis and his colleagues at Texas A&M University reported the results of an experiment that involved putting six cattle into a 2.7-acre paddock with six bison that had been inoculated with a massive dose of brucellosis. After a period of time, half of the cattle became infected with *Brucella abortus*.

What does Davis derive from this experiment? He states:

These data indicate that under controlled conditions, transmission of B. abortus from bison to cattle can occur as readily as cattle-to-cattle transmission (Davis, 1990).

But what does this experiment actually prove? Just what the title suggests: that interspecies transmission of brucellosis in *captive* bison is possible under certain artificial conditions. The paper demonstrates that brucellosis is a disease promoted by captivity, i.e., crowding, as opposed to free-range conditions.

Prior to the Davis experiments, researchers at the Sybille Wildlife Research Unit, Wheatland, Wyoming, demonstrated that close proximity causes transmission of brucellosis from elk to cattle. They penned eight pregnant cow elk artificially-infected with brucellosis together with eight disease-free domestic cows in a 3.2-acre enclosure, mimicking the crowded conditions on a feeding ground. Half of the cattle contracted brucellosis.

"These transmission studies demonstrate that brucellosis will spread from elk to cattle under conditions of close association. The probability of interspecific transmission increases in the presence of abortion and close contact," they conclude (Thorne, et al., 1979).

But based on that experiment are elk, like bison, lethally removed from the park when they attempt to migrate and mingle with cattle? No. Does that make sense? No, except possibly to APHIS. Recall that in its justification of culling wild bison as stated above, it claimed that "wild elk or bison in the GYA have been identified as the most probable source of infection for five additional cattle herds." While stating elk were also a source of brucellosis infection for cattle, did the agency recommend culling elk? No, it did not.

Let us take a look at an experiment similar to those described above: this one involving the captivity of diseased coyotes with disease-free cattle. This investigation was done again by Davis. In four separate trials, 10 coyotes were individually fed bovine placental and fetal tissue experimentally inoculated with *Brucella abortus.* The coyotes were then placed together with six pregnant heifers in 2.5-acre fenced isolation areas, as described in a paper titled "Interspecific transmission of *Brucella abortus* from experimentally infected coyotes to parturient cattle."

Out of the four trials, only one group of cows contracted *Brucella abortus*. That group was from heifers penned with the coyotes that ate tissue with the highest dose of brucellosis. In that trial, half the cows came down with the disease. In the other three trials where coyotes were fed lower doses of infected tissue, none of the cows contracted brucellosis.

How was the disease transmitted? The study made no conjectures. Most researchers believe oral transmission is the most common route. In the trial that caused the infections, *Brucella abortus* was isolated from fecal samples collected from two of the 10 coyotes, but from none of the coyotes in the other three trials.

Possibly, in this experiment, heifer ingestion of hay contaminated by coyote fecal material was the route of transmission.

The two experiments have similarities. In both investigations, half of the cows contracted *Brucella abortus* and in each case, the dose of the infectious agent was massive and delivered in a captive setting.

What does Davis conclude from the coyote experiment? If he were consistent, he would warn that coyotes pose a threat to the brucellois-free status of Montana.

But here is what Davis says: "The epidemiologic significance of the transmission of *B. abortus* from coyotes to cattle should not be overstated. The animals in the investigation were in an artificially crowded situation by experimental design (six cattle and 10 coyotes in a 1 ha area) that would be unusual in nature" (Davis, 1988).

Davis identifies correctly the reason for transmission: "artificially crowded situation by experimental design . . ." Plus, in the only trial that caused the transmission of *Brucella abortus* from coyotes to cows, the bacterial count of the inoculated tissue fed to the coyotes was the highest of the group.

So, what would these findings mean if applied to a wild setting, using Davis's method of extrapolation, that is, applying to a free-range environment what happens in a laboratory setting where bison and infected animals are crowded together?

The answer: haze or kill all coyotes that attempt to cross the border of the park into Montana. This, of course would be ridiculous.

In nature (not the laboratory), what is the probability of the transmission of brucellosis between coyotes and cattle? If aborted tissue from free-range bison in the Yellowstone National Park had bacterial levels high enough to infect coyotes, then coyotes and other scavengers that share the same range also should be highly infected. But is this the case--do coyotes in Yellowstone National Park have brucellosis?

No, they do not. Despite their potential to contract brucellosis, in one study 110 coyotes (Canis latrans) were captured and sampled from October 1989 to June 1993 for various diseases in Yellowstone National Park. No serologic evidence of brucellosis (*B. canis or B. abortus*) was found among the coyote population in Yellowstone (Gese, 1977).

What do these studies prove? According to Davis, in his discussion of the results of his coyote and cattle experiment, earlier researchers have stated that Brucella organisms are not readily transmitted from the preferential host to dissimilar hosts due to the species barrier. Davis noted that "The present study does support this conclusion but it also indicates that transmission from 'dissimilar hosts,' such as predators to the 'preferential host,' [such as cattle] is possible under certain conditions."

Those "certain conditions" are captivity of two different species in close proximity to one another and administration of massive doses of the *Brucella abortus* bacteria. These conditions do not mimic conditions in the field. Further, depending on the species involved, the route of exposure can have a profound influence on the outcome of exposure. In the Davis study, the means of transmission to infect an animal was not by the oral route, but by injection.

However, “a well designed experiment should have included additional groups of bison given an exposure orally to imitate exposure as it occurs in nature,” according to Mary Meagher, a leading biologist with Yellowstone National Park, in a letter to the editor in the *Journal of Wildlife Disease.*

What experiments have proved is that brucellosis is a disease promoted by captivity and other stresses inherent in non- natural settings, such as feeding grounds and stockyards.

For instance, it is known that the elk feeding grounds in Wyoming, such as the National Elk Refuge, promote such diseases as brucellosis. It is feared that it may also promote chronic wasting disease. Elk are fed by the state at the refuge to keep grazing pressure off cattle ranges in the area.

“This biological experiment has created a Petri dish for wildlife disease, and is now one of the most contentious and fiercely-debated issues in the Greater Yellowstone Ecosystem,” according to the narrator of an episode called "Feeding the Problem," aired July 2011 by Montana PBS.

“If you were to ask me to design a system to maximize and amplify transmissible infectious disease, I would tell you to go out there and crowd them together during the maximum stress period of winter and draw them there and probably the easiest way to draw them in there is just feed [them],” observed Dr. Thomas Roffe, chief of wildlife, US Fish and Wildlife Service.

“We look at the feeding grounds and the thousands of animals we crowd into a small area and that is possibly the best wildlife scenario for exacerbating wildlife disease,” he said (Feeding the Problem, 2011).

The reason feeding enhances the mechanism for transmitting wildlife diseases is because it concentrates animals, Roffe pointed out in a 2004 *New York Times* story, “Disease Outbreak Intensifies Debate on Feeding of Elk.” For instance, he said among groups of elk in the area that do not receive the feedings, brucellosis occurs at a rate of 1 to 4 percent, while rates of infection among the fed animals average nearly 20 percent and rise as high as 50 percent (Robbins, 2004).

Not only do elk carry brucellosis, but elk have been identified as the most probable source of the disease in recent outbreaks in cattle. APHIS notes:

> In addition, wild elk or bison in the GYA have been identified as the most probable source of infection for five additional cattle herds. Infected elk were the most probable source of brucellosis infection (fistulous withers) in horses in Wyoming. Most recently, elk were the source of infection of a cattle herd in Idaho (Brucellosis and Yellowstone Bison, 2012).

APHIS then poses this question: “can brucellosis be eradicated from Yellowstone wildlife?” Its answer is in the positive:

> Yes. APHIS officials are confident, based on experience in other public and private bison and elk herds, and on other successful disease eradication programs, that use of a combination of disease-eradication and herd-management measures will lead to the successful elimination of brucellosis from bison and elk in the Yellowstone ecosystem.

And how does APHIS propose to eliminate brucellosis? APHIS states its position:

> APHIS is interested in protecting the bison and neighboring livestock from diseases introduced into the herds from outside sources. APHIS intends to work with the cooperating agencies to develop a plan to eliminate brucellosis from the GYA while ensuring a wild, free-roaming, and viable bison herd in Yellowstone (Brucellosis and Yellowstone Bison, 2012).

Does APHIS state it will assure a “wild, free-roaming and viable” *elk* herd? No. By claiming it wants to assure bison migration, while doing the very opposite, it is attempting to look good rather than practice good science. Regarding elk, it has chosen to dodge the problem of the rising incidents of brucellosis transmission to cattle by elk and essentially do nothing.

But things are changing. Scott McMillion, writing for the November-December 2011 issue of *Montana Outdoors*, the magazine of Montana Fish, Wildlife & Parks, said in “Keeping Elk and Cattle Apart: How Montana is working to reduce the growing risk of brucellosis transmission from elk to cattle in the Greater Yellowstone Area”:

> Close your eyes and say two words: “brucellosis” and “wildlife.”
>
> Chances are, bison appear on the back of your eyelids. After all, the possibility of diseased bison infecting Montana’s cattle herds—and the various reactions to it by state officials and the livestock industry—has dominated headlines for nearly three decades.
>
> But think again. Over the past several years in Montana, Idaho, and Wyoming near Yellowstone National Park, animals in nine cattle herds and two domestic bison herds tested positive for the infectious disease. Scientists say the most likely source of the infections is not wild bison; it’s elk.
>
> In recent years, growing numbers of elk in southwestern Montana have tested positive for exposure to the disease. These “seropositive” elk, as they are called, aren’t necessarily infected with brucellosis or infectious to other animals, but they do harbor antibodies indicating exposure to the disease. The elk have been discovered increasingly farther from Yellowstone National Park, considered the last reservoir of brucellosis in the United States. The wild ungulates mix with cattle primarily in late winter, when they move down from deep snow in high elevations searching for snow-free forage.

McMillion continues:

> Montana Fish, Wildlife & Parks has embarked on an ambitious five-year plan to learn more about how widespread the disease has become in elk, how it affects the animals, how they might spread the disease, and possible threats to elk herds and Montana's beef industry (McMillion, 2011).

To be consistent, wildlife managers will be increasingly forced to constrain elk movements also. While elk are allowed to migrate out of the park, increased use of fencing has recently been employed to keep elk separate from cattle in Paradise Valley just north of Gardiner Basin and those entering this region are now being targeted for limited lethal removals.

In 2007 cattle were tested positive for exposure to brucellosis in Paradise Valley. Following a study, elk were blamed for the transmission, although it has never been conclusively proven that elk were the cause. The Montana Fish, Wildlife and Park Commission recently approved lethal control of elk for the valley, as well as governmental assistance to help finance special fencing to keep migrating elk away from cattle grazing there (Adams, 2014).

The number of elk killed is limited to 10 each time. Hunters on a roster are called to remove the elk. One of the latest requests for culling was for the lethal removal of elk from a cattle ranch near the Dome Mountain Wildlife Management Area, a winter habitat near Emigrant in Paradise Valley set aside for elk migrating out of Yellowstone (French, 2015).

Are bison allowed to enter this wildlife wintering area? No. But elk are. Their culling is limited to a few elk that get near cattle ranches in the valley. If the goal is the realistic suppression of the spread of brucellosis to cattle, the rational mind asks: Why are elk not culled also when they attempt to cross the park's border? Why the differential in treatment of two species that both carry the disease?

But an even greater question should be asked. If all this lethal removal of wildlife is being necessitated by the presence of cattle in the Greater Yellowstone Ecosystem, why are cattle permitted here? Is it worth the cost, both in terms of genetic diversity and financial outlay? This question is studied throughout this petition.

Government misrepresentation

In March 2008 the US Government Accountability Office issued a report titled "Yellowstone bison: Interagency plan and agencies' management need improvement to better address bison-cattle brucellosis controversy." It stated that the estimated annual bison management expenditures by the various agencies of the Interagency Bison Management Plan were as follows:

Table 3. Estimated Annual Bison Management Expenditures (Unadjusted for Inflation), by Agency, Federal Fiscal Years 2002–2007

	2002	2003	2004	2005	2006	2007	Total
National Park Service	$1,200,000	$1,148,075	$1,207,175	$1,204,300	$1,316,000	$1,182,463	**$7,258,013**
Forest Service	100,215	150,000	103,172	95,763	100,278	90,000	**639,428**
Animal and Plant Health Inspection Service	916,610	925,284	1,151,667	1,156,540	1,806,067	1,570,408	**7,526,576**
Montana Depart-ment of Livestock	6,053	47,628	19,504	18,533	20,353	16,906	**128,977**
Montana Fish, Wildlife and Parks	59,329	62,983	58,363	68,778	62,119	67,723	**379,295**
Total	**$2,282,207**	**$2,333,970**	**$2,539,881**	**$2,543,915**	**$3,304,817**	**$2,927,500**	**$15,932,288**

The GAO stated that:

> The plan has two broadly stated goals: to "maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission." The plan, however, contains no clearly defined, measurable objectives as to how these goals will be achieved, and the partner agencies have no common view of the objectives.

As indicated by the totals, the combined agencies spend on average about $3 million annually on this ill-defined wild bison management plan. APHIS alone has spent $7.5 million between 2002 and 2007. It has told the public that it can "work with the cooperating agencies to develop a plan to eliminate brucellosis from the GYA while ensuring a wild, free-roaming and viable bison herd in Yellowstone."

APHIS backs up this claim by stating:

> Similar eradication efforts have been successful in other parks, including Wind Cave National Park and Custer State Park in South Dakota and Wichita Mountain Wildlife Refuge in Oklahoma (Brucellosis and Yellowstone Bison, 2012).

Delany P. Boyd, in her 2003 masters thesis in environmental design from the University of Calgary titled “Conservation of North American bison: Status and recommendations,” categorized bison in Yellowstone National Park as “free-ranging,” while the bison at Wind Cave, Custer and Wichita Mountain are “captive.” Fencing is listed as “none” for Yellowstone National Park, while “perimeter and cross” fencing is listed for Custer State Park and Wichita Mountain Wildlife Refuge, and “perimeter” fencing for Wind Cave National Park (Boyd, 2003, pp. 156-160, 170-183). Cross fencing subdivides the area enclosed by perimeter fencing.

To delude the public into thinking that brucellosis can be eliminated in the free-range bison herds in the GYA by methods similar to eliminating brucellosis in the captive herds in the three conservancy herds is misrepresentation.

Briefly stated, APHIS is engaging in misrepresentation because Yellowstone National Park is permeable, while the other ranges are not. Complete separation from diseased ungulates, whether bison or elk, is not possible for YNP, while it is for the captive conservancy herds.

How serious is this misrepresentation? Could it rise to the level of fraud?

Fraud is the false representation of a matter of fact—whether by words or by conduct, by false or misleading allegations, or by concealment of what should have been disclosed—that deceives and is intended to deceive another so that the individual will act upon it to her or his legal injury.

The statement cited above is a misleading allegation and by not disclosing that the other three herds are captive herds, misleads by concealment.

Fraud must be proven by showing that the defendant's actions involved five separate elements: (1) a false statement of a material fact, (2) knowledge on the part of the defendant that the statement is untrue, (3) intent on the part of the defendant to deceive the alleged victim, (4) justifiable reliance by the alleged victim on the statement, and (5) injury to the alleged victim as a result.

Is the statement false that brucellosis can be eradicated in the GYA by similar efforts that have been successful in other parks, including Wind Cave National Park and Custer State Park in South Dakota and Wichita Mountain Wildlife Refuge in Oklahoma? Yes, it is false because the GYA herds are free-ranging, while the other herds are captive.

Does APHIS know that its statement is untrue? Yes, because AHPIS works closely with all the parks and knows whether the herds are captive or free-ranging.

Is APHIS intending to deceive the public about this matter? Possibly, by the very fact that its statement does not disclose the captive nature of the other herds.

Is the public reliant on APHIS for the truth of that statement? Yes, because the public normally does not have the time or resources to determine the truth and must rely on the veracity of the government.

And lastly, has the public been injured by this deception? Yes, millions of tax dollars have been spent on a wild bison "goose chase" solely for the benefit of the Montana livestock industry.

In sum, APHIS has misled the public by its various statements that it can "eliminate" or "eradicate" or "minimize" brucellosis in the YNP by methods it has used for other federally-managed herds. But all those herds are fenced. Yellowstone National Park is not fenced and fencing has been deemed incompatible with a wildlife ecosystem such as exists here.

The "wild, free-ranging" ruse

The misrepresentation is compounded by APHIS stating "The goal of the bison management plan is to maintain a wild, free-ranging bison population while minimizing the risk of transmitting brucellosis from bison to domestic cattle on public and private lands in Montana adjacent to YNP." They do so by killing every free-ranging, roaming wild bison they can get their hands on.

As noted, at the end of the migratory trail habitually used by YNP bison is the Stephens Creek capture facility. For all practical purposes, the capture facility, the fan of fencing and the government agents together function as a fence. However, it is a lethal fence—but lethal for bison only. While none of YNP is physically barricaded by wire fencing—and thus Yellowstone's wild bison are listed by Boyd (Boyd, 2003) as "free-ranging"—because of the interagency management actions, Yellowstone's bison are actually captive. Because they can not range freely they are in actuality not free-ranging. The massive culling program carried out via hunting and the capture facilities vitiate the IBMP members' claim that their goal is "to maintain a wild, free-ranging bison population." Wild creatures must have wilderness, and wilderness is not an area of captivity. Zoos are. For bison, YNP functions as a zoo, and at other times, a bison slaughterhouse.

This is all supposedly necessary because bison pose the threat of infecting cattle with brucellosis. But what is the reality of the situation? Setting hysteria, distorted scientific findings and bias aside, what do we know?

The "not zero" ruse

IBMP members, including APHIS, apparently are counting on the public to keep its eyes closed concerning the multiple brucellosis vectors. They insist that the risk of transmission from bison to cattle must be zero, while winking at this risk for elk. The *Record of Decision* observed:

> Commentors are correct that available evidence indicates the risk of transmission under natural field conditions is extremely low. However, because transmission between bison and cattle has occurred under experimental conditions and on ranches with privately owned bison and cattle, the risk of transmission is not zero (Record of Decision, 2000, p. 50).

The Interagency supported its actions as follows:

> Eradication of brucellosis is not an objective; however, a commitment that the plan move toward elimination is. This means seropositive rates cannot remain as they are or increase, but must decrease over the life of the plan. In the selected alternative, this is accomplished primarily through bison vaccination. Preventing brucellosis in cattle is one of the purposes of APHIS' brucellosis eradication program; however, the purpose of action in the plan is confined to actions in the analysis area and is to "maintain a wild, free ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the State of Montana." Although the risk of transmission is low, it is not zero. Also, although the likelihood of two outbreaks and a downgrade in state status is also quite low, it is a possibility with serious economic ramifications, should it occur. Both are legitimate reasons for taking actions (*Record of decision*, 2000, p. 57).

Two things are glaringly wrong here. Epidemiologically, a goal of zero transmission of a disease such as brucellosis is untenable. Only in a captive environment can such a disease risk be brought close to zero, but even then, cattle in fenced herds can contract brucellosis. The brucellosis disease risk for fenced cattle is also "not zero."

The governmental agencies involved in bison brucellosis risk management have established a goal regarding the risk of disease transmission that health organizations find does not exist.

For instance, the World Organization for Animal Health (OIE, a retained historical acronym for "Office International des Epizooties") was established to fight animal diseases at the global level and has 178 member countries. It has "a mandate to publish standards aimed at avoiding the introduction of pathogens via international trade in animals and animal products, while at the same time preventing countries from setting up unjustified sanitary barriers . . ."

The OIE standards were "developed on the basis of a highly meticulous risk analysis but taking into account that zero risk does not exist" (Seminar on sound governance for veterinary services, 2008).

Not only does zero risk not exist for disease transmission, but IBMP does not apply this same goal for the status of transmission between cattle and elk or coyotes. Is the risk of transmission between elk and cattle zero? No. Is the risk of transmission between coyotes and cattle zero? No. Has the ability for brucellosis to jump the species barrier been demonstrated in the laboratory between elk, bison, coyotes and cattle? Yes. Does the disease management of IBMP members target only bison, but not other brucellosis-carrying species? Yes.

This is crazy epidemiology. In fact, it is not epidemiology at all. It is science fiction. If this debacle were to be a film, it might be called "Cowboys and Brucella

Abortus." The scene would open with a huge blob inching toward their ranch, its flagellum wiggling. "It is after our cattle!" one cowpoke screams. "No worry," another answers. "It has escaped from elk. It can't hurt our cows. Only those creatures that escape from bison can hurt our dogies."

If the IBMP wants to assure its existence regardless of the reality of its goals, the "beauty" of this kind of goal is that because it can never be reached, IBMP is guaranteed perpetual work. Only when bison can no longer migrate will its goal be reached. And that would be extinction—extinction while all along members of the interagency pretend to want "to maintain a wild, free-ranging population of bison . . ."

10

Range war: Cattle good, elk good, bison bad

It is all about grass. America's last herds of wild buffalo are being killed in droves because of a range war at the border of Yellowstone National Park. The war is over the private use of primarily public wildlife habitat located in the Gallatin National Forest just outside the boundary of the park and within the Greater Yellowstone Ecosystem. The excuse for this war is the threat of the spread of *Brucella abortus* from wildlife that belong here to cattle that don't. The incentive is low grazing fees on public wilderness grasslands that enable cow-calf operators to produce organic, range-fed beef at premium prices, with protection from the park's biohazardous environment provided to the ranchers by the government for free, but at a cost to the public of $3 million annually.

Today over 99 percent of America's bison are kept like cattle behind fences, either on private ranges for meat production or on government conservancies for public viewing. They are not wild. Only 1 percent are wild, that is, the 5,000 bison inhabiting YNP out of a total of 500,000 bison in the United States.

In rejecting my original petition to list these bison under the Endangered Species Act, the government makes the claim that such wild bison are abundant. This finding is in error. Wild bison are exceptionally rare. What makes them particularly unique is that they possess and express the trait of migration, which exists in no other bison population.

Moreover, these wild bison comprise the only herds managed by the U.S. Department of the Interior that are genetically pure, having no cattle genes (Dratch, 2010). They congregate in Yellowstone National Park, the centerpiece of the GYE, the largest remaining nearly-intact ecosystem in the earth's northern temperate zone.

The major reason for the need of a federally-mandated listing is that the various governmental agencies now managing the existence of these wild bison have failed to exercise their responsibility to preserve wildlife in a wilderness setting and instead have bowed to the interests of the cattle industry. As mentioned, the collaborating agencies, initially established in 2000, as listed in the *Record of Decision for Final Environmental Impact Statement and Bison Management Plan for the State of Montana and Yellowstone National Park*, are the:

- National Park Service (NPS),
- U.S. Forest Service (USFS),
- Montana Department of Fish, Wildlife, and Parks (FWP),
- Montana Department of Livestock (DOL), and the
- U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS),

and added in 2009 the

- Confederated Salish & Kootenai Tribes (CSKT),
- Inter Tribal Buffalo Council (ITBC), and
- Nez Perce Tribe (NPT).

These governmental and tribal agencies, operating under the rubric of the Interagency Bison Management Plan, have been collectively given the court-approved authority to truncate all migratory movement of wild bison attempting to leave the park and enter the state of Montana. Such agencies, largely under the direction of the Montana Department of Livestock, may haze, capture and lethally remove bison from national forest area public grazing allotments adjacent to the park, as well as private property there, because:

- cattle interests want cattle to graze there instead and

- such interests do not want cattle to comingle with bison in those habitats because 50 percent of the bison herd in the park have contracted brucellosis, which can be transmitted interspecies to cattle.

Sanitizing a wilderness

The scheduled lethal removal of large segments of the park's bison herds has become a family tradition with members of the IBMP. In an attempt to sanitize wilderness, each spring a posse of government agents on horseback; in all-terrain-vehicles, squad cars, pickups and sometimes in helicopters, descend on bison mothers as they are giving birth and nursing their young outside the park. Their mission is to drive them back into the park before the cattle arrive. Some of the stampeding animals get entangled in fences and others, especially the calves, break their legs in holes. Others can't keep up to the hazed herd and die.

Some of the animals are driven into capture facilities. The captured animals are then coerced through a series of progressively smaller pens into a series of narrowing chutes until a single animal is contained in tight quarters. At this site, age, sex and morphology information along with a blood sample is collected (Cross, 2010). Following serological testing, some females are fitted with vaginal monitors to track birthing locations. Some are vaccinated. Some are slaughtered if tested positive for the disease brucellosis, while others are slaughtered if they are pregnant. This way—killing pregnant cows—you get two for the price of one, as pointed out by one government biologist.

The government is studying the possibility of injecting female bison with a birth control substance to prevent them from multiplying. It is called GonaCon, a contraceptive vaccine for wildlife. Originally developed by the USDA as a non-lethal form of pest control, it works by lowering the concentration of sex hormones in the bloodstream to weaken fertility and the urge to mate (Yager, 2011). Providing "multiple years of infertility following a single injection," it works well to control populations of white-tailed deer, prairie dogs and tree squirrels (Wildlife Contraceptives, 2012).

In the winter another posse is waiting for the bison. As snow levels deepen, bison descend to find forage. As noted previously, while still on park land and contrary to the park's founding act prohibiting the "capture or destruction" of animals there, government agents direct the migrating bison into capture facilities such as at Stephens Creek. At the entrance a funnel of fencing fans out from the specially-fortified pens into which they are herded or stampeded. The trapped bison are then loaded onto livestock trailers that have been backed up to ramps connected to the facility and trucked to slaughterhouses. (Unsurprisingly, this park facility is closed to the public.)

Wild bison are harassed and killed coming and going, breaking up family units, traumatizing entire herds, killing the aggressive leaders and their followers, leaving the genetics necessary for survival and migratory behavior rotting in the waste bins of the slaughterhouses. What has this achieved? Outrage by a large sector of the public, especially conservationists, the death of multiple thousands of bison, loss of wild bison genetics and less competition for forage by cattle on grasslands contiguous to the park.

Yet, it has not decreased the chance of brucellosis transmission to cattle. How do we know this? One way is to take the IBMP's word for what it says. It claims that in the wild the chance of the transmission of this disease from bison to cattle is "extremely low," but "not zero." Let us say that the culling did, indeed, reduce the risk of transmission by 50 percent. What is 50 percent of "extremely low," but "not zero"? Such a reduction would be infinitesimal and incapable of measurement.

The price we as a nation are paying for keeping up this ritual is the mathematical certainty that eventually the Yellowstone bison will be made extinct as a wild animal. Someday they might still look the same, but they won't be the same due to practices that promote domestication by means of artificial selection instead of survival of the fittest. Now only the non-migratory survive. It is a case of wildlife management out of control.

Beyond the problem of brucellosis, due to their physical characteristics bison have a potential of coming into conflict with humans. But this very potential makes the last remaining wild bison important. The National Park Service makes the following observations:

> Bison are massive animals that compete directly with humans and livestock for use of the landscape. Their preferred habitats include nutrient-rich valley bottoms where agriculture and development occupy most of the land, while public lands are more likely to be situated in mountainous areas above these valleys. Given existing habitat loss and the constraints modern society has placed on the distribution of wild bison, it is unlikely that many additional populations will be established and allowed to range across the landscape. Thus, the few remaining wild and free-ranging bison populations in North America are very important.

As noted by the NPS, of particular importance is its wildness, genetics and ecological function:

> Yellowstone bison comprise the largest (2,400 to 5,000) wild population of plains bison and are one of only a few populations to continuously occupy portions of their current distribution. They are managed as wildlife in multiple large herds that move across an extensive landscape (more than 150,000 hectares or 372,000 acres) they share with a full suite of native ungulates and predators, while being exposed to natural selection factors such as competition for food and mates, predation, and survival under substantial environmental variability. As a result, these bison likely have important adaptive capabilities compared to most bison populations that are managed like livestock with forced seasonal movements among fenced pastures, few predators, and selective culling for age and sex classifications that facilitate easier management (e.g., fewer adult bulls). These bison also provide meat for predators, scavengers, and decomposers; contribute to nutrient recycling that enhances plant production and diversity; and allow visitors to observe this keystone species and symbol of the American frontier (National Park Service's Decision, 2014).

It is troubling and logically inconsistent that this agency, while extolling the importance of the wild bison's "adaptive capabilities compared to most bison populations that are managed like livestock with forced seasonal movements" is, itself, managing the wild herd like livestock by prohibiting its seasonal movements via slaughter at capture facilities, targeting for destruction those animals exhibiting the adaptive capabilities of migratory behavior, the very trait the NPS finds valuable.

Elk get a free pass: a double standard

On the other hand, as pointed out previously, elk—as well as other wild ungulates such as bighorn sheep, deer and moose that spend summers in the park—are allowed to migrate out of the park in the autumn and winter to the lower level habitats forbidden to wild bison. Here some are harvested through hunting. Let us look at this issue in more detail.

Elk are the most abundant large mammal found in Yellowstone. Brucellosis incidence studies indicate elk are also reservoirs for this disease. According to the Wildlife Management Institute:

> The prevalence of brucellosis is increasing in many Greater Yellowstone elk herds and available evidence indicates that all recent cases of brucellosis transmission from wildlife to livestock have come from elk (Stemler, 2015).

"Seventeen instances of brucellosis transmission from elk to livestock were reported during the last decade," according to the Center for Disease Control. Writing in CDC's journal *Emerging Infectious Diseases*, Jack C. Rhyan, National Wildlife Research Center, summarizes the problem of brucellosis in the Yellowstone area:

> During the 1930s, a state-federal cooperative effort was begun to eliminate the disease from livestock in the United States. From an initial estimated prevalence in 1934 of ˜15%, with nearly 50% of cattle herds having evidence of infection, the United States now has no known infected livestock herds outside of portions of Idaho, Wyoming, and Montana, adjacent to Grand Teton and Yellowstone National Parks. This area, referred to as the Greater Yellowstone Area (GYA), also encompasses state and federal feeding grounds in Wyoming where elk are fed during the winter. Considered a spillover disease from cattle to elk and bison, brucellosis now regularly spills back from elk to cattle. Although bison-to-cattle transmission has been demonstrated experimentally and in nature, it has not been reported in the GYA, probably because of ongoing rigorous management actions to keep cattle and bison spatially and temporally separated (Rhyan, 2013).

Most likely, brucellosis was brought to the park years ago following the introduction of cattle into the park's valleys by the original park managers.

Epidemiologically, separating bison but not elk from areas outside and adjacent to Yellowstone National Park where cattle graze is irrational and ineffective disease management. Such a policy puts the national security vis-à-vis brucellosis containment in jeopardy. If the “ongoing rigorous management actions to keep cattle and bison spatially and temporally separated” is responsible for the lack of transmission of brucellosis by bison to cattle near the park, then the same “rigorous management actions” should be applied to Yellowstone area elk as well, that is, also prohibiting them from leaving the park by means of hazing or lethal removal to achieve effective separation. This double standard—one for migratory bison and one for migratory elk—can be seen by the two diagrammatic maps that follow.

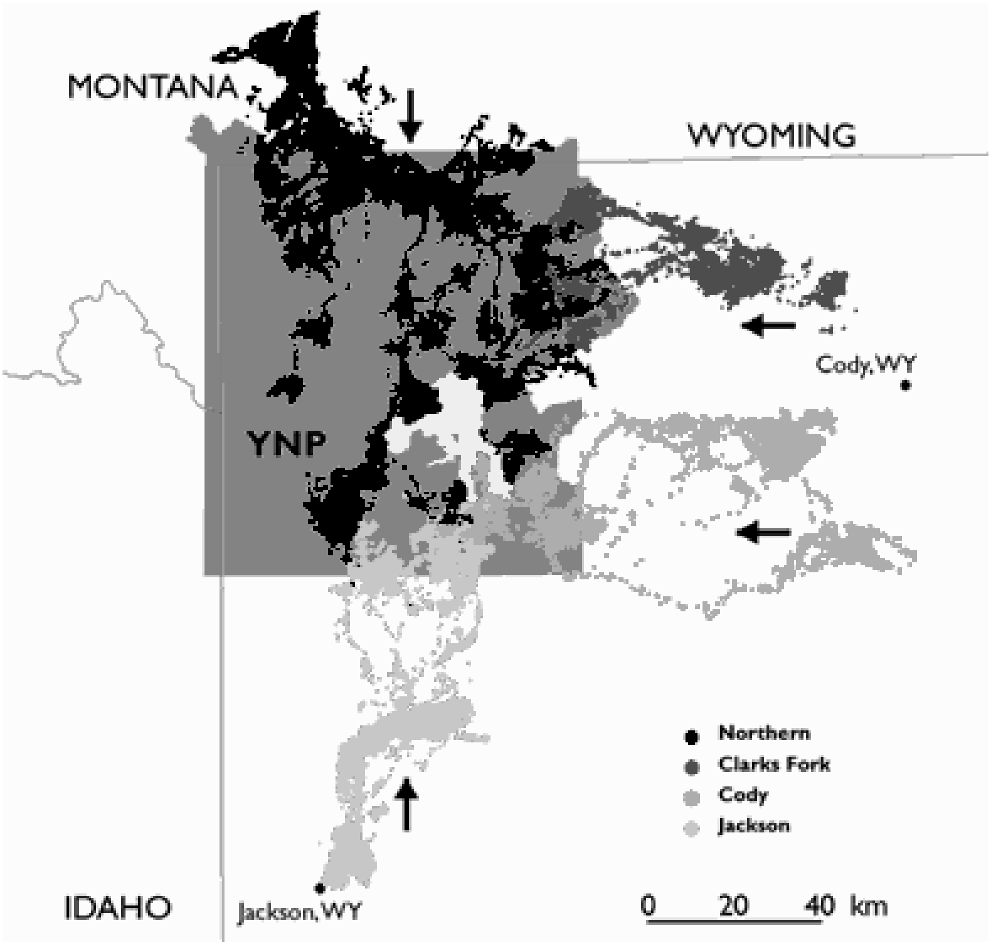

Figure 35. ELK MIGRATION IS SIMILAR TO BISON seasonal movements. Shown are converging elk herds, such as the Northern, Clarks Fork, Cody and Jackson herds. Moving in the direction of the arrows toward the interior of the park, the herds travel from their lower winter grounds to the high-altitude meadows of the park during the spring (Map from *Elk Migrations of the Greater Yellowstone: Project Overview,* 2014). Map used by permission from Arthur D. Middleton and *Proceedings of the Royal Society B*.

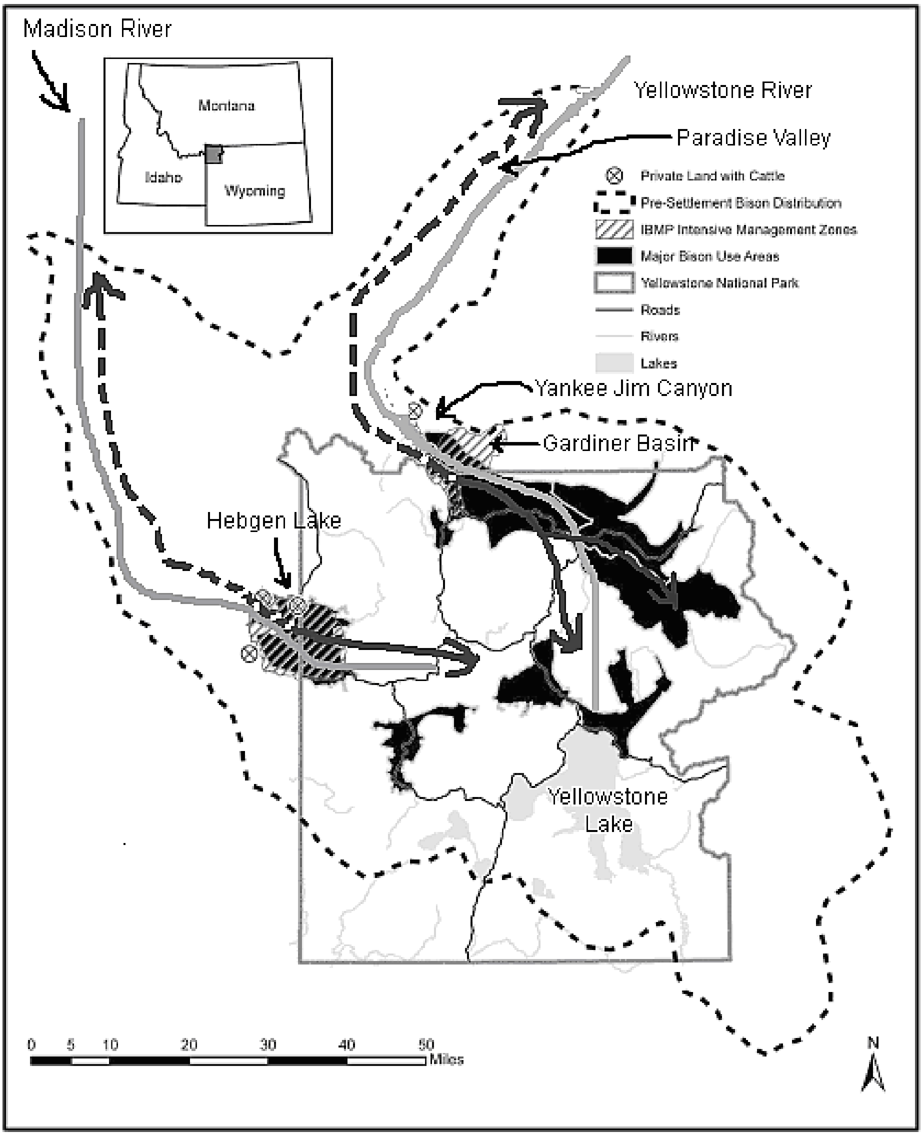

Figure 36. PRESENT AND HISTORICAL RANGE OF WILD BISON. Black areas are the present range of the park's bison and the dotted line their historical range limit. Migratory movements are back and forth on a seasonal basis from the high plateaus to the lower valleys. ***Image from White, 2011. Rivers, migratory paths and site names added by James Horsley.***

Shown above is the historical and present range of wild bison. Note that the movements are back and forth and limited. The thick arrowed lines represent both the historical and present migratory path of Yellowstone's wild bison. The solid portion of the arrowed lines represents their present path and the dashed arrowed lines their extended historical path. The dashed thin black boundary line represents the extent of the range of wild bison in pre-settlement times. The black areas are the present range, which overlaps portions of the park boundary, with the hatch-marks representing the IBMP's bison management areas. The thick gray lines are the Madison River and the Yellowstone River. The Yellowstone River runs from Yellowstone Lake through Yankee Jim Canyon and thence through Paradise Valley, of which Yankee Jim Canyon is the gateway, presently barring bison progression into the valley via a cattle guard, fencing and the white waters of the Yellowstone River, which runs through the steep-walled canyon.

Shown below are the migratory movements of elk in the GYE, which converge toward the interior of the park in the spring, then disperse toward lower elevations in the autumn and winter months. The migratory paths of both bison and elk involve comingling with public and private cattle grazing ranges just outside the park, yet only bison are routinely restricted by the IBMP.

As noted, preventing bison from entering Gardiner Basin, Paradise Valley and Hebgen Lake region is at a cost of $3 million annually. While done in the name of preventing the spread of brucellosis by wildlife to cattle, it addresses only part of the problem—the bison problem, but not the elk problem—and therefore fails in brucellosis control. Beef from cattle raised on grasslands north of the park, as well as west of it, is marketed as free-range, Yellowstone grass-fed beef and sold at premium prices. These are truly "cash cows."

The photographs below graphically show the double standard for elk and bison movements in Yellowstone. Elk are free to move as nature urges, while the urge for bison is often from the shouts of cowboys on horseback rounding them up for meat processing.

Figure 37. ELK ARE ALLOWED TO MIGRATE out of Yellowstone. Elk travel across the winter range in the northwestern Greater Yellowstone Ecosystem near the Gardiner River in Yellowstone National Park in 2008. Many proceed out of the park into Gardiner Basin and beyond (Conservation: Story, 2013). ***U.S. Geological Survey/photo by Jonny Armstrong.***

Figure 38. WILD BISON ARE NOT ALLOWED TO MIGRATE. A Montana Department of Livestock agent on horseback herds migrating wild bison into the Stephens Creek capture facility within Yellowstone National Park, where they are shipped to slaughter. These bison are in Gardiner Basin. ***Photo courtesy of Buffalo Field Campaign.***

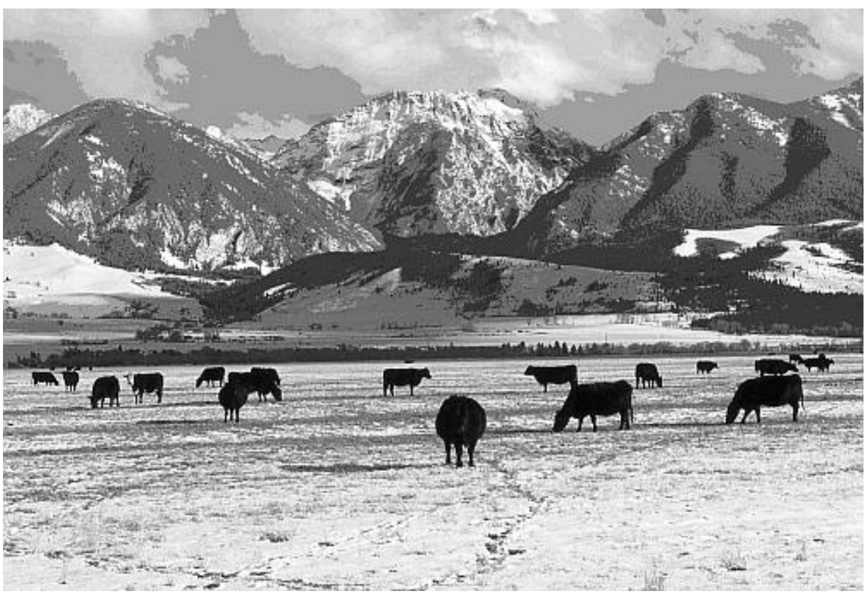

Figure 39. BISON ARE BARRED FROM PARADISE VALLEY so cattle can graze here, as well as from Gardiner Basin on the other side of the mountains to the south, just outside the park in the heart of the Greater Yellowstone Ecosystem. ***Yellowstone's Photo Collection, 1999. Photo by Jim Peaco.***

Effective disease control is not achieved by managing the chance of transmission by one species, but not the other. Although brucellosis has been essentially eradicated in the United States, the disease persists in the GYE because this region is one of the last places on the North American continent to remain wild and unfenced. For animals in close proximity, *B. abortus* can only be completely controlled by means of fencing so that separation can be maintained between infected and uninfected animals.

If the IBMP means what it says in its *Record of Decision* that "Cooperative management of Yellowstone bison requires an ecosystem approach" (p. 8), then management should not include the destruction of that ecosystem. But that is what is happening now with the decimation of the wild bison migratory herds and the now-legalized destruction of their natural predators, the gray wolf, just outside the park boundary. IBMP presently functions as a predatory pack itself, with the Montana Department of Livestock its alpha male.

In the end, the only solution to the problem of the transmission of brucellosis here is either to fence in the park, which would fence out wildlife from moving across the ecosystem, or to keep cattle out of the ecosystem. Yellowstone National Park is 3,470 square miles. The Greater Yellowstone Ecosystem is 28,000 square miles. Fencing in either of these two regions would not make sense fiscally or ecologically.

Figure 40. FENCING A PARK. In an effort to control overgrazing by elk in the Wind Cave National Park, South Dakota, fencing has been strung around portions of the 53-square-mile park. Adjustable gates have been installed to allow elk to leave the park in the spring and prevent their reentry for protection until after the fall hunting season. While wildlife fencing may be feasible there, one cannot fence an entire ecosystem such as the GYE (Farrell, 2010). ***NPS Photo.***

Figure 41. BISON MINGLE WITH CATTLE in Gardiner Basin despite attempts to fence them out—they just swim the Yellowstone River to leave the park and cross onto land where cattle graze. Experience has shown that separating wild ungulates from cattle in many wilderness regions for disease-control purposes is not effectively achieved by population reduction of wild bison, nor by their hazing or fencing. Photo shows bison behind fence in foreground, cattle in background. ***Photo courtesy of Buffalo Field Campaign.***

Conservation is predominant

According to the *Record of Decision*:

> Congress has provided that when there is a conflict between conserving park resources and values and providing for the enjoyment of them, conservation is predominant. Additionally, although Congress has provided the secretary with limited discretion to allow certain impacts within parks, that discretion is limited by the statutory requirement that the Park Service must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The NPS, thus, must manage park resources

> and values to allow them to continue to exist in a condition that will allow the American people to have present and future opportunities for enjoyment of them (p. 10).

Concerning the importance of the Yellowstone bison, according to the National Park Service,

> . . . several scientists recently concluded that plains bison are ecologically extinct across North America because less than 4 percent (%) are in herds managed primarily for conservation and less than 2% have no evidence of genes from inter-breeding with cattle. Instead, most bison are raised for meat production, mixed with cattle genes, protected from predators, confined in fenced pastures, and their mating structures are inhibited by low ratios of adult males in order to maximize offspring production. As a result, bison no longer influence the landscape as they once did by roaming across large areas while enhancing nutrient cycling, competing with other ungulates (hoofed animals), creating wallows (i.e., depressions in soil) when they roll on their backs to give themselves dust baths, and serving as a major converter of grass to animal matter (Remote Vaccination of Bison, 2014).

Despite these self-declaratory statements by the government partners of the IBMP concerning the resolution of conflict between enjoyment of the park and conservation of its resources, as well as the importance of wild bison to the ecosystem, the interagency has provided for the removal of bison from the ecosystem in favor of the cattle interests' enjoyment of profit, whereby those interests predominate over conservation.

The *Record of Decision* states, "The Park Service must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise." The NPS can impair the bison resources of the park because the right to do so is granted by law to the IBMP as recorded in the *Record of Decision* and in Montana statutes.

To counter these ecologically abusive decisions at the state and federal levels, the wild bison of the Greater Yellowstone Ecosystem should be protected under the Endangered Species Act by their listing as a species or distinct population segment threatened or endangered with extinction, and their migratory range just outside the park preserved as a critical habitat, specifically regions such as Gardiner Basin to the north and the Hebgen Lake region to the west of the park. Eventually, habitat should also comprise the entire historic range of wild Yellowstone bison, which extended along the Yellowstone River into Paradise Valley as well as regions along the Madison River. The distribution of this population involves altitudinal migration. Herds move (or attempt to move) seasonally from the high grassy plateaus where they graze in the spring and summer months down to the lower valley regions during the winter for forage along the rivers mentioned. Historically, their migration was limited, consisting of back and forth movements involving distances of about 100 miles. Today, due to government actions favoring commercial interests, their migration has been prevented, which will lead to their extinction as a wild species.

11

The migratory syndrome

Just what is migration—that animal act that is being so persistently prohibited at the borders of Yellowstone National Park? Migration means to move from one region or climate to another, usually periodically for feeding or breeding. Permeating the concept of migration is the meaning of ecology. According to the *Oxford Dictionary,* "ecology" is the branch of biology that deals with the relationships of organisms to one another and to their physical surroundings. As mentioned, the word ecology is derived from the Greek "oikos," meaning house, and "-logia," meaning "study of." Thus the ecology of migration would be the study of the movement of an organism going from room to room, that is, from one part of its habitat to another.

Migration is not a stand-alone trait. It involves the entire organism, its evolution and its ability to adapt to the environment. Biologist Hugh Dingle noted in "Animal migration: is there a common migratory syndrome?":

> It is a truism in evolutionary biology that traits do not evolve in isolation. Rather, they evolve in a coordinated way with other characters that may include behavior, physiology, morphology, and life histories; it is these correlated suites of traits or syndromes that are the targets of natural selection. Frazzetta (1975) called such suites of characters "complex adaptations," and likened them to the parts of a machine all of which must function together to make the machine work (Dingle, 2006).

Dingle himself called this complex of traits the "migratory syndrome." Its opposite is the domestic syndrome. It has profound implications. Domesticated animals usually cannot survive in a wilderness. They do not have the necessary fitness. By prohibiting migration, one is tinkering with not just migratory movements, but the entire, collective genetics of an animal. Take out a gear in a watch and one is not merely removing a part, but stopping the ability of the watch to keep time. Targeting for removal from the bison gene pool only those animals that express the migratory syndrome has the potential of reducing the species' ability to adapt and could lead to extinction.

For instance, as has been shown, in one area alone, that of disease prevention, ungulates such as elk that do not migrate have higher rates of brucellosis infection, for not migrating crowds animals, and crowding promotes disease. Ironically, IBMP's disease prevention policy would stand to exacerbate disease in bison by restricting movement. But it goes beyond that immediate effect to genetic ramifications that can be known only with the unfolding of time, for by playing with the migratory syndrome one is playing with a cascade of traits that in one form or another could lead to the collapse of that species via its inability to adapt to changes in the ecosystem.

Dingle identified five characteristics that apply to migration:

> The first characteristic of migrants is persistent movement. This actively carries the migrant beyond its original habitat where it obtained resources [such as food] to a new one in which it also gathers resources [such as food or nesting materials]; … An insect or bird, for example, may both feed and reproduce at the termination of a migration flight (the site of egg laying or nesting being a new resource) whereas it only fed at the site of origin. A habitat can thus be considered "the area that provides the resource requirements for a discrete phase of an [organism's] life."
>
> These migratory movements between habitats are quite different from movements within a single habitat. As noted…the within-habitat movements of station keeping and ranging [obtaining and defending resources within a home range or territory] are focused on the available resources and cease when a resource of a particular kind is encountered. Migratory movements are characterized by the temporary suppression of responses to resources. In the course of movement to a new habitat, an organism usually covers much greater distances than it does while performing station keeping or ranging activities. Many of these can be impressive indeed. The arctic tern may travel nearly 20,000 kilometers between Arctic breeding grounds and Antarctic feeding areas, and even tiny aphids may traverse 1,000 km or more migrating to a new host plant.
>
> The second characteristic of migratory behavior is that it is straightened out, in contrast to station keeping in particular in which there may be much turning or backtracking. In self-powered animals such as birds, fish, or whales, which make one or more round-trip journeys within a lifetime, this straightening may take a specific direction whose maintenance requires sophisticated orientation and navigation mechanisms…
>
> Third, migrant organisms are undistracted by those stimuli that would arrest their movements were they station keeping or ranging. Responses to inputs arising from resources promoting growth and maintenance are evidently

> inhibited or suppressed during migration. Except when they have depleted fat resources, migrant birds will not stop and feed even when they could easily do so.
>
> Fourth, distinct behaviors of leaving and arriving are characteristic of migrants. Most migrant birds, for example, become hyperphagic [exhibit excessive hunger and abnormally large intake of food] before departure and may increase food intake by as much as 40% above normal, with the excess stored as lipid fuel…
>
> Fifth, migrants reallocate energy specifically to support movement. Thus birds may double their body weight in subcutaneous fat, insects vastly increase their size of the fat body, and plants allocate fat to the embryo in a departing seed (Dingle, 1995, pp 24, 25).

In sum, the movement of migrants is persistent and straight ahead, instead of wandering. They prepare for the trip by such activity as overeating and putting on weight. And when they leave they are totally devoted to getting there—they cannot be distracted from their mission.

Migration is the opposite of staying put. A simple statement, but the mechanisms releasing the expression of migration are complex, not well understood and under genetic control. Biologists call the converse of migration “station keeping.”

No one knows where we are in the historical timeline that has been transpiring in the destruction of the migratory instinct of the park’s wild bison. At some point they will remain wild no longer, but simply obey the human-instilled response of station-keeping at all times, instead of migration, for among bison, it is the station keeper that survives now in Yellowstone National Park.

Dingle in *The Biology of Life on the Move*, has a good discussion about station keeping. An understanding of that term will help us understand migration. He wrote:

> Activities and movements that keep an organism in a home range have been called *station keeping*, and this seems a useful term to include a number of behaviors that can also be described as “here and now” movements. These include an array of interactions with both biotic and abiotic environmental inputs, all of which can be characterized as “vegetative functions,” a term used by J.S. Kennedy for activities that proximately exploit resources to promote growth and reproduction, in contrast to migration when growth and reproduction are temporarily suspended. These resources include not only food but also shelter, mates, nest sites, landmarks, enemy free space, microclimate and any other requirements of maintenance and survival of one’s self and offspring. These are usually incorporated within the home range, but on occasion resource acquisition may require considerable forays with subsequent return to the home range (station) as with *commuting*. A salient feature of

> station keeping is that movements cease when a resource is located. A predator stops hunting when it kills its prey, a female cockatoo stops searching when it finds a suitable nest cavity in a tree, and a male moth stops flying and orienting to female sex pheromones when it locates a mate. As we shall see, cessation of movement in the presence of suitable resource is not characteristic of migration (Dingle, 2014, p. 4).

On the other hand, Dingle noted that:

> Migration is different. It involves suppression and thus postponement of responses to resources; this facilitates travel to different habitats before response to resources again become evident. Migrants leave habitats when resources are deteriorating or their availability is otherwise reduced to colonize or take refuge in habitats where resources are available at least for maintenance. This relationship to resources drives the behavioral and life-history characteristic of migration (p. 13).

One can look at migration as the inhibition of the urge to stay put. In Dingle and V. Alistair Drake's essay "What Is Migration?" they state that migration can be viewed as an adaptation to changes in habitat quality in different regions at different times so that movement allows a succession of temporary resources to be exploited as they arise. They note: "It thus involves both escape and colonization."

Survival as an animal passes through the various habitats to its final destination is critical, for it allows for adaptation via natural selection.

> At a minimum, a habitat must enable survival; better quality habitats will allow development, physiological sequestering of resources, and breeding. Individuals unable to locate a sequence of such habitats will fail to produce offspring. The members of a migrant population are therefore directly subject to natural selection by the arena through which they travel (Dingle, 2007).

In the case of wild bison, it is not natural selection that is at play, but instead artificial selection by the lethal actions of the IBMP. But regardless of whether it is natural or artificial selection, selection is going on. What is being selected? By default, what has been left behind. If one picks up all the red marbles in a bowl of red and blue marbles, one has a bowl of blue marbles only. But let us say that all the red marbles are also oblong. By selecting out the red marbles, one has also taken out the oblong marbles. Such may be the case in principle with wild bison. By eliminating migratory wild bison, not only the migratory impulse, but most likely whatever traits are associated with migratory behavior have been eliminated also.

When escape is not allowed, there is no colonization. A habitat that cannot be occupied—such as the Gardiner Basin, because the wild bison seeking to occupy it via migration are killed before they get there—is an arena where those migrating fail to produce offspring. Animals that fail to produce offspring fail to pass on their migratory genes. This has the potential for profound genetic and behavioral consequences.

A 2011 study of the Blackcap warbler titled "Identification of a gene associated with avian migratory behaviour," headed by Jakob C. Mueller, Department of Behavioral Ecology and Evolutionary Genetics, Max Planck Institute of Ornithology, noted that:

> Personality traits have also been discussed in the context of variation in migratory behaviour. For example, it has been suggested that initiation of migration behaviour and migration distance are related to individual competitive ability or dominance, which in turn may be linked to aggression and anxiety-related behaviour. Furthermore, migratory and non-migratory birds may differ in exploratory behaviour.

His team noted that:

> High genetic correlations among incidence, amount, intensity and timing of migratory activity in blackcaps suggest that these components of migratory behaviour are influenced by common genetic mechanisms. As a consequence, we would expect that phenotypic variation of correlated migratory traits is linked to genetic variation at a single closely linked gene cluster or a few 'regulatory genes' with multiple pleiotropic effects.

Pleiotropy occurs when one gene influences multiple, seemingly unrelated phenotypic traits. An example is phenylketonuria (PKU), a human disease caused by one gene defect that affects multiple systems (whereby protein-rich foods, or the sweetener aspartame, act as poisons to people with the disease). Consequently, a mutation in a pleiotropic gene may have an effect on some or all traits simultaneously.

What gene could be affecting migratory behavior? Tests indicate that the ADCYAP1 gene, which is involved in stress responses, is "associated with high migratory activity in blackcaps, either measured as migratory restlessness of individuals in the laboratory or assessed as the proportion of migrants and migration distance in natural populations." They conclude that:

> The consistency of results among different populations and levels of analysis suggests that ADCYAP1 is one of the genes controlling the expression of migratory behaviour. Moreover, the multiple described functions of the gene product indicate that this gene might act at multiple levels modifying the shift between migratory and non-migratory states (Mueller, 2011).

Such findings help to confirm that the trait of migration is under genetic control.

David Quammen, writing for National Geographic in *Mysteries of great migrations: what guides them into the unknown?* points out that central to the migratory responses in animals is what Dingle terms the “undistractibility” of migrants.

> Migrating animals maintain a fervid attentiveness to the greater mission, which keeps them undistracted by temptations and undeterred by challenges that would turn other animals aside.
>
> An arctic tern on its way from Tierra del Fuego to Alaska, for instance, will ignore a nice smelly herring offered from a bird-watcher's boat in Monterey Bay. Local gulls will dive voraciously for such handouts, while the tern flies on. Why? “Animal migrants do not respond to sensory inputs from resources that would readily elicit responses in other circumstances,” is the dry, careful way Dingle describes it. In plainer words: These critters are hell-for-leather, flat-out just *gonna get there.* Another way, less scientific, would be to say that the arctic tern resists distraction because it is driven at that moment by an instinctive sense of something we humans find admirable: larger purpose.
>
> The arctic tern senses that it can eat later. It can rest later. It can mate later. Right now its implacable focus is the journey; its undivided intent is arrival. Reaching some gravelly coastline in the Arctic, upon which other arctic terns have converged, will serve its larger purpose, as shaped by evolution: finding a place, a time, and a set of circumstances in which it can successfully hatch and rear offspring (Quammen, 2010).

Ecologically speaking, for the survival of many species, the ability of unrestricted movement is requisite for survival. But, what happens when migration is hindered or completely stopped?

Interrupted migration

For instance, what happens when road construction bisects the feeding grounds of reptiles from breeding and egg-laying locations? Because of a migrating animal’s “undistractibility,” they head across busy roadways, without regard to the apparent danger of barren spaces and objects moving over those spaces. Thousands of turtles, snakes and salamanders are crushed under the tires of automobiles each year.

This undistractibility is especially noted in ungulates such as bison. While this instinct helps assure that the majority of a herd will get to a distant habitat favorable for survival, it can also work against them. Ungulates can be directed by hunters en masse when migrating because of this trait. The herd can be driven as a unit to a place where its members will be trapped and slaughtered. Post-Neolithic hunting societies built long funnel-like fences of rocks over desert landscapes, presumably along the migratory paths of ungulates. The funnel ended in a pile of rocks or a corral. The structures are called "kites" because they looked like the shape of kite from the air, given that name by pilots who first saw them from the air in the 1920s.

As societies began to transition from hunting wild animals to raising domesticated livestock beginning 10,000 years ago, instead of sustainable harvesting of animals, mass killings were conducted, sometimes of an entire migrating herd of wild ungulates, contributing to the eventual extirpation of a number of wild species, as noted by Guy Bar-Oz et al. in "Role of mass-kill hunting strategies in the extirpation of Persian gazelle (*Gazella subgutturosa*) in the northern Levant" (Bar-Oz, 2011).

According to Nadela et al., in "Walls, ramps and pits: the construction of the Samar Desert kites, southern Negev, Israel":

> Extensive stone-wall arms gather in gazelles from their habitual trails and canalise them into a sunken enclosure, cunningly hidden from view of the galloping herd until it was too late (Nadela, 2010).

Figure 42. UNGULATES WERE DRIVEN INTO FUNNELS of rock fences, diverting their migration between the stone walls to a destination where they could be slaughtered. Scene is from the Samar desert in southern Negev, Israel. ***From Wikimedia Commons: Samar desert kite by Galpaz (Own work) [GFDL (http://www.gnu.org/ copy left/fdl.html).***

So function the fans of wire fencing that direct driven-wild, migratory bison into the Stephens Creek capture facility and other such traps at Yellowstone National Park.

In Africa herds of wildebeests migrated from southern Botswana in long, single-file lines to the northern grasslands of the Central Kalahari Game Reserve. With the introduction of beef cattle, livestock owners feared that hoof and mouth disease, endemic in wild ungulates such as the African buffalo, might spread to domestic livestock. Hundreds of miles of fences were constructed to separate the wildebeests, oryx, gazelles and other wild ungulates from cattle. The result was an ecological disaster. Greta Nilsson, writing in the *Endangered Species Handbook*, told the story:

> The water and grasslands crucial to the survival of the herds were blocked by the fences. The wildebeests walked for days along the fences, hungrier and thirstier every day; they were joined by giraffe, gemsbok and zebras whose masses measured 3 miles wide and 5 miles long (Owens and Owens 1984). In 1961 and 1964, 80,000 wildebeests died near the fence, and during these years, an observer estimated that 10 percent of their population died every five days; in 1970, a massive die-off decimated the herds (Owens and Owens 1984). By the early 1990s, the once great southern wildebeest herd had been reduced to fewer than 30,000 animals (Nowak 1999). At least 250,000 wildebeests were killed between 1970 and 1984 (Owens and Owens 1984). The deaths of at least 1.5 million large animals have been called the worst wildlife slaughter of the 20th century (Owens and Owens 1992)… Along with the wildebeests and other ungulates went the once large populations of lions, leopards, and brown hyenas. (Nilsson, 2005).

All this fencing and range fragmentation of indigenous animals to satisfy the global preference to eat beef, while the meat of native African ungulates is under-utilized. It is puzzling, for the meat of such migratory African animals as wildebeests (which belong to the family *Bovidae* and include antelopes, cattle, goats and sheep) is described as "tender and extremely flavorful," or that of the oryx, an antelope, whose meat "tastes quite similar to beef but obviously leaner and just as juicy and succulent" (Eating My Way Through Africa's Game, 2014). One species, the scimitar oryx, was once migratory and widely distributed across North Africa, but now extinct in the wild and found only on reserves. It was hunted extensively for its horns. The unicorn myth may have originated from sightings of a scimitar oryx with a broken horn. (Scimitar oryx, 2015).

In general, large mammal migrations are in decline. "Nowhere is this more evident than at the Greater Yellowstone Ecosystem, where 58%, 78%, and 100% of the historic long-distance migrations of elk (*Cervus elaphus*), pronghorn antelope (*Antilocapra americana*), and bison (*Bison bison bison*) respectively, have been lost," notes David N. Cherney, in "Securing the free movement of wildlife: lessons from the American West's longest land mammal migration." "Despite the truncated movements of these species, the region is still home to the longest bison, elk, pronghorn, and mule deer (*Odocoileus hemionus*) migrations in the United States" (Cherney, 2011).

The seasonal migration of pronghorn antelope, *Antilocapra americana*, between Grand Teton National Park and the Upper Green River Valley in northwestern Wyoming is the longest remaining migration of any land mammal in the lower 48 states. Archaeological evidence indicates that pronghorn have traveled this same ancient migration route, which is less than 150 yards wide in some places, for at least 6,000 years.

However, the habitat covered by the 150-mile round trip is being fragmented and degraded by a ten-fold increase in vehicular traffic stemming from the proliferation of natural gas field operations. Animals are starting to avoid areas they formerly relied on to make it through the winter, according to Dr. Joel Berger, senior scientist with the Wildlife Conservation Society's North America Program, who studies pronghorn from his base at the WCS Teton Field Office (Ancient Pronghorn Path Becomes First U.S. Wildlife Migration Corridor, 2008).

Partially migratory species

Migration is often variable, with some groups of some species migrating, while others do not. The larva of fruit flies have two different types of behavior—most are "rovers," that is, they crawl around looking for food, but some are "sitters," that is, they stay in one place. In her research Professor Marla Sokolowski, a biologist at the University of Toronto Mississauga, found that a particular gene controlled this variable behavior, a gene that is found in many organisms, including humans. When the fruit fly larvae were competing for food, those that did best had a version of the foraging gene that was rarest in a particular population. For example, rovers did better when there were lots of sitters, and sitters did better when there were more rovers. Sokolowski explained:

> If you're a rover surrounded by many sitters, then the sitters are going to use up that patch and you're going to do better by moving out into a new patch. So you'll have an advantage because you're not competing with the sitters who stay close to the initial resource. On the other hand, if you're a sitter and you're mostly with rovers, the rovers are going to move out and you'll be left on the patch to feed without competition (Survival of the rarest, 2007).

Yellowstone pronghorns

Migration in many species is conditional, whereby an individual's genetic makeup allows for the adoption of a range of behaviors based on such factors as age, sex, experience and position of dominance, as well as an assessment of the risk of predation and the availability of resources, such as forage, as reported in "Partial migration and philopatry of Yellowstone pronghorn" by P.J. White and Troy L.

Davis of the National Park Service, and their research colleagues, Kerey K. Barnowe-Meyer, Department of Biological Sciences, University of Idaho; Robert L. Crabtree, Yellowstone Ecological Research Center; and Robert A. Garrott, Ecology Department, Montana State University.

Populations in which some, but not all, individuals migrate are known as partially migratory. As a result of genetic makeup, some individuals alter their behavior from year to year between migrant and non-migrant strategies. Take, for instance, the Yellowstone pronghorn. Most of the migration routes for bison, elk and pronghorn have been lost in the greater Yellowstone region. The researchers studied two migration corridors still being used, linking the pronghorns' summer ranges in the mountains to their winter ranges in the valleys:

> Only two long distance migrations by pronghorn remain in this region, one of which occurs in western Wyoming where pronghorn migrate 116–258 km (one-way) [72-160 miles] annually between Grand Teton National Park and the Green River Basin . . . This invariant migration corridor has been used for at least 6000 years, but is threatened by impediments (e.g., fences, highways, housing subdivisions, petroleum development) and several bottlenecks as narrow as 121m [about 400 feet].
>
> The other remaining long distance migration by pronghorn occurs in the upper Yellowstone River drainage of Montana and Wyoming. Pronghorn were once numerous (1000–1500 animals) and migrated 80–130 km [50-81 miles] down the Yellowstone River from higher-elevation summer ranges in Yellowstone National Park to lower-elevation winter ranges in the Paradise Valley and near Livingston, MT . . . However, human settlement reduced pronghorn abundance and effectively eliminated their migration north from the park sometime before 1920 . . . Feeding, irrigation, and fencing efforts until 1934 further reduced their distribution and apparently reinforced the tendency for some pronghorn to remain on the winter range year-round.

Additionally, the researchers were concerned that:

> Increasing recreation, fencing, residential and concessionaire developments, bison management operations on critical winter range, and other anthropogenic effects could also differentially influence the migratory and resident components of the population.

They concluded that:

> . . . it is conceivable that any further range restriction from natural or human-induced barriers to the relatively narrow, open pathways within this corridor could reduce the survival and reproductive success of migrant pronghorn.

Increased density of an animal population has often been cited as a cause for increased migratory behavior. However, the opposite turns out to be true for the Yellowstone pronghorn. As White and his team observed:

> The proportion of migrants changed from approximately 80% during 1967–1969 when densities on the winter range were low (5–7/km2; Barmore, 2003), to 20% during 1988–1993 when densities were high (20–25/km^2 . . . and back to 70% during 1999–2005 when densities decreased to 10/km^2. The factors influencing these changes in migration patterns are unknown and difficult to infer because, contrary to theoretical expectations, a smaller proportion of the population migrated at higher density . . .

Migration can be a costly strategy, exposing animals as they journey from habitat to habitat to a numbers of risks or impediments, such as mortality due to collision with vehicles when crossing a road, predators, hunters or fencing. On the other hand, remaining over the winter in mountainous country can also be a costly strategy if snow levels are high and temperatures cold, increasing the death rate due to starvation and freezing.

In Yellowstone, the long term viability of pronghorn is a concern because low abundance (fewer than 150) has increased their susceptibility to random, naturally-occurring catastrophes. Their migration had been truncated by up to 50 miles outside the park due to development and habitat fragmentation.

Whether animals migrate or stay put may be governed by philopatry, a term from animal behavior and ecology derived from the Greek for “home-loving.” In his 1963 book *Animal Species and Evolution*, Ernst Mayr defined philopatry as the drive or tendency of an individual to return to, or stay in, its home area, birthplace, or another adopted locality. Simply put, philopatry is choosing to go to, or stay in, a specific geographic location.

Philopatry may be behind the variable migrating populations of the Yellowstone pronghorn. Poor juvenile survival within either migrant or non-migrant groups due to philopatic behavior may significantly decrease the proportion of individuals adopting this strategy. These findings suggest changes in the proportion of migrant Yellowstone pronghorn may reflect changes in adult survival and reproductive success between areas of use. Individual differences in the costs and benefits of migration may promote a broad range of migratory strategies within a population, the White et al. researchers suggested.

The research team recommended protection of the migratory corridor for the Yellowstone pronghorn:

> This behavioral flexibility is consistent with the hypothesis that migration in Yellowstone pronghorn is a conditional strategy and likely contributed to dynamic and rapid changes in the proportion of migrants from 80% to 20% and back to 70% during 1967–2005. All migrant pronghorn traveled 10 km

> over a topographic bottleneck (Mt. Everts) separating the winter and summer ranges, primarily using grassland—sagebrush pathways through conifer forest. We recommend continued protection of this corridor because increased mortality and a decreasing proportion of migrants may be as important a threat to the persistence of partially migratory populations as habitat fragmentation, especially when local resources for non-migrants are inadequate to sustain the entire population (White, et al., 2007, pp. 502-510).

While protecting migratory corridors is strongly recommended for Yellowstone's pronghorns, protecting the critically important migratory corridor of Gardiner Basin for Yellowstone's wild bison is entirely disregarded by all the government agencies that comprise the IBMP, including the NPS, for which White, the lead author of the pronghorn migratory study, is a staff biologist. Instead, the mission of the member agencies of the IBMP is devoted to keeping wild bison out of this essential corridor by means of hazing and lethal control. And the agency directly responsible for protecting species and critical habitat, the Fish and Wildlife Service, supports IBMP's lethal removal program barring wild bison from Gardiner Basin as documented in its several findings on petitions submitted for the protection of wild bison.

Remedies to facilitate migration

Not only must an animal have the freedom to move to get to its required destination, but it also must know how to get there. Captivity often makes animals into dunces. The whooping crane is an example. Raised in captivity, when released at the species' traditional time for migration, it does not know where to fly. It has lost the migratory instinct.

As of April 2007 there were about 340 whooping cranes living in the wild and another 145 living in captivity. The wild flock nests in the summer at Wood Buffalo National Park in Alberta, Canada, and migrates in the winter to areas in and around the Aransas National Wildlife Refuge on the Texas Gulf Coast. Scientists have long recognized the risk of all wild whooping cranes using one wintering and breeding location. With all the wild birds concentrated in one small area, the population could be wiped out by disease, bad weather or human impacts. Whooping crane survival depends on additional, separated populations. To create a separate flock, chicks from captive breeding flocks were re-introduced at the Necedah National Wildlife Refuge in central Wisconsin. However, they did not know where to go for the critical winter months. They had lost the migratory instinct and had to be taught to migrate.

Cranes learn the migration route from the previous generation. Chicks hatched on the nesting grounds fly with their parents and will follow them in the fall to the wintering grounds. The route used to reach a destination evolved over an extensive period to time, but the path exists only in the memories of the birds. If all individuals of a species are lost from a region, the route is lost forever. Birds that are raised in captivity lack an older generation to teach them and they tend to become residents, staying the entire year in the same location.

To train those birds that had lost the ability to migrate, an experiment called “Operation Migration” was developed. The birds were raised in the presence of an ultralight aircraft and their human handlers dressed in special costumes so that the birds would imprint on humans like they would their natural parents. When it came time to migrate, the human-led whooping cranes took off, following the ultralight aircraft on a 1,000-mile journey to Florida. The experiment worked. Some of the cranes returned in the spring on their own, establishing their migration route (Endangered species, 2011; Whooping Crane Migration Tracking Project, 2011; Operation Migration, 2017).

Figure 42a. YOUNG WHOOPING CRANES completing their first migration, from Wisconsin to Florida, in January 2009, following an ultralight aircraft. This procedure was carried out by Operation Migration, Niagara Falls, New York. ***Photo January 17, 2009 released to the public domain by author Tim Ross.***

Recall that in a letter to this Petitioner concerning my query as to why my second petition submitted in 2015 was rejected, the Fish and Wildlife Service stated that, among other things, my examples of the harm done by hindering migration in other species were “inappropriate surrogate comparisons that this will happen in Yellowstone bison” (Assistant regional director of the FWS’s Mountain-Prairie Region, personal communication, April 19, 2016). When I asked the FWS how such examples were inappropriate, the agency never responded. Apparently, they have no answer.

The example of the whooping cranes makes one wonder just what would happen to wild bison when the last parent that knows the way out of the interior of Yellowstone National Park is culled by the IBMP, and a severe winter occurs with lethal weather in the high altitudes? Perhaps, since they do not know, members of the Fish and Wildlife Service as a precautionary measure can begin a similar Operation Migration for wild bison and dress up in bison costumes, imprinting themselves on the herd in preparation for such a winter so they can lead the non-migratory out of the park's interior.

Migration was facilitated for the Eastern box turtle, the Eastern hog-nose snake and a species of salamander that had their migratory route cut off by the construction of a highway near Brookfield, Connecticut. Under the auspices of the state's Department of Environmental Protection and the state Department of Transportation, a specially-constructed $1 million culvert was built under the highway, enabling reptiles to move safely from their wintering habitat, where they hibernate, to the summer habitat where the females lay their eggs (Miller, 2009).

To protect the seasonal movement of pronghorn in the Greater Yellowstone ecosystem, the U.S. Forest Service has established the nation's first designated wildlife migration corridor—the Path of the Pronghorn. Adopting an amendment to the Bridger-Teton National Forest Land and Resource Management Plan, the agency assures that future activities on Forest Service lands within the corridor will be compatible with the continued successful migration of pronghorn.

Although pronghorn are not listed as endangered, the population that summers in Grand Teton National Park numbers fewer than 200 animals. Because snow in the park is too deep to allow the animals to survive the harsh winters, obstruction of the migration corridor would result in the local extinction of pronghorn from Grand Teton National Park.

"This represents a tremendous conservation victory and demonstrates that by working together we can find solutions to preserve our nation's wildlife heritage," said Dr. Kim Murray Berger, a biologist with the Wildlife Conservation Society who has studied the pronghorn migration since 2003 (Ancient Pronghorn Path Becomes First U.S. Wildlife Migration Corridor, 2008).

To facilitate the antelope migration between Grand Teton National Park and the Upper Green River Valley, migratory travel over what has become known as the "Pronghorn Passage," an overpass at Trapper's Point in western Wyoming was built. It is one of eight special wildlife passages constructed by the Wyoming Department of Transportation along a 13-mile stretch of highway. Sections of eight-foot high barrier fencing were placed along the highway to channel animals to the crossing points. Two overpasses and six underpasses have been built, and accommodate pronghorn, mule deer, moose, elk and other wildlife, along with seasonal livestock drives, as reported by Emilene Ostlind, *High Country News* (Ostlind, 2012).

Wildlife seemed an inexhaustible resource fifty years ago in Africa. However, in such places as the southern African country of Botswana—known for its prolific and untouched wildlife—as noted, wildlife numbers plummeted following the construction of hundreds of miles of fences, called veterinarian fences, erected to reduce the risk of wild animal transmission of disease to cattle. This created a dilemma, namely, how to conserve wildlife, the basis of a highly profitable tourist industry, while preserving livelihoods based on livestock production and export.

Nature-based tourism, such as photographic safaris and trophy hunting, now contributes about as much to the economies of southern African countries as agriculture, forestry and fisheries combined. These countries are trying to maximize returns from the wildlife sector by forming transfrontier (or transboundary) conservation areas (TFCAs) such as the Kavango-Zambezi (KAZA) Transfrontier Conservation Area, a southern Africa game reserve, the world's largest conservation area straddling Angola, Botswana, Namibia, Zambia and Zimbabwe, and the Great Limpopo Transfrontier Conservation Area.

Dr. Steve Osofsky, the first wildlife veterinarian in Botswana and now the Wildlife Conservation Society's (WCS) director of Wildlife Health Policy, believes that a key to the economic well-being of southern Africa is to better understand the relationship between wildlife populations and livestock populations, including the management of wildlife disease that can spread to cattle. Key is ascertaining their relative economic importance. He explained his vision of a better future for southern Africa in an interview March 1, 2010 with Dr. Laurel A. Neme, host of *The Wildlife,* a Vermont-based radio show:

> Looking at how people can benefit not just from agriculture but from wildlife is very important. I tell students that my job in many ways is to help make wildlife an economically rational and a socio-culturally acceptable land use choice. Because if that's not the case, then wildlife isn't going to survive . . .
>
> One of the projects we've been working on since 2003 is in Southern Africa's Great Limpopo Transfrontier Conservation Area. This is a region shared by South Africa, Zimbabwe and Mozambique. These three countries have signed a treaty to reconnect land areas, not to create one giant national park but basically to rezone, so that wildlife can move back and forth across places that it hasn't roamed in any great numbers for many, many years—the idea being that wildlife, as a land use, can generate more per unit hectare in some of these areas than any other form of economic activity (Neme, 2010).

Key to protecting the economic viability of the region, he reasoned, was to facilitate wild animal movement, including migration, instead of hindering it.

As mentioned, in the Greater Yellowstone Ecosystem the cattle industry is opposed to movement by bison onto what it perceives to be its territory, because bison carry the disease brucellosis. Their migration is a major threat because of the possibility of co-mingling with cattle grazing near the park’s borders. Separation of the invasive species of cattle from the native species of ungulates is the preferred method of controlling that disease. This is currently being achieved by the Montana

DOL and other IBMP agency members either by fencing, hazing or culling of native species.

The member agencies of the IBMP act as a lethal fence in behalf of the Montana Department of Livestock. Any bison that touch the border between the park and the state of Montana, or even get near it, run the risk of a state-sanctioned summary execution, their “crime” being that they were migrating bison, while elk, which also carry the disease brucellosis, are free to roam.

The Stephens Creek capture facility, and other such wildlife traps that divert migrating bison to their doom, function in the same manner as did the primitive kite structures. Both wiped out entire migratory herds. As the kites contributed to the extirpation or extinction of wild ungulates, so operate Yellowstone National Park’s capture facilities.

The opposite approach is needed in wildlife management in the Greater Yellowstone Ecosystem, namely, no restriction of movement, no capture facilities and no fenced enclosures for wild animals, but instead allowing all indigenous wild animals to roam freely within the ecosystem.

Figure 43. SEPARATION BY FENCING. On its logo, the Montana Department of Livestock symbolizes its approach to livestock management, namely, fencing animal life for commercial purposes. This method of livestock management is being applied to wild bison, with lethal removal and hazing tantamount to fencing.

12

Candidate for listing option and invasive species

Cattle are an invasive, non-native species. They do not belong in the Greater Yellowstone Ecosystem. Their presence in the ecosystem presents a threat to the brucellosis-free status of the nation because here cattle are exposed to diseases carried by its wildlife, especially bison and elk infected with brucellosis. This disease is harmful to both humans and wildlife. To prevent the spread of this disease out of the park through the co-mingling of infected animals with cattle, instead of restricting the movement of bison within the ecosystem, cattle should not be shipped either into the ecosystem or out of it. This would dramatically reduce the biohazardous threat of the ecosystem and allow the park’s wildlife to heal from brucellosis, an endemic disease originally introduced to the park by cattle.

According to the Fish and Wildlife Service:

> The ultimate goal of the Endangered Species Act (ESA - (16 U.S.C. § 1531 et seq.)) is the recovery (and long-term sustainability) of endangered and threatened species and the ecosystems on which they depend. Recovery is the process by which the decline of an endangered or threatened species is arrested or reversed, and threats removed or reduced so that the species' survival in the wild can be ensured. The goal of the ESA is the recovery of listed species to levels where protection under the ESA is no longer necessary.

Invasive species can pose a major threat to the recovery of endangered species. The FWS continues:

> In many instances these threats may be caused by invasive species. They may either directly harm the species by causing mortality or may threaten a species

> by modifying or destroying the habitat or food source on which that species depends. A variety of methods and procedures are used to recover listed species, such as reduction of threats (including invasive species), protective measures to prevent extinction or further decline, consultation to avoid adverse impacts of Federal activities, habitat acquisition and restoration, and other on-the ground activities for managing and monitoring endangered and threatened species.

But reducing the threat of cattle grazing within the ecosystem by removing them from the ecosystem is something the FWS rejects. By its repeated refusal to do so and by its numerous denials of protection for Yellowstone's wild bison (four petitions have been denied so far), it has become evident that the Fish and Wildlife Service is bent on not listing the wild bison as endangered. Being that this has been the demonstrated case, why not consider wild bison as at least a *candidate* for listing? The FWS states:

> The Endangered Species program also works with candidate species. These are species of plants and animals being considered by the Service for listing as threatened or endangered under the ESA, but are not yet the subject of a proposed listing rule. When the Service has sufficient information on biological status and threats to justify preparing a formal proposed rule to list a species, but that action is precluded by other higher priority listing activities, the species is referred to as being a candidate for listing. Threats to these species may also be due to invasive species. The Candidate Conservation Program provides a means for conserving these species. The Service strongly encourages proactive conservation actions that can make listing candidate species unnecessary. Early conservation preserves management options, minimizes the cost of recovery, and reduces the potential for restrictive land use policies in the future (Invasive Species, 2016).

Just what are invasive species? The FWS explains:

> To understand what an invasive species is, one must first understand the difference between an exotic species and a native species. An exotic species is any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that habitat. Other terms sometimes used for exotic species include "non-native." "non-indigenous," and "alien." A native species is a species that, other than as a result of an introduction, historically occurs/occurred in that particular habitat. These definitions come from Executive Order 13112.

Executive Order 13112 was signed by President William Clinton on February 3, 1999. The FWS continues:

> An invasive species is an exotic species whose introduction into an ecosystem in which the species is not native causes or is likely to cause environmental or economic harm or harm to human health. It is important to note that when we talk about a species being invasive, we are talking about ecosystem or environmental boundaries, not political ones. In addition to the many invasive species from outside the U.S., there are many species from within the U.S. that are invasive in other parts of the country because they are not native to the ecosystem in which they have become established.

The FWS explains why invasive species are a problem:

> Invasive species are harmful to our natural resources (fish, wildlife, plants and overall ecosystem health) because they disrupt natural communities and ecological processes. This causes harm to the native species in that ecosystem because they are suddenly competing with a new species for the same resources (food, water, shelter, etc.). The invasive species can outcompete the native species for food and habitats and sometimes even cause their extinction. Even if the native species are not completely eliminated, the ecosystem often becomes much less diverse. A less diverse ecosystem is more susceptible to further disturbances such as diseases and natural disasters (FWS Questions on Invasives, 2016).

With that said, the FWS has repeatedly refused to make rulings to re-establish the balance of nature it touts and instead protects the imbalance: invasive cattle in the ecosystem. Its act of not practicing what it preaches is puzzling.

The result of protecting this dysfunction is public conflict—a range war. The war is between two camps, those who favor protecting cattle, essentially those with European-derived anti-wildlife values, and those who favor protecting bison, essentially Native Americans and conservationists. It is an Old World view that favors domestication versus the New World view that favors subsistence on wildlife and being in harmony with it.

This war can also be viewed as between two predators—humans and wolves. In mankind's past such mammals as lions and tigers and wolves, often collectively referred to as "beasts," had the upper hand, tearing the less powerful *homo sapiens* to shreds when in combat. But now, with the aid of technology, the human species almost always wins. Beasts are not able to triumph over bows and arrows, rifles, traps and fences.

Movement by the prey into a predator's range, that is, the habitat in which the predators hunt, can be restricted by essentially two ways: fear of their presence, and thus movement that avoids them, or by their capture and death under the predator's hands or paws.

Restricting or promoting the movement of wildlife can have dramatic results. When a system, a habitat, is altered either naturally or artificially, the interconnectivity of life with its environment can have an avalanche of effects. Human impact on the environment can have genetic effects downstream. When one plays with something as significant as migratory genes, one is potentially playing with a cascade of genetic modifications.

In Yellowstone, the government removes the migratory, and thus the strongest, making a weaker herd. But modifications can also be produced by such natural predators as wolves. Wolves remove from a bison herd the weak, young, aged and diseased, for they are easiest to kill. The result is a stronger herd.

The potentially most powerful and destructive predators are human functionaries acting under the approval of the government. Often heartless, motivated by orders from superiors and supported by law for their actions, they can band together to annihilate a species. The massive herds of bison on the plains were reduced to only a few in number by such functionaries, namely, the buffalo hunters of the Old West.

Figure 44. BUFFALO HUNTERS OF THE OLD WEST. After being shot by buffalo hunters and stripped of their skins, the animals were left to rot on the plains. Thousands of buffalo hides were piled up at hide yards, such as this one in Dodge City, Kansas. They were weighed on scales (shown at right) and shipped to the northeastern U.S. to be tanned (Frontier Forts, 2016).

Wolves met the same fate as bison, eradicated from most of the United States by the early 1900s. With the bison gone and replaced by cattle, and with cattle vulnerable to wolves as prey, they were viewed as an economic threat.

Over a million wolves inhabited the Northern Great Plains in the 1800s, with hundreds of thousands in Montana. In the latter 1800s wolf eradication plans were implemented. In 1899 alone, bounty hunters killed 23,000 wolves in Montana. However, even under these wolf-extermination efforts, viable populations remained. It was not until salaried, federal wolf hunters were employed that wolves were eradicated (Mauk, 2014).

In 1914 Congress appropriated funds for "destroying wolves, prairie dogs, and other animals injurious to agriculture and animal husbandry." In 1926 the last two wolves remaining in Yellowstone were killed after they were lured to a bison carcass (The Wolves of Yellowstone, 2016). One of the major government agencies responsible for wolf control was the Bureau of Biological Survey. In 1940, it was combined with the Bureau of Fisheries to become the US Fish and Wildlife Service under the Department of the Interior (United States Fish and Wildlife Service, 2016).

Gayle C. Shirley, in *Amazing Animals of Montana: Incredible True Stories*, described an encounter by a governmental wolf hunter with a wolf named Old Cripple Foot, dubbed "wolf queen of the Little Belt mountains." The government spent $20,000 to kill this wolf. Shirley recounted:

> Another cattle killer, Cripple Foot earned her name by losing part of one front foot in a trap.
>
> In 1926, Barney Brannin, a government hunter, followed her tracks to her den. When he slid off his horse to investigate, she charged out at him, snarling and baring her teeth. Unable to reach the rifle on his saddle, Brannin kicked dirt and threw stones into her face to drive her back into the den. Then he stuffed his coat and chaps into the entrance to prevent her escape. After digging a hole into the den from above, he shot Cripple Foot and her six pups, ending a ten- to twelve-year rampage that cost rangers an estimated $20,000 (Shirley, 2005, pp. 37, 38).

A case could be made that the most destructive animal on earth, the most environmentally harmful invasive species, is the cow. It was for the cow that the plains were cleared of bison. It was for the cow that the wolves were eliminated. It is for the cow that grizzly bears and mountain lions are killed. The cow is deadly because of its ever-present protector, man, especially those who rely on this ungulate as a major food or income source.

Domestic, not wild, the cow can not survive in nature without the protection of humans. Ecologically and monetarily, we pay a high price by trying to ranch in a wilderness.

Radically different was the relationship of the Native Americans to their major ungulate food source, bison, for wildlife, including the wolf and other predators, thrived in the presence of the American Indian. It is because they respected the web of life.

Figure 45. GOVERNMENT WOLF HUNTER Barney Brannin with part of the Cripple Foot pack taken on the Waite ranch in 1926. ***Photo: Montana Historical Society.***

13

The trophic cascade

Life is interconnected, often mysteriously so. In an ecosystem such as Yellowstone, kill off the wolves and willows will die. Restore the wolves and the willows will regrow.

When a predator is added or removed from an ecosystem it triggers what is called a "trophic cascade," the term coined by American zoologist Robert Paine in 1980 to describe what happens to an ecosystem when the predator-prey relationship is altered by the removal of a top predator. The word trophic comes from the Greek trophikos, pertaining to food or nourishment. Thus a trophic cascade in ecology would be a sequence of events involving nutrition.

Paine found that by systematically removing sea stars from the rocks along a nine-yard stretch of shore at Makah Bay, Washington, and tossing them into deep ocean water, he dramatically altered the diversity of species there.

Writing in *Nature*, Ed Young explained what happened:

> The bay's rocky intertidal zone normally hosts a thriving community of mussels, barnacles, limpets, anemones and algae. But it changed completely after Paine banished the starfish. The barnacles that the sea star (*Pisaster ochraceus*) usually ate advanced through the predator-free zone, and were later replaced by mussels. These invaders crowded out the algae and limpets, which fled for less competitive pastures. Within a year, the total number of species had halved: a diverse tidal wonderland became a black monoculture of mussels (Young, 2013).

Starfish are carnivores. An increase (or decrease) in carnivores causes a decrease (or increase) in herbivores and an increase (or decrease) in primary producers such as plants. For example, in eastern North America the removal of wolves has been associated with an increase in white-tailed deer and a decline in plants eaten by the deer. Lack of wolves promoted overgrazing by deer.

Blocking the cascade by removing a predator can have further effects. Like a stream of water, dam the cascade and one gets stagnation. Stagnation can produce disease. One interrupts millions of years of interaction and co-evolution.

Taal Levi et al. in "Deer, predators, and the emergence of Lyme disease," Proceedings of the National Academy of Sciences, observed:

> There is growing recognition that changes in host community ecology and trophic interactions can contribute to the emergence of infectious diseases. In particular, the transmission of vector-borne zoonotic diseases to humans depends on multiple species interactions that influence host and vector abundance and infection prevalence. Most zoonotic pathogens are harbored by wildlife that occupy low trophic levels. The extirpation of top predators and the consequent restructuring of predator communities may thus increase the risk of zoonotic diseases if predation of reservoir hosts plays a key role in disease suppression. A paradigmatic case of disease emergence that is thought to be driven by changes in the host community is Lyme disease (Levi, 2012).

White-tailed deer serve as a primary host for the adult blacklegged tick, a vector for Lyme disease. In a thirteen-year study of a Connecticut community before and after reducing the deer population by hunting, a dramatic drop of Lyme disease among permanent residents was noted. In "The Relationship Between Deer Density, Tick Abundance, and Human Cases of Lyme Disease in a Residential Community," *Journal of Medical Entomology*, a research team headed by Howard J. Kilpatrick found that:

> After hunts were initiated, number and frequency of deer observations in the community were greatly reduced as were resident-reported cases of Lyme disease. Number of resident-reported cases of Lyme disease per 100 households was strongly correlated to deer density in the community. Reducing deer density to 5.1 deer per square kilometer resulted in a 76% reduction in tick abundance, 70% reduction in the entomological risk index, and 80% reduction in resident-reported cases of Lyme disease in the community from before to after a hunt was initiated (Kilpatrick, 2014).

In nature, one of the prime predators of deer are wolves. Thus a reduction in wolves can cascade into a greater density of deer and a corresponding increase in Lyme disease. But the cascading effect of removing a top predator can be even more complex. Wolves also kill coyotes and coyotes sans wolves have thereby become more abundant. This can also affect the prevalence of Lyme disease due to the following cascade: a higher coyote population has reduced the population of red foxes by interference competition. Red foxes have a diet of rodents higher in percentage than coyotes. Rodents are a prime vector of Lyme disease. Fewer red foxes, more rodents, more Lyme disease.

As noted by Levi et al.:

> A major change in predator–prey interactions in North America over the last half-century has resulted from the range expansion and population growth of a new top predator—the coyote, *Canis latrans*, which has spread across the continent following the extirpation of gray wolves, *Canis lupus*. The expansion of coyotes likely suppressed the abundance of several small-mammal predators, with the reduction of foxes by interference competition with coyotes being the best documented. The replacement of foxes by coyotes would likely reduce predation rates on small-mammal prey (i.e., the reverse of mesopredator release) because red fox (*Vulpes vulpes*) densities are typically an order of magnitude higher than coyote densities, and small mammals make up a larger fraction of their diets, particularly in the eastern United States (Levi, 2012).

Lack of top predators can create unhealthy herds. In a study titled "Unhealthy herds: indirect effects of predators enhance two drivers of disease spread," a team led by Duffy noted:

> Theory suggests that many predators should "keep the herds healthy" for at least two reasons. First, predators reduce host density. As disease transmission often increases with host density, predation on hosts can reduce opportunities for disease spread. Second, predators eat infected prey, sometimes quite preferentially. If predators themselves cannot spread parasites while eating infected prey, predation that removes infected individuals should decrease contact between susceptible and infected hosts and/or free-living parasite propagules, thereby inhibiting disease spread. Indeed, recent theoretical and empirical work supports this "healthy herds" hypothesis, particularly in cases where predators preferentially select infected prey. This hypothesis suggests that two common management goals—conserving predators and reducing disease—act in concert (Duffy, 2011).

Diseased bison killed and eaten by wolves and other scavengers are in effect put into quarantine—absent from the ecosystem, they can not spread disease through it.

Wolf hunting is allowed in Montana, including just outside the park, resulting in wolf mortalities of park wolves who wander outside the park boundaries. Wolves that travel outside the park, but have dens inside the park, are potential predators of wild Yellowstone bison. A preferred habitat in the winter for both bison and wolves is Gardiner Basin. However, wolves may be killed here by hunters. This is epidemiologically contradictory. What has the state of Montana done about this? It closed Gardiner Basin to wolf hunting, then re-opened it.

The National Park Service explains:

> On December 10th 2012, the Montana Wildlife Commission voted to close two other small areas north of Yellowstone around Gardiner, Montana to hunting and trapping for wolves after three collared animals were harvested by hunters in November. Yellowstone National Park acknowledges the importance of regulated hunting as a tool used to manage many wildlife species in surrounding states, but appreciated the careful consideration of Montana's wildlife commissioners in their decision to close portions of the Gardiner hunting district to mitigate undesired harvest of wolves living primarily in Yellowstone. On January 2nd 2013, a Montana judge blocked the state from closing hunting and trapping in these two areas surrounding Gardiner. The judge sided with plaintiffs in a case that argued a lack of public notice on the Commission's vote to close wolf harvest appeared to violate the Montana Constitution and threatened to deprive the public of the legal right to harvest wolves. Hunting and trapping resumed in the Gardiner area on January 3rd. The Park Service and Montana continued to monitor and communicate on wolf harvests until the end of the season February 28th. No additional wolves living primarily in Yellowstone but using the Gardiner area were shot or trapped. Management of wolves outside of Yellowstone is under the jurisdiction of the states (Information on the 2012-13 Wolf Hunt Near Yellowstone National Park, 2016).

According to the Yellowstone National Park Wolf Project Annual Report 2014, wolves killed a diverse array of prey, with the majority being elk, bison and deer. The report stated:

> Project staff detected 227 kills that were definitely, probably, or possibly made by wolves during 2014, including 148 elk (65%), 20 bison (9%), 13 mule deer (5%), 10 deer of unknown species (4%, probably mule deer), five coyotes (2%), three moose (1%), three wolves (1%), one badger (<1%), one beaver (<1%), one bighorn sheep (<1%), one goose (<1%), one raven (<1%), one pronghorn (<1%), and 19 unidentified animals (8%). The composition of elk kills was 30% calves, 2% yearlings, 33% adult females (cows), 22% adult males (bulls), 10% adults of unknown sex, and 3% of unknown sex and age.

The report noted:

> Wolves still preferred elk, but predation on bison and mule deer appear to be increasing (Wolf Project Annual Report, 2014).

But the state of Montana and federal government agencies under the authority of the IBMP do not want to let nature alone. They have what they consider a more efficient way of controlling disease in the ecosystem—killing all bison migrating out of the park so they will not mingle with cattle grazing on the park's borders, but allowing all elk to migrate and mingle with cattle, knowing that both elk and bison are vectors of the disease brucellosis. It is, of course, nuts.

IBMP's slaughtering of migratory bison does not reduce the prevalence of *Brucella abortus* in the ecosystem. In fact, it has the potential of increasing it. It increased the density of bison within the park by discouraging dispersal and its culling program does not discriminate between healthy bison, bison with immunity to brucellosis or diseased ones. When it does discriminate, it favors killing the migratory, those that are strong. The IBMP makes a lousy wolf.

This government intervention has a cascade of harmful effects. By killing the aggressive and adventuresome members of the wild bison herds, that is, the migratory herd, one is selecting in favor of the more docile and tame. The problem with this is that the selection going on vis-à-vis the IBMP is not natural selection, but artificial selection, and the trouble with that in a wilderness community is that the evolving traits are not adaptive to the environment.

As discussed, in such an instance, survival of the fittest is not allowed to operate. The result can be less fit animals and the result of that is reduced survival, especially in the case of a changed environment, such as a severe winter. By weeding out that trait, the mechanisms that normally are put into play would no longer be operating, meaning reduced survival of wild bison. Given a severe enough change in the environment, it could cascade into the collapse of the entire wild herd because the trait governing the impulse to escape had been systematically removed.

Preventing migration stops animals from accessing alternate sources of nourishment. If a source of nourishment is diminished at home base, that is, where a species lives most of the time, and if that nourishment-deprived species can not escape to find another food source, it will either starve, or in a weakened condition, freeze to death.

Feasibility of bison population control by wolves

Central to the importance of protecting the wild bison is:

1. how to control its population so that it is kept within the carrying capacity of the park's grassland ranges as well as

2. how to best deal with its migratory behavior.

Since the founding of the park, the answer has been to have park management and now the IBMP cull bison that rise above a certain population number.

Currently, those selected for killing are those animals that attempt to escape beyond the boundaries of the park when the total park bison population goes beyond 3,000.

An objective of this petition is to suggest that there is a better way than human intervention, a way that has been provided by nature for eons and has worked on the plains for millennia. That better way is to allow bison to migrate and to control excess population by wolf predation and hunting. It is better because it can more effectively restore the balance of nature in the park and retain genetic diversity of wild bison, as well as other animals there.

This petition favors the New World methods of wildlife utilization for the good of society as practiced by American Indians prior to European settlement, as opposed to the Old World loathing of what is wild as demonstrated by the demonization of the wolf and the annihilation of the European bison, the wisent, the ancestor of the American buffalo. This anti-wildlife attitude was brought to America by Europeans and persists in many sectors today.

The industrialized killing of wild bison in the Greater Yellowstone Ecosystem is simply a manifestation of a system that is out of whack. It promotes disease and extinction. The problem does not just revolve around the preservation of wild bison, but rather, the preservation of the ecosystem. Without this generalist approach, nothing will work.

There is a promising bottom line to all this for all concerned: the preservation of wildlife can be profitable, more so than the exclusive dominance of cattle and other livestock in this ecosystem. Further, ask yourself this: how many people visit Yellowstone to see cattle? Why should the people of his nation allow the bison, this irreplaceable wildlife treasure, to be put in jeopardy?

So, let us look into the feasibility of the natural control of bison numbers via wolf predation. The official government position is that they do not think wolves are up to the job. The NPS states:

> Yellowstone bison are prolific and have high survival rates, with wolves currently killing few bison because elk are more vulnerable prey (Bison Management, 2014).

One of the reasons wolves are “currently killing few bison” is because the states surrounding Yellowstone are currently killing off the gray wolves that were re-introduced to the park at a cost of millions of dollars. Killing wolves disrupts a pack and has the potential of keeping packs small as they rebuild. It takes a large pack to bring down a bison.

Let us look at the ecological role of the wolf more closely. Prior to reintroduction into Yellowstone, as noted, wolves had been exterminated systematically by the government and private trappers and hunters. Following the destruction of the bison herds in the 1870s, wolves increasingly turned to cattle for prey. For the settler and the cattle rancher, this was intolerable. Wolf numbers declined from millions to a few hundred. They were poisoned by baiting carcasses with strychnine, trapped, shot, and the cubs killed in their dens. A few escaped the onslaught in Yellowstone, but even they were eventually destroyed. Between 1914 and 1926, at least 136 wolves were killed in the park. By the 1940s, wolf packs were rarely reported. By the mid-1900s, wolves had been almost entirely eliminated from the 48 states. A survey in the 1970s found no evidence of a wolf population in Yellowstone.

Following the passage of the Endangered Species Act in 1972 and after years of environmental impact studies, in 1995 gray wolves were first reintroduced into Yellowstone in the Lamar Valley. In 2013, 95 wolves in 10 packs lived in the park. Wolf numbers have decreased by about 45 percent since 2003 when the population estimate was 172. This is likely due to fewer elk in the ecosystem. Wolf numbers decreased less in the interior of the park than in northern Yellowstone, likely due to supplemental feeding on bison by those packs (Wolf Project Annual Report, 2013).

Adolph Murie, wildlife biologist who pioneered field research on wolves, in 1944 asked an important question:

> What, for instance, is the total effect of the wolf preying on the big game species in this national park? . . . How do such predators as the golden eagle, fox, grizzly bear, and lynx affect the hoofed animals, and how does the wolf affect these predators? In short, what is the ecological picture centering about the wolf . . .? (Murie, 1944, p. xiii).

These questions are still being asked today. Researchers are finding some interesting answers, beginning with how wolves interact with members of their own pack. Parks Collins, National Center for Case Study Teaching in Science, wrote in "The Return of Canis lupus?" a description of an alpha male dubbed "Wolf #21":

> Wolf #21 spent a little over two years with his mother (#9) before venturing out to become the alpha male of another pack. He fathered pups every year from 1998–2004, including 20 pups in 2000. #21 became a legend to "wolf watchers," not only because of his size, but also because of his calm and gentle spirit. He was often seen walking away from a kill he had just made so that he could urinate or take a nap. This would allow the younger wolves to take their fill. Alphas typically eat first and will defend their right against others. #21 also was seen playing with the young wolves and letting them climb on top of him, much like a human father might do when wrestling with his young sons. Rick McIntyre, a biological technician for the Yellowstone Wolf Project, describes #21 the following way:
>
> "When pups harassed him by biting his tail or ears, #21 would often just walk away; I once saw him cross the road and hide in some bushes to get away from pups that were bothering him. Of course, he also used his great size and strength to benefit his pack. If the younger wolves were attacking an elk, but could not pull it down, #21 would run in and help bring it down (Smith et al.

2005). #21 died in 2004, which made him an exceptionally long-lived wild wolf. He definitely left a legacy. In 2001, his pack numbered thirty-seven, the largest known wolf pack in history. Many of his pups went on to either join other packs or start other packs" (Collins, 2013).

To study these animals, park officials put GPS collars on some of the wolves to track their movements. One such animal was a large gray alpha female known as 832F. Nate Schweber, a New York Times reporter, described her:

> She also led the pack in Yellowstone's northeastern Lamar Valley, an area rich in bison and elk that has a road offering vantage points for wildlife watchers equipped with cameras and spotting scopes. The Lamar Canyon pack could be counted on to roam the valley near dawn and dusk, allowing scientists and tourists to observe wolf behavior at a level of detail rarely seen outside National Geographic specials.

"Wolf watchers" admired 832F's hunting prowess and fecundity and were moved by the way she cared for her pups, bringing them food and snarling ferociously at any animals that posed a threat to them (Schweber, 2012). They also called her "06" because she was born in 2006. She began to be termed the "most famous wolf in the world" (Platt, 2012).

Doug Smith, who heads the Yellowstone Wolf Project (which communicates findings of the park's wolf reintroduction program) talked about the wolf when interviewed by Beth Pratt, National Parks Traveler, on April 7, 2011:

> . . . what gets you stardom and fame is visibility and that happens in Lamar Valley and Slough Creek—and the pack in that area is Lamar Canyon. And what also gets you stardom and fame is having charismatic individuals. And Lamar Canyon does have one with their alpha female—06 is her nickname, but she's not collared. She's a very smart wolf, very atypical, and a big hunter. Males usually have a lot to do with the hunt—she does it all. To the wolf-watching community she is starting to be their rock star (Pratt, 2011).

However, they finally did get a collar on her. It took scientists years. She repeatedly hid from helicopters piloted by park scientists who were trying to capture her by using tranquilizing dart guns.

Trophic cascade

According to park officials, including wolf expert Smith, wildlife biologists are seeing some surprising results of wolf reintroduction—a phenomenon called "trophic cascade."

It is a top-down process involving environmental modifications. It works this way. Elk, which were overgrazing the park in absence of predators, are now declining, with wolves killing the weakest animals, making the elk herds healthier by removing the old, young and infirm. To avoid exposure to wolves and to avoid getting trapped out in the open, elk have changed their browsing behavior, staying away from the banks of rivers and open spaces. The result has been increased growth of aspen, willows, grasses and forbs. With more ground cover, stream erosion has been reduced.

More vegetation has increased bird species such as the yellow warbler and the willow flycatcher. More shrubs with berries have helped feed bears. Because there are now more aspen, beavers' favorite food and dam building material, more beaver-built ponds are being formed, providing increased habitat for fish, ducks, otters, muskrats, reptiles and amphibians.

Because wolves compete with coyotes for food supply, wolves kill coyotes. The reduction of coyotes increases the park's supply of rabbits and mice, leading to an increase of weasels and foxes and such birds of prey as bald eagles and hawks. Because the pronghorn antelope's major predator is the coyote, with fewer coyotes, there are now more pronghorns.

When wolves kill prey, the resultant carcasses attract a host of scavengers such as ravens, magpies, eagles, grizzly bears, coyotes and vultures as well as multiple insect species such as scavenger beetles.

In a study of the environmental rippling effect caused by the restoration of the wolf after its 70-year absence from the park, William J. Ripple and Robert L. Beschta reported their observations in "Trophic cascades in Yellowstone: The first 15 years after wolf reintroduction." They wrote:

> Synthesis results generally indicate that the reintroduction of wolves restored a trophic cascade with woody browse species growing taller and canopy cover increasing in some, but not all places. After wolf reintroduction, elk populations decreased, but both beaver (*Caster canadensis*) and bison (*Bison bison)* numbers increased, possibly due to the increase in available woody plants and herbaceous forage resulting from less competition with elk. Trophic cascades research during the first 15 years after wolf reintroduction indicated substantial initial effects on both plants and animals, but northern Yellowstone still appears to be in the early stages of ecosystem recovery. In ecosystems where wolves have been displaced or locally extirpated, their reintroduction may represent a particularly effective approach for passive restoration (Ripple, 2011).

Wolf restoration especially affected the population of not only elk, but two other keystone mammals, the beaver and bison. In fact, part of the reason for the bison increase can be credited to the wolf by making more forage available through its predation of elk, which had been over-grazing the park. But this trophic cascade is still in the early stages of ecosystem recovery. Looking back, the NPS noted in "Wolf Restoration Continued:"

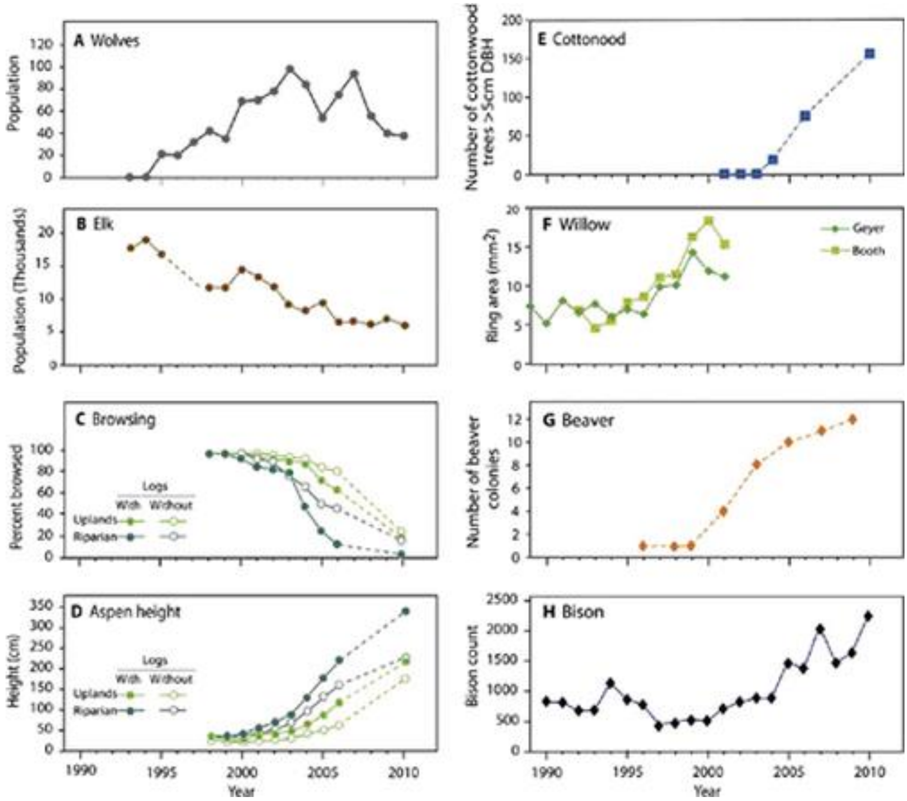

Figure 46. TROPHIC CASCADE after wolf reintroduction in Yellowstone National Park, with subsequent trends in (A) wolf populations, (B) minimum elk populations from annual counts, (C) percentage of aspen leaders [shoots] browsed, (D) mean aspen heights, (early springtime heights after winter browsing but before summer growth), (E) cottonwood recruitment, (F) willow ring area, (G) number of beaver colonies, and (H) summer bison counts (Ripple, 2011).

> Today, it is difficult for many people to understand why early park managers would have participated in the extermination of wolves. After all, the Yellowstone National Park Act of 1872 stated that the Secretary of the Interior "shall provide against the wanton destruction of the fish and game found within said Park." But this was an era before people, including many biologists, understood the concepts of ecosystem and the interconnectedness of species. At the time, the wolves' habit of killing prey species was considered "wanton destruction" of the animals (Wolf Restoration Continued, 2014).

True words. However, the "era before people, including many biologists, understood the concepts of ecosystem and the interconnectedness of species" has evidently returned. All is not so rosy. With wolf re-introduction in Yellowstone and in other areas of the nation, conflicts awakened the age-old prejudices against the big bad wolf. Livestock owners decried losses to wolves, despite programs of indemnification of ranchers and others for losses due to wolf predation and despite the fact that such losses were miniscule. Special interest groups such as elk hunters and elk hunting guide outfitters grew increasingly more vocal in opposition to the presence of the wolf in the park. They claimed that elk populations had fallen to unacceptable levels and that the primary cause was wolf reintroduction. Eventually, federal protection of the gray wolf was removed. Gray wolves were delisted in Idaho and Montana in 2011 and in Wyoming in 2012. These states now manage wolf harvest seasons, although by court order the wolf has been re-listed in Wyoming.

But just what are acceptable elk population levels? Prior to 1968, elk populations were kept at what was considered the acceptable population for the park's carrying capacity, about 4,000 animals. The herd was intensively culled by park managers from 1935 to 1968. On average, 2,040 elk were removed each year in an attempt to alleviate or prevent presumed range damage. Since 1968, the northern Yellowstone elk herd has been managed under a philosophy of natural regulation. In 20 years, the herd grew from 4,305 elk in 1968 to 18,913 in 1988 (Coughenour, 1996).

Following wolf reintroduction in 1995 the elk population declined to 3,915 in 2013, about the level of what park managers originally thought would be the right-sized population level.

What effect has the wolf had on humans hunting elk? Through an analysis of hunting licenses issued by Montana and elk harvest statistics from 1999 to 2010 Steven Robert Hazen, in a thesis for his masters degree in applied economics, found "no significant impact of wolves upon hunter harvest in any of the three regions analyzed" in the state. However, in both southwest and west central portions of the state, the presence of wolves were found to decrease hunter applications. Specifically, wolves within 25 miles of YNP decreased hunter applications by 36 percent, while wolves within 25-50 miles increased applications by 11 percent. He reasoned that this effect may be due to game being pushed out of areas close to the park and moving to areas approximately 50 miles away and that hunters are adjusting to this migration by shifting applications to these districts (Hazen, 2012).

What might be called "wolf-phobia" has resulted in a state stripping almost all regulations regarding the taking of wolves following delisting. Over most of Wyoming, for instance, after delisting it was "open season" on wolves. This, in turn, was challenged in court by conservationist groups such as Defenders of Wildlife, Natural Resources Defense Council, the Sierra Club and the Center for Biological Diversity, with the result that the courts ordered the wolf re-listed in Wyoming due to a lack of guidelines. Earthjustice attorney Tim Preso, who represented the groups, objected to what he termed "Wyoming's kill-on-sight approach to wolf management." He said Wyoming treated wolves as "vermin" and allowed them to be hunted "along the borders of Yellowstone National Park and throughout national forest lands south of Jackson Hole." Following the opening of

80 percent of Wyoming to "unlimited" killing, the group said 219 wolves had been killed. The groups also claimed that "weak protections" existed for wolves in the remaining 20 percent of the state (Winter, 2014).

One of those wolves killed was alpha female 832F, or 06, as some called her. She was one of the first to go following delisting. In December of 2012, she had strayed outside the protected boundaries of the park into Wyoming where a hunter waiting near the border shot her. The unidentified "trophy hunter" handed her $4,000 GPS radio collar over to authorities.

Doug Smith termed the wolf's death a serious blow to wolf conservation research (Platt, 2012). According to Smith, because 832F was the alpha, or breeding, female in the Lamar Canyon Pack, her death is also likely to have "important social impacts" on the park's wolves. Wolves from one pack occasionally attack a wolf from another pack, and in some of these cases, the alpha female has died—an event that can lead to the pack's break-up (Morell, 2012).

Figure 47. SHOT UPON DELISTING, alpha female 832f, or "06," a wolf from Yellowstone National Park, had a fervent following (Schweber, 2012). ***(Photo from Yellowstone Wolves Killed, 2012)***

Annual reports of the Wolf Project give a good insight into what the removal of a wolf from its pack, especially an alpha member, can mean behaviorally, namely, it can result in the disbandment of the pack:

- In 2012 the alpha females of the Agate Creek and Mary Mountain packs were pregnant, but died near their whelping dates. Both packs disbanded soon after.

- In late December 2005 the founding member and longtime alpha female of the Nez Perce pack was killed in the park interior by the Gibbon Meadows pack. At age nine, she was the oldest known wolf in the park population. Shortly after her death pack members split up and dispersed.
- In March 2005 the alpha male (#227) was killed by the Slough Creek pack and the founding alpha female (#106) disappeared and probably died. The combination of these events resulted in the dissolution of the pack (Wolf Project, 2012, 2005).

It is interesting to note that the largest packs not only survived, but thrived. The 2005 annual report of the Wolf Project records:

> At 17 wolves, the Yellowstone Delta pack was the largest in the park. The Yellowstone Delta and Bechler packs thrived in 2005, despite living in a deep snow/low prey environment. These wolves made forays outside the park in search of wintering ungulates.

Following the delisting, Wolf Project's 2012 annual report concluded that there should be no distinction between wolves living in and out of the park. The park border, for all practical purposes with regard to wildlife and its management, is a fiction. It said:

> Important highlights of 2012 were that wolf numbers were down to approximately the level that was present in the late 1990s, and that state hunting seasons outside of the park harvested 12 wolves that primarily lived inside YNP. These results generated a lot of comment and discussion about state and national park policy objectives, and what factors contributed to the drop in wolf numbers. Our work, some of which is presented here, suggests that there are multiple influences on wolves in YNP and, as importantly, it is misleading to consider wolves in YNP and those living adjacent to the park as two distinct populations—they are essentially one.

With the decline in elk prey and greater exposure to increasing numbers of bison, it appears that wolves are switching more to bison. This is called "prey switching." The 2012 annual report of the Wolf Project noted:

> An interesting finding from 2012 data is that wolves utilized more bison than any other year so far. Greater exposure to bison due to increasing numbers on the northern range was likely a factor. Also, winter 2011–2012 was mild, so

there were fewer vulnerable elk in spring, and this is when most of the bison were consumed by wolves. In short, wolves ate neonate bison because bison calve earlier than elk, and adult elk are hard to kill. This shift toward bison will be an important development to track in the future.

Are wolves to blame?

Perceptions vary with regard to the population dynamics in the park. While wolves have been blamed for much of the decline in the park's elk numbers, the park's wolves numbered 83 in 2013, only 20 of which were living in the northern range.

Despite these low numbers, Billings Gazette reporter Brett French wrote March 9, 2013 that:

> Yellowstone National Park's abundant carnivore population has meant a continued decline in the northern Yellowstone elk herd, according to a Feb. 18 aerial survey by the Montana Department of Fish, Wildlife and Parks and the National Park Service.

Yet wolf biologist Doug Smith noted in the interview with French that the northern range wolf population hasn't been this low since 1996. Concerning the decline in wolf numbers, he said, "I think they're low because there's fewer elk" (French, 2013).

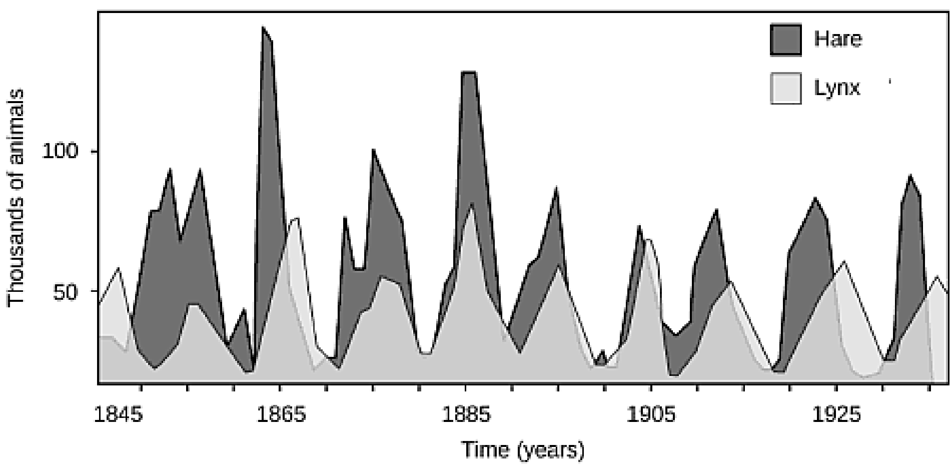

Figure 48. PREDATOR-PREY DYNAMICS of the hare and lynx. Notice that the peak of the lynx population follows the peak of the hare population, which in turn creates greater predation of hares and a corresponding decline of lynx because of a diminished prey base. *Image: Boundless.*

These declines may be part of the fluctuations seen in predator-prey dynamics. A good example of a predator-prey relationship would be the cycling of lynx and snowshoe hare populations in Northern Ontario. As hare populations increase, the lynx populations also increase due to increased food supplies. Many lynx eating many hares causes a decline in the hare population. This decrease in hares results in a corresponding decrease in the lynx population because of now lower food supplies. Then the cycle begins again (Predation, Herbivory, and the Competitive Exclusion Principle, 2014).

According to the predator-prey model, if the elk population declines due to wolves, then one would expect that a decrease in wolves would produce a corresponding increase in elk. However, this does not appear to be the case, although it is hard to tell, since there are periods of concurrent declines and rises in predator-prey populations that can span a number of years.

Wolf numbers have been declining since 2003. As reported in the Wolf Project's 2013 annual report:

> There were at least 95 wolves in 10 packs and one group (8 breeding pairs) living primarily in Yellowstone National Park during December 2013. These totals are slightly higher than reported in 2012, but similar to previous years when about 100 wolves were counted. Wolf numbers have decreased by about 45% since 2003 when the population estimate was 172. This is likely due to fewer elk in the ecosystem (Wolf Project annual report, 2013).

Even several years after wolf reintroduction, the elk population was considered too high and Montana Fish, Wildlife and Parks allowed an aggressive hunt for cow elk that migrated out of the park in 2005. According to FWP's news release August 23, 2005:

> FWP wildlife officials believe that by creating a larger pool of hunters with the option of taking a cow, elk numbers may be reduced, especially in areas where land-owners have severe depredation problems (Consider the Cow Elk Option, 2005).

Smith noted in the 2013 interview that the northern elk herd, which is only a portion of the park's entire elk herd, has declined from a high of more than 19,000 before wolves were reintroduced into the park in 1995 to 3,915 in 2013. The decline has been between 6 and 8 percent per year. He hinted that there may be an error in the count. He said it is more difficult to count elk within the park these days because they are in smaller groups often hidden in the trees. "In the old days, I'd see 300 to 500 elk out in the open," he said.

But that is not the case anymore. Herds are in smaller groups. "That's due to predation. A smaller herd is harder to find," Smith said (French, 2013).

As one can see in the graph of below, mapping population trends since wolf reintroduction in the park, the wolf population on average has been dropping. But so has the elk population. Contrary to the typical predator-prey cycle of ups and downs, it is all downs for both species' populations. (The steep decline in 2005 for wolves, the largest population decline since reintroduction, was attributed to pup mortality and disease.)

How could this concurrent sustained decline of both predator and prey be explained? Logically speaking, only two possibilities exist. One, either there has not been a sufficient lapse of time for the predator-prey cycling to manifest itself, or two, some force other than wolf predation is causing the decline of elk numbers. This latter hypothesis could be explained as follows.

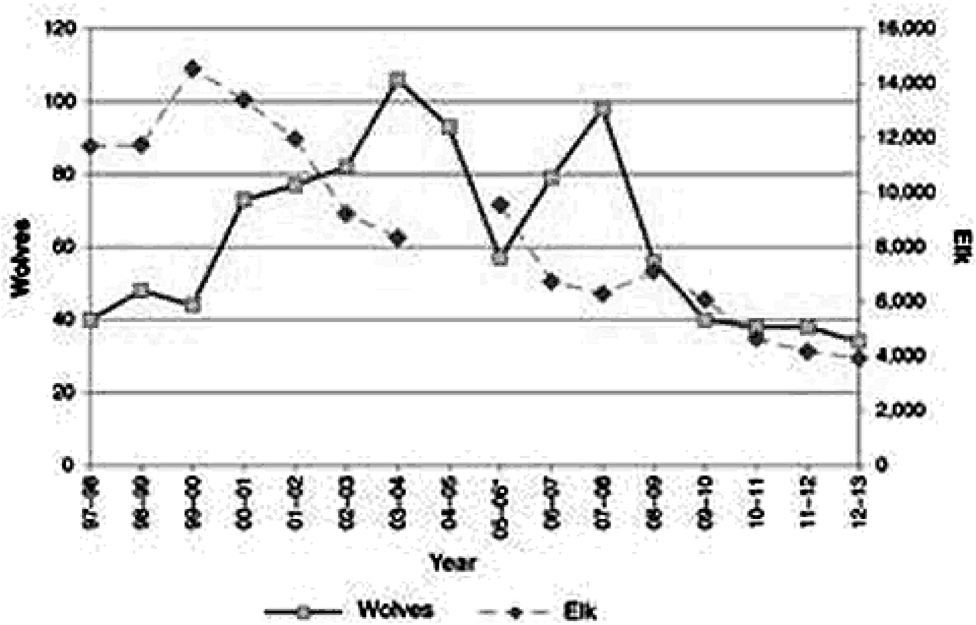

Figure 49. WOLF VERSUS ELK POPULATIONS ***(Wolf Project annual report, 2012).***

It is a given that the Yellowstone wolf population has declined by almost 50 percent since 2003. It has been theorized that this is due to the decline of the wolf's primary food source, the elk. But contrary to the predator-prey model, a corresponding increase in elk numbers has not followed that drop in the wolf population, even though that decline has continued more than a decade. This must mean that the decline in the elk populations is not due to the wolf itself, but instead some factor other than wolves consuming elk. The wolves are dying off because something other than themselves is responsible for elk mortality, the wolf's primary food source.

A ten-year period separates the troughs and peaks of the lynx-hare cycling. Intuitively, it would seem that a decade or more should be enough time for the predator-prey relationship to kick in and exhibit a cycling. But that has not happened. So what might be going on?

While the reintroduction of wolves to the park landscape was followed by a trophic cascade, the explanation of this rejuvenation as being solely attributed to wolves consuming elk may be too simplistic. Park scientists are studying the possibility that the reduction of elk, the primary trigger of the cascade, may have other, even more significant causes. Data indicate that it is not just limited to wolf predation, but a complex puzzle involving such factors as a six-year drought as well as other predators, such as grizzly bears, cougars, coyotes and heavy hunting pressures by humans (Stratton, 2013; Smith, 2008).

Scott Creel, an ecologist at Montana State University, published a study suggesting that the reason for the drop in elk numbers is due to a "non-consumptive effect," that is, instead of the decline in numbers being due to wolves eating elk, the mere presence of wolves has stressed the elk, causing them to flee into forests, reduce their feeding (elk prefer grazing to browsing) and increase their vigilance, leading to poor female health and fewer pregnancies (Creel, 2009).

But if this were the case, with a reduction of the number of wolves since 2003, and thus their intimidating presence, why was there not a population increase in over a decade in the now supposedly less-stressed elk?

In the Creel study, the supposed mechanism behind the elk population decline is that decreased forage intake results in a loss of body mass and fat, which in turn reduces progesterone concentrations, a hormone necessary for pregnancy, resulting in elk either failing to conceive during the autumn rut or elk losing the fetus during winter.

This hypothesis was tested in a study led by P. J. White, supervisory wildlife biologist at Yellowstone National Park. For both pre-wolf and post-wolf periods, they found that body fat of female elk was similarly high, as well as pregnancy rates at about 90 percent for both periods. The study titled "Body condition and pregnancy in northern Yellowstone elk: evidence for predation risk effects?" concluded:

> Thus, there was little evidence in these data to support strong effects of wolf presence on elk pregnancy (White, 2011).

But there has been little hard data tracking elk movements with wolf movements. To gain more direct insights, Ecologist Arthur D. Middleton led a study that focused on the interactions of wolves and elk in the Absaroka Mountains, working in collaboration with the Wyoming Cooperative Fish & Wildlife Research Unit, the Wyoming Game & Fish Department, and the U.S. Fish & Wildlife Service.

The team studied members of the Clarks Fork elk herd, which ranges in the Absaroka Mountains between Cody, Wyoming and the headwaters of the Lamar River inside Yellowstone National Park. There are two herds here: a resident or non-migratory herd that remains in the Absaroka foothills, where they have access to irrigated fields, and a migratory herd that travels up into the park to graze on the alpine meadows.

He fitted 90 female elk and 15 wolves with GPS collars, recording their coordinates every three hours to track their simultaneous movements. He also monitored elk body-fat levels and reproduction through biannual recaptures and closely observing winter elk behavior. From these data, a detailed map of long-term elk and wolf movements emerged.

His crew also counted the number of calves that survived each summer and recaptured the collared female elk twice a year for health checkups. He determined that the pregnancy rate among elk in the migrating herd was 19 percent lower than non-migrating herds nearby, and that from 1989 to 2009, the number of calves surviving to adulthood had declined 74 percent.

Results of the study indicate that elk responded to wolves, but only when wolves approached within about a half mile. Small increases in vigilance and movement occurred during the 24 hours after these encounters, but no changes in elk habitat use. He found that a typical migratory elk encountered a wolf within the half-mile range less than once a week. This relatively low encounter rate and the modest behavioral responses suggested that large, cumulative nutritional losses due to wolves should not be expected.

The study also found that the effect of elk body-fat losses over winter was not related to the frequency of wolf encounters, but rather to the amount of fat gained on the summer range—that is, those elk that got fatter during the summer did better during the winter. Further, the frequency of wolf encounters was found not to be related to pregnancy status. The study noted:

> These findings cast doubt on any link between the “fear” or “stress” of wolf predation and recent changes in the distribution, productivity, and abundance of elk.

What, then, caused the fall in the elk population?

> Among the elk we study (as discussed above), it seems more likely that the severe drought of the past decade, acting on an aging elk population, has reduced elk pregnancy—and that predators, particularly bears, kill many of the newborn elk calves (Absaroka Elk Ecology Project, 2010).

The bear connection to elk decline was unexpected. At the same time Middleton was doing his research, wildlife biologist Shannon Barber-Meyer, with the Department of Fisheries, Wildlife, and Conservation Biology at the University of Minnesota, followed 151 elk calves in Yellowstone for three years. Her team found that almost 70 percent of the calves died before their first birthdays and determined that wolves killed only 15 percent of them. On the other hand, 60 percent of the tagged calves had been killed by bears (more than half of them by grizzlies)—three times the level found two decades earlier (Barber-Meyer, 2008).

What had caused this shift? Jennifer Fortin, then a zoology Ph.D. student researching bear nutrition at Washington State University, conducted a long-term monitoring of grizzly bears in and around Yellowstone. She found that grizzlies had historically fed heavily on cutthroat trout they slapped out of the rivers as these fish spawned upstream. As reported by Christie Wilcox in *Discovery Magazine:*

> But in the 1980s, sport fishermen illegally released lake trout into Yellowstone Lake. The enormous invasive trout preyed on the native trout and competed with them for resources. And because the invasive trout spawn in deeper water than their native counterparts, they remain out of grizzlies' reach. Fortin's data showed that when fish were scarce, bears stalked the next easiest targets: elk calves.

But predation, even with bears included, didn't explain the low pregnancy rates of elk. Wilcox reported:

> A changing climate, on the other hand, did. Severe droughts since 2000, possibly correlated with climate change, reduced grass production in the areas of the park where elk migrate in the summer. Elk were forced to consume immense quantities of nutrient-poor fodder to try and meet their caloric needs, but most females were still undernourished and therefore unable to conceive (Wilcox, 2014).

The simplistic view that wolves were mainly responsible for the decline in the elk population was not supported by the data. Instead, it was a tangled web of contributing ecological factors: trout fishermen, bears, wolves, fish and climate change, with possibly others yet to be found.

Invasive species

But it doesn't stop here. To help restore the balance of nature that existed prior to the introduction of the invasive lake trout into Yellowstone Lake, park officials, along with Trout Unlimited and others are employing gill nets and fish traps to capture the non-native lake trout, removing so far 1.4 million. An initial study by Montana State University says that the invasive trout population is in decline (Miller, 2014). The effort in part is to keep bear predatory pressure off elk by providing them with their once favorite food: cutthroat trout.

The introduction of non-native fish goes back even further. Early park managers viewed fish in the park as resources to be used by sport anglers and to provide park visitors with fresh meals. Fish-eating wildlife, such as bears, ospreys, otters and pelicans were regarded as a nuisance, and many were destroyed as a result.

To supplement fishing and to counteract what was termed "destructive" consumption by wildlife, a fish stocking program was established in Yellowstone. Almost half of Yellowstone's waters were once fishless.

F. A. Boutelle, captain first cavalry, the acting park superintendent, mentioned in a report to the Secretary of the Interior in 1890 that:

> In passing through the Park I noticed with surprise the barrenness of most of the water of the park. Besides the beautiful Shoshone and other smaller lakes there are hundreds of miles of as fine streams as any in existence without a fish of any kind. I have written to Marshall F. McDonald, U.S. Fish Commission, upon the subject and have received letters from him manifesting a great interest. I hope through him to see all of these waters so stocked that the pleasure-seeker in the Park can enjoy fine fishing within a few rods of any hotel or camp (Report of the Secretary of the Interior, 1890, pp. 148-9).

His recommendation led to a program that stocked more than 310 million native and non-native fish, such as brook, brown and lake trout, into Yellowstone between 1881 and 1955. This had an ecologically destructive effect on the native cutthroat trout. Attempts to undo this misstep are ongoing today (History of Fisheries Management in Yellowstone, 2014).

Now, to remove non-native brook trout from tributaries of the Yellowstone River and in other waters, biologists have introduced a fish toxin (a piscicide called rotenone) into the streams to remove the non-native brook trout as part of Yellowstone's Native Fish Conservation Plan and Environmental Assessment. The streams will be restocked with native Yellowstone cutthroat trout (Nash, 2014).

The moral of the story is if you want to make elk hunters angry at wolves, alter the ecosystem by doing such things as introducing lake trout into Yellowstone Lake. Of course this is said tongue-in-cheek, but this concatenation of events is implicit in a trophic cascade. But the cascade can go either direction. What might appear to be a trivial event or a good idea at the time can turn out to have catastrophic ecological implications later on.

Over the years, what has gone wrong in Yellowstone National Park is the displacement of native species by the introduction of non-native species into the ecosystem. This is true of cutthroat trout, which were being pushed out of their native habitat by the human introduction of lake trout and other non-native trout. This is true for the park's wild bison, which are being pushed out of their native migratory habitat by the human introduction of cattle into the ecosystem. And this is true of the gray wolf, which is being killed because it kills the invasive species called cattle and because it kills elk, which hunters want to kill themselves.

When this is done, when humans begin to meddle with the way things were, the system begins to collapse, as we have seen—and that system, a wildlife system, is the ecosystem. In the case being studied, it is the Greater Yellowstone Ecosystem, with its centerpiece being Yellowstone National Park.

These same observations above were contained in the second petition I submitted. Recall that in its finding of that petition the Fish and Wildlife Service wrote:

> The second petition discusses the ecological impacts of stocking nonnative fish, such as lake trout, in YNP waters; however, the petitioner and sources cited do not provide information regarding the potential impacts of non-native fish stocking on YNP bison. Therefore, we do not find the petitioner's present substantial information that non-native species may be a threat to the YNP bison such that listing may be warranted.

This is a classic example of a non sequitur. Evidently, the FWS evaluator merely scanned portions of the petition submitted March 2, 2015. This certainly lacks due diligence. No reasonable person could miss the points being made, namely, that the introduction of a non-native, invasive species into an ecosystem can have a cascade of deleterious effects, that lake trout were merely an *example* and that with regard to bison, cattle are the invasive species. Pretending that a point of the petition was about the invasive threat to bison by non-native fish, when instead it was clearly about non-native cattle, is a straw man tactic.

In life, predation is the name of the game. Animals eat plants and animals to survive. In a broad sense, ungulates and other grass and plant consumers are predators, for they eat what is alive, or has lived, to remain alive themselves. The word "predation" comes from Latin "praedatio," meaning the taking of booty. The zoological sense dates from the 1930s. Whether that booty or plunder is animal or plant makes little difference in the end, for all are involved in the chain of life. When that chain, which has self-adjusted itself over a period of eons, is altered by man, the mechanism can be so changed that one of the cogs breaks. That break is called extinction. One of those stressed cogs today is the park's wild bison herd.

In effect, cattle have become the greatest predator of wild bison, for the IBMP, acting on behalf of its cows, is like the alpha male in a pack, with migratory wild bison its favorite and most vulnerable prey. Without exaggeration it can be said that every winter the IBMP pack engages in a feeding frenzy on its prey. Migration has ceased to be protective for bison in the park, but instead exposes it to its greatest mortality. With all other bison behind fences, the migratory instinct no longer serves its evolutionary-developed purpose anywhere in the United States. In fact, migration is now its greatest liability.

Does it not seem reasonable that by systematically and lethally removing almost every migratory bison from the herd year in and year out, and by also lethally removing bison that test positive for brucellosis and thereby removing bison that have immunity to that disease, that some severely cold winter with deep ice-encrusted snow the entire herd might die of disease and starvation behind the imaginary fence established by the IBMP, that is, the park boundary that they cannot cross for survival? Nature gave the migratory instinct for a purpose, but the IBMP operates as though it is not important for survival. Apparently, either the IBMP thinks Mother Nature is wrong or does not care if she is right. And remarkably, the FWS supports this outlook as exemplified in its several findings on petitions to list wild bison.

Perhaps one spring day following an aerial count of bison winter-kill, we might learn as a nation that the entire Yellowstone herd has died inside the park during a particularly severe winter and that the only ones that would have survived were those migrating out of the park—all of which had been slaughtered by the IBMP.

Liability of migration for elk

Like wild bison, elk are also finding migration is becoming a liability. In the Ecological Society of America's June 2013 *Ecology*, Middleton reports another study, this one focusing on elk migration. Writing in "Animal migration amid shifting patterns of phenology and predation: lessons from a Yellowstone elk herd," he and his team found that migrating elk are not doing as well as non-migratory herds.

Take, for instance, the 4,000 elk of the Clarks Fork herd that winter near Cody, Wyoming. Every spring a portion of that herd follows the greening grass into the highlands of the Absaroka Mountains, where they spend the summer growing fat on vegetation fed by snowmelt. From 1979 to 1980 studies showed that 81 percent of that herd was migratory. However, things have changed. From 2005 to 2009 studies indicate that only 48 percent are currently migratory.

Why? The Middleton team found two factors that appeared to be reducing the benefits of migration in this population, as noted in a prior study: a growing abundance of carnivores, especially grizzly bears, and a severe, long-term drought. In contrast, the non-migratory resident elk appeared to be benefiting from the removal of such large carnivores as wolves, their hunting now legalized outside the park with the delisting of the gray wolf, and by irrigated agriculture in this area. Such human intervention, the study proposed, has contributed to the recent expansion of the non-migratory herd (Middleton, 2013).

Concurrent with this growing concentration of non-migratory elk has been an increase of brucellosis. According to the Wyoming Fish and Game Department, while there is a clear link showing higher prevalence of brucellosis in those elk that annually congregated on winter feedgrounds in northwestern Wyoming, in other areas of the state the disease historically has been either non-existent or present at very low levels in free-ranging elk (Wyoming Game and Fish, 2009).

Brucellosis seropositive levels in Cody elk were low between 1991 and 2004, with a range of 0 to 4 percent, rising after 2004 to 9 percent for three years and then peaked at 17 percent in 2009. In 2010 seropositive elk dropped to 11 percent, and then increased to 13 percent in 2011.

With regard to the increased levels of brucellosis in the Cody elk population, according to the Brucellosis Management Action Plan by the Wyoming Brucellosis Coordination Team:

> One potential cause is the large wintering elk groups that approximate densities seen on feedgrounds in western Wyoming (2012 Cody Elk BMAP, 2014).

The threat of the spread of brucellosis from elk vectors in and around the Greater Yellowstone Ecosystem is further exemplified by what is happening in Paradise Valley, Montana. Part of the job of Livingston-based wildlife biologist Karen Loveless, Montana Department of Fish, Wildlife & Parks, is to scare elk off agricultural lands. Such action is part of the state's plan to keep elk, some of which carry the brucellosis bacteria, from mingling with cattle. In recent years this has involved the lethal removal of elk in a herd in an attempt to disperse groups. The department is also helping to repair fences, fencing haystacks and firing nonlethal cracker shells to scare elk away from cow feeding areas (French, 2013).

Further, as mentioned previously, plans are being studied to institute lethal control of elk by private property owners in Paradise Valley, as well as providing financial assistance to fence off elk from possible contact with cattle.

In sum, the Rocky Mountain states adjoining the Greater Yellowstone Ecosystem are at war with their wildlife. Some interests want more elk, some want less, some want more bison, some want less, some want more wolves, some want less—all for conflicting reasons. The resultant tug-of-war can become rancorous. And it is not limited to Midwestern states alone. Here is one comment following a guest opinion in the Herald and News, Klamath Falls, Oregon, concerning the re-introduction of the gray wolf:

> I find it a shame that we have such idiots in charge of our game populations when organizations like The Rocky Mountain Elk Foundation, Mule Deer Foundation, Wild Sheep Foundation, and many more have raised monies for decades to make healthy populations of these ungulates. Now a bunch of psychopathic environmentalists are destroying everything, as well as the livelihood of many small ranchers, restaurants, gas stations, and other hunter and recreational businesses, and for what? (My Recent Comments, 2014).

For what? Good question.

Ecosystem like the economy

Part of the answer is that no matter what state agencies are in charge of this or that species or segment of wildlife, or what special interests are trying to exercise control to advance those interests, no one group is smart enough or rich enough to run wildlife. It is sort of like the economy.

The Greater Yellowstone Ecosystem can be compared to a nation. But this is a special type of nation, a nation of wildlife run by wildlife. In this nation, there are various resources, such as trees, meadows, rivers, lakes, and prey and predators. Who is in charge here? Who determines who survives and who gets this or that resource necessary for survival? Like an economy, it is a matter of supply and demand. If there are too many elk they will eat too much grass and the range cannot support them, so they dwindle and become less populous. If the population of elk becomes too dense, their close proximity encourages brucellosis and they die. If there are too many wolves and not enough elk, the wolf population declines.

The value of each animal and each plant is determined by the interaction of all the species. If a balance is not reached, if one animal or plant becomes too costly or too cheap in this wildlife economy, that animal or plant will eventually cease to prosper. But who establishes their various values? Who sets their ecological price, so to speak? It is the individual participants themselves comingling.

Shortly after the Russian Revolution, Ludwig von Mises, an Austrian economist, wrote in 1920 that Communism would fail because it had abolished free markets so that officials had no market prices to guide them in planning production (Greaves, 1991).

Communism failed in part because such a highly-managed economy cannot control distribution or determine how much of this or that should be produced, because no central government can successfully set values. In the Soviet Union, planning was to be done by a central committee, insuring plenty for everyone. But it didn't work because the owners' lack of ability to exchange one item for another disabled the ability to determine worth.

When mankind in a wildlife setting starts to favor one species over another, setting itself up as the central planner, usurping Mother Nature, such a system will eventually collapse, just as did communism, because no one is smart enough to establish the value of each species or its contribution to the whole. They have to do it among themselves by species freely competing one with the other.

If this is not allowed, the system in the end will become diseased. And this is just what is happening by the encroaching spread of brucellosis in the GYE.

So, what can be done? One tactic would be to reduce densities of ungulates, but not necessarily to an unacceptable reduction in numbers. How can that be done? By encouraging dispersal by encouraging migration.

Areas with supplemental feeding grounds for elk had higher seroprevalence in 1991 than other regions, but by 2009 many areas distant from the feeding grounds were of comparable seroprevalence. A 19-year dataset of over 6,400 brucellosis tests of adult female elk in northwestern Wyoming was analyzed.

The study, "Mapping Brucellosis Increases Relative to Elk Density Using Hierarchical Bayesian Models," showed that the seroprevalence of brucellosis in Wyoming elk is increasing in some regions where elk are not artificially aggregated onto supplemental feeding grounds and these increases in seroprevalence are correlated with elk densities at the hunt area.

The study involved Paul C. Cross and Angela Brennan of the Northern Rocky Mountain Science Center, Dennis M. Heisey of the National Wildlife Health Center, Brandon M. Scurlock and William H. Edwards of the Wyoming Game and Fish Department and Michael R. Ebinger of the Big Sky Institute, Montana State University (Cross, 2010).

To mitigate brucellosis prevalence, one proposal by the Wyoming Fish and Game Department is to allow more hunters on private land, with assistance given to land owners, so that elk harvest in the area could be increased (2012 Cody Elk BMAP, 2014) and thus elk densities decreased.

But there is another option beside human predation. While wolves have been blamed for much of the decline in the park's elk numbers, the northern range wolf population currently is now at its lowest since 1996. As mentioned, the park's wolf population since reintroduction in 1994 peaked in 2003 at 174 animals. At the end of 2011, the number had declined to 98 wolves. Twenty Yellowstone wolves were shot by hunters when they ventured out of the park into Montana and Wyoming in the 2011 hunting season.

In the past, elk found it profitable to migrate into the higher altitudes of the park where there was highly nutritional grass and less predation as compared to staying on the wintering grounds, which were populated with predators that had increased needs in the spring for prey to feed their young. But now that land in the wintering grounds is being irrigated and with wolf numbers reduced by hunting, it becomes considerably less profitable to migrate.

Further, as the migratory herd ages, with less reproduction, there are fewer young elk learning the migratory routes from their parents. At some point, this learned behavior most likely will be lost and herds will have collectively forgotten the knowledge of how to get into the high country or even where it is. Not harvesting or taking wolves as "trophies" in elk wintering regions would be an option to decrease elk densities through the stimulation of dispersal by predators.

Value of wolves

Which returns us to an important point epidemiologically. Instead of the demonization of the gray wolf, it should be considered as an ally in the reduction of brucellosis prevalence levels, for its presence and predatory behavior can serve to decrease detrimental ungulate densities. By not only allowing, but encouraging wolves into regions experiencing overpopulation of brucellosis-carrying ungulates, such places as Gardiner Basin, Montana and Cody, Wyoming would benefit from the wolves' deterrent effect on prey congregation.

With regard to Gardiner Basin and the Hebgen Lake region, let the wolf do the lethal removal and hazing of bison. It would in the end be far less costly both economically and genetically than involving humans via IBMP.

Which brings us to another, equally important point. As has been shown, killing a member of a wolf pack, especially an alpha male or female, can result in the disbanding of that pack. With regard to the control of wild bison within and without the park, this can have a detrimental impact.

Recent Wolf Project reports have shown an increased incidence of prey-switching from elk to bison by the gray wolf in Yellowstone National Park. A study using direct observations of Yellowstone wolves hunting bison found that larger packs were more cooperative when hunting difficult prey and more successful.

The study by Daniel R. MacNulty and Aimee Tallian of the Department of Wildland Resources, Utah State University and Daniel R. Stahler and Douglas W. Smith of the Yellowstone Wolf Project correlated "capture success," that is, killing prey, and "wolf group size," that is, pack size. They knew from past study results that elk were three times easier for wolves to kill than bison. The team reported in their study that:

> Whereas improvement in elk capture success leveled off at 2–6 wolves, bison capture success leveled off at 9–13 wolves with evidence that it continued to increase beyond 13 wolves . . .
>
> Our evidence that bigger groups were better hunters of larger, more dangerous prey provides rare empirical support for the hypothesis that an advantage of grouping in carnivores is that it increases the diversity and size of prey they can capture.

As applied to Yellowstone, the authors noted:

> The ability to exploit a wide range of prey is likely a particular advantage in migratory ungulate systems, where the availability of different species is irregular. For example, in Yellowstone's Pelican Valley, where we recorded many wolf-bison interactions, migratory elk were absent in winter (December-April), leaving non-migratory bison as the main prey resource for the resident wolf pack.

Correspondence between the mean annual size of this pack (10.6 wolves) during the study (1999-2013) and the group size that apparently maximized bison capture success (11 wolves), implies that this pack is well-adapted to hunting bison. However, the study noted, the optimal group size for capturing bison may exceed 11 wolves.

According to the 2012 Wolf Project annual report, pack size that year ranged from 4 (Blacktail and Snake River) to 11 (Lamar Canyon, Cougar, and Yellowstone Delta) and averaged 10, which is the long-term average. But why, then, are Yellowstone wolves not killing more bison? As the study points out:

> . . . wolves in northern and western Yellowstone continue to hunt mainly elk despite decreasing elk availability relative to bison. On the other hand, wolves in Wood Buffalo National Park, Canada, hunt mainly bison yet live in packs

> somewhat smaller than those in Yellowstone (8.6 wolves . . .) So it seems unlikely that insufficient pack size constrains the ability of Yellowstone wolves to hunt bison. We suspect large wolf packs avoid hunting bison when and where less dangerous prey exist because the profitability (energetic gain/handling time) of bison, discounted for the fitness consequences of injury and probability of injury, is relatively low despite improved group hunting success. This highlights how generally invulnerable bison are to wolf predation as well as how the benefit of group hunting for increasing carnivore diet breadth can be contingent on other predator and prey traits that determine the outcome of predator-prey interactions.

With regard to the ability to hunt bison, wolves in Yellowstone appear to have sufficient pack size to do the job. As the study noted:

> Although improved ability to capture formidable prey is not an obvious driver of grouping patterns in Yellowstone wolves, our results demonstrate the potential for such an effect . . . Our study clarifies that the benefit of improved hunting success could favor large groups in populations and species that hunt large, dangerous prey (MacNulty, 2014).

The study in sum demonstrates that among wolves in the Yellowstone area, while the region's average pack size is large enough to hunt bison successfully, "improved hunting success could favor large groups."

So, if pack-size is not the total answer, what is missing? Taking down large ungulates is a team effort. According to Living with Wolves' blog "How Wolves Hunt":

> Other observers of wolves have reported that often fewer than half of wolves on a hunt are actually involved with physically bringing down the prey. The youngest wolves frequently do nothing more than observe and learn from the sidelines. Each of the other pack members contributes according to its particular experience and ability. Speedy, lightly built females often take on herding roles, darting back and forth in front of prey, causing confusion and preventing escape. Slower but more powerful males are able to take down a large animal more aggressively and quickly.

Obtaining prey requires learned behavior:

> The young wolves watch the behavior of the adults and see how the game is played. They witness how the adults change their strategy according to conditions and type of prey. They learn how the hunters handle each different situation: what to do when the prey dashes for open ground, or jumps into a river, or turns to defend itself.

> When juvenile wolves finally join in the hunt, they imitate the more experienced wolves and perfect the precise skills of herding and tackling. By the time they are full grown adults, they have become part of a well-oiled machine (How Wolves Hunt, 2016).

But what happens when the teachers, the leaders, the alpha-males and the alpha-females are gone? What happens when hunters kill them, as is now being done? Of course, there are fewer instructors. According to the Northern Rockies Wolf Summary for 2015, the population in the states comprising the Greater Yellowstone Ecosystem, that is, Montana, Idaho and Wyoming, was estimated to be 2,421 wolves. Human-caused mortality, such as by hunting and predator control, was 684 wolves. Thus, about 28 percent of the total population is removed each year.

Since trophies are being sought in the wolf hunts, this annual reduction of about one-third of the population would result in proportionally more juveniles remaining. While the packs may be sufficiently large, in this scenario they would contain a higher composition of juveniles that lack the leadership skills to bring down bison.

Such large-scale removal of adults also stimulates compensatory mating, meaning larger litters, more cubs, less experienced hunters (Wielgus, 2014).

Predator removal can have further long-term effects. One of the reasons more elk than bison are being killed by wolves in the park is because some elk have lost the ability to migrate, as shown in a doctorial dissertation by Smith Becker titled "Applying predator-prey theory to evaluate large mammal dynamics: Wolf predation in a newly-established multiple-prey system."

The study area focused on the interaction of three species in the west-central portion of Yellowstone National Park called the Madison headwaters, that is, the two ungulate prey species comprising a non-migratory elk herd and a central bison herd, and their predator species the gray wolf. Data was collected from 1996-97 to 2006-07. Wolves were reintroduced and colonized in the area beginning in 1995-96.

During the study period wolf numbers varied between 2-50 wolves in 1-5 packs. Elk were resident throughout the year, but their numbers decreased from approximately 600 to 174 following wolf establishment. In contrast, bison were seasonally migratory with numbers increasing through each winter (200-1500) until they exceeded elk numbers by several orders of magnitude in late winter.

Prior to wolf recolonization, late winter starvation was the primary source of mortality for both elk and bison. Following the reintroduction of wolves, the study found that elk were the preferred and primary prey for wolves in the Madison headwaters area, even though bison were more abundant during winter. Kill rates on elk were primarily influenced by elk abundance and wolf pack size, while kill rates on bison were primarily influenced by the abundance of bison calves and snow pack severity. The weakening influence of snow pack made formidable prey such as bison considerably more vulnerable to wolf predation.

The study concluded that:

> Prey-switching evaluations indicated increasing selection of bison with increasing bison:elk ratios, however no concurrent decrease in elk predation occurred. Increased bison predation is not solely dependent on relative abundance of the two prey species; therefore it is unlikely at this time that wolf prey-switching will stabilize the system.

What could be done to stabilize the system? To buffer the effects of predation, Becker posits that seasonal migrations to areas with lower snow pack must be restored. He reasons:

> . . . interactions between physical, behavioral and environmental vulnerability of a prey species that enhance its predation risk can result in substantial distribution and abundance changes across systems.
>
> A good example of this is the strong decrease documented in the resident Madison headwaters elk herd due to wolf predation. A nonmigratory herd in this system may have arisen due to the absence of wolf predation for nearly seven decades that allowed colonization of a formerly risky area, as elk likely historically wintered outside of these high-risk areas. The return of top predators such as wolves therefore emphasizes the need for broad-scale management of landscapes to effectively maintain prey assemblages and allow species to successfully employ the defenses they evolved with, such as seasonal migrations to areas with lower snow pack, to buffer the effects of predation. Conservation of high-quality ungulate wintering ranges outside protected areas is therefore of paramount importance (Becker, 2008).

Apparently, elk have lost the ability to migrate and that ability most likely has been lost because of the effects of natural selection and survival of the fittest. Once the wolves were extirpated, the elk that had the greatest survival differential were those that stayed within the park, as opposed to those that went beyond the park boundaries and were shot by elk hunters. The offspring of the stay-at-home parents grew up, survived and had offspring themselves. None of those that survived in this herd knew the way out of the park and therefore stayed in the Madison headwaters area. Paradoxically, those that survived were those elk that had no one to teach them where to go in the winter.

When the wolf was reintroduced into the area, these now non-migratory elk simply did what their parents did, that is, remain as elk residents of their area. Gradually, year after year their numbers declined because the wolf population, regardless of the number of elk in the area and regardless of the number of bison, preferred the easier prey: elk.

Thus, one way to stabilize the predation ratio of elk versus bison is to restore elk migration. If there are no elk to kill in a given area, no elk will be lost as prey there. But how does one get elk to migrate when they have lost that instinct?

Restoring elk migration

Possibly all is not lost. Maybe it is just a matter of time that is needed for elk to adjust to the new predator environment. Maybe some of the park-resident elk, also called sedentary elk, have not lost that instinct after all. Possibly one of the reasons for the decline in non-migratory elk numbers in that region is because some of these elk have become migratory. Clair N. Gower with the Department of Ecology, Montana State University, led a study of elk and wolf interactions in the Madison headwaters of Yellowstone, as reported in chapter 18 of *The Ecology of Large Mammals in Central Yellowstone,* titled "Spatial Responses of Elk to Wolf Predation Risk: Using the Landscape to Balance Multiple Demands." She made the following observations (citations omitted):

> . . . while an environment without predation may favor year-round sedentary behavior, migratory movements may be evolving as the environment changes with the addition of wolves. In African systems migration has been suggested as a way to enhance survivorship. Theoretical modeling of migration in the Serengeti ecosystem suggests that population regulation by predators may affect non-migratory animals, while migratory species are more commonly regulated by food. This implies that the top-down effect of predation would dominate in a non-migratory herd such as the Madison headwaters. Thus, it is not surprising that high wolf numbers have contributed to low rates of over-winter adult survival, low calf recruitment, and a significant population decrease. In the Madison headwaters, winter is a time when deep snow exacerbates the vulnerability of large herbivores to wolves due to reduced mobility and potential for escape. It is also the time when wolves have an almost continual presence within the Madison headwaters. Under these conditions, seasonally escaping predators during winter when vulnerability reaches a peak, and returning in summer when vulnerability is reduced may be more profitable. Interestingly, all long distance movements that we documented following reintroduction occurred from areas of intensive wolf activity. No collared animals vacated the Madison drainage, which is the area wolves frequented least. These data thus allow us to speculate that animals that have displayed strong fidelity to a range can actually "make a decision" that their traditional range has changed in such a fundamental way that it is no longer conducive to remain in this area. Thus while it has been documented that density dependent factors such as crowding and resource limitation would promote animals to relocate in search of more profitable surroundings, our data suggest that the risk of predation can promote a similar response. These results also indicate that while we attribute the majority of the decline of the

Madison headwaters elk population to direct predator mortality, permanent dispersal and animal switching from non-migratory to migratory seasonal movement strategies also contributed to the population decline (Garrott, 2009, pp. 391-392).

Important lessons can be learned from the elk native to the Madison drainage: 1. apparently, the instinct for migration in ungulates can be lost through the absence of wolves, whose presence normally promotes avoidance behavior during the winter, and 2. without the fear of predations, over time offspring will not learn the way out and will not migrate. How to restore what has not been learned, such as the routes out of a region where they may be seasonally vulnerable, is a conundrum. What governs ungulate population levels and densities, that motivates these animals to disperse and why they develop the strategies they do in migratory behavior is not fully understood.

Throughout the ecosystem, each spring thousands of elk in a number of separate herds migrate from winter ranges in Wyoming, Montana, and Idaho to high-elevation summer ranges in the interior of the park.

Some of these elk populations are declining due to the reintroduction or growth in numbers of such predators as the gray wolf and the grizzly bear, loss of habitat, the effects of hotter and drier summers, invasive species and the introduction of disease, such as brucellosis.

While some of the individual herds have been studied, an understanding of their collective migratory behaviors at the ecosystem scale has been lacking, such as migration routes, seasonal ranges, the productivity of the herds and the influence of spring and summer climate on elk migration behavior.

To get a better understanding of elk migration, Middleton and Joe Riis, a wildlife photojournalist and a contract photographer for National Geographic, took part in a project of “rediscovery” of elk migration called the Wyoming Migration Initiative. They followed the herds by walking on foot and traveling on horseback, recording what they saw in notes and through the use of photography, including camera traps at migration bottlenecks.

The two-year project was completed by spring 2016. Collared migratory elk were fitted with satellite collars that transmitted “real-time” locations and were used to identify migration bottlenecks. Collected data was used to produce a comprehensive map and scientific report on the elk migrations. The result was incorporated in a museum photography exhibition at National Geographic Headquarters in Washington D.C. titled “Invisible Boundaries: Exploring Yellowstone's Great Animal Migrations,” with a mirrored exhibit at the Draper Natural History Museum at the Buffalo Bill Center of the West in Cody, Wyoming.

The project had wide support. Project cooperators include the Wyoming Game and Fish Department, Montana Fish Wildlife and Parks, the National Park Service (Yellowstone Center for Resources), the U.S. Fish and Wildlife Service (National Elk Refuge), the U.S. Forest Service (Shoshone National Forest), the Wildlife

Conservation Society, and numerous private ranches in the Greybull and South Fork of the Shoshone River valleys. Project funders include the Prince Albert II of Monaco Foundation, the Buffalo Bill Center of the West, the University of Wyoming's Biodiversity Institute, the George B. Storer Foundation, the Knobloch Family Foundation, the Fran and Lenox Baker Foundation, the National Geographic Expeditions Council, and the Rocky Mountain Elk Foundation (Elk Migrations of the Greater Yellowstone: Project Overview, 2014) (Riis and Middleton open "Invisible Boundaries" exhibit, 2016).

What, in a nutshell, did Middleton learn? In *The Atlantic's* feature story June 21, 2016 titled "On the Path of Yellowstone's Elk: Tracking a herd's movements on horseback shows how essential migration is to Wyoming's ecosystems," Nathan C. Martin wrote:

> "With elk in the GYE," Middleton said, "migration is the engine of the whole (expletive) system" (Martin, 2016).

Announcing the Riis-Middleton exhibit celebrating the National Park Service's centennial, National Geographic stated online:

> The Greater Yellowstone Ecosystem lies in the path of some of the most significant wildlife migration routes on the planet. However, major challenges await migratory animals as they leave Yellowstone National Park. The long-term conservation of these animals depends on the actions of landowners and other stakeholders far beyond the national park's borders.
>
> As part of the National Park Service's centennial celebration, and in conjunction with the May issue of National Geographic magazine, "Invisible Boundaries" uses stunning photographs, immersive video, interactive migration maps, cultural objects, and original artwork to explore the compelling story behind some of the most amazing animal migrations on the planet.
>
> Come examine why animals make these incredible journeys and learn about the cutting-edge conservation science that's taking place in one of America's crowning natural treasures—Yellowstone National Park (Invisible Boundaries: Exploring Yellowstone's Great Animal Migrations, 2016.)

What is absent from the exhibit touting the park's "cutting-edge conservation science" is telling. Among "the most amazing animal migrations on the planet" is the migration of Yellowstone's wild bison, but unlike the celebrated elk, they are not allowed even near the park's "invisible boundaries." Absent is an exhibit of the Stephens Creek capture facility, IBMP's Dark Age wild bison trap inside the park that systematically obstructs this species' major migration corridor. It has extinguished multiple thousands of animals trying to leave the park in their annual migratory journey, stripping valuable genetics and learned behavior from the herd.

An exhibit that tells the truth about Yellowstone National Park would include that important fact.

Et tu, bison?

Like the non-migratory elk in the Madison headwaters, bison in the park's Pelican Valley are being consumed by wolves. Why? Because these bison are also non-migratory. To kill an elk, it appears that only one big male wolf is needed. However, as Doug Smith pointed out:

> With bison, it appears that you need multiple big males because bison are twice the size of an elk, and they stand their ground . . . You need huskier, stronger animals. And the bison kills I've seen, I've seen up to four big males ripping and tearing at the same bison and you won't often see that with elk.

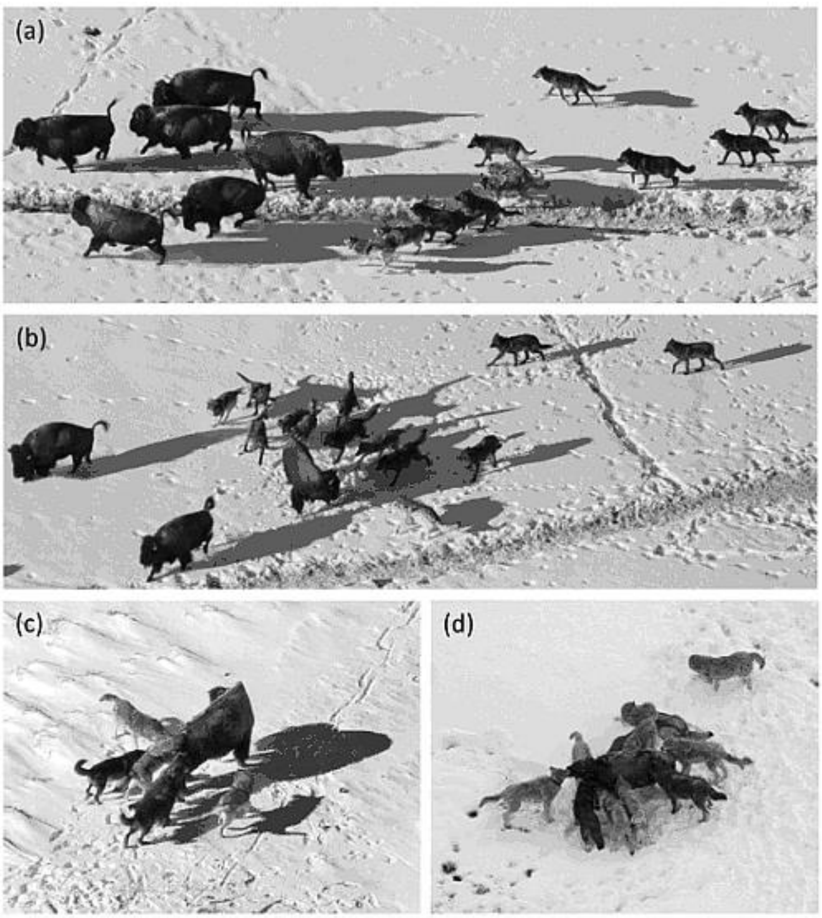

Figure 50. BEHAVIOR OF WOLVES HUNTING BISON: (a) approach, (b) attack-individual, (c, d) capture. "Attacking" is the transition from (a) to (b), and "capturing" is the transition from (b) to (c, d) (MacNulty, 2014). ***Photo credit: Daniel Stahler, Douglas Smith.***

In the Pelican Valley and along the Firehole River, wolves stay behind in the fall when the elk head to lower wintering grounds. Why the wolves do not follow the elk is not known, but what is known is that the wolves have figured out how to effectively kill bison. These wolves are 5-10 percent larger than those that prey on elk through the winter. One male from the Mollie Pack weighed 144 pounds. Smith noted that:

> The pack that lives in Pelican Valley kills nothing but bison all winter. In the summer they switch back to elk, because the elk return. If you get a choice, you're going to take elk . . . They have that skill now, they know how to do it, and when elk leave they just stick and kill bison. That's what they've been doing the last few years. They just start whacking bison as soon as the elk leave. And that pack, as well as the one that lives in the Firehole, has more large males than any other pack in the park (Repanshek, 2010).

It would be interesting to know what percentage of these Pelican Valley bison, if any, belong to the elusive Mountain bison herd that some have claimed to have sighted and that historically inhabited this region. It would be tragic indeed if mountain bison were made extinct because they were trapped in the park, stopped from migrating because of the actions of the IBMP and killed by the wolves in the park because they did not migrate.

What has been learned about the migration of elk can be applied to bison.

"Elk are the ultimate transboundary species in terms of entering and exiting Yellowstone Park," Middleton told Todd Wilkinson of *National Geographic*, noting that their journeys across borders underline how essential it is that Greater Yellowstone be viewed as a whole.

He said that Middleton likes to compare Yellowstone's migrations to the circulatory system in a human body, carrying nourishment everywhere, and that he hopes the system doesn't suffer its own version of a coronary episode. In *National Geographic* magazine's May 2016 issue, Wilkinson wrote in "Great Migrations: Keeping Yellowstone's Lifeblood Flowing":

> "A person who suffers a heart attack has done incremental things over time that lead to poor health. The same thing could affect the circulatory system of Greater Yellowstone," Middleton says. "With these magnificent migrations and the corridors they depend upon, it won't be a single clog in the arteries—but many, encroaching slowly over time. Then one day, the heart just stops beating, and it's over. We have to make sure that never happens" (Wilkinson, 2016).

For wild bison, it is more sinister. The threat is from those that pretend to care for them, those who claim they are "committed to maintaining a viable and free-roaming bison herd." In the heart of Gardiner Basin is located the Stephens Creek capture facility. Every year the member agencies of the IBMP purposefully and methodically inject via the operation of that facility what is tantamount to injecting potassium chloride into the circulatory system of Greater Yellowstone, stopping the heart, selecting only migratory bison for its lethal dose.

In FWS's April 19, 2016 letter to me, it stated that "there is evidence that migration is a learned behavior." *Note to the IBMP:* killing off all the class members that know the answers may not be the best way to teach.

A study similar to the Wyoming Migration Initiative should be launched for wild bison, but this would mean allowing the bison to migrate so their movements could be studied, instead of slaughtering them mid-migration.

14

Wildness

What is transpiring at Yellowstone National Park is a direct assault on wild life. The actions of the member agencies of the IBMP are a continuation of what occurred in the past during the settlement of this nation. With the destruction of the wild bison herds on the plains and the introduction of the plow and cattle, the Great Plains as a wilderness steppe vanished. Along with this extirpation came the loss of a part of our national character, including elements of esthetic, ecological, educational, historical, recreational and scientific value to our nation and its people. We lost part of our world. Along with that loss came the loss of bison as wild animals capable of surviving harsh winters without human assistance. Only those relatively few head of bison in Yellowstone National Park can be termed truly wild, that is, unfenced and migratory. And this wild herd is at risk. With the continuation of the lethal “fence” of the IBMP, their wild trait is increasingly jeopardized, for it is being strictly and progressively curtailed.

If one is known by one’s deeds, then the member agencies of the IBMP hate what is wild or are too passive to be of any protective worth.

It is our obligation to preserve as much of our wild world as we can. As Henry D. Thoreau said in his essay, "Walking":

> The West of which I speak is but another name for the Wild; and what I have been preparing to say is, that in Wildness is the preservation of the world . . .

Part of the reason for this is that the seeds of instinct and the genetics for survival are preserved in what is wild. Wilderness is the raw material of life. Thoreau mused in “Walking”:

> Ben Jonson exclaims, –
> “How near to good is what is fair!”

> So I would say, –
> "How near to good is what is WILD!"
>
> Life consists with wildness. The most alive is the wildest. Not yet subdued to man, its presence refreshes him. One who pressed forward incessantly and never rested from his labors, who grew fast and made infinite demands on life, would always find himself in a new country or wilderness, and surrounded by the raw material of life . . .
>
> To preserve wild animals implies generally the creation of a forest for them to dwell in or resort to. So it is with man . . .
>
> In literature it is only the wild that attracts us. Dullness is but another name for tameness. It is the uncivilized free and wild thinking in Hamlet and the Iliad, in all the scriptures and mythologies, not learned in the schools, that delights us. As the wild duck is more swift and beautiful than the tame, so is the wild—the mallard—thought, which 'mid falling dews wings its way above the fens . . .
>
> I love even to see the domestic animals reassert their native rights—any evidence that they have not wholly lost their original wild habits and vigor; as when my neighbor's cow breaks out of her pasture early in the spring and boldly swims the river, a cold, gray tide, twenty-five or thirty rods wide, swollen by the melted snow. It is the buffalo crossing the Mississippi. This exploit confers some dignity on the herd in my eyes—already dignified. The seeds of instinct are preserved under the thick hides of cattle and horses, like seeds in the bowels of the earth, an indefinite period.

Note that Thoreau equates wild character with the bison crossing the Mississippi. What is wild is not merely in and of itself. It is not just genetics or instinct. It is something more. It is an expression of the relationship between a life form that possesses certain instincts and its environment or, as Thoreau says: "It is the buffalo crossing the Mississippi." It is not the buffalo crossing the Mississippi being shipped by boat, but rather by means of its own unrestricted volition. Bison and their ability to roam and migrate are the iconic symbol of what it means to be wild. And to be wild means to be free.

In 2005, Steven Rinella won a lottery permit to hunt for a wild buffalo in the Alaskan wilderness. After killing one on a snow-covered mountainside, he wondered, "How can I claim to love the very thing that I worked so hard to kill?" In *American Buffalo: In search of a lost icon*, he summed up the actual and symbolic relationship that bison have to our land and its people:

> In a historical sense, I suppose that my confused and convoluted relationship to the buffalo is nothing new. For the entirety of man's existence in North America, we've struggled with the meaning of this animal, with the ways in which its life is intertwined with our own. I think of the first hunters who walked through some long ago gap between glaciers and stumbled onto a landscape populated with strange and massive creatures. The buffalo was just one of many then, a giant among a host of other giants, but over time these many animals were whittled away by the forces of man and nature. Eventually the buffalo stood alone, the continent's greatest beast, like the winning contestant in a game show.
>
> Its prize was humanity's never-ending attention, which was ultimately a bittersweet award.

The American Indian co-existed in the wilderness with this animal. Rinella wrote:

> For thousands of years, the first people of North America fed on the buffalo's meat and wore the buffalo's skin…

The Sioux believed that the greatest power was Wakan Tanka, or Great Spirit, because Wakan Tanka had sent them buffalo (Lakota Sioux, 2001). But then came the European immigrants. Rinella said:

> My own European ancestors came to the New World and scoffed at the heathen nature of the Indian's ideas, then stood by as the buffalo nearly vanished from the earth beneath their notion that the animal was an expendable gift of their own God, a commodity meant to get them started before stepping aside and letting "civilization" bloom in the wilderness.

After exterminating the vast herds, they attempted to revive them. "But why?" he asks.

> I sometimes imagine that we saved the buffalo from the brink of extinction for the simple reason that the animals provided a handy mirror in which we could see our innermost desires and failures, and our most confounding contradictions. Our efforts to use the buffalo as a looking glass have rendered the animal almost inscrutable. At once it is a symbol of the tenacity of wilderness and the destruction of wilderness; it's a symbol of Native American culture and the death of Native American culture; it's a symbol of the strength and vitality of America and the pettiness and greed of America; it represents a frontier both forgotten and remembered; it stands for freedom and captivity, extinction and salvation (Rinella, 2008, pp. 254-256).

Caught in this mirror are the wild, free-roaming herds of buffalo that graze within and sometimes outside Yellowstone National Park. They are, perhaps, America's most emblematic image of wilderness.

One of the defining characteristics of "wilderness" is that it is a region not enclosed by fencing. It is not owned by an individual, but is set aside for public enjoyment. Indian tribes originally lived in wilderness. They did not own bison herds, but instead, ownership of an individual bison was conferred on the tribe which killed the buffalo.

Wilderness is lost with domestication. Domestication is gained by control of one's environment. It brings with it private property rights and fences. Not only do fences demark the boundaries of a person's property, but they also keep owned livestock such as cattle in, and non-owned animals and non-owners out.

The term "wild" generally refers to:

- Wildlife, all non-domesticated plants, animals, and other organisms.
- Wilderness or wilderness area, a natural environment on earth.
- Wildness, the quality of being wild or untamed (Wild, 2011).

The opposite of "wild" is "domestic."

The following meanings are given according to the *Concise Oxford dictionary of ecology*:

> **Wildlife** Any undomesticated organisms, although the term is sometimes restricted to wild animals, excluding plants.
>
> **Wilderness** An extensive area of land which has never been permanently occupied by humans or subjected to their intensive use (e.g. for mineral extraction or cultivation) and which exists in a natural or nearly natural state.
>
> **Domestication** The selective breeding by humans of species in order to accommodate human needs. Domestication also requires considerable modification of natural ecosystems to ensure the survival of, and optimum production from, the domesticated species (e.g. the removal of competing weeds species when growing cereal crops) (Allaby, 1994).

According to Noah Webster's 1828 dictionary, "wild" means:

> 1. Roving; wandering; inhabiting the forest or open field; hence, not tamed or domesticated; as a wild boar; a wild ox; a wild cat; a wild bee.
> 2. Growing without culture; as wild parsnip; wild cherry; wild tansy. Wild rice, a palatable and nutritious food, grows spontaneously in the lakes and ponds of the North West territory.
> 3. Desert; not inhabited; as a wild forest.

4. Savage; uncivilized; not refined by culture; as the wild natives of Africa or America.
5. Turbulent; tempestuous; irregular; as a wild tumult.

According to *The Oxford Dictionary of English Etymology*, the word wild comes from the Old English word wilde, (Onions, 1966), meaning “in the natural state, uncultivated, untamed, undomesticated, uncontrolled” (Wild, 2015).

Given these meanings, it is easy to see that there would be a conflict of interest between a domesticated (controlled, tamed) environment and a wilderness or wild (uncontrolled, untamed) environment, for what is wild would be viewed as something noxious, such as a weed, to be rooted out and controlled. As mentioned, domestication requires considerable modification of natural ecosystems to ensure the survival of the domesticated species. That modification harms what is wild.

There is a certain undefined passion associated with what is wild. The fence and cultivation kill wilderness—ditto cage bars and setting plants in rows. What is domesticated is tamed. With that docility, something is lost.

William Stolzenburg, in *Where The Wild Things Were: Life, Death, and Ecological Wreckage in a Land of Vanishing Predators*, wrote:

> And I can only believe, from somewhere deeper than any logic center of the brain, that a life of incomprehensible loneliness awaits a world where the wild things were, but are never to be again (Stolzenburg, 2008).

Americans have given their lives to remain free and thus identify with what is wild. Our country was founded by the collective desire to be independent and a refusal to be subjugated, as demonstrated by the Declaration of Independence. The Revolutionary War and the World Wars were fought to remain free. The American Indians fought to preserve their freedom and independence in the face of the European settlement of this nation, but were subjugated via the systematic elimination of their habitat resources, which included the great herds of bison by means of exclusion from them by confinement to reservations, as well as the concurrent destruction of the herds.

Key to subjugation is ownership. What refuses to be owned is often killed. When something, say an animal or a plant, is subjugated, penned in or put in rows to form a crop, what was once free is put into a kind of slavery for the service of its owner. That is, the animal or the plant is put to commercial use. It can be bought and sold. Commercialization is facilitated by capture. What is caught and controlled can be used to gain profit.

Thus, commercialization is an attribute of domestication. But the opposite of commercialization is not necessarily wilderness. A zoo can be for non-commercial purposes, but no one would consider animals there as living in the wild. A tiger in the Bronx Zoo may have the same genetic structure as a similar species in India, but the tiger in the zoo is not wild. Taken from its habitat, it loses its wildness. One of the principle reasons is that captured animals have had their movements restricted—they cannot search for prey, they cannot roam in search of food, they cannot migrate. Instead, they are fed. Raised in a cage, an animal can forget how to survive on its own. If released, it may not have the ability to forage or stalk. It may not know where to get food or how to escape winter—and will die. Movement and migration are essential to survival. One of the hallmarks of wilderness is the ability to move about freely, either to range or to facilitate migration.

Logically speaking, the only way the conflict between domestic and wild life could be dealt with, without destroying one or the other, would be to create a buffer of separation, a kind of "no man's land" that keeps domestic livestock, especially cattle, out of the migratory or dispersal habitat of such wild animals as bison, elk and wolves.

"No man's land" is a term used for land that is unoccupied or is under dispute between parties that leave it unoccupied due to fear or uncertainty. The term was originally used to define a contested territory or a dumping ground for refuse between fiefdoms. It is most commonly associated with the First World War to describe the area of land between two enemy trenches that neither side wished to openly move on or take control of due to fear of being attacked by the enemy in the process. The *Oxford English Dictionary* contains a reference to the term dating back to 1320, and was spelled "nonesmanneslond." The term was used to describe a disputed territory or one over which there was legal disagreement. The same term was later used as the name for the piece of land outside the north wall of London that was assigned as the place of execution (No man's land, 2011).

The region outside the perimeters of the park is now a lethal removal zone for bison. What is needed is a buffer around the Greater Yellowstone Ecosystem that tolerates wildlife. But instead of a "no man's land," or a "no bison land," it would be a "no cattle land," thereby giving room for the migratory instinct of wild animals.

15

Domestication syndrome

Charles Darwin noticed that in addition to domestic species being more tame than their wild ancestors, they also tended to have a number of physical features in common. “Not one of our domestic animals can be named which has not in some country drooping ears,” Darwin noted in *Origin of Species*, chapter 1, “Variation under domestication.”

Biologists have observed that domestic animals have characteristics that often included floppy ears, patches of white fur, curly tails and more juvenile faces with smaller jaws. These traits have been termed the “domestication syndrome.” Darwin thought that these variations were due to use and disuse, stating “and the view which has been suggested that the drooping is due to disuse of the muscles of the ear, from the animals being seldom much alarmed, seems probable” (Darwin, 1896, p. 13). This was before the discovery of genetics. Now biologists think that selecting for tameness causes changes in such diverse traits. But how can this be?

It is interesting to note that not only do animals migrate, but their cells do also. The migratory impulse pervades the biosphere. It thus must be fundamentally important to life. Remarkably similar to the macro-migratory movement of animals such as bison and elk is the micro-migratory movement of embryonic cells called the neural crest cells, which form in the region of the developing embryonic spine. This population of cells collectively leaves its original territory and migrates throughout the embryo to colonize a myriad of tissues and organs where they settle and differentiate into various tissue types. Just as migratory animals pick up cues from one another as they head out in their migratory journey, the social interaction of cells leads to cell cooperation, eventually generating an overall polarity to the population, leading to directional collective cell migration (Theveneau, 2012).

The underlying cause of the features attributed to the “domestication syndrome” could be the group of embryonic stem cells called the neural crest, suggests Adam Wilkins, from the Humboldt University of Berlin, in a paper titled

"The 'Domestication Syndrome' in Mammals: A Unified Explanation Based on Neural Crest Cell Behavior and Genetics," published in *Genetics.*

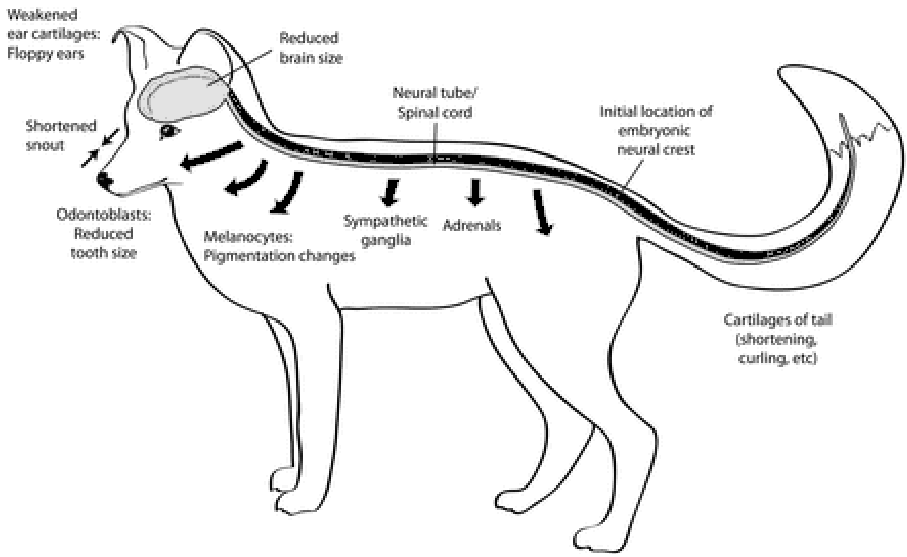

Figure 51. DOMESTICATION SYNDROME in dogs, livestock and other tame animals is thought to be caused by defective neural crest cells migrating down the spine during embryonic development, creating floppy ears, shortened snout, curling tail and reduced brain and tooth size. The black tube indicates position of the neural crest in the early embryo. Arrows indicate pathways of neural crest cell migration *(Wilkins, 2014). Image courtesy of Genetics.*

Neural crest cells give rise to such tissues as pigment cells and parts of the skull, jaws, teeth and ears—as well as the adrenal glands, which are the center of the "fight-or-flight" response. Neural crest cells also indirectly affect brain development. *ScienceDaily* reported the findings in "Domestication syndrome: White patches, baby faces and tameness explained by mild neural crest deficits":

> In the hypothesis proposed by Wilkins and co-authors Richard Wrangham of Harvard University and Tecumseh Fitch of the University of Vienna, domesticated mammals may show impaired development or migration of neural crest cells compared to their wild ancestors.
>
> "When humans bred these animals for tameness, they may have inadvertently selected those with mild neural crest deficits, resulting in smaller or slow-maturing adrenal glands," Wilkins says. "So, these animals were less fearful."
>
> But the neural crest influences more than adrenal glands. Among other effects, neural crest deficits can cause depigmentation in some areas of skin (e.g. white patches), malformed ear cartilage, tooth anomalies, and jaw development changes, all of which are seen in the domestication syndrome.

The authors also suggest that the reduced forebrain size of most domestic mammals could be an indirect effect of neural crest changes, because a chemical signal sent by these cells is critical for proper brain development (Genetics Society of America, 2014).

Selecting for culling *only* migrating bison selects *also* for associated traits such as aggressiveness and fear, leaving behind a breeding population that is less aggressive and less fearful. Less aggressive and less fearful animals are more tame. So too will be their offspring.

When Yellowstone National Park becomes inhabited by bison that look like the animal pictured below, a stupid, floppy-eared, juvenile-faced, small-jawed, curly-tailed animal with white patches, members of the IBMP may scratch their heads and say to themselves, "maybe we have gone too far."

Maybe.

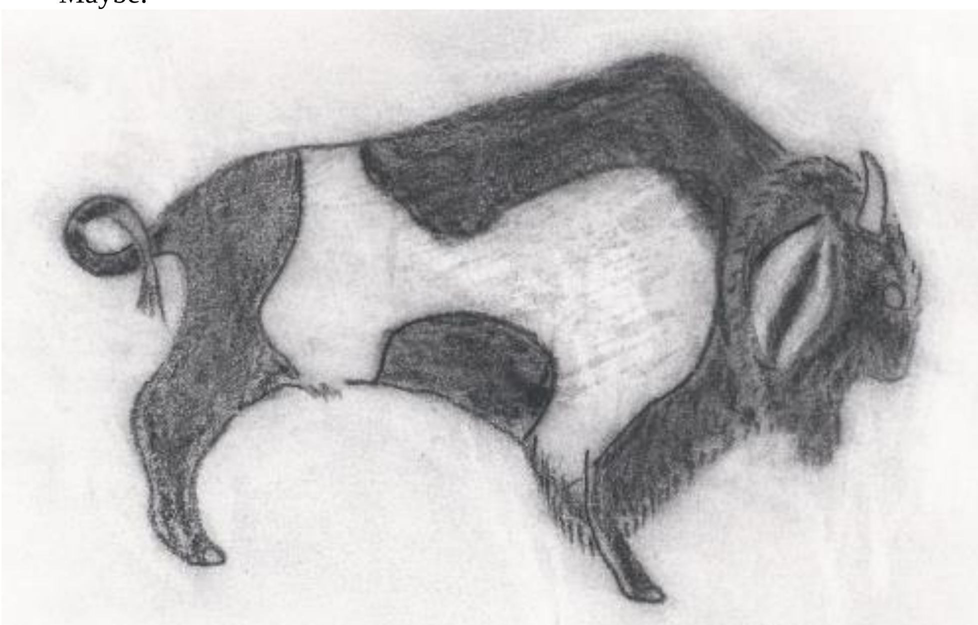

Figure 52. DOMESTICATION SYNDROME of Yellowstone bison may be the genetic outcome of the IBMP's policy of lethal removal of only those bison that express the migratory instinct. Selection for docility and tameness can result in a shorter snout, smaller jaws, white patches, floppy ears and a curly tail. Hypothetically, selective breeding could produce the above bison. *Image released to the public domain by its author James Horsley.*

The central controversy

At the center of this controversy regarding wild bison is the free movement of this native ungulate. At present, they must respect property boundaries or off with their heads. Even public land is out of bounds because that public land is being used for livestock. Key to the Montana DOL's management plan for keeping the wild bison off public and private land used by cattle in this ecosystem is to erase their instinct to migrate. Its stated objective is to lethally remove from this wild species those animals expressing the philopatric instinct to migrate.

"It's a no-second-chances plan, so there's no herd memory of getting out," Christian Mackay, executive director of the Montana DOL, said in 2011 concerning a proposal to keep bison from migrating beyond Yankee Jim Canyon in the Gardiner Basin (Flandro, 2011).

As mentioned, by targeting and killing only bison attempting to leave the park to survive, the interagency group is using methods of artificial selection to control their unwanted behavior. This is having and will increasingly have deleterious repercussions. Such methods inevitably lead to the domestication of these wild animals by eliminating those with the instinct to migrate.

Whether wild bison end up looking different or still the same, they will have lost the instinct that enabled them to survive in the wild and that led them from the Old World to this continent in the first place. With the loss or impairment of that instinct, they will be wild no longer.

Since migratory behavior is a complex of traits such as aggressiveness, learned behavior and a sense of fear, these traits will be weeded out also. With the loss of these characteristics, this nation will also lose an important connection with prehistoric man, for it was in concert with these wild animals that the first human inhabitants populated this continent 10 millennia ago.

An impossible mission

When a group of people, such as those participating in carrying out the goals of the IBMP, attempts to carry out a plan that is impossible to carry out, we have a problem. The stated goals of the IBMP are to:

- Maintain a wild, free-ranging bison population;
- Reduce the risk of brucellosis transmission from bison to cattle;
- Manage bison that leave Yellowstone National Park and enter the State of Montana;
- Maintain Montana's brucellosis-free status for domestic livestock (Interagency Bison Management Plan, 2014).

Question: how can one carry out a goal that allows bison to be wild and free-ranging, yet have a stipulation in a mandated agreement that if they exercise free-ranging behavior by attempting to leave the park they must be killed? The answer is that it cannot be done. It would be similar to telling a prisoner "you are free to leave this prison, but when you do, you will be shot."

The goals of the IBMP are irrational. They are irrational because the purpose of the goals is to sound good but get their own way regardless. They are irrational because they are duplicitous. They are meant to deceive the public into thinking that the essential character of wild bison—their roaming, migratory nature—is being protected, when in fact it is being annihilated.

By insisting that a relatively few cattle graze on federal and private land adjacent to Yellowstone National Park, land that comprises essential habitat for bison migration, these goals cannot be accomplished and thereby, as experience has proven, will continue to result in large herd reductions of wild bison. Such lethal actions represent a threat to the genetic vitality of wild bison and the maintenance of learned behavior.

A major defense by the FWS of this culling policy is that since wild bison are still trying to migrate, the plan has not harmed their migratory instinct and therefore the plan is working. The only empirical way to prove their position wrong is:

1. to find that one winter the entire herd, lacking a migratory instinct, collapses in the park because none retained the capacity to escape an especially severe winter, and/or

2. that along with eliminating those with migratory behavior, such associated traits as aggression, herd leadership and fear have been rooted out, leaving behind a form of domestic bison.

In other words, *only* the extinction of wild bison will suffice for the government as proof of the need to protect them from extinction. And then it will be too late.

What must be done

To prevent the extinction of wild bison, the ecosystem in which it lives must be reset back to its original condition by creating an environment that will allow wilderness to stand on its own, as it has in the past, instead of being managed, that is, enslaved. The Greater Yellowstone Ecosystem is a wilderness laboratory in which we can learn much, if allowed to function. By putting it under the management leadership of the Montana Department of Livestock, which literally and figuratively calls the shots, what we will end up with is livestock, not wildlife—and because of the proximity of free-range, caged and fenced livestock bordering the park and within the ecosystem—wildlife with livestock diseases.

Bison are a symbol of what is free. Yes, bison can be dangerous, can destroy private property, can pose a threat to automotive traffic and may spread a disease that is a threat to domestic animals. But it was the cow that brought brucellosis to Yellowstone in the first place and experiments have shown that it is enclosure that is a major cause of wildlife diseases and interspecies transmission. It is the cage that is the threat, for in crowding disease is incubated. Further, it is the cage and the fence that civilize. Fencing of wildlife in an ecosystem that restricts the available habitat necessary for survival of any species, including an invisible lethal fence, destroys the operation of that system and thus deprives us of the increasingly rare opportunity to learn from what is wild.

To a large extent, what makes this continent historically different from Europe is the way its inhabitants have treated wildlife over the millennia. The American Indian tribes lived with the wild buffalo and depended on it for their livelihood, instead of exterminating it. They co-existed with bison as a free-roaming, migratory animal. While wild bison of Yellowstone are an example of that will to be free, the wild bison in Europe has been extirpated and wild cattle driven to extinction. We can learn from what happened to those animals.

16

A lesson from the wisent and aurochs

Without its protector, the Indian tribes, Yellowstone's bison at present are headed down the same path as the European bison (also known as wisent) and the arouchs.

Historically, wisent inhabited much of Europe and were abundant on the plains between the Carpathian and Caucasus mountains in the region of the Black Sea. However, hunting and displacement due to growing agricultural practices increasingly led to range contraction and fragmentation. By the end of the 18th century wisent had disappeared throughout most of their former range. During World War I, German troops occupying Poland killed 600 of the European bison in the Bialowieza Forest for sport, meat, hides and horns. A German scientist informed army officers that the European bison were facing imminent extinction, but at the end of the war, retreating German soldiers shot all but nine of the animals there.

After the Russian revolution of 1917, portions of the Caucasus were overrun by cattle herders, lumbermen, army deserters and hunters armed with triple-barreled rifles who destroyed nearly all the Caucasian bison in that area. In 1919 an epizootic disease, probably endemic to domestic cattle grazing in the mountains, broke out among the remaining bison and killed virtually all those left in the wild (Vereshchagin, 1967).

The last wild European bison in the world was killed by poachers in 1927 in the western Caucasus mountains. Fewer than 50 then remained, all held by zoos.

Attempts now are being made to re-introduce wisent to various European landscapes. But none have occupied continuously the landscape they once freely roamed. We are fast headed in that direction by simply not allowing our wild bison to migrate to habitat they once occupied as a species.

The extinction will be either the collapse of the entire herd or the elimination of wildness from the wild bison that remain and its iconic, phenotypic trait, the migratory syndrome. Genetically, we are playing a form of Russian roulette, but with a slight twist: with each spin of the cylinder, we add another shell. It will only be a matter of time before we blow the migratory urge and its associated traits from the brains of the Yellowstone bison.

Opposing interests can overcome this short-sightedness by working together and concentrating on preserving the treasure that exists in the ability of the Greater Yellowstone Ecosystem to function on its own.

As mentioned, part of the problem is allowing caged or fenced animals in the GYE, for it is fencing that restricts movement, it is fencing that promotes the transfer of disease by crowding, it is fencing that disrupts wilderness and it is fencing that domesticates—all in opposition to wildness.

By providing a lethal barrier to bison around Yellowstone National Park, the IBMP is fencing in the park. Elk, which pose a higher threat than do bison for spreading brucellosis to cattle grazing on land adjacent to the park, most probably will be next on the anti-wildlife docket. It is already happening in Paradise Valley.

The necessity of migratory behavior

By restricting movement in an ecosystem, the animals' "house," one makes it a prison. The iconic trait of wild bison is that they still migrate, unlike all other bison in the nation, traveling from high altitudes to lower altitudes to seek forage in severe winter months and to calve in the spring. Movement is necessary for survival in such a climate as the Rocky Mountains.

Most of Yellowstone National Park is above 7,500 feet. Winter temperatures often range from zero to 20 degrees Fahrenheit during the day. Sub-zero temperatures overnight are common. The lowest temperature recorded in Yellowstone was -66 degrees near West Yellowstone February 9, 1933. While the average snowfall is 13 feet per year, higher elevations can get twice that amount—33 feet has been recorded.

Occasionally, warm winds will raise daytime temperatures into the 40-degree range, causing melting of the snowpack. When the snow melts and later refreezes, it forms ice sheets that can make foraging impossible (Weather, 2014; Uhler, 2014).

It is during these severe winter weather conditions that bison migrate to lower levels. As noted, this migratory behavior—an instinctive response to seasonal changes in weather and feed conditions, a behavior that brought them to this continent—is being selectively rooted out by means of the collaboration of government agencies that have been given the legal authority to lethally remove any bison that migrate or stray beyond the boundaries of the park.

The government's defense of this systematic killing is that there is still an abundance of buffalo and they are still migrating from the higher altitudes in Yellowstone. For the FWS, only abundance of a species, not its traits or behavior, matters. Here in Montana there is also an abundance of the descendants of aurochs, a fierce wild bovine almost the size of an elephant once found throughout Europe and Asia. An account of their observation in the Hercynian Forest, an ancient forest which included a part of the Black Forest in Germany today, is given in Caesar's *Gallic War*s, written somewhat prior to 46 B.C.:

> There is a third kind, consisting of those animals which are called uri. These are a little below the elephant in size, and of the appearance, color, and shape of a bull. Their strength and speed are extraordinary; they spare neither man nor wild beast which they have espied. These the Germans take with much pains in pits and kill them.

Due to conflict of aurochs with farming and their over-hunting, only their smaller, protected domesticated progeny exist today: beef cattle and milk cows. The aurochs are extinct. None exist—not even in zoos.

Figure 53. AUROCHS DRAWN BY PREHISTOIC MAN 10,000 to 15,000 years ago, found in the Lascaux Cave, France. ***Image by Peter80, Creative Commons license. (Lascaux, 2014).***

Wild bison are being driven down the same path to extinction as the aurochs via domestication by the IBMP's elimination of the most fit, the migratory. However, according to the FWS's line of reasoning, namely that traits and behavior do not count in defining a species and that species are only endangered when their numbers are low, aurochs would still exist today because their progeny, domestic cattle, thrive. Welcome to government biology.

A lesson from the wisent

A lesson can be learned from the historical range of the European bison, the wisent. Two subspecies are recognized, namely, the Lowland bison (*Bison bonasus bonasus*) and the Caucasian bison (*Bison bonasus caucasicus*).

Figure 54. EUROPEAN BISON OR WISENT, which share the same ancestral line as the American bison, at the Bison bonasus nursery of the Russian Academy of Sciences in Shebalinsky District, Republic of Altai, Russia. ***Photo by Alexandr frolov. From Wikimedia Commons.***

One species inhabited the lowlands of the European plains and the other species the mountains. Roughly speaking, these species compare to the American plains bison and those bison that now inhabit the mountain regions, such as in Yellowstone. What is of interest is that as time progressed the Caucasian bison's habitat did not overlap the habitat of the Lowland bison.

The Holocene epoch began at the end of the last ice age 11,700 years BP (before present), indicated by the light gray region. The high middle ages were from 11th, 12th, and 13th centuries (c. 1001–1300), indicated by the dark gray areas. Relict populations are those that survived from an earlier period, indicated by the black spots. Notice on the above map that the bison were separated into two herds that were not contiguous during the high middle ages—the northern European herd and the herd in the Caucasus Mountains (the dark gray splotch with the black spot at the end of the arrow).

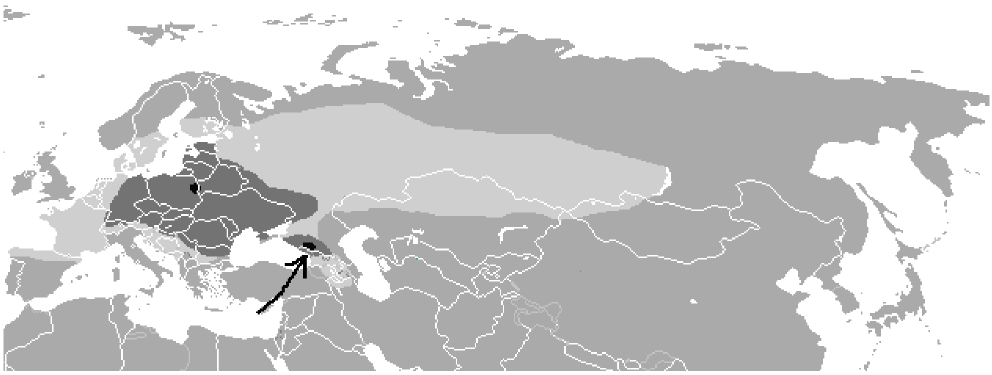

Figure 55. WISENT HISTORIC RANGE. Map of the historic habitat of the European bison (Bison bonasus) shows its Holocene range 10,000 years ago in light gray, its range in the high middle ages in dark gray and relict populations in the 20th century in black (European bison, 2014). The arrow marks the habitat of the Caucasian bison which, like Yellowstone bison, migrate altitudinally. ***From Wikimedia Commons. Author: Altaileopard.***

Some instructive parallels between the Yellowstone bison and the Caucasian bison are found in a description of the history of mountain wisent restoration in the northwest Caucasus region titled “Bringing wisents back to the Caucasus mountains: 70 years of a grand mission” by authors Taras Sipko and Ivan Mizin, Institute of Problems Ecology and Evolution RAS, Moscow, Russia; Sergei Trepet, Caucasian Biosphere Reserve, Maikop, Russia, and Peter J. P. Gogan, USGS—Northern Rocky Mountain Science Center, Bozeman, Montana. The study makes this observation:

> But let us return to the subsequent fate of the mountain wisent, saved from absurd administrative decisions. Their population continued flourishing in the western Caucasus, reaching close to 1,500 animals (in 1991 year) and having dispersed throughout the territory of the reserve and beyond its borders. The external phenotype and the behavior of the wisent became identical to those of their exterminated ancestors. Yet, the circumstances changed again in the early 1990s. Funding of nature conservation efforts practically stopped and the social and economic structures of the region collapsed. Poaching, even with the use of helicopters, the sound of which still causes panic among wisent, spun out of control and eradicated mountain wisent throughout most of their former range. Only due to the difficult mountain terrain and unprecedented efforts of the Caucasian Reserve staff that the animals were not exterminated completely. Zoologists estimated that only 150 wisent had survived and these were in the hard-to-reach Umpir depression! Surviving wisent even changed their behavior. Previously, prior to the onset of winter, mountain wisent migrated down into the foothill forests where snow was usually less abundant

and wisent could still find food. These forests, however, were most accessible to poachers. Surviving wisent started migrating upward to the wind-blown, snow-free mountain tops, where they now spend the entire winter season. Currently the conservation status of Caucasian wisent is improving, with numbers exceeding five hundred (Sipko, 2010).

Figure 56. CAUCASIAN BISON have changed their migratory habits due to human interference and now spend the winter on the mountain tops to avoid poachers. They used to descend in the winter to lower altitudes. *Photo used with permission from Dr. Taras Sipko.*

The poachers who brought the restored Caucasian bison to the brink of extermination are equivalent to the IBMP. Terrorized (like the Yellowstone bison) by helicopters, driven from their migratory habitat (like the Yellowstone bison), they now survive on the snow-free mountain tops of the Caucasus region. If the wisent's migratory habits can be changed by lethal removal means (poaching and the use of helicopters), how can one justify similar actions brought against the migrating Yellowstone bison as harmless, as did the FWS evaluating my first and second petition?

Hopefully, Georg Wilhelm Friedrich Hegel will be proven wrong when he wrote in *The Philosophy of History* that "What experience and history teaches us is that people and governments have never learned anything from history, or acted on principles deduced from it" (Hegel, 1956, p. 7).

What could we learn? Notice on the above map that bison disappeared from much of Eurasia prior to the high middle ages, while in North America, there were vast populations of bison up until the late 19th Century. What could be the cause of this differential? Cormack Gates et al. in "Wood Bison Recovery: Restoring Grazing Systems in Canada, Alaska and Eastern Siberia" wrote:

> The relationships between bison, human populations and other environmental factors have been diverse, with no single defining pattern. Nevertheless, it is clear that during the last millennium bison populations were dramatically reduced in Eurasia and much of North America in areas where the amount and distribution of suitable late Holocene habitat were more limited than on the Great Plains. Wood bison were extirpated from most of their original range in northern Canada, and rapidly approached extinction following over-hunting during the 19th century. European bison also declined during the Holocene, with less than 100 wisent (B. bonasus) persisting in the forests of eastern Europe in the early 1900s. Habitat reduction and overhunting were key factors causing their near extinction. Bison persisted in northern Eurasia into the middle or late Holocene but apparently disappeared earlier than in Alaska or adjacent parts of Canada. Plains bison persisted in a large region in North America despite being hunted extensively before the introduction of firearms. Annual long-range migration was likely a key factor accounting for the relative abundance of plains bison, similar to some African ungulates (Gates, 2014).

The observation that "Plains bison persisted in a large region in North America, despite being hunted extensively before the introduction of firearms," gives us a clue as to the cause of the differential. The people of Europe and the North American plains interacted with bison in dramatically different ways spanning multiple millennia. For thousands of years, bison on the American plains persisted, while bison on the Eurasian plains were extirpated.

Old World view of wildlife

What was behind this decimation in the Old World? Listen to a description of how animals were hunted near the Caucasus by N. K. Vereshchagin in *The Mammals of the Caucasus: A History of the Evolution of the Fauna*. Vereshchagin writes:

> The sharp decrease in the large-animal population on the Caucasus undoubtedly occurred during the Middle Ages when the techniques of bow-manufacturing and forest and mountain hunting were at a very high level.
>
> Large-scale hunting into late medieval times was made possible by the conditions of a feudal society and by the existence of large bands of free armed men which provided the necessary manpower.

Quoting an Iranian historian of the 14th century named Rashid ad-Din, he relates how Ghazan-Khan, a Mongolian ruler of Iran described as "the king of Islam," hunted in the mountains of the southern Caucasus:

> "Ghazan-Khan ordered the construction of two wooden fences in the mountains, each fence the length of one day's travel, which together would

> form a wedge fifty gyaz [about 100 feet] wide at the narrow end and one day's travel apart at the wide end. At the dead end the fences were to be closed off as a corral. After this the warriors drove the game—mountain buffalos, dzhurs [apparently, some kind of wild mammal], wild goats and asses, jackals, foxes, wolves, bears and other various wild and predatory beasts—between the fences until all were in the corral. The king of Islam was seated with Bulugan-Khatun [a Mongol princess] on the stage which was built in the middle, and enjoyed the sight of the animals. Some were killed and some set free."

Ghazan-Khan's method of capturing animals is hauntingly similar to that used at the Stephens Creek capture facility, which as has been noted employs a design that directs animals into a corral using a system of fencing fanning out from the enclosure of the facility.

But there was an even more effective method of killing wild animals. In the 16th and 17th centuries in Iran, "often as many as ten thousand or more" peasants were called for hunting duty by order of the Shah. They formed a gigantic oval around a forested area to prevent the animals from escaping. As the hunters converged toward each other into the area, the enclosure got smaller and smaller. The human ring surrounding the animals at the beginning of the drive was about 12 miles long and 3 miles wide. Vereshchagin notes:

> Before the beginning of the big hunt, the animals were driven for several days into the encircling ring. Hundreds and even thousands of large animals were killed during such hunting. In addition to the mounted warriors, foot soldiers were used to drive the animals.

Perhaps a reason for this war against wildlife in the Eurasian plains and mountains was the need to clear the way for cattle. As Vereshchagin states:

> . . . the disappearance and displacement of wild horse, kulan, saiga, tur and bison from the Ciscaucasian steppes were well advanced as early as the Middle Ages, brought about by domestic cattle herding and game drives by thousands of mounted Khazars, Polovtsy [Cumans] and Mongolians (Vereshchagin, 1967, pp. 520-524).

A similar drive to eliminate wildlife occurred when Europeans migrated to America, taking with them their prejudices toward ungulate competitors to cattle. For instance, to make way for cattle on the prairie and the railroad across it, the bison had to go. As just one example of the extent of the level of extermination, to supply workers for the Kansas Pacific Railroad with buffalo meat after the Civil War, William Frederick Cody (Buffalo Bill) killed over 4,200 bison in 18 months. Our government today is even more efficient, killing in a few months during the winter of 2008 over 1,700 bison as they migrated—either on Yellowstone National Park land or just beyond its boundary.

On the other hand, I remember reading about how Sitting Bull with his warriors would come upon the skull of a buffalo as they were riding across the plains. He would stop his horse and offer a prayer of thanks to the Great Spirit for the sustenance of his people provided by the bison. A simple act, but so disparate from the industrial killing of bison that is now being conducted by members of the Montana Department of Livestock and their cohorts in the IBMP. Wildlife treated as a commodity to be depleted by the most efficient methods of killing—as conducted by early Eurasian populations against various wildlife species, by European settlers of this nation against such species as bison and passenger pigeons, and now by our own government against bison and the wolf—demonstrates a lack of respect for wildlife and perpetuates an early Eurasian anti-wildlife attitude.

Behind that disrespect was avarice and a desire to control. That attitude persists to this day. Migratory animals cannot be easily controlled. Migratory bison jeopardize the exclusive use of public grasslands for private profit. This perceived encroachment is anathema to the cattle industry, for grazing fees are considerably less on federal and state lands than on privately-owned land. With breath-taking arrogance, the cattle industry wants the public to pay for the protection of their use of public grasslands for grazing cows to the tune of $3 million dollars annually. Why do they not simply take their cattle out of these areas instead, in order to provide the most affordable means of disease protection for the cattle herds in their state? And if they are unable to make this rational decision, why does the government not withdraw their cattle grazing permits from these critical areas?

What must be done if we are going to save Yellowstone National Park and the Greater Yellowstone Ecosystem for future generations as a wildlife reserve, is to allow it to function on its own without malicious human intrusion and decimation. That can best be done by bringing to bear an attitude of reverence and respect toward wildlife, including bison and wolves, as gifts not to be squandered. It is this attitude—one that existed prior to European settlement among Indian tribes on this continent and still exists among them as well as among conservationists—that for the good of our nation must prevail.

17

Epidemiology gone mad

The fight to save wild bison migrating out of Yellowstone National Park from extinction is one of the most significant conflicts in America today. It is little understood. What it boils down to is this: it is a millennia-long struggle between an economy based on common access to large game (called hunting) and the privatization and domestication of that game (called ranching). It is a fight for the control of access to publicly-owned animals, wildlife, by those who privately own animals, livestock.

In this fight, Europe's wild bison were extirpated and its wild cattle were driven to extinction. America's wild bison is heading in the same direction via the IBMP. Culling 1,000 animals was proposed for the winter of 2016, and another 1,400 for the winter of 2017 in total contradiction to biologists' warnings against large-scale herd reductions. As mentioned, eventually what will be left is virtually domestic, non-migratory, non-adaptive bison, incapable of surviving an especially harsh winter.

America stands out as the last continent on which a civilization thrived on the wild ungulate called bison. That civilization was here in the New World, collectively called the American Indian tribes. Plains Indians and Columbia Basin Indians today are still trying to base their lives on wild bison, but our government is devoted to stopping them by denying sufficient access to a wild bison population to hunt and by not allowing the wild herds to increase in population. Instead, our government provides tribes only token handouts of IBMP-slaughtered bison, token numbers of bison to hunt and token bison hunting habitat.

As mentioned, during the brutal winter of 1996-1997, two-thirds of the Yellowstone bison perished. A thousand froze or starved and an equal number were slaughtered by officials of the Montana Department of Livestock as bison, in search of forage, came down from the high elevations of the park. In the devastating 2007-2008 winter, 1,631 bison died, most killed by the DOL.

Part of the problem, according to Mike Mease, co-founder of the Buffalo Field Campaign, is the "fear of anything wild" and of "anything they can't control." Speaking of wild bison, he added:

> And until we step back and look at what they show us and teach us, then we can work around their ways, and that's the only way we'll ever come up with a solution to this (Jawort, 2011)

Killing wild bison at the industrial level—as is being done now by the IBMP—is extermination. There is a better way to relate to wild bison.

This petition advocates allowing bison to migrate out of the park, just as elk do, and hunting of bison by the common man, just as elk are, as a means of protecting wild bison from its impending extinction. But it does not advocate the kind of hunting that is going on today at the perimeters of Yellowstone National Park, for it is not fair chase. To restore a balance of nature, this petition also advocates prohibiting the hunting of the gray wolf within the Greater Yellowstone Ecosystem.

As noted in chapter 32 that provides my comment submitted to the National Park Service and the state of Montana for an environmental impact statement on alternatives for a proposed revision of the IBMP:

> A change in the management of wild bison is long overdue, for the present plan is not only driving wild bison into extinction as wild animals, but it is also depriving the Plains Indians of the right to practice their cultural heritage, which centers around the hunting of wild bison as a source of sustenance, as opposed to the European way of life, which is based on livestock, that is, domesticated animals. It was under the Plains Indians' pre-European settlement management that the ecosystem, including its ungulate and predatory wildlife, remained healthy and in balance for millennia.
>
> The Montana Department of Livestock, a member of the IBMP, is leading the charge in the destruction of this ecosystem. It is attempting to domesticate wildlife here, as exemplified by its efforts to systematically weed out the migratory instinct in wild bison by means of artificial selection, i.e., only the non-migratory are allowed to survive and breed. The tragedy is that it just might succeed if not stopped. This strikes at the very character of Yellowstone, for wild bison are iconic to it. They have been seasonally descending from the high country of the park and ascending back again for survival for thousands of years.

We, the citizens of this nation have been misled by our government regarding issues surrounding the management of wild bison. As mentioned in Chapter 32 of this petition:

> The single most important issue that should be addressed in the future management of wild bison is the need for honesty with the public about the needs and status of wildlife in Yellowstone National Park and its surrounding environment, the Greater Yellowstone Ecosystem. This is sadly lacking now.
>
> By dancing around the fact that elk are the greater vectors of the disease of brucellosis, by not facing the fact that bison are not the only potential disease transmitters to cattle, by trumping up studies that support culling bison at a population level of 3,000 in the park, by justifying claims that genetic diversity is maintained by culling when numbers are about 3,000 with studies that are not relevant, by citing studies that justify capture facilities as natural dispersal sinks when they are not, by pretending to meet the Plains Indian tribes' cultural needs by giving them a handout of government-killed bison, by offering only a restricted number of alternatives for a new bison management plan and on top of that, not allowing public comment on additionally selected-alternatives recommended by the public, the IBMP only promotes a culture of deception.
>
> If the IBMP were honest, it would face the facts and say what those facts are, instead of using scientists to mislead by manipulating facts. By not doing so it misrepresents. Since the program annually costs $3 million in state and federal funds to administer, IBMP is potentially opening itself up to being criticized with engaging in mismanagement, waste and fraud (this petition, Chapter 32, “Comment on alternatives for revision of the IBMP”).

The central reason for the culling of wild bison is based on the theory that the spread of brucellosis can be controlled by preventing bison from comingling with cattle in the regions exterior to the park in the Greater Yellowstone Ecosystem. The focus of this disease control effort has been most recently Gardiner Basin, the area denoted on the map below (see Figure 57). As mentioned, here wild bison attempt to migrate in the winter, but are prevented from doing so by the actions of the IBMP, which lethally remove any bison that attempt to enter that region.

Bison can not be allowed outside the park, according to the August 2000 *Final Environmental Impact Statement for the Interagency Bison Management Plan for the State of Montana and Yellowstone National Park,* because:

> As bison travel onto private lands, or onto public lands where cattle are grazed, the chances of contact and of the transmission of brucellosis would increase, jeopardizing the state's class-free status. If the disease were to spread undetected, it could quickly move to other states since Montana exports breeding cattle (Vol. 1, p. 218).

To give teeth to this position, as previously mentioned the IBMP established 3,000 head of bison as the population level that would be tolerated in the park—the supposedly theoretical level at which bison would most likely migrate out of the park in winter. Any bison attempting to wander outside the park when the population went above that number would be a candidate for lethal removal.

Apparently, nothing can defeat this number's game. Any head of bison above that number and off with that head. It has a Machiavellian brilliance to it as far as promoting the self-interests of the IBMP, an agency highly influenced by one of its members, the Montana Department of Livestock.

The IBMP has not been stopped in its mission to kill migrating bison despite the spending of multiple millions of dollars by the Departments of the Interior and the Department of Agriculture to set aside land outside the park for bison and other wildlife. Beginning in 1999 thousands of acres of land and easements were purchased or leased in the Gardiner Basin, becoming part of the Gallatin National Forest. And still the heads rolled—those that exceed the 3,000 limit.

The IBMP has not been stopped despite a 2014 Montana Supreme Court ruling that at first blush looked like it allowed more tolerance for bison to roam into Gardiner Basin outside the park, but on a second look, merely allows the IBMP the right to allow more tolerance if it wants more tolerance. Net result: a rise in lethal removal goals year after year.

This has been all due to the court-approved settlement that allows the culling of any bison above that drop-dead number of a 3,000-head population limit. One could set aside all of Montana for wild bison, but with that 3,000 number in place, off with their migratory heads.

Because of that mandated limit, when the population reached 4,900 in 2014 within the park, the IBMP exercised its authority and set a population reduction goal of up to 900 for the winter of 2015, and as the population rose, up to 900 for 2016, and 1,400 for 2017, focusing on those bison attempting to leave the park via Gardiner Basin.

To augment the numbers culled, during hunting season bison are allowed to cross the park’s border so they can be killed by hunters standing on the other side. But this is a government-led hunt. During the winter of 2014-2015, over 700 were culled either by hunting or by capture and slaughter. Because annual population-reduction goals have not met for the past few years, the goals keep increasing each year.

My petition submitted March 2, 2015 called on the US Fish and Wildlife Service to stop the slaughter immediately with an injunction. This issue was addressed by the FWS denying an immediate emergency listing.

A copy of the second petition was submitted to the Government Accountability Office, which had been critical of the IBMP in a past report. The petition pointed out numerous instances of misrepresentation. My complaint was forwarded to the Office of Inspector General of the Department of the Interior, the umbrella department of the National Park Service, a member of the IBMP. However, this has the potential of the fox investigating the henhouse. To date no action has been taken by the Department of the Interior regarding the information disclosed in that petition, which provided such information as given in this current petition, namely, that the IBMP is spending $3 million on culling wild bison in an ineffective brucellosis-disease control program that it knows can not succeed, but is hoodwinking the public into thinking it can succeed.

Yes, apparently, nothing can stop the IBMP in its headlong obsession to eliminate migratory wild bison as they attempt to leave the park, especially through the migratory corridor of Gardiner Basin.

However, as can be seen graphically in the map below, focusing on bison and on their attempt to leave the park via Gardiner Basin so as to prevent the spread of brucellosis is epidemiologically futile. Wild bison primarily inhabit river valleys, such as along Yellowstone River, while the distribution of elk is more diffuse—that is, they are all over the ecosystem. The majority of the exposure to *Brucella abortus* is from elk shedding the disease as they comingle with cattle grazing in allotments within the northern portion of the Greater Yellowstone Ecosystem (See Figure 57). Shedding refers to reproductive discharges infected with brucellosis, such as aborted fetuses or afterbirth. Yet only the comingling of a relatively few cattle with bison in Gardiner Basin is presently being addressed by the IBMP.

This is astoundingly bad epidemiology. It fact, as an application of the study of disease control to the Greater Yellowstone Ecosystem, it is not epidemiology at all. It has little effect on the overall containment of the disease brucellosis in the Yellowstone region. Ask any epidemiologist. They will tell you that you can not stop the spread of a communicable disease if you do not stop the comingling of diseased animals with healthy animals. That does not mean just separating one species of animal from the healthy, but all species that have the disease. If it is impossible to keep diseased wildlife from comingling with non-diseased domestic animals, then the domestic animals must be taken from the presence of the diseased wildlife. It is that simple conceptually.

Concerning disease control for Yellowstone, we are being sold a bill of goods. We are told by member agencies of the IBMP that we, the public, must spend millions annually to prevent wild bison from a "mass migration" out of the park into Gardiner Basin, Tom Miner Basin and southern Paradise Valley, to prevent the spread of brucellosis throughout the state, yet access beyond Gardiner Basin by bison into that northern portion of the ecosystem is restricted by the Yankee Jim Canyon bottleneck.

There is no need for the boondoggle efforts of the IBMP's culling and hazing posse now being employed in the northern Yellowstone region because wild bison are already separated from Paradise Valley topographically and structurally.

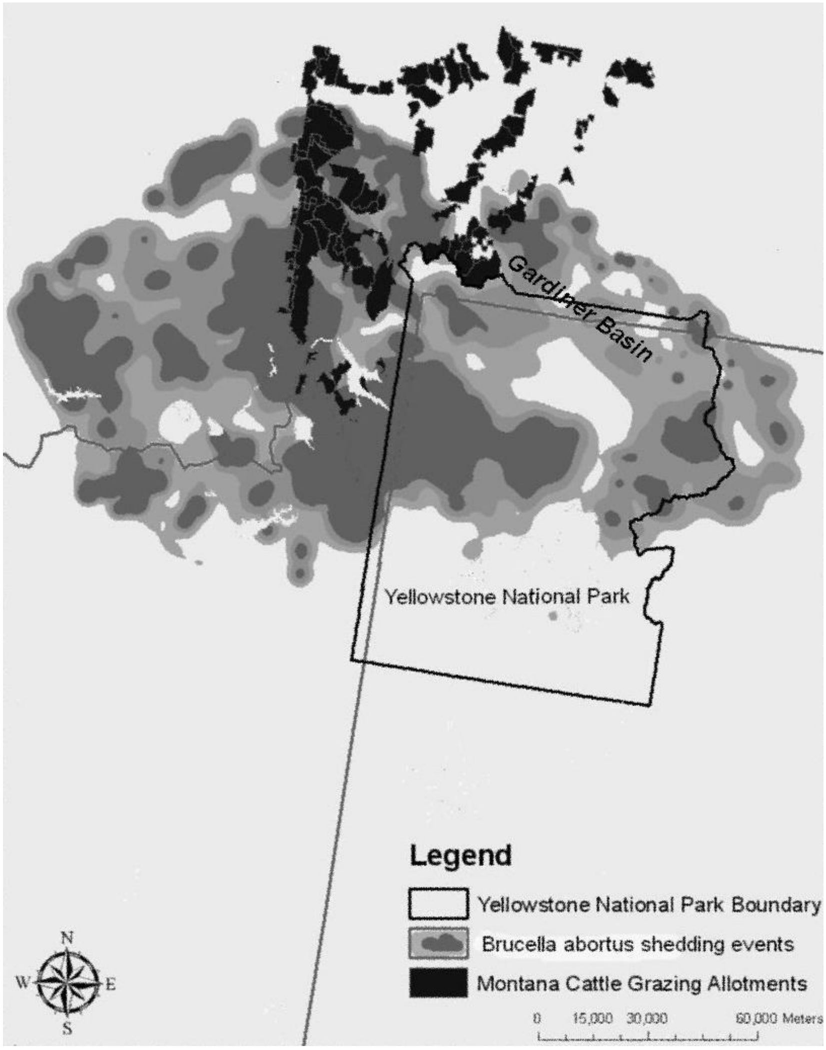

Figure 57. MAP OF TOTAL B. ABORTUS SHEDDING EVENTS from bison and elk populations during June in the northern portion of the greater Yellowstone area based on an average winter. Montana cattle grazing allotments are in black. Darker gray areas indicate higher levels of shedding while lighter gray areas indicate lower levels of shedding. (Adapted from Schumaker, 2010, p. 69).

A proposed adjustment to the Interagency Bison Management Plan made in 2011 by Montana Fish, Wildlife & Parks and the Montana Department of Livestock (a joint plan that would have given bison more room to roam in the Gardiner Basin, but was never carried out) explains:

> Yankee Jim Canyon (the most northern boundary of Zone 2) is a narrow, natural constriction point for bison movement that permits the agencies to halt bison movement north. The steep rocky terrain that impinges immediately on the Yellowstone River at this point provides a pincer point for bison movement. Bison restriction is further enhanced through installation of the two roadway bison guards immediately south of the canyon and fencing running up the hillsides from the roads installed in response to the 2010-2011 bison migration. The Yellowstone River, steep terrain, snow depth, and other features would also help prevent bison movement to the north (Draft Joint Environmental Assessment: Adaptive Management Adjustments to the Interagency Bison Management Plan, 2011, p. 15).

In other words, the IBMP does not need to kill bison to stop them from migrating out of Gardiner Basin. The terrain will do it. Culling bison in Gardiner Basin is a red herring. It serves as a straw man tactic in the war against wild bison, leaving unaddressed the real problem, the comingling of cattle with bison *as well as* elk throughout the northern Yellowstone area.

Most of the cattle grazing allotments accessible from Gardiner Basin are part of the Gallatin National Forest. Land management of national forests focuses on conservation, timber harvesting, livestock grazing, watershed protection, wildlife and recreation. Unlike national parks and other federal lands managed by the National Park Service, extraction of natural resources from national forests is permitted. However, national forest goals of conservation of natural resources, such as grasslands and wildlife, and the raising of livestock, such as cattle, on these public lands have the great potential of producing conflicts such as now exist in Gallatin National Forest.

Setting a population limit of 3,000 bison in the park as a means of resolving the present conflict in Gallatin National Forest between bison and cattle is of little value. Effectively mitigating the spread of brucellosis out of the park from its wild ungulates is not dependent on population levels, but rather on proximity at *any* population level between *any* disease-carrying animal vectors and cattle. Just one bison or just one elk whose diseased material comes in contact with just one cow or many cattle can produce contagion.

Unless almost all the elk and bison were killed in the ecosystem, the only rational and effective solution to the control of the spread of brucellosis prevalent in the GYE is through the removal of cattle from the region in which *Brucella abortus* is shed by wild ungulates.

But no one is listening. All ears are closed. Large-scale culling has not been diminished despite warning after warning of the genetic damage of such practices. Recall that one of the most recent alarms was sounded in the *Journal of Heredity* by biologists Natalie D. Halbert, Peter J. P. Gogan, Philip W. Hedrick, Jacquelyn M. Wahl, and James N. Derr in a study titled "Genetic Population Substructure in Bison at Yellowstone National Park" published February 8, 2012. They noted:

> The continued practice of culling bison without regard to possible subpopulation structure has the potentially negative longterm consequences of reducing genetic diversity and permanently changing the genetic constitution within subpopulations and across the Yellowstone metapopulation (Halbert, 2012).

Several years have passed since that statement was made, yet massive culling continues and more is planned.

By the government putting wild bison behind fences at the capture and quarantine facilities and by slaughtering wild bison just like cattle, it is depriving this wild species from the forces of natural selection, reducing wild bison to captivity, which domesticates, destroying the very purpose of the park as a place that preserves wilderness and wildness. The Interagency Bison Management Plan has transformed Yellowstone National Park into a stockyard.

So far, the IBMP is unstoppable in its wild bison extinction program. Yet, the exercise of its power is grossly ineffective brucellosis-control, failing at the very mission for which it was established.

Listing wild bison as endangered appears to be the only solution left to disable the government's interagency wild bison culling program. If such bison are listed, they would be allowed to migrate out of the park. But that would mean they would come in contact with cattle at the park's border, increasing the probability of the spread of brucellosis, which would be irresponsible epidemiologically. Yet, elk already are allowed to migrate, posing the same threat now as would freely migrating bison in the future. Thus, cattle should not have been permitted in the ecosystem in the first place.

One can well understand the potential resistance of cattle ranchers when they contemplate what addressing the solution means: the abandonment of years of tradition as livestock operators in a magnificent wilderness setting. But since both elk and bison are the vectors of brucellosis and since their comingling with cattle promotes a biohazardous disease which puts the nation's brucellosis-free status in jeopardy, what other choice is there if the disease is to be contained and the ecosystem's wildlife, which includes bison, preserved?

The petition submitted March 2, 2015, contained the following challenge:

> In retrospect, the NPS should post the answer to another question on its "Frequently Asked Questions: Bison Management" website. That question is this:
>
> > How do you propose to reduce to zero the risk of transmission of brucellosis from wildlife in Yellowstone National Park to cattle just outside the park by lethally removing only migratory bison, when migratory and resident elk pose the greatest threat of brucellosis transmission?

> I challenge the agency to answer that question. If it cannot, it should allow bison to migrate from the park just like elk, ban cattle from the Greater Yellowstone Ecosystem to promote the national security regarding disease control and participate in disbanding the IBMP or withdraw from it.

Following the submission of the petition, I saw a new post on the "Frequently Asked Questions: Bison Management" website. It was a videotaped interview of Rick Wallen. As stated in the public comment I submitted June 15, 2015 as feedback for a new Interagency Bison Management Plan (see chapter 32 "Comment on alternatives for revision of the IBMP," I wrote:

> The park's primary spokesman, Rick Wallen, lead wildlife biologist for the bison program at Yellowstone National Park since 2002, commented on the conundrum involving brucellosis in both bison and elk in an NPS video titled: "Why are elk managed differently than bison?" He said:
>
>> Brucellosis infection in elk functions the exact same as brucellosis infection in bison, and brucellosis infection in livestock. So, biologically, there's really no difference in the transmission and infection cycles. Some of the details of how it works within each individual species is a little bit different, but the bottom line is that any of those three species could be transmission vectors to any of those three species. Many of our constituents ask**,** "Why do you treat elk differently than you treat bison?" Why do you treat elk differently than you do bison? Our state wildlife managers in Idaho, Wyoming, and Montana are more tolerant of elk and allow the elk from Yellowstone National Park to move freely back and forth across the boundary.
>
> There you have it. Why are the two brucellosis-carrying species treated differently? Because of issues of tolerance and intolerance. Because they legally can be treated differently. Because, as its name states (Interagency *Bison* Management Plan) and as its credo states, (a "multi-agency effort that guides the management of *bison* and brucellosis") *bison*—but not elk or any other brucellosis-carrying animal—are its sole concern.
>
> Brucellosis really has nothing to do with the issue. If it did, it would be addressed epidemiologically in both species. Both species would be prohibited from migrating and mingling with the cattle on the park's borders. Such biased treatment of species nullifies the disease control actions mounted against park bison. At the human level, it would be like banning entry into this country of a patient from nation A with Ebola, but allowing entry of a patient from nation B with Ebola. Such a practice would not contain the spread of the disease. Claiming it could would be double talk. Or bad science. Or both.

Indeed, there you have it. This is epidemiology gone mad.

Would it not make more sense to retire cattle grazing allotments in the Gallatin National Forest and compensate the permit holders? Could not private land owners be compensated by permitting hunting of bison on their land, as many do for elk?

Would banning cattle from the ecosystem not be worth it to keep one of America's last wildernesses wild?

18

Smoke and mirrors

It is the winter of 2015, the thirteenth day of February. Yellowstone National Park is in the process of capturing and slaughtering its iconic wild bison in an attempt to reach its goal of eliminating 900 this year and 900 next year, 100 percent of which are from the migratory herd. It is an artificially-selective process. Many of the animals are pregnant. Many of the mothers are followed by their calves. The non-migratory do not try to leave the park and thus do not get into the trap prepared for them, a funnel of fencing that leads into the Stephens Creek capture facility.

The bison escorts—our very own protectors of the park, the Yellowstone rangers—and agents of the Montana Department of Livestock, are mounted on horses to drive them into this funnel. They yell "Hey, hey, hey, yo, yo, yo!" as though they were herding cattle. Outside the facility, which is built on park land not far from the north entrance, is parked an array of pickups and livestock trailers. This is the staff's busiest time of year.

Once the bison enter the open arms of the fan of fencing they are trapped between the narrowing walls. As they progress, they suddenly find themselves in a high-walled enclosure—the capture facility. They are processed through a series of narrowing chutes that eventually squeeze them single file onto a loading ramp, where they will enter the open doors of a livestock trailer. The doors will be shut and from here they go on a long ride to the slaughterhouse. The area around the facility is closed to the public while it is in operation.

While this is transpiring, hunting is still going on. Bison hunting is allowed in Montana from November 15 to February 15. Hunters can call Montana Fish, Wildlife and Park's buffalo hunt "hotline" or regional office for information about the location of bison that have come down from the higher altitudes and are leaving the park, entering the killing zone. According to FWP:

> The 2013 Montana Legislature granted Montana Fish, Wildlife & Parks the ability to provide hunters with general hunt information regarding areas where bison may be found. FWP is committed to ensuring a fair chase hunt for bison. Hunters should not expect to be told the exact location of individual bison—only areas in which bison have been spotted (Bison Hunt Application Frequently Asked Questions, 2016).

According to Andrea Jones, Montana FWP's information and education manager, it works this way:

> I generally update the bison hotline on a weekly basis or if significant changes in bison movement occur. The information on the hotline is generally limited to letting hunters know whether there are reports of (many or just a few) bison outside of Yellowstone National Park in either of the hunt districts and whether they are in a "huntable" location (i.e. bison that hunker down in a West Yellowstone subdivision would be unhuntable). I rarely record more than that.
>
> The idea of the hotline is to give hunters that might be travelling from far distances information with which to help them decide whether to come hunt or not. If bison have not migrated outside YNP, it doesn't usually make sense for someone to spend to travel across the state or across the country. Plus, bison present a challenge in terms of retrieval –so many people need to line up horses, etc.
>
> Information as to bison movement for purposes of the hotline typically comes to me from our game wardens or in checking in with colleagues with the U.S. Forest Service in the area. There are not helicopters used to spot bison for this purpose. In many cases – especially in the Gardiner district – bison can simply be spotted leaving YNP with the naked eye. In West, wardens may note fresh tracks or look to common places for bison. However, with any wild animal, there is no guarantee and we make no guarantees for our hunters.
>
> If a hunter calls me personally, if I can I will provide a bit more information than the hotline. There is no hand holding, but I might say something along the lines of "We had reports yesterday of a group above Eagle Creek." I might also direct him or her to one of the wardens directly (Andrea Jones, personal communication, September 26, 2016).

Out of the goal of culling 900 bison for 2015, between those killed by hunting and those captured and sent to slaughter, as of February 12 they had reached the 525 mark (Update from the field, February 12, 2015). All told, for the winter of 2014-2015 a total 739 bison were killed.

We are led to believe by government spin doctors that this is all necessary and scientifically supported, but it is not. By obscuring the truth with misleading information we are led to believe a number of falsehoods through a public relations effort of smoke and mirrors. For instance, the National Park Service website titled "Frequently Asked Questions: Bison Management," announcing the planned 2015 culling activities, leads us to believe that the culling will be done randomly. The NPS states:

> The plan is to capture and ship at least 50 to 100 bison per week from mid-January through mid-February without regard for age, sex, or disease status.

We are led to believe that the culling is necessary because of issues related to disease. The NPS states:

> Yellowstone bison have been chronically exposed to the non-native disease brucellosis that can be transmitted to cattle and cause them to abort calves. As a result, bison are not allowed to move unimpeded into cattle-occupied areas in Montana.

We are led to believe that the culling is also necessary because of the threat of a bison mass migration into Montana. The NPS states:

> Biologists from the National Park Service (NPS) have proposed removing 900 bison near the northern boundary this winter to reduce population growth and the potential for a mass migration of bison into Montana (Frequently Asked Questions: Bison Management, 2014).

However, what we are *not* told by the NPS in its announcement of the culling is the truth: that it is not random (only migratory bison are being selected for culling), that actually elk are the greatest threat of brucellosis transmission to cattle (yet elk are not being culled), that those bison migrating north out of the park are restricted from going any further by barriers at Yankee Jim Canyon a few miles distant, and that recommendations have been made against large-scale herd reductions of bison by the NPS itself due to the potential of increasing the rate of genetic loss.

All this so cattle can graze in a wildlife grassland critical for the survival of numerous wild ungulates, especially wild bison, the only species barred from the habitat.

All this makes no sense. In an attempt to get a straight answer from the National Park Service, just prior to submitting my March 2, 2015 petition I wrote the following email to Rick Wallen, Wildlife Biologist, Bison Ecology and Management Team, Yellowstone National Park, with whom I had previously corresponded. Here is the email, dated February 3, 2015:

> Thanks for your reply. I will soon be submitting a petition to list the wild bison in Yellowstone National Park. On the NPS's "Frequently Asked Questions:

Bison Management" website under the question "What is the current bison population?" it says this:

> Biologists from the National Park Service (NPS) have proposed removing 900 bison near the northern boundary this winter to reduce population growth and the potential for a mass migration of bison into Montana.

I would be interested in knowing who these biologists are and what studies they are relying on for that statement. I would also be interesting in knowing if this ongoing culling is selecting only migratory bison.

Here is his reply, dated Wednesday, February 4, 2015:

> The report we produced to evaluate the annual abundance and distribution of the population was presented to the managers in August of 2014. Much debate ensued and the final operations plan by the agencies was completed in December. To help inform that debate we provided a prediction of what to expect for migration of Yellowstone bison this winter based on our previous work studying the relationship between population abundance, distribution and winter severity. That report was provided to the managers in September.
>
> All three of these reports are provided to interested constituents to review as well and can be found at a world wide web site called IBMP.INFO. I encourage you to take a look at our reports and the interagency operations plan that the agencies produced. Follow the link on ibmp.info titled Library and there you will find a second link titled Winter Operations and Surveillance/Harvest Plans. You can see that we post these documents each year for interested folks like yourself to study the details of our recommendations . . .

I was being directed to get the answers I wanted from the IBMP, the group that is in charge of the wild bison culling. I went to the sites as directed and learned that the authors of the documents were all biologists with Yellowstone National Park, which, through its affiliation with the National Park Service, is a partner with the IBMP. The supporting studies cited in these documents were predominately by park staff also.

The documents were revealing. Three categories were listed for the year 2015 under "Winter Operations and Surveillance/Harvest Plans." Under each category was a document. Categories and document titles plus authors follow:

- Winter Populations Disease Model:

  "Population Dynamics and Adaptive Management of Yellowstone Bison," August 5, 2014, by Chris Geremia, Rick Wallen, and P.J. White, Yellowstone National Park.

- Winter Operations Plan:

  "Operating Procedures for the Interagency Bison Management Plan," signed approval by the following organizations (names of individual signers omitted as some were not legible):

  > Animal and Plant Health Inspection Service, District Director, Veterinary Services;
  > Confederated Salish Kootenai Tribe, Chairman;
  > Intertribal Buffalo Council, President;
  > Montana Board of Livestock, Executive Officer;
  > Montana Fish, Wildlife, and Parks, Region 3 Supervisor;
  > Montana State Veterinarian;
  > National Park Service, Superintendent, Yellowstone National Park;
  > Nez Perce Tribe, Chairman;
  > U.S. Forest Service, Forest Supervisor, Custer Gallatin National Forest.

- Winter Bison Spatial Distributions:

  "Spatial Distribution of Yellowstone Bison—Winter 2015," September 5, 2014 by Chris Geremia, Rick Wallen, P. J. White, Yellowstone National Park, and Fred Watson, California State University, Monterey Bay.

First document

On reading "Population Dynamics and Adaptive Management of Yellowstone Bison," it appears that biologists, at least in this document, are not concerned about a massive migration into Montana. They are instead hopeful that *enough* bison come toward the park's borders so they can kill 900 of them, the recommended culling level for the year 2015. The authors state:

> We recommend removing 900 bison during the forthcoming winter, including 180 calves, 70 yearling females, 410 adult females, 60 yearling males, and 180 adult males. To reduce abundance and productivity, it is most important to meet the removal objectives for females and calves.

They believe this is achievable because:

> Predicted migrations suggest sufficient numbers of bison will move beyond park boundaries to facilitate the recommended removals.

Further, because “large removals (e.g., >1,000 animals)” could “threaten long-term preservation of Yellowstone bison” IBMP managers decided on “moderated culls.” The authors noted:

> In 2008, IBMP managers decided to implement moderated culls in an attempt to avoid large annual fluctuations in the bison population, which occurred during the early IBMP period and could threaten long-term preservation of Yellowstone bison, cause societal conflict, and reduce hunting opportunities outside the park. The removal of 900 bison (as recommended above) during each of the next two winters through hunting and culling should reduce abundance to approximately 3,500 before calving.

Supposedly “moderated culls” are 900 bison this year and 900 bison next year. Like beauty, “moderated” is in the eyes of the beholder. And what is the reason for reducing the bison herd to 3,500? Under “Need and Purpose,” we have an answer:

> Yellowstone bison are managed under an Interagency Bison Management Plan that is primarily designed to reduce the risk of brucellosis transmission from bison to livestock. Pursuant to this plan, bison are supposed to be managed towards an end-of-the-winter guideline of 3,000 animals.

Apparently, the IBMP actually wants to reduce the populations to 3,000 and is working its way down toward that number. But why? As the thinking goes, when the bison population in the park goes beyond 3,000 head, the IBMP believes that such a bison density will trigger migration out of the park. When bison migrate out of the park the concern is that they will come in contact with cattle grazing on the perimeters. And when that happens, they might transmit the disease brucellosis to their cattle.

The only trouble with that line of reasoning is that elk are not put through a similar gauntlet, yet they pose a greater threat of transmitting the disease to cattle. Elk used to be culled by the park to prevent overgrazing. On average 2,000 elk were lethally removed each year. But that practice was stopped in 1968 due to public outrage. With the subsequent introduction of wolves into the park the overgrazing ceased. Now only bison are targeted for removal from the park.

Figure 58. HAZING ELK BY HELICOPTER into a capture facility at Crystal Creek in January 1968. Ted Scott (Yellowstone's Photo Collection, 2015).

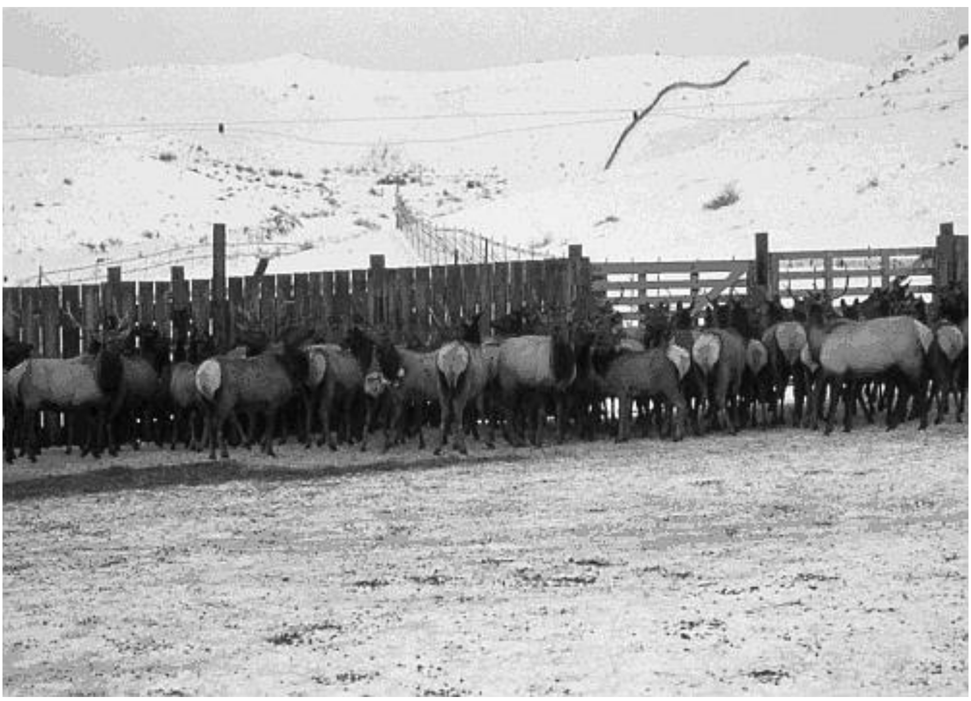

Figure 59. ELK HERDED INTO A TRAP at a capture facility in February 1965. Ted Scott. (Yellowstone's Photo Collection, 2015).

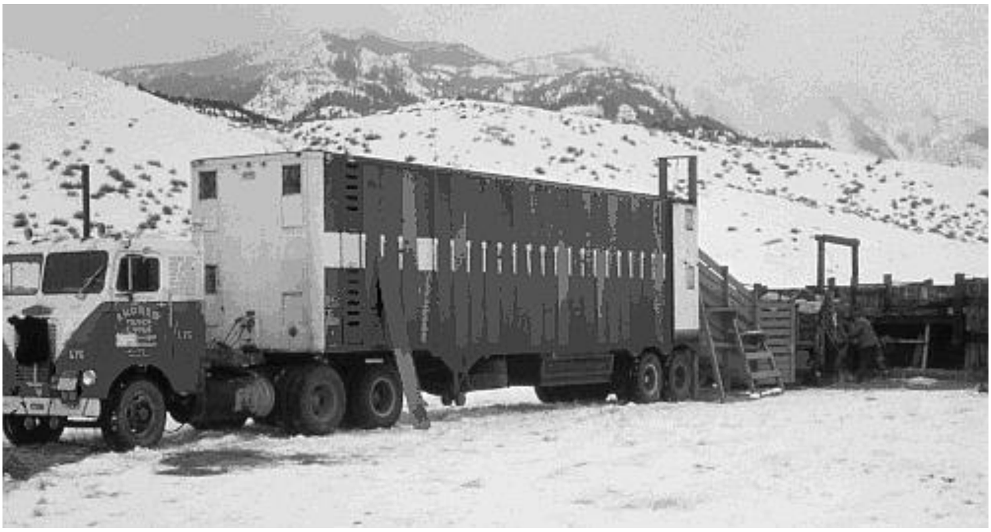

Figure 60. LOADING ELK ONTO A TRUCK for shipment to a slaughterhouse in February 1965. Ted Scott. (Yellowstone's Photo Collection, 2015).

As mentioned, this differential in actions toward distinct species, where one brucellosis reservoir (bison) is removed from the presence of cattle, while the other (elk) is not, is not only rotten epidemiology, it accomplishes no disease control whatsoever. In light of this one fact alone, the IBMP is providing a useless, make-work service that serves only one purpose: increasing yearly the probability of the extinction of the Yellowstone bison as a wild species.

But then again, maybe it is not all about separation and stopping migration after all. Just about the time one thinks one understands the perspective of the documents referenced by Wallen, such as the one he helped write, "Population Dynamics and Adaptive Management of Yellowstone Bison," one reads this on the next-to-the-last page:

> Furthermore, building evidence (3) suggests that end of winter herd sizes of >2,500 northern and >1,500 central may be more appropriate for maintaining annual migrations where sufficient numbers of animals move beyond the northern park boundary to support state and tribal hunting outside of Yellowstone and removals that are large enough to offset growth. IBMP partners agreed to implement moderated culls in an attempt to avoid large annual fluctuations in the bison population, which occurred during the early IBMP period (Figure [61]) and could threaten long-term preservation of Yellowstone bison (4).

The document provided four citations (reference No. 1 same as No. 3). They are given below:

1. Geremia, C., P. White, J. Hoeting, R. Wallen, F. Watson, D. Blanton, and T. Hobbs. 2014. Integrating individual- and population-level information in a movement model of Yellowstone bison. Ecological Applications 24:346-362.

2. Geremia C., P. White, R. Wallen, F. Watson, J. Treanor, J. Borkowski, C. Potter, and R. Crabtree. 2011. Predicting bison migration out of Yellowstone using Bayesian models. DOI 10.1371/journal.pone.0016848

4. White, P, R. Wallen, C. Geremia, J. Treanor, and D. W. Blanton. 2011. Management of Yellowstone bison and brucellosis transmission risk—Implications for conservation and restoration. Biological Conservation 144:1322-1334.

Now it appears that migration is being encouraged, large reductions discouraged and a population of 4,000-plus targeted. The studies cited include Wallen himself and his long-time co-authors. Some of the relevant quotes from each citation given in support of the above quote will be provided below, followed by the Petitioner's comment:

Reference No. 1. "Migration pathways were increasingly used over time, suggesting that experience or learning influenced movements. To support adaptive management of Yellowstone bison, we forecast future movements to evaluate alternatives. Our approach of developing models capable of making explicit probabilistic forecasts of large herbivore movements and seasonal distributions is applicable to managing the migratory movements of large herbivores worldwide. These forecasts allow managers to develop and refine strategies in advance, and promote sound decision-making that reduces conflict as migratory animals come into contact with people."

- *My comment:* If this is so, then why are IBMP decision-makers increasing conflict between migratory animals and people by its culling practices? Why are they culling the very animals that have acquired experience or learned behavior? How long can this selective culling last without harming that behavior?

Reference No. 2. "Simulations of migrations over the next decade suggest that allowing increased numbers of bison beyond park boundaries during severe climate conditions may be the only means of avoiding episodic, large-scale reductions to the Yellowstone bison population in the foreseeable future."

- *My comment:* If this is so, then why is IBMP recommending large-scale culls?

Reference No. 4. "Frequent large-scale, non-random culls could have unintended effects on the long-term conservation of bison, similar to demographic side effects detected in other ungulate populations around the world."

- *My comment:* The study, however, never spells out at what level a reduction may be termed "large-scale," but recommends against large-scale fluctuations and reductions. It also recommended against "non-random culls," yet selects only migrating animals to cull.

What is the real story? In reality, are the reduction quotas large or moderate-scale reductions? Wallen provides a graph of the fluctuations over the years. Recall that the intent is to avoid large-scale reductions as has been the case in the past. If one projects the scheduled level of culling into the next two years following 2014, one comes up with a troubling picture, indeed: a proposed 30 percent reduction of the herd.

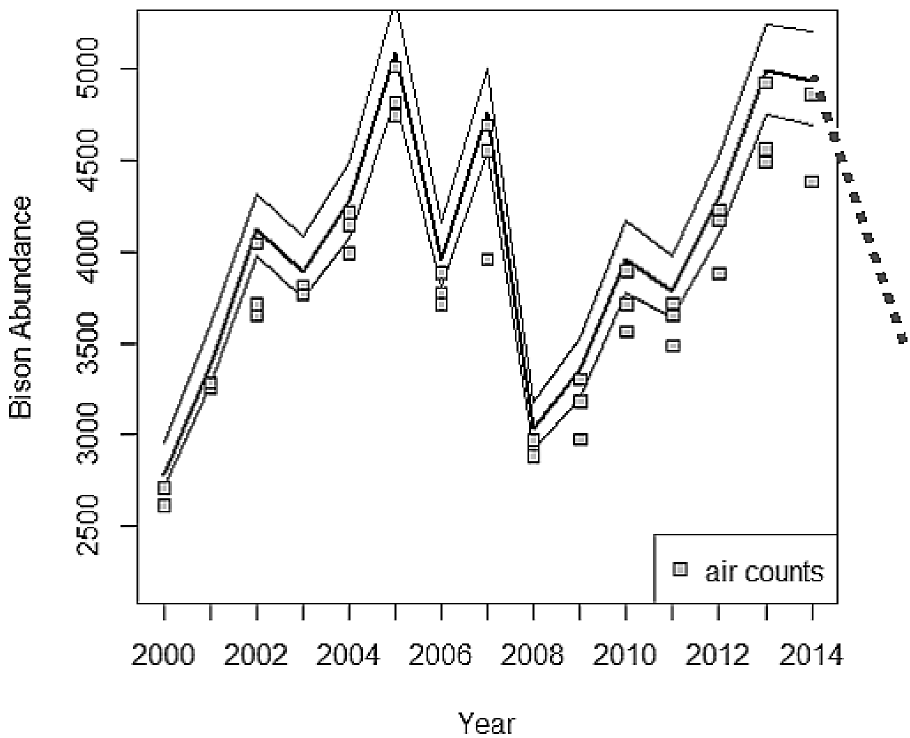

Figure 61. PLANNED REDUCTIONS AMOUNT TO 30 PERCENT of the herd in two years. Figure based on estimated Yellowstone bison abundance from aerial counts conducted during the Interagency Bison Management Plan. Bold lines indicate mean abundance and thin lines show 95% credible intervals (Geremia, 2014). Dashed line drawn by Petitioner represents a projection of planned culling for 2015 and 2016.

Note: the dashed line (drawn by the Petitioner as an addition to the existing graph provided in the study) in Figure 61, represents a projection of the predicted result of carrying out the planned reductions for the next two years of 900 plus another 900, including the additions of births, for a total two-year population goal of 3,500 head. Total reduction is 28.57 percent or approximately 30 percent. One can tell merely by looking at that projection that the planned magnitude of culling is large both in terms of fluctuation and the level of reductions.

The troubling aspect of all this is the irrationality and inconsistency. On one hand, we are told by an NPS website that 900 bison must be culled to stop a mass migration into Montana. On the other hand we are told that they can expect enough animals will migrate to "facilitate the recommended removals." Then we are told the IBMP wants to reach a level of 3,000 in population. Then we are told later that in two years the level should be 3,500, but that maybe at some point 4,000-plus (>2,500 + >1,500) would be better, that is, a number that "may be more appropriate for maintaining annual migrations where sufficient numbers of animals move beyond the northern park boundary to support state and tribal hunting outside of Yellowstone and removals that are large enough to offset growth."

That is, we need more bison to migrate so we can kill more so they won't migrate. Interesting reasoning.

At any rate, 900 x 2, or 1,800 bison, must be killed over a course of two years so as to "avoid large annual fluctuations in the bison population" because such large-scale reductions "could threaten long-term preservation of Yellowstone bison." But as noted, when one projects the plan, one comes up with a great fluctuation.

Second document

The second documents referenced by Wallen, "Memorandum December 19, 2014. Operating Procedures for the Interagency Bison Management Plan," essentially is an operations manual outlining the logistics of hazing and lethally-removing bison. A few samples follow. On page 8 we read:

> Hazing may be accomplished by personnel using ATVs, snowmobiles, on foot, horseback, and/or helicopters, and may include the use of cracker shells or rubber bullets . . .
>
> Furthermore, NPS rangers may at times ask the MDOL to cease helicopter hazing operations within Yellowstone National Park to allow bison to rest.

On page 9 we read:

> Hazing operations will be coordinated with the administration of the hunt. The NPS and MDOL [Montana Department of Livestock] will make efforts to

> integrate management of hazing actions with treaty and state-regulated hunting in Montana.

According to Sam Sheppard, Montana Fish, Wildlife and Parks, such hazing is done so as not to interfere with hunting activities, that is, so as not to drive migrating bison back into the park or away from hunters (Sam Sheppard, MFWP, personal communication, September 6, 2016).

In the spring during bison calving season, to make way for the more important arrivals on the public grasslands just outside the park, our government will make sure everything is just right to accommodate their bovine guests. On page 9 we read:

> The IBMP members will coordinate in April to compile and update knowledge on bison movements and distribution, snow conditions, vegetation green-up, stream flow in the Madison River, logistical issues (e.g., staff, horse, and helicopter availability; traffic control; visitation and road closures), and cattle turn-on dates and locations.

Once this is done, the bison will be evicted. On page 9 and 10 we read:

> The IBMP members will assess this information and discuss a step-wise, integrated plan for hazing bison from the Gardiner and Hebgen basins back into Yellowstone National Park. The current target dates for bison to be back into the park are May 1 from the Gardiner Basin and May 15 from the Hebgen basin.

Now, if hunting does not kill enough bison, then the bison that did not cross the boundary of the park and remained on the Gardiner Basin grassland inside the park during hunting season (where they had a refuge from hunting) will be rounded up and driven into the Stephens Creek capture facility operating there. On page 10 we read:

> Bison may be captured . . . to reduce abundance if hunting will not achieve annual removal objectives . . . **(**Memorandum, 2014).

Once they are captured, they are shipped to a slaughterhouse.

This document contains a map of the Northern Management Area, describing various removal zones, with the intensity of hazing and lethal removal increasing as bison progress from one to the other. As one can see in Figure 62 below, Zone 1 begins in the park. The dotted boundary denotes an area providing more tolerance of bison movements all year, part of proposed adjustments to the Interagency Bison

Management Plan, with lethal removal beginning beyond that boundary, which is a crest of mountains.

The proposed adjustments are delineated in “Draft Joint Environmental Assessment: Year-round Habitat for Yellowstone Bison,” developed by Montana Fish, Wildlife and Parks along with the Montana Department of Livestock. One of the proposed alternatives, Alternative B, would allow bull bison only to occupy Gardiner Basin all year. However, even though agreement was achieved on the implementation of these adjustments, the proposal was shot down (tabled) by the Montana Board of Livestock.

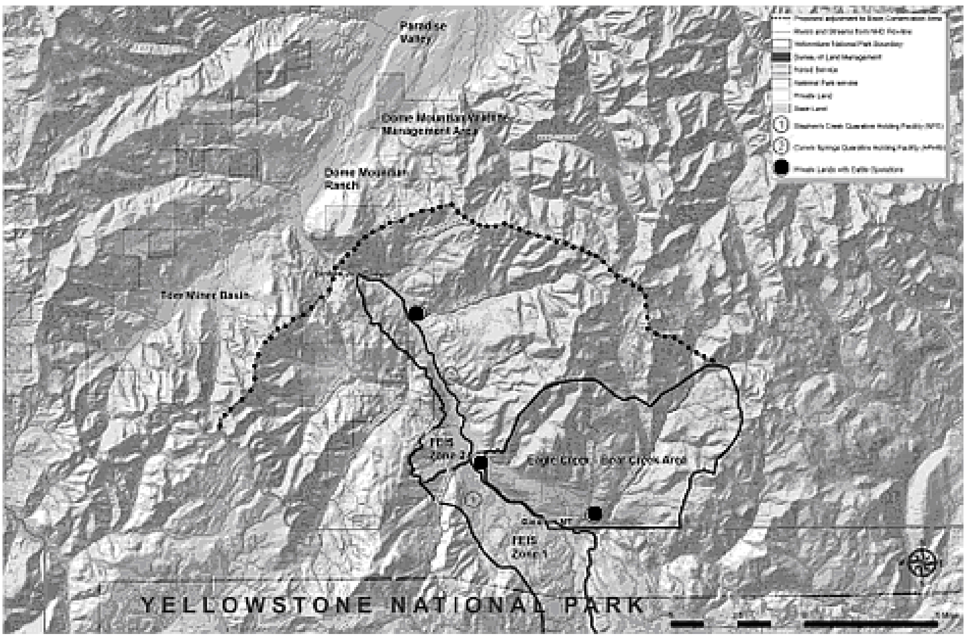

Figure 62. IBMP NORTHERN MANAGEMENT AREA. Large black dots denote locations of private land with cattle operations. Black lines demarcate management boundaries and zones. Dotted line follows crests of mountains and demarcates proposed adjustment to Bison Conservation Area (tolerance zone) within which some bison would be free to move, but beyond which all would be lethally removed. (Memorandum, 2014).

However, these proposed adjustments to the Interagency Bison Management Plan have been resurrected and are now being studied in the form of alternative bison management objectives. On March 16, 2015 the National Park Service and the State of Montana (consisting of the Montana Department of Livestock and Montana Fish, Wildlife & Parks) announced that it was inviting public comments to help prepare an Environmental Impact Statement (EIS) for a new plan “to manage a wild and migratory population of Yellowstone-area bison, while minimizing the risk of brucellosis transmission between bison and livestock to the extent practicable." The implications of this study are analyzed in chapter 32 "Comment on alternatives for revision of the IBMP," my comment submitted June 15, 2015.

Third document

The third document referenced by Wallen, "Spatial Distribution of Yellowstone Bison—Winter 2015," a document of which Wallen was a co-author, provides the following information in the Executive Summary:

> During July 2014, 4,865 bison were counted in Yellowstone National Park following calving, including 3,421 in northern Yellowstone and 1,444 in central Yellowstone. National Park Service biologists recommended removing 900 bison from the population during the forthcoming winter through hunter harvests (~300-400) in Montana and the capture and shipment of animals (~500-600) from northern Yellowstone to meat processing facilities.
>
> To assist with planning for these removals, current information about bison movements was used to predict the timing and extent of migrations to management areas near the Park boundary. Under average snow conditions, numbers of bison in the Northern Management Area (Mammoth to Yankee Jim Canyon; see Figure [65]) should increase substantially during January through March 2015, with approximately 2,000 bison present by the end of winter. Smaller migrations of fewer than 1,000 bison are expected if snow conditions are well-below normal. In the Western Management Area (Madison Junction to the Hebgen basin), approximately 100 bison should be present throughout autumn and winter, with numbers increasing during March to about 350 bison during April and May. Natural migrations by bison back into the interior of Yellowstone National Park should begin in April in the Northern Management Area and early June in the Western Management Area.
>
> If weather conditions are approximately average, then sufficient numbers of bison should move to the Park boundary and into Montana to enable the recommended removal of 900 animals, primarily from the Northern Management Area. To limit impacts to hunting in the Northern Management Area, captures and shipments of bison should be implemented throughout the winter with small numbers (e.g., 25-100) of animals removed weekly through March. Captures and shipments of bison to meat processing facilities will likely need to be significantly biased towards adult females, calves, and juveniles to meet removal recommendations. It is important to begin these efforts early in winter to avoid sending females late in pregnancy to processing facilities.

Based on snow conditions, this document predicts the feasibility of providing enough bison to meet the goals for shipment of these animals "to meat processing facilities." If weather conditions are average, "sufficient numbers of bison should move to the Park boundary and into Montana to enable the recommended removal of 900 animals."

Again, to prevent a "mass migration," the Yellowstone biologists are hopeful enough bison will migrate. Yes, interesting reasoning.

In the end, one wonders what is being recommended to achieve their goals, that is, whether it is non-random "shipments of bison to meat processing facilities" "significantly biased towards adult females, calves, and juveniles to meet removal recommendations," or random removals "without regard for age, sex, or disease status," as stated by the NPS for the present culling.

Regardless, to meet the culling goal, most bison will not be allowed to migrate out of the park, but will be captured as they congregate inside the borders of the park and shipped to slaughter. Our own park is not safe for bison.

To say that the NPS must kill 900 bison to prevent a "mass migration of bison into Montana" and then produce an operations manual that appears hopeful that "sufficient numbers of bison should move to the Park boundary and into Montana to enable the recommended removal of 900 animals" is self-contradictory. To cull bison on the park side of the Gardiner Basin grassland, which is bisected by the park's invisible northern boundary, before they migrate off it so as to prevent migration into the state-side half of the grassland, and do so in the name of stopping a "mass migration of bison into Montana," knowing full-well that if they travel further north they will be stopped by the Yankee Jim Canyon bottleneck, is dissimulation. For Yellowstone rangers to be involved in this wanton destruction on park property when it is their task to protect wildlife there is hypocrisy. I support the Buffalo Field Campaign in saying "Shame on Yellowstone."

It makes no sense

On the whole, the bison removal program of the IBMP makes no sense. The *Record of Decision for Final Environmental Impact Statement and Bison Management Plan for the State of Montana and Yellowstone National Park,* which in 2000 established legally what management actions can be carried out toward wild bison, states:

> The agencies, therefore, would allow untested bison up to a tolerance level of 100 in both the northern and western boundary areas to freely range in both the western and northern boundary areas, and manage them as described above.
>
> In the spring, the agencies would haze all bison remaining in the Reese Creek or western boundary areas back into the park. The agencies would use capture facilities in Stephens Creek and the West Yellowstone area to maintain the bison population at 3,000, to enforce tolerance levels of bison in either the Reese Creek and West Yellowstone boundary areas, and to ensure no bison remain outside the park after the respective haze-back dates (Record of Decision, 2000, p. 13).

Prima facie, this passage describes self-defeating disease control. If 100 bison are allowed to mingle with cattle in the management areas, this is allowing 100 potential carriers of brucellosis to transmit the disease to cattle. How does that make any sense? How does one physically count the presence of these animals day by day and, in fact, why count them? It takes only one diseased bison proximate to cattle to transmit brucellosis.

In practice, this provision is not followed. For the northern management area (Gardiner Basin and Paradise Valley), when the total bison population reaches 3,000, almost all migrating bison are lethally removed in the winter, with few left to haze back in the spring, and in the western management area (Hebgen Basin), no migrating bison are lethally removed (because most bison do not go there in the winter), and in the spring, are allowed to remain year-round in a portion of it, namely, Horse Butte. Result: inconsistent disease containment—which translates into no disease control.

The third document provides the following demographic maps showing areas used by bison:

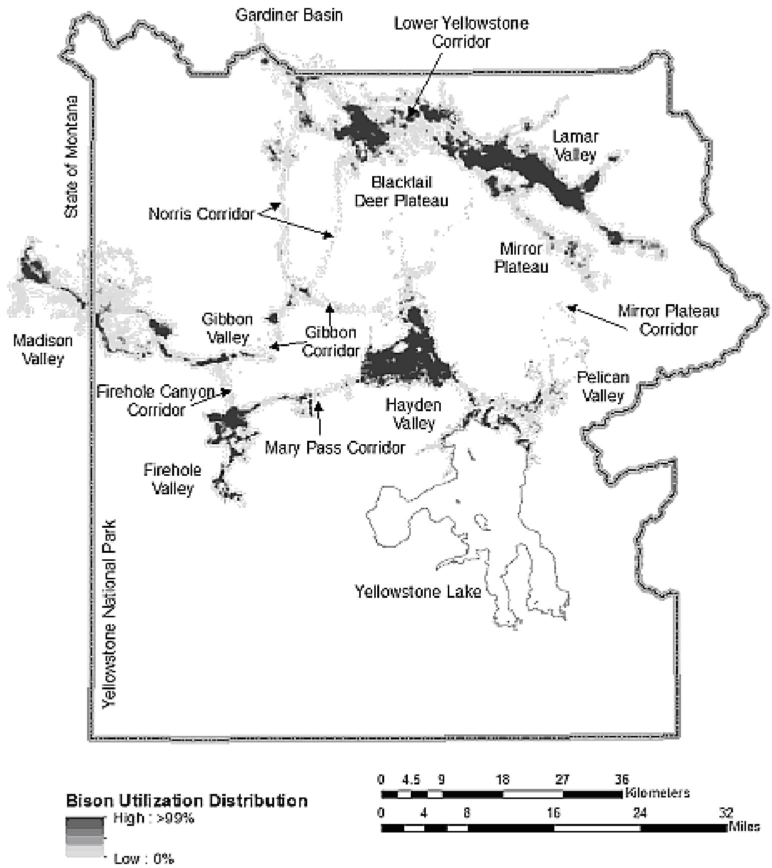

Figure 63. BISON USE AREAS. Names of various places and areas used by bison in and near Yellowstone National Park. Darker shading indicates areas used more frequently by about 66 adult female bison fit with GPS radio collars during 2004 through 2012 (Geremia, 2014).

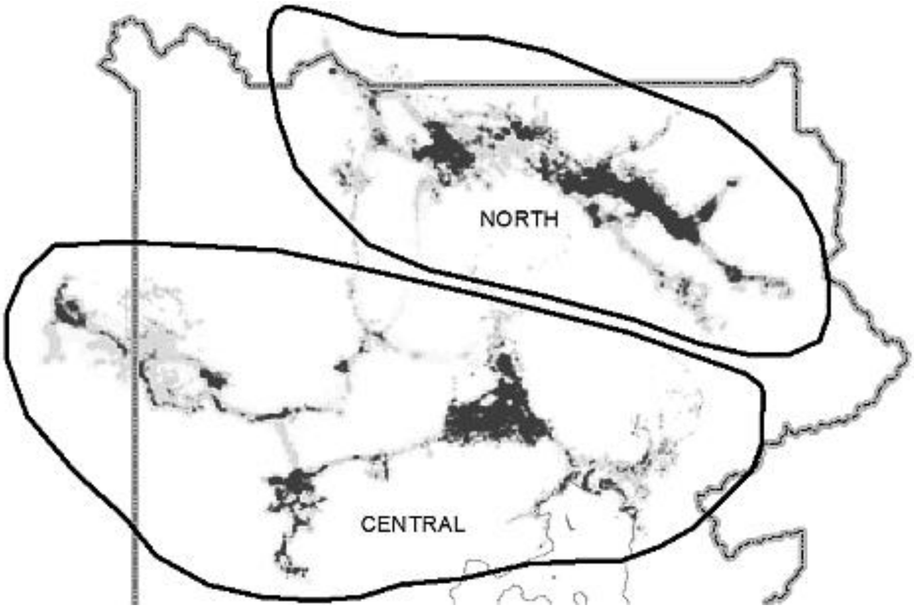

Figure 64. HERD LOCATIONS. Circled areas delineate the north herd and the central herd (Geremia, 2014).

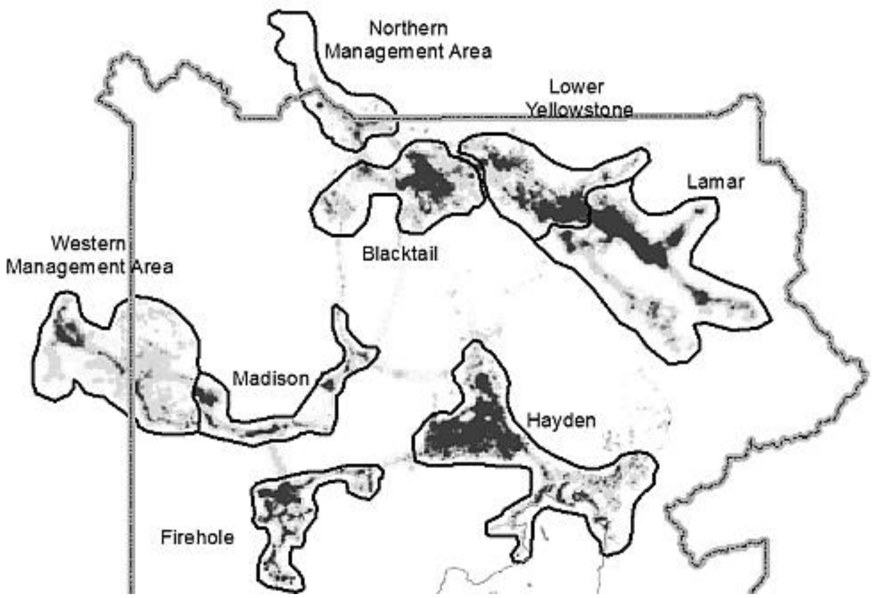

Figure 65. MANAGEMENT AREAS (Geremia, 2014). As one can see, outside of the park there is more tolerance and thus more use allowed for bison occupying the Hebgen Lake region west of the park (dark splotches) in the Western Management Area, as opposed to north of the park, Gardiner Basin, the Northern Management Area.

Figure 66. BISON ARE STOPPED in their migration north by Yankee Jim Canyon (indicated by the tip of the arrow) in the Northern Management Area (Geremia, 2014). Arrow drawn by Petitioner points to the north end of Gardiner Basin. Light to dark gray splotches indicate areas used by bison. High-use area indicated by spot under the irregular boundary of the park is the location of the Stephens Creek capture facility. It is high use because the bison are driven there for capture.

Dark gray indicates a higher concentration of the herd while light gray indicates less concentration. Bison that roam into the Northern Management Area will roam no more. A few are hazed back into the park, while the rest are driven into the capture facility in the park, shipped out of the park and slaughtered. Except for the relatively few bison that are tolerated temporarily in Gardiner Basin and hazed back, the only bison that migrate north out of the park are those that migrate in a livestock trailer.

In the Western Management Area (see Figure 65), under a recent ruling, a number of bison are allowed year-round in a portion of the Hebgen Lake region called Horse Butte, while the rest are hazed back into the park in the spring. Any tolerance granted to wild bison, however, is only temporary. In the winter, most bison do not migrate west, but instead north, whether members of the northern herd or the central herd. All those doing so are subject to slaughter.

This entire issue boils down to a controversy essentially concerning that light gray splotch on the map in Gardiner Basin north of the park's border, for that is where a scattering of bison, according to this distribution map, slip by and congregate outside the park's border in the forbidden portion of the basin. They can go no further beyond into Paradise Valley due to the bottleneck of Yankee Jim Canyon. Because bison have the potential of migrating into that portion of Gardiner

Basin outside the park, they are culled on that portion of the basin that lies within the park via the Stephens Creek capture facility.

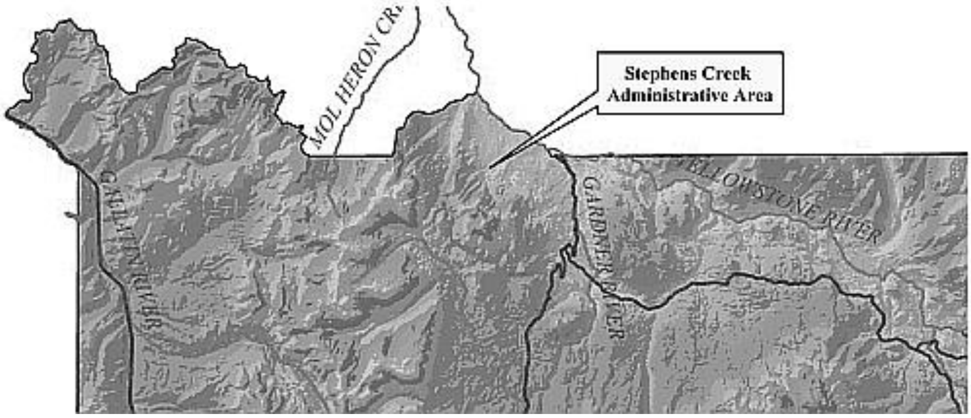

Figure 67. LOCATION OF STEPHENS CREEK ADMINISTRATIVE AREA. The Stephens Creek capture facility lies within the SCAA (Stephens Creek Administrative Area, Yellowstone, 2006).

Apparently, the prevailing thinking is that cattlemen have preemptive claims to the public land here, even in an ecosystem, even if it takes millions in government funds every year to clear wild bison from wildlife habitat so domestic cattle can graze in their place, and even if it takes millions to keep the area indicated by the splotch just north of the park from possibly turning from light use to greater use.

Of paramount concern in the management of bison herds and brucellosis is that all this expenditure of effort and funds is targeting only one species of ungulate, bison, while the disease is spread by two species, both bison and elk, with elk being the primary vector.

This is all done methodically, calculatedly, year in and year out, with the approval of epidemiologists and the legislature and it makes no sense. And presently, under the parameters established by the IBMP, there is no way out, either for bison or for those who favor more tolerance for bison movement both inside the park in Zone 1, where lethal action can commence, and outside the park. As long as cattle graze in Gardiner Basin and Hebgen Basin, all the increased habitat that has been explored or obtained for bison occupancy will mean nothing, since under present law any bison that roams toward the border from a herd totaling more than 3,000 head is a candidate for lethal removal regardless of how much habitat is available.

Bowing down to cattle in the Greater Yellowstone Ecosystem has apparently reached the level of a religious cult, for nothing else could explain the suppression of reason at this magnitude. And the public is being forced to pay tribute for the continuation of this practice at the rate of $3 million a year. The annual slaughter from which the public is barred has elements that remind one of a sacrificial rite.

19

A numbers game

How many cattle and wild bison are involved in this turf war on the border of Yellowstone National Park? This is important to know because a lot of money is being spent on behalf of cattle grazing on the park perimeters. The numbers will help establish a benefit-cost ratio (BCR). The benefit-cost ratio takes into account the amount of monetary gain realized by performing a project versus the amount it costs to execute the project. The higher the BCR the better the investment. General rule of thumb is that if the benefit is higher than the cost the project is a good investment.

Establishing the population of bison is relatively easy. According to the National Park Service, the number of bison in the park was estimated at 4,900 in July 2015. This includes two sub-populations in Yellowstone: northern (3,600) and central (1,300) (Yellowstone Bison, 2015).

However, obtaining the number of cattle on the perimeters of the park is another story. According to a 1999 report by the Government Accountability Office (GAO), "Depending on the time of year and the size of the cattle herds, over 2,000 cattle can occupy public and private land in the Montana portion of the Greater Yellowstone area."

But this is not the whole story. The GAO report continues:

> According to the Park Service, it is important to note that only a portion of these 2,000 cattle actually occupy lands where bison are most likely to move. Specifically, on the north side of the park, approximately 300 cattle occupy private lands and about 80 cattle occupy public lands where bison are likely to move during the winter and early spring. On the west side of the park, approximately 350 cattle occupy lands where bison are likely to be found. However, these cattle are not grazed year-round and are not present when bison are actually in the area. As a result, only about 730 of the 2,000 cattle in

the Greater Yellowstone area actually occupy lands that bison generally use when they leave the park.

While this may be the case, the report states:

> Montana officials noted, however, that if the Yellowstone bison were left uncontrolled, they would likely continue to migrate farther north along the Yellowstone River valley and northwest along the Madison River valley, to where more cattle are maintained year-round on extensive private lands. (Wildlife Management: Negotiations on a Long-Term Plan for Managing Yellowstone Bison Still Ongoing, 1999).

A number of years have passed since this report was made. Let us do some research of our own as an update to either confirm or revise these figures.

The "Draft Joint Environmental Assessment: Year-round Habitat for Yellowstone Bison, 2013," reviews the status of the cattle population adjacent to the park. It notes:

> . . . there are two active grazing allotments within the existing bison tolerant area, one on each side of the Yellowstone River near Yankee Jim Canyon: Slip n' Slide on the east side and Green Lake on the west side that are used during the summer when bison are not present.

These active allotments are at the northern end of Gardiner Basin and abut Paradise Valley. The document also states:

> . . . there are two year-round and six seasonal livestock producers in and near the Gardiner Basin. The two year-round operators winter their cattle in the Gardiner Basin and move the cattle to the Cinnabar Basin to graze in the summer. The seasonal producers manage herds ranging in size of 100-600 cow/calf pairs on private lands. The seasonal arrival date of cattle on private lands is mid-May, and all are moved out of the northern management area by the end of December.
>
> Some of the livestock operators have improved their existing fencing or installed new fencing with the DOL's assistance in order to maintain spatial separation between cattle and bison. Three active grazing allotments are within the existing bison-tolerant zone within the GNF. Use of the allotments range from mid-June until mid-October, and the allotments are only used by cattle. In additional to those allotments, there are three more allotments just north of the hydrological divide boundary of the bison-tolerant zone.

Along the western boundary area, according to the "Draft Joint Environmental Assessment":

> . . . there are two private landowners that lease out their pastures for cattle grazing and one livestock owner that leases one of the USFS allotments. There are ten active grazing allotments within the GNF in the proposed year-round bison-tolerant zone. Use of the allotments range from mid-June until mid-October, and the allotments are used by either cattle or horses depending upon the location.

Let us take a look at what the cattle population for allotments near the park is today. According to figures supplied by Kim Reid, Range Management Specialist, USDA Forest Service, cattle population levels for National Forest allotments in the Gardiner Basin region are as follows:

Table 4. 2015 National Forest Allotments along the park's northern border (Kim Reid, personal communication, August 19, 2015).

Allotment	**Allotment Status**	**Acres**	**Permit Type**	**Permitted Numbers**	**Livestock**
Slip and Slide	Active	6773	Term	47	Cow/Calf Pairs
Wigwam	Active	2487	Term	76	Cow/Calf Pairs
Green Lake	Active	3586	Term & Term Pvt Land	46	Cow/Calf Pairs
Horse - Reeder Creek	Active	5115	Term	81	Cow/Calf Pairs
Horse - Reeder Creek	Active		Term	22	Yearlings (cattle)
Horse - Reeder Creek	Active		Term/Term Pvt. Land	30	Horses
Section 22	Vacant	592			
Mill Creek	Vacant	406			

522 cattle graze in allotments along northern border

The table above summarizes active and vacant allotments along the northern border for the year 2015. Cow/Calf pairs equal two cattle. As the table denotes, cattle in the area number (47 + 76 + 46 + 81) x 2 = 500. Adding the yearling cattle one gets 500 plus 22 for a total of 522 cattle. The map below shows the location of the allotments:

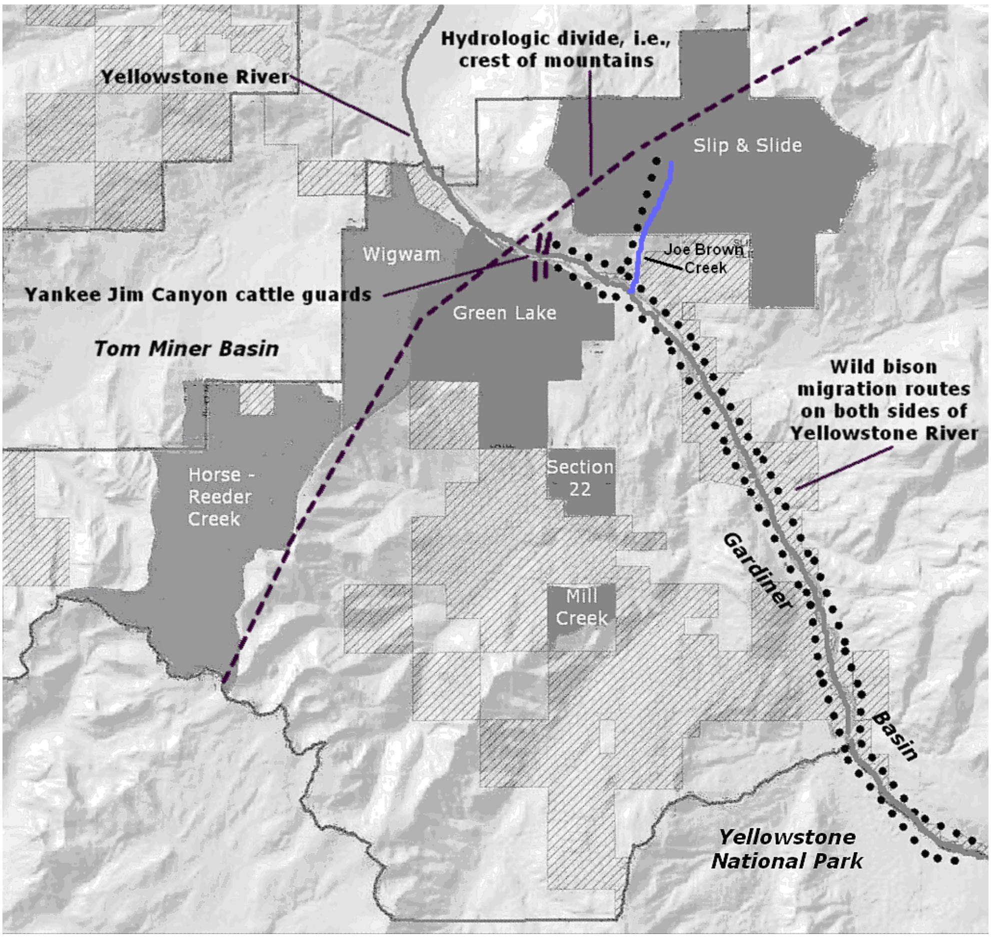

Figure 68. GARDINER RANGER DISTRICT, Custer Gallatin National Forest, 2015 grazing allotment status. Dark gray indicated grazing allotments contiguous to Gardiner Basin and medium gray those contiguous to Tom Miner Basin. Diagonal hatching indicates privately owned land (Map from 2015 Custer Gallatin National Forest Grazing Permit Information as provided by Kim Reid, personal communication, August 19, 2015). ***Map modified by James Horsley, including converting to grey-scales, names other than allotment designations, bison migration routes and location of hydrologic divide.***

But the above allotment population figures are misleading in terms of the number of cattle needing separation from bison dispersing north out of the park.

Instead of 522 cattle needing protection via separation activities (hazing and lethal removal) by the IBMP north of the park, only 186 actually need that protection. Here is why: Yankee Jim Canyon stops bison in their tracks. We have touched on this earlier, but let us look at it in more detail.

Only 186 cattle in allotments in Gardiner Basin

For bison, there are essentially two ways out of Gardiner Basin into Tom Miner Basin and Paradise Valley, according to Sam Sheppard, region three regional supervisor, Montana Wildlife, Fish & Parks. One is via the saddle between Dome Mountain and Red Mountain east of the Yellowstone River. That is reached by ascending Joe Brown Creek, a tributary of the Yellowstone River. Bison generally follow the Yellowstone River out of the park when heading north. But bison rarely take the route up the tributary Joe Brown Creek (Sam Sheppard, personal communication, August 25, 2015).

One bull tried in 2013. On the morning of Friday, April 12 a bull bison heading toward Joe Brown Creek wandered into a remote wildlife sanctuary called the Dome Mountain Wildlife Management Area. But this sanctuary is in Zone 3, designated by the IBMP as a killing zone for bison. As noted in an opinion piece in the *Bozeman Daily Chronicle* headed "Guest columnist: Bison management out of touch with reality," agents of the Montana Department of Livestock and the Montana Wildlife, Fish & Parks tracked him down and killed him in this refuge (Watermann, 2013).

Wild bison are not even safe in a wildlife refuge. Why? Because wild bison are not considered wildlife in the eyes of the Montana Department of Livestock and this department rules outside the park—as well as inside, for the Stephens Creek capture facility is located here.

Bison prefer to take paths of least resistance, according to a memorandum by the Montana Wildlife, Fish & Parks titled "Bison Habitat Evaluation East of the Yellowstone River from Dome Mountain to YNP." The memorandum states:

> Preferred bison habitat on the east side of the Yellowstone is determined largely by topography, elevation, and vegetation. Bison tend to use relatively low elevation habitat, typically using flat areas or rolling foothills dominated by sagebrush grassland vegetation. When available they will also use irrigated hay meadows, livestock pastures, and wet riparian sedge/grass areas. Bison habitat east of the river ranges from approximately 5,100' to 7,200' in elevation, with most of the heavily use areas occurring below 6,400'. Bison typically avoid using steep rocky terrain or densely timbered habitat for any length of time. They can of course pass through these areas, but are constantly looking for open paths of least resistance in moving from one preferred area to the next. Bison have no problems traveling along narrow corridors to avoid steep, rugged or timbered terrain.

In areas that bison have previously occupied, they are creatures of habit, using the same general routes to return as a social unit to preferred locations. However, when exploring new territory without a known destination, bison travel routes may be determined largely by terrain or topography. Without a relatively easy pathway, bison may easily “miss finding” suitable adjacent winter range areas such as those in Cedar and Slip and Slide Creek drainages. In both cases there are existing roads that may help lead bison into these areas.

The route of least resistance out of Gardiner Basin north is via Yankee Jim Canyon. The memorandum explains:

> The natural travel route for bison on both sides of the Yellowstone leads to Yankee Jim Canyon. Once there, bison can easily and quickly traverse the narrow canyon using the county road and the abandoned railroad right-of-way on the west side and Hwy 89 on the east side to enter Paradise Valley. When bison leave Yankee Jim Canyon they enter a huge area of biologically suitable bison winter range. However, in reality, for disease and private landownership reasons among others, wild bison are not currently allowed in this area (Lemke, 2006).

But bison today do not leave Yankee Jim Canyon, which sits on the hydrologic divide defined by the crest of mountains in that region. There are two cattle guards along the roads through the canyon, one on either side of the Yellowstone River. The highways down which the bison travel skirt the whitewater region of the river and are walled in by steep canyons and fencing, and are closed by gates in the winter. It is virtually impassable for bison.

However, the IBMP claims in its 2014 annual report that numerous bison *did* cross this hydrologic divide and entered Tom Miner Basin. The MDOL and MFWP annually document the dates and the number of bison that attempt to move north of Yankee Jim Canyon into Tom Miner basin or Paradise Valley. The agencies reported that for 2014:

> Bison crossed the hydrological divide and moved into Tom Miner basin on several occasions in early April. Four operations took place to return the bison to Zone 2 (Table [5]). This breach into Zone 3 seems to have been caused by dispersal of animals when the total abundance in the northern management area exceeded 450 to 500 animals (Figure [70]). The IBMP management agencies moderated the abundance to fewer than 500 animals and breaches of Zone 3 did not recur for the remainder of the management season.

Figure 69. YANKEE JIM CANYON, a bottleneck restricting bison passage into Paradise Valley, Montana. Notice cattle guard, cliffs and fencing to the right, and railing and the Yellowstone River gorge to the left. ***Photo courtesy of Buffalo Field Campaign.***

The following table and figure were provided to illustrate the actions:

Table 5. Bison moving north of Yankee Jim Canyon (Annual Report of the IBMP, 2014)

Date	Number	Type	Location	Hazing operation
4/3/2014	136	mixed bison	Tom Miner	Yes
4/4/2014	65	mixed bison	Tom Miner	Yes
4/5/2014	365	mixed bison	Tom Miner	Yes
4/7/2014	3	mixed bison	Tom Miner	Yes

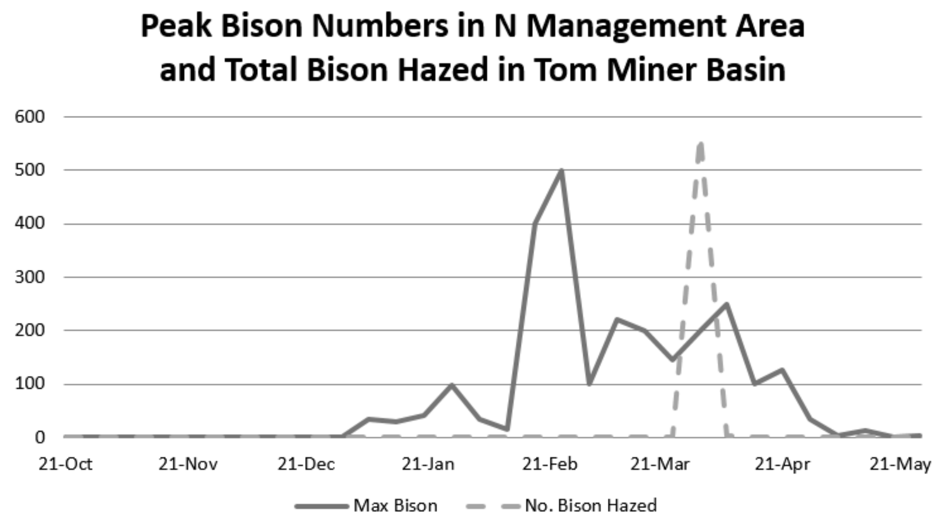

Figure 70. Bison in the N Management area and the Tom Miner basin during the 2013-2014 management season (Annual Report of the IBMP, 2014).

Curious about how all these bison got through Yankee Jim Canyon into Tom Minter Basin and what happened to them eventually, I emailed Sam Sheppard. On August 20, 2015 I wrote:

> As I recall, you said during our recent phone conversation that occasionally a bull will cross or attempt to cross the hydrological divide via Joe Brown Creek, travelling through the saddle there, but bison usually can not proceed beyond the cattle guards at Yankee Jim Canyon. In looking at the annual reports for the IBMP, I see this is confirmed by the 2013 report, which states that “The only report of bison attempting to exit Zone 2 was a single bull entering the Dome Mountain area near Yankee Jim Canyon. This bull was lethally removed on April 12, 2013.”

I then quoted the numerous breaches by bison into Zone 3 as delineated in IBMP’s 2014 annual report. I asked:

> How many bison actually crossed the hydrological divide and how many entered Tom Miner Basin or Paradise Valley? How did they get past the Yankee Jim Canyon cattle guards or did they go over the saddle at Joe Brown Creek? What happened to the bison that were hazed? Were they hazed eventually into the Stephens Creek capture facility? How many of the hazed bison were lethally removed?

He answered August 25:

> The bison left the Gardiner basin via the hydrological divide south and west of the highway (hence Tom Miner). The bison were hazed back into the Gardiner Basin. They were not hazed into the Stephen's Creek facility. None of these bison were lethally removed during these operations.

Still puzzled, on August 26 I wrote:

> It is still unclear to me if the bison crossed the cattle guards at Yankee Jim Canyon. If they did, how did they do this and how far from the guards did they get before they were hazed back? Was there snow over the guards? Can other wildlife traverse these guards, such as pronghorn antelope, bighorn sheep and elk?

He replied the same day:

> The bison did not cross the cattle guard. Other species such as antelope, sheep are able to get through the jack leg fencing. Also most antelope migration occurs prior to the gates adjacent to the cattle guard being closed for the winter season.

Technically speaking, the IBMP may be correct when it says bison entered Tom Miner Basin, for one could say Tom Miner Basin begins at the hydrologic divide. The cattle guards in Yankee Jim Canyon are in the region of the divide. Gardiner Basin is on the south side, Tom Miner Basin on the north side. Encroach into the region dividing the two basins and one can say as one proceeds north that Tom Miner Basin has been entered—even if one does not go beyond the cattle guards. Or the gates.

However, by reporting that bison have entered Tom Miner Basin, the IBMP is dissembling. Its members signatory to the annual report are behaving like the errant husband who calls his wife and says he is going to have to work late and is calling from “The Office.” He is correct. He is calling from “The Office,” but “The Office” is a bar.

White lies are still lies. All the whitewashing in the world will not make a lie the truth. The truth is, no bison entered Tom Miner Basin in 2014. Although the IBMP claimed it “moderated the abundance” of bison by its hazing, it was not separating bison travelling north in Gardiner Basin from cattle in Tom Miner Basin. No, instead it was the cattle guards, fencing and cliffs.

So, subtract 76 cow/calf pairs (152 cattle) in the Wigwam allotment, 81 cow/calf pairs (162 cattle) and the 22 yearling cattle in the Horse-Reeder Creek allotments, totaling 336 cattle, from the total needing protection from Yellowstone’s migrating bison and one gets the grand total of 186 cattle in allotments needing protection in the region north of the park.

1,319 cattle graze on private land along the northern border

The "2014 Annual Report of the Interagency Bison Management Plan" provides the following data for the number of cattle grazing on the northern and western borders of the park on private land. In Gardiner Basin, Tom Miner Basin and Paradise Valley there are (20 + 23 + 100 + 100 + 150 + 100 + 100 + 64) x 2 = 1,314. Five bulls plus 1,314 cows and calves = 1,319 cattle grazing on private land along the northern border. The data supporting this figure is summarized below (Annual report of the IBMP, 2014).

Table 6. 2014 Ownership and Turn-out dates for Northern Management Area*

Owner	**Zone**	**No. Cattle**	**Maxi-mum**	**Class**	**On-date**	**Off-date**
BH	GB	20/1		pairs/ bull	year-round	n/a
JT	GB	23		pairs	year-round	n/a
Grizzly Creek	3	100	250	pairs	May 21	Dec 31
Yellowstone Cattle Co	3	100	600	pairs	May 21	Dec 1
B-Bar	3	150	600	pairs	June 15	Nov 15
Anderson Ranch	3	100	160	pairs	June 15	Nov 15
West Creek Ranch	3	100	100	pairs	June 1	Nov 1
Bridger Cunningham	3	64/4	68	pairs/ bulls	July 5	Oct 6

**** All zone 3 producers are in Tom Miner Basin except Bridger Cunningham and West Creek Ranch, which are in Paradise Valley (Leslie Doely, Montana Department of Livestock, personal communication, September 15, 2015). GB is Gardiner Basin.***

Only 87 cattle are on private land in Gardiner Basin
In Gardiner Basin (denoted GB above) the total number of cattle grazing on private property is (20 + 23) x 2 = 86. One bull plus 86 cows and calves = 87. Since the cattle needing protection from wild Yellowstone bison are limited to Gardiner Basin due the restrictions at Yankee Jim Canyon—which prohibits movement into Tom Miner Basin and Paradise Valley—those cattle north of the Yankee Jim Canyon do not enter into the count, meaning that a total of only 87 cattle on private land need protection from intermingling with migrating wild bison.

All told, only 273 cattle need protection north of park
This gives makes a total of 186 cattle on allotments and 87 cattle on private land for a grand total of 273 cattle grazing on land in the Gardiner Basin, the total needing protection in the northern management area of the Yellowstone region. This is an infinitesimal amount of cattle compared to the total number in Montana.

140 cattle graze in allotments along the western border
The table and map below summarizes the details of each allotment's use and their locations.

Table 7. 2015 National Forest Allotments along the park's western border (Kim Reid, personal communication, August 19, 2015)

Allotment	Allotment Status	Acres	Permit Type	Permitted Numbers	Livestock
Grayling	Active	123	Livestock Use Permit	24	Horses
Moose	Active	23	Term	4	Horses
North Cinnamon	Active	1043	Livestock Use Permit	60	Horses
Sage Creek	Active	15552	Term	129	Horses
South Cinnamon	Active	1599	Livestock Use Permit	35	Horses
South Fork	Active	148	Term	15	Cow/Calf Pairs
Taylor Fork	Active	976	Livestock Use Permit	90	Horses

Watkins Creek	Active	3654	Term	55	Cow/Calf Pairs
Sheep Mile	Vacant	3500	N/A	N/A	N/A

As delineated in Table 7, in Hebgen Lake region there are eight active allotments in the Gallatin National Forest, the majority used for grazing horses. Total permitted number of cattle are (15 + 55) x 2 or 140 cattle grazing on allotments along the western border of the park.

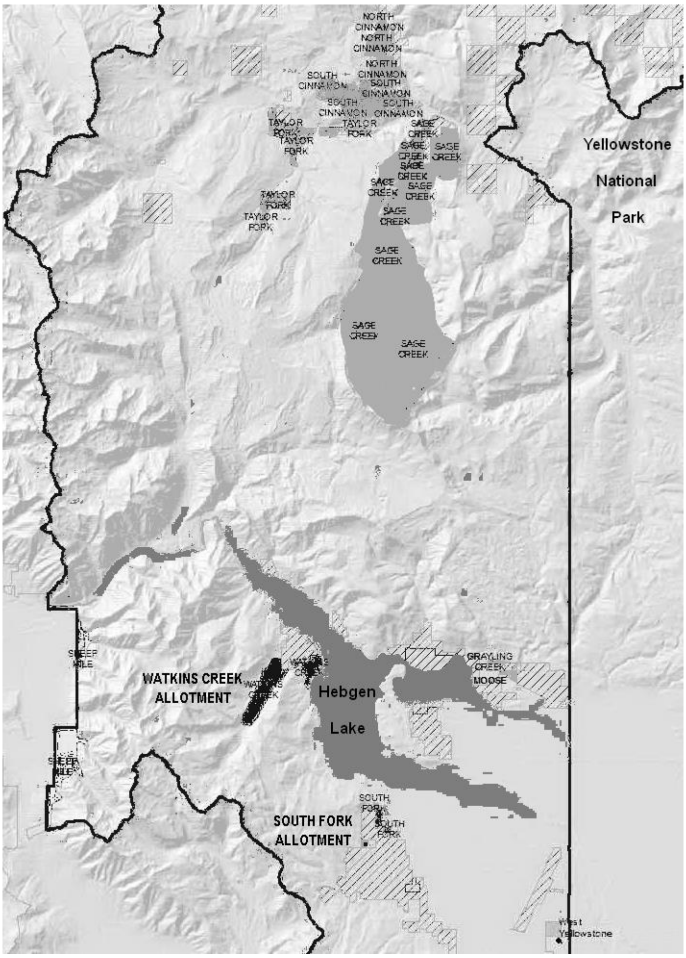

Figure 71. HEBGEN LAKE RANGER DISTRICT, Custer Gallatin National Forest, range allotments for 2015. Black areas are cattle allotments, lighter gray areas are horse allotments. Note the majority of land (acreage) is devoted to horse allotments. (Map from 2015 Custer Gallatin National Forest Grazing Permit Information as provided by Kim Reid, personal communication, August 20, 2015). ***Colored map modified by James Horsley, converting to grayscale and labeling cattle allotments.***

1,099 cattle graze on private land along the western border
Along the western border of the park in the Hebgen Lake region there are a total of 1,099 cattle grazing on private land. The data supporting this figure is summarized below.

Table 8. Ownership and Turn-out dates for the Western Management Area (Annual Report of the IBMP, 2014)

Property Owner	Livestock Owner	Zone	Date in	No. Cattle	Class	Date out
SR—Red Creek Ranch	BM—Reed Point, MT	2	Jun 20	200/4	Pairs/Bulls	Oct 9
PP—Deep Well Ranch	LM—Twin Bridges, MT	3	Jun 15	320/10	Pairs/Bulls	
LD—Quarter Circle JK	CC/BF—Cameron, MT	3	Jul 1	22/1	Pairs/Bulls	

The number of cattle on private land in the Hebgen Lake region total (200 + 320 + 22) x 2 = 1,084 plus 15 bulls, for a grand total of 1,099.

Breaking down the number of cattle north and west of the park, one gets the following summations:

For the north:

- 522 cattle graze in allotments along the northern border,
- 186 cattle are in allotments in Gardiner Basin north of park,
- 1,319 cattle graze on private land along the northern border.
- 87 cattle are on private land in Gardiner Basin north of the park.

Since bison can not go beyond Gardiner Basin because of the bottleneck and cattle guards at Yankee Jim Canon only

- 273 cattle, all told, need protection from migrating bison north of the park.

For the west:

- 140 cattle graze in allotments along western border,
- 1,099 cattle graze on private land along the western border.

Since there are no natural divisions separating bison from cattle in the Hebgen Lake region, other than Horse Butte, a peninsula that extends into Hebgen Lake on which there are no cattle,

- 1,239 cattle all told need protection from migrating bison west of the park.

This gives a grand total of

- 1,476 cattle needing protection from bison migrating north and west of the park, or roughly speaking 1,500 head of cattle.

Yet only bison migrating into Gardiner Basin have been culled in the past few years. In 2016, the IBMP planned to cull wild bison at the Stephens Creek capture facility in the north of the park between February 15 and the end of March (Reichard, 2016), but nowhere else. The other capture facilities west of the park at Horse Butte and Duck Creek are not in operation. How come?

For an answer, let's take a look at bison movements out of the park. Few bison migrate to Hebgen Basin during the winter because of its high elevation and often brutal winter conditions. Bison come to Hebgen Basin to calve in the spring and in the past were later hazed back into the park from that region. But as predicted and as we now know, they return by themselves without the need of hazing in late spring to forage on the high elevation meadows. Under new tolerance rules, in 2016 bison were allowed to occupy Horse Butte in Hebgen Basin year-round without being hazed back. On June 30, Stephanie Seay of Buffalo Field Campaign reported that "Just a small number of buffalo remain around Horse Butte, and they will likely join the others soon" (Seay, 2016).

Most bison return to the park from the west boundary area when green-up conditions in the Hayden Valley are just getting started. In 2014 a total of 450 bison entered Hebgen Basin and were hazed back into the park between May 12 and July 3. In the past, the timeframe for natural migration in the absence of hazing was difficult to identify because the agencies had hazed bison every year since the Adaptive Management Plan had been in place. However, an analysis of observations over the past 6 to 8 years was conducted and determined that the natural time for expecting 80 percent of the bison to migrate back eastward into the park is between May 24 and June 7. It appears that prediction was right.

On the other hand, herds of bison enter Gardiner Basin in the winter to escape the harsh winter conditions of the high plateaus and valley regions of the park. Unlike Hebgen Basin, Gardiner Basin is significantly lower in elevation. In 2015 few bison moved out of the park until early February. Throughout February, 40 to 50 bison were often observed north of the boundary, with a count of 281 observed on February 22. During the final week of March and through the first week of April, the number of bison in the Gardiner Basin reached a peak. On March 31 nearly 1,200 bison were observed there. On April 3 about 700 were observed north of the park boundary. By the end of the second week in April, the number had declined to less than half the peak abundance and by the end of the month there were less than 200 bison remaining in the basin (Annual Report of the IBMP, 2014, pp. 11, 12, 22).

We know that brucellosis is spread by bison to cattle when cattle come in contact with infected bison birthing materials. Epidemiologically, one might think that the optimum time to separate cattle from bison via culling would be in the spring when bison give birth. This would logically mean culling in Hebgen Basin during the spring. But this is not what is being done. As noted, instead of being culled, in the past bison here were usually hazed at this time back into the park after calving. Now those in Horse Butte are allowed to stay and return to the park on their own.

So, what is going on? A major objective of the IBMP is to keep wild bison inside Yellowstone National Park. Wild bison are programmed instinctually to head back to the park in late spring. Hazing in the spring is not necessary and is merely make-work. On the other hand, hazing bison in the winter back into the park is in opposition to their instinct to migrate out of the park to escape the harsh winter conditions of the higher elevations. So hazing has a lesser chance of successfully returning them to the park in the winter.

Because bison resist going back in the winter, shooting or capturing and shipping them to slaughter would be the logical alternative. But what time of the winter? Lethal removals in late winter would involve mothers that are pregnant and would not be popular with the public--nor would killing them in the early spring as they are giving birth or in the late spring as they are nursing their young. It has the potential of negative media coverage. Fall, early or mid-winter would thus be more tolerated by the public because this is hunting season. And that is just what is being presently done.

Now, Gardiner Basin has been chosen for culling because it is the most popular place for wild bison to go outside the park in the winter. The most convenient time to cull these wild animals would be at the time of winter when the deep snows force them out of the interior. This is when they have the highest "undistractibility," or as Dingle puts it, when a migrating animal "resists distraction because it is driven at that moment by an instinctive sense of something we humans find admirable: larger purpose." Because they are hell-bent on leaving the park as a group, this is the ideal time for the IBMP to operate. This is when the bison can most easily be herded en masse into the Stephens Creek capture facility. Since the goal is to reduce the herd to 3,000 head, this is the easiest way to do it—kill them in Gardiner Basin. And that is just what is being presently done.

But what is good public relations and what is most feasible is not necessarily good wildlife management nor epidemiologically or fiscally prudent.

The ridiculous rationale for the lethal removals is that bison are more likely to migrate when the population is above 3,000 head. The interagency government members want to kill bison entering Gardner Basin in the winter to prevent migration onto habitat used by cattle, where chance of contact in the winter with brucellosis-infected material is remote, but not cull bison that enter Hebgen Basin in the spring, allowing them temporarily on habitat used by cattle, where chance of contact with infected birthing material is highest and where the cattle population is over four times greater than in Gardiner Basin. Historically, all bison were hazed back into the park prior to shipment of cattle into Hebgen Basin.

However, as of 2016 tolerance has been increased in this area. During birthing season when brucellosis is spread, bison are now allowed year-round in a portion of Hebgen Basin, namely the peninsula called Horse Butte which juts into Hebgen Lake. They are not hazed back from here in part because no cattle now graze the peninsula. But bison still wander to areas just outside Horse Butte because, of course, they do not observe invisible borders. Bison are still subject to spring hazing outside Horse Butte to make way for cattle being shipped onto land that has the potential of containing the brucellosis-infected birthing materials of both bison (those that gave birth or aborted prior to hazing) and elk (that are not hazed).

Of what use then is hazing? It does not separate cattle from brucellosis shed by both bison and elk. Of what use is culling? Bison are still allowed to migrate in the spring—the winter culling at Gardiner Basin did not stop the spring migration—and inhabit regions where they, as well as elk, can shed brucellosis on land occupied by cattle.

Factually, the government is spending millions primarily to protect cattle in Gardiner Basin when they are not there, that is, in winter, when brucellosis can not be spread even if they were there because of the cold weather and because the disease is not shed then, since ungulates do not calve then, but allows the comingling of cattle with the shedding of brucellosis-infected birthing materials from elk and bison when cattle are there. In a nutshell, they kill bison in the winter ostensibly so they won't migrate in the spring and then allow over a thousand bison, along with elk, to migrate in the spring to spread *Brucella abortus* all over the place in calving season, each spring trucking hundreds of cattle to these freshly-contaminated sites.

Cost for protecting roughly 300 cattle in Gardiner Basin for those months they do not need protecting is $3 million annually, or about $10,000 a head.

Would one not think that IBMP members are in need of a crash course in remedial epidemiology?

Over time, brucellosis seroprevalence rates have increased in some Montana elk herds. More than 50 percent of the elk sampled from the Mill Creek area of

Paradise Valley tested positive for exposure to brucellosis, Montana Fish, Wildlife and Parks reported in February 2015 (French, 2015). That rate is similar to the rate historically occurring in the Yellowstone bison herd. While bison are aggressively managed, elk are not.

Is this disease management? Is there any epidemiological justification for this? Is there any fiscal justification? Is there any ecological justification? There is not. What we are witnessing is a public relations campaign by member agencies of the IBMP to justify one thing only: killing off wild bison.

Being that the disease-control efforts of the IBMP are a farce, an epidemiological charade, one can come to only one conclusion why this is going on: cattlemen want habitat, critical for the survival of wild bison, for their own profit, so wild bison must step aside, even though it puts that species at risk of extinction, even though it costs the public millions of dollars and even though it puts in jeopardy the brucellosis-free status of the remaining cattle in Montana by grazing livestock near a region that has and will always have brucellosis-infected wildlife, thereby promoting the spread of that disease state-wide and nation-wide.

The evidence points to this: The cattle industry, which profits off wildlife habitat, does not want the public to get a taste of what the New World was like before they took over and obliterated the wild bison from the landscape, no longer to be hunted by the general public except for a few token animals. They don't want a return to the Indian tribes' way of life, because then the hunters, rather than they themselves, would benefit from the habitat outside Yellowstone National Park. Instead of wild bison, the public is getting smoke and mirrors.

The bison shown in Figure 72 below were most likely killed because they occupied this grassland during the winter. In the background is the Roosevelt Arch at the park's north entrance near Gardiner, Montana. The top of the arch is inscribed with a quote from the Organic Act of 1872, the legislation which created Yellowstone. It reads "For the Benefit and Enjoyment of the People."

At the commemoration of the arch, Theodore Roosevelt praised "the Yellowstone Park" as "something absolutely unique in the world . . . Nowhere else in any civilized country is there to be found such a tract of veritable wonderland made accessible to all visitors, where at the same time not only the scenery of the wilderness, but the wild creatures of the Park are scrupulously preserved . . ." (Roosevelt Arch at Yellowstone's North Entrance, 2016).

In the next chapter, we will look more closely at the benefit-cost ration of IBMP's wild bison lethal removal program.

Figure 72. WILD BISON IN KILLING ZONE. Regardless of whether bison are on one side of the park's northern boundary (demarked by the stone arch in background) or on the other, when they migrate here to Gardiner Basin in the winter for survival, the IBMP has the authority to dispatch them and does so. Killing Zone 1 is inside the park, killing Zone 2 is just outside. *Photo from IBMP's 2015 Annual Report.*

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Is it worth the price?

Cost and national security are important factors in designating critical habitat for the protection of an endangered species. According to the Endangered Species Act , Section 4:

> The Secretary shall designate critical habitat, and make revisions thereto, under subsection (a)(3) on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security, and any other relevant impact, of specifying any particular area as critical habitat. The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species concerned (Endangered Species Act, Section 4, 2016).

The most critical of the habitats for wild bison historically and at present include those regions that extend out of the park down the Madison River to the west and down the Yellowstone River to the north, with Gardiner Basin and Hebgen Basin—where bison migrate in the fall, winter and spring—being most important to the survival of this species,.

Of these two habitats, the most critical is Gardiner Basin, a dispersal sink and the site of the Stephens Creek capture facility, which annually destroys a large percentage of migratory bison, putting in jeopardy their continued existence as a distinct population segment (DPS).

To have a critical habitat that has been used for survival by Yellowstone's wild bison for millennia the on-site location of their extermination center is an ecological travesty. It is economically wasteful and epidemiologically ineffective, threatening the national security as it promotes the wrong solution to the spread of brucellosis out of the park.

As will be argued, the benefits of including these two habitats as critical habitats outweigh the cost and risk of not doing so.

Let us begin with a rough cost/benefit analysis, looking at the benefits of keeping cattle in the Greater Yellowstone Ecosytem versus the costs.

According to information supplied in March 2006 by the US Forest Service and the Greater Yellowstone Coalition, the specific number of cattle being grazed in the western (Hebgen Lake) and northern (Gardiner Basin) Special Management Areas were 266 (four herds) and 0 in winter, respectively, and 677 (nine herds) and 686 (nine herds) in spring, respectively. This totals 1,629 head of cattle yearly on 9,360 ha in size in the northern SMA and 31,025 ha in the western SMA, amounting to a total of 40,385 ha (Kilpatrick, 2009). One hectare equals about 2.5 acres.

As noted in this petition, that number has dwindled during the intervening years. As of 2015, a total of about 1,500 cattle all told need protection from migrating bison north and west of the park.

Much of the SMA is not pasture. The state of Montana measures 38,083,807 hectares, meaning the dispute is over 0.1 percent of the state. But it is actually even less. If it takes about one hectare to graze one cow, then 1,500 cows need about 1,500 hectares. If the total SMA is about 40,000 hectares, then about 4 percent of that miniscule habitat (in comparison to the rest of the state) is being grazed by cattle.

Economics of running a cattle operation in an ecosystem

The Livestock Marketing Information Center projects returns over cash costs (including pasture rent) to be near $350/head for an "average" cow-calf operation in 2014. If realized, that would be sharply higher than the $123/head return in 2013 and the previous record high of $150/head in 2004. In 2013 an average profit of $160 per head for a cow-calf producer was predicted. Profit per head in 2012 was $48 and in 2011 was $75 (Darrell, 2014; Boetel, 2013).

If we take the average profit per head for the years 2011 ($75), 2012 ($48), 2013 ($123) and 2014 ($350), we get a four year average profit for a cow-calf producer of about $150 per head. Roughly speaking, this would mean an average annual profit of $225,000 on 1,500 head of cattle, the number grazing in the SMAs bordering the park. Let us round this figure off to $300,000 a year profit for the owners of up to 2,000 cattle in the area.

According to the US Government Accountability Office, the agencies comprising the IBMP are spending $3 million annually to manage wild bison migrating out of the park, with the major management task being to separate them from the cattle grazing on plots bordering the park (Yellowstone bison: Interagency plan and agencies' management need improvement to better address bison-cattle brucellosis controversy, 2008).

Is this havoc worth the price? Bison are a keystone species. A keystone species is one that has a disproportionately large effect on its environment relative to its abundance. Such species are described as playing a critical role in maintaining the structure of an ecological community, affecting many other organisms in an ecosystem and helping to determine the types and numbers of various other species in the community. But today they are being systematically barred from their historical range. How is this "adaptive management"? Probably the underlying meaning is that bison must adapt, or else.

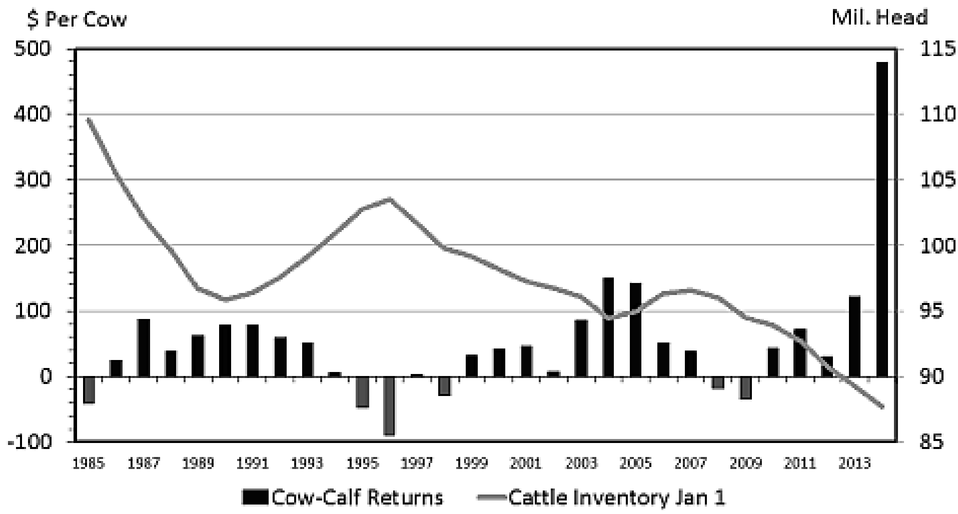


Figure 73. ANNUAL U.S. COW-CALF RETURNS AND CATTLE NUMBERS. Data source: USDA-AMS and USDA-NASS, compilation and analysis by Livestock Marketing Information Center. 07/16/14 (Mayo, 2014). Used by permission of the LMIC. *Note:* ***These are estimated returns over cash costs plus pasture rent, therefore they do not include all economic costs of production including owner labor, owner management, and return on investment (or depreciation) for breeding stock (cows and bulls), horses for ranching purposes, equipment like tractors and trucks, etc.***

All this ecological havoc for the sake of a few cows whose owners are determined they should graze on two bubbles of land, one north of the park, the other west.

Ask yourself this question. Does it make sense for the government to expend $3 million each year so that a few cow-calf producers can make a total annual profit of $300,000? Should it be a public responsibility to finance the choice of a business to operate in a high risk biohazadarous environment by underwriting the cost of doing business there, spending ten times the profit of that enterprise to protect it via publically-funded emergency responders (squad cars, snowmobiles, ATVs, horseback riders, helicopters, pickups and livestock trailers)? The figures cited are for example only. Profits in the cattle industry fluctuate dramatically. Some years are good and some years are bad. Given all the ups and downs in the cattle market, the average annual profit industry-wide is about at the break-even level due to the cyclical risks involved.

As Wes Ishmael in *Cattle Today Online* pointed out in 2003: “Thankfully, there will never be any marketing guarantees since reward necessitates risk.”

Ishmael noted:

> “The average cow/calf producer has made about $3.04 per head since 1980. On average high return producers realize about $65 per head higher profits than an average producer, while low return producers return about $54 per head lower profits than average,” says Cattle-Fax. “High return producers (low cost and high production) have been profitable most of the time over the past 20 years. Low return producers are likely eroding away the equity in their land” (Ishmael, 2003).

In the January 2014 *Farm Journal’s Beef Today*, Greg Henderson said, “Indeed, price and profit expectations are sky high for 2014. With tight supplies, analysts project record-high prices for every class of cattle, and average profits of nearly $300 per cow” (Henderson, 2014).

A portion of the financial risks involved is the cost of grazing land, which is measured in animal unit months or AUMs. An AUM is the unit of measure for livestock grazing and equates to forage needed to support one cow/calf pair for one month. The rate for an AUM in 2012 was only $1.35 for land rented the Bureau of Land Management. Private grazing land, on the other hand, was $16.80 per AUM in 2011. Grazing on BLM public lands accounts for 0.41 percent of the nation’s livestock receipts (Cole, 2013).

What a windfall if a cow-calf producer can get cheap land via government grazing allotments, as well as protection by the government from grazing competitors by means of emergency responders, who will provide free hazing and lethal removal services of wildlife ungulates that come onto that public land.

For a number of years following the formation of the IBMP, the government was charging grazing fees of $1.35 per AUM. This means the government was spending $3 million annually for the protection of commercial enterprises doing business on public land, yet charging grazing fees of $1.35 (AUM) x 4 (cattle graze here 4 months: mid-June to mid-October) x 2,000 (head of cattle) annually, for a total revenue of $10,800 per year.

The grazing fee for 2016 is $2.11 per AUM, as compared to the 2015 fee of $1.69 (Gorey, 2016). Grazing fees of $2.11 per AUM x 4 months x 1,500 head of cattle annually, amount to a total revenue of $12,660 per year

According to these calculations, the government is presently receiving in revenue about $13,000 a year for grazing fees, but collectively spending $3 million annually to protect privately-owned cattle grazing on federal public grazing allotments. Benefit: $13,000 a year. Cost: $3 million a year (for protective services only).

Add to these financial costs the ecological cost in wildlife: the proposed lethal removal for the winter of 2016-2017 of up to 1,500 wild bison for the supposed protection of 1,500 cattle and the lethal removal of predators that pose a threat to those cattle, predators that function to reduce the spread of disease among wild ungulates in the ecosystem. The benefit-cost ratio is exponentially in favor of wild bison, no matter how you look at it, for their existence in the ecosystem does not involve the costs of their protection.

What can we conclude from this? One thing is certain: something does not add up in this numbers game. No business should get such governmental favoritism. It is economically unfair to the American public, unjust and promotes risky ecological and financial choices. If a business does not have to pay for risks it takes, why should they bother to make prudent financial decisions? The government is not protecting the public from brucellosis; rather, it appears that it is using that protective ruse to shield its real purpose: protecting the cattle industry, and a few individuals in that industry, so that cattle can remain in the Greater Yellowstone Ecosystem at any cost.

Now let us do a rough risk/benefit analysis, looking at the benefits of keeping domestic animals, such as cattle, in the Greater Yellowstone Ecosytems, versus the risks.

The most obvious benefit is to the ranchers and the economy, which has been explored above. However, what are the risks of keeping cattle in the ecosystem as far as disease-control—the major reason for the lethal removal and hazing actions of bison by the IBMP?

Brucellosis has cost billions to eradicate nation-wide. According to APHIS:

> Brucellosis has caused devastating losses to farmers in the United States over the last century. It has cost the Federal Government, the States, and the livestock industry billions of dollars in direct losses and the cost of efforts to eliminate the disease.

The last reservoir of the disease is the Greater Yellowstone Ecosystem. APHIS states:

> As of March 1, 2002, 48 States have achieved brucellosis-free status with no known infection. The only known focus of Brucella abortus infection left in the nation is in bison and elk in the Greater Yellowstone Area (GYA). With respect to this area, APHIS is cooperating with State and Federal agencies to implement a bison management plan, in order to provide for a free ranging bison herd and to prevent exposure of cattle to potentially infected wildlife (Brucellosis and Yellowstone Bison, 2012).

However, as mentioned, brucellosis still remains a problem in the GYE despite years of effort and in fact is rising in the elk population. According to a U.S. Geological Survey study published in *Ecological Applications,* Paul Cross, USGS disease ecologist and lead author of the study, said:

> Elk-to-elk transmission of this disease may be increasing in new regions of the Greater Yellowstone Ecosystem, which remains the last reservoir for brucellosis in the United States . . .

The study noted that infected animals often abort pregnancies, and the presence of the disease within livestock results in additional testing requirements and trade restrictions statewide. Several cattle herds have been infected in Wyoming, Idaho, and Montana since 2004. Recent cases of brucellosis in cattle are thought to have come from elk due to the lack of contact between bison and cattle. According to the study:

> Biologists have known that brucellosis in parts of the ecosystem was sustained by abnormal densities and restricted winter distribution of elk that congregate on feeding grounds in Wyoming. Bison populations also independently maintain brucellosis irrespective of population size. The new research shows that brucellosis may also be increasing in some elk populations that are distant from supplemental feeding grounds and bison.

The authors note that some elk populations were 5 to 9 times larger in 2007 than they were in the 1970s, and tend to refuge for prolonged periods on lands with limited or no hunting, creating a situation similar to feeding grounds. Some elk groups are as large as those on the supplemental feeding grounds in Wyoming (Elk Brucellosis Infection may be increasing in the Greater Yellowstone Ecosystem, 2010).

By the IBMP targeting only wild bison for separation from cattle, wild bison have become a a straw man. IBMP members are addressing the brucellosis problem in the GYE by ignoring its presence in elk. And that is not a solution and by not facing the facts continues to promote risk of transmission.

Because cattle are domestic animals and are sold and shipped in and out of the region, they have the potential of not only contracting brucellosis from the wild ungulate population in the GYE, but also of transmitting the disease back into the park to its wildlife, as well as to cattle outside the park state-wide and nationally. This presents a significant disease transmission risk and can not be dealt with by hazing and lethally removing only bison.

Not only are cattle potential vectors of disease transmission to wildlife, but so are other livestock, such as domestic sheep.

Montana Fish, Wildlife and Parks reported December 15, 2014 that ten bighorn sheep had died of pneumonia near Gardiner, noting that at the time flocks of domestic sheep were in the area. While the cause of the outbreak is unknown, research has shown bacteria can be transmitted from healthy domestic sheep (or goats) to bighorn sheep, causing pneumonia in the wild sheep.

And what is the solution devised by the FWP? Instead of banning domestic sheep from the region of the park borders, FWP, a member of the IBMP, "within its scope of authority, works to ensure separation of domestic and wild sheep. This includes the lethal removal of any wild sheep known to have been in direct contact with a domestic sheep" (Pneumonia Detected in Gardiner Area Bighorn Sheep, 2014). More ecological havoc.

To allow domestic sheep near an ecosystem that contains wildlife susceptible to the diseases of domestic sheep makes no sense. A wildlife conservation agency such as the Montana Fish, Wildlife and Parks that goes about its job of protecting wildlife by participating in the killing of those species which it is responsible to protect, such as bison, wolves and bighorn sheep, while letting livestock grazing in the wildlife ecosystem off the hook, appears irresponsible. By having a policy of killing bighorn sheep, such as those in the Gardiner Basin, that come in contact with domestic sheep, the Montana FWP is simply killing the messenger. The message is this: do not allow grazing of livestock in a wildlife ecosystem for they cause harm to wildlife. The risk and cost of not facing the facts is enormous.

Land use plan needed

What is missing from the environs of the Greater Yellowstone Ecosystem is a land use plan. Questions must be asked and answered. For instance, what is the best way to make use of the animals and plants growing in this ecosystem, which includes Paradise Valley, Gardiner Basin and the Hebgen Lake region? One answer comes immediately to mind: it is by first satisfying the needs of local residents and secondly by meeting the needs of visitors.

This means that hunters should have access to private and public lands outside the park and adjacent to it. It means that ungulates should be allowed out of the park so that both local and out-of-area hunters could hunt those animals that inhabit the park, but migrate to regions outside the park. It means that the wild nature of these animals should be preserved so that they will migrate. It means that cattle and livestock should be kept out of the habitats bordering the park so that wildlife, such as bison, can migrate into these regions for the purpose of survival and for the purpose of providing access to them for hunting. It means finding ways to prosper by utilizing the wildlife resources so unique to this area, instead of depleting it. This perspective has been especially strong with regard to trout fishing, elk hunting and wolf watching. The same could be done with bison with regard to both viewing and hunting.

With regard to the value of the park economically and ecologically, a June 13, 2013 letter by Daniel N. Wenk, superintendent of Yellowstone National Park, to Jeff Hagener, director of Montana Fish, Wildlife & Parks, concerning proposed

Montana wolf hunting and trapping regulations, is instructive and relates to the entire arena of wildlife preservation, not just wolves.

Wenk said:

> As stated in your 2008 Strategic Plan, the mission of Montana Fish, Wildlife & Parks is to provide "for the stewardship of the fish, wildlife, parks, and recreational resources of Montana, while contributing to the quality of life for present and future generations." This is accomplished by providing "the leadership necessary to create a commitment in the hearts and minds of people to ensure that, in our second century, and in partnership with many others, we will sustain our diverse fish, wildlife and parks resources and the quality recreational opportunities that are essential to a high quality of life for Montanans and our guests."
>
> The State of Montana benefits directly from tourism and wildlife viewing in and around YNP. More than 3.4 million people visited YNP during 2012, and 50-90% of the visitors to YNP indicate the park was the primary reason for their trip to the area. A study by the University of Idaho in 2006 found that wildlife viewing is a primary motivation for tourism in YNP, with most visitors taking scenic drives and watching wildlife. According to a Michigan State University study, visitors spent more than $270 million within 150 miles of the park during 2006, which supported almost 5,000 jobs in the area and generated $336 million in sales, $133 million in labor income, and $201 million in value added (e.g., labor income, profits, rent, sales, and excise taxes) (Wenk, 2013).

Thus, the park contributes about $1 billion annually to the local economy.

With the main attractions being wildlife, it would make sense that wild species be protected from practices that have the potential of driving them to extinction as wild animals. At present the greatest threat to this end is the presence of livestock grazing within the ecosystem and on the borders of the park. Prudent adaptive management does not expose an ecosystem to such risks.

If wild bison were designated a candidate for listing, then such groups as the American Indian tribes, hunters, wildlife viewers, ranchers, wildlife biologists, and the various governmental agencies and conservation groups could sit down and decide collectively what would be the best use of the ecosystem in which they operate or visit.

But right now, the IBMP has a strangle hold on the ecosystem.

21

IBMP as Big Brother

How did the members of the Interagency Bison Management Plan get their almost unlimited power over Yellowstone's wild bison? Their most sweeping authority is the stipulation that allows the Interagency to kill all wild bison beyond the population target of 3,000 head. Let us look at this mandate more closely. That number was chosen because it was determined that when the bison population reached that level it triggered migration out of the park during severe winters (*Record of Decision*, 2000, pp. 26, 30). Regrettably, this population level has no correlation to the number needed to protect the wild bison's genetic diversity nor does it reflect sound disease control management. The fallout of this provision is that any bison that approaches the boundary of the park is a candidate for lethal removal when the herd reaches that magic number of 3,000, regardless of available habitat.

Cattlemen want cheap federal grazing land. Tragically, they are getting it via various statutes and agreements at the cost of a $3 million annual expenditure in public funds that allow government agencies to keep bison out of cattlemen's favorite Yellowstone grazing plots. According to the *Record of Decision:*

> The major federal laws that apply to federal agency actions in the Joint Management Plan are the National Park Service Organic Act and General Authorities Act, the Yellowstone Enabling Act, the National Forest Management Act, the Forest Service Organic Act, the Multiple-Use Sustained-Yield Act, the Federal Land Policy and Management Act, the Department of Agriculture Organic Act, the Animal Industry Act, the Animal Disease Control Cooperative Act, the Cattle Contagious Diseases Act, the Act of July 2, 1962, the Endangered Species Act, and the National Environmental Policy Act.

The *Record of Decision* further states:

> These statutes provide our agencies broad discretion to exercise our expertise to manage the lands, programs, and wildlife, as applicable, under our administrative authority in a manner deemed best to meet the purposes Congress has delineated.

In sum, what the interagency thinks is best in this realm is best, period. In implementing its management plan for Yellowstone bison, the IBMP claims its actions comply with the various laws, are based on the "best available scientific information" and are "ecologically sound." Further:

> They will provide for the conservation of bison in Yellowstone National Park and provide protection for the economic interest and viability of the livestock industry in the State of Montana.

On its face, this is an absurd claim, for if the intent is to "provide for the conservation of bison in Yellowstone National Park," it would not kill them in droves, and if the intent is to "provide protection for the economic interest and viability of the livestock industry in the State of Montana," cattle would not be exposed to the last environment in the United States that contains wildlife vectors of brucellosis. Simply put, if one is trying to protect livestock from a disease, one does not place them near it.

The *Record of Decision* states that the Forest Service has the responsibility of "providing habitat for wildlife and grazing allotments for cattle." But while the Forest Service provides habitat, it knows Montana dictates what is done with it. The *Record of Decision* states:

> The Forest Service recognizes that the State of Montana has primary management responsibilities for livestock disease and wildlife on national forest as well as private lands surrounding Yellowstone National Park.

The *Record of Decision* notes the following:

> When Congress created Yellowstone National Park in 1872, it set apart the area as a "public park or pleasuring ground for the benefit and enjoyment of the people." (16 USC 21) Congress also declared that the park would be under the "exclusive control" of the Secretary of the Interior. Congress charged the secretary with "providing for the preservation, from injury or spoliation…the natural curiosities, or wonders, within the park, and their retention in their natural condition." The secretary also must provide against the "wanton destruction of the fish and game found within the park." In 1894 Congress provided additional protection to wildlife within the park, largely in response

> to continued poaching of bison. In what is often referred to as the original Lacey Act, Congress prohibited within the boundaries of the park "all hunting, or the killing, wounding, or capturing at any time of any bird or wild animal, except dangerous animals, when it is necessary to prevent them from destroying human life or inflicting an injury."

Actions permitted

With those high-sounding objectives stated, the *Record of Decision* launches into "various actions" the IBMP can carry out "in Yellowstone National Park, the Gallatin National Forest, and private lands on the north and west boundaries of Yellowstone National Park . . . particularly with regard to managing bison on winter range outside Yellowstone National Park."

The primary objective of these various actions is "to address the risk of transmission of brucellosis," with the major tool to achieve this being "the spatial and temporal separation of bison from an affected herd and cattle."

What follows is a total capitulation to the cattle industry by the agencies responsible for the protection of wildlife. To achieve separation of cattle from "bison from an affected herd" (which is any bison from the park), bison are removed from the park, while cattle are allowed to graze just outside it.

Its method of doing so is simply stated: "The agencies will not allow bison to intermingle with cattle" (p. 10).

The prevalent actions to prohibit intermingling is killing bison in the winter that look like they might be headed toward the fringes of the park where cattle graze in the spring and summer, but are now absent, being it is winter. Absent is any mention of elk not being allowed to intermingle with cattle as a disease-prevention strategy—absent because elk are allowed to intermingle with cattle. If the objective is "to address the risk of transmission of brucellosis," does this unilateral effort make sense? No, but nothing has to make sense with the IBMP member agencies because they have the law that allows this on their side.

For those that escape the winter culling or migrate out of the park in the spring, the *Record of Decision* states:

> Additionally, in the spring the agencies will haze bison back into the park, at or near the time when bison historically can return to the park based on snow and weather conditions, or capture or shoot them if hazing is unsuccessful. The Joint Management Plan includes capture, test, and slaughter of seropositive bison at both the Reese Creek and West Yellowstone areas in steps one and two, and the use of hazing, capture, test and slaughter operations, or quarantine, if available, of all bison that might remain outside the park in these areas after specified haze-back dates.
>
> The agencies will control the risk of transmission to cattle outside the boundary areas by limiting the number of bison in the boundary areas through intensive monitoring and zone management. The agencies will increase the

> intensity of management as bison move toward the edges of management Zone 2 . . .

But what good is intensive management of bison in the winter when the disease is spread in the spring? What good is it when it does not stop migration in the spring and what good is it when elk are not intensively managed also?

Can anyone answer me? Anyone? The silence reminds me of the lyrics: “Ground Control to Major Tom. Your circuit's dead, there's something wrong. Can you hear me, Major Tom? Can you hear me, Major Tom? Can you hear me . . . ?”

In probing the archives of the IBMP, we hear some answers, but they are not good ones. Regarding the lack of managing elk for the disease brucellosis, the IBMP has this to say in its 2011 memorandum with regard to the significance of new information in complying with the original Final Environmental Impact Statement that formulated the mission of the IBMP:

> There have been several brucellosis infections to cattle from elk in the greater Yellowstone area during the past decade and the prevalence of the disease in elk has significantly increased in some areas. However, this new information does not change the analysis contained in the FEIS. The FEIS for the IBMP did “not analyze brucellosis in elk” per se (page x) because the stated purpose of the FEIS was to “. . . maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission . . .” by those bison to Montana cattle in the impact area (page 62). The FEIS acknowledged that elk carry brucellosis and detailed seroprevalence rates known at that time. However, the purpose of the FEIS has not changed and the existing analysis on risk of brucellosis transmission from bison to cattle is still valid.

The IBMP speaks with a forked tongue. This proves that the IBMP does not care first and foremost about the health of cattle. If it did it would be equally concerned about the potential of elk transmitting brucellosis to cattle. But it is not. Instead it justifies its continued focus on targeting the disease in bison only as “still valid.” Apparently, the IBMP interprets the purpose of the FEIS as dealing only with brucellosis containment in bison and if the disease exists in other species, so what? That attitude betrays its real mission: to do whatever it can to kill bison, even if it does not reduce the spread of the disease, since its transmission by elk is not also addressed.

The IBMP continues its self-justification, stating:

> The FEIS indicated that the separation of bison and cattle on public grazing allotments by 45 days should be adequate to eliminate the risk of cattle being exposed to viable Brucella bacteria (p. 189). New information indicates that 99% of all births, when bison are mostly likely to shed Brucella bacteria, are completed before June 1st. Also, new information indicates the persistence of

> Brucella bacteria shed in the environment during late pregnancy is probably limited to a few weeks. This information should allow the agencies to adjust the temporal separation between cattle and bison, given prevailing climatic conditions outside the park during the spring. Based on this information, the time periods for bison being outside the park could be modified by the joint agreement of the agencies pursuant to and consistent with the FEIS (page 23).

So, it appears (according to uncited new information) that possibly bison could stay a bit longer on the land prior to the cattle coming on site without increasing the risk of contracting brucellosis. Right? Wrong. Yes, possibly without cattle having an increased risk of contracting the disease from bison, but what about elk, whose calving season starts later? According to Brant A. Schumaker, Center for Animal Disease Modeling and Surveillance (CADMS), University of California, Davis, California, who co-authored a study titled "A Risk Analysis of Brucella abortus Transmission among Bison, Elk, and Cattle in the Northern Greater Yellowstone Area":

> The risk period for *B. abortus* transmission is well-defined. In general, data suggest that bison and elk in the northern portion of the GYA exhibit a high degree of birth synchrony, with the majority (80%) of bison calving during late-April to late-May and elk calving between mid-May to mid-June (Cheville et al., 1998; Berger and Cain, 1999). Feed ground data from the southern portion of the GYA in Wyoming have shown birth dates for elk that are later in the year, but parturition events are still unlikely after the third week of June due to the normal pattern of sexual segregation (Cross et al., 2009; Maichak et al., 2009). Including abortions in the last 90 days of pregnancy, late-January to mid-June is the most likely period for *B. abortus* transmission (Roffe et al., 2004) (Memorandum, 2011).

Newly-shed *Brucella abortus* bacteria can still be on the ground and viable up to the third week of June. Early turn-on dates for cattle in the northern and western GYE are May 21 and June 15 respectively, both within the window for elk calving.

But apparently, this does not count to the IBMP. Only brucellosis shed by bison count for our interagency biologists. "Don't confuse me with this elk stuff," the IBMP seems to be saying. "We are doing our job and that job is stopping the spread of brucellosis from bison." But even with this tunnel vision of disease-control (which ends up being no disease control), are they doing their self-proclaimed job of reducing the risk of brucellosis transmission from bison to cattle to zero by means of effective temporal and spatial separation?

The disease is managed within the perimeters of three geographical zones. Figure 74 below delineates the management zones in relationship to public grazing allotments and private grazing land as shown in the *Record of Decision.*

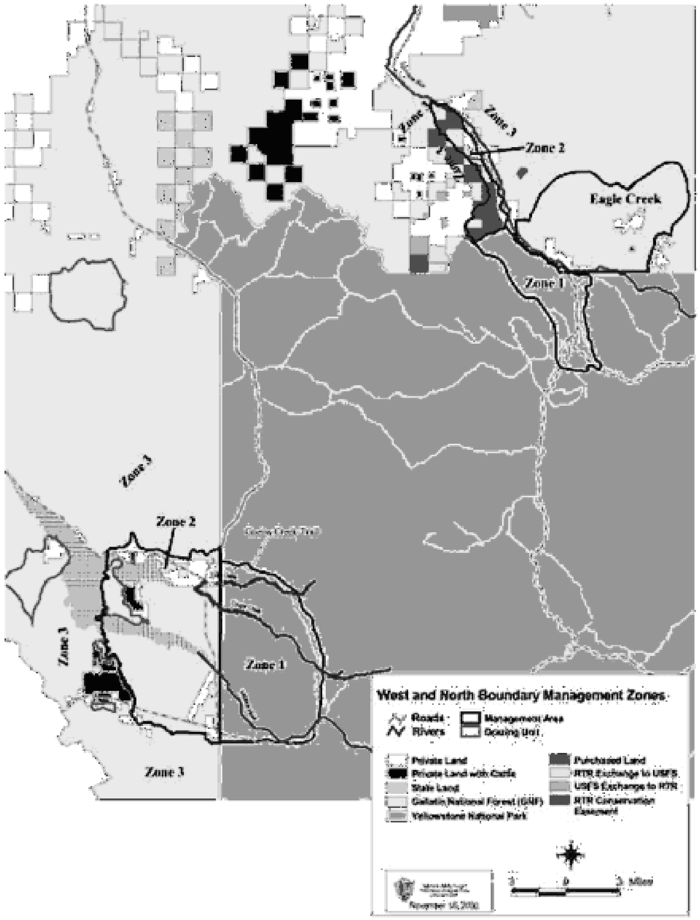


Figure 74. WEST AND NORTH BOUNDARY MANAGEMENT ZONES map in the *Record of Decision,* 2000, p. 7. Black denotes private land with cattle, most separated from Gardiner Basin by a mountain range. Dark gray indicates purchased land set aside for wildlife within Gardiner Basin.

The northern and western migratory habitats are divided into three zones. As mentioned, Zone 1 is on park property and comprises Gardiner Basin and Hebgen Basin, where lethal removal can commence and where "agencies will increase the intensity of management as bison move toward the edges of management Zone 2." Zone 2 is just outside the park and Zone 3 is anything outside Zones 1 and 2.

In Zone 1 "bison attempting to exit the Park may be subject to hazing, capture, testing and vaccination, or lethal removal" (*Record of Decision,* 2000, p. 30). Both Zone 1 and Zone 2 include the critical habitat of Gardiner Basin, for it straddles the boundary of the park.

"Attempting to exit the park" is signaled by what government agents perceive to be bison migrating. This terminology has allowed for the use of the Stephens Creek capture facility as a kind of death camp for bison in Gardiner Basin. It is within Zone 1 inside the park near its northern gateway where bison are captured and shipped to slaughter. This is in direct violation of the Congressional prohibitions for capture and destruction of wild animals in the park. But in the case of the IBMP, because these actions are court-approved, such exceptions to these prohibitions are allowed on park property in Zone l.

If these migrating wild bison somehow travel to Zone 2, the following happens:

> The agencies will use hazing, capture facilities, or shooting, if necessary, to prevent bison from leaving management Zone 2, enforce zone management, and ensure the removal of all bison from management Zone 2 in the spring, to maintain temporal separation as described in the Joint Management Plan, infra. The agencies also will defer cattle grazing on the Gallatin National Forest for the summer until after bison are hazed back into the park in the spring. Additionally, the agencies will use vaccination of bison and cattle to reduce risk even further and to work toward the eventual elimination of brucellosis in bison.

If a wild bison manages to survive the governmental gauntlet in its migratory progression through Zone 1 and Zone 2, and reaches Zone 3, it is all over: "Zone 3 is the area where bison that leave Zone 2 would be lethally removed" (*Record of Decision*, 2000, pp 8-11).

As noted, Zone 3 is any place outside the first two zones. By this edict, wild bison have been outlawed from migrating out of the park into Montana, yet incomprehensibly, when it comes to disease control, pardoned when the risk of disease transmission is the highest: spring. All for what? A pipedream?

The goal of "eventual elimination of brucellosis in bison" is, indeed, a pipedream and has been so recognized by biologists with the acquisition of data since 2000. Further, reaching that objective is surely not promoted by what amounts to "playing with fire" in disease control, that is, by bringing cattle onto land in the spring where potential disease-carrying wild ungulates have just calved or aborted. The *Record of Decision* discusses the number of days the disease is viable following separation of bison from cattle via hazing and lethal control:

.

> These actions will ensure that sufficient time (initially approximately 45 days or less depending on research results) passes so that the *B. abortus* bacteria are unlikely to have survived when cattle return to graze in the summer. Research in Wyoming on *B. abortus* Strain RB51 bacteria (used as a surrogate for field strain *B. abortus* in the research) and data on field strain *B. abortus* in Yellowstone National Park indicate the bacteria are highly unlikely to survive after an approximate 45-day period (or less depending on research results) due to heat, ultraviolet light, and a number of other factors. The release of untested bison outside the park (i.e., Step Three) in the Joint Management Plan, however, relies on research sufficient to allow the agencies to determine an

> adequate temporal separation period. The research would address the viability and persistence of the bacteria in environments to the west and north of the park. Such release also relies on the initiation of a vaccination program for bison in the park with a safe and effective vaccine and a safe and effective remote delivery system (Record of Decision, 2000, p. 11).

While bison are gone by the time cattle are allowed to graze outside the park, nevertheless, they are released to habitats that have been the site of multiple bison births, environments where birthing materials, including fetuses infected with *Brucella abortus*, are left behind. Bison are hazed off of Gardiner Basin May 1 and off Hebgen Basin May 15 (except for Horse Butte where they may remain year-round). In 2014 cattle came onto privately held land in Gardiner Basin between May 21 and July 15, while some graze year around (see Table 6), and onto Hebgen Basin between June 15 and July 5 (see Table 8).

If bison are off Gardiner Basin May 1 and cattle are on May 21, only 21 days of separation have elapsed, while if bison are off Hebgen Basin May 15 and cattle are on June 15, only a month of separation has elapsed.

So, based on these figures, who is kidding whom? In practice, cattle are sometimes brought onto grazing plots within the 45-day window specified as the maximum survival time for *Brucella abortus* in the field. Further, some cattle graze year-round in Gardiner Basin. In other words, cattle are placed or remain on these grazing sites while the brucellosis organism is still viable. This practice does not entail zero risk.

Moreover, a "safe and effective vaccine and a safe and effective remote delivery system" have proven infeasible, because even if one existed, successfully carrying out a vaccination program in the field is highly unlikely. According to the IBMP's 2015 annual report:

> However, high levels of uncertainty in implementing these management actions due to random variations in the number of bison accessible for capture or vaccination from year-to-year substantially reduced the probability of achieving goals compared to no action.

Further, such a vaccine is probably not necessary, given the actual low infectious levels of bison. The IBMP's 2015 annual report states:

> About 60% of adult females tested positive for previous exposure to brucellosis, but only 8-12% were infectious (2015 Annual Report of the Interagency Bison Management Plan, 2016).

The *Record of Decision* goes on, describing how female pregnant bison will be monitored by telemetry (which consists of electronic monitors vaginally attached) and that such bison could be removed if signals indicate they are about to give birth:

> As with the modified preferred alternative, the agencies will use radiotelemetry to monitor seronegative pregnant bison outside the park in steps one and two to evaluate the risk and develop appropriate mitigation measures if needed. While the agencies collect data, they also will use telemetry to provide an added measure of security in the event that any of these bison either abort or give birth outside the park. In steps one and two, the agencies could remove telemetered females giving birth to live calves or aborting fetuses outside the park.

What is described in the last sentence is repugnant. Removing, either by hazing or lethally, a mother in the act of giving birth or aborting, connotes an agency obsessed with control.

Figure 75. BISON MOTHER NURSING HER CALF in the spring. It is at this time that the IBMP hazes back into the park those bison that either escaped the winter lethal removals or migrated in the spring, severely disrupting the bison's calving season. A recent exception to the haze-back provision is Horse Butte in Hebgen Basin, where bison may remain year-round. *Photo courtesy Buffalo Field Campaign.*

With regard to Gardiner Basin specifically, which is included in the Northern Boundary Area, the *Record of Decision* states:

> NPS would continue to monitor bison from approximately November 1 to April 30 within YNP and use hazing within YNP to prevent bison movement north onto private and public lands in the Reese Creek area. If hazing is unsuccessful, the NPS will operate the Stephens Creek capture facility and capture all bison attempting to exit the Park in the area. The agencies will test all captured bison, send seropositives to slaughter, and temporarily hold up to 125 seronegative bison at the Stephens Creek capture facility. Vaccination eligible bison that are captured would be vaccinated with a safe vaccine. Once the capacity of the capture facility is reached, all additional bison attempting to exit YNP would be removed at the Stephens Creek facility (seropositive bison would be sent to slaughter and seronegative bison may be sent to a quarantine facility, if available, and, if not available may be sent to slaughter or be removed for jointly approved research. The seronegative bison held at the facility will not be retested and will be released to the Park in the spring. Bison outside the Park that cannot be hazed back into the Park and evade capture would be subject to lethal removal (p. 27).

Zone 2 here comprises a narrow corridor that includes Highway 89 and the Yellowstone River. Reese Creek is part of the northern boundary of the park just south of the town of Gardiner. It is not necessarily crossing the park boundaries that triggers the removal of bison, but their movement north while still on park land.

For the Hebgen Lake area, termed the Western Boundary Area, according to the *Record of Decision*:

> To ensure temporal separation [of bison from cattle] after May 15, the bison that agency personnel cannot haze or capture will be subject to lethal removal. The agencies also would manage all bison in the West Yellowstone area in zones, with progressively more intense management as bison move toward the edge of management Zone 2 (p. 12).

If the number of bison exceed 100 animals in the Hebgen Lake or Gardiner Basin region and/or if the bison population in the park exceeds 3,000 animals, then these levels can trigger management actions such as hazing, capturing or lethally removing them (pp. 26, 30).

In reality, the zones are essentially meaningless, merely providing a gloss of science and orderliness. In winter, the majority of bison that enter any zone are killed. It goes something like this: In the winter when a bison following the Yellowstone River north enters Zone 1 it is killed. When it enters Zone 2 it is really killed and when it enters Zone 3 it is really, really killed.

Hebgen Basin has the same zoning structure as Gardiner Basin, but in the last few years they have ceased lethal control and for Horse Butte, hazing.

Migrating bison traversing these zones in Gardiner Basin for forage in the winter and Hebgen Basin for calving in the spring, except for Horse Butte, in effect run a gauntlet through the very habitat that is essential for the survival of wild bison, and that is within or contiguous to the park. Only for this wild and migratory species are portions of the park and all of the national forests outside the park off-limits and zoned against them. America's national mammal is America's animal outlaw.

There is something Orwellian that emanates from the *Record of Decision*. Wild bison are owned by the public. They are not private property, but they are being dominated by commercial interests via the government. The *Record of Decision* exudes a totalitarian outlook, a certain "big brother is watching you" quality as described in George Orwell's novel *1984*, and embodies his fear that even such nations as the United States could fall under the control of "the intellectuals" who "are more totalitarian in outlook than the common people" and where "two and two could become five if the fuhrer wished it" (Orwell, 1944).

In the society that Orwell describes, every citizen is under constant surveillance by the authorities, mainly by telescreens. The people are constantly reminded of this by the phrase "Big Brother is watching you." However, in the nature of doublethink, this phrase is also intended to mean that Big Brother is a benevolent protector of all citizens (Big Brother [Nineteen Eighty-Four], 2015).

In the instance at hand, Big Brother is "protecting" the public from brucellosis and watching its property, the wild bison, by means of telemetry (vaginal implants) and government agents so as to control its property for them and, in so doing, driving the wild bison—this heritage of the American people—into extinction.

Church Universal and Triumphant lands

Adding to the surreal nature surrounding this issue is the government's purchase of land and easements from the Church Universal and Triumphant, a New Age religious organization which owns much of the land in Gardiner Basin under the name of Royal Teton Ranch. The church bought the property from publisher Malcolm Forbes in 1981.

The organization was founded in 1975 by Elizabeth Clare Prophet, who called on her followers in the late 1980s to prepare for a nuclear Armageddon, some members reportedly stockpiling weapons, food and clothing in underground bomb shelters on the property. She wrote several books, including "Reincarnation: The Missing Link in Christianity" (Grimes, 2009). In 1998 Prophet contracted Alzheimer's disease and died in 2009 at the age of 70.

In an effort to preserve Gardiner Basin, in 1999 the government spent $13 million to acquire a major portion of the 12,000-acre Royal Teton Ranch, giving the US Forest Service 9,300 acres. At the time the White House was quoted as saying that the acquisition would provide a critical winter range for Yellowstone bison, noting that in some years bison face starvation because of inadequate food supplies in the park. President Bill Clinton said:

> Permanently protecting these lands will help to ensure the survival of the bison and other herds that roam the wilds of Yellowstone (US buys Yellowstone land from cult, 1999).

The next year the Interagency Bison Management Plan was formed, designating Gardiner Basin, including the recently-purchased land, under the control of the interagency and dividing the basin into Zones 1, 2 and 3. Much of the purchased land was designated Zone 3, meaning that automatic lethal control would be exercised if any bison strayed into that zone, land intended to be set aside for wildlife, including bison.

The IBMP continued its culling program unabated despite the land purchase, in part because the church was grazing cattle on its remaining land and such cattle could become infected by bison entering the area.

In December 2008 several nonprofit and government parties negotiated a $3.3 million deal to lease private Royal Teton Ranch lands and have the owners of that land remove cattle from it under the terms of a 30-year contract. Yellowstone National Park pledged $1,500,000 for the 30-year lease, the State of Montana $300,000 with additional funding to be raised by Greater Yellowstone Coalition, National Wildlife Federation, and National Parks Conservation Association (Royal Teton Ranch Land Deals, 2015).

But even this effort has not curtailed culling by the IBMP because it has in place, via the *Record of Decision,* the authority to kill any bison that attempts to wander outside the park when the herd's population rises above 3,000 head. It has exercised this authority every year since the formation of the interagency group, culling as many as 1,729 animals in one year.

Government perspective of conflict

What does the government and other organizations sympathetic to the government have to say about this? A synopsis of the problem is found in *Brucellosis in Cattle, Bison, and Elk: Management Conflicts in a Society with Diverse Values*, written by P.C. Cross and M.R. Ebinger, U.S. Geological Survey; V. Patrek, Department of Ecology, Montana State University and R. Wallen, Yellowstone National Park.

It is a justification of wildlife harassment in the name of brucellosis control. Its conclusion that the management regime has been "highly effective" is an unscientifically-based claim and is in error. Rather, it has been a failure since the brucellosis eradication program has not reduced the prevalence of this disease in the park from day one and never will. The document states:

> Every year in late winter as the snow piles up in Yellowstone National Park (YNP), bison migrate to low elevation winter ranges outside the Park boundary where less snow makes foraging easier. Bison that migrate out of the park encounter a landscape where cattle ranching activities conflict with bison conservation near West Yellowstone and Gardiner, Montana. Once bison have

left YNP they enter the jurisdiction of Montana Fish Wildlife and Parks (MFWP) and the Montana Department of Livestock (MDOL), which have different constituencies and mandates. MFWP treats the animals as a game species, while the MDOL view them as threats to the livestock industry. To manage bison in the conflict zone, these agencies, along with YNP, the Gallatin National Forest and the U. S. Animal and Plant Health Inspection Service developed an Interagency Bison Management Plan (IBMP) in 2000.

> The intention of this plan is to "maintain a wild, free-ranging population of bison and to manage the risk of brucellosis transmission from bison to livestock in Montana." The plan is focused on making sure that bison and cattle are separated during the late winter and early spring when the transmission of brucellosis is most likely. The IBMP allows for some bison in designated management areas during portions of the year that risk of brucellosis transmission is low. The plan calls for more aggressive control and culling of the population as the risk increases. Managing for a population abundance of about 3000 bison was determined to minimize the risk of bison migrating beyond the park boundary and thus reduce the risk of brucellosis transmission from bison to cattle (Cheville, McCullough & Paulson 1998). To keep bison within designated management areas and to keep abundance in these areas within accepted limits the agencies use a variety of tactics (riders on horseback, snowmobiles, helicopters) to haze bison away from cattle occupied areas and, if necessary, use corral traps located in the Madison Valley and Gardiner Basin to capture bison and remove them from the population.

To sum up these paragraphs, separation of bison from cattle has been adopted as the solution to the twin goals of maintaining wild bison as migratory animals as well as controlling brucellosis transmission to cattle. However, while separation makes good scientific sense, the method of separation does not, for it involves violating the mandate not to capture or destroy wildlife within the park for the sake of profit, and clearly lethal removal via capture facilities on park property is such a violation, especially when one considers this is being done so that commercially-sold cattle can graze near the park. A domesticated animal species just outside the park has been ascribed the status of a sacred cow and is given priority over wildlife within a wildlife ecosystem. That does not make good sense. The Cross document continues:

> In 2008, 1729 bison were removed from Yellowstone through hunting and management actions, which was roughly 40 percent of the pre-winter population estimate. This was the largest removal in the history of YNP. Conservation groups vary in their approach and philosophy, but most objected to this level of removal and the way in which it occurred. Part of the controversy revolves around the appropriate use of public lands outside of

YNP. Some believe that bison, like other wildlife species, should be allowed access to public land, but this potentially brings them into close proximity with cattle herds. The extensive press coverage of bison management activities suggest that bison are a major risk of transmission to cattle. In fact, as is often mentioned by the press, there are no confirmed cases where bison have transmitted brucellosis to cattle in the wild. This is true, but not because bison are unable to transmit the disease to cattle, rather it is true because the current management practices of hazing, boundary quarantines, and removal effectively separate cattle and bison. The management regime is unpalatable to many conservation groups, but it is highly effective (Cross, 2010).

Highly effective? If what is meant here is that, *because of* the IBMP's lethal removal of bison from the cattle ranges near the park, *no transmission* of brucellosis between wild bison and cattle has occurred, then such a pat on the back is a delusional accolade that lacks scientific grounding. Correlating the findings of no brucellosis transmission between bison and cattle on common grazing land with the government's actions of lethal removal of cattle from those common areas is not necessarily a proof of causation.

For instance, look at the experiences of the neighboring state of Wyoming. In "Developing Sustainable Management Practices: Lessons from the Jackson Hole Bison Management Planning Process," Christina M. Cromley, Northern Rockies Conservation Cooperative, Yale School of Forestry and Environmental Studies, made the following observation:

It is important to learn not just from scientific studies, but also from history and experience. For example, the attempt to eradicate brucellosis from the Jackson herd failed in the 1960s because of an inadequate vaccination and possibly re-infection of bison by elk. Given no safe, effective vaccine and the continued infection of elk, attempts to eradicate brucellosis from bison would probably fail. Additionally, Jackson area ranchers have grazed cattle next to bison for decades without a brucellosis outbreak, and they claim that vaccinating cattle works effectively to prevent the spread of brucellosis. One resident stated, "A serious attempt should be made to better educate the states bordering Wyoming as to the high improbability of cattle cont[r]acting brucellosis from the bison and to inform them that killing a herd of bison that may not even have brucellosis will serve no purpose" (Steller 1995). Experiential data like this can be used to promote Wyoming's cattle as clean despite brucellosis in wildlife (Cromley, 2000).

The Jackson area ranchers could just as easily claim that their program of allowing bison to graze with cattle was "highly effective" in avoiding a brucellosis outbreak.

Pretty darn well?

In reality, just what has been the effect of these bison management practices and how has that effect been measured? Boundary culling has not contributed to a measurable reduction in brucellosis infection in the bison population. In fact, the proportion of seropositive adult female bison has increased slightly since 1985 or remained constant at about 60 percent (Hobbs et al. 2009).

Further, what about the herds' genetic health as wild animals? Recall what was said by Chuck Davis, endangered species litigation coordinator for the FWS, regarding my failed original petition to list the wild Yellowstone bison. He said "Quite frankly our herd continues to grow and it doesn't show any problems with breeding and things like that. In fact, the herd is doing pretty darn well."

But what does the FWS mean by saying the herd is doing "pretty darn well"? That the herd is growing? So do herds of domestic ungulates. That they are breeding? So do domestic ungulates. How is annually eliminating virtually all bison that exhibit the wild trait of migration promoting a herd that is doing "pretty darn well"? It turns out they really don't know what they are talking about. If they did, they would not be practicing artificial selection on wildlife. What is happening in Yellowstone National Park is the opposite of the evolutionary forces of natural selection and survival of the fittest that have molded life in the wild since the beginning of life. The so-called government protectors of park and ecosystem wildlife have an "in-your-face Darwin" attitude. They are taking the wild out of wild bison.

And they are doing "pretty darn well?" Welcome to the brave new world of wildlife preservation. We are watching ecological bankruptcy. We are withdrawing beyond its capacity to sustain what gives this region its value. This is especially true regarding the genetic diversity of wild bison, for the management practices of the IBMP favor the non-migratory bison by its policy of selectivity toward eliminating the migratory members of those herds.

By not permitting wild bison to inhabit their natural range, by barring them from their once traditional spring and winter habitat, the IBMP is forcing this species into two related forms of extinction. While the FWS findings concerning my initial petition claim that the wild bison are being managed satisfactorily because they are still demonstrating migratory behavior and are "abundant," and thus are not endangered or threatened with extinction, *by definition* the IBMP's very actions have already forced this species into two forms of extinction, namely, ecological extinction and local extinction, also known as extirpation.

Ecological extinction is defined as "the reduction of a species to such low abundance that, although it is still present in the community, it no longer interacts significantly with other species." Local extinction is characterized by "the disappearance of a species from part of its natural range." By restricting wild bison from Gardiner Basin during certain times of the year, as well as the Hebgen Lake region, the IBMP is causing their disappearance from part of their natural range (local extinction) and thus their ability to interact with other species in that excluded community (ecological extinction). Ecological extinction is functional extinction whereby a species, such as wild bison, does not significantly interact with other species in its environment where it was once common. It no longer counts there. Being absent, it no longer can interact as a competitor, symbiont, mutualist, or prey (Estes, 1989).

As one can readily see, these habitats are fractured and fragmented both spatially and temporally. Bison of course have no concept of zones or survey lines or numbers permitted on the floor. Such designations are confusing to even those that presume to manage them.

Recently, the interagencies appeared to be making attempts at being more bison-friendly. The 2013 Annual Report of the Interagency Bison Management Plan recorded the following action (YELL stands for Yellowstone National Park):

> Adopted—New tolerance area north of YELL: The IBMP Partners negotiated an area of increased tolerance for bison in mid-March 2011. The enlarged conservation area encompasses the north end of the Gardner Basin on both sides of the Yellowstone River, extending essentially to Yankee Jim Canyon (pp. 4, 5).

This region would be Zone 2 of the Gardiner Basin. But a few paragraphs later in the annual report it says this:

> Adopted—Support hazing of bison within Zone 2: Partners agreed to an AM [Adaptive Management] change to support hazing of bison within Zone 2 for the entire management area to reduce the opportunity for bison to exit the tolerance area.

What one hand gives, the other takes away. If bison are hazed when entering this newly-expanded tolerance area, it hardly can be termed a “new tolerance area.” If the intent of tolerance is to allow occupancy, but you do not want wild bison there in the first place and use hazing to “reduce the opportunity for bison to exit the tolerance area,” why bother with setting up a tolerance area? This is classic doublespeak. In questioning Sam Sheppard, Montana FWP, he explained:

> We support and in general do our best to avoid hazing. There are times however where it becomes necessary to move bison from private lands where they are not welcome or have overstayed their welcome due to property damage concerns. There are instances where we move bison in response to public safety concerns. Lastly there are times when bison move beyond the tolerance area and must either be brought back via hazing or they would have to be lethally removed.

What governs the IBMP's actions and adjustments to its original plan outlined in the 2000 *Record of Decision* is the concept of "adaptive management." Sheppard noted:

> We currently operate on an adaptive scale of management with regards to the areas and times of tolerance. We utilize counts to determine the total number of bison in the area, combine that with conditions on the ground including evaluating risks to property and public safety and manage accordingly (Sam Sheppard, Montana FWP, personal communication, October 3, 2016).

Key to understanding what is transpiring is the term "Adaptive Management" or AM. According to one definition adaptive management "is a structured, iterative process of robust decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring." This is a bit obscure.

Concerning the IBMP, adjustments or modifications of the plan governing management of Yellowstone's bison are "based on the adaptive management framework and principles outlined in the U.S. Department of Interior's Technical Guide on Adaptive Management" (2013 Annual Report of the Interagency Bison Management Plan, 2016).

According to the DOI's *Technical Guide on Adaptive Management:*

> Adaptive management is a systematic approach for improving resource management by learning from management outcomes.

This looks a lot like "learning from your mistakes." However, the DOI expounds:

> Contrary to this commonly held belief, adaptive management is much more than simply tracking and changing management direction in the face of failed policies, and, in fact, such a tactic could actually be maladaptive.

Instead, the DOI explains:

> An adaptive approach involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions. Adaptive management focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable resource systems.

To cut to the chase, as the DOI notes:

> But in essence, adaptive management will be seen to be learning by doing, and adapting based on what is learned.

As the DOI points out, complexities and conflict are involved in using adaptive management to manage resources:

> A context for resource management involves a decision making environment characterized by multiple (often competing) management objectives, constrained management authorities and capabilities, dynamic ecological and physical systems, and uncertain responses to management actions (Williams et al., 2007).

This kind of organizational environment would appear to be vulnerable to groupthink, especially when you consider there are two organizationally-competing objectives in the case of the IBMP: letting bison that have brucellosis roam, and protecting cattle from their roaming. It becomes especially daunting when the mandate does not include elk, the greatest vector of the disease the IBMP was designed to control. To make matters even more challenging is the overarching mission of all such ecological management efforts if IBMP goes by the book, that is by DOI's *Technical Guide on Adaptive Management*, namely "to create and maintain sustainable resource systems."

According to Merriam-Webster, a sustainable resource is one which is used or harvested in such a way that it is not depleted or permanently damaged.

The question then becomes: Are cattle in the Greater Yellowstone Ecosystem a sustainable resource? All the adaptive management one can bring to bear becomes maladaptive if the outcome is not sustainable. One can not adapt to a goal that is not achievable.

To get a better picture of how this all plays out in the field, let us take a look. Upon investigation, it gets "curiouser and curiouser," as Alice, growing taller and taller, said in *Alice in Wonderland*. Let us see what has been learned by doing, and what has been adapted based on what has been learned.

In 2011, modifications were made to the Interagency Bison Management Plan that specified bison were allowed on habitat on U.S. Forest Service and other lands north of the park boundary and south of Yankee Jim (essentially Gardiner Basin). On the other hand, bison were not allowed north of the hydrological divide (i.e., mountain ridge-tops) between Dome Mountain/Paradise Valley and the Gardiner Basin on the east side of the Yellowstone River, and Tom Miner basin and the Gardiner Basin on the west side of the Yellowstone River. "These adjustments were based on the adaptive management framework and principles outlined in the U.S. Department of Interior's 2007 technical guide on adaptive management," according to the IBMP (Adaptive Adjustments to the Interagency Bison Management Plan, 2011).

This expanded tolerance for bison was greeted with enthusiasm by a number of conservation groups, including the Natural Resources Defense Council, which wrote the following story April 13, 2011 headlined “Great News: Yellowstone's Bison Get More Room to Roam”:

> The furry beast of the plains can finally dance a little jig, and—for the first time in many decades—it can bust those moves north of Yellowstone National Park.
>
> Yesterday, the federal, state, and tribal agencies that collectively manage Yellowstone’s bison population signed an historic agreement that gives these iconic animals access to tens of thousands of acres of habitat north of the Park.
>
> An attorney for the Nez Perce Tribe in Idaho commented, “This is the most significant advance in recent times in tolerating bison outside Yellowstone.”
>
> Specifically, the Interagency Bison Management Plan agencies agreed to allow wild bison from the Park to roam the 75,000-acre Gardiner basin north of the Park during the winter and most of the spring. While bison will not be allowed to enter Paradise Valley north of the Yellowstone River’s Yankee Jim Canyon, they will have access to U.S. Forest Service habitat and other lands in the Gardiner basin.
>
> In modern times, this area has been off-limits to Yellowstone bison because of concerns related to the disease brucellosis, which some of Yellowstone’s bison carry. Brucellosis causes pregnant females to abort, and livestock producers fear wild bison may transmit the disease to domestic cattle.
>
> Thousands and thousands of wild bison from Yellowstone have been hazed or slaughtered in the past few decades in the name of brucellosis – and millions of taxpayer dollars have been spent along the way.
>
> But significant changes in recent years have forced all stakeholders to take a fresh look at the Yellowstone bison issue, which has been marred in conflict and controversy for too long.
>
> These changes include new science documenting the very low risk of a brucellosis transmission, land-use changes near the Park (e.g., fewer cows on the landscape), more tolerant landowners, the reality that elk also carry the disease but are allowed to roam freely, and, maybe most significantly, a radical overhaul last December of the brucellosis regulations by the Department of Agriculture (which lessened the burden of brucellosis on livestock producers (Skoglund, 2011).

But not everyone was a happy camper. Over 300 bison entered Gardiner Basin north of the park’s northern border, causing property damage and some calving close to cattle. Lawsuits were filed by the Park County Stockgrowers Association, Montana Farm Bureau Federation, and Park County, Montana to block implementation of the new policy and sought to require state officials to adhere to the original plans for bison hazing and slaughter.

A news release May 24, 2011 by the Montana Farm Bureau Federation headed "MT Farm Bureau Wants in on Bison Lawsuit" tells the story:

> The Montana Farm Bureau Federation (MFBF) has filed to intervene in a lawsuit on bison mismanagement in Park County. The lawsuit, Park County v. the State of Montana, Montana Fish, Wildlife and Parks and the Montana Department of Livestock, centers around the Adaptive Management Plan (AMP) that is part of the Interagency Bison Management Plan (IBMP). Montana Farm Bureau is opposing the change to the AMP.
>
> "We completely understand the frustration of Park County officials in dealing with this case," notes Sky Anderson, a Park County rancher and MFBF district director. "There was no public input to the plan change and no one was aware of it until there were hundreds of bison wandering the streets of Gardiner."
>
> Damage done to property by the large beasts includes destruction of fences, irrigation systems, satellite dishes, telephone boxes and buildings.
>
> "Under the Adaptive Management Plan, the government was to release 25 bison, see how that went, then release more the following year," explains MFBF Vice President of Governmental Relations John Youngberg. "This year there were approximately 320 bison outside of the park and they caused considerable damage. A major problem is little feed in the valley where they are released. Although the government touts 73,000 acres for these bison to roam, the majority of the ground is the same elevation as Yellowstone National Park; therefore, the valley has few open meadows for grazing and provides very little forage. The only good forage is on private land along the river in the bottom of the valley near cattle and homes."
>
> Because of the plan change, cattle in the valley are being exposed to bison at this critical time of year. The bison, which can carry the brucellosis disease, are now calving close to cattle. Intermingling of the bison with cattle is how brucellosis is spread. The disease causes abortion in bison and cattle, and can cause undulant fever in humans. According to federal rules, if a single cattle herd in a state that is free of brucellosis becomes infected with brucellosis, that herd must be destroyed and herds around it tested so the disease doesn't spread. There has been a tremendous amount of money already spent on this issue, and the discovery of brucellosis in a cattle herd can have dire economic consequences for the state.
>
> "Other threats we discuss in this lawsuit include not only property damage caused by bison, but how bison distract motorists trying to drive around them, the danger of having them close to bus stops with children, and

even risks to county law enforcement who generally are the ones trying to haze the bison away from a risky situation," noted Anderson. "Bison are aggressive animals and are a threat to humans, pets and property."

It is hoped by filing the lawsuit, the changes in AMP will be halted and bison management will once again be implemented as was agreed to originally instead of just letting the buffalo roam (MT Farm Bureau Wants in on Bison Lawsuit, 2011).

To correct perceived deficiencies of IBMP's new bison tolerance plan and to address the criticism that the public had not been allowed to comment on that plan, the Montana Department of Livestock and Montana Fish, Wildlife and Parks launched a review of the decision. In a July 23, 2012 news release headed "FWP, MDOL Announce Environmental Review of Year-Round Bison Tolerance," the FWP explained:

> The Montana Fish, Wildlife & Parks and Montana Department of Livestock today announced that the two agencies will be jointly conducting an environmental review of allowing some bison to inhabit lands adjacent to or near the border of Yellowstone National Park year-round. This scoping notice – the first step in the environmental review process – is intended to solicit public comment regarding the proposal.
>
> The proposed action is an adaptive change to the Interagency Bison Management Plan that would allow for year-round bison use in the following portions of the Gallatin National Forest: The Hebgen Basin, the Cabin Creek Recreation and Wildlife Management Unit, the Monument Mountain Unit of the Lee Metcalf Wilderness Area, the Upper Gallatin River corridor, and for year-round use by bull bison in the Gardiner Basin (FWP, MDOL Announce Environmental Review of Year-Round Bison Tolerance, 2012).

This issue eventually reached the Montana Supreme Court, which affirmed a decision of a lower court, allowing wild bison outside the northern boundary of park, upholding a joint decision of the Montana Department of Livestock and the Montana Fish, Wildlife and Parks, which provided at the state level for greater access by bison to Gardiner Basin.

In a March 12, 2014 news release headed "Montana Supreme Court Affirms Bison Can Roam: Rejects unreasonable demand to return to widespread buffalo slaughter," Earthjustice attorney Tim Preso, who defended the bison policy in the case on behalf of the Bear Creek Council, Greater Yellowstone Coalition and Natural Resources Defense Council, said:

> . . . now that the Court has rejected claims requiring bison to be slaughtered at the park's boundaries, we can move forward to secure space for wild bison outside of Yellowstone National Park (Richards, 2014).

In making the decision, Judge E. Wayne Phillips dismissed the petitioners' contention that since wildlife is owned by the state, the state must protect its citizens from harm caused by that wildlife. He stated:

> Montana's wildlife is owned by the State; however, no fundamental right is implicated by damage done to private property by the YNP bison. In Rathbone, the Montana Supreme Court eloquently addressed a similar matter in which elk were causing damage to an individual's property. The Court said:
>
>> Montana is one of the few areas in the nation where wild game abounds. It is regarded as one of the greatest of the state's natural resources, as well as the chief attraction for visitors. Wild game existed here long before the corning of man. One who acquires property in Montana does so with notice and knowledge of the presence of wild game and presumably is cognizant of its natural habits. Wild game does not possess the power to distinguish between fructus naturales and .fructus industriales, and cannot like domestic animals be controlled through an owner. Accordingly a property owner in this state must recognize the fact that there may be some injury to property or inconvenience from wild game for which there is no recourse (Petition for Declaratory and Injunctive Relief, 2016).

Oh, happy day for bison. Except for one thing. Bison are still on death row. It's the same old same old. The IBMP keeps on setting annual slaughter goals and the slaughters continue.

The IBMP recommended the lethal removal of up to 900 bison for 2014-2015, up to 1,000 animals for 2015-16 and up to 1,400 animals for 2016-2017, according to IBMP annual reports. The ante keeps being upped. So far, the IBMP members have not been able to meet their goals. According to the Montana Farm Bureau Federation, 230 bison were removed in 2010-2011, 33 in 2011-2012, 254 in 2012-2013, 654 in 2013-2014, and 739 in 2014-2015 (History of bison management in Yellowstone National Park, 2016).

How could this be after the Supreme Court's order concerning more tolerance? Because the court's decision did not order more tolerance, it *affirmed* the right of the IBMP to increase tolerance based on adaptive management procedures.

In an email query to Sam Sheppard, FWP, I asked:

> The Montana Supreme Court has allowed bison to roam into Gardiner Basin, but agency members of the IBMP are still hazing bison out of Gardiner Basin and back into the park. How is this possible?

He answered:

> The Montana Supreme Court has not made any determination or ruling regarding bison tolerance. The accurate information you seek is contained within the annual operating procedures and adaptive management changes of the IBMP (Sam Sheppard, personal communication, September 19, 2016).

As Judge Phillips wrote in his order:

> As a component of bison management, the State enacted the IBMP which provides the State the discretion to make changes through adaptive management.

In sum, based on adaptive management, that is, learning from experience and making decisions based on what it learns, the IBMP can increase or decrease the level of lethal removals as it pleases. In a broad sense, the judge was simply affirming the right of the IBMP to make decisions based on adaptive management principles. Based on those guidelines, if it wanted more tolerance, so be it. If it wanted less tolerance, so be it.

On July 23, 2012 the Montana Fish, Wildlife and Parks and the Montana Department of Livestock announced they were exploring the potential of year-round habitat for Yellowstone's bison. An environmental assessment (EA) was made by both agencies describing six alternatives, including a no-action alternative. The environmental assessment, which analyzed consequences of each option, was released for public comments.

Beyond the no-action alternative, five alternatives were based on recommendations made by the Yellowstone Bison Citizens Working Group in 2011. The citizens group was concerned that bison did not have enough habitat given current population levels. More habitat, the group reasoned, would allow for more fair-chase hunting as a population management tool, which was deemed more desirable than the expenditure of taxpayer dollars to haze, capture and slaughter migrating bison (Addendum to the Year-round Bison Habitat Draft Joint Environmental Assessment, 2014; FWP, MDOL Announce Environmental Review of Year-Round Bison Tolerance, 2012).

In January 2014 the Board of Livestock rejected the idea of expanded tolerance for bison, saying it wanted to wait until a completely revised Interagency Bison Management Plan was produced (Lundquist, 2014), not just an adjustment. This would be done through the writing of an Environmental Impact Statement (EIS), a document under environmental law required by the National Environmental Policy Act (NEPA) for certain actions "significantly affecting the quality of the human environment." An EIS is a tool for decision-making and involves gathering comments from the public concerning the outcome of proposed alternatives.

The board consists of seven members appointed by the governor with the consent of the senate. Each member must be a resident of the state and an active livestock producer (Montana Board of Livestock, 2016).

In November 2014, the MFWP and the MDOL reported in "Addendum to the Year-round Bison Habitat Draft Joint Environmental Assessment" that a final decision could not be reached between the agencies on which alternative to choose, and suggested an addendum that gave several alternatives involving various limits on population levels within the park before lethal action would commence.

The two agencies stated that they had "determined an environmental impact statement was not warranted because the agencies have proposed and described mitigations that would reduce the impacts to the human environment" and because impacts on the environment could be handled by "adaptive management adjustments" (Addendum to the Year-round Bison Habitat Draft Joint Environmental Assessment, 2014).

How the board is thinking about this issue is seen in its news release January 14, 2014 headed "Board of Livestock Backs No Action Alternative on Year-Round Bison EA":

> The Montana Board of Livestock has weighed in on a draft environmental analysis (EA) regarding year-round tolerance of bison outside of Yellowstone National Park by initially endorsing the no-action alternative (Alternative A).
>
> "We're keeping the door open, but the board unanimously believes there are unanswered questions that need to be resolved before we can do anything other than support the no action alternative," said board chair Jan French, a cattle industry representative from Hobson, after the board concluded its meeting earlier today.
>
> "Specifically, we'd like to see more information about bison population thresholds," she said. "Would more habitat mean more bison? We don't know, and with the park's bison population hovering at near-record highs, it just wouldn't be prudent to move forward without having more information on that and a few other topics" (Merritt, 2014)

March 16, 2015 the National Park Service and the State of Montana announced they were launching a complete revision of the Interagency Bison Management Plan via an Environmental Impact Statement, just as the Board of Livestock wanted (National Park Service and State of Montana Seek Public Input, 2015). A number of alternatives were given on which the public was invited to comment. The alternatives were essentially concerning the range of populations that would be allowed in the park prior to triggering hazing or lethal removals.

None of the alternatives provided for the banning of cattle. On June 15, 2016 I pointed out this glaring omission in my comment on the proposed revision of the IBMP (see chapter 32 "Comment on alternatives for revision of the IBMP"). In later checking a November, 2015 summation of the comments online (Yellowstone-area Bison Management Plan / Environmental Impact Statement Public Scoping Comment Analysis Report, 2015), I saw no such comment listed. I pointed this out to Sheppard in an email query. I asked:

> I did not see that my comment recommending banning or not allowing bison in the Greater Yellowstone Ecosystem was included in the November 2015 public scoping comment analysis report. Was it? If so, where is it in that online document? Also, was the public allowed to make comments on the other alternatives suggested by the public or will they be allowed to do so at a future date?

He answered October 3, 2016:

> The new EIS was scoped. We have received and compiled the comments. There was a great range of comments and opinions. I don't know if the "banning" was included. It is my understanding that all comments were taken and accounted for. As this process moves forward there will be additional public comment sought and welcomed (Sam Sheppard, personal communication, October 3, 2016).

On doing a subsequent word search for the term "ban," I did not find that word mentioned in the comment analysis report; however, I did find this comment report under "Preliminary Alternatives: Alternative 2: Minimize Human Intervention":

> Commenters expressed support for alternative 2 because it prioritizes bison conservation and manages bison as wildlife outside the park. Commenters also stated support for the population goal of 7,500 because it is based on biological carrying capacity.
>
> Commenters expressed support for alternative 2, but noted that it should do more to allow for a free-roaming wild bison herd. One commenter expressed concern about genetics and the potential for disease to wipe out the population. Another commenter suggested removing hazing from this alternative.
>
> Commenters expressed support for alternative 2 because it would include population management strategies such as hunting and natural processes. One commenter suggested that allowing citizens to hunt large herds of bison on public lands would create significant revenue for the state.

The last summation of comments was close to my comment and is put in italics:

> Commenters suggested that the National Park Service work with ranchers to reduce conflict. *One commenter suggested that ranchers should be*

> *compensated for reinforcing boundaries and allowing bison to roam and moving their cattle elsewhere.* Another commenter recommended that the National Park Service buy out the grazing allotments in the areas where bison roam (Yellowstone-area Bison Management Plan / Environmental Impact Statement Public Scoping Comment Analysis Report, 2015).

Until a new EIS is made, the status quo rules. Limiting the number of bison that can inhabit the park will continue if the public is not allowed an opportunity to comment on a critical alternative: removing cattle from the Greater Yellowstone Ecosystem.

As it stands now, the *Record of Decision* has granted agents of the National Park Service the legal authority inside the park to lethally control any bison that comes from a herd size that exceeds 3,000 animals, while outside the park that same authority is granted to the State of Montana. Hypothetically, all the habitat in the world could be acquired for wild bison to roam, but if the herd goes beyond the mandated abundance limit, bison are subject to culling. According to the *Record of Decision*:

> As an additional risk management measure, the agencies would maintain a population target for the whole herd of 3,000 bison. This is the number above which the NAS (1998) report indicates bison are most likely to respond to heavy snow or ice by attempting to migrate to the lower elevation lands outside the park in the western and northern boundary areas (*Record of Decision*, 2000. p. 20).

Conclusion: kill those bison that attempt to migrate. The purpose? Only one: so bison don't get near cattle. The *Record of Decision* states:

> Although it is true that environmental and other conditions in the analysis area are variable and other research suggests the population in the park would likely fluctuate between 1,700 and 3,500, the agencies are trying to balance factors such as natural regulation and maintaining ecosystem processes, which contribute to the wildness of the herd, with protection of Montana cattle from the risk of transmission. The agencies have adopted 3,000 as a spring population limit, maintained through culling of bison as they attempt to exit the park, to both maximize the effects of ecosystem processes inside the park and help keep relatively large-scale migrations from occurring. Additionally, the agencies recognize that severe winter weather conditions, including deep, crusted snow, can occur on bison winter ranges within the park. These conditions can force larger numbers of bison to lower elevation winter ranges outside the park (p. 52).

Despite the recognition that “natural regulation and maintaining ecosystem processes” “contribute to the wildness of the herd,” and despite the recognition that “severe winter weather conditions” “can occur on bison winter ranges within the park,” in carrying out the interagency goal of keeping the population at 3,000, these factors cease to have importance. IBMP is skilled at sounding like it has concerns for wild bison’s survivalist need to migrate, while at the same time making it impossible for them to migrate. To talk about an effort to “maximize the effects of ecosystem processes inside the park” is mere talk. Regardless of the rhetoric, wild bison’s winter migrations are diverted into capture facilities, where bison are then shipped to slaughter, putting in jeopardy their genetic diversity. Scientific jargon is being used to deceive. This is not science, but claptrap.

A snapshot of what the Interagency Bison Management Plan is doing is this: to eliminate brucellosis from the park, cull all bison above a park population of 3,000 that attempt to migrate out in the winter when cattle are absent and when brucellosis is not shed and then in the spring allow cattle onto habitat where bison have shed brucellosis via birthing materials during the calving season.

Big Brother is a little dense. Or just likes to kill wild bison and will manufacture any excuse to do so. And all for what? Let us look at the big picture. Does it make sense to put at stake the existence of wild bison as a species in the Greater Yellowstone Ecosystem—a herd of 4,000 to 5,000 genetically and ecologically rare wild animals that depend on a habitat outside the park to survive in the winter and give birth in the spring—for the sake of a few cows on the park’s border, yet at the expense of putting at risk the health of the rest of the cattle in Montana?

To help answer that question, below are two maps of the management areas of the IBMP, that is, the northern and the western regions just outside the park. Take a look at this pristine area, the home of a wide variety of wildlife, and note how few cattle are here in relationship to the total area. Why sacrifice such a national treasure for a few domestic animals that have trivial economic importance to Montana, and are, in fact, an economic drag to the state and to the nation when you consider all the protective services they need to survive in this biohazardous region, and because the presence of cattle near the park promotes the spread of brucellosis not only state-wide, but nationally also?

If adaptive management is based on learning from past experience, then the IBMP has learned one thing: how to con the public. If, indeed, it was learning from its 16 years of experience, it would have made adjustments that solved the problem. But it resists this with failed policy after failed policy. Brucellosis continues to emanate from the park.

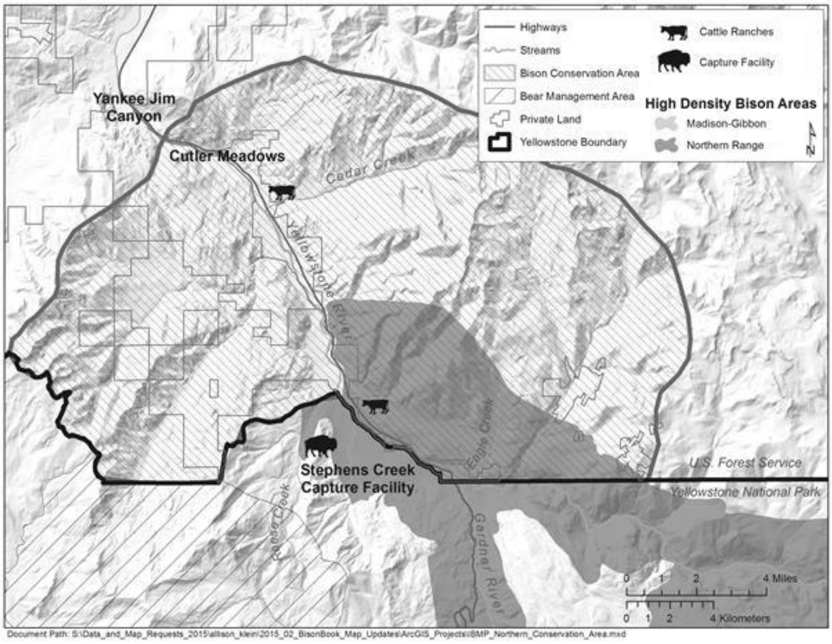


Figure 76. NORTHERN MANAGEMENT AREA for the Interagency Bison Management Plan as adjusted in 2012.

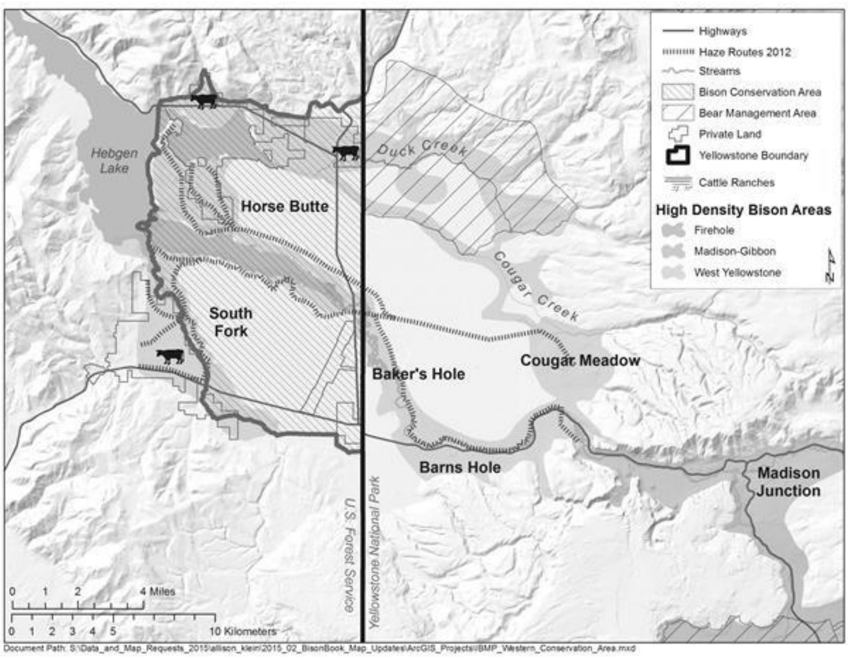


Figure 77. WESTERN MANAGEMENT AREA for the Interagency Bison Management Plan *(Images from the 2015 Annual Report of the Interagency Bison Management Plan).*

If the members of the IBMP were interested in the health of cattle and the cattle industry as well as the health of the Greater Yellowstone Ecosystem, one would think they would change their tune and see the wisdom of grazing cattle in disease-free regions.

The present EIS now being conducted by the National Park Service and the State of Montana should also provide an alternative for future comment: banning or removing cattle from the ecosystem, for only that would solve the problem of brucellosis transmission from both bison and elk. An expanded population range of up to 7,500, one of the most tolerant current alternatives, while keeping cattle in the ecosystem does nothing to address the problem of brucellosis transmission through mingling of diseased ungulates migrating out of the park.

Approximately 223 bison were harvested by public and tribal hunters during winter 2015. According to IBMP's 2015 annual report:

> Public hunters harvested 47 bison, including 29 in the Gardiner basin north of Yellowstone National Park (Hunting District 385) and 18 in the Hebgen basin west of the park (Hunting District 395). Tribal hunters harvested 176 bison in the Gardiner basin, including 142 by the Salish-Kootenai, 25 by the Nez Perce, 5 by the Shoshone-Bannock, and 4 by Confederated Umatilla tribes. The overall harvest removed 160 adult or yearling males, 35 adult or yearling females, 8 male calves, 13 female calves, and 7 bison of unreported age and sex.

Approximately 519 bison were captured at the Stephens Creek facility in the northern management area of Yellowstone National Park during January 14 through February 5, 2015.

According to the report:

> Specific capture dates were January 14-17, 23, and 30-31; and February 2-5. Many bison had either moved beyond the capture facility or were already outside the park on days when captures occurred (Table [9]). Also, many of the bison north of Stephens Creek had already returned to the park after being engaged by hunters close to the boundary. Seventy bison were harvested in the northern management area by January 22 and 145 bison were harvested by February 5.

According to the report:

> A total of 507 bison were shipped to processing facilities, including 347 by the Salish-Kootenai tribes, 138 by the InterTribal Buffalo Council, and 22 by the Eastern Shoshone tribe. Specific shipping dates were January 20-23, 26-28, and 30-31; and February 2-5, 11, and 18-20. All bison consigned to processing

were shipped within two days after testing for brucellosis exposure. Seven bison were transferred to the Animal and Plant Health Inspection Service for fertility control research. Four bison died during confinement (starvation; unknown cause) or processing (broken leg; capture myopathy), and one bison was released from the facility (2015 Annual Report of the Interagency Bison Management Plan, 2016).

The table below records the numbers of bison observed north of the Stephens Creek capture facility or outside Yellowstone National Park in the northern management area of Montana during winter of 2014-2015 by personnel from the National Park Service. Capture operations occurred over three weeks between January 14 and February 5, 2015 (indicated by bold font).

Table 9. Numbers of bison observed north of the Stephens Creek capture facility during winter of 2014-2015.

Date	Stephens Creek to Park Boundary	North of Park Boundary	Eagle Creek Management Area	Total
December 4	0	0	4	4
December 11	0	0	0	0
December 15	0	0	0	0
December 31	0	0	0	0
January 5	0	11	0	11
January 9	78	39	0	117
January 12	17	113	7	137
January 14	**105**	**24**	**0**	**129**
January 20	**53**	**2**	**21**	**76**
January 23	**25**	**0**	**0**	**25**
January 27	**50**	**1**	**11**	**62**
January 28	**20**	**0**	**11**	**31**
January 30	**37**	**2**	**10**	**49**
February 4	**0**	**1**	**0**	**1**
February 2	**25**	**77**	**0**	**102**
February 9	0	1	0	1
February 11	0	0	3	3
February 18	1	0	0	1
March 3	0	1	0	1
March 9	0	1	0	1
March 20	2	1	0	3
April 16	2	1	0	3

According to the table above, in the Gardiner Basin area 476 bison were observed during capture operations and another 283 before and after capture operations, for a total of 757 bison. In the Gardiner Basin area 223 bison were harvested by hunters and another 507 culled, for a total of 730 lethally removed, that is, 96 percent of the observed migratory herd in or near Gardiner Basin, the most critical winter habitat in the GYE for wild bison, a dispersal sink. However, not all of the observed bison are necessarily additive—some may be the same bison date to date. Thus, the number of migratory bison killed could be 100 percent.

What is the purpose of killing virtually every bison that enters the environs of Gardiner Basin? Answer: to keep bison from exiting the park in an attempt to achieve separation from cow-calf pairs shipped into the GYE for grazing in the spring.

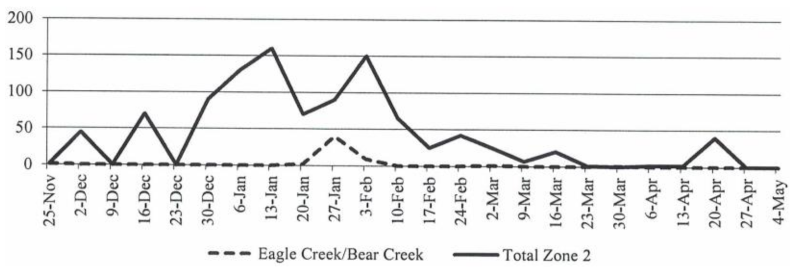


Figure 78. WINTER BISON MIGRATION in the Northern Management Area, including Gardiner Basin. The number of bison observed during 2014-2015 by Montana Department of Livestock personnel. ***Chart from the 2015 Annual Report of the Interagency Bison Management Plan.***

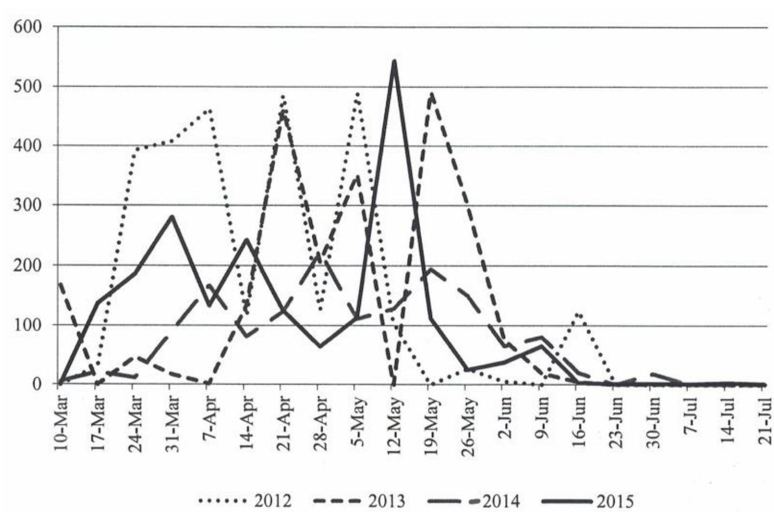


Figure 79. SPRING BISON MIGRATION in the West Management Area, including Hebgen Basin and Horse Butte. The number of bison observed during 2012-2015, according to the Montana Department of Livestock. ***Chart from the 2015 Annual Report of the Interagency Bison Management Plan.***

Graphically speaking, the ups and downs of observed bison abundance in the Gardiner Basin area, as shown above, was flat-lined at the level of zero by the lethal removal efforts of the IBMP in that basin by the end of winter.

If the point of killing bison in the winter when their numbers exceed the maximum allowed in the park (3,000)—that number based on the theory that at or below that number bison will not migrate in the spring when brucellosis shedding is the highest—then what validity does that theory possess and what does the culling achieve when migration continues in the spring? One diseased bison coming in contact with one cow can transmit brucellosis to that cow, who in turn can transmit the disease to the cattle herd to which she belongs. If the idea is to cull bison in the winter so they will not migrate in the spring, a look at the two charts above show the futility of such a program. Bison are sill migrating out of the park in significant numbers. If, after 16 years of doing the same thing (culling bison) to achieve the separation of bison from cattle to prevent the spread of brucellosis, if bison are still migrating and the disease is still being spread (by elk), what would adaptive management principles tell you? Apply what you have learned. Change tactics. Adapt.

To help the IBMP adapt through learning from experience, here are several questions it might ask with regard to the expenditure of $3 million annually on its program vis-a-vis controlling the spread of brucellosis from the park by wild ungulates to cattle grazing outside the park.

What would achieve the largest disease-control gain: killing or hazing only wild bison migrating into Gardiner Basin in the winter or removing cattle from Gardiner Basin and Hegben Basin? Consider these facts:

- Only a few head of cattle are year-round in Gardiner Basin and only a few hundred in the spring and summer;

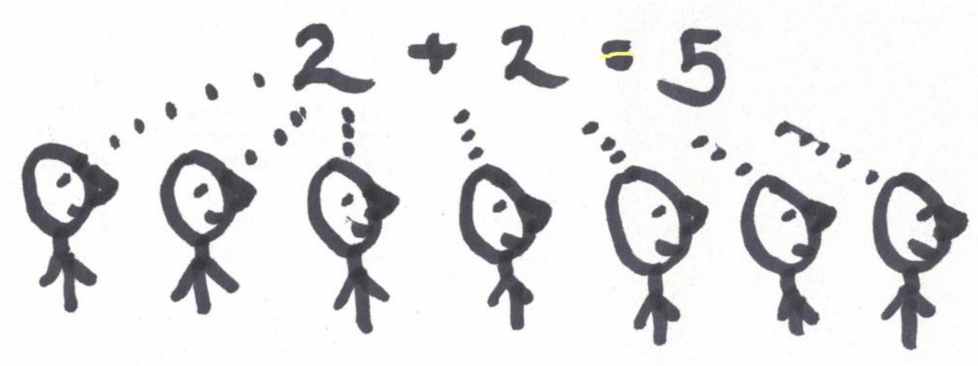
- Because of freezing temperatures, even if brucellosis is shed during the winter, which is rare, the probability of its transmission nears zero;

- Killing or hazing only bison does not stop the spread of brucellosis by elk;

Spring is the season when most abortions and discharge of birthing materials occur, the greatest site of spring migration presently is Hebgen Basin, and minimal hazing and no lethal removal program operates in Hebgen Basin.

Now ask this question. What would produce the greater profit, considering the fact that to keep cattle in the ecosystem $3 million must be spent annually to protect them:

- Remove bison from near the borders of the park, or remove cattle?



22

Groupthink

Groupthink is a psychological phenomenon that occurs within a group of people in which the desire for harmony or conformity in the group results in an irrational or dysfunctional decision-making outcome. Group members try to minimize conflict and reach a consensus decision without critical evaluation of alternative viewpoints by actively suppressing dissenting viewpoints, and by isolating themselves from outside influences (Groupthink, 2016).

To understand the farce that prevails in the GYE, we must look more deeply. We read stories like the following. Under the heading “Agreement to let bison roam Gardiner Basin finalized,” Carly Flandro, staff writer for the *Bozeman Daily Chronicle*, April 15, 2011 wrote about a plan developed by the FWS and the Montana DOL:

> For bison in the Gardiner Basin, tolerance is a new word.
>
> For years, the animals have been hazed, fenced, shot and sent to slaughter for migrating to the basin north of Yellowstone National Park.
>
> But on Thursday, an agreement was finalized that will allow bison to roam on the same land they’ve been pushed away from for decades.
>
> Nine signatures from tribal, state and federal representatives were needed to make the agreement valid. The InterTribal Buffalo Council was the last to sign the document Thursday evening.
>
> The agreement calls for installation of fences and bison guards at the southern end of Yankee Jim Canyon, and bison hunting on all public lands

> outside the park, and private land with permission, during the hunting season. However, the plan's biggest impacts won't likely be felt until next winter.

The head of the DOL praised the new plan, with Flandro reporting that:

> Christian Mackay, executive director of the Montana Department of Livestock, said the new agreement has "some very positive things about it for the livestock industry."
>
> For one, the fence and bison guards will help keep bison from leaving the Gardiner Basin and heading north toward Paradise Valley, Mackay said. There are more cattle herds in the Paradise Valley.
>
> Secondly, there will be zero tolerance for bison outside the new boundaries of the plan. That means if the animals leave the Gardiner Basin, they'll immediately be "removed lethally," Mackay said.
>
> "It's a no-second-chances plan, so there's no herd memory of getting out," he said.
>
> Mackay added that agency partners are still deciding whether all bison will be able to roam the basin, or if that will depend on whether the animals test positive for exposure to brucellosis (Flandro, 2011).

Then one reads that despite the fact that the FWP received almost 120,000 comments from the public in favor of the proposed expansion to open up the Gardiner Basin's Gallatin National Forest to migratory bison, as well as the expansion being endorsed by numerous wildlife groups,

> In January [2014], the Board of Livestock voted to conditionally reject any expanded tolerance for bison, sending it back to FWP and DOL for more specifics.
>
> After considering the compromise proposed in March, the board voted in May to indefinitely delay action on the assessment, saying it wanted to wait until the park produced a new Interagency Bison Management Plan. But the new plan will take three to four years to develop (Lundquist, 2014).

Then one reads the following, written August 1, 2014 by *Bozeman Daily Chronicle* reporter Lundquist, headed "Yellowstone proposes to eliminate more bison," concerning the targeting of those bison attempting to migrate into Gardiner Basin:

> On Wednesday during the Interagency Bison Management Plan meeting in Polson, Yellowstone National Park representatives recommended removing about 900 park bison this winter through both hunting and ship-to-slaughter . . .

> Yellowstone representatives said the higher cull rate was needed after the park's July census counted more than 4,800 bison in the park, almost the same as last year. They noted that the summer range is heavily cropped.
>
> Last year, after 640 bison were eliminated through hunting and trapping for slaughter, the park expected that winter-kill and predation would further reduce the population by around 450 animals. But the census showed the actual number of natural deaths was about half that.
>
> The park considered three scenarios that would remove 600 to 1,000 bison, half of which would be female. The removal of 900 is predicted to result in a population of about 3,700 bison by the end of the winter.
>
> The park predicted more than 400 could be eliminated through hunting with much of the rest going to slaughter.
>
> The livestock department and FWP concurred with the proposal, but tribal representatives from the CSKT [Confederated Salish Kootenai Tribes], Nez Perce and InterTribal Buffalo Council questioned the increase. (Lundquist, 2014).

Then you read online in "Bison Management" by the National Park Service, in its rationale for slaughtering migratory wild bison:

> . . . bison could rapidly fill available habitat, and if given the opportunity, attempt to migrate further during some winters, which will eventually bring them into areas (e.g., Paradise Valley) occupied by many hundreds of cattle. Without human intervention, some bison that spend winter north and west of Yellowstone National Park in Montana will not migrate back into the park during spring, but will attempt to expand their range into other areas with suitable habitat but currently no tolerance for bison (Bison Management, 2014).

And you read in its rationale for the need of the planned slaughter:

> The food-limited carrying capacity inside the park could be as high as 5,500 to 7,500 bison during winter . . . (Frequently Asked Questions: Bison Management, 2014).

On March 16, 2015 the National Park Service and the State of Montana (consisting of the Montana Department of Livestock and Montana Fish, Wildlife & Parks) announced that it was inviting public comments to help prepare an Environmental Impact Statement (EIS) for a new plan "to manage a wild and migratory population of Yellowstone-area bison, while minimizing the risk of brucellosis transmission between bison and livestock to the extent practicable."

Six alternatives were provided for the public to comment on, all essentially dealing with how many bison should be allowed in the park before commencing lethal removals or hazing when herds approach the park's borders. Maximum bison population to be allowed in the park ranged from 2,500 to 7,500.

As discussed more fully in the chapter 32 "Comment on alternatives for revision of the IBMP," glaringly absent was the alternative of managing cattle in the GYE by removing them from the perimeters so disease transmission would not be possible.

If one puts this line of thought together here is what one comes up with:

- that an agreement to let bison roam Gardiner Basin has been finalized,

- that the agreement calls for installation of fences and bison guards at the southern end of Yankee Jim Canyon,

- that the Montana DOL finds the plan to have some very positive things about it for the livestock industry,

- that despite massive public approval of the expanded tolerance for bison in the Gardiner Basin, as well as its support from numerous wildlife groups, the Montana Board of Livestock blocked its approval,

- that Yellowstone National Park representatives recommend lethally removing about 900 park bison that attempt to migrate into Gardiner Basin during the winter,

- that tribal representatives questioned this increased removal number, but were disregarded,

- that, while the NPS claimed "the summer range is heavily cropped," the "food-limited carrying capacity inside the park could be as high as 5,500 to 7,500 bison during winter" and that there are now in the park substantially fewer than this amount, namely 4,900 bison.

- that this is all supposedly necessary because even though Yankee Jim Canyon is an impassable bottleneck, bison might get through to Paradise Valley because some bison "will not migrate back into the park during spring, but will attempt to expand their range . . ."

- that the alternatives for the public to comment on to form the Environmental Impact Statement the Board of Livestock wanted for a revised Interagency Bison Management Plan were limited to choices only acceptable to the IBMP, thereby hampering the critical evaluation of alternative viewpoints by actively suppressing dissenting viewpoints.

And finally, with biologists warning about the deleterious effects of large-scale reductions of Yellowstone's bison population and with the IBMP formed to eliminate large-scale reductions, the IBMP is planning even greater large-scale reductions for the winter of 2016-2017.

Welcome to groupthink.

.

Groupthink

The one rational group appears to be the tribal representatives of the Interagency Bison Management Plan coalition who questioned the slaughter. Most likely what is going on within the IBMP is a form of "groupthink." Merriam-Webster's dictionary defines the term as "a pattern of thought characterized by self-deception, forced manufacture of consent, and conformity to group values and ethics." Input by tribal members is discounted.

Roland Bénabou in "Groupthink: Collective Delusions in Organizations and Markets" notes that

> . . . groupthink was strikingly documented in the official inquiries conducted on the Challenger and Columbia space shuttle disasters. It has also been invoked as a contributing factor in the failures of companies such as Enron and Worldcom, in some decisions relating to the second Iraq war, and most recently in the housing and mortgage-related financial crisis.

Benabou explains that:

> In the aftermath of corporate and public-policy disasters, it often emerges that participants fell prey to a collective form of overconfidence and willful blindness: mounting warning signals were systematically ignored or met with denial, evidence avoided, cast aside or selectively reinterpreted, dissenters discouraged and shunned. Market bubbles and manias exhibit the same pattern of investors acting "color-blind in a sea of red flags," followed by a crash (Benabou, 2009).

The term "collective delusion" may be defined as delusions of threats to society that spread rapidly through rumors and fear. Groupthink gets its fuel to influence others to do a group's bidding by the promotion of fear, such as has been the case in IBMP's utilization of the threat of the spread of brucellosis from bison to cattle, even though no transmission of the disease has been recorded as occurring in the field between bison and cattle.

If members of the IBMP were truly concerned with the chance of the spread of the disease due to cattle grazing in the proximity of the park that contains brucellosis-infected wildlife, it would not facilitate the grazing of cattle there. Prudence and economics would argue against grazing cattle next to one of the continent’s largest ecosystems, for brucellosis infection can place in jeopardy the brucellosis-free status of a state.

Further, the greatest vector of the disease in the GYE, elk, is disregarded.

No field studies have shown that the type of culling being employed by the IBMP is necessary, nor does it work to accomplish the goal of making the environment of the GYE safe for cattle.

Culling based on invalid assumptions has been historically exemplified by actions directed toward red deer, tahr and chamois in the New Zealand mountains, according to population ecologist G. Caughley in “Dynamics of large mammals and their relevance to culling.” For 50 years these animals were vigorously culled on the assumption that these lethal removal operations significantly slowed the rate of flooding and riverbed deposits in the lowlands. Research proved the assumption wrong.

This type of culling, guided by assumption and wishful thinking, is being conducted by the IBMP and its member agencies. According to Caughley such lethal removal of wildlife has been termed IDIOTIC culling, an acronym for

> “Inept Decisions, Ignorance Or Thoughtlessness, In Combination.” Here included are those operations that are unnecessary or counterproductive to their stated objectives, or those objectives themselves reflect invalid assumptions. Usually they take the form of indefinite culling to hold densities at economic carrying capacity under the misapprehension that this represents ecological carrying capacity (Caughley, 1983, p. 118).

The IBMP’s culling of wild bison is IDIOTIC, indeed.

23

The Martians are coming!

If you want to get the public to support a dubious position, give it something to fear. In Yellowstone National Park, the threat of *Brucella abortus* is that fear. Fear of that disease, and pointing the finger at bison, has enabled the continuation of program after program that does not work, but no one takes time to seek the truth. It is like yelling "The Martians are coming!" Everyone runs around hysterically, but without examining the facts.

What are those facts?

For the last several winters culling of wild bison has focused on that portion of the northern range—the Northern Special Management Area—called Gardiner Basin. It comprises a grassland extending beyond the park's northern boundary to Yankee Jim Canyon (see map, Figure 80 below). Notice that the entire grassland, both in and outside the park, is bisected by the northern boundary of the park. The grassland slopes downward toward the town of Gardiner, drained by the Lamar River and the Yellowstone, with the Gardiner Basin several thousand feet lower than the upper end of the range.

A limited number of bison are sometimes permitted into Gardiner Basin, which is inside as well as beyond the park borders. As noted, it is to this basin that wild bison attempt to migrate to find forage during winter as the snow piles up inside the park, and where wolves also congregate. The basin is also habitat for spring calving. Wild species obviously cannot tell where the park's boundary begins or ends, but merely occupy this grassland in response to environmental conditions, not the rules of men. They of course should not be expected to comply with invisible demarcations.

This is the major migratory corridor out of the high altitude regions of the park. Bison have migrated here since prehistoric times. But, as mentioned, there are also a number of cows here, grazing on privately-held or low-rent federal land adjacent to the park, all within a national forest environment.

Yellowstone pronghorn also migrate through here, travelling a route out of the park similar to the historical bison migration route, following the Yellowstone River in winter to the lower elevations of Paradise Valley. Over the past 80 years, habitat fragmentation has truncated the migration, and now most of the 200 Yellowstone pronghorn are forced to stop in Gardiner Basin, restricted by barbed wire fences. Because pronghorn are reluctant to jump these traditional cattle barriers, the fencing is a major impediment to their movement. Conservationists are working with rangers to make more pronghorn-friendly fences by removing the lower strand so they can crawl under that barrier.

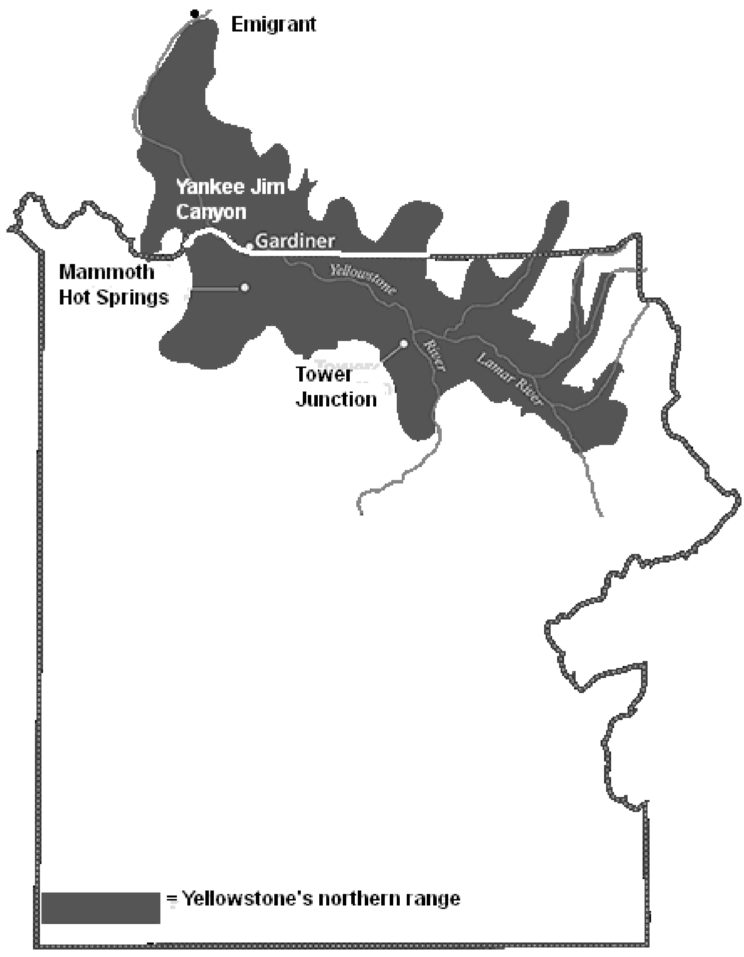


Figure 80. YELLOWSTONE’S NORTHERN GRASSLAND is the winter range for numerous ungulates. It includes Lamar Valley, Gardiner Basin (ending north at Yankee Jim Canyon) and portions of Paradise Valley. Its northern border is Emigrant (Savage, 2010; Cycles and Processes, 2015; Ecological dynamics on Yellowstone's northern range, 2002). The rangeland is bisected by the park’s north boundary. Bison that attempt to go beyond may be lethally removed by government agents.

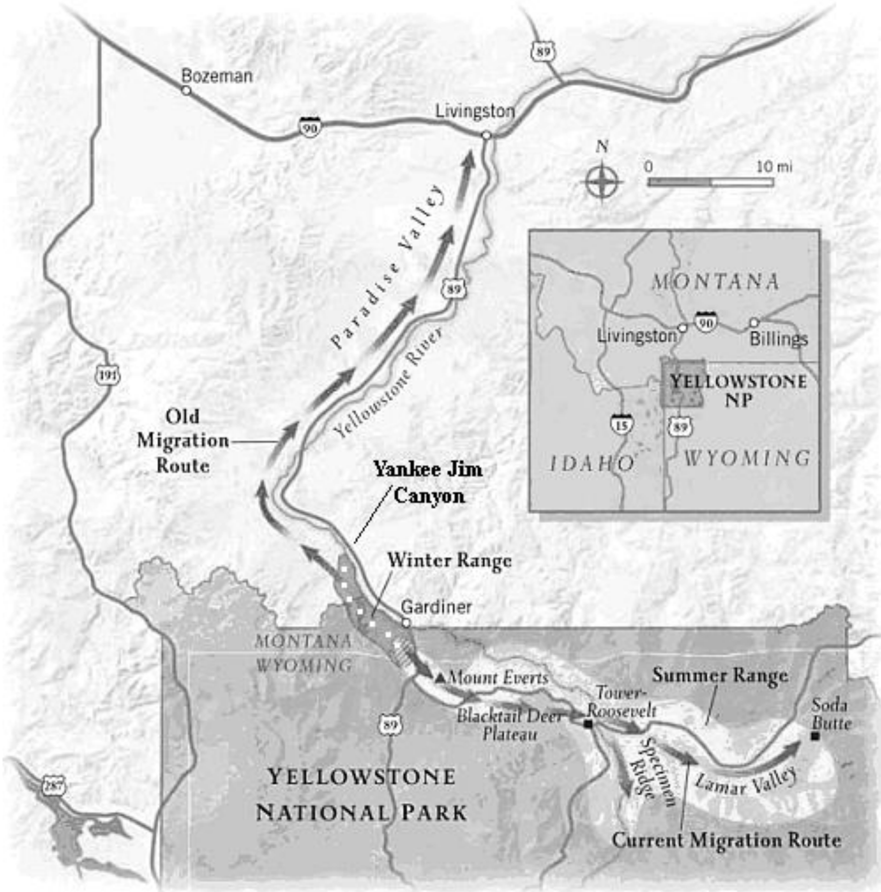


Figure 81. HISTORICAL YELLOWSTONE PRONGHORN MIGRATION was similar to the historical altitudinal migration of Yellowstone bison. Now this pronghorn herd's winter habitat is restricted to Gardiner Basin (dotted shaded area) (Porco, 2011).

Elk continue to exhibit a migratory pattern similar to the historical routes of both bison and pronghorn

This grassland north of the park has been a focus for bison harvesting historically. C. Cormack Gates documented its importance to both bison and Native Americans in *The Ecology of Bison Movements and Distribution in and Beyond Yellowstone National Park: A Critical Review with Implications for Winter Use and Transboundary Population Management*. He said (citations omitted):

> The Lamar Valley and the Yellowstone River Valley north of the park to Livingston and beyond was an important area for bison and Native peoples throughout the Holocene. This system can be considered the original Northern Range for Yellowstone bison, functioning as an ecological continuum of

> grasslands that likely supported seasonal migrations by bison as far south as the high elevation ranges in the Upper Lamar Valley. Davis and Zeier described the lower Yellowstone Valley as an exceptional area for Native people to gather, drive and kill bison. Eight bison jumps and three kill sites have been documented south of Livingston. The closest jump site to YNP is 25 km north of the park boundary. It was used during the late prehistoric period between 1,700 and 200 b.p. There is evidence of a human use corridor from the Gallatin and Madison River drainages into the interior Yellowstone National Park. Several major bison kill sites are located in the Gallatin Valley outside of Bozeman, Montana.

This grassland, part of the Buffalo Commons mentioned in the introduction, is thought to have been in continuous use by both bison and Native Americans for 10,000 years. Gates continues:

> Although the exact nature of early historic period bison movements is a matter of conjecture, inferences can be drawn from knowledge of contemporary movement patterns and archaeological evidence. Mary Meagher inferred that prehistorically, during the spring and early summer, bison would have moved into YNP following advancing plant phenology. Depending on snow conditions in the park, most would have moved out to lower elevation ranges during the fall and early winter. However, Meagher provided evidence that some bison wintered in the park in the Lamar, Pelican and Hayden Valleys.
>
> What is now considered the Northern Range used to extend from the Upper Lamar Valley to Livingston, Montana and beyond. This larger area is considered the prehistoric annual range of northern herd, occupied continuously by bison for ca. 10,000 years. There are a dozen or so buffalo jumps documented between Yellowstone and Livingston, indicating the Yellowstone and Lamar Valleys were important for both bison and the original human occupants of the region (Gates, 2005).

Potential outcome of the scheduled culling

A new version of a bison jump site is now located on park property that is vastly more effective than the old ones, compliments of the government, specifically IBMP. It is the Stephens Creek capture facility. While the culling currently going on there has been described as "random," this is not so. Not only is it limited to the migratory bison, but the incidence of culling most likely will fall disproportionally on the central herd. Contrary to what the IBMP originally expected at the inception of the plan, after more than a decade of field studies, "findings based on radio-collared bison suggest that the vast majority of bison culled at both the northern and western boundary areas during 1995-2006 came from the central herd" (Garrott, 2009, p. 273).

Aerial surveys the summer of 2014 by Yellowstone National Park counted 3,500 bison in the northern herd, 1,400 in the central herd and a total of 740 calves (Yellowstone Releases Summer 2014 Bison Population Estimate, 2014). If one were to consider the term "vast majority" to mean 90 percent, then about 800 bison from the central herd could be expected to be culled the winter of 2015 under the proposed goals at that time. With a total of 1,400 animals in the central herd, this scheduled lethal removal action would reduce the herd by 60 percent, which would decimate the herd, leaving 600 surviving bison in that herd. As it turned out, about 740 bison were culled, with the potential of reducing the number in the central herd proportionally. However, the government does not routinely keep track of which animals come from which herd, so the impact of this blind culling on specific herds is not known. Groupthinking does not evaluate when evaluation does not promote its agenda.

For those bison that escape culling by remaining within the park, additional mortality can be expected due to winterkill and starvation. Aerial counts have shown that the decrease due to winter mortality in animals older than calves can be 15-20 percent (Meagher, 1971, updated 2005). Further, winter mortality for calves can exceed 50 percent by the end of the second year (Meyer, 1995).

Due to government action and winter mortality, bison central herd numbers could plummet, forever erasing by artificial methods genetic diversity and the learned behavior of herd leaders. Sooner or later this can end in herd collapse.

In 2015, bison were culled without regard to genetics, disease status, age, sex or herd membership or herd status. They were lethally removed for one trait only: migratory behavior. The National Park Service stated:

> The plan is to capture and ship at least 25 to 50 bison per week from mid-January through mid-February without regard for age, sex, or disease status.

As spring approaches (calving season):

> Another 200 to 300 females (8 months to 5 years of age) will be shipped during the last two weeks of February and first week of March (Frequently asked questions: Bison management, 2014).

Most likely, the female bison will be pregnant. They and calves are the prime culling target. The 2015 IBMP annual report states:

> Biologists from the National Park Service recommended removing at least 900 bison during the winter of 2015 (November 2014 - May 2015), including 180 calves, 70 yearling females, 410 adult females, 60 yearling males, and 180 adult males. Biologists stressed it was important to meet the removal objectives for females and calves to reduce bison abundance and productivity.

One of the reasons for the goal of lethally removing such a large number is that such a number would have a higher chance of culling enough calves and adult females so as to most effectively reduce the total population of the herds to the desired level. The objective first and foremost of the IBMP is wild bison population reduction.

But this did not happen as planned. The annual report continues:

> Culls and harvests during the winter of 2015 (November 2014 through May 2015) totaled 737 bison, including 18 harvested from the western management area, 201 harvested from the northern management area, 507 consigned to meat processing facilities, 7 consigned to research facilities, and 4 that died within the containment facilities at Stephens Creek in Yellowstone National Park. Removals included 276 males, 297 females, 161 calves, and 3 animals of unknown age and sex. The total sum of removals was below the recommended guideline of 900 animals. Importantly, only 223 adult (at least two years old) females were removed, which was significantly below the recommended guideline of 410 adult females.
>
> The net result was a slightly larger bison population after calving in the spring of 2015. About 4,910 bison were counted during June and July, including 3,626 in northern Yellowstone and 1,284 in central Yellowstone.

This was not the desired result. A similar reduction was also planned for 2016, but that, too, failed to achieve its goals.

Culling not the solution

Why is this being done? As time passes and as evidence mounts, a disturbing picture is being painted. As mentioned, the culling is being done supposedly because half the wild bison in the YNP herds have *Brucella abortus*. Even though the IBMP has acknowledged that risk of inter-species transmission of the disease between cattle and bison is remote, it is, as it says in its environmental report, "not zero."

While no transmission of the *B. abortus* bacteria between bison and cattle has been documented under field conditions, its possibility to do so has been demonstrated under laboratory conditions of confinement. University experiments have shown that when infected bison are penned in close confinement with cattle, the disease can be transmitted inter-species. Similar laboratory experiments have shown that it can also be transmitted by diseased elk and diseased coyotes to cattle when confined closely together.

In an outdoor wildlife region such as the GYE, *B. abortus* is thought to be transmitted to other animals via contact with birthing materials, such as the fetus or placenta. However, while substantial shedding of *B. abortus* is from bison, the most substantial risk of *B. abortus* transmission to cattle is from elk, whose range, like bison, overlaps with domestic cattle grazing allotments adjacent to the park (Garrott, 2009).

So why are elk not more aggressively managed? And what good has the aggressive management of bison accomplished?

After years of attempting to eradicate brucellosis from the Greater Yellowstone Ecosystem, with Yellowstone bison currently experiencing a brucellosis seroprevalence of around 50 percent (Cross, 2010), the program administered by the IBMP can be accurately termed a complete failure. Killing thousands upon thousands of wild bison plus attempts to vaccinate them has done nothing to eliminate or even reduce the disease inside the park.

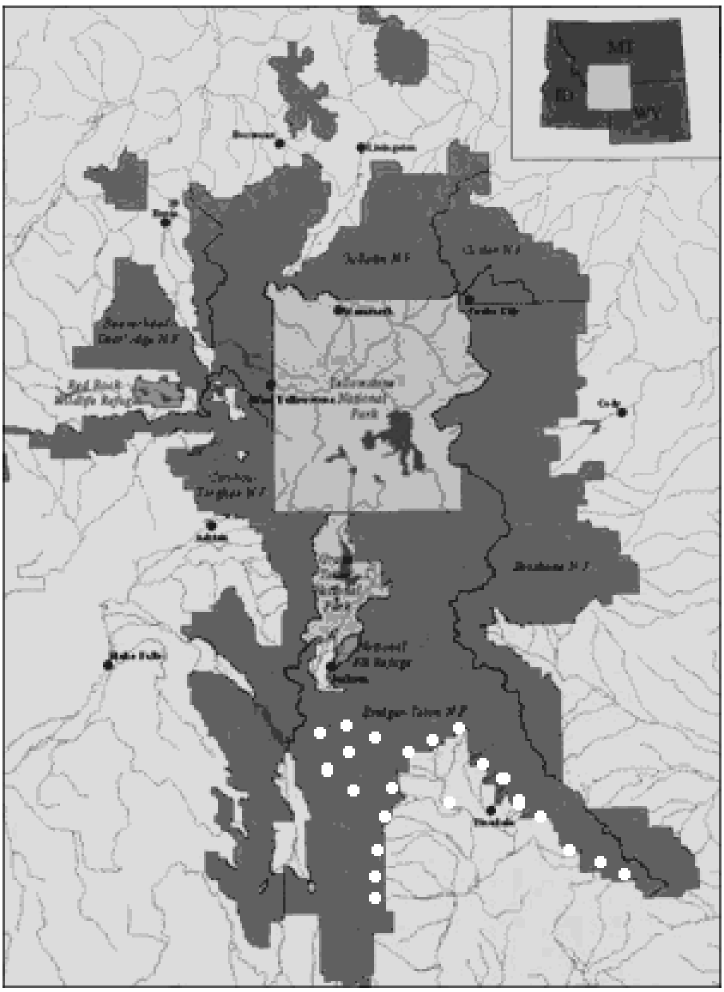


Figure 82. MAP OF THE GREATER YELLOWSTONE ECOSYSTEM. Public lands are dark gray. Yellowstone and Grand Teton National Parks are light gray. Approximate location of the supplemental elk feed grounds are shown as white dots (Cross, 2010). ***Map (Greater Yellowstone Area, 2015) modified by James Horsley.***

In fact, it can be argued that the potential of inter-species transmission from the park's bison and elk to cattle has only been exacerbated by the actions of diverse government agencies. Artificially feeding elk can promote the very conditions shown in the laboratory to contribute to inter-species disease transmission, namely, crowding. Increasingly, scientific findings indicate that minimizing disease spillover to cattle grazing in the Greater Yellowstone Area is best addressed by reducing elk herd densities (Schumaker, 2013). That would mean not providing feed for elk.

The practice of such feeding was questioned in "Brucellosis in Cattle, Bison, and Elk: Management Conflicts in a Society with Diverse Values," a joint report written by members of the U.S. Geological Survey, Northern Rocky Mountain Science Center; Department of Ecology, Montana State University and the National Park Service, Yellowstone National Park. Wildlife scientists noted that feeding elk presents a puzzle:

> In the Jackson and Pinedale regions of Wyoming, state and federal wildlife managers feed elk during the winter at 23 sites . . . to control the spread of brucellosis from elk to cattle. The supplemental feeding program cost the state of Wyoming $1.5 million in 2007, but the feeding also appears to increase the prevalence of brucellosis among the portion of the elk population that frequent feeding grounds. This leads us to another riddle. Why do managers spend time and money on a policy that increases the prevalence of a disease in one host in order to decrease the chances that it infects another? (Cross, 2010).

Adding insult to injury, the government's penning of bison and feeding them hay in the various capture facilities creates once again the crowded conditions that promote such disease transmission. This has been acknowledged by Yellowstone park officials.

Increased bison population

Accompanying the practice of large herd reductions has been the continued increase in bison population. The population is now headed toward 5,000. Survival rates may have increased due to government programs of intervention. While female bison that have contracted brucellosis usually gain immunity to the disease eventually, they also experience reduced fertility rates. P.J. White, chief of wildlife and aquatic resources at Yellowstone National Park, in a report notes:

> There was a reproductive cost of diminished birth rates following brucellosis infection, with only 59% of seropositive and recently seroconverting females with calves compared to 79% of seronegative females with calves (White, 2008, updated 2014).

By killing those animals with brucellosis, the net effect is a herd with a higher percentage of fertile females and thus a potential for a higher reproductive rate.

In addition, the practice of vaccinating bison has the potential to increase their survival rate (Garrott, 2009) and their productivity, thereby increasing the very numbers that contribute to bison migration, exacerbating the resultant conflict with cattle interests.

Studies on the central bison herd of the park have determined that:

> . . . population growth rates will likely increase by more than 15% if vaccination plans are implemented and successful. Wildlife managers would then be challenged with greater numbers of disease-free bison dispersing or migrating outside of the park in response to density and climate effects (Garrott, 2009).

Further, the IBMP has a program of testing captured animals, slaughtering those that test positive for brucellosis, quarantining healthy animals and later letting them go. Result? More productive animals.

While it is well known that stress in animals, such as captivity in zoos, decreases productivity, stress can also have the opposite effect. In an experiment involving zebra finches, stressed males produced more offspring than their unstressed brethren (Brookshire, 2014).

Government reintroduction of wolves may also have increased bison population numbers. Wolf predation on elk has reduced the elk population, decreasing ungulate grazing, leaving more fodder for bison (Ripple, 2011).

Contributing to even greater productivity has been the relatively recent decision to now depopulate the wolf packs in the Rocky Mountain states. The resultant reduced predation on bison automatically increases the survival rates of calves and young females, thereby increasing reproductive levels due to a less diminished population.

Result of that result? More bison—and members of the national park service and others scratching their heads saying that the Yellowstone bison herds for some reason are more productive than expected and they just can’t kill enough of them.

Again and again the problems posed by Yellowstone bison turn out to be caused by the government intervention sought to solve the problem, creating a cascade of ecological dysfunction.

Thus governmental intrusion, by increasing the percentage of fertile females, by its vaccination program, by stressing bison herd members through the disruption of family bonds via slaughter and hazing, and by wolf pack reductions, may be producing the very effect not wanted by opponents of bison migration, namely, larger populations.

It all amounts to the practice of pseudo-science by the IBMP members. And one of the most glaring cases in point is the show of brucellosis control by targeting only one vector of the disease, bison, while irresponsibly ignoring a more contagious vector, elk.

Selective, non-random culling

As we have seen, because of this population increase, park officials in 2014 announced plans to cull up to 900 animals attempting to leave the park by means of the North Gateway route during winter, reducing the total bison population of 4,900 by one fifth (Zuckerman, 2014). This is being done despite findings that the park's grazing capacity is estimated to be as high as 5,500 to 7,500 bison during winter (Frequently asked questions: Bison management, 2014), and despite recommendations by wildlife scientists to avoid large-scale herd reductions because of the deleterious potential of reducing genetic diversity by such a practice.

While this herd reduction by lethal control is touted by the government as being random, this is of course not true, for the targeted animals will be those heading out of the park toward the Stephens Creek capture facility that has been placed strategically in their migratory path. Killing only migratory animals is artificially selecting out which animals will survive, defeating nature's method of favoring the most fit via natural selection and survival of the fittest. In the artificial environment of Yellowstone National Park, the fittest now become those that are the least apt to migrate—including those without associated migratory traits, such as leadership, knowledge and aggressiveness—for the non-migratory, those that stay behind, are the ones that now survive. The government is selecting in favor of traits such as non-migratory behavior and docility, i.e., domesticity. So much for wildness.

It is ironic and instructive that these wild animals, feared because of the disease they carry, contracted this disease from cattle when these domestic animals were first brought to the park years ago. The introduction of captive animals into the park has caused bison to be captives of the park.

As mentioned, crowding is the root cause of the interspecies spread of brucellosis. Fencing causes crowding. So does feeding elk hay in the winter. Such crowding at feedgrounds increases the spread of brucellosis among elk. Packing bison into capture facilities and feeding them hay increases the chance of brucellosis transmission. Domestic animals such as cattle are notorious for having diseases of all types when put in stockyards because of the intensification of close proximity between animals.

Bison do not function as a preferential host and a reservoir for transmission of brucellosis, particularly in the wild. The host-organism relationship in bison differs markedly from that of cattle and abortions are relatively rare. It is domestication, with its associated crowding of animals, that is the causative source of the disease. Mary Meagher, writing in "The origin of brucellosis in bison in Yellowstone National Park: A review," noted:

> Domestication likely ensured that more animals remained in relatively close contact for longer periods of time and in more restrictive loci than occurs among naturally gregarious wild ancestors. There seems little reason to doubt the influence of man in domesticating livestock and thereby ensuring that most brucellosis foci would be called anthropogenic. Brucella appear primarily to be organisms of animal husbandry that have adapted to and exist secondarily in some wildlife hosts (Meagher, 1994).

But it is the practice of domestication of wild bison that is going on near the northern gateway of the park and elsewhere just outside the park, the very practice that promotes brucellosis. By park bison not being allowed to disperse via migration and by putting animals in capture facilities, feeding them hay and crowding them together, the environment of domestication is promoted and thus increases the propensity for incubation and transmission of the very disease the government is trying to control. Behind this governmental policy is either naivety or stubbornness or delusion, or a combination of these factors. It is not good science.

Although bison have been the biased target of the government's policy of separation-by-slaughter disease-control methods for the park, the next wild animal on this agenda most likely will be elk. In the past, while elk herds are known to have brucellosis, elk have been allowed to migrate out of the park and have been exempt from the government's lethal control program. But recently, elk have been deemed to pose a greater risk than bison concerning the transmission of brucellosis to cattle in the ecosystem. To be consistent, wildlife managers will be increasingly forced to constrain elk movements also.

For instance, in 2007 cattle were tested positive for exposure to brucellosis in Paradise Valley just north of Gardiner. Following a study, elk were blamed for the transmission, although it has never been conclusively proven that they were the cause. The Montana Fish, Wildlife and Park Commission recently approved lethal control of elk for the valley, as well as governmental assistance to help finance special fencing to keep migrating elk away from cattle grazing there (Adams, 2014).

The plan was delayed following the filing of a lawsuit in opposition to it by sportsmen's clubs, asking that an environmental impact review be performed before any further action is taken to haze, fence out or kill elk on private land in an attempt to control the spread of brucellosis (French, 2014).

However, in November 2014, the plan was once again approved by the Montana FWP to control the movement of elk that may be infected with brucellosis.

Director of Communication and Education Ron Asheim said the effort continues to keep wild elk from mixing with commercial cattle, because of the risk of exposing livestock to brucellosis.

“This is the third year that the plan has been in place by a local working group made up of landowners, sportsmen and the agency,” Aasheim said. “The plan potentially includes some fencing and in some cases, some lethal removal. The whole idea is to minimize the potential risk of transmission of brucellosis to livestock from elk” (Christian, 2014).

But are the elk, like bison, prohibited by the Montana FWP from migrating en masse? No.

If the goal is the realistic suppression of the spread of brucellosis to cattle, the rational mind asks: Why not? Why the differential in treatment of two species that both carry the disease? Not to be anthropomorphic about this, but surely it could not be some form of animal racism, that is, a bias toward persecuting one species over another for no reason other than the species it is.

One thing is certain: with regard to the restraining of wild bison, something strange is going on.

Vaccination not a solution

As mentioned, epidemiologically, the control of such a disease as brucellosis either in the wild or elsewhere is through separation. This can be achieved in several ways: a fence, the removal of the infected animals from the environment shared by the animals to be protected, or the removal of attractants that promote crowding, such as hay at feed grounds.

As mentioned, about 50 percent of wild bison have *B. abortus*. After decades of culling of wild bison, no reduction of the disease has been achieved among the herds. The practice is a proven failure. The only alternatives to the control of this disease here would be fencing the park, which is incompatible with wildlife management for an ecosystem, or by removing cattle from the park environment.

Attempting to mitigate the disease by means of vaccination is useless, because it is not effective. According to the National Park Service:

> Even if brucellosis prevalence could be reduced by 50% (i.e., to about 30%), which would be quite difficult to achieve given current technology and conditions, such a change would not have any significant effect on bison management practices or the risk of brucellosis transmission from bison to cattle, which is already extremely low compared to elk. Bison would still need to be managed to maintain separation with cattle and mitigate human safety and property issues. Testing requirements for livestock producers within the greater Yellowstone area would not change because elk would remain a far greater threat of brucellosis transmission to livestock than bison. There have been zero incidences of Yellowstone bison transmitting brucellosis to cattle, while at least 23 cattle and domestic bison herds have been infected with brucellosis by elk since 2002. The states in the greater Yellowstone area have not lost their class-free status in recent years despite multiple brucellosis outbreaks in cattle and domestic bison herds due to transmission by elk. Thus,

> there is no reason these states should lose their class-free status if there is one or more outbreaks due to transmission from wild bison.

And even if brucellosis could be eliminated from Yellowstone bison, "Reinfection of bison by elk would likely occur in the future," according to the National Park Service (Frequently Asked Questions: Bison Vaccination, 2014).

According to the NPS:

> Moreover, the implementation of aggressive, intrusive actions to suppress brucellosis in bison, while not taking similar actions to address increasing prevalence in elk across the greater Yellowstone area, is difficult to justify given the high costs and values that many residents, visitors, and tribal interests have toward bison. A reduction in brucellosis prevalence in Yellowstone bison will have little to no effect on the risk of brucellosis transmission to cattle if the prevalence of brucellosis in elk is stable or increasing throughout the greater Yellowstone area and substantial, region-wide actions are not taken to prevent comingling of elk and cattle during the elk abortion and calving season (which overlaps with cattle occupancy on private lands and with cattle turn-on dates throughout the area) (Remote Vaccination of Bison, 2014).

For these reasons, there is no point in trying to eliminate the disease in bison in the Greater Yellowstone Ecosystem, other than creating jobs for government officials and providing the delusion that by working toward this end the goal can be achieved. It simply cannot be achieved while still maintaining a wilderness. Bacteria are predators, too, just like wolves, and are part of the ecosystem.

Given this scenario, by default one would logically choose the only tenable option, namely, removing cattle from the perimeters of the park. But this, of course, is not being done. So how is this policy continuing to be supported? Here is the official line as stated by the National Park Service in its online information piece "Bison Management."

The Martians are coming

First, we are provided with the information that migration by bison is a necessary survival behavior when herds are experiencing a deep snow pack:

> Yellowstone bison are prolific and have high survival rates, with wolves currently killing few bison because elk are more vulnerable prey. As a result, bison numbers increase rapidly when environmental conditions are suitable, with abundance increasing to more than 4,000 individuals on several occasions and reaching a high of approximately 5,000 bison in 2005. At these numbers, a winter with deep snow pack can induce many hundreds of bison to migrate into Montana because lower-elevation habitat for bison is limited by

> mountainous topography within Yellowstone National Park. As a result, bison will continue to move from the park into Montana during winter, with higher numbers migrating as bison abundance and winter severity increase.

While migration is stated to be necessary for survival, it is deemed unacceptable for bison to do so by the National Park Service and its allied government partners. Here is why:

> Due to existing agriculture and development in the Yellowstone and Madison River valleys, however, there is not sufficient low-elevation, valley bottom habitat north and west of Yellowstone National Park where bison are currently tolerated that could sustain many hundreds or thousands of bison for extended lengths of time during winter. Thus, bison could rapidly fill available habitat, and if given the opportunity, attempt to migrate further during some winters, which will eventually bring them into areas (e.g., Paradise Valley) occupied by many hundreds of cattle. Without human intervention, some bison that spend winter north and west of Yellowstone National Park in Montana will not migrate back into the park during spring, but will attempt to expand their range into other areas with suitable habitat but currently no tolerance for bison. In addition, there are still tangible concerns about the transmission of brucellosis from bison to cattle, with regulatory and economic consequences of cattle contracting brucellosis. As a result, there is a need to manage bison to prevent comingling with cattle. Furthermore, there are political and social concerns about allowing large numbers of these massive, wild animals into Montana, and options for relocating Yellowstone bison elsewhere are limited by real and perceived disease and social concerns. Therefore, bison will at times need to be intensively managed and culled from the population to prevent the limited tolerance for wild bison on the landscape in Montana from being rescinded (Bison Management, 2014).

The expressed concern is that bison, these “massive, wild animals” will eventually burst through into Paradise Valley and flood Montana. This statement promotes hysteria and is akin to saying “The Martians are coming,” as did Orson Welles in a 1938 Halloween radio broadcast called “War of the Worlds,” about a fictitious attack by creatures from Mars. It threw numerous listeners into a panic.

The New York Times.

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NEW YORK, MONDAY, OCTOBER 31, 1938.

MEAD STANDS PAT AS A NEW DEALER IN BID FOR SENATE

Democratic Candidate Opposes Any Except Minor Changes in Labor and Security Laws

UPHOLDS THEORY OF TVA

Radio Listeners in Panic, Taking War Drama as Fact

Many Flee Homes to Escape 'Gas Raid From Mars'—Phone Calls Swamp Police at Broadcast of Wells Fantasy

A wave of mass hysteria seized thousands of radio listeners throughout the nation between 8:15 and 9:30 o'clock last night when a broadcast of a dramatization of H. G. Wells's fantasy, "The War ... and radio stations here and in other cities of the United States and Canada seeking advice on protective measures against the raids. The program was produced by Mr. Welles and the Mercury Theatre on

OUSTED JEWS FIND REFUGE IN POLAND AFTER BORDER STAY

Exiles Go to Relatives' Homes or to Camps Maintained by Distribution Committee

REVEAL CRUELTY OF TRIP

Figure 83. TAKING FICTION FOR FACT. The New York Times headline from October 31, 1938. ***From "The War of the Worlds (radio drama)," Wikipedia.***

How could this hysterical reaction happen? Hadley Cantril, chairman of the Princeton University Department of Psychology, in his study "The Invasion from Mars" had this to say:

> The persons who were frightened by the broadcast were, for this occasion at least, highly suggestible, that is, they believed what they heard without making sufficient checks to prove to themselves that the broadcast was only a story."(Cantril, 2014).

In sum, he said, such persons lacked "critical ability."

That is what is lacking in the groupthink that governs this issue. That is also what the members of the IBMP do not want to see the public engaging in, for if they looked at the interagency critically, they would not permit it to continue to exist.

After looking at the facts, we see that containing brucellosis is not the reason why bison are being killed. If it were, elk would be killed also. Instead, by default, the reason bison are being culled is to keep them off the ranges just outside the park occupied by cattle so as to reduce forage competition. Apparently, elk are thought by ranchers to not be as big a competitor on the range as bison.

While the northern range outside the park is an open range, being in a national forest, it is also under the Multiple-Use Sustained-Yield Act. Putting an invasive species, European cattle, on a national forest landscape, exposing these cattle to the biohazardous environment of the Greater Yellowstone Ecosystem, spending millions of dollars every year to protect these cattle from the risks of doing that, and culling to possible extinction wild bison to make it all work on that landscape, does, indeed, involve "Inept Decisions, Ignorance Or Thoughtlessness, In Combination" and is, indeed, IDIOTIC.

While this northern grassland is under the Multiple-Use Sustained-Yield Act which allows multiple uses of our national forests, it also mandates sustained yield. Underwriting a business venture with taxpayer money is not sustained yield, but indeed, sustained loss. To continue that is not only the acronym IDIOTIC, but in fact idiotic.

24

IDIOTIC culling

Listen carefully to the following quote. It comes from a simulation study by leading Yellowstone biologists published in the science journal PLOS ONE titled "Predicting Bison Migration out of Yellowstone National Park Using Bayesian Models." The authors conclude:

> Yellowstone's restored bison herds have established migratory patterns that lead them to low elevation areas out of the park where they come into conflict with society. Our simulation results suggest scenarios that remove 50% of migrants similar to management policies outlined in the Interagency Bison Management Plan will not prevent future large-scale, recurrent migrations and numbers exiting park boundaries will be much greater than predictions underlying those policies. Thus, limiting bison numbers and allowing increased numbers of bison beyond park boundaries during severe climate conditions may be the only means of avoiding episodic, large-scale reductions to the Yellowstone bison population in the foreseeable future. Limiting bison abundance to lower numbers will likely reduce (but not eliminate) the frequency of large-scale migrations into Montana, but could also hamper the conservation of this unique population of wild, free-ranging bison by adversely affecting the population's resiliency to respond to environmental challenges, genetic diversity, and the ecological role of bison in the ecosystem through the creation of landscape heterozygosity, nutrient redistribution, competition with other ungulates, prey for carnivores, habitat creation for grassland birds and other species, provision of carcasses for scavengers, stimulation of primary production, and opened access to vegetation through snow cover (Geremia, 2011).

Question: If IBMP's culling policies "will not prevent future large-scale, recurrent migrations" and if "numbers exiting park boundaries will be much greater than predictions underlying those policies," why are those policies still being carried out?

Question: If "allowing increased numbers of bison beyond park boundaries during severe climate conditions may be the only means of avoiding episodic, large-scale reductions to the Yellowstone bison population in the foreseeable future," why are more bison not being allowed to migrate?

Question: If limiting "bison abundance to lower numbers" "could also hamper the conservation of this unique population of wild, free-ranging bison by adversely affecting the population's resiliency to respond to environmental challenges, genetic diversity, and the ecological role of bison in the ecosystem," then why continue culling?

Consider that this report was authored by Chris Geremia, P. J. White, Rick L. Waller and John J. Treanor, all with the Yellowstone Center for Resources, Yellowstone National Park, as well as Fred G. R. Watson, Watershed Institute, California State University Monterey Bay; John Borkowski, Department of Mathematical Sciences, Montana State University; Christopher S. Potter, Ames Research Center and Robert L. Crabtree, Yellowstone Ecological Research Centre (Geremia, 2011).

Many of the biologists conducting the study are with Yellowstone National Park, National Park Service, a member of the IBMP. The article was published in 2011. Should not the word have gotten out by now that the culling policies of the IBMP are deleterious?

Apparently not, since large-scale reductions by the IBMP are still going on and are still being planned for the future.

The implications of the continuation of these policies are profound. Large-scale culling has a higher potential of doing genetic harm. This is compounded in the case of bison. Discussing the great destruction of bison in the late 1800s, Montana Fish, Wildlife & Parks, in an article with the subheading "Genetics," stated:

> The decrease of such a vast bison population to a small fraction of its original size in a relatively short time may have caused a genetic bottleneck or founder effect. This occurs when the genetic diversity of a population is greatly reduced due to the small sample of bison, which were present in the surviving population.

Lost with those millions of bison were an indeterminate number of genes, reducing the reservoir from which adaptive traits could be drawn. This limited genetic diversity may be frozen in the surviving population due to genetic drift.

> Genetic drift, which is the random fixation of genes within a population, may occur because the founder population represents only a limited selection of the genetic diversity that once occurred in the original herds.

Manipulation of the Yellowstone herd's possibly compromised genetic makeup can lead to extinction. The article states:

> Extinction of a species can occur through two routes. The first is extinction brought about when the last individual of a species dies (Freese, 2007). The second is when the genetic makeup of the species is altered substantially over time either through natural evolutionary processes or through human manipulation (Freese, 2007). Human management of bison in both the public and private sector has led to the manipulation of bison genetics through hybridization and domestication (Genetics, 2015).

Add to those manipulations an extensive history of culling by wildlife managers, an activity which is now focused on Gardiner Basin. The stated goal by the IBMP is bison herd reduction. The prime target is female bison. However, because the IBMP kills what it can get its hands on—the migratory—it does not selectively cull females. It makes no preferences. It does not cull according to disease status, age, sex, pregnancy or species. To get at the prime targets—the females—one has to kill a large number of bison to increase the chances probabilistically that a sufficient number of those killed will be female. Why females? Because that is where the reproductive force resides. If you kill a female, you 1. kill that female, 2. possibly kill an actual calf *in utero*, 3. possibly kill through starvation a calf orphaned by its mother's death, for only its biological mother will nurse it, and 4. because the female will not be around for breeding next year, kill a potential calf producer.

This is the most efficient way to make way for the cow/calf pairs that will be trucked here in the spring just outside the park to take the place of those bison mothers who have been slaughtered in the winter.

Literally, the IBMP does not know what it is doing when it culls. It does not care. It just wants more bison gone. For instance, some herds are affected more than others with mitochondrial disease. In bison, the disease is characterized by lethargy, lack of endurance and inability to "crater" in deep snow to obtain forage. Because of the policy to cull bison randomly, the government does not know if it is killing the relatively disease-free animals or the less fit ones.

Further, evidence indicates that historically the bison herds are a mixture of both plains bison and mountain buffalo. Pure mountain buffalo have been thought to be extinct in the United States. However, there is a possibility that some YNP herds in fact do not interbreed with other herds and that a pure mountain buffalo species may still exist in the remote recesses of the park. Reports of sightings of this animal, noted for its fear of humans, have been made. However, current park officials claim that mountain bison no longer exist in the park. Their claim is a fact-free statement. What is a fact is that this issue has never been studied by park scientists. It should be.

It is an urgent concern. Guide operations by outfitters leading pack trains into the remote regions of the park are thought by some to possibly be spooking mountain buffalo into joining other bison herds for protection, which would reduce their pure status.

Killing bison solely because they migrate is indiscriminate slaughter. Government agents are in effect functioning as "loose cannons." Such stochastically-administered culling could not only include mountain buffalo, but remove genetic and behavioral traits contributing to survival of the wild bison.

Prohibiting migration tends to isolate herds. Isolated herds reduce individual and population fitness via inbreeding depression. Reduction of the size of one herd in the YNP will reduce the opportunity to cross-breed and hence the ability to restore genetic diversity for other herds. Smaller, isolated herds can exacerbate genetic drift. Genetic drift, along with natural selection and mutation, is one of the basic mechanisms of evolution. In each generation, some individuals may, just by chance, leave behind a few more descendents than other individuals. The genes of the next generation will be the genes of the "lucky" individuals, not necessarily the healthier or "better" individuals (Genetic drift, 2016). This random process of genetic drift in small populations can have a rapid, significant effect on the stock of different genes in an interbreeding population of subsequent generations (Small Population Size Effects, 2016). It has the potential of making a species drift into a less fit, less adaptive population.

But it is not just a matter of reducing the size of the herds in Yellowstone. By IBMP's removal of bison from the breeding pool by means of culling at the border, it of course removes those with the migratory trait, which has associated with it other traits. It is probable that the most fit are among those killed and the least fit survive, that is, those that do not cross the invisible line of the park's boundaries—those that stay behind, the non-migratory, those that stay put, which could include the aged, the diseased, the more docile, the less wild. A portion of bison are naturally migratory in the wild. That is a biological fact. That instinct, due to governmental over-reach, has become the wild bison's death sentence.

The experience gained by past management of the wild herd of bison in the park by state and federal agencies has demonstrated that the various conflicting interests in this wildlife species have defaulted to cattle interests. They are now running the show. Their economic interests in the wilderness region preempt all others. This is demonstrated by their ability to have their livestock remain in the ecosystem and by their ability to dictate the removal of any migratory bison from their government-subsidized and protected grazing plots adjacent to the park.

Bias among wildlife managers and in brucellosis epidemiological studies can be seen in such statements as the following:

> Disease management at the wildlife-livestock interface is hampered by the challenge of balancing wildlife conservation with the livelihoods and traditions of livestock producers. The potential for disease transmission

> between wildlife and livestock exacerbates conflicts between natural resource managers and cattlemen, reduces tolerance for wildlife near livestock operations, and negatively impacts conservation. *Therefore*, diseases that affect both wildlife and livestock are important in resource management, *regardless* of their direct impact to the wild animal populations which may serve as their reservoirs (emphasis added) (Schumaker, 2010).

This statement is found in the 2010 study "A Risk Analysis of *B. abortus* Transmission among Bison, Elk, and Cattle in the Northern Greater Yellowstone Area." The authors of this passage are among those that wrote the passage on the harm being done by large-scale reductions in the park at the beginning of this chapter. The above study just quoted was conducted by the Center for Animal Disease Modeling and Surveillance (CADMS), the Wildlife Health Center and the California Department of Medicine and Epidemiology—all the latter affiliated with the University of California, Davis—as well as Yellowstone National Park and the Montana Department of Livestock. Authors are Brant A. Schumaker, Jonna A.K. Mazet, John Treanor, Rick Wallen, Ian A. Gardner, Martin Zaluski, and Tim E. Carpenter.

The "therefore" statement in the above quote is revealing. It concludes that the methods used to manage diseases such as brucellosis are important "*regardless* of their direct impact to the wild animal populations which may serve as their reservoirs" (emphasis added).

By the use of the word "regardless," this is saying, in effect, that even if the obliteration of certain segments of a wildlife population is necessary to control such a disease as brucellosis in a captive population of domesticated animals such as livestock grazing near that wildlife source, so be it.

Carrying this philosophy to its logical conclusion, biologists and wildlife managers can justify the travesty that is going on in Yellowstone National Park. Under this "regardless" mindset, the majority of bison migrating down from the high altitudes of the park are routinely diverted into capture facilities such as the Stephens Creek corral. From there they are transported for slaughter.

When bison migrate in the park today they migrate into a slaughterhouse. This practice is the industrialization of their killing. What is being done is tantamount to driving all bison migrating out of the park over a cliff, year in and year out, for the last several decades. It will have a catastrophic effect on the genetics and behavior of America's last wild bison, animals deemed necessary to preserve because of their high level of genetic diversity.

It gets more idiotic. Capitalizing on the wild bison's instinct to migrate, the destruction of bison as wildlife is easy enough to accomplish and can be done by riders on horseback and in vehicles because in the bison's migratory determination to get to a destination (in migratory lingo called "persistent and straightened out movement") they stick together and can be driven as a unit into the traps set up for them, such as at Stephens Creek. Their instinct to survive is being used against them for their destruction.

As noted, such lethal removal of wildlife is deemed necessary in the case of bison to prevent the spread of disease. As the Schumaker report states, billions of dollars have been spent eradicating brucellosis from livestock in nearly every state, but multiple recurrences of bovine brucellosis, caused by the bacterium *B. abortus* in the states surrounding the greater Yellowstone area "have greatly complicated the eradication effort." Wild, free-ranging bison and elk in the GYA persist as the last known reservoir of *B. abortus*-caused brucellosis in the US, the study states.

The big problem is the overlap of the range of bison and elk with cattle. "The proximity of cattle-grazing to wildlife populations makes interspecies disease transmission a concern," the report observes.

There is another problem, too, namely the size of the wildlife populations of elk and bison. But, the study asks, which is the bigger contributor to this problem—elk or bison? The study's answer: elk:

> In addition to overlap, the major contributors to risk were wildlife population size and the number of elk that were shedding *Brucella* bacteria. While elk currently have a lower density of shedding events throughout their range, they have a larger spatio-temporal overlap with cattle and are more tolerated by managers and livestock keepers on public grazing allotments. Thus, the predominant source of risk to cattle in the northern portion of the greater Yellowstone area is from elk. With increased disease prevalence due to increased winter densities or other factors, elk are likely to contribute greatly to the overall level of bacterial shedding on the northern GYA landscape (Fig. [57]) and will continue to represent the vast majority of risk of *B. abortus* exposure to cattle grazing in the northern portion of the GYA. Therefore, brucellosis management efforts should focus more on the comingling of cattle and elk during the critical abortion period to more effectively decrease risk of transmission (Schumaker, 2010, pp. 53-54)

The map shown in Figure 57 graphically pictures the problem—Montana cattle grazing allotments in the middle of a wildlife ecosystem of both bison and elk rampant with brucellosis shedding events.

What the authors of the study are saying when it all plays out is that "regardless of their [the diseases] direct impact to the wild animal populations which may serve as their reservoirs," bison and elk must be managed to prevent comingling. Cattle are exempt from management.

As is plain to see, there are two ways to eliminate comingling—either remove the elk and bison from the range or remove the cattle. However, there is a third alternative. No action.

Regions other than the northern portion of the greater Yellowstone area have chosen to handle this problem differently. Take, for instance, the southern greater Yellowstone area—the Grand Teton National Park region.

In a 1992 article headed "Ruling could restrict bison, elk movement" in the magazine *Feedstuffs*, it reported that:

> A federal judge has ruled that two U.S. agencies were at fault in not restricting movement of brucellosis-infected bison and elk herds roaming the Grand Teton and Yellowstone National Parks in northwestern Wyoming. The ruling, handed down here by Judge Clarence Brimmer, found that the National Park Service and U.S. Fish & Wildlife Service did not sufficiently limit the herds' sizes. He explained that the herds grew larger than the parks could support, forcing infected bison and elk outside the parks in search of food. Brimmer's ruling came on a suit brought by the Parker Land & Cattle Co., which claimed the bison and elk infected its cattle, causing them to abort fetuses and requiring their destruction. However, Brimmer did not award damages to Parker, saying the ranch, which grazes on adjacent forest service land, did not prove the cattle were infected by the wildlife.

This ruling was not to the liking of either the public land ranchers or the park and wildlife services, for it meant that either bison and elk must go, or cattle must go. The article continues:

> The ruling also could turn out to be contrary to Parker's and other ranchers' interests, according to government officials and public lands ranchers who submitted supporting briefs or testified in the case. The park and wildlife services suggested that the ruling means they either must destroy bison and elk because brucellosis vaccines effective for cattle are not proven to work for bison and elk, or they must withdraw public grazing permits on nearby land (Anon., 1992).

Oh, goodness gracious, what have we gotten into, all wondered after the decision. We can't destroy the bison and the elk for they are a big part of the park's income as well as the state of Wyoming's, with funds being generated from tourism and elk hunting. Worse was the alternative facing the wildlife services: withdraw public grazing permits on nearby land.

Maybe we can forget all this brouhaha, they in effect said, and that is just what all concerned in this conflict did. Wyoming, unlike Montana, has not made it illegal for bison to cross park lines. They can migrate into Wyoming.

However, this does not address the IBMP's requirement that the risk of transmission of brucellosis be reduced to zero and it does not address the growing problem of brucellosis transmission by elk to cattle.

Since it has proven impossible and unrealistic to attempt to eradicate brucellosis from such a vast wildlife ecosystem, the most sensible and the most economical solution to reduce spillover of brucellosis from bison and elk to cattle is to contain that disease within the Greater Yellowstone Ecosystem. The only way to do this is to prohibit cattle from grazing on these plots bordering the park.

The reason for the immense complexity and controversy surrounding the seasonal movements of wild bison, and now elk, is solely the fear of the spread of brucellosis to cattle. With cattle removed, that fear is gone. The various plans proposed over the years, usually dubbed alternatives A, B, C, or 1, 2, 3, etc., with boundaries drawn here and there and everywhere, and then subdivided into zones, will all fail because the demarcations and restrictions need the interpretation of lawyers to understand and obey, and bison can't afford lawyers.

Historically, wild bison followed the Madison River and the Yellowstone River down from the higher altitudes in winter to obtain forage, then migrated back again after calving in the spring. With the Hebgen dam along the Madison and the bottleneck at Yankee Jim Canyon on the Yellowstone River, natural restrictions exist that discourage bison from following these river courses to the full extent of their original historical range.

It would be of great value to let bison migrate naturally over a period of time, exploring with them how their population grows, where they travel, when they return—with wolves, weather, disease and range-capacity governing them, that is, Mother Nature, instead of the IBMP. Problems arising from this experiment could then be studied and addressed. The data would be invaluable and give field biologists something to go on besides assumptions and simulations.

Further, having government agencies provide the slaughtered Yellowstone bison to American Indian tribes and tribal organizations, as done by the NPS, is insulting for historical reasons and economically wasteful. Instead of ship and slaughter by the government, only American Indian tribes, tribal organizations and non-tribal hunters should be utilized in the harvest of wild bison

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Wildlife managers' pseudoscientific flimflam

Let's exercise a little critical ability with regard to this government-promoted mess. Recall that the National Park Service has said that bison must be killed "to reduce population growth and the potential for a mass migration of bison into Montana" (Frequently Asked Questions: Bison Management, 2014). If one looks into that statement by the NPS, that a bison invasion of Montana is bound to happen if migration is permitted, one finds it is not credible.

First of all, as has been discussed, the only way bison can exit the valley floor of the Gardiner Basin into Paradise Valley is through Yankee Jim Canyon, which is a bottleneck formed by the walls of a canyon through which the Yellowstone River flows. Roads run on both sides of the river. On one side is a gravel road called the Old Yellowstone Trail, a portion of the first transcontinental automobile highway in the United States through the northern states. On the other side is Highway 89, which is paved. When one looks down from either road, one sees whitewaters hemmed in by cliffs. When one looks up, one sees fencing ascending steep mountain walls. Looking straight ahead on each road are cattle guards. In the winter both roads are gated. The barricades are designed to keep bison from going into Paradise Valley.

This passage has always been a bottleneck for travel between Paradise Valley and the park. It was originally called "Yankee Jim's Canyon" because James "Yankee Jim" George squatted here in 1871 on a newly-built road from Bozeman, Montana, to Mammoth Hot Springs. Four months later, Yellowstone was designated America's first national park. Yankee Jim helped improve the road for the increased traffic, installed a gate on his claimed property through which the road ran, charged a toll for passage, and built a cabin where he offered food and lodging (Yankee Jim, 2014).

Figure 84. YANKEE JIM CANYON. The Yellowstone River runs through the canyon, above which can be seen a road on either side. Bison prefer travelling a route of least resistance. As the river progresses, it becomes whitewater and the walls of the canyon more steep. ***Photo by Mike Cline, May 11, 2010. Released by the author to the public domain.***

The only alternate route to Paradise Valley is over the crests of high mountain ranges rimming the basin, and it is rarely travelled.

To address the possibility of bison migrating from the Gardiner Basin into Paradise Valley, as well as to provide more migratory room for wild bison, modifications to the presently existing plan (IBMP) were under study by Montana's Department of Livestock and Department of Fish, Wildlife and Parks. As discussed, this proposal sought to allow YNP bison to inhabit forest service and other lands north of the park boundary and south of Yankee Jim Canyon within the Gardiner Basin during the winter. Bison would be prohibited from moving north of the hydrological divide (i.e., mountain ridge-tops) between Dome Mountain/Paradise Valley and the Gardiner Basin on the east side of the Yellowstone River, and Tom Miner basin and the Gardiner Basin on the west side of the Yellowstone River (Draft Joint Environmental Assessment: Year-round Habitat for Yellowstone Bison, 2013).

However, as mentioned, the Montana Board of Livestock (BOL) tabled such proposals May, 2014, leaving the status quo in place, that is, lethal removal and hazing (Rice, 2014; Forrest, 2014). Creating a sense of urgency that something must be done to prevent bison from entering Paradise Valley, yet tabling measures that would have mitigated that need, demonstrates a lack of sincerity by the government agencies involved.

Hysteria is generated through various studies by government biologists and on various government websites, such as those of the NPS, that if left alone and not stopped, if not extensively culled, wild bison will invade Montana, mass migrate into that state, not return to the park, but instead will expand their range, and not migrate back to the park in the spring without hazing. Possibly the NPS should have read the report it helped write, namely the 2013 Annual Report of the Interagency Bison Management Plan. It says the following:

> The timeframe for natural migration in the absence of hazing is difficult to identify because the agencies have hazed bison every year since the Adaptive Management Plan has been in place. However, observations over the past six to eight years show that at the beginning of the haze back program, few if any bison remain in the Park and immediately return to the boundary or beyond. Thus, the following analysis was conducted using an assumption that the bison are not likely to be successfully hazed until they are naturally inclined to migrate back to the Park. More likely, bison would migrate back to the Park on their own slightly later than the time period in which the agencies are successful at getting bison to stay in the Park following management hazing operations.

According to the IBMP, of which the NPS is a participating member, what does this suggest?

> The data suggest that bison are likely to return to the Park on their own between 24 May and 7 June most years. However, bison currently respond to multiple hazing operations during this time, therefore the timing and whether they would naturally return to the Park cannot be definitively assessed from this data (Annual Report of the IBMP, 2013).

With new tolerance of bison on Horse Butte in the Hebgen Basin instituted in 2016, we now have data supporting this hypothesis. They do return without government hazing (Seay, 2016).

Imagine that. Bison are not trying to expand their range, they are simply following a cyclical impulse to descend from the high altitudes of the park in winter, then in spring return to those high altitudes after calving. Next thing you know, the government will be forming the Interagency Goose Management Plan, buzzing flocks of geese with helicopters so they will migrate south in the winter. They will spend millions of dollars on a plan called the Wild Goose Chase.

Using science to trick

One of the tactics used by the IBMP to justify its actions is to establish a premise that leads to a desired conclusion. In the case at hand, that premise is the need to keep the wild bison herd at the 3,000 population level.

Here is the method in use. The *Record of Decision* first establishes a premise, namely, that as a risk management measure a population at or below 3,000 park bison must be maintained. In the 2014 National Park Service's website on Yellowstone under the heading of "Frequently Asked Questions: Bison Management" the following line of logic was built on the above premise. The points below are direct quotes from the website, except for the additions of the lettering A, B, C. The line of reasoning leads from A to B to the need for item C. The NPS website states:

> A. As an additional risk management measure, the agencies would maintain a population target for the whole herd of 3,000 bison. This is the number above which the NAS (1998) report indicates bison are most likely to respond to heavy snow or ice by attempting to migrate to the lower elevation lands outside the park in the western and northern boundary areas (p. 20).

Then it concludes from the above premise the actions needed to maintain that 3,000 population target:

> B. If the late-winter/early-spring bison population is above the 3,000 target, specific management actions may be undertaken at the Stephens Creek capture facility or outside the Park in the western boundary area to reduce its size. For example, instead of hazing bison remaining in boundary areas back into the park in the spring, they may be removed to quarantine or slaughter (p. 32).

To justify these removal actions and to establish the desired conclusion C., the NPS website further states:

- During summer 2014, there were about 4,900 bison in the Yellowstone population following calving, including about 3,500 bison in the northern herd and 1,400 in the central herd.

- In 2000, the Secretaries of Agriculture and Interior and the Governor of Montana signed a court-mediated agreement that included guidelines to limit bison abundance near 3,000.

- Biologists from the National Park Service (NPS) have proposed removing 900 bison near the northern boundary this winter to reduce population growth and the potential for a mass migration of bison into Montana.

- Bison populations increase rapidly when environmental conditions are suitable. Yellowstone bison are prolific and have high survival rates, with wolves currently killing few bison because elk are more vulnerable prey.

- Bison need to be removed from the population at times. The fast-growing bison population could fill available habitat and out-pace the acquisition of additional habitat and tolerance for bison in Montana. Options for relocating Yellowstone bison elsewhere are limited by real and perceived disease and social concerns.

- Under-nutrition (starvation) only contributes to high mortality when bison abundance is high and snow pack is at or above average. Also, most bison migrate to lower elevation areas in response to such severe weather events—which eventually brings them into conflict with agriculture and development.

- The food-limited carrying capacity inside the park could be as high as 5,500 to 7,500 bison during winter, but lower-elevation habitat for bison is limited by mountains in the park and by competition with agriculture, development, and transportation systems outside the park.

- A panel of expert scientists reviewing Yellowstone bison and brucellosis issues in 2013 concluded that culling or removals of bison, along with hunting, would be necessary to limit the size of the bison population for biological, social and political reasons.

C. Therefore, bison will at times need to be intensively managed and culled from the population to prevent the limited tolerance for wild bison on the landscape in Montana from being rescinded (Frequently asked questions: Bison management, 2014).

If we boil this line of reasoning down to its essentials, here is what is being said:

1. Because wild bison tend to migrate out of the park in the winter in search of forage when their population exceeds 3,000, kill beyond that number those that attempt to migrate.

2. If we do not kill 900, there is the potential of a mass migration of wild bison into Montana.

3. Wolves cannot do the job of herd reductions of wild bison since wolves currently are killing few bison because elk are easier to kill.

4. Wild bison might starve during a severe winter, so we might as well kill them off when they try to migrate to lower elevations to avoid starvation.

5. Lower-elevation habitat for bison is limited by mountains in the park and by competition with cattle outside the park.

6. A panel of expert scientists has concluded that lethal removal of wild bison is necessary because of disease, social and political reasons.

7. Therefore, off with the wild bisons' heads.

Big questions

Question: With regard to those animals to be removed lethally, how do those government agencies or the "expert scientists" know which wild bison are diseased and which animals might die of starvation? How do they know which animals have valuable genetics or immunity? How do they know what population level is optimal genetically? The answer is, they do not know. There is only one agent smart enough to know this and that is the wolf, which kills vulnerable prey, including the diseased, aged and lame. That the wolf cannot serve in this capacity as claimed by the National Park Service is not supported by the data. The issues listed above, cited for the support of the removal of bison from the park by the IBMP, do not hold water. The only reason the bison are being removed is to make way for cattle, an invasive species within this ecosystem.

Further, why is there a level of brucellosis infection among migratory elk of 1 to 3 percent, among non-migratory elk of 20 percent, and bison of 50 percent? The answer may be because none of the so-called migratory bison are being allowed to migrate. By eliminating on a systematic basis those animals that try to disperse, a non-migratory regimen is being encouraged in the park, one that leads to concentration of population. And it is crowding that promotes disease.

What better incubator of disease could there be than the overcrowded environment that exists around the thermal pools of the park? Here is warmth. Here is limited forage. Here is contamination of the area by fecal material that is fed upon by bison during the winter. Here is where many are trapped by the IBMP's policy of killing all those who venture away.

Moreover, the percentage of bison labeled as having brucellosis infection may not be accurate because most testing only indicates whether the animal once was infected. If the animal has recovered and no longer has an active brucellosis disease, it is still termed by park managers to have the disease, when it does not. As biologist John J. Treanor of Yellowstone National Park and his park colleagues point out in "Estimating probabilities of active brucellosis infection in Yellowstone bison through quantitative serology and tissue culture":

> In bison, *B. abortus* antibodies are long lived (Rhyan et al. 2009); thus, seroprevalence overestimates the level of active infection (Roffe et al. 1999) by failing to distinguish between infected and recovered animals (i.e. bison that have cleared the bacteria) (Treanor, 2011).

In fact, as the IBMP's 2015 annual report states concerning the level of infectious brucellosis in wild bison:

> About 60% of adult females tested positive for previous exposure to brucellosis, but only 8-12% were infectious (2015 Annual Report of the Interagency Bison Management Plan, 2016).

And lastly, how do we know that wild bison, if not reduced by 900 animals, will migrate into Montana, that is, the whole state of Montana? The National Park Service should be able to tell us how they expect wild bison to go beyond Yankee Jim Canyon. How are masses of bison to get through the fencing and the cattle guard there? It is a major migratory bottleneck for numerous animals.

Yes, the National Park Service may be technically correct in saying that bison will migrate into Montana, which is just across the northern border of the park, but what is implied by saying there is the "potential for a mass migration of bison into Montana" is that the state will be overrun by these wild animals. That is not true and thus it is fear mongering. Such claims by governmental authorities are an exercise in duplicity. Once again, it is simply kowtowing to the cattle industry.

Conservation of habitat outside the park

In his dissertation, Becker recommends the "conservation of high-quality ungulate wintering ranges outside protected areas." But what does that entail? Elk, such as those elk near Cody, Wyoming, have protected ranges outside the park, and here they are experiencing elevated brucellosis rates due to unhealthy concentrations. With plenty of irrigated alfalfa fields for forage, from an elk's point of view, why leave?

But staying put creates vulnerability, both to disease and predation. Like a stagnant pond, Greater Yellowstone Ecosystem has become an incubator of disease. Without ungulate movement and without sufficient predation to stimulate that movement, with fences in such places as Paradise Valley acting like dams to retard flow of these animals, and with fields devoted to fodder for domestic animals acting as attractants to ungulates, wild animals such as elk will stagnate. With regard to wild bison, those habitats outside the park that could serve as wintering ranges are essentially off limits, reducing dispersal.

While private land may be owned contiguous to the park and while public non-park land may be used privately bordering the park, to alter the land by the use of fences, the introduction of non-native species such as cattle and the cultivation and irrigation of these properties bordering the park, as well as the elimination of predators that serve to selectively maintain a balance of species in the region, and at the same time expect this wild system, this ecosystem to run smoothly with such alterations, is unrealistic.

The Yellowstone region is beautiful because it is wild. To alter her is to make her ugly and to do so for private gain is to prostitute her. Leave her alone and she will flourish. She will be able to run, dance and play and not be imbalanced and a contagion of disease. A sultan's attitude of dominance toward wildlife is incompatible with a healthy Greater Yellowstone Ecosystem.

IBMP has wild bison under house arrest

As mentioned previously, the word ecosystem comes from the Greek oikos "house" combined with the word "system." The Greater Yellowstone Ecosystem is indeed like a house for the animals that live in it. But, if one were to prohibit movement in that house, the occupant would most likely die. The inhabitant would perish because it could not move into the kitchen when hungry nor move to another room to protect itself if attacked. But think of the horror and impossibility of such a life if the occupant, when it did attempt to move, was shot by a government agent stationed at the door for making such a move.

That is what is transpiring in Yellowstone National Park for the wild bison when it attempts to forage at lower elevations and to avoid wolf attacks in the deep snow. Literally standing at the exit of the northern door of the park are government agents whose one purpose is to see that they move no further, and they accomplish this mandated purpose by slaughtering them. For the wild bison the park is a prison. The custodians of the park are their executioners. The Northern Gateway to the park now functions as the Berlin Wall for bison.

Mixed messages

In the preparation of this petition, what is so frustrating is that a wealth of data and research points to the inadvisability of large herd reductions of these wild animals. This information is often in the form of studies generated by government staff, such as those working for the National Park Service and Yellowstone National Park. Yet time and again, after stating the merits of allowing wildlife to function without human intrusion, the reports end up recommending lethal removal of bison.

Among the apologists for the mass culling of wild bison is Dr. P.J. White, chief of wildlife resources, Yellowstone National Park. Writing in "Management of Yellowstone bison and brucellosis transmission risk: Implications for conservation and restoration," White and co-authors Rick L. Wallen, Chris Geremia, John J. Treanor and Douglas W. Blanton, discuss in the review article *Biological Conservation* the problems surrounding the issues related to bison migration out of the park and delineate the ecologically destructive consequences of large-scale bison culls. But the authors conclude by citing research that justifies such removals and gives those advocating large-scale culls, such as the IBMP, the cover they need.

The problem is that the pivotal study used for this justification is a mathematical model of prediction and is not based on field evidence. It is tantamount to an opinion. Pretending that it is fact is, to say the least, disappointing.

White's review begins by pointing out that not allowing ungulates such as bison to migrate creates crowding in the park and thus greater risk of disease transmission both within and outside the park. He states (citations omitted):

> Infectious diseases transmitted between wildlife and livestock are increasingly becoming one of the primary drivers threatening the long-term viability of wildlife populations through the isolation of protected areas. The increase in human agricultural activities along the boundaries of wildlife reserves has augmented the sharing of diseases between wildlife, livestock, and humans. These multi-host situations, where the disease has been eradicated or is under control in domestic livestock, are exceptionally difficult to manage because a single transmission from wildlife to livestock can have severe consequences for public health, the region's economy, and wildlife conservation … As a result, wildlife hosts are often restricted to reserves which may not offer all the seasonal habitat requirements for survival and reproduction. This is the case for many migratory ungulates, where most protected areas do not include the entire migratory range and intact ungulate migrations have declined as these conservation areas have become increasingly insularized by human activities. A consequence of restricting wildlife access outside reserves is the crowding of hosts within protected areas which can lead to an increase in disease transmission within the wildlife host populations and, ultimately, greater transmission risk to nearby livestock.

That crowding promotes disease and that migration by promoting dispersal mitigates disease is a major thesis of this petition.

According to White, migration is an essential behavioral feature necessary for bison survival. An essential characteristic of this migratory pattern is seasonal movements out of and then back into the park (or at least attempts to do so, as most migratory bison are diverted into the Stephens Creek capture facility and lethally removed). Concerning Yellowstone bison, he states (citations omitted):

> Large annual migrations of bison to low-elevation winter ranges north and west of the park boundary highlight the importance of these areas as winter habitat for bison. Migration during winter allows bison to access food resources that are more readily available in lower snow depth areas of their range, and serves to release portions of the bison range in the park from intensive use for a portion of the year. Most bison migration into Montana occurs during mid- to late winter, with peak numbers moving to the north boundary in late February and March and to the west boundary in April and May as vegetation begins to green-up on low-elevation ranges. Migration back

to interior park ranges typically occurs during May through June, following the wave of growing vegetation from lower to higher elevations, similar to other ungulates in this system. Thus, hazing operations to move all bison back into the park during mid-May often occur at a time when bison are undernourished at the end of winter, have vulnerable newborn calves, and may want to remain on low-elevation ranges with new grasses because there is typically still substantial snow on their higher-elevation summer ranges. The reluctance of bison to be returned to the park before sufficient vegetation green-up at higher elevations is evidenced by the repeated attempts of hazed bison to return to lower-elevation ranges with new grasses in Montana during May and early June.

White claims that if the bison population in the park can be maintained at above 3,000, adaptive capabilities and genetic diversity will be maintained. Providing four citations to support this claim, he states:

> . . . recent demographic and genetic analyses suggest that an average of more than 3000 bison total on a decadal scale is likely needed to maintain a demographically robust and resilient population that retains its adaptive capabilities with relatively high genetic diversity (Gross et al., 2006; Freese et al., 2007; Plumb et al., 2009; Pérez-Figueroa et al., 2010).

In the review White states that large scale culling can have detrimental consequences:

> Brucellosis risk management actions have been periodically implemented under the IBMP to reduce the numbers of bison attempting to move outside the park. However, more than 1000 bison (21%) were culled from the population during winter 2006 and 1700 bison (37%) were culled during winter 2008 because hazing was no longer effective at keeping them in the park or adjacent conservation areas, as required during step 1 of the IBMP. Frequent large-scale, non-random culls could have unintended effects on the long-term conservation of bison, similar to demographic side effects detected in other ungulate populations around the world.

He noted that 556 bison were sent to slaughter from the west boundary and 2,650 bison from the north boundary of the park during 2003–2008. An analysis of that group's sex ratio showed more females than males were slaughtered, contributing to changes in the gender ratio of bison in the park. White stated that:

> Skewing bison sex ratios in favor of males could increase mate competition among males and result in higher levels of aggression and mortality during the breeding season. Also, over-winter survival is usually lower in males than

females in large sexually dimorphic species such as bison due to the expenditure of resources during the rut. For male Yellowstone bison, internal resources depleted during the autumn rut cannot be replenished until new forage is produced in the spring. Thus, management actions that skew the sex ratio in favor of males may further reduce male over-winter survival by increasing the intensity of competitive interactions during the breeding season.

By such non-random culling, the central herd's productivity is being diminished. As White pointed out:

> In addition, large-scale culls of females apparently reduced the productivity of the central herd . . .

White noted that while "relatively few calves show positive responses on serological tests" for brucellosis, an age analysis of the 488 female bison "processed" at the Stephens Creek capture facility during the winters 2006 and 2008 revealed for those years one-third and one-half of the park's calf crop, respectively, had been wiped out by culling. These calves had not been tested for brucellosis prior to culling, resulting in the needless lethal removal of juvenile wild bison. These were the calves that had migrated with their mothers to survive. In sum, White observed:

> Large-scale culls also contributed to a substantial reduction in juvenile cohorts when captured bison were not tested for brucellosis exposure before being removed from the population.

White stated that at the time of his review (2011) "there is no evidence that culling has significantly altered the genetic structure or diversity in the Yellowstone bison population." But he had this warning:

> However, our analyses suggest the continuation of erratic, large-scale culls over the coming decades could have unintended consequences on the demography of Yellowstone bison.

The critical importance of conserving bison in their wild state is discussed in the review. White states:

> Yellowstone bison are managed as wildlife in multiple, large herds that migrate and disperse across an extensive landscape (>90,000 ha) they share with a full suite of native ungulates and predators, and are subject to natural selection factors such as competition for food and mates, predation and survival under substantial environmental variability. Thus, they have retained the adaptive capabilities of plains bison, which is an essential quality for

> restoring other wild populations, and contribute significant and unique genetic diversity to plains bison. The ecological future of plains bison could be significantly enhanced by resolving issues of disease and social tolerance for Yellowstone bison so that their wild state and genetic diversity are retained and can be used to synergize the recovery of the species and the restoration of grassland biodiversity across central and western North America.

But there is a problem involved, White claims, in the conservation of wild bison and it is this: if left alone, they might invade Montana. He states:

> Yellowstone bison will continue to migrate into Montana during winter, with higher numbers migrating as bison abundance and winter severity increase. Without human intervention, some bison will not migrate back into Yellowstone National Park during spring, but will attempt to expand their range into suitable habitat areas in Montana (Plumb et al., 2009).

And then immediately follows this big “thus:”

> Thus, a deliberate risk management strategy such as the IBMP is necessary to maintain separation between bison and cattle and prevent the tangible risk of brucellosis transmission between these species (White, 2011).

And thus is provided justification for the past orders and the impending ones by the IBMP of “off with their heads,” that is, off with wild bison heads—with the goal of 1,800 of them in two winters, a goal that so far has not been met, to the disappointment of the ruling coalition members of the IBMP.

White’s latter statements promoting the infusion of cattle into the ecosystem that he seeks to preserve and the resultant need to massively cull wild bison should leave a rational mind incredulous. How could any right thinking person advocate the culling of bison in behalf of the separation of cattle from bison, decimating wild bison and truncating their wild migratory behavior, yet say the following:

> The ecological future of plains bison could be significantly enhanced by resolving issues of disease and social tolerance for Yellowstone bison so that their wild state and genetic diversity are retained and can be used to synergize the recovery of the species and the restoration of grassland biodiversity across central and western North America.

How can White promote the retention of the wild bison’s “wild state and genetic diversity” and the use of wild bison in “the restoration of grassland biodiversity across central and western North America” while at the same time support a policy that kills thousands of wild bison at the borders of the park, stopping their entrance into the very grasslands of central and western North

America he wants restored by wild bison being on those grasslands? What is he thinking?

It would be like saying "Ladies and gentlemen, we must paint this fine, historic house white to preserve its classic beauty," then in the next breath say, "Yes, ladies and gentlemen, and now help me burn it down."

Some overriding factors, such as the forces operating in groupthink, must be behind the irrationality exhibited by White. But such thinking is not isolated, for it pervades those associated with the management of the park's bison, namely, the Interagency Bison Management Plan, with the partial exception of the Native American tribal members.

The Plumb study

Let us try to untangle all this. Let us look at White's cited study "Plumb et al., 2009" used to support his argument. The title is "Carrying capacity, migration, and dispersal in Yellowstone bison," published in *Biological Conservation*. The lead author is G.E. Plumb, with co-authors P.J. White, M. B. Coughenour and R.L. Wallen. It is already making a little more sense. Plumb, White and Wallen are all with Yellowstone National Park. Both White and Wallen were authors of the review article citing the Plumb et al. 2009 study and both papers were published in *Biological Conservation*. In essence, White is self-citing.

As Plumb notes with regard to the rarity of the Yellowstone bison and attempts to limit their abundance:

> . . . by the early 20th century, YNP provided sanctuary to the only relict, wild and free-ranging bison remaining in the United States. Park ungulate management policies evolved in 1969 to preclude deliberate culling inside the park and allow ungulate abundance to fluctuate in response to weather, predators, resource limitations, and outside the-park hunting and land uses. Bison numbers increased rapidly under this policy and, since the 1980s, increasing numbers have moved outside the park during winter where some have been culled or hunted by state, tribal, and federal agencies. The YNP policy of ''natural regulation" proved to be a highly contentious approach to wildlife management, with criticisms primarily focused on effects of perceived overabundance of wild ungulates on range health in the park. Bison movements beyond the YNP boundary led to claims that bison were overabundant and had degraded the range health inside the park. Such claims, in turn, have led to calls for intensive management to limit the abundance and distribution of bison inside YNP, including fencing, fertility control, hunting, and brucellosis test-and-slaughter programs.

According to Plumb:

> A central question in this debate is whether bison move outside the park because their abundance has surpassed levels that can be supported by the forage base in the park, considering year-to-year variations in food production, habitat use, diet selection, and energy balance.

To help answer this question, Plumb looked at a number of analytical studies that evaluated whether bison numbers have exceeded their theoretical food-limited carrying capacity in the park and why bison moved outside the park during winter and spring. He examined data on "site water balance, plant biomass production, plant population dynamics, litter decomposition and nitrogen cycling, ungulate herbivory, ungulate spatial distribution, ungulate energy balance, ungulate population dynamics, predation, and predator population dynamics submodels."

What is important to realize is that the method employed here to determine answers is a theoretical one, using a computer and a mathematical model of a biological system, in this case the Yellowstone ecosystem, to simulate the behavior of that system. The answer is an "if this, then we can expect that" type of answer—an educated guess, a prediction. According to the review:

> When the model was run for eight simulations for the northern and central herds simultaneously over 50 years . . . neither the central nor the northern bison herds have exceeded the estimated mean food-limited carrying capacities in the park . . .

However, there is a caveat. Plumb noted:

> During severe winters, the energy balance model predicted that the populations would be under nutritional stress well below food-limited carrying capacity and, as a result, the population model predicted considerable calf mortality and small increases in adult mortality due to starvation.

The simulations reviewed by Plumb indicated that a factor in nutritional stress was that during severe winters as more bison came down from the higher elevations in the park, where there was higher-quality foraging, densities of bison at the lower level in the park increased, creating pressures on resident bison, forcing them to move out of the park. He noted:

> There were indications of nutritional stress via decreasing minimum body condition and calf:cow ratios in simulations of Yellowstone bison dynamics during 1969 through the mid-1990s as bison and elk numbers increased. These findings suggest there was increased competition for food supplies, even though less than one-half of the total forage was eaten. Higher-quality foraging areas for bison in YNP are limited in overall area, patchily-distributed, and likely depleted first. Residence times in winter foraging areas were negatively

> correlated with bison numbers, suggesting that competition increased in high-quality foraging areas as more bison moved onto the winter range and bison travel and redistribution increased suggested an increasing probability of larger bison movement beyond the park boundary when their abundance exceeded 3000. More-recent analyses of data collected during 1970–2008 suggest that limiting the population to <3500 bison in the central herd and <1200 bison in the northern herd could abate most large-scale movements outside the park during near-average winter conditions.

As Plumb noted, the population level at which migration out of the park is triggered according to recent simulations is 3,500 in the central herd and 1,200 in the northern herd. Previously, it was predicted that this trigger would be reached at the 3,000 level for both herds together.

Plumb explained that climate variability is a primary factor in bison migratory behavior:

> Yellowstone bison spend the majority of their time finding and eating forage during winter, with nearly one-third of that time spent displacing snow to reach forage. Thus, snow is the primary factor that reduces foraging efficiency and bison prefer patches with minimal snow pack compared to the surrounding landscape. As snow depth increases, the available foraging area for Yellowstone bison is reduced to increasingly limited areas at lower elevations and on thermally warmed ground, even though many geothermal areas contain low biomass and/or relatively poor quality forage. Also, snow melts earlier at lower elevations and, as a result, there is earlier green-up and energy-efficient foraging opportunities while upper-elevation portions of the winter range are still covered with snow. Thus, the numbers and timing of bison migrating from the summer range to the winter range is positively related to snow build-up on the summer range, while return migration from lower elevation winter ranges aligns with temporal and spatial patterns of onset phenology [that is, climatic response]. Upon initiation, onset phenology occurs progressively at the rate of approximately 10 days for every 300 m. of elevation gained, suggesting Yellowstone bison may employ a conditional migration strategy based on climate variability.

Plumb concludes his review by stating that even though bison are not overgrazing the park nor exceeding its carrying capacity of 6,200, large-scale bison migration could "overwhelm manager's abilities to maintain separation between bison and livestock," making it necessary to prevent dispersal and range expansion via hunting and culling. He stated:

> While evidence indicates the Yellowstone bison population has not exceeded the park's food-limited carrying capacity of approximately 6200, it also

> appears that the interactive effects of severe winters with population levels greater than 4700 bison could induce large-scale movements of bison to lower-elevation winter range outside YNP. Such large movements jeopardize brucellosis risk management objectives by overwhelming manager's abilities to maintain separation between bison and livestock. Thus, we propose that a Yellowstone bison population that varies on a decadal scale between 2500 and 4500 animals should satisfy the collective long-term interests of stakeholders, as a balance between the park's forage base, conservation of the genetic integrity of the bison population, protection of their migratory tendencies, brucellosis risk management, and other societal constraints. Within this range of abundance, management agencies should continue to prioritize conservation of bison migration to essential winter range areas within and adjacent to the park, while also actively preventing dispersal and range expansion via hunting, outside YNP, and periodic brucellosis risk-management (i.e., dispersal sink) (Plumb, 2009).

But one wonders how "protection of their migratory tendencies" is accomplished "while also actively preventing dispersal and range expansion via hunting, outside YNP, and periodic brucellosis risk-management (i.e., dispersal sink)."

One wonders how "protection of their migratory tendencies" can be a goal, when Plumb reports that historically and at present "range expansion beyond park boundaries" has been "precluded." Plumb stated:

> Since the mid-20th century, and more recently under the IBMP, range expansion beyond park boundaries was precluded by culling and hazing bison back into the park during winter and spring to reduce the risk of brucellosis transmission to livestock.

Dispersal is defined by Plumb as "movement from one spatial unit to another, without return (at least in the short term), while range expansion is the outward dispersal of animals beyond the limits of the traditional distribution for a population."

According to Plumb's definition, it is not only range expansion that is being precluded by the culling practices, but dispersal also. One wonders what he means by the term "dispersal sink." Apparently, he equates *culling* with a dispersal sink, for her says "periodic brucellosis risk-management (i.e., dispersal sink)."

In ecology literature, a "dispersal sink" is defined as any habitat in which, in the absence of immigration, the resident population is expected to decline to extinction because local births are insufficient to compensate for local deaths. Dispersal sinks are assumed to occur in suboptimal habitat, whereas "source" populations from which immigrants derive, that is, those populations where births are greater than deaths, are assumed to occur in optimal habitat (Clinchy, 2001).

Or simply put, as defined by Frank B. Golley et al. in *Small Mammals: Their Productivity and Population Dynamics:*

> Space which provides an outlet for wandering impulses is termed a "dispersal sink" (Golley, 1975).

Recall the quote from the White review that started this discussion, the one that ended with the Plumb, 2009 citation, namely:

> Yellowstone bison will continue to migrate into Montana during winter, with higher numbers migrating as bison abundance and winter severity increase (Geremia et al., 2011). Without human intervention, some bison will not migrate back into Yellowstone National Park during spring, but will attempt to expand their range into suitable habitat areas in Montana (Plumb et al., 2009) (White, 2010).

A search of the Plumb article, however, does not mention anything about the bison "not migrating" back in the spring, but it does mention a simulation representing a dispersal sink from which some bison would leave the "higher-elevation park landscape and not return." The simulation discussed is what would be predicted to happen if 45 percent of the migratory herd were culled. Plumb writes:

> In simulations that represented a brucellosis risk management induced off-take [culling] of 45% of bison leaving the park, the northern herd fluctuated between 200 and 400 animals and the central herd fluctuated between 1700 and 2500 animals. This simulation can be thought of as representing a dispersal sink, wherein some bison would normally leave the higher elevation park landscape and not return.

Plumb continues, noting that:

> Dispersal movements and sinks are common in wildlife populations and should be expected in nomadic, wide-ranging species such as bison.

Culling is thus equated by Plumb with a "dispersal sink," supposedly a normal event that "should be expected in nomadic, wide-ranging species such as bison." Plumb continues:

> Intermittent brucellosis risk-management removals at the park boundary, combined with over-winter natural mortality of >1000 bison in 1997, 2006, and 2008, temporarily reduced the density of bison and likely diminished the magnitude of density dependent effects on demography and movements.

> Conversely, in the absence of hunting or brucellosis risk management removals, hazing bison back into the park likely maintained the density dependent effects of exploitative competition (Gates et al., 2005), and increased retention of learned movement behaviors that otherwise would be lost in a management-induced ‘‘dispersal sink.”

Of special importance is the statement that “hazing bison back into the park likely maintained the density dependent effects of exploitative competition (Gates et al., 2005), and increased retention of learned movement behaviors that otherwise would be lost in a management-induced ‘dispersal sink.’”

The Gates et al, 2005 citation mentioned by Plumb is contained in *The Ecology of Bison Movements and Distribution in and Beyond Yellowstone National Park.* Gates states:

> Under the Interagency Bison Management Plan, state and federal agency officials either haze bison that leave YNP back into the park, or bison are captured and tested for brucellosis and those testing positive are slaughtered. Removals at the boundary temporarily reduce the density of the park population, diminishing the magnitude of density dependent effects on survival and reproduction from resource limitation within the park bison ranges. Either range expansion or removals at the boundaries compensate for forage limitation effects within the park on fecundity and particularly juvenile survivorship. Hazing bison back into the park should result in maintaining density dependent effects caused by exploitative competition. The additional energetic cost induced by hazing should accentuate the negative effects of resource limitation for bison exposed to this action.

Notice that Gates’ statement concerning the effects of “hazing bison back into the park” is followed by noting a negative outcome:

> The additional energetic cost induced by hazing should accentuate the negative effects of resource limitation for bison exposed to this action.

On the other hand, the Plumb passage notes a positive outcome as the result of “hazing bison back into the park,” namely,

> . . . increased retention of learned movement behaviors that otherwise would be lost in a management-induced ‘‘dispersal sink.”

Since bison are not hazed back in the winter (for the simple reason bison resist returning to an environment they tried to escape for survival via dispersal), the hazing mentioned must be those that migrated down in the late winter or early spring months. What we do know about them is that they are the ones that “otherwise would be lost in a management-induced ‘dispersal sink’” and that, because they had not been lost, had “increased retention of learned movement behaviors,” most likely referring to their knowledge of migration routes out of the park.

Plumb twists Gates’ observation on the negative effects of hazing to have a positive outcome. Plumb elaborates on the merits of a “dispersal sink,” equating “lethal brucellosis risk management” with such a sink:

> In natural populations, animals often disperse to marginal habitats in response to food competition and nutritional stress in core, high quality habitats. Thus, the dispersal area acts as a population sink (Owen-Smith, 1983; Coughenour, 2008). In a situation like YNP, these movements are a natural process resulting from successful conservation and population increases inside the park. Though potential bison habitats adjacent to YNP should not be considered marginal, lethal brucellosis risk management in these areas can serve as a surrogate for the dispersal sink that would otherwise be an expected part of natural ecosystem processes.

So these artificial dispersal sinks, such as the Stephens Creek capture facility, are just a substitute for marginal habitats. But wait a minute. How can this type of a dispersal sink be a good thing for bison when those that are not hazed back, those that enter it, are lost along with their “learned movement behaviors,” lost in the IBMP’s “management-induced ‘dispersal sink’”?

Plumb’s passage that reasoned, “increased retention of learned movement behaviors that otherwise would be lost in a management-induced ‘dispersal sink,’” was immediately followed by this non sequitur:

> Without this intensive management intervention, there is little doubt that bison would have continued to expand their winter range and dispersed to suitable habitat outside the northern and western boundaries of the park (p. 2384).

That statement, combined with the Plumb statement quoted previously, namely, “This simulation can be thought of as representing a dispersal sink, wherein some bison would normally leave the higher-elevation park landscape and not return (p. 2383),” most likely provided the synthetic support for the following statement by White upon which the artifice of the IBMP and the NPS’s justification for lethal removal of bison rests:

> Without human intervention, some bison will not migrate back into Yellowstone National Park during spring, but will attempt to expand their range into suitable habitat areas in Montana (White, 2010).

The statement that bison "will not migrate back" is built on the statement describing a computer-generated model that shows some bison entering marginal habitat called a dispersal sink will "not return." This is true, because they have entered a dispersal sink of a special type, one that involves "periodic brucellosis risk-management (i.e., dispersal sink)," also termed a "management-induced 'dispersal sink.'" What is this managed dispersal sink? The Stephens Creek capture facility.

Except for the few that are vaccinated and released in the spring, they do not return or migrate back because from the capture facility there is no return—they are dead, slaughtered by the IBMP.

Recall the statement providing the rationale for slaughtering 900 bison this winter:

> Biologists from the National Park Service (NPS) have proposed removing 900 bison near the northern boundary this winter to reduce population growth and the potential for a mass migration of bison into Montana.

That statement is based on the kind of thinking delineated above. What the NPS is warning us about and what we must protect the state of Montana from is in actuality a mathematically-simulated mass invasion of wild bison *ghosts*. We are told bison do "not return" and thus supposedly will increasingly occupy Montana by means of a "mass migration," but in reality they do not return because they are dead. They do not return because this "mass migration of bison" goes into the slaughterhouse, the capture facility from which they are shipped to slaughter—Plumb's "dispersal sink." That is Plumb crazy.

In keeping with this warning of impending bison doom and as background music for this cinematic-quality fantastical thinking, let us now play Darth Vader's Imperial Death March.

We have been sold a pack of lies. In other studies, recall we have been told that bison are most likely to return in the spring to take advantage of spring grasses with higher nutritional value in the higher elevations. We have also been told they most likely would return by themselves without hazing, but since they have never been allowed to follow this instinct because of annual spring hazing by the IBMP, we did not have the data to support that likelihood. We now are acquiring that data at Horse Butte, where bison are allowed to stay year-round, but nevertheless return to the higher altitudes of the interior of the park in late spring. To imply, as does the National Park Service in its apparent reliance on such studies as the Plumb study, that the IBMP is Mother Nature herself—a surrogate dispersal sink—and that on top of that we need the management actions of the IBMP to protect the state of Montana from a mass bison migratory invasion, is using science to mislead.

It is intuitively obvious that culling is not natural and to try to pawn off on the public that it is natural is an example of scientific hubris. Dispersal sinks lead to extinction within the dispersal area when there are fewer births than deaths and when no immigration from outside makes up for the losses. Plumb identified IBMP's brucellosis control management, i.e., lethal removal, with a dispersal sink. When a spatial area is emptied routinely by killing its inhabitants, such a dispersal sink guarantees extinction of its occupants, for dead bison cannot multiply.

Douglas W. Morris, professor of evolutionary and conservation ecology at Lakehead University, writing in the *American Naturalist* "On the evolutionary stability of dispersal to sink habitats," argues that a dispersal sink without migration back to the source is not evolutionarily stable. He states:

> A recurring theme in the literature of population regulation is that surplus reproduction in high-quality "source" habitats is exported to low-quality "sink" habitats. Two recent innovative papers by Pulliam (1988) and Pulliam and Danielson (1991) have shown that equilibrium densities in both kinds of habitats can be maintained by an evolutionary stable strategy (ESS) of habitat selection. Yet the basic idea that populations exist indefinitely in habitats in which mortality exceeds recruitment seems counter to other evolutionary models that argue convincingly for habitat specialization. I show that emigration to sink habitats is likely to be an ESS only if there is reverse migration back to the source (Morris, 1991).

Neither dead bison, nor their ghosts, can migrate back or return to the park, nor expand their range, except in a computer simulation. Yellowstone National Park is not, however, a simulation video game nor bison avatars, although some biologists studying the park are treating them as such.

The point is this: while computer simulations of wildlife behavior have their place, with regard to making studies on migratory behavior of something as complex and controversial as wild bison migratory movements, field biologists should also be conducting the studies. And this means allowing the bison to migrate outside the park so that their migratory behavior can be examined in real life, not simulated life.

If one looks at past field studies and records, the fears expressed by the National Park Service that wild bison will invade the state of Montana if allowed to migrate is unfounded. According to the Plumb review, the map below shows the extent of the range of the wild bison presently and historically. A similar map is depicted in the White review.

Notice that even if wild bison expanded their range to its historical limits it would only occupy portions of the Madison Valley and Paradise Valley, a range expansion amounting to a small part of the entire state of Montana. The present distribution of wild bison is indicated by the dark shaded areas. The regions being subjected to lethal removal are those relatively small areas extending just beyond the borders of the park as well as small portions within the park (Zone 1). Since the Madison River exit is essentially blocked at Hebgen Dam due to terrain, the dam itself and high winter snows, and since the Yankee Jim Canyon exit is blocked by fencing and a cattle guard, migration beyond these regions is unlikely.

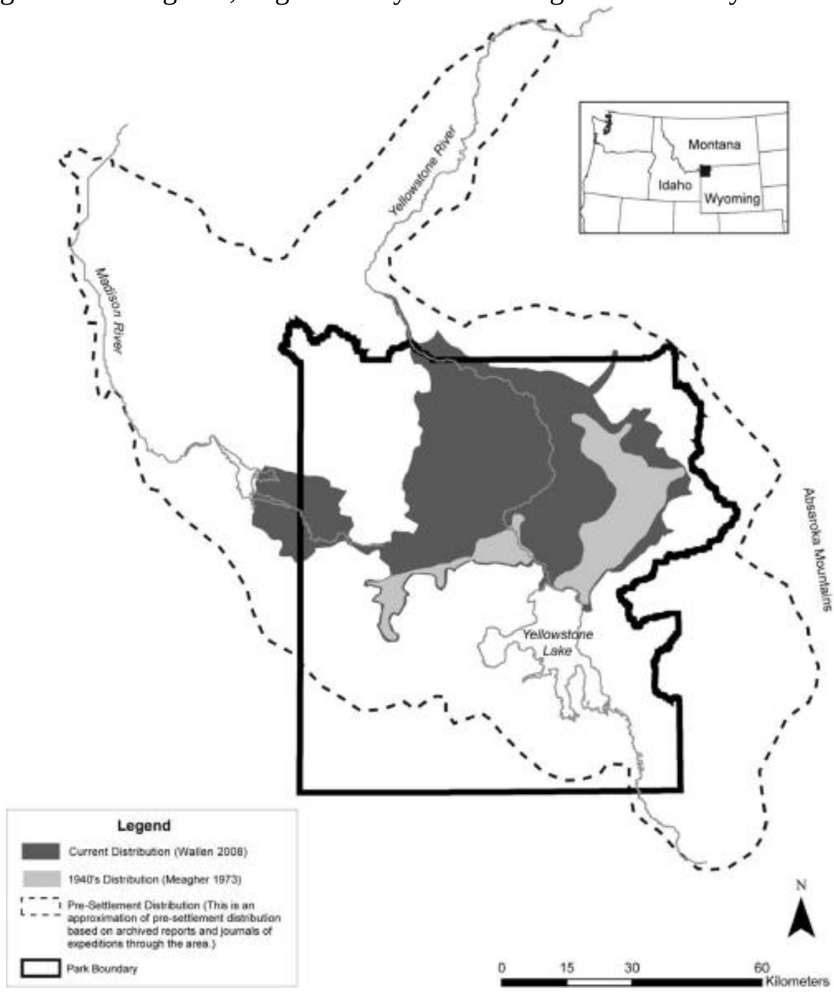

Figure 85. BISON DISTRIBUTION NOW AND THEN. Map depicting Yellowstone National Park and the pre-settlement, mid-20th century, and current distribution of Yellowstone bison. ***From Plumb, 2009.***

The most plausible reason for this limitation of range expansion historically is due to energy expenditures by bison as they seasonally travel from the high elevation areas of the park in winter down to the lower elevations. If they were to travel further distances than the historical range boundary indicated by the dotted line, the amount of energy needed to get back to the high elevations of the park would most likely be too costly.

To better understand such migratory returns and why extensive range expansion is not likely by wild bison in Yellowstone, nor a Montana bison invasion, think like a buffalo. If your favorite restaurant were up in the mountains and it was opening up in the spring, why go the opposite way to a greasy hamburger joint on the plains? As the snows melt, the upper elevations begin to green with the bison's favorite sedges, forbs and grasses, and off they go. For these Yellowstone bison, being "snowbirds" has been a family tradition for millennia. But they return to their favorite summer resort, the high country, when the weather gets good. Here is where they fatten up, for in the winter they are often reduced to skin and bones.

A similar range limitation caused by altitudinal migration movements apparently is in operation for the European bison or wisent of the Caucasus Mountains.

The magic number of 3,000

Once the fake rationale for culling had been established, the number to be culled had to be determined and supported by the members of the IBMP.

Recall that in the justification to cull 900 bison, the National Park Service stated in its "Frequently Asked Questions: Bison Management" that:

> In 2000, the Secretaries of Agriculture and Interior and the Governor of Montana signed a court-mediated agreement that included guidelines to limit bison abundance near 3,000.

Since the signing of this agreement, biologists have been trying to justify this number as sufficient to maintain genetic diversity. You see, it would be helpful for the slaughter apologists to have their wild bison legal maximum population for the park agree with science.

Writing in 2009, Plumb noted that to maintain genetic diversity of the park's wild bison a population of 2,500 bison would be needed. The importance of wild bison, the need to preserve their wild traits and what is needed to do so is eloquently stated:

> Freese et al. (2007) documented that the North American bison is ecologically extinct across its former range and, along with Sanderson et al. (2008), called for urgent measures to conserve the remaining wild and free-ranging bison, and restore the species as wildlife in focal areas across its historic range. Conservation of the migratory and nomadic tendencies of bison, as well as their genetic integrity and ecological role, is paramount for the perpetuation of the species. Yellowstone bison can be characterized as a single population with two genetically distinguishable breeding groups or subpopulations (Halbert, 2003; Gardipee, 2007). Analyses estimate that 1000–2000 bison likely are needed in each of the central and northern breeding herds to retain enough genetic diversity to enable bison to adapt to a changing environment through natural selection, drift, and mutation (Gross and Wang, 2005; Gross et al., 2006; Freese et al., 2007). Also, many thousands of bison are likely necessary to fully express their ecological role through the creation of

landscape heterozygosity, nutrient redistribution, competition with other ungulates, prey for carnivores, habitat creation for grassland birds and other species, provision of carcasses for scavengers, stimulation of primary production, and opened access to vegetation through snow cover (Freese et al., 2007; Sanderson et al., 2008). Thus, while the IBMP initially indicated that 2100 bison would satisfy conservation values (US Department of Interior, 2000a,b), strong scientific and management support has developed for managing the Yellowstone population above a minimum conservation target of 2500 bison.

Writing in 2011, White noted that to maintain genetic diversity and the adaptive capabilities of the park's wild bison a population of more than 3,000 bison would be needed. He stated:

> Until the late 1970s, bison persisted at relatively low numbers (less than 1500 total) and generally remained isolated in interior park valleys by deep snows (Meagher, 1998). However, recent demographic and genetic analyses suggest that an average of more than 3000 bison total on a decadal scale is likely needed to maintain a demographically robust and resilient population that retains its adaptive capabilities with relatively high genetic diversity (Gross et al., 2006; Freese et al., 2007; Plumb et al., 2009; Pérez-Figueroa et al., 2010).

The three studies they cite to support their claims for the appropriate population levels to maintain genetic diversity and adaptive capabilities are:

- Gross, J.E., Wang, G., Halbert, N.D., Gogan, P.A., Derr, J.N., Templeton, J.W., 2006. Effects of Population Control Strategies on Retention of Genetic Diversity in National Park Service Bison (Bison bison) Herds. United States Geological Survey, Biological Resources.

- Freese, C.H., Aune, K.E., Boyd, D.P., Derr, J.N., Forrest, S.C., Gates, C.C., Gogan, P.J.P., Grassel, S.M., Halbert, N.D., Kunkel, K., Redford, K.H., 2007. Second chance for the plains bison. Biological Conservation 136, 175–184.

- Pérez-Figueroa, A., Wallen, R., Antao, T., Coombs, J.A., Schwartz, M.K., Allendorf, F.W., Luikart, G., White, P.J., 2010. Conserving Genetic Variation in Large Mammals: Effect of Population Fluctuations and Male Reproductive Success on Genetic Variation in Yellowstone Bison. University of Montana, Missoula, Montana.

Following is a summary of the findings of each study and the methods employed to reach each finding. But first, a short detour through some scientific jargon.

Genetic diversity, alleles and heterozygosity

Major concepts to understand with regard to these studies are the terms "genetic diversity," "allele" and "heterozygosity." MA Toro and A Caballero in "Characterization and conservation of genetic diversity in subdivided populations," *Philosophical Transactions B, Royal Society Publishing,* wrote:

> Genetic diversity has been defined as the variety of alleles and genotypes present in a population and this is reflected in morphological, physiological and behavioural differences between individuals and populations (Frankham et al. 2002).

The authors noted that genetic diversity is the foundation for evolutionary potential and adaptivity. They noted:

> Maintenance of biodiversity is one of the most important current concerns of humankind, as wild species and domestic breeds and strains are disappearing at an alarming rate, and an increasing number of these require human intervention to guarantee their survival (Frankham et al. 2002). As genetic diversity is the basis of evolutionary potential of species to respond to environmental changes, this becomes an essential pillar in conservation genetics. Most populations of endangered species are commonly subdivided in different breeding groups, either in different fragments of habitats, natural reserves, arboreta or zoos, or in different breeds or strains in the case of domestic plants and animals, which are, in turn, subdivided into smaller reproductive units more or less interconnected. Thus, characterization and management of genetic diversity has to be made considering idiosyncratic population structures.

According to the authors, quoting M. Nei in "Analysis of gene diversity in subdivided populations," *Proceedings of the National Academy of Sciences*:

> The most widely used parameter to measure diversity within populations is the expected heterozygosity, or gene diversity, defined by Nei (1973) as the probability that two alleles chosen at random from the population are different (Toro, 2005).

.

What is an allele? As mentioned earlier, it is part of a gene. Genes come in pairs, with each member of the pair called an allele. The alleles are in pairs because chromosomes are paired strands of DNA, with each allele located on a specific portion of the chromosome and each allele coming from one or the other parent. A gene determines what traits an individual has, such as eye color. An allele controls what *kind* of color, such as brown or blue. How the trait is expressed in the individual is determined by whether the pair of alleles in each parent are the same or different and which allele in that pair is dominant (covers over) or recessive (covers up). Following fertilization, the resultant pair of alleles inherited from each parent may be the same (homozygous) or different (heterozygous). Heterozygosity confers adaptive advantages since more varied progeny may be produced, increasing the probability that some may be more fit. For example, if a black fox has alleles for both a black coat and a white coat (a heterozygote), the fox that is born may have either a black or white coat. If the climate changes to one producing a landscape primarily covered with snow, the kit with a white coat will have a better chance of survival than those born with a black coat. But if neither of the parents has an allele for a white coat, but only for black coats (homozygotes), no fox will be born with a white coat, compromising survival. Genetic diversity provides greater genetic choices for evolution to work on.

In sum, high heterozygosity means lots of genetic variability. Low heterozygosity means little genetic variability. A goal for managing wild populations of animals is to retain genetic heterozygosity in that population. In the process of natural selection, without an allele for "white coat" but only an allele for "black coat," for instance, no selection for "white coat" can be made for the obvious fact that it is not there to select, compromising fitness.

Study 1

The 2006 study led by Gross, National Park Service and Natural Resource Ecology Laboratory, Colorado State University, concluded:

> A moderate bison population size—about 1000 animals—is necessary to meet a long-term goal of achieving a 90% probability of retaining 90% of allelic diversity for 200 years.

Methods used were computer simulations of herds. Gross noted:

> We simulated the dynamics of bison herds inhabiting National Park Service (NPS) units to evaluate the consequences of management actions on retention of genetic diversity. We used an individual-based model to evaluate the effects of management strategies on the retention of genetic heterozygosity (H0), retention of alleles, and on herd sex and age structure. To identify general recommendations that could be applied across conditions typical of captive bison herds, we estimated vital rates of herds occupying harsh, average, or good ranges, and we used these vital rates to drive simulations with herd size targets of 200 to 2000 animals. Simulations were initialized with data from observations of microsatellite allele frequencies obtained from NPS bison herds (Halbert 2003).

The study evaluated removals according to the following groups:

> We examined the effects of removal of bison that were young, old, or a random selection of ages, and removals that contained a high proportion of cow-calf groups (24% or 50% of animals removed) (Gross, 2006).

Study 2

The Freese 2007 study is a review of other studies. It concluded:

> Gross and Wang (2005) estimate that to retain 90% of existing alleles over 200 years an actual population size of 1000 bison is required. However, to meet the need for bison to adapt to new areas where they are reintroduced and to adapt to large current (e.g., exotic diseases) and future (e.g., climate change) alterations in their habitats, as well as for the intrinsic value of conserving genetic diversity, a more prudent goal would be retention of at least 95% of allelic diversity over 200 years. Their analysis suggests a herd size of at least 2000 animals is required to meet this goal.

It stressed the importance of the preservation of wild bison genes and behavior:

> Urgent measures are needed to conserve the wild bison genome and to restore the ecological role of bison in grassland ecosystems (Freese, 2007).

Study 3

The Pérez-Figueroa 2010 study involves "stochastic simulation modeling" to "investigate strategies to conserve genetic variation for nearly any species or population with age structure and complex demography, as illustrated here for bison." A stochastic system is one whose state is non-deterministic, that is "random," and in such a system the subsequent state of the system is determined probabilistically. Used here, simulation modeling can provide an estimate of a population's level of genetic diversity.

In the simulation model:

> Culling was random among all age classes or random within the age groups culled (e.g., among juveniles less than 3 years old or adults greater than 3 years old). Individuals were culled until the target population size (2500 or 3000) was reached.

According to Perez-Figueroa the Yellowstone bison are unique:

> Yellowstone is the only remaining wild population of plains bison that currently meets the objective of maintaining a large population size with greater than 2000 individuals. Most North American populations have fewer than 400 bison because this species requires large conservation areas and modern society currently provides little space for wild bison outside nature preserves and national parks.

The study concludes by saying the genetic diversity can be maintained with about 3,250 bison:

> These simulations suggest that fluctuations in population census size do not necessarily accelerate the loss of genetic variation, at least for the relatively large census size and growing populations such as in Yellowstone bison. They also suggest that the conservation of high allelic diversity (>95%) at loci with many alleles (e.g., P5) will require maintenance of a population size greater than approximately 3250 and removal of mainly or only juveniles (Perez-Figueroa, 2012 [2010]).

It is interesting that with each subsequent study, the bottom line for a population size that must be maintained to assure genetic diversity in the future gets higher and higher.

It is also interesting to note that removal of mainly juveniles is what the wolf does in its predation on bison. For instance, according to the 2012 Wolf Project's annual report, the composition of bison kills by wolves in Yellowstone was 17 calves, 8 cows, 1 yearling, 1 bull, 2 adults of unknown sex, and 3 of unknown sex and age (Wolf Project, 2012).

Studies must reflect reality to be useful

While these studies are interesting and make several valuable points, with regard to the population size needed to preserve the genetic diversity of the wild bison in Yellowstone, they are useless as a guide for the genetic and behavioral conservation of the herd. In the simulation models cited, all culling scenarios are on a *random* basis. The culling at Yellowstone National Park, however, is not random but deterministic, selecting out bison for lethal removal only those bison that are exercising their migratory instincts. No population level of wild bison in the park will assure the preservation of genetic diversity if the IBMP's policy of artificially selecting out only migratory animals continues.

These studies and the propaganda resulting from them have created a false sense of complacency with the status quo. As pointed out throughout this petition, if the trajectory of these studies continues to be followed, it will inevitably lead to the extinction of the Yellowstone wild bison. In reality, wild bison are going down the dispersal sink of the Stephens Creek capture facility and other such facilities and we will not get them back. And no one knows, including any biologist, how much has already been lost nor what genetic strengths have been forever destroyed.

Robert J. Lennox et al. in "Conservation physiology of animal migration" noted:

> Migration is exhibited by every major animal taxon and, ultimately, maximizes survival and reproductive success through the utilization of

> key habitats, food sources and breeding grounds and/or the avoidance of adverse environmental conditions

Because failed migration can directly affect an animal's fitness, it has the potential of leading to extinction. Lennox and his co-authors state:

> Given that a failed migration directly affects lifetime fitness of individuals (Dingle, 1980), natural selection has the potential to alter populations and migratory phenotypes rapidly. In some cases, this can lead to changes in population structure, evolutionary bottlenecks, inbreeding depression and extirpation or extinction (Wilcove and Wikelski, 2008), which have broader impacts on animal communities and entire ecosystems.

In conserving an animal, it would then make sense to conserve those traits that make the animal successful, such as the phenotype of migration. The authors wrote:

> Conservation is a varied and dynamic science, the goals of which extend beyond simply avoiding extinction risk to understanding and conserving the traits and attributes of species that make them successful (Redford et al., 2011) (Lennox, 2016).

But with a sweeping statement of dismissal, the Fish and Wildlife Service evaluators of my second petition in personal communication to me said with regard to the Endangered Species Act:

> The Act is not designed to conserve behaviors/traits (Fish and Wildlife Service, personal communication, April 19, 2016).

Apparently, the Fish and Wildlife Service is more interested in protecting what might be called the Interagency Bison Meat-processing Plant (IBMP) now operating on park property, aka the Stephens Creek capture facility, which specializes in butchering the alleles, heterozygosity and genetic diversity of wild bison.

Reality check needed

If Yellowstone biologists are interested in learning about the migration of wild bison, conserving that phenotype (instead of doing everything they can to rationalize its destruction) and simulating what is actually going on at YNP, why not consult Vishwesha Guttal and Iain D. Couzin, Department of Ecology and Evolutionary Biology, Princeton University? In their study titled "Leadership, collective motion and the evolution of migratory strategies," they discuss results and insights from a recent computational model developed to "investigate the evolution of leadership and collective motion in migratory populations" based on evolutionary biology. Guttal and Couzin write:

> Our entire biosphere is under severe threat due to increasing anthropogenic influences, and as a consequence many migrations around the world are at risk. Our computational and evolutionary approach may offer potentially useful insights into the influence of human activities such as hunting or habitat fragmentation on animal migration.

Preventing bison from migrating into regions such as the Gardiner Basin, the Hebgen region and other environs of the Madison and Yellowstone Rivers is habitat fragmentation. Wild bison are not only prevented from entering critical habitat, but killed upon doing so. Eventually this can lead to the "collapse of migration." They write:

> . . . genetically coded migratory behavior can undergo rapid changes on relatively short ecological time scales such as decades, as seen in wild populations of blackcaps [a gray warbler with a black head cap]. In such scenarios, where environmental deterioration and evolutionary processes occur over comparable time scales, our model predicts that [the] number of leaders in the population reduces to zero leading to a collapse of migration.
>
> Changes in migratory patterns have been recorded in many natural populations; for example, migration has disappeared in bison (Bison bison) of North America and wildebeest of the Kalahari. Wildebeest in the Serengeti may face a similar fate due to a proposed road that bisects the national park in Tanzania. Our model predicts a potentially bleak future for such migrants; it suggests that it may be extremely difficult to recover lost migrations. This is because leader mutants are not as favorable, and occur infrequently, in highly fragmented habitats. Much greater habitat restoration is required to recover such lost migration (in the parlance of physical sciences, this is known as the hysteresis effect).

Hysteresis is the lagging of an effect behind its cause, as when the change in magnetism of a body lags behind changes in the magnetic field. In other words, the effects of hindering migration can develop later and result in problematic restoration.

Leaders in the wild bison population in Yellowstone are being selectively killed off by the IBMP at a rapid rate.

Migratory behavior is characterized by going in one direction en masse toward a habitat. The authors explain:

> A key feature that characterizes migratory individuals is relatively long-term directionality of motion to reach habitats that offer safety from predation, better grazing grounds, and/or enhanced opportunities for breeding. This process is often facilitated by individuals sensing and following directional cues from the environment.

Migration is achieved by animals interacting with one another to achieve a correct direction:

> In addition to responding to environmental cues, migratory organisms may interact socially with one another. In some cases social interactions during migration result in the formation of very large mobile groups, the mass migration of wildebeest of the Serengeti being an iconic example. Previous mathematical models have shown that although each individual may, itself, be error prone in determining correctly the direction in which to move, combining information with others (through relatively simple local interactions such as a tendency to align direction of travel with near neighbors) reduces, facilitating effective information transfer about resources and migratory routes over large spatial scales.

Summing up their methodology, they state:

> In summary, we present a novel approach to the study of leadership, collective motion and migration by looking at plausible origins of these processes. We show how simple trade-offs between individuality (i.e., leadership) and collectivity, result in a wide range of migratory strategies, including resident populations, solitary migrants and those who migrate collectively. Among these, collective migration occurs over a very wide range of ecological assumptions, and within such populations there typically exist a relatively small proportion of leaders who can sense and follow environmental cues, and a majority who migrate by following social cues.
>
> Our model predictions could provide potentially useful insights into conservation and management of migratory species. That leaders are often relatively few in number could mean that collective migrations may be prone to sudden, and practically irreversible, collapse in the event of leader populations undergoing extinction due to inherent fluctuations, habitat fragmentation, disease or through harvesting by humans.

The authors note that indigenous Arctic caribou hunters do not harvest the herd leaders, but instead take those in the middle, serving as an example of the need to preserve leaders to conserve migratory populations. They state:

> It is worth noting that indigenous peoples in the Canadian Arctic hold the belief that migratory caribou herds have few leaders. Furthermore, their traditional hunting practices allow the migratory front to pass before beginning the hunt and then they take those from the middle of the herds since this is considered to reduce chances of eliminating leaders, and thus of disrupting migratory routes. In light of our model predictions, a rigorous scientific test of this traditional knowledge may aid in designing sound management practices for preserving populations of caribou herds, and to limit their hunting to within sustainable levels. More generally, our work highlights that an approach that considers both proximate and ultimate factors will be crucial for developing strategies for long term conservation of migratory populations (Guttala, 2011).

Leadership is either acquired by mutation or learned behavior. As the Fish and Wildlife Service said in personal communication to me, "there is evidence that migration is a learned behavior." However, an aim of a member agency of the IBMP is to wipe out the memory of migratory routes in Yellowstone's wild bison. Recall that Christian Mackay, executive director of the Montana DOL, said in 2011 concerning a proposal to keep bison from migrating beyond Yankee Jim Canyon in the Gardiner Basin:

> It's a no-second-chances plan, so there's no herd memory of getting out (Flandro, 2011).

Before it is too late and before the genetic and behavioral components of the migratory response of Yellowstone's bison are lost, it would appear to be prudent to have biologists examine the potential outcome of IBMP's continued lethal control of Yellowstone's wild bison. According to Barry J. McMahon, writing in *Evolutionary Applications*, we are at a critical turning point. He and his co-authors wrote (citations omitted):

> At present, the world is losing species at a rate comparable to the mass extinctions signifying the major transitions of geological time periods. Previous mass extinctions can be attributed to geological and extra-terrestrial impact, while the present mass extinction is caused by human impact. Society has to find means to counteract this loss of biodiversity and save habitat and areas where threatened species reside.

One way to stop the erosion of biodiversity, the authors noted, is for wildlife managers and scientists to engage in discussions for the purpose of avoiding "the deleterious and costly effect of 'emergency room conservation'" (McMahon, 2014).

One of the casualties headed for emergency room conservation—or should already be there—is Yellowstone's wild bison.

26

Keeping out of the emergency room

To keep out of the emergency room of disappearing species, members of that species must be fit, in particular fit to adapt to a changing environment. In wildlife, preservation of the traits that enabled a species to survive during its evolution is key to protecting a species from extinction. What specifically does one want to preserve? Whatever contributes to fitness. What indicators would one look for to measure fitness? Such factors as heterozygosity are key indicators. As noted previously, low genetic heterozygosity is associated with loss of fitness in many natural populations. High heterozygosity means lots of genetic variability. Low heterozygosity means little genetic variability and can be attributed to forces such as inbreeding (McDonald, 2008).

But just what is heterozygosity? We have touched on it, but let us look a little deeper into population genetics, for it will help us appreciate what is going on with the wild bison at Yellowstone.

The word heterozygosity comes from the word heterozygote, whose etymology is from Greek “heteros,” meaning different, and “zygotos,” meaning yoked (from zygon “yoke”). A yoke, of course, is a wooden crosspiece that is fastened over the necks of two animals and attached to the plow or cart they are to pull. Synonyms are harness, collar or coupling.

Biologists, who love Greek words, thus define a heterozygote as “an organism whose somatic cells have two different allelomorphic genes on the same locus of each pair of chromosomes. It can produce two different types of gametes.”

Well, of course.

This is a case where the definition is more complicated then the word itself. Just think of heterozygous as two different forms (alleles) of a (trait such as eye color) yoked together. The same two forms or the dominant form when linked together through fertilization will be the trait that is expressed in the animal or plant produced.

What does this mean in a real life animal or plant? Let us take a look at pea plants. A gene is composed of a pair of alleles. The gene for seed shape in pea plants exists in two forms, one form or allele for a round seed shape (R) and the other for a wrinkled seed shape (r). A heterozygous plant would contain the following alleles for seed shape: (Rr). One of the pairs is dominant and the other is recessive. In the case of peas, the round seed shape (R) is dominant and wrinkled seed shape (r) is recessive.

When these forms are combined following pollination and fertilization, this outcome can be produced: a plant with round seeds by means of the combination (RR) or (Rr), or wrinkled seeds (rr).

A heterozygous plant would contain the alleles for seed shape (Rr). This quality is valuable because it promotes genetic variation. Here is why.

When an (Rr) individual produces a gamete, a reproductive cell, it splits R from r. Shifting from the plant metaphor to animals, in male mammals it makes a sperm with either R or r and in females an egg with either R or r. When mating occurs, this can thus produce an offspring that is either (RR), (Rr) or (rr).

Thus, high heterozygosity means a population with the potential for lots of genetic variation. Lots of genetic variation is important because it provides for the production of lots of potentially adaptive traits.

As an example of what this can mean, let us take a look at fruit flies feeding on the landscape of an apple. Fruit flies are attracted to rotten fruit because it contains yeast on which their maggot progeny feed. As we all know, over-ripe apples are often not uniformly rotten, but instead have rotten spots. These are the favorite grazing plots for fruit fly larvae.

Fruit flies have a particular gene that controls foraging behavior. It governs whether a maggot will be a sitter or a rover, whether it will stay put or migrate to another nutritional source, say another rotten spot.

Researchers found that when the fruit fly larvae were competing for food, those that did best had a version of the foraging gene that was rarest in a particular population. For example, rovers did better when there were lots of sitters, and sitters did better when there were more rovers.

"If you're a rover surrounded by many sitters, then the sitters are going to use up that patch and you're going to do better by moving out into a new patch," says Professor Marla Sokolowski, a biologist at the University of Toronto Mississauga, who discovered the gene. "So you'll have an advantage because you're not competing with the sitters who stay close to the initial resource. On the other hand, if you're a sitter and you're mostly with rovers, the rovers are going to move out and you'll be left on the patch to feed without competition" (University of Toronto, 2007).

But what would happen if one were to selectively destroy all the fruit fly maggots that were rovers? Let us take a look.

Let us say (RR) and (Rr) are those that display the rover behavior and R is dominant, while (rr) are the sitters. If one destroys all the rovers, then only the sitters will be left. Once the rotten spot is eaten up, since none will have looked for alternative food sources, fewer of this sitting group of maggots will survive due to competition. In a group consisting of both rovers and sitters, the rovers would have migrated to another rotten spot. By the rovers leaving, it would take the competitive pressure off the sitters and by migrating the rovers will have more food.

The (Rr) maggots are of particular value because they enable a population to adjust to whether more or fewer rovers or sitters are needed to adapt to environmental changes.

How would this perspective apply to wild bison and migration? Let us say that bison have alleles for movement behavior. What potentially will the systematic culling of bison moving out of the park do to the movement behavior and heterozygosity of this wild species? A number of possibilities exist. Here are two concepts that might happen. Both are highly oversimplified "proof of concept" models, not a real projection (which is probably impossible).

Scenario 1: Migration is under simple genetic control, and when you select against it by culling migrants, it goes away. The non-migrating allele is at low frequency initially, so change is slow at first but then speeds up.

Scenario 2: Migration out of the park is an aspect of general movement behavior. Culling emigrants selects for more conservative behavior, but the effect on emigration rate is limited.

Computational biomodeling builds computer models of biological systems to assess their behavior under different possible assumptions and conditions, when the complexity of the biological system means that we cannot make predictions based on our intuitions. This is accomplished by calculation and visualization software. Computer-generated mathematical simulation models help predict how systems will react under different environments.

Such models can help "predict which species are at greatest risk of extinction" and "identify effective measures for their preservation," according to *Dynamic Models in Biology*, authored by Stephen P. Ellner, Department of Ecology and Evolutionary Biology and John Guckenheimer, Mathematics Department, Cornell University (Ellner et al., 2006). For the purpose at hand, a simulation model can help predict what the outcomes of the two above scenarios might be.

A programming language widely used by statistical researchers and theoretical biologists for simulating dynamic models of biological systems is simply called R (R Core Team, 2015) . Ellner provided the following simulations for Scenarios 1 and 2, using the R language to perform the calculations (see Appendix B). A locus is the specific location of a gene (paired alleles) on a chromosome.

Scenario 1: One locus controls migration and nothing else. Individuals with 2 copies of the "A" allele have 20% probability of migrating, and are culled.

Individuals with 2 copies of the “a” allele don't migrate. Heterozygotes are exactly intermediate. Initial state is “A” allele at 99% frequency in the herd.

Scenario 2: Still one locus, but migration is assumed to be one aspect of a general tendency to seek greener pastures when local conditions are poor. Those who migrate out of the park are culled, but this is countered by selection for “seek greener pastures” behavior within the park. As “seekers” become rarer, the odds of a "”seeker” finding greener pastures go up (because more of the herd stays where it’s not so good). Thus, as the “a” non-migrant allele increases in frequency, the baseline fitness (fitness unrelated to culling) of the “A” allele goes up, leading to a stable polymorphism. The final frequency of “A” and “a” alleles could be anything—it’s determined by the assumed relationship between “non-seeker” frequency and the baseline fitness of “seekers”.

In both examples, segments of the bison population are culled annually to keep them near a 3,000 total population level. Running these simulations provides the following visualization:

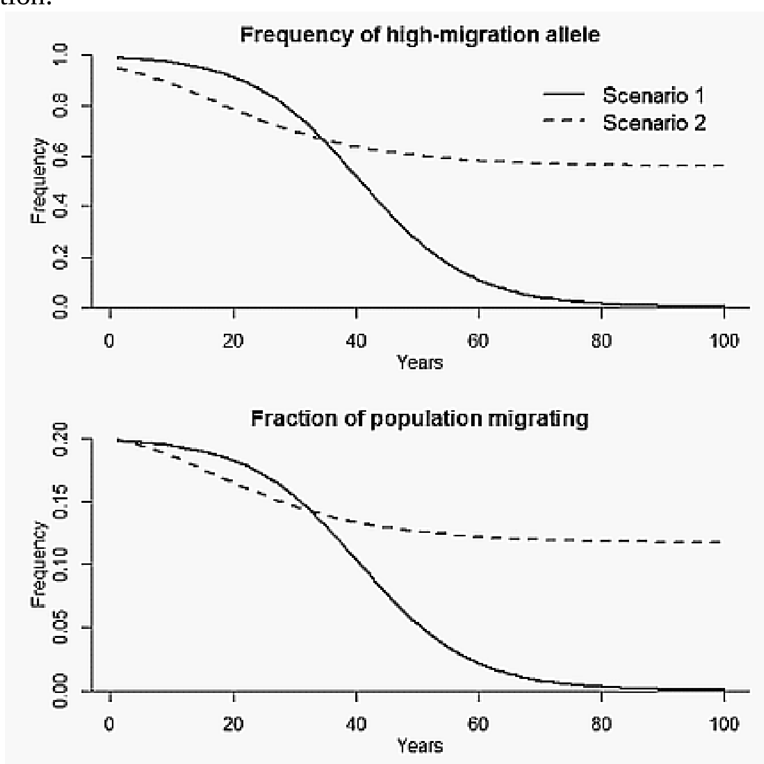

Figure 86. MIGRATION SCENARIOS 1 and 2. See Appendix B for computer script in the R language for calculations (Ellner, personal communication, August 5, 2015).

In Scenario 1, the allele governing migration, and thus the fraction of the population migrating, gradually declines over the years, then starts to nosedive. In this scenario the wild, migratory herd is headed for extinction as it approaches 80 years of culling at 20 percent. This is what could happen if the present culling of wild bison continues at the present rate, for 900 animals culled is about 20 percent of a herd size of 4,900.

In Scenario 2 a heterozygous herd is maintained. This is what could happen if bison come down from the higher elevations of the park in winter and congregate in the lower interior valleys, such as Lamar, Madison, Firehole and Hayden. Those that drift into Gardiner Basin would be culled, but high heterozygosity would be maintained, because the probability of being culled as a result of migration is counterbalanced by the advantage of the movement behavior at other times and places.

Being scenarios, these simulations are of course not a reflection of reality but merely show a range of possible outcomes. What is happening in Yellowstone is most likely a combination of both scenarios and with different variables.

But there is a third scenario—a worst case scenario. It has many variants. Let us take a look at one of them.

Let us say that after a number of years of Scenario 1 (strong selection against migratory genotypes), punctuated by a few years of Scenario 2 (selection for intermediate movement behavior), the herd's heterozygosity is diminished. This means the herd would become less adaptive year by year. Let us say the bison population has increased because bison that have tested positive for brucellosis have been culled, resulting in a higher percentage of disease-free animals. While this may be immediately beneficial for the herd, what is being eliminated along with those that have an active disease are those bison that have immunity to the disease, for testing does not discriminate between those animals that have an active disease and those that have an immune response. This means that over time the herd will become less resistant to *Brucella abortus.*

During severe winters, large segments of both the northern herd and the central herd migrate out of the park, resulting in high numbers culled. As mentioned, Yellowstone's bison herd was reduced from a population of 3,500 in 1996 to 1,700 in 1997, including births. A total of 1,100 head were culled and another 1,000 head died of starvation inside the park that winter (NASDA Policy Statements, 2011), totaling a reduction of 2,100 animals. This represents a 60 percent reduction of the herd.

In 2008, 1,087 bison were captured and shipped to slaughter from the Stephens Creek and Horse Butte capture facilities. Another 166 bison were lethally removed by state-licensed and tribal hunters. Total herd population went from 4,700 to 3,000, winter die-off accounting for the mortality of another 500 animals (National Park Service, 2008). This represents a 64 percent reduction of the herd.

Culling is now directed at the Gardiner Basin dispersal sink. Being lower in elevation than the interior of the park, it is a place where animals find refuge when the going gets rough. Here bison instinctively migrate to survive the Yellowstone winters, descending first from the high elevation regions such as Mirror Plateau (9,000 feet), down to the high valleys and basins, such as Lamar Valley or Lake Hebgen (both 7,000 feet) and then down to Gardiner Basin (5,000 feet). During a harsh winter they have nowhere else to go.

Let us say during one severe winter, one-third of the bison are culled in Gardiner Basin at the Stephens Creek capture facility, another one-third die of starvation or freeze to death and another one-third die of disease, those congregated around the thermal pools. When the rangers make their count of winter kill the following spring, what number would be left? Zero. What would have been left if not slaughtered by the IBMP? The third that had escaped to the dispersal sink, Gardiner Basin.

Scenario 3, the worst case scenario, can have multiple components and outcomes. Another possibility is that all bison perish except a few non-migratory bison within the park. What has survived is *only* the non-migratory. Result? Extinction of the migratory, genomic extinction.

Whether scenario 1 or 3 turns out to be the case, Gardiner Basin is the escape hatch, the life boat for bison, as well as other wild ungulates. It is the genetic insurance policy nature has built into the environment to protect the diversity of wild bison in a changing environment. But in the middle of this life boat the IBMP has poked a hole. That hole is the Stephens Creek capture facility and the IBMP's policy of large-scale reduction of migratory bison. All bison that attempt to use it will perish. At some point this artificial practice guarantees extinction.

27

Managing to extinction

When you manage what is wild, it ceases to be wild. What little wilderness we have left is being destroyed by the very systems designed to preserve it (The Abstract Wild, 2016). One of those systems is the IBMP. What we need from its agency managers and biologists is honest talk and the abandonment of hidden agendas. One of its sham agendas is that it is devoted to controlling the spread of brucellosis from wildlife to cattle in the Greater Yellowstone Ecosystem. It should be a real agenda, but it is not. Its real and hidden agenda is to continue to graze cattle in this ecosystem regardless of the costs both ecologically and financially. The IBMP functions as a front for the Montana cattle industry, taking for its benefactors property rights once held in common. Extinction of wild bison and the alienation of tribes may be the price.

The interagency has demonstrated one thing: you cannot eradicate brucellosis in an ecological setting by its methods. The reason the plan is not working is because it is duplicitous, internally contradictory and thus irrational. Only a magician could make it work.

In 2008 the interagency's plan was reviewed by the Government Accountability Office. The GAO found the plan lacking, criticizing it in a report entitled "Yellowstone bison: Interagency plan and agencies' management need improvement to better address bison-cattle brucellosis controversy." The GAO report stated:

> The plan has two broadly stated goals: to "maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission." The plan, however, contains no clearly defined, measurable objectives as to how these goals will be achieved, and the partner agencies have no common view of the objectives (Yellowstone bison, 2008).

In response to that critical review, a report was prepared in 2008 and updated in 2014 by P. J. White, Chief, Wildlife and Aquatic Resources; Rick Wallen, Bison Ecology and Management Program and John Treanor, Yellowstone Wildlife Health Program, entitled "Yellowstone National Park: Monitoring and Research on Bison and Brucellosis." Contained in that report is a flowchart summarizing the conditions desired and the means by which those conditions would be achieved. That chart is reproduced below.

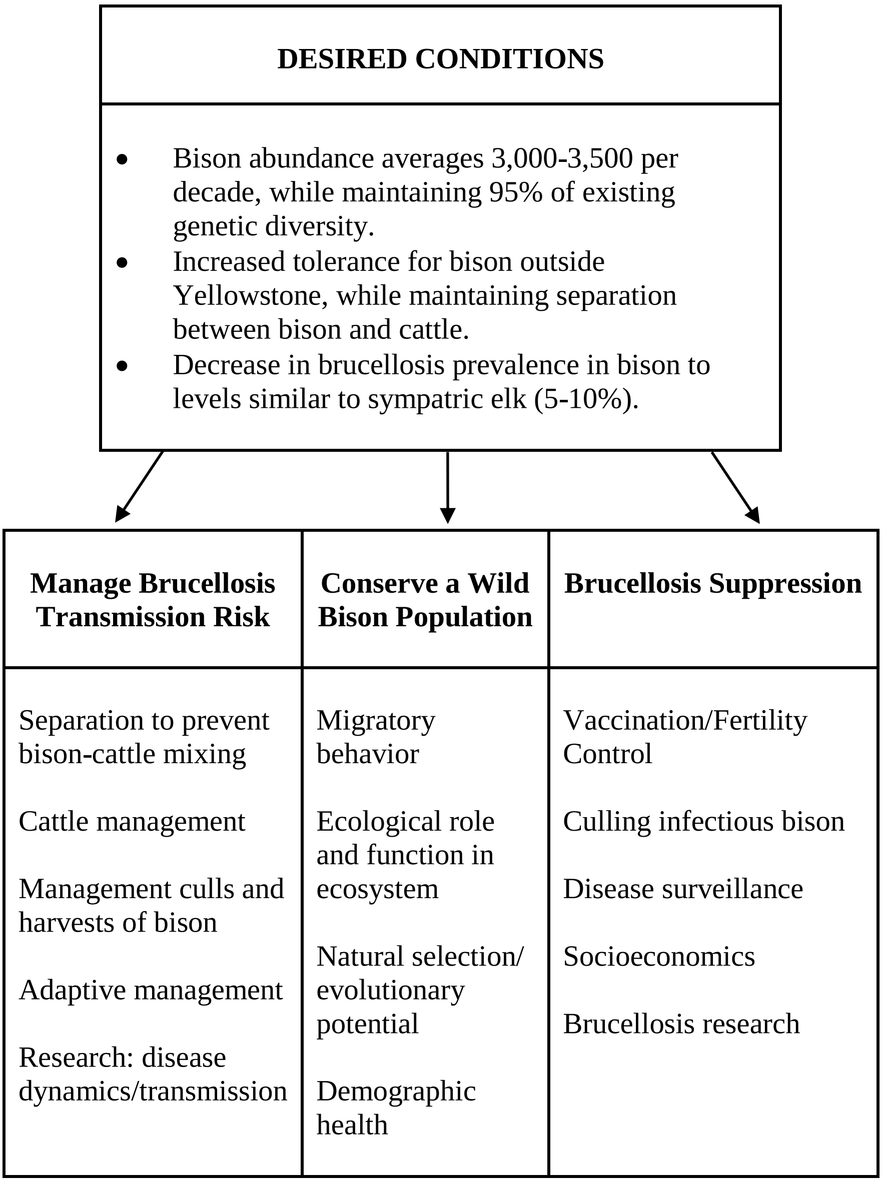

Figure 87. PRESENT CONCEPTUAL MODEL of "conservation and brucellosis management for Yellowstone bison."

Upon inspection, the report is, once again, disappointingly Janus-faced. Out of one side of their mouths the authors espouse high-sounding bison conservation concerns such as preserving their migratory behavior, ecological role and function in an ecosystem, the role of natural selection and evolutionary potential as well as their demographic health—of which a key promoter is availability of habitat. To control brucellosis transmission they indicate the need for the separation of cattle from bison. This is all fine and dandy.

But out of the other side of their mouths they list the need for culling and harvesting bison to achieve this separation, as opposed to the permanent removal of cattle from critical migratory habitat historically occupied by bison. Further, by setting a goal of 95 percent retention of genetic diversity, IBMP is tolerating a 5 percent reduction of that diversity. This is unacceptable ecologically, especially when you consider that no identification has been made of which genes may be expected to be lost, that this reduction is biased toward certain traits expressed behaviorally and that lethal selections will be progressively incremental toward that bias.

When one reads through the document to find ecological justification for such culling, one finds the opposite.

Lethal removal of large numbers of mammals from a population has the potential of reducing the genetic fitness of that group. If a subpopulation of a group of animals (such as wild bison) is genetically rich, it would stand to reason that one would do everything possible to preserve that strength—namely, adaptive capabilities with relatively high genetic diversity—instead of depleting it.

In fact, this is the conclusion some of the authors of the above report came to in a 2010 study, "Management of Yellowstone bison and brucellosis transmission risk: Implications for conservation and restoration." In this study, P. J. White, Rick L. Wallen, Chris Geremia, John J. Treanor and Douglas W. Blanton concluded:

> In summary, the risk of disease transmission from migratory ungulates to livestock near reserve boundaries often restricts ungulates to areas that do not contain all the seasonal habitats necessary for their survival. Even relatively large reserves such as Yellowstone National Park generally contain only a subcomponent of the habitat needed by migratory ungulates. Long-term conservation of plains bison requires restoring populations to other locations. Yellowstone bison provide the wild state and adaptive capabilities needed for restoration but, to date, the brucellosis issue has prevented their use in restoration efforts. Thus, management plans should incorporate a conservation component that does not limit wildlife to isolated reserves, but facilitates responsible restoration efforts for long-term conservation (White, 2010).

Yellowstone bison genetically have what it takes to survive in the wild. They are a genetic treasure trove. They have "the wild state and adaptive capabilities" essential for the genetic restoration of other bison herds because of their genetic strength and fitness, an attribute of their wildness. And wildness means being left alone to evolve through natural selection and survival of the fittest. And that means not fencing such wild animals, for fencing is the primary tool of domestication. It is used to selectively separate the wilder animals from the more tame. Fencing comes in many forms: wire, wood, stone and management actions that retard movement and confine, such as by lethal removals and hazing.

However, while the government acknowledges that fencing is not compatible with wilderness, under the auspices of the IBMP, it is not only fencing in wild bison by restricting their migratory movements through hazing, but it is killing those very animals that in effect touch that "fence," that invisible park boundary.

This is not wilderness. Again, this is domestication. Wilderness is where animals are free from enclosure and are unrestricted in movement. Wilderness and domestication do not mix. Domesticated animals do not have what it takes to survive in a wilderness. They lack fitness.

Nudge nudge wink wink

Let us look at a sampling of the findings of the report "Yellowstone National Park: Monitoring and Research on Bison and Brucellosis." It is a self-justification of the management practices directed toward wild bison now being conducted by the IBMP inside and outside Yellowstone National Park.

If you want the public to support a dubious position, in addition to instilling fear, you praise what the public wants, but do what you want. In Yellowstone, it goes like this: first you say something like "Watch out, the bison are coming! They are migrating into your back yards!" Then you warble to a shaken public: "But we love buffalo. They are so iconic. We love to see them roam, nudge nudge wink wink." Then you roam them into a bison trap and migrate them off to a slaughterhouse. By the thousands. Such love.

On examination, the report is a collection of contradictions when one matches words (assessments) with actions. Petitioner's observations of IBMP's actions (under "Contradictory action being taken,") will follow each self-assessment passage by IBMP as found in the report.

The report, an exercise in apologetics by IBMP, states:

> ***Page 6:*** Overarching principles for conserving bison were to (1) maximize the number of bison in a population (i.e., 'maximum sustainable' rather than a 'minimum viable' population size) to better retain natural variation and provide more resiliency to 'surprises' or catastrophic events, (2) support and promote 'wild' conditions and behaviors in an environment where bison are integral to community and ecosystem processes, exposed to natural selection, and active management interventions are minimized, (3) preserve genetic integrity and health by maintaining bison lineages and carefully evaluating all movements of bison between populations, and (4) conducting routine monitoring and evaluation of demographic processes, herd composition,

habitat, and associated ecological processes that are central to evaluating herd health and management efficacy.

Contradictory actions being taken: Instead of acting on these proclaimed "overarching principles for conserving bison," the IBMP has 1. scheduled a reduction of the number of wild bison by a factor of up to 900 animals in 2015, another 900 animals in 2016 and 1,400 in 2017; 2. discouraged wild behavior by culling those obeying the instinct to migrate; 3. depleted the genetic integrity and health of the herds by these actions. The term "overarching principles" as used here is lip service.

Page 8: Bison from the central herd were partially migratory, with a portion of the animals migrating to the lower-elevation Madison headwaters area during winter while some remained year-round in or near the Hayden and Pelican valleys.

Contradictory action being taken: While acknowledging the existence of a partially-migratory herd, the IBMP is continuing to cull only the migratory, i.e., those that attempt to leave the park, favoring survival of the non-migratory herd.

Page 9: Simulations of migrations over the next decade suggest that a strategy of sliding tolerance where more bison are allowed beyond park boundaries during severe climate conditions may be the only means of avoiding episodic, large-scale reductions to the Yellowstone bison population in the foreseeable future.

Contradictory action being taken: Scheduling large-scale reductions for the future.

Page 10: Based on mitochondrial DNA analyses, there was significant genetic differentiation between bison sampled from the northern and central breeding herds, likely due to strong female fidelity to breeding areas (Gardipee 2007).

Contradictory action being taken: Scheduling culling this winter that will disproportionally reduce the size of the central herd, thereby diminishing the genetic health of the herd, which in turn will diminish the health of both the central herd and the northern herd due to the increased potential for inbreeding and less gene flow.

Page 10: Yellowstone bison have relatively high allelic richness and heterozygosity compared to other populations managed by the Department of Interior.

Contradictory action being taken: Instead of doing all it can to conserve this "allelic richness and heterozygosity," the IBMP is depopulating this valuable source of heterozygosity by means of scheduling continued large-scale reductions for the future.

> ***Page 10:*** Yellowstone bison are the only population with no molecular evidence (i.e., microsatellite markers) or suggestion (i.e., SNPs) of potential cattle ancestry (i.e., introgression of cattle genes). Thus**,** this population constitutes a genetic resource that must be protected from inadvertent introgression.

Contradictory action being taken: Instead of keeping cattle and bison separate, the IBMP is allowing up to 100 bison (and often more) to spatially occupy the same habitat as cattle, increasing the probability of the "inadvertent introgression" of cattle genes to bison.

> ***Page 11:*** NPS staff collaborated with colleagues at the University of Montana to conduct a mathematical modeling assessment that provided predictive estimates of the probability of preserving 90 and 95% of the current level of genetic diversity values (both heterozygosity and allele diversity) in Yellowstone bison (Pérez-Figueroa et al. 2012).
>
> Findings suggested that variation in male reproductive success had the strongest influence on the loss of genetic variation, while the number of alleles per locus also had a strong influence on the loss of allelic diversity.
>
> Fluctuations in population size did not substantially increase the loss of genetic variation when there were more than 3,000 bison in the population. Conservation of 95% of the current level of allelic diversity was likely during the first 100 years under most scenarios considered in the model, including moderate-to-high variations in male reproductive success, population sizes greater than 2,000 bison, and approximately five alleles per locus, regardless of whether culling strategies resulted in high or low fluctuations in abundance.
>
> However, a stable population abundance of about 2,000 bison was not likely to maintain 95% of initial allele diversity over 200 years, even with only moderate variation in male reproductive success. Rather, maintenance of 95% of allelic diversity is likely to be achieved with a fluctuating population size that increases to greater than 3,500 bison and averages around 3,000 bison.

Contradictory action being taken: This is an example of governmental sleight of hand. The IBMP's plan in fact does not involve random culling, but instead is aimed squarely at migrating bison. The study does not simulate what is actually going on at the border of Yellowstone National Park vis-à-vis culling strategies. The *in silico* model is not relevant. The computer simulated bison populations study simulates the wrong populations. The culling transpiring at the park's border is not random, juvenile, or adult, but instead limited to those bison that are migratory.

Therefore the study is utterly useless as a predictive model regarding the loss of genetic variation by the population reduction methods being used at the park. It is an example of garbage-in, garbage-out.

In point of fact, the park service knows that the large-scale culling removals are *not* random. As "Estimating probabilities of active brucellosis infection in Yellowstone bison through quantitative serology and tissue culture," by John J. Treanor, Chris Geremia1, Philip H. Crowley, John J. Cox, Patrick J. White, Rick L. Wallen and Douglas W. Blanton (some of the very same authors who wrote the report "Yellowstone National Park: Monitoring and Research on Bison and Brucellosis"), explains:

> These large-scale bison removals have not been random, because bison social structure and the reproductive demands of pregnancy predispose female bison and their recent offspring (i.e. male and female calves and yearlings) to culling as they move onto low-elevation winter ranges outside the park. The effects of several large, nonrandom culls during the past decade have contributed to a skewed sex ratio in favour of male bison, gaps in the population's age structure and reduced productivity that, if continued over time, could reduce the potential of Yellowstone bison to respond to future challenges (White et al. 2011) (Treanor, 2011).

Further, the Pérez-Figueroa study makes the following claim, which has produced a misunderstanding:

> . . . conservation geneticists have suggested that a reasonable management goal for maintenance of genetic variation is to retain approximately 95% of H_e [heterozygosity] over 100–200 years.

This statement, upon which the White report is based, contains a conceptual error. A 2002 paper by F.W. Allendorf and N. Ryman titled "The role of genetics in population viability analysis" is cited as an authority for this claim. Yes, that paper says that "We recommend retaining at least 95% of heterozygosity in a population over 100 years." But it also stresses that this is a worst-case scenario:

> The population size required to meet this genetic criterion should not be considered a goal, but rather a lower limit below which genetic considerations are likely to reduce the probability of population persistence (Allendorf, 2002, p. 51).

> ***Page 12:*** Allowing the bison to migrate and disperse between breeding herds would be in the best interest of the bison population for the long term.
>
> The NPS will continue to allow ecological processes such as natural selection, migration, and dispersal to prevail and influence how population and genetic substructure is maintained in the future rather than actively managing to perpetuate an artificially created substructure. The existing population and genetic substructure may be sustained over time through natural selection or it may not.

Contradictory action being taken*:* The IBMP, instead of allowing ecological process to prevail, is doing the opposite by slaughtering migrating animals and killing a disproportionate number in the central herd, reducing breeding opportunities, coupled with artificial selection biased toward non-migratory herd members, discouraging natural selection forces and promoting an artificially created substructure.

> ***Pages 14-15****: B. abortus* isolates from bison, elk and cattle . . . [were collected to] test which wildlife species was the likely origin of recent outbreaks of brucellosis in cattle in the greater Yellowstone area (Beja-Pereira et al. 2009).
>
> Findings suggested that isolates from cattle and elk were nearly identical, but highly divergent from bison isolates. Thus, elk, not bison, were the reservoir species of origin for these cattle infections.

Contradictory action being taken: Instead of acting on these findings, the IBMP continues to target only bison for slaughter as a means of controlling brucellosis that tests show is being spread by elk, not bison.

> ***Page 15:*** The risk of transmission of brucellosis from bison to cattle is likely to be a relatively rare event, even under a ‘no plan’ (no management of bison) strategy.
>
> The risk of transmission of brucellosis from bison to cattle will increase with increasing bison numbers and severe snow fall or thawing and freezing events. As the area bison occupy outside Yellowstone in the winter is enlarged and overlaps cattle grazing locations, the risk of transmission will increase. Thus, adaptive management measures to minimize risk of transmission will be most effective.

Contradictory action being taken: Brucellosis is rarely transmitted in winter, but to reduce that chance to zero—the only acceptable level for the IBMP—removing cattle from the habitat now shared is the only solution. However, the IBMP refuses to take this action, the most cost-effective and most disease-preventive adaptive management measure. So far “adaptive management” in the hands of the IBMP is management heavily biased toward the cattle industry and against wildlife and conservation interests in the middle of one of the world's largest and most valued ecosystems.

> ***Page 16:*** Allowing bison to occupy public lands outside the park where cattle are never present (e.g. Horse Butte peninsula) until most bison calving is completed (late May or early June) is not expected to significantly increase the risk of brucellosis transmission from bison to cattle because: 1) bison parturition is essentially completed weeks before cattle occupy nearby ranges; 2) female bison consume many birthing tissues; 3) ultraviolet light and heat degrade *B. abortus* on tissues, vegetation, and soil; 4) scavengers remove fetuses and remaining birth tissues; and 5) management maintains separation between bison and cattle on nearby ranges.
>
> Allowing bison to occupy public lands outside the park through their calving season will help conserve bison migratory behavior and reduce stress on pregnant females and their newborn calves. The risk of brucellosis transmission to cattle can still be minimized through effective management of bison distribution.

Contradictory action being taken: Instead of managing the disease of brucellosis, the IBMP manages only bison, exempting elk which calve until late June when cattle are grazed on land that has the high potential of containing brucellosis-infected birthing materials, nullifying any disease-control efforts directed toward bison.

> ***Page 16:*** There was a reproductive cost of diminished birth rates following brucellosis infection, with only 59% of seropositive and recently seroconverting females with calves compared to 79% of seronegative females with calves.

Contradictory action being taken: Instead of allowing natural ecological processes, by culling female bison showing signs of past infection with brucellosis, the IBMP is increasing the proportion of more fertile bison, a status contrary to the expressed goal of a reduced bison population.

> ***Page 17:*** Population size and winter severity were major determinants influencing bison movements to lower elevation winter grazing areas that overlapped with private ranches and federally-regulated cattle grazing allotments. Increasing population size resulted in higher bison densities and increased bacterial shedding . . .
>
> Natural bison migration patterns and boundary management operations were important for minimizing brucellosis exposure risk to cattle from bison, which supports continued boundary management operations for separation between bison and cattle.

Contradictory action being taken: The passage is self-contradictory. “Natural bison migration patterns” do not “minimize brucellosis exposure risk to cattle from bison,” they increase it. Effective, realistic, cost-effective separation without harming the ecosystem can only be achieved by removing cattle from the park environs.

> ***Page 17:*** *B. abortus* field strain persisted up to 43 days on soil and vegetation at naturally contaminated bison birth or abortion sites.

Contradictory action being taken: Cattle are trucked onto grazing allotments either without sufficient temporal separation or just barely sufficient, providing no “fudge factor” for the prevention of potential disease transmission. According to the “Draft Joint Environmental Assessment Year-round Habitat for Yellowstone Bison” for 2013, three active grazing allotments are within the existing bison-tolerant zone within the Gallatin National Forest. Use of the allotments ranges from mid-June until mid-October. Untested bison are tolerated outside the west boundary Nov. 1 to May 15 and outside the northern boundary Nov. 1 to May 1. Elk are allowed year-round and calve in the presence of cattle in the GYE. Result: no disease control between brucellosis-infected ungulates and cattle.

> ***Page 18:*** This study [by APHIS] indicates that elk play a predominant role in the transmission of *B. abortus* to cattle located in the greater Yellowstone area.

Contradictory action being taken: Despite warning after warning, the IBMP continues to target only bison for slaughter as a means of controlling brucellosis that tests show is being spread by elk, not bison.

> ***Pages 19-20:*** Removing brucellosis-infected bison is expected to reduce the level of population infection, but test and slaughter practices may instead be removing mainly recovered bison. Recovered animals could provide protection to the overall population through the effect of herd immunity, thereby reducing the spread of disease.

Contradictory action being taken: Without paying attention to disease status or recovery levels, the IBMP continues and sometimes accelerates bison culling, promoting the eventual collapse of the herd due to dwindled immunity.

Further, the statement that “Removing brucellosis-infected bison is expected to reduce the level of population infection” is in error. Such culling has not reduced the level of brucellosis in bison. The study “Estimating probabilities of active brucellosis infection in Yellowstone bison through quantitative serology and tissue culture,” led by Treanor of Yellowstone National Park, points out that:

> Additionally, boundary culling has not contributed to a measurable reduction in brucellosis infection in the bison population. The proportion of seropositive

> adult female bison has increased slightly since 1985 or remained constant at c. 60% (Hobbs et al. 2009).

In fact, as the study states, such culling may be counter-productive, collectively harming the immune response in bison.

> ***Page 20:*** Intensive management near conservation area boundaries maintained separation between bison and cattle, with no transmission of brucellosis.

Contradictory action being taken: This is untrue. Transmission of brucellosis from elk to cattle has occurred, regardless of the separation between bison and cattle maintained.

> ***Page 20:*** However, brucellosis prevalence in the bison population was not reduced and the management plan underestimated bison abundance, distribution, and migration, which contributed to larger risk management culls (total >3,000 bison) than anticipated.

Contradictory action being taken: While recognizing this, the IBMP continued culling, despite evidence that it has not reduced the disease among bison and despite evidence that such culling may be increasing productivity of bison.

> ***Page 20:*** Culls differentially affected breeding herds, altered gender structure, created reduced female cohorts, and temporarily dampened productivity.

Contradictory action being taken: While recognizing this, the IBMP continues large-scale culling.

> ***Pages 20-21:*** This assessment was used to develop adaptive management adjustments to the IBMP in 2008 (USDI et al. 2008) and similar future assessments will be essential for effective management to conserve the largest free-ranging population of this iconic native species, while reducing brucellosis transmission risk to cattle.

Contradictory action being taken: The IBMP plans to continue massive culls to (nudge nudge wink wink) “conserve the largest free-ranging population of this iconic native species.”

A realistic alternative plan

A conceptualization of why the Interagency Bison Management Plan is not working and what would be a more realistic and thus more workable flowchart is as follows—comparing one that keeps cattle in the migratory habitat of bison and elk and one that removes cattle from it:

Start

↓

Desired condition:
No brucellosis transmission between bison, elk and cattle.

Alternative 1:
Allow cattle on bison and elk migratory habitat adjacent to Yellowstone National Park.

↓

Does this promote disease transmission to cattle?

↓

Yes.

↓

Problem solved?

↓

No.

↓

Haze and lethally remove only migratory bison from habitat adjacent to park

↓

Problem solved?

↓

No.

↓

Alternative 2:
Remove cattle from bison and elk migratory habitat adjacent to Yellowstone National Park.

↓

Does this promote disease transmission to cattle?

↓

No.

↓

Problem solved?

↓

Yes.

Rationalize lack of
success, issue
misleading scientific
reports, create media
hysteria, groupthink.

↓

Problem solved?

↓

No.

↓

Go back to **Start.**

Figure 88. PROPOSED REALISTIC CONCEPTUAL MODEL of brucellosis management.

When a workable and simple solution is avoided in favor of a non-workable, complex one, it often means that those who have the power to make it work don't want it to work.

28

Enclosing a wilderness

What is going on in the Greater Yellowstone Ecosystem is similar to the "enclosure acts" of the 18th and 19th centuries in England where a series of acts of Parliament allowed the enclosure of open fields and common land in the country by fencing, creating legal property rights to land that was previously considered held in common, that is, public land.

An ecosystem is common property, like the village green and the common land in England. By the government providing to the cattle industry the legal muscle to control the usage of these common lands, it is robbing the public of their prior common right. What happened in England during the Industrial Revolution is happening here both inside and outside Yellowstone National Park, especially along its borders.

In England, many landowners became rich through the enclosure of the commons, while many ordinary folk had a centuries-old right taken away. Land enclosure has been condemned as a gigantic swindle on the part of large landowners. In 1770 Oliver Goldsmith wrote *The Deserted Village*, deploring rural depopulation due to enclosure. An anonymous protest poem from the 17th century summed up the anti-enclosure feeling:

> The law locks up the man or woman
> Who steals the goose from off the common
> But lets the greater felon loose
> Who steals the common from off the goose.

George Orwell wrote in 1944:

> Stop to consider how the so-called owners of the land got hold of it. They simply seized it by force, afterwards hiring lawyers to provide them with title-

> deeds. In the case of the enclosure of the common lands, which was going on from about 1600 to 1850, the land-grabbers did not even have the excuse of being foreign conquerors; they were quite frankly taking the heritage of their own countrymen, upon no sort of pretext except that they had the power to do so (Enclosure, 2014).

Enclosing the land led to a number of revolts. One of the most famous was Kett's Rebellion, a revolt in the county of Norfolk, England during the reign of Edward VI in 1549. It began when a group of peasants destroyed hedges that had been put up by wealthy landowners to fence off the common land for their own use. The rebel forces grew to 16,000, but eventually failed with 3,000 rebels being killed by the king’s army (Kett’s Rebellion, 2015).

Figure 89. FENCING OFF THE COMMONS was accomplished by acts of enclosure, by law taking public land for private use. Here are the remnants of a hedge planted to fence the commoner out and sheep in, sheep owned by the nobility. These decaying hedges mark the lines of the straight field boundaries created by the “Plan and Apportionment for the 1768 Parliamentary Act of Enclosure of Boldron Moor” (Durham County Record Office) (Enclosure, 2015). ***Creative Commons Attribution-Share Alike 2.0 Generic license. Attribution: Andy Waddington.***

The heritage of hunting bison here in America has been going on for 10,000 years, but only in these latter years have hunting and harvesting this most valuable of wild ungulates been dominated by government forces. By law the Montana Department of Livestock can sell captured bison. By law the livestock industry can have cattle raised in a biohazardous environment under government protection. By law it can keep wild bison from leaving the park and entering public grasslands. By law, it can have wolves killed that might prey on cattle in a wildlife ecosystem, and by law it is entitled to keep the profits for itself from the sale of cattle that graze on these public grasslands and from bison barred from these grasslands. By law the government can keep doing this even though it does not accomplish its goal of controlling the spread of brucellosis out of the park.

Why should the rather obvious solution to this problem be so assiduously resisted, that is, not grazing cattle near a wildlife reserve where zoonotic disease is prevalent in two wild species, both bison and elk? When it comes to wild bison, it has a lot to do with dominance and competition. Bison can survive on their own in harsh winter climates. Cattle can not. Wild bison are a public animal and thus are not bought and sold. Cattle are privately held. Bison favor grazing valley grasslands. So do cattle.

When bison come on either private or public property, they can infect cattle with the disease of brucellosis they got from cattle in the first place, which over the course of time is relatively harmless to most bison, but can mean that if one domestic cow contracts the disease, an entire herd of cattle can be subject to lethal action as a means of preventing the spread of the disease to other cattle.

Try as they might, the IBMP has not been able to eradicate brucellosis from bison. And if bison remain wild, they never will. Even though there is no record of bison spreading brucellosis to cattle in the wild, as the IBMP has stated, that risk is not zero, so in their minds the wild bison must remain enclosed in the park forever.

But somehow, somehow it is OK for brucellosis-infected elk to migrate.

If the disease of brucellosis were really the problem, the cattle industry would have long ago seen the wisdom of not grazing cattle in a wilderness where disease-carrying bison *and* elk also graze. While elk represent a major disease threat, in practice the disease in elk is ignored because the presence of elk is not as great a threat as bison for forage. No, brucellosis is a ruse. It is just a good excuse to kill wild bison. The real problem is two-fold. First, wild bison, if allowed to expand their numbers, could once again feed the population without having to buy meat from a private source and secondly, wild bison consume forage that is public. You see, the cattle industry wants the benefit of public grass but does not want the public to have the benefit of publicly-owned meat—wild bison. Wild bison represent a major economic, cultural and philosophical threat to the cattle industry.

The word "capital" comes from the Latin word "caput," meaning head, as in a head of cattle, livestock. The word "cattle" similarly comes from Anglo-French "catel," meaning property, from Medieval Latin "capitale," meaning property, stock. In capitalism, money takes the place of cattle as the unit of wealth. Wealth entails ownership. Cattle do not migrate. Cattle stay behind fences. Cattle can be owned. Cattle can be sold to acquire wealth. Wild bison, on the other hand, migrate, cannot be owned, do not stay behind fences and cannot be sold.

At the heart of the matter is that bison can wander anywhere because they are wild, roaming and migratory and when that animal is in range, merely by taking that animal via hunting the hunter becomes a capitalist, that is, that person has acquired capital, livestock, i.e., wealth. Such an event can be viewed by the property owner as a threat because wild bison cannot be owned and thus it is thought that no profit can be made by a third party from its acquisition.

Ain't necessarily so

But that ain't necessarily so. The threat is illusory. Private property owners can still make money from wild bison killed via proceeds from hunting licenses or by means of fees charged for taking such bison on their land. Bison outfitters could be just as big a business as elk outfitters and hunting guides. Government also can obtain funds from the killing of such bison via hunting licenses. There are ways to make wild bison profitable. The return of the buffalo to the plains would revolutionize the Midwest, but it takes strong wild bison to do it without compromised genetics. The preservation of the rich genetic structure of wild bison is for this reason prudent and will assure that this wild, survivalist species will not go extinct. It is human intrusion into the genetic health of wild bison that is the problem, a problem that is far-reaching.

By not allowing bison out of Yellowstone National Park, the common person has been excluded from his or her traditional right to hunt wild animals—traditional in that the plains bison were the common property of the American Indian and the European settlers. By legislative fiat, wild bison have been partitioned off their historic migratory haunts in the Greater Yellowstone Ecosystem just outside the park. The very same animals that once fed tribes of Indians and European settlers simply by their taking were common property just like deer and elk. Now privately-owned cattle, instead of bison, have been given priority on public property. Here private cattle interests preempt public interests in wildlife.

The un-wilding of the Greater Yellowstone Ecosystem is in effect the disarming of the American hunter, for without wilderness there is no hunting. Cattle have no business in a wilderness because the business of cattle ranching denies wilderness.

Recall *Bozeman Daily Chronicle* Staff Writer Laura Lundquist's comment in the 2014 story announcing the culling of 900 wild bison in the upcoming winter. She reported in "Yellowstone proposes to eliminate more bison" that:

> The livestock department and FWP concurred with the proposal, but tribal representatives from the CSKT, Nez Perce and InterTribal Buffalo Council questioned the increase.

Why did these tribal members object to the increased culling? They objected, according to Lundquist, because they believed a reduced population would reduce migratory numbers:

> Smaller herds could mean fewer bison leaving the park during winter, which would reduce the hunting opportunities.

Further, Lundquist wrote:

> Opening public lands west of the park to bison year-round could improve hunting opportunity, but the Board of Livestock is sitting on the environmental assessment that could lead to that (Lundquist, 2014).

Recall that the National Park Service on its website "Frequently Asked Questions: Bison Management" states this:

> Federal, state, and tribal members involved with the management of Yellowstone bison agreed to use hunting as the primary method for removing bison from the population. However, logistical and social challenges currently limit the effectiveness of hunting to a maximum of several hundred bison annually.
>
> During the winter of 2015, it is anticipated public and tribal treaty hunting in Montana will remove 300 to 400 bison, while another 500 to 600 bison could be shipped to meat processing or research facilities following capture at the Stephens Creek facility. Congress has specifically prohibited hunting within Yellowstone National Park.
>
> The plan is to capture and ship at least 50 to 100 bison per week from mid-January through mid-February without regard for age, sex, or disease status. Another 200 to 400 females (8 months to 5 years of age) could be shipped during the last two weeks of February and first week of March.

Reducing the bison population by hunting inside the park is out because, as NPS notes, "Congress has specifically prohibited hunting within Yellowstone National Park." But the NPS winks at what Congress also specifically prohibited with regard to the park, namely, "their capture or destruction for the purposes of merchandise or profit" (Yellowstone Act, 1872). The Stephens Creek capture facility is on park property and the captures are specifically for the profit of the cattle industry, that is, so there is no conflict with bison regarding disease or forage.

Why can't bison be harvested outside the park solely through hunting instead of shipping them to meat processing facilities? Apparently, because not enough bison can be killed by hunting only due to "logistical and social challenges," so a more efficient method of slaughter must be employed, namely, that method used at stockyards—capture in a corral, load onto a cattle truck, ship and slaughter. As NPS explained in its website referenced above:

> . . . there appears to be a social tolerance that will limit substantial increases in bison hunting and associated gut piles in places near the park boundary.

What the NPS is saying is that it must remove bison from the population by shipping animals to a slaughterhouse because "bison hunting and associated gut piles" "is considered undesirable." Apparently, putting a pile of guts in a slaughterhouse barrel is more acceptable.

At a scientific level, however, the qualms expressed by the NPS are surprising when one considers that the presence of gut piles serves to feed numerous scavengers, such as coyotes, grizzly bears, magpies, crows, ravens, wolves and vultures, not to mention species of fungus and bacteria.

Bison have been spilling their guts due to man since man began to hunt them. The image below, one of the first to depict a human being, shows a dead hunter next to a bison with its entrails flowing out. It was drawn over 10,000 years ago.

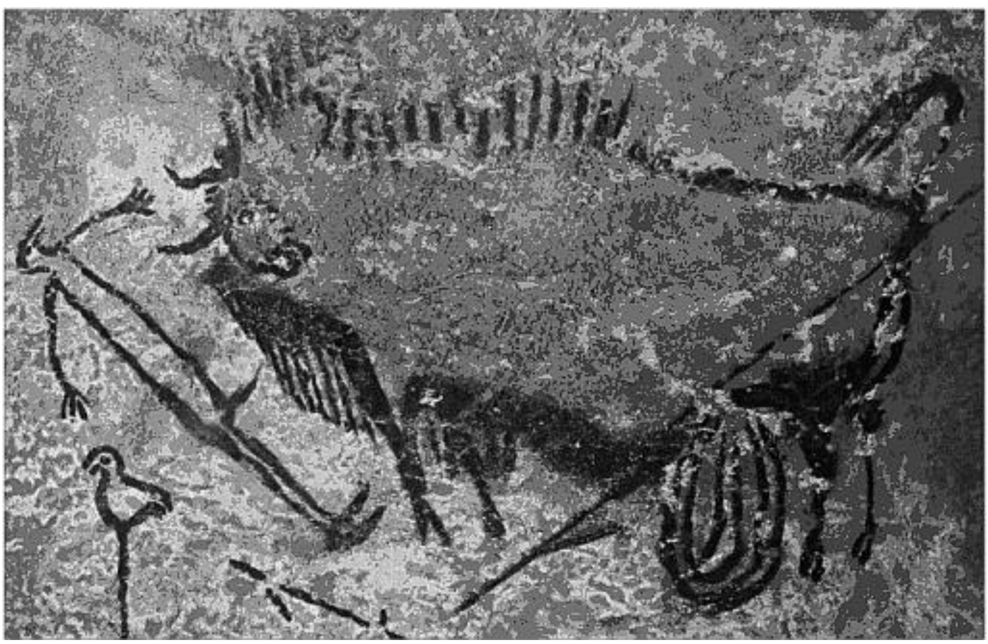

Figure 90. A WOUNDED BISON. Pre-historic painting (c.15,000-10,000 B.C.) in Lascaux Cave, France. A wounded bison, intestines spilling out, stands over an apparently dead human figure. The scene has been interpreted as an appeal to supernatural forces rather than as a simple record of a hunting incident. ***This image, "An Appeal to Supernatural Force" is free to use under the Creative Commons license (Hajar, 2015).***

However, there may be more than just an aesthetic dislike of gut piles going on. Most likely the NPS's reservation about having park visitors view bison gut piles is because in winter most female bison are pregnant. When killed at that time of year, their gut piles often contain a fully-developed calf fetus. Most likely, the public relations strategy employed by the NPS and the rationale for off-site slaughter is to prevent the public from seeing the result of their winter lethal removal of migratory bison. It is a case of "out of sight, out of mind," the idea being that no one will know and thus no one will care what goes on behind the closed doors of a slaughterhouse.

Regardless, the result is often the discarding of fully-developed calves just weeks from birth. Rather than being left lying in a field, under IBMP management they are dumped in waste containers. As P.J. White, chief of aquatic and wildlife resources in Yellowstone National Park, notes, this way you get two with one kill. At an IBMP meeting he observed that "removal of one cow is the equivalent of removing two animals—the cow and its calf of the next year" (Bischke, 2014, p. 4). It is all a numbers game and when it comes to Yellowstone bison the government's game is population reduction.

Figure 91. BISON CALF FETUS with umbilical cord and placenta intact in gut pile discarded by hunters north of Yellowstone National Park (Stachowski, 2014). ***Photo courtesy of Buffalo Field Campaign.***

But something tells us something is wrong with this numbers-only perspective. For one thing, it lacks heart. Further, wilderness has a dignity similar to mankind. Wild animals resist domination. They thrive on freedom. We humans identify with wildlife in that regard and can find clues to our own nature by studying them, not only concerning their organic and chemical reactions, but also their emotional and behavioral components. We identify with animals, and wonder at the family relationships displayed by animals such as bison, that will not leave fallen members of the herd, as though in mourning, and will nudge and try to revive them.

But why should we care? Do we have moral obligations to animals? Emmanuel Kant in *Lectures on Ethics* thinks we do, at least indirectly. He reasons that if a dog has served his master long and faithfully, when the dog has grown too old to serve, his master ought to keep him until he dies. However, Kant states:

> If a man shoots his dog because the animal is no longer capable of service, he does not fail in his duty to the dog, for the dog cannot judge, but his act is inhuman and damages in himself that humanity which it is his duty to show towards mankind. If he is not to stifle his human feelings, he must practice kindness towards animals, for he who is cruel to animals becomes hard also in his dealings with men. We can judge the heart of a man by his treatment of animals (Kant, 1930, p. 240).

However, science can be used to justify inhumanity. The annual slaughter regimen is deemed necessary because, as the NPS website continues in its public relations effort:

> A panel of expert scientists reviewing bison and brucellosis issues in 2013 concluded that culling or removals of bison, along with hunting, would be necessary to limit the size of the bison population (Frequently Asked Questions: Bison Management, 2014).

In biology, culling has been defined as the process of segregating organisms from a group according to desired or undesired characteristics. In animal breeding, culling is the process of removing or segregating animals from a breeding stock based on specific criteria. This is done either to reinforce or exaggerate desirable characteristics, or to remove undesirable characteristics from the group. For livestock and wildlife, culling often refers to the act of killing those animals removed from the population—with the synonym being “lethal removal.”

Central to the idea of culling is that it is used to achieve an objective. What is the objective here stated? NPS has a simple answer: “to limit the size of the bison population.” That is it. Whether the culled animals are the most fit, the least fit, old, young, diseased or healthy is not a criteria. Whatever is headed toward the park boundary is a candidate for this limiting action. Yes, this indeed is IDIOTIC.

When it comes to wild bison, the mindset should not be herd reduction, but herd increase for the benefit of the public and to assure the conservation of this species, for wild bison could be a valuable resource once again in America. But to survive in the wild, they must have strong genetics. Killing the most fit, the migratory, is obviously off track.

29

At the deliberative table

At a meeting of the partners of the Interagency Bison Management Plan on July 30, 2014, which established the lethal removal of 900 bison the winter of 2014-2015, the logistics of lethal removal were discussed, including the pros and con of hunting versus ship and slaughter.

The nine partners attending the meeting were Don Herriott (APHIS), Leonard Gray (CSKT), Ervin Carlson (ITBC), Christian Mackay (MBOL), Martin Zaluski (MDOL), Pat Flowers (MFWP), McCoy Oatmann (NPT), Daniel Wenk (NPS-YNP), and Mary Erickson (USFS-GNF). In addition to those at the "deliberative table" were about 20 staff members from across IBMP organizations and about 25 members of the public.

The meeting provides a window into some of the thinking within the IBMP. According to a summary of the report, the meeting opened accordingly:

Germaine White, CSKT Information and Education Specialist, introduced Tony Incashola who offered an opening prayer and invocation, including some words in his native tongue. Tony introduced the drumming group Yamncut, who provided two songs, one of which was the *Calling Buffalo Song*. Ron Trahan, current CSKT Tribal Council Chair, next welcomed the IBMP Partners on behalf of the Tribe. Ron said that the drumming was a good way for good people—as all those assembled here were—to start the day. It is also good, he said, to work to bring back bison, the animal that has always protected and fed us.

The last sentence is key, that it is good "to work to bring back bison, the animal that has always protected and fed us." As noted, here in America, prior to European settlement, millions of bison on the plains fed the human population on this continent and provided the basic elements of life. While wild bison here in the New World were utilized, in the old world they were exterminated.

Being that there are now 500,000 bison on the plains, what could be meant by "work to bring back bison, the animal that has always protected and fed us"? The half-million bison referred to are privately-owned animals raised behind fences for commercial purposes, for meat production and docility. They are not wild. They do not migrate. They are not publicly-owned animals as are ungulates such as elk that migrate and can be hunted. One can obviously not go onto a bison ranch and shoot a bison to gain possession of it, just as one cannot go onto a cattle ranch and by shooting a cow take possession of it, yet this can be done with wild bison coming out of YNP.

This is a fundamental difference and central to the conflict between the cattle industry and the bison culture.

The meeting summary reported answers to a number of questions related to the harvesting of 900 wild bison. Some excerpted questions (in **bold**) and paraphrased answers follow:

Is the recommended harvest of 900 animals realistic?

> PF [Pat Flowers] agreed that 900 seemed reasonable. He said that in addition, he believed that 300-400 animals allowed in the Gardiner Basin was about the limit of what was possible before conflict, public safety, and social stress issues snowballed.
>
> NPS reminded the Partners that it is not only the overall number of bison harvested, but the sex ratio that matters in population control . . . Several Partners argued that (a) the population should not be allowed to spike upward, the swings and resulting need for huge harvests some years is socially unacceptable, and (b) that while we might not be able to get there all at once we should year-by-year design the harvest plan to continuously lower the bison population toward . . . [sentence not finished].

What is the IBMP population goal for bison in YELL [Yellowstone National Park]?

> This discussion went in circles, with numbers ranging from 3000 to no limit. Some said that the forage base is not sufficient for the current number, others said that the bison harvested even given last year's high population and hard winter were in excellent health. Comments were made that improving habitat through range restoration, and expanding habitat such as available through the West Side EA [Environmental Assessment] . . . would allow for more bison. Statements were made that the Partners are currently operating under the mandates of the 2000 ROD [*Record of Decision*], meaning a goal of 3000, and that to change it meant going through an AM [Adaptive Management] change. For a longer term goal, many said that such a discussion will happen under the new EIS [Environmental Impact Statement] . . .

Some Partners said that they were not clear what the long term trend for YELL bison population should be: decreasing, stable, or increasing.

This discussion had no resolution. In the end, there appeared to be agreement on only three numbers: the 2000 ROD indicates a goal of 3000; the average number of bison in YELL since the 2000 ROD has hovered around 4000; and the current number of bison in the Park is roughly 4800.

What if there are not 900 animals that come out of the Park?

Partners recognized that if the upcoming winter is mild, it is possible not as many bison will come out of the Park. RW [Rick Wallen] stated that after ~ [about] 30 years of data, NPS can predict that with numbers alone (2500 central herd, 3500 northern herd) animals will migrate out of the Park.

Notwithstanding that comment, Partners asked, is it possible that there will not be enough out-migration to harvest (hunt, ship and slaughter) 900 animals? What then? Won't we then potentially risk having huge numbers the next year and thus a potentially huge outmigration two years hence?

This same question was asked in many different ways. And over the course of the discussion, multiple responses were presented. Those answers are captured below, though with the recognition that these ideas were presented in what was effectively a brainstorming session and none of these ideas had 100% Partner consensus:

- *Hunt inside the Park.* DW [Dan Wenk] stated that this activity would be outside NPS mandate, plus would result in large public opposition. EC [Ervin Carlson] stated that if allowed, the tribes would carry this activity out in a respectful way.

- *Animals move on their own away from the northern boundary.* A Partner asked if there is any possibility that members of the Northern Herd might move to the Central Herd, thus decreasing pressure on bison to migrate into the Gardner Basin. NPS responded that while anything was possible, in fact in recent years the trend has been for the Central Herd animals to move into the Northern Herd. PJ [P.J. White] noted that NPS does not understand why, that's just what they have observed.

- *Drive animals out of the Park (i.e., "haze to trap").* Those bison, then, would be available for hunting and/or ship and slaughter. Comments were provided that this activity would result in large public opposition. Also, hazing animals to push them outside the Park required a bigger conversation, DW [Dan Wenk] noted, for example because of the interplay with animals being pushed back into the park by hunting. The two management efforts do not stand in isolation.

- *Allow the bison population to spike again and deal with it in the following years.* Many spoke to the concern that large population swings ultimately lead to a large out-migration at some point, with subsequent need for large ship and slaughter operations (plus public safety and other concerns) that are socially unacceptable to many in the public.

- *Is an increase in winter kill possible?* One Partner asked if a harsh winter might increase calf mortality, thus lowering the bison population. DaveH [David Hallac] said not likely, that current survival rate for bison calves over winter is high even in harsh winters—0.6 for bison calves versus 0.3 for elk fawns.

- *Is use of operational quarantine and then translocation of live bison to tribes possible?* No, because (a) the two pastures at Corwin Springs are not available, and (b) the operational quarantine facility concept is just starting into an EA review now, so surely not available this year (the only possible streamlining of the process would come if an existing facility is found rather than starting from scratch . . .). ITBC stated their support of transfer of live bison to tribes as a goal that should be prioritized over ship and slaughter once operational quarantine is available.

How many animals can be taken by hunting? And if insufficient animals come out of the Park, how do we prioritize hunting versus ship and slaughter?

A discussion, again without resolution, proceeded regarding the maximum number of animals that could be reasonably harvested by hunting, and whether hunting should be considered the priority. Some noted that 400 seemed to be the capacity that could currently be met both with hunters available, and for social acceptance in park boundary areas. PF stated that even 400 might be ambitious. RW agreed. MO [McCoy Oatman] noted that the NPT have met their hunting goal and want to maximize the hunt as a priority. He and TM [Tom McDonald] disagreed that we are at the maximum hunt harvest since tribal hunts are new since 2007, and that their hunters are becoming more and more efficient. JH

[John Harrison] noted that the tribes don't think of hunting as a tool whose goal is for population control. Instead they would like to hunt to replace ship and slaughter.

RW stated that hunters take 2-3% of animals that migrate into the Gardiner Basin. The rest often go back until pushed back out by pressure from other bison, or pulled back out by bison who have not been out and been hunted yet.

Opinions of equal fervor were put forward championing hunting (e.g., treaty rights, not yet maximized, more socially accepted) over ship and slaughter (efficiency, ability to handle higher numbers of bison) as a priority. No resolution was reached. But several ideas were mentioned for possible consideration:

- Allow capture for ship and slaughter early in the season—assuming animals come out—before the hunt moves into full swing.

- Can more tribal groups be allowed—whether via currently unused treaty rights or otherwise—to hunt?

- Can we haze animals to, for example, Cutler Meadows to make them more accessible to hunters?

- Can we stagger the hunts (tribal and state) to say hunt 3 days, then rest 4 days, to allow the bison more time to move out of the Park, feel less harassed, and thus be more available?

- What if for the north side we did an AM change similar to the west side; i.e., with time and number targets? For example:

  Dec – Jan 1: all bison that come out of the Park are allowed to pass. Hunt allowed only in Cutler Meadows and Eagle Creek, nowhere else, to allow animals to better disperse away from the Park.

  Jan 2 – Mar 31: Capture and ship some animals. Let some pass for the hunt, which is allowed in all areas. Use the guideline of 300-400 animals as the maximum allowed in the Gardiner Basin (includes Eagle Creek) to begin stopping all animals at the Park boundary. The 300-400 animal guideline is used as sufficient to serve the needs of hunters, while minimizing safety issues and bison-associated social conflicts in the Gardiner Basin. (It was noted during the discussion that based on last year, shipments to slaughter are only expected to occur in February and/or March.)

April 1 on: If there are greater than 400 animals in the Gardiner Basin, capture and hold the animals until May 1, then release them back into the Park.

How do we distribute the animals destined for ship and slaughter?

DaveH noted that the logistics of ship and slaughter may be the biggest issue that the Partners face. To date, only ITBC and CSKT have been takers for animals in the ship and slaughter program. NPS can capture the animals. From there, NPS needs Partners to provide transportation, security, processing, and distribution.

How do we accomplish harvesting 900 animals?

The Partners expressed some concern about the how the harvest might break out, even given that enough animals come out. CM led a discussion to come up with a potential breakdown, based on last year's results and this year's expectations. The numbers that follow were the Partners best guesses, and only that—they do not reflect commitment at this stage by any Partner:

- 300 Hunt (combined state and tribal, recall NPS goal of focus on cows)
- 150 Ship and slaughter (ITBC, funding concerns noted)
- 450 Ship and slaughter (CSKT; popular program; likely could increase their take of these animals from last year; Tribal Council has stated that it is critical not to take pregnant females)
- 35 Research (APHIS)
- ? Ship and slaughter (NPT, uncertain pending tribal council allocation)

Total: 900+ animals

JS [Jim Stone] noted that bison ship, slaughter and package came to ~$330 per animal. Several Partners stated that this cost seemed reasonable, and might open up other avenues for final bison disposition, including (no order of preference intended): other tribes (e.g., other treaty hunting tribes or 26 affiliate tribes of YNP), Montana food bank networks, USDA food programs

> for tribes, contacts available from APHIS from when they managed the ship and slaughter program, and/or the general public.

Fundamental differences revealed

Of all the statements made, the two comments that make the most ecological sense in the opinion of this Petitioner were by John Harrison, who is quoted as saying, "the tribes don't think of hunting as a tool whose goal is for population control. Instead they would like to hunt to replace ship and slaughter," and by the Tribal Council, quoted as stating, "it is critical not to take pregnant females."

The report reveals a fundamental difference between the government agency members of the IBMP and its tribal members. Recall that the report mentioned:

> Opinions of equal fervor were put forward championing hunting (e.g., treaty rights, not yet maximized, more socially accepted) over ship and slaughter (efficiency, ability to handle higher numbers of bison) as a priority. No resolution was reached (Bischke, 2014).

The government views bison as an entity to be efficiently reduced in number, while the tribes simply view wild bison as animals to hunt. That no resolution was reached time and again in the meeting set to establish the parameters for the culling of 900 bison is indicative that the IBMP is in over its head. They should defer to Mother Nature. As mentioned, trying to run nature as a centrally-controlled administrative effort will fail just as communism failed. Something as complex as an economy must run on its own. The same goes for nature.

At a similar meeting of the IBMP members the next year on August 6, 2015, Quincy Ellenwood, Chair of Natural Resources Committee, Nez Perce Tribal Executive Committee, asked a number of important questions. One of the areas of particular concern is in the Beattie Gulch area, a 65-acre piece of Forest Service land north of Gardiner where tribal hunters assemble to shoot bison as they leave the park. Scott Bischke, facilitator for the IBMP, reported his remarks:

> Quincy said that a driving force in the NPT [Nez Perce Tribe] approach is how are we going to listen to our ancestors. The meat is very important to us, he said, even the DOI [Department of the Interior] recognizes bison meat as the best natural protein you can get.
>
> When will we listen to the bison, Quincy asked, and let them roam free? Why are they considered to be less important than livestock? We want to have more land for the bison to roam in and more land for our people to hunt on.
>
> We don't agree with the proposed alternatives for hunting in Beattie Gulch . . ., Quincy said. If you close the Beattie Gulch area, then it seems like an expansion of YNP. Are these alternatives policy or science driven? Where did the population goal of 3500 come from? Was it because of policy or science?

> We believe that actions should involve the best science and respect the needs of wild bison, encompass population dynamics, habitat use, and migration needs; plus value Native cultural hunting traditions. There should be no hazing, and no ship and slaughter. Hunting should be the only control on population. We support habitat restoration (Bischke, 2014).

This is an eloquently spoken statement of the importance of listening to the bison, that is, recognizing its status as a valuable resource, instead of a population to be controlled. Indeed, why are bison less important than livestock? Can anyone answer this? Indeed, are the alternatives for managing bison science-driven or something else? And why the population cap on bison?

This petition has shown that the 3,000-3,500 maximum number of bison allowed in the park by the IBMP is based on the use of bad science to support bad policy. IBMP members are sticking theoretical pins into simulated bison in a ritual of lethal removals that is supposed to banish brucellosis from the park by keeping bison numbers at the magic number of about 3,500. This is voodoo science.

What appears in part to be motivating this wanton killing is an obsessive blood-lust toward bison. It reminds me of a poem by Vachel Lindsay called "The Congo." Here is an excerpt:

> Then along that riverbank
> A thousand miles
> Tattooed cannibals danced in files;
> Then I heard the boom of the blood-lust song
> And a thigh-bone beating on a tin-pan gong.
> And "BLOOD" screamed the whistles and the fifes of the warriors,
> "BLOOD" screamed the skull-faced, lean witch-doctors,
> "Whirl ye the deadly voo-doo rattle,
> Harry the uplands,
> Steal all the cattle,
> Rattle-rattle, rattle-rattle,
> Bing.
> Boomlay, boomlay, boomlay, BOOM."

Substitute the reference to cattle with the word bison and the poem aptly describes the ethos of the IBMP.

At the August 6, 2015 meeting, hunting by tribal members was mentioned as an alternative to the perceived need for bison culling. Bischke summed up the discussion ("MZ" refers to Martin Zaluski, DVM, state veterinarian, Montana Department of Livestock, and "DW" for Dan Wenk, Superintendent of Yellowstone National Park):

> Allowing hunting in the Park was mentioned a number of times (by tribes and by state of Montana) as a way to aid in hunter harvest, alleviate the Beattie Gulch bottleneck issues, decrease public safety concerns, meet tribal hunting needs and desires, still allow hunting when mild winter weather does not force bison out of the Park, and so on. As he has before, DW noted the public outcry that would result, and that no hunting in YNP is not a "policy," as many keep saying, but a law. He said that he does not have decision authority as Park Superintendent to allow hunting in YNP. The only way to move ahead with hunting in the Park is for the tribes to enter into government-to-government negotiations. The first step is for those who have suggested this action (tribes and the state of Montana) to formally request (in a letter to the National Park Service) that hunting be allowed in the park (MZ noted that he agreed, any petition from the state to this effect would have to come from the governor, not the Montana State Veterinarian).

On October 15, 2015 I wrote to Zalusky about his thoughts on hunting inside the park:

> I just came across a 2014 Reuters story on the Nez Perce wanting to hunt bison inside the YNP and I agree in part with a comment you made. The article stated:
>
> > Marty Zaluski, Montana state veterinarian and member of a state, federal and tribal team that manages bison in and around Yellowstone, is a proponent of hunting in the park and told Reuters in February it needed to be "looked at more seriously as a possible solution".
> >
> > He said it would bring the herd closer to a population target of 3,000 to 3,500 and lessen the public outcry tied to slaughter of wayward buffalo.
>
> I agree that hunting in the park by Indian tribal members makes sense, however, I don't see much evidence scientifically that keeping the population of bison at 3,000 to 3,5000 has much to do with mitigating the spread of brucellosis by wildlife to cattle because elk are the greater vector. However, I see merit in park hunting as it would make the harvest of bison more equally divided between migratory and non-migratory bison.
>
> What is your thinking on this?

As of the submission of this petition, Zalusky has not replied.

Prior to this exchange, on September 16, 2015 I queried Zalusky, saying "only bison migrating into Gardiner Basin have been culled in the past few years. How come?"

He responded, saying, “James – the Stephens Creek capture facility is located in the Gardiner basin so that is where the capture operations are performed.”

I replied September 18:

> Thanks so much Martin. I wondered how that question was going to be answered . . . Your reply actually makes sense. The bison's “crime,” not to be anthropomorphic about it, is not necessarily that they are migrating into a given area. Instead, it is because their numbers are above 3,000--which according to one simulation study is the trigger for migration. The most convenient way to whittle them to the number at or below the trigger is the Stephens Creek capture facility. Right?
>
> But what about the bison that do get into the arena with cattle outside the park in the Gardiner Basin, let's say? I thought epidemiology was based on keeping diseased animals from non-diseased. In reality, not just according to simulations, if bison do comingle with cattle in the GB or elsewhere, isn't the capture facility in the end accomplishing little because it has not achieved effective separation? And are not elk allowed to comingle with cattle and are they not greater brucellosis vectors? To assure neither bison nor elk comingle with cattle just outside the park, would it not make more sense to remove all the cattle there, since you can't remove all bison and all elk from the park or its environs? At least $3 million would be saved annually, which is the cost of the wild bison reduction efforts.

On September 23, 2015 Zaluski wrote “it will take me a while to respond because of other priorities” and on October 1 after asking how long would be “a while,” he wrote “At least a couple weeks I expect. I’ve just been assigned additional duties, and those must take priority” (Martin Zaluski, personal communications, September 18 to October 1, 2015).

No reply has been received by the Petitioner from Zalusky as of the submission of this petition.

At the meeting of September 5, 2015, Superintendent Wenk commented that “we also need to consider starting to treat bison like wildlife that are free to roam as they please.” A summary of the meeting noted that the Forest Service:

> Has actively retired grazing permits of Forest Service lands so that is not an impediment to bison movement onto those lands outside the Park. The USFS sees two goals that need to be balanced: doing right by the tribes and maintaining public safety (Bischke, 2015).

But apparently access to habit, as mentioned before, is not the issue. Even if such places outside the park as Gardiner Basin were free of cattle, the IBMP holds that it has the mandated right to kill any bison that attempts to leave the park and migrate into Montana if the bison park population rises above 3,000.

Before the meeting a study was released August 1, 2015 titled "Population Dynamics and Adaptive Management of Yellowstone Bison," by Chris Geremia, Rick Wallen, and P.J. White of Yellowstone National Park. It provided the following rationale for recommending culling 1,000 bison for 2016 (bold text part of original):

> During June and July 2015, up to 4,910 bison were counted in the Yellowstone population following calving, including approximately 3,600 bison in northern Yellowstone and 1,300 in central Yellowstone. Culls and harvests during winter 2015 (October 2014 - May 2015) totaled 737 bison, including 18 harvested from the western management area, 201 harvested from the northern management area, 507 consigned to meat processing facilities, 7 consigned to research facilities, and 4 that died within containment facilities. Removals included 276 males, 297 females, 161 calves, and 3 animals of unknown age and sex. The total sum of removals was below the recommended guideline of 800 to 900—importantly, only 223 adult (at least two years old) females were removed, which was significantly below the recommended guideline of 410 adult females. The net result is a slightly larger bison population after calving.
>
> **We recommend removing 1,000 bison during the forthcoming winter, including 200 calves, 60 yearling females, 420 adult females, 40 yearling males, and 280 adult males. To reduce abundance and productivity, it is most important to meet the removal objectives for calves and females.**
>
> Predicted migrations suggest sufficient numbers of bison will move beyond park boundaries to facilitate the recommended removals. Hunter harvests can likely account for more than 300 of these removals with hunts occurring in both northern and western management areas. However, we recommend limiting harvest in the western management area to adult males because other central herd animals will likely be removed after migrating outside the northern park boundary. We also recommend the capture of bison in the northern management area and consignment to meat processing or research facilities. Removals through capture will likely need to be biased towards adult females, calves, and other juvenile animals to meet recommendations.
>
> In 2008, IBMP managers decided to implement moderated culls in an attempt to avoid large annual fluctuations in the bison population, which occurred during the early IBMP period and could threaten long-term preservation of Yellowstone bison, cause societal conflict, and reduce hunting opportunities outside the park. The removal of 1,000 bison (as recommended above) next winter through hunting and culling should reduce abundance to approximately 3,800 before calving (Geremia, 2015).

Keep in mind that this culling level is in response to the unacceptable levels of culling carried out prior to 2009. And what were unacceptable levels? In the winters of 2007/2008, 2005/2006 and 1996/1997 a total of 1,631, 1,015 and 1,084 bison, respectively, were culled.

From 2009 to 2015 annual culling levels have been creeping up: 22, 7, 230, 33, 254, 653 and 739 bison were culled between those years. With the scheduling of 1,000 lethal removals for 2015/2016 we are back to where we started.

Characteristic of the duplicity of the IBMP is the concluding paragraph quoted above. The authors first state something that sounds good:

> In 2008, IBMP managers decided to implement moderated culls in an attempt to avoid large annual fluctuations in the bison population, which occurred during the early IBMP period and could threaten long-term preservation of Yellowstone bison, cause societal conflict, and reduce hunting opportunities outside the park.

But this is immediately followed by what they want to do anyway:

> The removal of 1,000 bison (as recommended above) next winter through hunting and culling should reduce abundance to approximately 3,800 before calving.

With the large-scale culling of about 1,000 bison a year in the past deemed unacceptable, to "avoid large annual fluctuations in the bison population," the IBMP recommended in 2015 the large-scale culling of 1,000 bison.

Does this make sense? Of course not.

The suspension of reason continues. Stated goals and objectives are routinely disregarded and instead actions are planned that directly contradict the goals and objectives stated. In the 2000 *Record of Decision* in a section devoted to the comments on the planning process that eventually led to the formation of the IBMP, it was noted that:

> Many people (1,016) indicated they believed comments on the draft EIS asking that bison be managed through non-lethal means, or in support of the Citizen's Plan, were ignored.

The response by the writers of the *Record of Decision* was:

> Considering public sentiment against human intervention and lethal control, the agencies have constructed a plan whose ultimate goal is to alleviate the need for large-scale capture and slaughter, as occurred under the interim bison management plan during the winter of 1996-97. The agencies are accomplishing this by keeping the population size near the number below which evidence suggests they are less likely to exit in large numbers because of severe winter weather conditions, and by moving steadily toward allowing

bison to migrate to winter range in the analysis area without being handled by humans (Record of Decision, 2000, p. 60).

Culling recommendation: up to 1,400 bison

But what goes in one ear goes out the other. In an August 2016 IBMP status report on the Yellowstone bison population by Chris Geremia, Rick Wallen, and P.J. White, the authors provided the following summary and culling recommendations:

- The bison population is estimated near 5,500 (range = 5,200-5,800), which is an approximate 11% increase since summer 2015.

- Known culls and harvests during 2015-2016 totaled 552 bison and included 384 harvests, 18 wounded animals dispatched by rangers during hunts, 101 animals sent to meat processing facilities, and 49 animals held at Stephens Creek for possible quarantine.

- About 900 animals (70% adult, 10% yearlings, 20% calves; 60% females, and 40% males) would need to be removed during winter 2016-2017 to stabilize population growth. Removal of 1,400 animals, which is 25% of the current population, would lead to a forecasted bison population of 4,850 (95% range: 4,300-5,300) next summer.

- We recommend that population management actions during winter 2016-2017 substantially reduce the number of bison in northern Yellowstone (estimated at 4,000 animals).

- We recommend using harvests and culling at Stephens Creek through the winter to keep the number of bison migrating north of the park within a range that allows some migration while reducing brucellosis transmission risk and other potential conflicts in the local community. If migrations are large, we recommend removing less than 25% of the total summer population to reduce potential demographic effects.

- In the western management area, we recommend state and tribal harvests of bison through the winter (Geremia, 2016).

After working for 16 years with the objective of "moving steadily toward allowing bison to migrate to winter range in the analysis area without being handled by humans," and "whose ultimate goal is to alleviate the need for large-scale capture and slaughter, as occurred under the interim bison management plan during the winter of 1996-97," where are we now?

In 1996 the bison population in the park was estimated to be 3,436. During the winter of 1996-97 a total of 1,084 were lethally removed and another 1,300 died from natural causes, such as freezing to death and starvation. During severe winters, bison mortality spikes because more bison migrate, exposing them to greater lethal removal actions and because more bison die from environmental causes. (History of bison and bison management in Yellowstone National Park, 2016).

This amounts to a 31.5 percent reduction by means of lethal removals and in total, including winter kill, a 38.7 percent reduction of the herd.

For the winter of 2016-17, a population of about 5,500 is planned to be reduced by culling up to about 1,400 or a 25 percent reduction. What is planned is large-scale culling. If a severe winters occurs, bison mortality will increase. If the park's bison experience a high rate of culling coupled with a high winterkill, the chance of extinction multiplies. Heading into our second decade, no progress has been made.

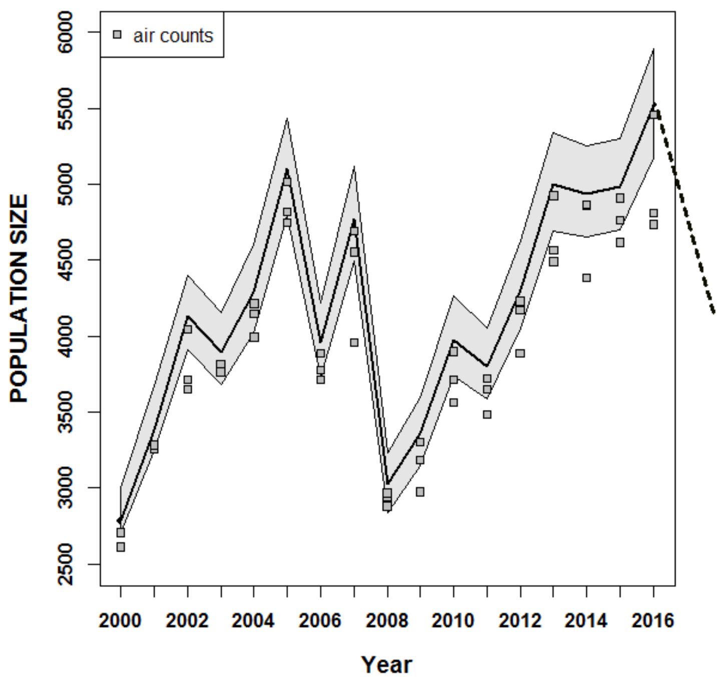

Figure 92. A LARGE POPULATION FLUCTUATION results if the stated goals for culling are met by the IBMP for 2016-17, as shown in this figure. ***Dotted line is graphic projection of those goals drawn by the Petitioner, James Horsley. Figure from "Status Report on Yellowstone Bison, August 2016" (Geremia, 2016).***

For the last few years, the planned large-scale cullings have not been achieved due to a number of possible factors, among them more mild winters and possibly the cumulative effects of weeding out the members of the migratory herd over decades of selective culling, with an ever-increasing percentage of the herd those who had been left behind to breed—the less migratory. So now, to meet its goal of reducing the bison herd, IBMP members are going to have to play "catch-up."

But recall that a trio of Yellowstone National Park biologists in 2014 in "Population Dynamics and Adaptive Management of Yellowstone Bison" stated:

> IBMP partners agreed to implement moderated culls in an attempt to avoid large annual fluctuations in the bison population, which occurred during the early IBMP period and could threaten long-term preservation of Yellowstone bison (Geremia, 2014).

Is the IBMP listening to its own recommendations for moderate culling levels? No. Is the IBMP listening to the NPS's recommendations to avoid large-scale culling? No. Have large scale culls abated the spread of brucellosis to cattle by present methods? No. Will it ever bring the risk of the spread of brucellosis from bison to cattle at the park borders to zero, the self-proclaimed goal of the IBMP? No. Are the state and federal agency members of the IBMP listening to its tribal members asking to limit culling of bison to hunting? No. And they do not have to, for they out-vote the tribal faction five to three.

Why have they decided to do this large-scale lethal removal of wild bison? The answer is simple—because they can. It has nothing to do with disease control and everything to do with reducing competition for forage in a national forest at tax-payers' expense.

The only resolution to this ongoing travesty that threatens the long-term preservation of Yellowstone bison that makes sense is to stop this level of culling. This can be done by removing the motive for the culling by removing cattle and other livestock from private and public properties near the park. Such invasive species, under the protection of humans, promotes an artificial environment that can never be self-controlled and thus will always be out of control. As mentioned, the only way to economically and effectively control the interspecies transmission of diseases between cattle, elk, bison and other wildlife, as well as maintain a balance of species populations without doing harm to the ecosystem, is to leave things alone and let nature function. By doing so there would be no need for the IBMP's "efficiency, ability to handle higher numbers of bison" by means of ship and slaughter. By such a ban, hunting and wolf predation by default become the most effective method of restoring the balance of nature within the Greater Yellowstone Ecosystem. In doing so, the public will once again be able to observe wild bison that are truly wild, as well as put meat on the table without it being a government handout, or have it stolen from the public by the government via ship and slaughter.

A question

In retrospect, the NPS should post the answer to another question on its "Frequently Asked Questions: Bison Management" website. That question is this:

How do you propose to reduce to zero the risk of transmission of brucellosis from wildlife in Yellowstone National Park to cattle just outside the park by lethally removing only migratory bison, when migratory and resident elk pose the greatest threat of brucellosis transmission?

I challenge the agency to answer that question. If it cannot, it should allow bison to migrate from the park just like elk, ban cattle from the Greater Yellowstone Ecosystem to promote the national security regarding disease control and participate in disbanding the IBMP or withdraw from it.

Further, the FWS should grant this petition for the listing of Yellowstone's wild bison as endangered if its biologists, epidemiologists or anyone else cannot provide an answer to that question. The lack of an answer would show the IBMP for what it is, an interagency whose actions are based on wishful thinking, united in its opposition to reason, merely performing illusionary brucellosis containment instead of science, with the net result of its continued actions being the extinction of the wild Yellowstone bison.

30

Yellowstone wild bison a subspecies

It would have been all over for listing wild bison as a subspecies in need of protection from extinction if the National Park Service and the Fish and Wildlife Service had not found it was a “distinct population segment.” The decision that transpired is of great importance. The IBMP 2015 annual report states:

> In November 2014, the Western Watersheds Project and the Buffalo Field Campaign submitted a petition to the Fish and Wildlife Service requesting that the Fish and Wildlife Service designate the Yellowstone bison a distinct population segment of plains bison and protect them as an endangered species. Another petition with a similar request was submitted to the Fish and Wildlife Service by a private individual during March 2015. Both petitions are currently under review. In June 2015, the National Park Service submitted comments on these petitions to the Fish and Wildlife Service which recommend Yellowstone bison meet the criteria for a distinct population segment, but that their conservation status is not threatened or endangered.

The first hurdle to be jumped in order to list wild bison or any other subspecies, is to have it found a distinct population segment. Without that finding, the race is over. That positive finding was originally made regarding my first petition, reversed in a finding on a subsequent petition by James and Natalie Bailey, then with the recent submission of the two petitions referenced above, again confirmed.

The annual report continues, stating:

> The more pertinent question is whether additional wild, wide-ranging populations subject to the forces of natural selection need to be augmented or

> established elsewhere to preserve the species (2015 Annual Report of the Interagency Bison Management Plan, 2016).

This comment demonstrates a fundamental misunderstanding of the challenges present. The wild bison are a distinct population segment because, in part, of their relationship to the landscape, namely, they are the only bison that have remained on the same landscape as a species since they migrated to the Yellowstone region 10,000 years ago. Take them away from this location and they cease to be the species being sought to preserve.

Following is the argument presented to the Fish and Wildlife Service in my March 2, 2015 petition. The FWS affirmed the designation of wild Yellowstone bison as a distinct population segment, but denied listing the species for protection due to abundance and current management.

My March 2, 2015 petition made the following arguments as quoted here and in the next chapter. (Passages in brackets have been added to the original):

* * *

Overview of ESA

Under the Endangered Species Act, species may be listed as either endangered or threatened. “Endangered” means a species is in danger of extinction throughout all or a significant portion of its range. “Threatened” means a species is likely to become endangered within the foreseeable future. For the purposes of the ESA, Congress defined species to include subspecies, varieties and, for vertebrates, distinct population segments.

The purpose of the ESA is to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such imperiled species, and to take steps as may be appropriate for these objectives. It is administered by the U.S. Fish and Wildlife Service and the Commerce Department’s National Marine Fisheries Service (NMFS).

According to the FWS’s online site titled “Little Known but Important Features of the Endangered Species Act: Distinct Population Segments, 4(d) Rules, and Experimental Populations:”

> In addition to the listing and delisting of species and subspecies, the ESA allows the listing/delisting of Distinct Population Segments of vertebrate species (i.e., animals with backbones, mammals, birds, fish, reptiles, and amphibians). A Distinct Population Segment is a portion of a species' or subspecies' population or range. The Distinct Population Segment is described geographically instead of biologically, such as "all members of XYZ that occur north of 40 north latitude."

> The use of Distinct Population Segments is a benefit to species conservation and a benefit to people whose activities may be affected by the ESA's prohibitions. Conservation efforts are more effective and less costly if they are started early and a Distinct Population Segment listing makes earlier listings possible. By listing a Distinct Population Segment, we apply the ESA's protections only to the deteriorating portion of a species' range.

One potential designation for the Yellowstone wild bison herd would be to list it as an "experimental population," a designation that has been applied to the Colorado pikeminnow, the southern sea otter, the gray wolf and the black-footed ferret. According to the FWS:

> Re-establishing a threatened or endangered species in areas of its former range is often necessary for recovery. However, residents and businesses frequently oppose such reintroductions because they fear the presence of the species will also bring severe restrictions on the use of private and public land in the area. To overcome this serious obstacle to species reintroductions, Congress added the concept of experimental populations to the ESA. Experimental population designations are sometimes referred to as section 10(j) rules.
>
> An experimental population is a geographically described group of reintroduced plants or animals that is isolated from other existing populations of the species. Members of the experimental population are considered to be threatened under the ESA, and thus can have special regulations written for them under section 4(d) (Little Known but Important Features of the Endangered Species Act, 2015).

[Yellowstone's wild bison have been range-restricted by the hazing and lethal removal policies of the IBMP. Historical ranges include grasslands along the Madison and Yellowstone Rivers, such as Gardiner Basin, Paradise Valley and Hebgen Basin. These habitats are essential to the recovery of this species.]

Note: those "special regulations" could incorporate the provisions of regulated hunting with regard to listing wild bison, banning the taking of wolves and the removal of cattle in the ecosystem.

Distinct population segment (DPS)

A distinct population segment is one of the lowest taxonomic ranks. According to the Fish and Wildlife Service's policy regarding the recognition of distinct vertebrate population segments under the Endangered Species Act:

> Available scientific information provides little specific enlightenment in interpreting the phrase ''distinct population segment.'' This term is not commonly used in scientific discourse, although ''population'' is an important

> term in a variety of contexts . . . In all cases, the organisms in a population are members of a single species or lesser taxon.

Generally speaking, a taxon is a group of organisms, which a taxonomist adjudges to be a unit. Usually a taxon is given a name and a rank. There are seven main taxonomic ranks: kingdom, phylum or division, class, order, family, genus, species. It is not uncommon for one taxonomist to disagree with another on what exactly belongs to a taxon, or on what exact criteria should be used for inclusion. A "distinct population segment" or DPS is a unit ranked below "species" and is sometimes referred to as "subspecies."

The Glossary of the International Code of Zoological Nomenclature (1999) defines a "taxon" as

> . . . a population, or group of populations of organisms which are usually inferred to be phylogenetically related [that is, to be related in an organism's evolutionary development and history] and which have characters in common which differentiate [that is, distinguish] the unit (e.g. a geographic population, a genus, a family, an order) from other such units. A taxon encompasses all included taxa of lower rank and individual organisms.

The FWS policy explains that a unit is considered a DPS if it represents an evolutionarily significant unit (ESU) of a biological species. To be considered an ESU it must satisfy two criteria:

- It must be substantially reproductively isolated from other conspecific population units; and

- It must represent an important component in the evolutionary legacy of the species.

Note that to define a unit as a DPS one must determine that it is both separate from other populations and a component of its evolutionary history. Thus, what one initially considers a population has a critical bearing on how one measures what it is separate from and a component of.

In practice and more specifically, according to the policy:

> Three elements are considered in a decision regarding the status of a possible DPS as endangered or threatened under the Act. These are applied similarly for addition to the lists of endangered and threatened wildlife and plants, reclassification, and removal from the lists:

1. Discreteness of the population segment in relation to the remainder of the species to which it belongs;

2. The significance of the population segment to the species to which it belongs; and

3. The population segment's conservation status in relation to the Act's standards for listing (i.e., is the population segment, when treated as if it were a species, endangered or threatened?).

Discreteness: A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions:

1. It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation.

2. It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

Significance: If a population segment is considered discrete under one or more of the above conditions, its biological and ecological significance will then be considered in light of Congressional guidance (see Senate Report 151, 96th Congress, 1st Session) that the authority to list DPS's be used ‘‘ * * * sparingly’’ while encouraging the conservation of genetic diversity. In carrying out this examination, the Services will consider available scientific evidence of the discrete population segment's importance to the taxon to which it belongs. This consideration may include, but is not limited to, the following:

1. Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon,

2. Evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon,

3. Evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range, or

> 4. Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics. Because precise circumstances are likely to vary considerably from case to case, it is not possible to describe prospectively all the classes of information that might bear on the biological and ecological importance of a discrete population segment.
>
> *Status*: If a population segment is discrete and significant (i.e., it is a distinct population segment) its evaluation for endangered or threatened status will be based on the Act's definitions of those terms and a review of the factors enumerated in section 4(a). It may be appropriate to assign different classifications to different DPS's of the same vertebrate taxon.

Summary of August 17, 2007 finding on first petition

According to the August 17, 2007 90-day finding:

> The bison (also referred to as the American buffalo) is a member of the family Bovidae, which includes domestic cattle. Two subspecies of bison are currently recognized in North America—the plains bison (Bison bison bison) and the wood bison (Bison bison athabascae) (Boyd 2003, pp. 28–31). The species once ranged across central and western North America, but market hunting nearly extirpated the herds by the 1880s.
>
> Numerous Federal, State, and private bison herds currently exist in the United States, but YNP is the only area in the United States where bison have existed in the wild state since prehistoric times (Gates et al. 2005, p. 92). Boyd (2003, p. 38) estimated the plains bison population in North America at 500,000, and identified 50 herds (containing approximately 19,200 head) currently being managed with clear conservation objectives.

To determine whether the Yellowstone bison merit federal government conservation as a "distinct population segment" under the Endangered Species Act, three hurdles must be cleared in an analysis: the population segment must be found to be 1. discrete and 2. significant in relation to the taxon to which it belongs, and then, if so, 3. a population endangered or threatened to go extinct without protection.

Discrete

The 90-day finding found that the Yellowstone herd was *discrete*. It said (bold emphasis added):

> Information in our files support the conclusion that **the YNP bison population is the only herd in the United States that has remained in a**

> **wild state since prehistoric times (Gates et al. 2005, p. 93). All other bison in the United States are reconstituted herds and are confined with fencing, or otherwise range restricted.** Individuals from the Jackson bison herd in Grand Teton National Park and the National Elk Refuge have been known to migrate north into YNP, but this is a rare occurrence (Gates et al. 2005, p. 109). **Therefore, we find that the YNP bison herd may be discrete from other members of the taxon Bison bison because of physical distance and barriers**.

Significant

The next step is to determine if the Yellowstone herd is of biological and ecological significance to the taxon to which it belongs.

The finding stated that following extirpation of bison, YNP is the only area in the United States where bison have existed in the wild state since prehistoric times. As stated under "Information provided in the petition on significance," the information in the petition (bold emphasis added):

> **. . . indicates that the YNP bison herd may exist in a unique ecological setting within the meaning of our DPS policy.**

Further, according to the finding (bold emphasis added):

> Many of the numerous bison herds currently extant in the United States and Canada were reconstituted from stock that was used to develop bison cattle hybrids (Boyd 2003, p. 23). Research on 11 Federal herds revealed that the bison herd in YNP was 1 of 3 that showed no evidence of genetic introgression with cattle (Halbert 2003, pp. 86–87) based on the alleles examined. (Introgression occurs when the genes of one species infiltrate the genes of another through repeated crossings.) The other two herds were Wind Cave National Park in South Dakota and Grand Teton National Park in Wyoming (Halbert 2003, p. 87) . . .
>
> The Grand Teton National Park/ National Elk Refuge bison herd is separate from the YNP herd (Gates et al. 2005, p. 93), and there are less than a dozen other unconfined bison herds in the entire lower 48 States (Gates et al. 2005, p. 2). Therefore, the YNP herd is discrete from other members of the taxon. **Recent genetic research confirms that the YNP bison herd is significant because of a lack of nuclear domestic cattle introgression.** Although 3 other Federal herds exhibit this characteristic, the YNP bison are the only remnant population that has remained in a wild state since prehistoric times and, therefore, is important to the management of bison genetic diversity.

The finding observed that the bison herd in YNP is one of three herds that show no evidence of genetic introgression with cattle, it is separate from the other herds and is the only surviving wild indigenous remnant herd since prehistoric times. The FWS thus held that (bold emphasis added):

> **Because of the limited number and extent of bison herds that show no evidence of introgression with domestic cattle, we find that loss of the YNP herd might result in a significant gap in the current range of the taxon.**

And also, according to the finding:

> Halbert (2003, pp. 44–45) found only four of the Federal herds made positive contributions to overall bison genetic diversity (measured in terms of allelic richness and gene diversity). Those herds were: YNP, National Bison Range (Montana), Wichita Mountains National Wildlife Refuge (Oklahoma), and Wind Cave.

Thus, the YNP herd was one of the four Federal herds that made positive contributions to overall bison genetic diversity. The FWS determined that (bold emphasis added):

> Maintenance of genetic diversity is an important long-term goal for management of species populations. Halbert (2003, p. 94) concluded her study by stating: ‘‘In conclusion, this study has assessed levels of domestic cattle introgression in 10 federal bison populations and identified at least 2 populations, Wind Cave and YNP, which at this time do not have any evidence of domestic cattle introgression and also have high levels of unique genetic variation in relation to other federal populations. As such, these populations should be given conservation priority * * *’’ **Thus, we conclude that the YNP bison herd satisfies this genetic criterion of significance under the DPS Policy.**

Further, the habitat inside the YNP was determined to constitute a significant portion of the range for the bison herd (bold emphasis added):

> According to Gates et al. (2005), most bison in the YNP herd are confined within Yellowstone National Park for all or most of the year. Rut takes place within YNP from around mid-July to mid-August (Meagher, 1973) in one of three rutting areas—the largest rutting aggregation is in the Hayden Valley, the second largest in the eastern Lamar Valley, and a small aggregation occurs in small high elevation grasslands on the Mirror Plateau and Cache/Calfee Ridge (Gates et al. 2005). Most bison remain in YNP during winter, especially in the

> geothermally-influenced central portion of the Park. Calves are born in April–May on the winter range (Meagher 1973). **For these reasons we have determined that there is substantial information that Yellowstone National Park may constitute a significant portion of the range for the potential YNP bison herd DPS**.

In addition, the Gardiner Basin just outside the north end of the park was determined to constitute a significant portion of the YNP bison herd (bold emphasis added):

> The proportion of Yellowstone bison that move to winter ranges outside YNP varies from 3 to 30 percent per year, depending on conditions (YNP, 2007). Bison move beyond Park boundaries in late winter in response to forage limitation caused by interactions between population density, variable forage production, snow conditions, and grazing competition (Gates et al. 2005). The Gardiner Basin has been considered important winter range for bison since at least the 1940s and is an important component of the Northern winter range; in contrast, the West Yellowstone area does not have unique ecological value as winter range according to Gates et al. (2005). **For these reasons we believe there is substantial information that the Gardiner Basin provides resiliency to the herd during harsh winters, and, therefore, may constitute a significant portion of the range for the potential YNP bison herd DPS.**

However, the findings disagreed with several positions stated in the petition. While being free of domestic cattle introgression was held to be evidence that the Yellowstone herd differed markedly from other populations of the species in its genetic characteristics, the conclusion stated by Meagher that the Yellowstone bison were mountain or wood bison was held to be incorrect. The finding stated (bold emphasis added):

> The petition alleges that the YNP bison herd may be a unique hybrid of the wood and plains bison. No citations are provided, but this conclusion was stated in Meagher (1973, pp. 14–16), who considered the ‘‘mountain’’ bison a separate species. **This controversy has since been resolved, and YNP staff now considers the remnant population, as well as the introduced bison, as being of plains bison origin** (Boyd 2003, pp. 182–183; Wallen 2006).

Delaney P. Boyd, University of Calgary’s Faculty of Environmental Design Environmental Science, did her dissertation on the conservation status survey on North American bison for the World Conservation Union/Species Survival Commission’s (IUCN/BSG) Bison Specialist Group (BSG). Rick Wallen is leader of the park's bison ecology and management team.

In sum, the 90-day finding made this determination regarding discreteness and significance of the Yellowstone bison herd (bold emphasis added):

> **On the basis of the preceding discussion, we believe that there is substantial information to conclude that the YNP bison herd may be discrete and significant within the meaning of our DPS Policy, and therefore may constitute a DPS**.

Despite the findings that the Yellowstone herd is both distinct and significant and that the Gardiner Basin constituted a significant portion of its range, the FWS concluded that because the herd was considered by the FWS as sufficiently abundant and managed with "clear conservation objectives," listing was not warranted (bold emphasis added):

> The bison in Yellowstone National Park are considered to be plains bison (Bison bison bison). As mentioned previously, Boyd (2003, p. 38) estimated the plains bison population in North America at 500,000, and identified 50 herds (containing approximately 19,200 head) currently being managed with clear conservation objectives. **Given the abundance and management status of the subspecies, we have concluded that the petition has not presented substantial information indicating that its listing under the Act may be warranted**.

In particular, the finding reasoned that since the herd is abundant, control actions (including lethal control) of Yellowstone bison both inside and outside the park does not harm its "quasi-migratory" ranging behavior. The finding stated (bold emphasis added):

> The petitioner's assertion that hazing and killing of bison outside the Park will affect the "quasi-migratory" behavior of the herd, and will result in a restriction of the range is not supported by information available in our files. Bison in YNP attempt to compensate for declining per capita food resources by range expansion (Gates et al. 2005, p. 131). In other words, bison move out of the Park in the winter in search of food, and this pattern has continued since implementation of the Joint Bison Management Plan (discussed in greater detail under Factor D) in 2000 (Clarke et al. 2005, p. 29). **Therefore, the available information indicates that control actions have not affected the ''quasi-migratory'' ranging behavior of the YNP herd**.

That is, according to the finding, regardless of whether the wild bison were able to access habitat such as Gardiner Basin, deemed to provide "resiliency to the herd during harsh winters, and, therefore, may constitute a significant portion of the range for the potential YNP bison herd DPS," since members of the bison herd keep migrating, their migratory behavior must not have been harmed by the lethal removal of numerous individuals, and that because the bison population continues to grow, bison are not harmed by the practice of lethal control of migrating individuals, namely, those that attempt to cross park borders into Montana. In this instance, the finding addresses the issue of abundance in connection with the Yellowstone bison, stating (bold emphasis added):

> With regard to YNP bison population abundance, the team found that the abundance of bison has grown steadily since the implementation of the Joint Bison Management Plan . . . The population reached almost 4,900 head in the summer of 2005, and now numbers around 4,500. Winter weather conditions have been mild to average during the first 5 years, and the population has not dropped below 2,300 bison. The late winter population has been above the population target and management decision threshold of 3,000 head in 4 of the 5 years of implementation (Clarke et al. 2005, p. 28). Management-related mortality has resulted in greater than 200 bison removed during 3 of the 5 winters, but the population continues to expand … [p. 20 col. 3]
>
> Population data for the YNP bison herd indicate that, since the winterkill and lethal brucellosis control actions in Montana during 1996-97, **the YNP bison herd has continued to grow despite culling for population and brucellosis control, and currently numbers approximately 4,500 animals. We therefore conclude that the petition does not present substantial information indicating that listing the Yellowstone bison herd within YNP may be warranted.** [p. 22 col. 2]

Part of the reasoning behind the denial of listing status is the claim that the Yellowstone bison are being managed well, establishing a lethal-control population threshold of between 2,100 and 3,800. The 90-day listing stated (bold emphasis added):

> As part of the Joint Bison Management Plan, variable numbers of bison may be removed from the herd to maintain optimal population size and for brucellosis control. In addition, the Joint Bison Management Plan establishes that when the population drops to 2,300 bison, measures to protect bison will be increased. Management mortality would cease if the herd drops to 2,100 head. The herd may stabilize at about 3,500 to 3,800 head, but could fluctuate over time based on the severity of winter weather (USDI and USDA 2000, pp. 51-52)…
>
> This size range was identified by YNP staff as sufficient to protect the long-term status of the herd. The latest conservation genetics information indicates that a population in this range should be able to sustain the current level of genetic diversity indefinitely without the need for introducing immigrants from other populations (Wallen 2006).

Further, the finding states that the migratory behavior of the Yellowstone bison is not significant.

In assessing "Evidence of the persistence of the discrete population segment in an ecological setting that is unique or unusual for the taxon," the finding concluded that the migration of the Yellowstone herd was not unusual. It said (bold emphasis added):

> The petitioner asserts that the YNP is significant because of its "quasi-migratory behavior." Gates et al. (2005, p. 160) concludes that YNP is a forage-limited system, and that, "Bison move beyond park boundaries in winter in response to forage limitation caused by interactions between population density, variable forage production (driven by spring/early summer precipitation), snow conditions, and herbage removal primarily by bison and elk." Winter movement of large herbivores, such as bison and elk, in search of forage is normal behavior. **The fact that bison and elk range outside the Park is not unusual. Based on this information, we would not consider the YNP bison herd movements to winter range outside the Park boundary as a unique behavior within the meaning of our DPS Policy**.

The finding argued that since it is not unusual for herbivores to migrate, the migratory movements of the Yellowstone herd are not significant.

Discussion of the August 17, 2007 finding

The finding stated that:

> The petitioner implies that existing regulatory mechanisms are inadequate to ensure protection of the YNP bison herd because some animals are killed outside the Park. We are assuming that, based on the information in our files, the petitioner is referring to lethal control of bison in conjunction with Montana's brucellosis control program.

Petitioner's criticism: The implication is not that the regulatory mechanisms are merely inadequate to ensure protection of the YNP bison herd, but rather, that *the regulatory mechanisms are a cause of the herd's inadequate protection*. The finding states that:

> Management-related mortality has resulted in greater than 200 bison removed during 3 of the 5 winters, but the population continues to expand (Clarke et al. 2005, p. 28). Based on this information we concur with the Status Review Team that the Joint Bison Management Plan is working with regard to successful management of the YNP bison herd.

The issue is not merely herd expansion, but rather the genetic viability of the herd that may or may not be expanding. Lots of bison that have lost the instinct to migrate will not ensure survival of the Yellowstone bison in the event of an unusually severe winter. For bison to exhibit migratory behavior, they must be allowed to be free-ranging. By subjecting free-ranging behavior to lethal control by killing migrating bison, the free-ranging instinct is being selected out.

Recall that the 2007 finding stated in defense of its position that IBMP's bison culling program was not harming the genetic diversity of the Yellowstone herd:

> The latest conservation genetics information indicates that a population in this range should be able to sustain the current level of genetic diversity indefinitely without the need for introducing immigrants from other populations (Wallen 2006).

The 2007 finding also stated, under "evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics," the following in regard to my original petition:

> The petition alleges that the YNP bison herd may be a unique hybrid of the wood and plains bison. No citations are provided, but this conclusion was stated in Meagher (1973, pp. 14-16), who considered the "mountain" bison a separate species. This controversy has since been resolved, and YNP staff now considers the remnant population, as well as the introduced bison, as being of plains bison origin (Boyd 2003, pp. 182-183; Wallen 2006).

I was curious how these statements were supported by research, so I looked for citations at the end of the 2007 finding. There were none listed. Instead was this note under "References":

> A complete list of all references cited herein is available on request from the Region 6 Endangered Species Program, U.S. Fish and Wildlife Service (see ADDRESSES section).
>
> Author: The primary author of this document is Chuck Davis, Region 6 Endangered Species Program, U.S. Fish and Wildlife Service (see ADDRESSES section).

I emailed the FWS and received this reply:

Dear Mr. Horsley,

In response to your question on the 2007 90-day finding on Yellowstone National Park Bison, I found the attached documents in our files. I believe these are the references you were looking for.
Thank you for your interest.

Sarah Fierce
Listing Biologist
U.S. Fish and Wildlife Service
134 Union Blvd., Lakewood, CO 80228

The reference "Wallen 2006" is a memorandum by Rick Wallen to Chuck Davis, with a copy to Glenn Plumb, dated 07/19/2006. This memo apparently was in reference to my petition and provided citational support to refute my claims regarding the status of Mountain bison in the park and the genetics of the herd. The memorandum will be quoted in full. It stated:

> Thank you for the update regarding the petition to list Yellowstone bison.
>
> Our winter 2005/2006 flights to estimate population abundance occurred in January and February of 2006. We conducted two flights and made population estimates based on sightability models using a habitat based correction model for each of the two flights separately and a replicate correction model using data from both flights. The replicate model tends to estimate population abundance better than the habitat model. The replicate model estimate was 3546. Attached is the project report provided to park management.

The report below followed:

> We are conducting our summer count flights at this time and will finish in two weeks. I should be able to provide an estimate shortly after we finish the third flight. If you need a number earlier I can provide an estimate based on one count in just a few days. We will need a few days to compile our notes from today's flight.
>
> As per my quick review of the finding, I compiled the following thoughts . . .
>
> On the bottom of page 4 and top of page 5 you talk about hybridization of plains and wood bison at Yellowstone. This is incorrect. The Meagher book referred to "Mountain" bison as a separate species from plains bison but this debate was resolved some time ago and we consider both the remnant population of bison as well as the introduced bison as being of plains bison

origin. I refer you to a thesis by Delany Boyd on the conservation status of bison.

Boyd, D. 2003. Conservation of North American bison: status and recommendations. MS Thesis, Univ. of Calgary. 220pp.

On page 13 you identify that the current management establishes a population range between 1700 and 3000 bison. While the FEIS identifies 3000 as the target or populations objective, the final decision as noted in the ROD [*Record of Decision*] identifies that when the population drops to 2300 bison, measures to protect bison will be increased and management mortality will cease at a population estimate of 2100. You capture this concept quite well later in the finding. The EIS analysis estimated that the population may stabilize at about 3500 to 3800 bison but would definitely fluctuate in abundance over time based on the severity of weather. At this population level our management plan accepts that there would be some persistent culling to manage the risk of brucellosis transmission at the management zones articulated near the National Park boundary. The latest conservation genetics information suggests that a population of this size should be able to sustain the current level of genetic diversity indefinitely without the need for immigrants from other populations. I believe Fred Allendorf and Gordon Luikart at the University of Montana have a very recent Conservation Genetics text to use for citation if necessary. The National Park Service also has an internal report that specifically addresses conservation of genetics in bison populations and determined that the 96% of the current level of genetic diversity could be maintained when populations of greater than 1000 bison are protected. Dr. Luikart argues that even dips in population abundance below this number would not be detrimental unless the abundance stayed at low levels for several generations of individuals in the populations.

Your discussion of factor C on page 14 should note that reproductive capability for this population is approximately 17% as was exhibited by growth rates when bison were restored to vacant ranges within the park at the turn of the last century and in the 1930's. Population growth rates from 1990 to 2000 were more like 5% and since the IBMP has been in place growth rate of the population is about 8%. I would not consider the growth rate of the population as exponential as referenced by Dr. Tom Roffe. The management culling of bison that has occurred over the last 20 years has certainly dampened the potential rate of growth from 17% to the current calculated rates of 5 to 8%. Cite the Gates report and one new thesis from a graduate student at Montana State University. I can also send you a spreadsheet evaluation I did for park management last winter that looks at IBMP period growth rates.

Fuller, J 2006. Population demography of the Yellowstone National Park herds. MS Thesis, Montana State University, Bozeman. 85pp.

Julie successfully defended her thesis in April.

The 1077 to 3000 objective is used again on page 17. I would refer to our management program of conserving a population of greater than 2100 bison and reference one of the two primary goals of the IBMP is to "conserve a population" of Yellowstone bison.

Rick Wallen
Wildlife Biologist
Bison Ecology and Management Program
Yellowstone National Park

The writer of the 2007 finding, Chuck Davis, endangered species litigation coordinator for the Fish and Wildlife Service at YNP, chose not to cite the two recommended sources regarding genetic diversity, namely the text *Conservation and the Genetics of Populations* by Fred Allendorf and Gordon Luikart, University of Montana, nor an untitled National Park Service's internal report. Instead, he cited Wallen's 2006 memo itself.

Because Glenn Plumb was copied with the Wallen 2006 memo, the "internal report" most likely was a study generated by G.E Plumb, referenced above (see "Plumb study"). As I have argued above, the study did not support the contention by the FWS that the genetics of the wild herd of bison in Yellowstone were being protected by the actions of the IBMP.

Nor does Allendorf and Luikart's text appear to support the claim by Wallen in his 2006 memo that the "latest conservation genetics information suggests that a population of this size should be able to sustain the current level of genetic diversity indefinitely without the need for immigrants from other populations" or that "even dips in population abundance below this number would not be detrimental unless the abundance stayed at low levels for several generations of individuals in the populations."

The resulting 2007 finding discounts the effect on populations of selecting out only migratory animals. Discounting the effects of selection does not reflect what is actually going on in the park by the removal actions of the IBMP. It is undeniable that, indeed, animals are being selected for removal by the IBMP that have certain genetic traits. These actions have an effect similar to genetic drift, as referenced previously. Genetic drift does not result from the effects of natural selection, but instead from a random event that obliterates a certain segment of a population, thereby eliminating a pool of genes that would otherwise have existed.

Allendorf gave as an example the intense natural selection on cliff swallows during a harsh winter storm, whereby larger birds were much more likely to survive the storm than smaller birds. Adult progeny in the next generation were much larger than the mean of the population before the storm event. Bison have also experienced a similar "storm," that is, the massive slaughter of the population at the hands of the European buffalo hunters. Such a sudden reduction of the population is called a bottleneck.

With these genes gone, according to Allendorf, the “loss in genetic variation caused by a population bottleneck may cause a reduction in a population’s ability to respond by natural selection to future environmental changes,” especially if the populations are too small. As Allendorf pointed out, small populations are more likely to go extinct due to environmental change because they are less able to adapt than are large populations. This is particularly true regarding disease:

> The effect of small population size on allelic diversity is especially important at loci associated with disease resistance. Small populations are vulnerable to extinction by epidemics, and loci associated with disease resistance often have an exceptionally large number of alleles (Allendorf, 2007).

The genetic effects of the actions of the IBMP, however, are even more damaging than the effects of genetic drift, for its actions are not random, nor natural selection, but instead artificial selection. Effective population size in maintaining genetic diversity has little meaning when it comes to the constant weeding out of various traits in a population at the hands of artificial selection. Allendorf cited as an example what has happened to the size of horns in bighorn sheep in response to trophy hunting (Allendorf, 2007). According to David W. Coltman, the author Allendorf cited, a 30-year study of a wild bighorn sheep population—in which trophy hunting targeted rams with rapidly growing horns—resulted in the production of smaller-horned, lighter rams, and fewer trophies. Horn length was found to be highly heritable (Coltman, 2003). The trait of migration is also thought to be heritable.

Apparently the author of the 2007 finding, Chuck Davis, never read the text recommended by Wallen, or if he did, discounted relevant studies.

And genetics is not the only factor. Reservoirs of learned behavior—involving a limited, select number of bison—are being removed. Management actions involving lethal control eliminates those bison that have learned from the past—including their parents and older females—the way to winter forage during severe winters. Removing these bison removes those who serve as leaders out of the park, destroying learned behavior favoring survival. Older female bison are often the leaders. When you kill the teacher, you end up with an uneducated class. Commenting on one instance of lethal control by government agents, Meagher noted: “This removal probably included many of the older experienced females, commonly the leaders . . .” (Meagher, 1989).

The 2007 finding, however, disagrees that lethal control is harming migratory movement. In the finding, recall the FWS reasoned that since bison have continued to move out of the park in search of food in the winter following the implementation of the Joint Bison Management Plan, it concluded that lethal control by the government has not affected their migratory behavior nor restricted their range. Let us look at this issue more closely.

Recall that the finding regarding the Yellowstone herd noted:

> All other bison in the United States are reconstituted herds and are confined with fencing, or otherwise range restricted.

Recall that in the finding the FWS stated:

> The petitioner's assertion that hazing and killing of bison outside the Park will affect the "quasi-migratory" behavior of the herd, and will result in a restriction of the range is not supported by information available in our files.

Why has this killing of migratory bison somehow not resulted in a restriction of their range? This magical conclusion relies on three factors:

1. redefinition of the term “free-ranging,”

2. reasoning that culling large segments of wild bison does not restrict their range because, well, so far bison keep heading toward the park borders in an attempt to expand their range, and

3. winking at contradictory statements made by the FWS in its 2007 finding, namely:

    - The Gardiner Basin has been considered important winter range for bison since at least the 1940s and is an important component of the Northern winter range.

    - For these reasons we believe there is substantial information that the Gardiner Basin provides resiliency to the herd during harsh winters, and, therefore, may constitute a significant portion of the range for the potential YNP bison herd DPS.

    - The petitioner's assertion that hazing and killing of bison outside the Park will affect the "quasi-migratory" behavior of the herd, and will result in a restriction of the range is not supported by information available in our files.

Finding: bison are free-ranging, not range-restricted and other myths

Let us look at the FWS’s attempt to redefine “free-ranging.” In the finding, the FWS stated:

> One of the primary goals of the Joint Bison Management Plan is to provide for a “free-ranging bison herd” (USDI and USDA 2000, p. 6).

The FWS defines the Yellowstone as being unique from other herds because other herds "are confined with fencing, or otherwise range restricted." In the face of these statements, the FWS concludes:

> Bison in YNP attempt to compensate for declining per capita food resources by range expansion (Gates et al. 2005, p. 131). In other words, bison move out of the Park in the winter in search of food, and this pattern has continued since implementation of the Joint Bison Management Plan . . . in 2000 . . . Therefore, the available information indicates that control actions have not affected the "quasi-migratory" ranging behavior of the YNP herd.

In other words, as long as bison in the YNP can move toward the border, they are migratory and thus free-ranging. While the Yellowstone bison cannot range outside the park without exposing themselves to lethal control, they are still termed "quasi-migratory" with regard to behavior because some do attempt to cross the park boundaries. The FWS has, in effect, defined "quasi-migratory" and "free-ranging" as having practical meaning only in relationship to the intent to migrate as indicated by behavior and not having significance in relationship to actually carrying out that behavior, that is, to actually *be* free-ranging or to actually migrate.

Apparently, the FWS can claim the Yellowstone herd is not "range-restricted" nor is its range behavior restricted, because it can migrate up to the park boundary. Not being able to go beyond the border somehow is not a factor with regard to "free-ranging" or its "quasi-migratory" behavior. In sum, as long as the genes of some members impel them up to the border, they are still deemed migratory. Since the result of crossing that border, lethal control, has not resulted *to date* in destroying that instinct, the FWS concluded that the Yellowstone bison can be considered free-ranging and their migratory behavior uncompromised.

That, of course, is absurd. In human terms, if this line of reasoning were applied to a prison, a prisoner would be termed free if he merely intended to leave the prison. That he got shot when he tried to step through the gate would somehow, um, not mean he had been restricted, according to FWS lingo. However, natural selection does not operate on intent. If a mouse intends to run down a hole to escape a hawk, but it does not do so and gets eaten, that intent will not propagate its line nor will its genes be inherited.

What has actually been demonstrated is that *despite* the management actions carried out by the IBMP, some bison still possess the genetically-controlled behavior to migrate, as well as the learned behavior to do so.

Conversely, to prove that management actions were harmful to the herd's migratory behavior, apparently the only acceptable evidence to the FWS might be something like this:

> 1. after shooting or slaughtering a portion of the migrating bison, a significantly reduced number of bison attempted to migrate the following year and were destroyed,
>
> 2. that despite severe winter conditions, those remaining in the park, unable to exercise their migratory instinct because they now had no such survival instinct or learned behavior, stayed within the park and died due to starvation,
>
> 3. thus resulting in the collapse of the entire herd due to management actions, which artificially selected out via lethal control those with the ability to migrate, leaving only non-migratory bison in Yellowstone National Park, where they expired.

If the way out of the park is not known, if the genetics for that urge have been erased, or if the leadership has been lost, the scenario for a collapse of an entire herd is possible. In addition to deaths inside YNP in the past due to severe winter conditions, such die-offs have occurred elsewhere. J. Dewey Soper in *History, range, and home life of the northern bison*, wrote about such an event in Canada in the early 1800s:

> Excessive snowfall with mid-winter thaw, sleet, and freezing again at severe sub-zero temperatures, is unquestionably the gravest danger. Vague reports were heard of such an occurrence many years ago, alleged to have been disastrous to bison. It seems to be well established, however, that such calamities are exceedingly rare. In the above respect, one of the most suggestive bits of evidence is contained in Preble's report (1908:145-46). Two men on their way to the Yukon in 1871 made a portage from Peace River to Hay River, evidently in the vicinity of Watt Mountain. Here they saw "thousands of buffalo skulls" along the portage route and trails two to three feet deep. Later, making an inquiry regarding this self-evident disaster, they were informed that, about 50 years before, snow fell to an estimated depth of 14 feet and so enveloped the animals that they perished by thousands.
>
> Dawson (1881:54B) writing of the Peace River country about 1880, remarked that “The Indians state that the extinction of the buffalo was not entirely due to the introduction of firearms and the active hunting carried on for the supply of the Hudson Bay forts, but that all remaining were killed many years ago by an excessively severe winter when the snow was over the buffaloes’ backs” (Soper, 1941, pp. 347-412).

If the entire herd does not collapse within the park, what is increasingly more likely to happen is the extinction of their wild traits, which is their defining characteristic. This is being caused now by means of artificial selection via the lethal removal actions of the IBMP that favor bison with more domestic traits, as documented in the Discussion.

The illogic continues. Try to follow this line of reasoning. It goes like this (and these are direct quotes from the 2007 finding): Of course, even though the "Gardiner Basin has been considered important winter range for bison since at least the 1940s," and even though it "is an important component of the Northern winter range" and even though it "provides resiliency to the herd during harsh winters, and, therefore, may constitute a significant portion of the range for the potential YNP bison herd DPS," the "petitioner's assertion that hazing and killing of bison outside the Park will affect the 'quasi-migratory' behavior of the herd, and will result in a restriction of the range is not supported by information available in our files."

Maddening.

Wild bison, one way or another, either physically as an entire herd, or genetically or behaviorally, by the continued exclusion from its range via lethal removal will become extinct under the management of the IBMP.

But the FWS does not see this. Apparently, for the FWS, only extinction of this bison DPS would prove that its listing should have been implemented to prevent extinction.

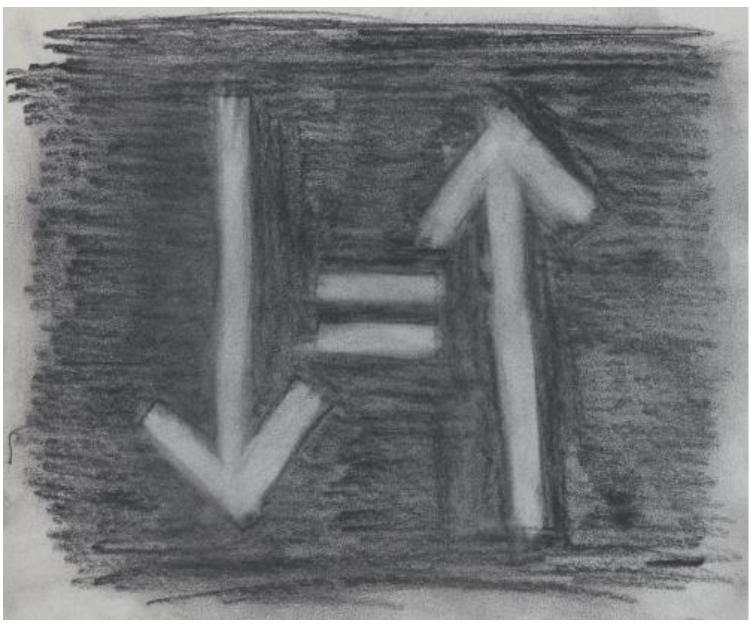

Figure 93. UP EQUALS DOWN THINKING is characteristic of the type of logic that pervades much of the reasoning dominating the Fish and Wildlife Service's findings regarding listing of wild bison as endangered, as well as related studies used to support those decisions. Possibly the above figure could be the new logo for the FWS. Maybe the NPS, too.

Finding: migrating herbivores migrate

The FWS found that not only did the governmental lethal control actions have no effect on the "quasi-migratory" ranging behavior of the YNP herd, but the finding concluded that the “quasi-migratory behavior” of Yellowstone’s bison is not significant. Recall that according to the finding:

> Winter movement of large herbivores, such as bison and elk, in search of forage is normal behavior. The fact that bison and elk range outside the Park is not unusual. Based on this information, we would not consider the YNP bison herd movements to winter range outside the Park boundary as a unique behavior within the meaning of our DPS Policy.

This finding is in error because it is simply a tautology, namely, it is saying that there is nothing unusual about migratory animals migrating. However, the zoography of the Yellowstone bison is unique, especially in relationship to its distinctive migration routes. The Greater Yellowstone Ecosystem has served as a refugium (a location of an isolated or relict population of a once widespread species) for bison, its isolation protecting it from unfavorable and extensive change, namely predators, such as wolves and grizzly bears, as well as the invasion of man into that system, whereby man functioned as an overwhelming predator. The isolation of the higher altitudes and the dense forests helped protect the subspecies during the summer months, and the isolation and the lower snow pack of the geothermal habitat, as well as extra-YNP habitat, at lower levels provided protection during the winter months.

The forested areas surrounding the meadows of the plateau regions, for instance, provided protection from predators, as bison under physical attack could run into the dense cluster of trees and "dislodge any of his attackers that have secured a hold by rubbing or crushing them against the trees" (Fuller, 1960). However, when the limits of tolerance for bison due to climatic conditions was exceeded, to survive harsh winters many bison were forced to lower altitudes where the climate was less severe and forage more available. According to Robert A. Garrott, department of ecology, Montana State University and a member of the Fish & Wildlife management program, in *The Ecology of Large Mammals in Central Yellowstone*:

> The odds of predation on bison increased many orders of magnitude with increasing accumulations and duration of snow pack, presumably weakening bison such that they were less able to defend themselves or calves. While we did observe bison being killed in deep snow, observations of wolves attacking bison in late winter typically occurred in low snow meadow complexes and defense sometimes lasted several hours, as wolves continually attempted to isolate and injure vulnerable individuals. An animal in a weakened state is likely much less able to sustain such defense in the face of an attack. Snow

> pack is also highly influential in driving broad-scale movements of bison, such as winter migrations into the Madison headwaters area and movements among drainages (chapter 12 and 28 by Bruggeman et al., this volume) (Garrott, 2009, p. 327).

The geothermal habitat of the Madison headwaters area is comprised of low-snow areas and provides forage, such as sedges, because of the reduced snow cover, facilitating grazing.

As stated, part of the behavior that contributes to the Yellowstone bison's survival is its migratory response to the ecosystem, namely, persisting in the secluded niches of the higher altitudes, then descending to lower, more exposed areas, for forage so as to maintain strength necessary to ward off predators. If the Yellowstone herd is *bison bison*, that behavior is exceptionally unique, for it enabled 25 bison to survive out of millions that remained on the plains. While plains bison migrate, the vast majority migrated over a level habitat from region to region, instead of from one elevation to another, and were thus easily slaughtered by market hunters. Not only was the Yellowstone herd's survival aided by the unusually rugged mountain region, but in addition the creation of the park by legislative fiat helped protect them from extermination.

To sum this up, when park areas experience greater bison density and when winters become more severe, bison often migrate into areas outside the park, such as the northern egress of the Yellowstone River. This migratory instinct has helped the Yellowstone bison survive forage limitations imposed by winter conditions, as well as predators such as wolves.

What is historically unique about Yellowstone bison is their altitudinal migratory habits, as opposed to the more common migration over level land that typified the plains bison. Most likely this is because they are the descendants of mountain bison that were noted for that behavior by early park observers.

(Ironically, what is presently most unusual about these ungulates is that they are the only ones in the park that drop dead as a result of attempting to migrate out of the park, and for that unique migratory behavior alone, the park's bison should be protected.)

Meaning of species and subspecies

Despite finding the herd distinct and significant, the FWS concluded that the "subspecies" was not in danger of becoming extinct due to two factors, 1. its abundance and 2. its management.

But what is meant by "subspecies" and for that matter, "species?" The first hurdle in determining a DPS relies on determining its discreteness, and discreteness is in relation to its taxon, that is, in this case in relation to its rank as a species or subspecies. Since listing a possible DPS depends on the "discreteness of the population segment in relation to the remainder of the taxon," it is important that we understand what is indeed meant by the words "species" and "subspecies."

Within the 90-day finding, there are several usages that appear to be in operation regarding those terms.

The definition of these terms used in the finding is elucidated by the context in which each term is found. Usage of a word and context controls meaning. The meaning of the Yellowstone herd as a species has profound implications. If the herd is viewed as a member of a species or subspecies that is unique to Yellowstone National Park, that would make it discrete, but if the herd is viewed merely as belonging to the 50 conservation herds spread throughout the nation, it would not be discrete and thus would not qualify as a distinct population segment. Here are the usages and their associated context as found in FWS' 90-day 2007 finding (for convenience sake, a table has been used):

Table 10. Usage of the word "subspecies" or "species" in a sentence and in context in the 90-day 2007 finding by FWS

	Sentence with word "subspecies" or "species"	**Associated sentence or phrase explaining the word "species"**
First usage	"Mr. Horsley requested that the Service list the herd as a **subspecies** or 'distinct population group,' and to designate critical habitat in and adjacent to YNP."	"…as a subspecies or 'distinct population group,'"
Second usage	"Two **subspecies** of bison are currently recognized in North America–the plains bison (Bison bison bison) and the wood bison (Bison bison athabascae)"	"The bison (also referred to as the American buffalo) is a member of the family Bovidae, which includes domestic cattle. …the plains bison (Bison bison bison) and the wood bison (Bison bison athabascae)"
Third usage (Conclusion)	"Given the abundance and management status of the **subspecies**, we have concluded that the petition has not	"The bison in Yellowstone National Park are considered to be plains bison (Bison bison bison). As mentioned

	presented substantial information indicating that its listing under the Act may be warranted.”	previously, Boyd (2003, p. 38) estimated the plains bison population in North America at 500,000, and identified 50 herds (containing approximately 19,200 head) currently being managed with clear conservation objectives.”
Fourth usage	“Under section 3(15) of the Act, we may consider for listing any species, **subspecies**, or, for vertebrates, any DPS of these taxa.”	“The petitioner asked us to list the YNP bison herd as a ‘distinct population group.’ We assume that the petitioner meant a Distinct Vertebrate Population Segment (DPS) for purposes of listing under the Act.”
Fifth usage	A portion of a species’ range (in this case, ‘‘**species**’’ refers to the potential YNP bison herd DPS)…	…refers to the potential YNP bison herd DPS)…
Sixth usage	This information will help us monitor and encourage the conservation of the **species**.	In summary, we have determined that the petition has not presented substantial information indicating that the potential YNP bison herd DPS may warrant listing as threatened or endangered throughout all or any significant portion of its range.

Meaning [of species and subspecies] by context:

- the **first usage** suggests that “subspecies” means a distinct population group,

- the **second usage** suggests that "subspecies" means either plains bison or wood bison,
- the **third usage**, the findings conclusion, suggests that "subspecies" in this instance means herds of Bison bison bison that are managed with "clear conservation objectives," namely the 50 conservation herds containing 19,200 head,

- the **fourth usage** suggests that "subspecies" means something distinct from species and means a distinct population group,

- The **fifth usage** states that "species" means the YNP bison herd DPS, and

- The **sixth usage** suggests that "species" means the YNP bison herd DPS. Elsewhere, the YNP bison herd is identified as numbering "approximately 4,500 animals."

What can we conclude? In regard to the meaning of "species" and "subspecies" as used in the 90-day finding, the nomenclature is unclear. While a portion of the finding argues on behalf of a subspecies being defined as a distinct population group that is part of Yellowstone National Park, numbering about 4,500, and which is uniquely wild, being unfenced, in other sentences it implies by association that the subspecies is Bison bison bison, plains bison, and not Bison bison athabascae, wood bison, of which there are 500,000, and which include the so-called *wild* subspecies, consisting of 50 herds managed with "conservation objectives," containing about 19,200 head.

We are thus left with a confused message. Recall that in one portion of the finding it says this:

> The bison in Yellowstone National Park are considered to be plains bison (*Bison bison bison*). As mentioned previously, Boyd (2003, p. 38) estimated the plains bison population in North America at 500,000, and identified 50 herds (containing approximately 19,200 head) currently being managed with clear conservation objectives. Given the abundance and management status of the subspecies, we have concluded that the petition has not presented substantial information indicating that its listing under the Act may be warranted.

Abundance in the above paragraph is in reference to its abundance as Bison bison bison and the 19,200 head being managed with "clear conservation objectives." One wording implies that despite geographic separation, the Yellowstone herd is essentially part of one great population and is not markedly separate from other conservation herds. Because it is deemed part of that large population, and because those herds are managed with conservation objectives, it does not merit listing. On the other hand, the other usage states that while the herd is markedly separate, it is of sufficient abundance (4,500 head) to make listing as endangered unwarranted.

So, which is the correct view in this context? Recall that the FWS's 90-day 2007 finding explicitly states that the YNP herd is distinct, that is, discrete and separate (bold emphasis added):

> The petitioner asserts that the YNP bison ''herd is the only wild, unfenced buffalo herd in the nation,'' but no specific citations are provided to support this conclusion. Information in our files supports the conclusion that the YNP bison population is the only herd in the United States that has remained in a wild state since prehistoric times (Gates et al. 2005, p. 93). All other bison in the United States are reconstituted herds and are confined with fencing, or otherwise range restricted. Individuals from the Jackson bison herd in Grand Teton National Park and the National Elk Refuge have been known to migrate north into YNP, but this is a rare occurrence (Gates et al. 2005, p. 109). **Therefore, we find that the YNP bison herd may be discrete from other members of the taxon *Bison bison* because of physical distance and barriers.**

Further, abundance in the latter portion of the document is related to the YNP herd, not the larger element of the conservation herds:

> On the basis of our review of the petition and other information readily available in our files, we have concluded that the petition does not present substantial information that the Yellowstone bison herd may be threatened or endangered in either of the potentially significant portions of the range as outlined in the two previous paragraphs. Management of the Yellowstone bison herd is guided by a Joint Bison Management Plan for the YNP bison herd (USDI and USDA 2000). Management of bison within the Park is the responsibility of the National Park Service. Culling of bison in interior YNP for population and brucellosis management stopped in 1968 (Gates et al. 2005). Population data for the YNP bison herd indicate that, since the winterkill and lethal brucellosis control actions in Montana during 1996–97, the YNP bison herd has continued to grow despite culling for population and brucellosis control, and currently numbers approximately 4,500 animals.

Here abundance appears to refer to the size of the YNP herd and not to the size of the 50 conservation herds, of which the YNP herd is a member. The range of the YNP bison herd is the environs of Yellowstone National Park and is not contiguous with the general collection of the ranges of conservation herds. Therefore, the

Yellowstone herd is not merely a component of the 50 herds, but is distinct in and of itself.

A number of years have passed since that decision. Which of these two broad taxonomic alternatives is now being employed by the FWS regarding the wild bison herd of Yellowstone National Park? We find the answer in a more recent 90-day finding by the FWS.

2009 90-day finding

In 2009 the FWS received a petition from Biologist James A. Bailey and his wife Natalie A. Bailey requesting that the wild plains bison be listed as threatened or that each of its four major ecotypes be considered DPSs and listed as threatened. The petitioners specified four ecotypes (population segments) of wild plains bison: the northern Great Plains, the southern Great Plains, the Rocky Mountains, and the Great Basin-Colorado Plateau. A 90-day finding concluded that the petition did not provide substantial information to conclude that each of the four population segments may be discrete.

The finding included the wild bison of the Yellowstone National Park, which were labeled as not being any more wild than any other bison in conservation herds. This reversal from its previous determination in 2007 was achieved by re-defining the term “wild” to simply mean any bison from herds not being used for commercial purposes, reasoning that all bison today are a mixture of genes. Further, from their usage by the FWS, the terms “wild” and “natural occurrence” have only genetic meaning.

Specifically, the finding stated:

> However, we note that the wild plains bison is a generalist with regard to its habitat requirements, as evidenced by its broad historical range, and none of the ecological settings of the four population segments is unique or unusual. Each of the population segments contains multiple herds managed under different Federal, State, municipal, or private regimes, and the complete loss of any population segment is very unlikely. No population segment represents the only surviving natural occurrence of the taxon. Lastly, due to multiple, diverse origins and subsequent translocations, no population segment is genetically, behaviorally, or ecologically unique.

As noted, this finding of 2009 contradicts the finding of 2007. The 2009 FWS finding states:

> We recognize that this conclusion differs to some extent from an earlier decision. In a previous negative 90-day finding published on August 15, 2007 (72 FR 45717), we determined that the Yellowstone plains bison herd may meet the criteria of discreteness and significance as defined by our policy on DPS. However, this finding and the previous 90-day finding differ in scope.

> The August 15, 2007, finding only addressed plains bison in the Yellowstone herd. The current finding addresses wild plains bison in all conservation herds.
>
> The 2007 finding concluded that the Yellowstone herd may be discrete from other plains bison, because it was considered the only herd that has "remained in a wild state since prehistoric times" and because of physical distance and barriers. The best available information now indicates that the basis for our 2007 DPS determination was erroneous. We still use the term "wild plains bison" to describe the Yellowstone herd because they are managed as a conservation herd, rather than as a commercial herd. However, we no longer consider the Yellowstone herd to have remained in more of a "wild" state than any other conservation herd.

And how has the herd not remained in more of a "wild" state than any other conservation herd? Because the 2009 finding claims they have not remained "unaltered." The 2009 finding explains (bold emphasis added):

> Specifically, these wild plains bison are no longer thought to have remained in an unaltered condition from prehistoric times, as implied in the previous determination. In 1902, no more than 30 wild plains bison remained in Yellowstone (Halbert 2003, p. 24). In the same year, 18 female plains bison from the captive Pablo-Allard herd in Montana and 3 bulls from the captive Goodnight herd in Texas were purchased to supplement the Yellowstone herd (Halbert 2003, pp. 24-25). Additionally, intensive management (supplemental feeding, roundups, and selective culling) of the Yellowstone herd occurred from the 1920s through the late 1960s (Gogan et al. 2005, p. 1719). Wild plains bison from Yellowstone also have been used to start or augment many later conservation herds (Halbert and Derr 2007, p. 2). **Despite geographic separation, the Yellowstone herd is essentially part of one metapopulation and is not markedly separate from other herds.**

Like scrambled eggs, the FWS has whipped together the YNP herd with other conservation herds, saying in effect that the YNP herd is just part of a species omelet called a "metapopulation." Further, it has reduced the meaning of the term "wild" to mean any animal that is not for commercial use, namely, as the 2009 finding states: "We still use the term 'wild plains bison' to describe the Yellowstone herd because they are managed as a conservation herd, rather than as a commercial herd."

When one considers that the term "wildlife" is part of the agency's name, maybe the Fish and Wildlife Service should be renamed to more accurately define its new perspective. How about Fish and Non-Commercial Life Service?

In point of fact, the term wild has been eroded by the FWS. It is now defined in terms of economic and genetic status only. Wildness in this new world of the FWS is a factor determined by human management practices, and since no herd has remained in “an unaltered condition from prehistoric times, as implied in the previous determination,” no bison herd is more wild than another other herd.

The distortion of the actual position of both the 1999 petition and the 2007 determination is a “straw man” tactic, representing a logical fallacy. To visualize this fallacy, imagine a fight in which one of the combatants sets up a man of straw, attacks it, then proclaims victory. All the while, the real opponent stands by untouched. This ploy is commonly used in political debates and is committed when a person ignores an opponent’s actual position and substitutes a distorted, exaggerated or misrepresented version of that position, then refutes it. An illusion of refutation is created by attacking the “straw man,” that is, the misrepresented or distorted position of the argument, while never actually refuting the opponent’s original position.

The straw man attack in this case is the phrase “these wild plains bison are no longer thought to have remained in an unaltered condition from prehistoric times, as implied in the previous determination.”

As used in the FWS’s 2009 finding, the term being challenged, namely, “unaltered,” refers to the breeding status of bison only. The 2009 finding stated that the 2007 finding “implied” that the herd had remained genetically unaltered. The 2009 finding then refuted that implication, noting that herds had been genetically mixed throughout history, including post-settlement history through translocations and other government management practices.

If either the 1999 petition or the 2007 finding implied that the Yellowstone bison were wild because they had been unaltered, the concept of “unaltered” was broader than merely a genetic interpretation limited to breeding between bison herds. As stated in my 1999 petition (bold emphasis added):

> The Yellowstone herd is the only wild, unfenced buffalo herd in the nation…
>
> These herds, protected by the mountains and by the Yellowstone National Park status as a national park, escaped the slaughter of the mid to late 1800s. A few score survived, creating in part a genetic pool responsible for the thousands of buffalo that now populate the United States.
>
> Some scientists believe that because the herd inhabited mountainous regions that it consisted of Mountain Buffalo, often also called Wood Buffalo. **It is this remnant herd that helped save the buffalo from extinction**.
>
> The herd grew from a few score to about 3,000 in 1966. Part of its growth stems from the introduction of Plains Buffalo into the Yellowstone National Park. The Mountain or Wood Buffalo as a pure species is now extinct in the United States. **However, a hybrid or cross between the Mountain Buffalo and the Plains Buffalo may exist at Yellowstone, thus being the only such herd in the nation.** Over 1,000 animals of this unique group were shot or slaughtered by the Montana Department of Livestock as the animals crossed the border of the Park in 1997 to escape the severe winter.

The 2007 FWS determination said this under the heading of “Biology and distribution” (bold emphasis added):

> Numerous Federal, State, and private bison herds currently exist in the United States, **but YNP is the only area in the United States where bison have existed in the wild state since prehistoric times** (Gates et al. 2005, p. 92). Boyd (2003, p. 38) estimated the plains bison population in North America at 500,000, and identified 50 herds (containing approximately 19,200 head) currently being managed with clear conservation objectives.

And under the heading of “Information provided in the petition on discreteness,” recall the passage where the FWS said this (bold emphasis added):

> The petitioner asserts that the YNP bison ‘‘herd is the only wild, unfenced buffalo herd in the nation,’’ but no specific citations are provided to support this conclusion. Information in our files support the conclusion that the YNP bison population is the only herd in the United States that has remained in a wild state since prehistoric times (Gates et al. 2005, p. 93). **All other bison in the United States are reconstituted herds and are confined with fencing, or otherwise range restricted**. Individuals from the Jackson bison herd in Grand Teton National Park and the National Elk Refuge have been known to migrate north into YNP, but this is a rare occurrence (Gates et al. 2005, p. 109). Therefore, we find that the YNP bison herd may be discrete from other members of the taxon Bison bison because of physical distance and barriers.
>
> The position in the 2007 determination was that the “YNP is the only area in the United States where bison have existed in the wild state since prehistoric times (Gates et al. 2005, p. 92).”

The Gates et al. citation is from *The ecology of bison movements and distribution in and beyond Yellowstone National Park,* Chapter 4, “History of bison management in Yellowstone National Park: Yellowstone bison in prehistory.” The relevant passage stated:

> Yellowstone National Park is the only place in the lower 48 States where bison have existed in a wild state since prehistoric times. Bison occupied the region encompassing the park from shortly after recession of the last glaciers 10,000 to 12,000 years ago, until the 19th century when they came close to extirpation (Gates et al. 2005, p. 92.)

Apparently such unaltered ecological conditions as “unfenced,” not being “reconstituted,” not being “confined with fencing, or otherwise range restricted” and being “the only area in the United States where bison have existed in the wild state since prehistoric times” do you qualify for the designation “unaltered.” The mere and unproven possibility that Yellowstone wild bison genes may have cross-bred with other bison of the same species from another location is interpreted by the FWS as meaning the wild bison in the park have not remained in an unaltered condition from prehistoric times and therefore are not a distinct population segment.

And ironically, while my 1999 petition specifically mentioned that the YNP herd may be a hybrid between plains bison and wood or mountain bison, and while altered, unique and distinct, this was disregarded in the 2009 determination.

The conclusion in the 2009 determination that "we no longer consider the Yellowstone herd to have remained in more of a 'wild' state than any other conservation herd" is fallaciously supported by refuting a position that has been misrepresented, saying that "these wild plains bison are no longer thought to have remained in an unaltered condition from prehistoric times, as implied in the previous determination." The 2009 finding tamed the wild Yellowstone bison by recounting a history of the possibility of the original park inhabitants interbreeding, citing genetic evidence only, reducing wildness to a factor of genes only, instead of including environment, behavior (such as migratory behavior) and the historical record.

The 1999 petition and the 2007 determination did not imply that the herd's genetic purity has been unaltered since prehistoric times, but instead that the bison's continuous and in that respect unaltered relationship with the land in Yellowstone National Park has retained its wild ecology by not being extirpated or fenced.

To add insult to injury, the 2009 determination ignores a finding of the 2007 determination concerning one area demonstrating an instance of unaltered genetics, so the 2009 finding is selective in where it sees examples of the significance of altered and unaltered conditions regarding wildness. The 2007 determination by the FWS stated that:

> Additional information in our files compiled after this petition was submitted indicates that the YNP bison herd is one of three Federal herds that do not display genetic introgression with cattle. Maintenance of genetic diversity is an important long-term goal for management of species populations. Halbert (2003, p. 94), concluded her study by stating: "In conclusion, this study has assessed levels of domestic cattle introgression in 10 federal bison populations and identified at least 2 populations, Wind Cave and YNP, which at this time do not have any evidence of domestic cattle introgression and also have high levels of unique genetic variation in relation to other federal populations. As such, these populations should be given conservation priority * * *" Thus, we conclude that the YNP bison herd satisfies this genetic criterion of significance under the DPS Policy.

But the 2009 finding now implies that genetic purity and this unaltered genetic condition do not mean much, after all. It states (bold emphasis added):

> The presence of cattle DNA in the genetic makeup of wild plains bison appears widespread, but occurs at low levels. Conservation herds are managed according to their genetic background, so as to maintain genetic diversity and introgression-free herds. We expect the frequency of cattle DNA to remain low in conservation herds. Wild plains bison from introgressed herds conform morphologically, behaviorally, and ecologically to the scientific taxonomic description of the native subspecies. Some wild plains bison herds with evidence of cattle introgression also contain valuable genetic diversity that is not found elsewhere and should be conserved. **We do not believe that there is substantial information indicating that listing may be warranted due to introgression with cattle genes**.

This is a complete and historically tragic abrogation of the original position by the FWS that found value in a bison population such as the YNP herd that was free of cattle genetics. The 2009 determination concluded:

> In summary, the petition does not present substantial information that wild plains bison may require listing either as a subspecies or a DPS. The conclusion that impacts from the various factors discussed above may constitute a threat is not supported by the available information regarding distribution, abundance, and population trends of wild plains bison. Wild plains bison are distributed in parks, preserves, other public lands, and private lands throughout and external to their historical range. The current population of wild plains bison is estimated to be 20,500 animals in 62 conservation herds. Recent population trends appear stable to slightly increasing in conservation herds (as noted by the petitioners).

With the magic of government speak, wild bison have just been increased by a magnitude of five and are everywhere in "metapopulations." The only problem with this position is that it is not true. The only wild, unfenced bison herd without cattle genes in the United States is in Yellowstone National Park.

Metapopulations are defined as a set of local populations within some larger area, where typically migration from one local population to some other habitat is possible (Definitions and synonyms of terms used in metapopulations studies, 2011). But where are the migrations between the habitats of the various conservation herds? These "migrations" are achieved by shipping bison by truck and other "translocations" by government agencies. This is "wild"? And when migration is attempted by natural means, i.e., buffalo crossing the border of Yellowstone National Park into the Gardiner Basin, they are shot or captured for slaughter by government agents positioned there.

According to government speak, bison that are fenced are still wild, bison that have cattle genes are still wild and bison carted around by truck from pasture to pasture are still wild. Under these governmental parameters, a mule trucked from zoo to zoo would be wild.

31

Mountain bison

Concurrent with the extermination of millions of bison across the United States during the late 1800s, as has been discussed, the bison herds found in and around Yellowstone National Park dwindled to about 200 animals due to killing those outside the park (Hornaday, 1887). Poaching further reduced the herd to a count of 25 in 1902 (Meagher, 1973).

"Again—considering habits, behavior, and census difficulties—the population probably was higher; perhaps 40-50 mountain bison survived," noted Margaret Mary Meagher, research biologist with the National Park Service, a leading authority on Yellowstone bison. In *The bison of Yellowstone National Park*, she wrote in 1973 the following historical account:

> The bison of Yellowstone National Park are unique among bison herds in the United States, being descendants, in part, of the only continuously wild herd in this country. They are today a hybrid herd, being a mixture of the plains bison (*Bison bison bison* Linnaeus), introduced into Yellowstone National park in1902, and mountain or wood bison (*Bison bison athabascae* Rhoads), which originally inhabited the Yellowstone and surrounding country. They are a wild population, unrestricted by either internal or boundary fences, and subject to minimal interference by man.
>
> Although members of a species which nearly became extinct, and a species of great historical interest, Yellowstone's bison have not been objects of extensive research . . .
>
> Yellowstone National Park was established in 1872, before the surrounding area became the states of Idaho, Montana, and Wyoming . . . Most of the land adjacent to the boundary is administered by the U.S. Forest Service.

Haines (1963) summarizes the history of man's occupation of the Yellowstone Plateau. Prehistoric hunters and gatherers used the area extensively. Members of several tribes of modern Indians were primarily summer hunters, although a few sheep-eaters lived a marginal existence throughout the year . . .

During the early years of the park, wildlife had little protection … Legal means for enforcing regulations were lacking, although the Army troops stationed in the park after 1886 did what they could. Attempts at protection had limited effect until passage of the Lacey Act in 1894 provided legal machinery and jurisdictional authority for dealing with violators. Outside the park, ineffective laws contributed to poaching within the boundaries.

Not until 1901 did the Superintendent of the park believe the laws of all three surrounding states were such that the wild bison left in Yellowstone might be effectively protected, but their numbers were so few that survival seemed doubtful. Intensive management of an introduced herd began in 1902 to ensure survival of some bison in Yellowstone …

The present (1970) bison population is completely wild and unfettered by fencing or artificial management (Meagher, 1973 pp. 1-12).

Morphological evidence suggests that the present wild herd are descendants of the wood or mountain bison species. Meagher writes:

The genus *Bison* probably invaded North America during the later part of the early Pleistocene. The bison occupying the continent in historic times were descendants of a second migration of Bison from Eurasia, which crossed the Bering Straits at the start of the late Pleistocene according to Skinner and Kaisen (1947). Of the invading species, only one persisted to give rise to *B. occidentalis*, the ancestor of B. bison, the modern form. Two subspecies, *B. b. bison* and *B. b. athabascae*, are recognized by cranial evidence, although historical accounts suggest there may have been others (Roe 1951). The form athabascae is apparently the more primitive of the two subspecies (Skinner and Kaisen 1947).

Just when bison first reached the Yellowstone plateau is not known, but modern bison inhabited the area before historic times, perhaps before the most recent period of intermountain glaciation . . . In 1964 a fossil cranium (B. b. athabascae) was found embedded in a natural oil seep on the Mirror Plateau in the park.

The Yellowstone bison of historic times were a remnant of a once much more extensive bison population, known to trappers and Indians, which inhabited the mountain ranges and the intermountain valleys of the Rockies and extended on west into Washington and Oregon. Most of these bison were gone by the 1840s (Aubrey Haines 1968 pers. comm.). According to the distribution map of Skinner and Kaisen (1947), these were mountain bison . . .

The existence of mountain bison, different in appearance and behavior from the plains type and gone from much of their range by the 1840s, has generally been little known. Christman (1971) reviews historical evidence for the subspecies, their distribution to the west of the plains type, and reasons for their early disappearance. He believes the Indians' acquisition of the horse was the factor underlying the extermination of mountain bison from extensive areas of original range, particularly in Washington, Oregon, and Idaho.

Figure 94. MOUNTAIN BISON. Cows and calves photographed in a remote part of Hayden Valley sometime before 1894. These bison were frequently called mountain bison by early observers. Photo by John Folsom, a winter keeper at Canyon (Meagher, 1973, p. 15).

Figure 95. SKULLS OF BISON BISON ATHABASCAE (left) and B. b. bison from the Mirror Plateau, Yellowstone National Park. *Photo by David Love, U.S. Geological Survey* (p.17).

Many early references to Yellowstone bison use the term "wood" or more commonly "mountain" bison or buffalo; some of the characteristics of the race were recognized by a number of early travelers and observers. Historical accounts generally agree that, compared with the plains bison, these mountain animals were more hardy, fleet and wary, and had darker, finer, curlier hair. Sex and age differences among animals seen may account for discrepancies in description of size. The geologist Arnold Hague (1893) provides the following:

> The Park buffalo may all be classed under the head of mountain buffalo and even in this elevated region they live for the greater part of the year in the timber . . . most unusual, save in midwinter, to find them in open valley or on the treeless mountain slope. They haunt the most inaccessible and out-of-the-way places, … living in open glades and pastures, the oases of the dense forest, …[their behavior characterized by] the rapidity of their disappearance on being alarmed. It is surprising how few buffalo have been seen in midsummer, even by those most familiar with their haunts and habits. They wander about in small bands . . .

Blackmore (1872) was informed that the mountain buffalo congregated usually in bands of 5-30, rarely more. Other observers agree that the bands were small, and the animals quite wary. Superintendent Norris described them as "most keen of scent and difficult of approach of all mountain animals" (Superintendent of the Yellowstone National Park 1880).

Altitudinal migrations were another characteristic of mountain bison (Christman 1971). Historical accounts from Yellowstone also suggest this habit. Superintendent Norris, in his annual report of 1880, describes summer and winter distributions of bison in the park, stating clearly:

> …summer in the valleys of the Crevice. Hellroaring, and Slough Creeks, and the mountain spurs between them, descending with the increasing snows, to winter…East Fork [Lamar]…and as the snows melt…returning to their old haunts.

The historical accounts of dates and locations of bison (Appendix II) collectively also show a repetitive pattern of seasonal bison distribution which reflects altitudinal movements.

Historical accounts recognizing a mountain buffalo are supported by limited cranial evidence. Skinner and Kaisen (1947) show an overlap in general distribution between mountain and plains bison along the east slopes of the Rockies, including Yellowstone, but state that ranges for historic times must be based on early accounts plus occasional bones or crania. Seven skulls from the Yellowstone's original wild herd were picked up on the ground along the Gardner River and at Mammoth in 1902. All had weathered surfaces. These were considered as most likely representing *athabascae*. The 1964 skull

(Fig. [95]) found on the Mirror plateau was identified by Skinner (1965) as "an exceptionally long horned, apparently young Mountain bison = B. (B.)b. athabascae…" No Yellowstone skulls which predate the 1902 introduction have been identified as plains type. (Meagher, 1973, pp. 13-17).

A record of numerous sightings of mountain or wood bison is provided in Appendix II of *The bison of Yellowstone National Park*, "A Summary of bison reports prior to 1905, Yellowstone National Park and vicinity." The table is reproduced below in part (bold emphasis added) (Meagher, 1973).

Table 11. A summary of bison reports prior to 1905, YNP and vicinity

Source	Date	Report
DeLacy (1867)	7 Sept. 1863	Eastern side of Shoshone Lake "through scrubby pines, without underbrush. There were many game trails made by the **wood buffalo**, whose tracks appeared numerous and fresh.
Blackmore (1872)	1872	Lamar. "B.H. informs me that this valley is a favorite resort of the **mountain buffalo or bison**.
Dunraven (1876)	1874	General locale of Yellowstone National Park. "On the little prairies, open glades, and sparsely wooded slopes, grazes the small **mountain bison or buffalo**, whose race has also nearly vanished from the scene; . . ."
Grinnell (1876)	1875	"The so-called **'Mountain Buffalo'** was abundant in the Yellowstone Park."
Supt. Annual Report (1877)	1875	Refers to the triangle of land with the East Fork (Lamar) as the base, extending south 50 miles to the head of Yellowstone Lake (Mirror Plateau, Pelican) "Here is still a herd of three or four hundred of the curly, nearly black bison or **mountain buffalo**."
Holmes (1878)	1878	Twin Buttes (Firehole area) "there are some upland parks in which there are buffalo signs (the **Mountain Bison**)."

Supt. Annual Report (1880)	1880	"Bison or **Mountain Buffalo**" "Bison, so called, in the Park, are somewhat smaller, of lighter color, less curly, and with horns smaller and less spread than those of the bison that formerly inhabited the great parks of Colorado.
Livingston Enterprise (1885)	Winter 1884-85 March 7	"the herd of bison or **mountain buffalo** that has long inhabited the Yellowstone Mountain slopes and valleys was seen to number two or three hundred in the Park this winter."
Hague (1893)	(1893)	"That buffalo were among the animals inhabiting the Yellowstone Park was known in the early days of its history; . . . The Park buffalo may be classed under the head of **mountain buffalo**, and even in this elevated region they live for the greater part of the year in the timber, . . . their habits are quite different from . . . the buffalo of the plain . . .
Supt. Annual Report (1895)	1895	"So long as the only herd of **wild bison** now existing in the United States is on the border of this State, . . . inquiry into various rumors of the killing of bison . . . convince me that this last remaining herd is in danger of extinction by these people . . . estimate . . . two hundred still remain."
Supt. Annual Report	1902	During the past winter . . . 22 of these animals on the head of Pelican Creek, and there are probably a few more that we were unable to find. **This herd is exceedingly wild**, and will probably never increase in size, and may possibly die out completely.

The reports were based on generally held understandings of what comprised mountain or wood bison, including outward appearance, range and behavior. Historically, sightings of wood or mountain bison often focused on a "triangle of land with the East Fork (Lamar) as the base, extending south 50 miles to the head of the Yellowstone Lake (Mirror Plateau, Pelican) (Meagher, 1973 p. 118). This is a region that encompasses the Mirror Plateau, Specimen Ridge, Lamar River and Pelican Creek.

Bison herd divisions in YNP

Historically, three bison herd have been recorded as existing in the park. One of the most extensive descriptions of bison in the park is in the park superintendent's annual report of 1880 (Meagher, 1973, p. 118):

> "Bison or Mountain Buffalo" "Bison, so called, in the park, are somewhat smaller, of lighter color, less curly, and with horns smaller and less spreading than those of the bison that formerly inhabited the great parks of Colorado. They have also smaller shoulder humps, and larger, darker brisket wattles. They differ materially from the buffalo of the Great Plains, being more hardy, fleet, and intelligent; their hides are also more valuable for robes, as they are darker, finer, and more curly; and these animals are, in all probability, a cross between the two varieties just mentioned.
>
> "There are about three distinct or separate herds of bison within or adjacent to the Park.
>
> [north edge of park]
>
> "The first, numbering about two hundred, pasture in summer in the valleys of the Crevice, Hellroaring, and Slough Creeks, and the mountain spurs between them, descending, with the increasing snows, to winter in the deep, sheltered grassy valleys of the East Fork [Lamar] of the Yellowstone and Soda Butte, and as the snows melt, accompanied by their young, returning to their old haunts.
>
> [Mirror Plateau and Upper Lamar]
>
> "The second, numbering over one hundred, summer in the elevated and abruptly broken, little-known section of the Park, extending from the Hoodoo region to the Grand Canyon, and from Amethyst Mountain to Pelican Creek, near the foot of the Yellowstone Lake, and winter occasionally upon the East Fork [Lamar] of the Yellowstone and on Pelican Creek. Their other winter haunts are unknown.
>
> [west side of park]
>
> "The third herd, numbering about three hundred, roams in scattering bands. This season they were discovered upon the Madison Plateau and Little Madison River. Their winter haunts are unknown, though it is probable they are on the pacific side of the Continental Divide, and, if so, they are not permanent occupants of the Park, and are therefore likely to be slaughtered by advancing settlers.
>
> "most keen of scent and difficult of approach of all mountain animals."

Separate herd of wood or mountain bison?

In a review of the taxonomy of the wood bison Valeries Geist, Professor Emeritus of Environmental Science, Faculty of Environmental Design, University of Calgary, questioned whether wood bison were of genetic origin or an ecotype, that is, a subdivision of an ecospecies consisting of a population that is adapted to a particular set of environmental conditions. He wrote:

> As determined by the careful and critical Roe (1970:43-57), there is little doubt that in historic times bison existed in at least two forms, a dark, large, shy, non-migratory wood bison in the north, and a smaller, lighter, aggressive, migratory plains bison in the south. There may have also been populations of mountain bison (Meagher, 1973), possibly analogous to the small mountain wisent *(B. bonasus caucasicus)* of Europe (Heptner *et al.*, 1961), as well as some regional differences that native people recognized (Seton, 1929:709). Roe (1970) was not concerned if these differences were taxonomically relevant, that is, of *genetic* origin, or if they were ecotypic, that is, a product of environmental circumstances; he was concerned if the differences reported had some foundation in reality. He concluded they had (Geist, 1991).

University of Alberta Biologists G.A. Wilson and C. Strobeck, in a study on the *Genetic variation within and relatedness among wood and plains bison populations*, held that the genetic differences between the bison in Yellowstone National Park and plains bison were not large enough to establish separation from plains bison. The researchers noted that:

> It has been proposed that the bison indigenous to Yellowstone National Park were actually a type of bison called mountain bison, referred to as Bison bison athabascae (Meagher 1973). Again, this taxonomic issue is in doubt (for review, see Roe 1970). Plains bison were also added to the indigenous herd at Yellowstone, which diluted the amount of local input to the gene pool to about 40% (Meagher 1973). If mountain bison did exist in this park, the current population should be genetically distinct from other bison populations which do not contain any mountain bison input in their gene pool, or more similar to wood bison as mountain bison and wood bison share the same subspecific designation…
>
> If mountain bison existed and made a significant contribution to the gene pool of the bison at Yellowstone National Park, we would expect this population to be on a branch by itself or amongst the wood bison populations, as both mountain bison and wood bison were considered *Bison bison athabascae*. The genetic distances between the Yellowstone bison and the other populations would also be expected to be larger.

However, that difference was not established by the study. Instead, the study speculated that the Yellowstone bison were plains bison that inhabited the park region when they fled from hunters:

> As neither of these are supported by our results, the bison indigenous to Yellowstone were probably not mountain bison, but rather plains bison driven to the area by hunters (Wilson, 1999).

However, the study relies on data that was assumed to be from randomly collected samples and thereby cannot be analyzed for differences to sub-populations within the park. In the study, the researchers stated that 33 tissue samples were from YNP bison and "were obtained from the DNA repository maintained by the Canadian Parks Service at the University of Alberta. As bison groups are quite fluid, and associations between individuals random, it can be assumed that these are random samples from the populations."

Based on the genetic analysis of various herds and subherds, the assumption that associations between individual bison are random is not valid, for some herd populations have higher incidence of a genetic disease than others within the same contiguous geographical area. For instance, the several herds in the YNP have different levels of mitochondrial disease (See discussion below: Pringle, 2011). If "bison groups are quite fluid, and associations between individuals random," the level of genetic disease would be evenly distributed among the various herds. It is not.

Historical accounts and the archeological record refute the conjecture that plains bison were driven by hunters into the mountains of the Yellowstone area and instead indicate that bison have inhabited the park region going back at least 8,000 years.

"The notion that bison are not native to the area now known as Yellowstone National Park, though still apparently a popular opinion, has no basis in historical record," wrote Yellowstone National Park historians Paul Schullery and Lee Whittlesey in *Greater Yellowstone Bison Distribution and Abundance in the Early Historical Period*. Schullery currently serves as an adjunct professor of American Studies at the University of Wyoming and as an affiliate professor of history at Montana State University. Whittlesey is a park archivist at YNP.

The authors summarized accounts that include formal government survey reports, published and unpublished journals of explorers, trappers, prospectors, military parties and tourists, early published and unpublished maps, anthropological literature, popular journalism such as books and periodical articles about the Greater Yellowstone Ecosystem, and contemporary newspaper articles, as well as the archeological record.

"Contrary to still-popular belief, bison and other large herbivores were not 'driven into higher country' by settlement, but inhabited those higher regions as environmental conditions permitted prior to the arrival of Euro-Americans," they noted, explaining:

> Prehistoric bison distribution in the GYE can perhaps best be summarized simply by saying that bison appear to have been living everywhere in Greater Yellowstone where habitats were suitable…
>
> In the first few decades of the nineteenth century, various writers reported vast herds of bison on the prairies along the edges of the Greater Yellowstone Ecosystem, including the Yellowstone, Wind, and Snake River drainages. Smaller numbers of animals were reported here and there throughout the ecosystem, most often in the internal valleys…
>
> Archeological work, most of it within the past 20 years, has identified bison remains at park sites near Gardiner, Montana; in the Hellroaring drainage; near Tower Junction; in Lamar Valley; and on the Yellowstone Lake shore. These finds indicate bison presence in the park area for 8,000 years (Johnson 1997). Likewise, a recent survey of Greater Yellowstone archeological research has identified bison remains in 29 archeological and three paleontological sites (Cannon 2001).

Two recognized bison species

The Integrated Taxonomic Information System (ITIS), a reference database of scientific and common names for species, recognizes *Bison bison athabasacae* Rhoads, 1898 as a valid subspecies. However, the ITIS provides the following comment:

> According to Wilson & Ruff, eds. (1999), "Recent evidence that environmental influences may explain pelage differences between plains and wood bison, and comparisons of mitochondrial DNA, suggest that subspecific distinction may not be justified. This reassessment has important conservation implications because the presumed subspecies athabascae is listed as endangered." They also suggest that "Although most authorities still favor Bison, several recent reviews have advocated placing American bison in the genus Bos." Still, they retain Bison as a valid genus, and list the two subspecies (*Bison bison athabascae* and *Bison bison bison*)

However, Geist contends that assigning subspecies based on genetic analysis is often flawed, involving fundamental difficulties and ambiguous results. He posited that taxonomic differences may not involve *evolved* differences, but rather differences due to adaptation. Further, he noted that a reduction in genetic diversity can be attributed in part to the fact that bison herds were established from only a few remaining animals after the extirpation numbering in the millions. He noted:

> Concurrent with conventional means of defining wood and plains bison taxonomically, attempts were made to analyze genetic differences among bison populations. The results were ambiguous. Peden and Kraay (1979) found that plains bison populations differed in blood-typing reagents and carbonic anhydrase alleles as much as did the NR bison from plains bison in EINP, even though different herds of plains bison originated from the same limited stock at the turn of the century. One cannot assign individual bison to a given subspecies using unique genetic markers on chromosomes (Ying and Peden, 1977) or in blood proteins (Peden and Kraay, 1979), mitochondrial DNA (Cronin, 1986) or nuclear DNA (Bork *et al.*, 1991).
>
> Moreover, there are fundamental difficulties with the genetic analysis when applied to current bison herds: any differences discovered are assumed to represent *evolved* differences, possibly related to differences in *adaptation.* Unfortunately, divergences in allelic frequencies between today's salvaged bison populations are expected for reasons other than adaptation or random mutation. These include differences based on the *founder effect* (reduction of the genetic diversity due to taking of a small sample of bison to found new herds), *genetic drift* (random fixation of alleles in small populations), the *maternal effect* (bison captured from the same herd have a high probability of being related by maternal descent, and have thus reduced genetic diversity) and the *mule dominance effect* (disproportionate genetic contribution of the most dominant founder bull in tiny founding populations) (Geist, 1991).

However, genetic differences have been found between herds that make them distinct, as observed by researchers Natalie D. Halbert and James N. Derr, Department of Veterinary Pathobiology, Texas A&M University, writing in *Molecular Ecology* (2008) "Patterns of genetic variation in US federal bison herds:"

> Like many wide-ranging mammals, American bison (*Bison bison*) have experienced significant range contraction over the past two centuries and are maintained in artificially isolated populations. A basic understanding of the distribution of genetic variation among populations is necessary to facilitate long-term germplasm preservation and species conservation. The 11 herds maintained within the US federal system are a critically important source of germplasm for bison conservation, as they include many of the oldest herds in the USA and have served as a primary resource for the establishment of private and public herds worldwide. In this study, we used a panel of 51 nuclear markers to investigate patterns of neutral genetic variation among these herds. Most of these herds have maintained remarkably high levels of variation despite the severe bottleneck suffered in the late 1800s. However, differences were noted in the patterns of variation and levels of differentiation among herds, which were compared with historical records of establishment,

> supplementation, herd size, and culling practices. Although some lineages have been replicated across multiple herds within the US federal system, other lineages with high levels of genetic variation exist in isolated herds and should be considered targets for the establishment of satellite herds. From this and other studies, it is clear that the genetic variation represented in the US federal system is unevenly distributed among National Park Service and Fish and Wildlife Service herds, and that these resources must be carefully managed to ensure long-term species conservation.

For reasons that are hard to understand, despite the historical reality that mountain bison existed in Yellowstone National Park for thousands of years, including up to the present time, and despite the fact that bison herds in Yellowstone are found to be distinct and thereby could preserve that lineage, there appears to be little scientific interest in verifying that mountain bison still live in the park.

Eyewitness of mountain bison

Bob Jackson, a forest ranger with the Yellowstone National Park for 30 years, and now a buffalo rancher, believes a small group of mountain bison is still up on the Mirror Plateau and does not come down into Pelican Valley during the winter any further than Astringent Creek. Demonstrating classic bison behavior, the larger family unit fragmented itself into smaller groups to save itself, he claims. Further, by the lethal control of bison leaving the park, Jackson contends that this practice is breaking up bison family units, which disrupts the entire herd structure of YNP.

In an email dated April 3, 2011, I asked him if he had any information on a wood bison herd in Yellowstone National Park and if any of these animals fit the description of wood bison as given by the federal government. I gave him the following description:

> Wood bison is the largest native extant terrestrial mammal in North America (Reynolds et al. 2003, p. 1015). Average weight of mature males (age 8) is 910 kilograms (kg) (2,006 pounds (lb)) and the average weight of mature females (age 13) is 440 kg (970 lb) (Reynolds et al. 2003, p. 1015). They have a large triangular head, a thin beard and rudimentary throat mane, and a poorly demarcated cape (Boyd et al. 2010, p. 16). In addition, the highest point of their hump is forward of their front legs; they have reduced chaps on their front legs; and their horns usually extend above the hair on their head (Boyd et al. 2010, p. 16). These physical characteristics distinguish them from the plains bison (Reynolds et al. 2003, p. 1015; Boyd et al. 2010, p. 16).

I received the following answer from Jackson April 5, 2011. Apparently, the mountain bison may be separate from the wood bison and a species distinct to Yellowstone National Park. Historically, the bison in Yellowstone were described as a species that was smaller and more fearful than plains bison. Wood bison are described as being bigger than plains bison. Regarding the distinction between mountain and wood bison, Jackson made a humorous reference to the comedy film, "The Big Lebowski," involving confusion between characters with similar names: Jeff "The Dude" Lebowski, an unemployed Los Angeles slacker, and Jeffrey, the "Big" Lebowski, a wheelchair-bound millionaire:

> Dude (James),
> Your description of a "woods bison" may be so but, like man, we're talking of Mt. Bison here (to use the lingo of the Dude in the movie, The Big Lebowski).
>
> Yellowstone has something a lot rarer and distinctly unique than those dime a dozen up north Woods boys. It has the LAST of the Mt. Bison . . . and this last of the last herd is on the Mirror Plateau . . . well mostly. They never did mix with the Plains Bison brought in to Yellowstone. Yes, a few bodily fluids were shared but the culture of the Mt. bison was . . . and is . . . very much more in tune with its environment (except for their running fear of an influx of Homo sapiens). Thus, just like the core of Chinatown in San Francisco stays culturally unique, so does the Mt. Bison. They are in the last throes, though. The Park has pretty much opened the Mirror up to those environmentally incorrect outfitters . . . and the summer range (and its privacy very much needed during early calf rearing) . . . and those ten thousand year old cultured bison are desperate to find a place away from humans. They run to the East entrance Absoraka, then north, then south along its boundary, then back to the Mirror and Pelican Valley.
>
> Of course all this uniqueness means those transplants, the Plains bison, aren't eligible for endangered saint hood, are they? Or are they? I feel they have taken on some of the traits of the Mt. boys . . . enough so to wedge a foot in the door.
>
> Sooo, do you want to continue, dude? Go too far and you might be risking the welfare of those Plains type now leaving Yellowstone in the winter? An expendable throwaway? Or that is what you might be thinking, right? I say save both of them. Bob . . . aka Aj.

On April 8, 2001, I wrote Jackson, saying: "I lack a first-hand account. Your personal observations, whatever they might be, Bob, regarding the size and appearance of the mountain bison of YNP would be very helpful. If those on the Mirror Plateau don't look any different, well, that is OK, too. What is is what is." I received the following answer that same day:

James, The bison on the Mirror mirrors what the original Mt. Bison descriptions were. Smaller, agile and VERY scared of Humans. Their culture is most important since any animal will pick up traits needed for that area over time. The woods of North have to be larger because of the cold. The Mt. bison have to be agile and scared because they can be trapped in canyons and draws. The Mirror bison go into the woods for cover as compared to the plains bison. The above is what I observed to the "T".

I doubt you get any support from Park Biologists as for Mt. bison being in Yellowstone. If they don't discover it then it is a no . . . and as for Mary Meagher she . . . thinks of bison as densities of populations not families and extended families. Thus to her it is all "hard" science. There is no culture. "Scientists" go forever trying to determine subspecies, races etc. Thus with "woods" and plains it goes back and forth. Now the mood is to lump them together. As for Mt. bison those studying the herds of YNP don't have a clue. And as for bison management and brucellosis it is all symptom management.

The more the Interagency breaks up bison families the less the herds spread out into remote sections during the summer. Thus a lot of overgrazing in the Lamar Valley in the summer . . . and then animals having to go out of the park during the winter. Good luck on your thrust in declaring YNP bison unique. I think the uniqueness is in the culture. Any herd allowed to form up into families and thus learn from their ancestors is what Yellowstone needs . . . because they are so much more ecologically compatible. Today's YNP are dysfunctional but not far enough gone that they can't be salvaged in 12-15 yrs (3-4 generations without disruption). Bob

In a reply the afternoon of April 8, 2011, I quoted Meagher, who had stated that, "Over roughly 20 years, an apparent ecosystem change has occurred involving the bison of the interior of Yellowstone National Park." I said the following:

For some reason, this does not make a great deal of sense to me and I don't know why she is calling this the “domino effect.” I thought the “domino effect” would be, in this situation, one herd pushing another herd out, but she doesn't seem to be saying that. Or is she?

I read some report that said the Mirror bison are more stressed than the other park bison herds because of an observed weight loss in that herd, compared to other herds. Why should they be more stressed?

Question: why would the Interagency actions (I presume the slaughter of bison that cross the park border) have something to do with preventing the spreading out into the remote sections during the summer, overgrazing in the Lamar Valley in the summer and going out of the park during the winter? I simply don't get it.

I received this reply the evening of April 8, 2011:

James,
The core Pelican herd never goes below Astringent Creek. To go further means contact with humans . . . something Mt. Bison can't tolerate . . . especially during calving season. And this is why the Pelican herd is stressed. Outfitters now go up on the Mirror most every day all summer.

Thus the Mt. bison was ELIMINATED from the upper Lamar, not because of those Mt. Bison wanting to move West but rather summertime outfitting increased dramatically in this area. Thus Saddle Mt., the traditional calving area from the increase of the Mirror, was destroyed as "home."

The bison on the lower Pelican and lower Hayden were and are a cross of Mt. bison and Plains. The “pure” Mt. bison are still on upper Pelican and Mirror . . . just like the core of Chinatown in San Francisco is still Chinese.

Mary [Meagher] was very good at following populations as they moved around. She did a lot of flying to observe. She just didn't get the dynamics, let alone recognize extended families, thus her focus and conclusions were wrong.

And as for interagency actions causing less area for grazing, think of when you and your family move into a new neighborhood. You are more careful, lock the doors and in general feel more like holing up.

Or think of Native Americans and how they clumped together when attacks on them by other tribes made closing ranks necessary. Or think of castles, fortresses and the middle ages. Not very efficient but a necessity.

Bison families are the same. Confidence is an infrastructure phenomenon. There is no one leader. It is the same as the Indians with no one chief. The Steven's Creek trap busts up all the families. Just the fact they feed those bison makes families dysfunctional . . . no different than reservation agents giving food to all members of a tribe does the same for those human extended families. Roles are gone!!!

The end result is Yellowstone bison, those that go to the traps, end up very scared. Thus no Oregon Trail expeditions by them. Territories shrink and overgrazing winter grounds in the summer (one hardly saw a bison in Lamar valley in the '70's) is now the norm. And it will be no different until hunting of the bulls stops and outfitters are denied access to ALL bison calving areas (road side shows are what bison expect . . . not back of Hayden horse trips EVERYDAY).

The bulls are the scouts and the protectors. No hunting of them until functional families are again established. If any hunting is to happen outside Yellowstone it should be limited to wiping out entire families and then leaving the rest of the families intact . . . and infrastructure staying status quo.

THEY (herd biologists, scientists, game managers, hunting season statisticians . . . all dealing with herds, you name it), have it all wrong. It is all so dark ages. Bob

From this exchange of information, we learn that Yellowstone may contain a species called the Mountain Buffalo and that it may not be the same as the Wood bison. Or if it is the same, it may have adapted evolutionarily to the Yellowstone environment by expressing a different phenotype. If this is the case, it would be a profound finding.

Third species hides in Yellowstone?

Under the heading, "Information Provided in the Petition on Significance," in the 90-day finding regarding my (James Horsley's) petition to protect the wild Yellowstone bison herd was this discussion (a portion of which has been quoted above) by the FWS that concluded that the wild bison in the YNP were of "plains bison origin:"

> (4) Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics. The petition alleges that the YNP bison herd may be a unique hybrid of the wood and plains bison. No citations are provided, but this conclusion was stated in Meagher (1973, pp. 14–16), who considered the ''mountain'' bison a separate species. This controversy has since been resolved, and YNP staff now considers the remnant population, as well as the introduced bison, as being of plains bison origin (Boyd 2003, pp. 182–183; Wallen 2006).

Delany P. Boyd's 2003 masters thesis in environmental design from the University of Calgary titled "Conservation of North American bison: Status and recommendation" was cited as a reference to substantiate the FWS's claim. This document is a status assessment of plains and wood bison herds managed by municipal, state, provincial and federal governments, as well as several private herds, compiled by interviews with herd managers and a review of relevant literature. Pages 182-183 follow:

> **Yellowstone National Park, WY/MT Free-ranging**
> The Yellowstone National Park bison herd is the only population of plains bison in North America that has existed continuously in the wild (Coder 195; Ward 2000). During the early 1900s, the remnant herd was augmented with bison from the Goodnight and Allard herds (Wallen 2002, pers. comm.). The NP bison population is considered to be chronically infected with brucellosis (Chevette et al. 1998). Nevertheless, studies have determined that brucellosis is not a threat to the long-term survival of the YNP bison (Mayer and Meagher 1995; USDOI and USDA 2000), the population is currently at 4,000 and increasing (Wallen 2002, pers. comm.). Herd management is affected by the presence of brucellosis primarily because of the potential risk the disease poses to the livestock industry (Chapter 7). The current cooperative management plan incorporates several elements including spatial and temporal

separation of bison and cattle, capture, test, and slaughter of seropositive bison, hazing of bison back into the park, vaccination and radiotelemetry monitoring of pregnant bison (USDOI and USDA 2000). The ultimate purpose of the plan is to maintain a wild, free-ranging population of bison while protecting the economic viability of the livestock industry in Montana by addressing the risk of brucellosis transmission; it is not a brucellosis eradication plan (USDOI and USDA 2000). Bison in YNP are subject to predation by wolves (Smith et al. 2000; Laundre et al. 2001). This is one of five national park bison herds participating in a genetic management study led by Texas A&M University. Genetic testing to date has found no evidence of cattle DNA introgression in YNP bison (Ward 2000).

Apparently the only attempt to substantiate that the YNP herd contains no mountain or wood bison is the statement by Boyd that "The Yellowstone National Park bison herd is the only population of plains bison in North America that has existed continuously in the wild . . ." Boyd's unsubstantiated statement does not provide evidence of the claim "the remnant population, as well as the introduced bison, as being of plains bison origin." Plus, if it has continuously been wild in the park and is the only such population in North America, what proof is there that the genetics of the herd have been so diluted by the introduction of plains bison as to have changed the species? There is no such proof and there is no such study.

Recall Chuck Davis' statement in the 2007 finding, namely:

The petition alleges that the YNP bison herd may be a unique hybrid of the wood and plains bison. No citations are provided, but this conclusion was stated in Meagher (1973, pp. 14–16), who considered the ''mountain'' bison a separate species. **This controversy has since been resolved, and YNP staff now considers the remnant population, as well as the introduced bison, as being of plains bison origin** (Boyd 2003, pp. 182–183; Wallen 2006).

Recall the reference to "Wallen 2006" refers to the 07/19/2006 memo by Rick Wallen to the author of the 2007 finding, Chuck Davis, as provided by Sarah Fierce, FWS listing biologist, to me by email June 14, 2011:

As per my quick review of the finding, I compiled the following thoughts . . .
On the bottom of page 4 and top of page 5 you talk about hybridization of plains and wood bison at Yellowstone. This is incorrect. The Meagher book referred to "Mountain" bison as a separate species from plains bison but this debate was resolved some time ago and we consider both the remnant population of bison as well as the introduced bison as being of plains bison origin. I refer you to the thesis by Delaney Boyd on the Conservation status of

bison. Boyd, D. 2003 Conservation of North American bison: status and recommendations. MS Thesis, Univ. of Calgary, 220pp.

Stating that “this debate was resolved some time ago and we consider both the remnant population of bison as well as the introduced bison as being of plains bison origin” does not constitute a finding of fact. Nor does citing a survey study. Nor does the parroting of that statement by Davis provide a finding of fact. Apparently, the FWS staff believes that saying something establishes fact. This is merely an exercise in bureaucratic wishful thinking.

Such thinking about something as important as the composition of bison species in the park has the potential of driving the herds in Yellowstone into extinction, if, for no other reason, the government’s actions are based on ignorance. And apparently they want to remain ignorant, dismissing the possibility of the presence of mountain bison in the park with a cavalier waving of the hand saying, “this debate was resolved some time ago.”

Answer this: resolved how?

The issue of whether mountain bison exist in the park deserves to be investigated, instead of being swept under the rug. Politics often resorts to solutions of difficult questions by avoidance, but science should not.

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Comment on alternatives for revision of the IBMP

Following is a copy of a public comment I submitted June 15, 2015 to Yellowstone National Park on a proposed revision of the Interagency Bison Management Plan to be conducted by the National Park Service and the state of Montana, specifically the Department of Livestock and Fish, Wildlife and Parks. It serves as a review of the problem and an update.

Following submission of my public comment, a few lines have been edited out by lined-through because they were in error, resulting from a misunderstanding of hazing and hunting protocols of the IBMP. According to a "Memorandum on the Operating Procedures for the Interagency Bison Management Plan," December 19, 2014, "Hazing operations will be coordinated with the administration of the hunt. The NPS and MDOL will make efforts to integrate management of hazing actions with treaty and state-regulated hunting in Montana." The document also states "Furthermore, NPS rangers may at times ask the MDOL to cease helicopter hazing operations within Yellowstone National Park to allow bison to rest."

It appeared to the Petitioner from these passages that federal and state agents could haze bison into the range of hunters and use helicopters to do so, as long as they gave bison a little rest, but on seeking clarification of this issue from MFWP, the hazing statement refers to <u>not</u> hazing bison back into the park so as <u>not</u> to interfere with hunting opportunities during hunting season. Evidently, this misunderstanding was not limited to myself. A state of Montana and tribal treaty bison hunt meeting was held in Missoula, Montana on May 27, 2015. According to the IBMP's 2015 annual report, issues discussed included the perception of unethical hunting practices. Recommendations to alleviate these issues included "no hazing of bison toward the road to shoot."

My corrected and edited public comment follows:

From: James Horsley
Fargo, North Dakota 58103
jamesahorsley@gmail.com

Submitted by regular mail June 15, 2015
USPS Tracking # 9500 1111 1955 5166 5555 53

To: Superintendent
Yellowstone National Park
Yellowstone Bison Management Plan EIS
PO Box 168
Yellowstone National Park, WY 82190

Submission deadline June 15, 2015

The only effective disease-control alternative: Ban cattle from Yellowstone for a healthy ecosystem

On March 2, 2015, I submitted to the Secretary of the Interior a 329-page document titled "A petition to protect Yellowstone's wild bison from extinction." Its central purpose is to provide federal protection under the Endangered Species Act for Yellowstone National Park's wild bison, which are being decimated by a coalition of state and federal wildlife and livestock managers formed 15 years ago in 2000 called the Interagency Bison Management Plan (IBMP).

My 2015 petition was written in part because of an announcement by the National Park Service in 2014 that massive culling was to be initiated against Yellowstone's wild bison beginning in 2015 to prevent the threat of a bison "mass migration" into Montana. The NPS stated:

> Biologists from the National Park Service (NPS) have proposed removing 900 bison near the northern boundary this winter to reduce population growth and the potential for a mass migration of bison into Montana.
>
> According to the NPS, the so-called "mass migration" is a threat because:
>
> Yellowstone bison have been chronically exposed to the non-native disease brucellosis that can be transmitted to cattle and cause them to abort calves. As a result, bison are not allowed to move unimpeded into cattle-occupied areas in Montana (Frequently Asked Questions: Bison Management, 2014).

Although this same finding applies even more to elk, which are a greater vector of the disease, elk are allowed to migrate en masse out of the park and mingle with cattle. This indicates an inconsistent disease-control program and thus an ineffective one.

Next year, the IBMP member agencies plan to cull 900 more wild bison. This will amount to a 30 percent reduction of the herd in two years. Large scale culling has been identified as putting the wild bison herd at risk genetically by the NPS itself, yet this practice continues. Reason does not rule in the Greater Yellowstone Ecosystem. Special interests do.

On March 16, the National Park Service and the State of Montana (consisting of the Montana Department of Livestock and Montana Fish, Wildlife & Parks) announced that it was inviting public comments to help prepare an Environmental Impact Statement (EIS) for a new plan “to manage a wild and migratory population of Yellowstone-area bison, while minimizing the risk of brucellosis transmission between bison and livestock to the extent practicable.”

In addition to the request for comments, three topic questions are asked:

Question 1: What other alternatives, alternative elements, or management tools should be considered?

Question 2: What issues should be considered when evaluating future management of Yellowstone-area bison?

Question 3: What do you like and dislike about the preliminary alternatives?

Following is my comment and my answers to the three questions asked. They will show that for a healthy ecosystem the only effective disease-control alternative is to ban cattle from the Greater Yellowstone Ecosystem. Cattle originally introduced brucellosis to wildlife in the park, did not co-evolve with this ecosystem and are harmful to it because they are an invasive, non-wild species.

Further, it will be argued that to advance its objective to keep cattle in the ecosystem, misrepresentation is being used by the IBMP members. One of the deceptive ploys by the IBMP is to provide a chance for public comment only on its choice of alternatives. The alternative to ban cattle from the ecosystem has not been provided for comment, yet it is the most obvious practical solution.

Overview

A change in the management of wild bison is long overdue, for the present plan is not only driving wild bison into extinction as wild animals, but it is also depriving the Plains Indians of the right to practice their cultural heritage, which centers around the hunting of wild bison as a source of sustenance, as opposed to the European way of life, which is based on livestock, that is, domesticated animals. It was under the Plains Indians’ pre-European settlement management that the ecosystem, including its ungulate and predatory wildlife, remained healthy and in balance for millennia.

The Montana Department of Livestock, a member of the IBMP, is leading the charge in the destruction of this ecosystem. It is attempting to domesticate wildlife here, as exemplified by its efforts to systematically weed out the migratory instinct in wild bison by means of artificial selection, i.e., only the non-migratory are allowed to survive and breed. The tragedy is that it just might succeed if not stopped. This strikes at the very character of Yellowstone, for wild bison are iconic to it. They have been seasonally descending from the high country of the park and ascending back again for survival for thousands of years.

The Interagency Bison Management Plan, consisting of agencies under the US Department of the Interior and the Department of Agriculture, as well as the State of Montana, represents our government at war with our wildlife and *still* at war with the Plains Indian tribes. Its involvement in the park is a direct assault on the Indian way of life and the value placed on wild animals by conservationists.

With regard to the IBMP's planned 30 percent reduction of the bison population in two years, it is proceeding with no knowledge of how the culling will affect the herds. Unknown are the characteristics of the culled members of the wild bison herds vis-a-vis sex, age, pregnancy status, genetic status (degree of genetic diversity and heterozygosity), species status (whether plains or mountain bison), disease status (whether infected with brucellosis or having mitochondrial disease), or herd status (whether from the north or central herds, whether from the migratory or non-migratory herds).

Free of restraints among wild bison in the ecosystem, the IBMP is a loose cannon. Its one mantra regarding these last remaining wild members of a species is "mow them down." It is ironic, for this is what our European ancestors did to the wild cattle called aurochs. They killed them all and now they are extinct. Only their domesticated descendents, beef and milk cows, are left.

Justification for these blindly-carried-out, large-scale culling operations is IBMP's claim that the herds must be kept at or below a population of 3,000 because, above this level, computer and mathematical simulations have shown that bison are more likely to migrate out of the park in severe weather. However, this predictive model has generated a meaningless figure, for historically they will migrate out at any population level. Reality trumps the hypothetical.

Since close proximity of diseased animals promotes the transmission of brucellosis, the clear objective should be to keep the park's brucellosis-infected wild ungulate population, such as both bison and elk, separate from cattle to prevent the spread of disease—not to just kill bison with the instinct to migrate. If bison migrate at any population, killing bison at any population level is vacuous epidemiology. One must instead control proximity at any population level. Unless one kills all the bison and elk in the park, separation can only be achieved by removing cattle from the ecosystem.

But this is not being done. Only migratory bison are being killed. For no good reason, the adaptive evolutionary history of a species is being wiped out by artificially selecting out the migratory trait of these wild animals.

The herds in Yellowstone National Park are the *only* wild bison left in this country that have continuously occupied as a species the same land to which they migrated, travelling to this continent over the Bering Land Bridge more than 10,000 years ago. In the late 1800s they found protection here from the destruction of bison promoted by our government as a strategy to subdue the Plains Indians. Now this refuge has become their doom, for they are being drive to extinction here by the management practices of our own government.

Wildness—especially as expressed by migratory animals—to key government agencies and special interest groups is a threat, instead of something to preserve. It is as though the National Park Service and Montana Fish, Wildlife & Parks, the guardians of wildlife, are in handcuffs. Actually, it is worse than this. They are the ones now actively engaged in the extermination of wild bison.

To claim that wild bison must be stopped in order to prevent a mass migration misrepresents the issue. It is a straw man tactic. Migration into Montana by wild bison is *not* the problem. Instead, it is the co-mingling of cattle with disease-carrying wildlife, cattle that feed on cheap public grazing allotments adjacent to the park so cattlemen can sell their beef at premium prices. Stating that we must kill bison before they invade is like yelling, “the Martians are coming.” It is fear mongering. It is done to promote the interests of cattlemen, who want these wilderness meadows all to themselves.

Because the Greater Yellowstone Ecosystem contains wildlife that has brucellosis, it is a biohazardous environment. To prevent the disease from spreading to domestic animals, it is self-evident that cattle should not be allowed to graze along the perimeters of the park or within the ecosystem. But at present they are allowed here because of inadequate epidemiological controls.

Removing cattle from the ecosystem would be reasonable. But reason no longer rules when it comes to the wild bison issue surrounding Yellowstone National Park.

Instead of banning cattle, IBMP member agencies have collectively mounted a brucellosis witch hunt on behalf of the livestock industry against wild bison, killing virtually all those that attempt to leave the park, sometimes culling more than 1,000 animals annually. In the winter of 2007-2008 they killed 1,631. This has no disease-control value whatsoever because it targets only one species, bison, instead of elk, which also carries the disease. Such repetitive large-scale reductions are driving wild bison toward extinction.

The recent news release inviting comment on the proposed revision of the IBMP stated that:

> A range of six preliminary draft alternative concepts has been developed by the NPS and the State of Montana, with input from cooperating agencies. The

preliminary alternative concepts primarily differ in terms of bison abundance, bison tolerance outside of the park, and the tools that could be used to manage the bison population within the park and on lands adjacent to the park (Interagency News Release, 2015).

Proposed abundance levels range from 2,500 to less than 7,500 as tolerable numbers of bison allowed within the park, as summarized in the table below:

Table 12. Alternative population ranges

Alternatives	**Population limit**
1. Continue 2000 IBMP, as adjusted—No Action Alternative	3,000
2. Minimize Human Intervention	7,500
3. Limit Bison Migration into Montana	3,000
4. Suppress Brucellosis Transmission	3,000
5. Tolerance in Montana Linked to Overall Bison Abundance	3,000
6. Balance Bison Conservation and Brucellosis Transmission Risk	2,500 to 4,500

But what do bison abundance and population limits have to do with the problem? We have been told in the past that bison populations above 3,000 increase the probability of bison leaving the park. In the announcement by NPS, it is stated that because "new data about general biology and disease prevalence are available, and public opinion is shifting toward more tolerance for bison in Montana," it is now possible to consider allowing wild bison populations within the park larger than 3,000 before they are culled (Bison Management, 2015).

But what is this data? What does public opinion have to do with disease transmission? At any population level, transmission can occur when bison with brucellosis come into contact with cattle present on the outskirts of the park. If bison leave the park at any population level in heavy snowfall winters (Herbert, 2015), why set any level in the future for culling? Further, when only migratory bison are being selected for culling, at what population level is genetic diversity being maintained among wild bison—3,000, 4,500, 7,500? The public is not told. How then can the public make meaningful comments? How can it weigh evidence when it has not been provided the relevant data in support of a revision for a new plan? It can not.

Common to all proposed alternatives is the need to maintain "physical separation of bison and livestock" (Public Scoping Newsletter, 2015). What will happen when wild bison do come in contact with cattle following the implementation of any of the alternatives? The only way to maintain separation without removing cattle is by means of either hazing bison back into the park or culling them. Being that is the case, regardless of which presently-proposed alternative is chosen, hazing and lethal removal remain protocol under any of the alternatives. That represents no change from the present Interagency Bison Management Plan.

Offering a choice of tolerable bison population levels is an empty gesture. It is grandstanding, but it is the same old game. Take Montana law, for instance. What effect will the public's choice of alternatives have on the law presently in place that prohibits wild bison from entering the state of Montana? None. Statute 81-2-120 of the Montana Code Annotated is still in force and will remain so unless changed by the legislature. It states that "Whenever a publicly owned wild buffalo or wild bison from a herd that is infected with a dangerous disease enters the state of Montana on public or private land and the disease may spread to persons or livestock," the Department of Livestock may either haze them back into the park, capture and ship them to a slaughterhouse, shoot them or have them taken by public hunting (Montana Code Annotated, 2014).

All bison in Yellowstone National Park, diseased or not, are from a herd infected with brucellosis, a "dangerous disease." Likewise, all elk migrating out of the park and entering Montana come from herds with brucellosis. However, there is no such law against elk. They can mass migrate out of the park. Controlling the spillover of brucellosis from park wildlife to cattle is not being addressed by any of the alternatives because all alternatives neglect the role of elk in the spread of the disease.

None of the proposed alternatives can maintain separation without driving wild bison into extinction, making the development of an adequate EIS impossible under the presently restricted range of alternatives. Further, the stated goal "to manage the bison population within the park and on lands adjacent to the park" is an inadequate goal in and of itself, for the only effective disease-control objective is to separate all disease-carrying wildlife from cattle, not just bison from cattle.

The present alternatives are merely smoke and mirrors, an illusion of change, just different shades of the status quo. And none will do the job of preventing the transmission of brucellosis to cattle in the ecosystem. All alternatives promote proximity of cattle to the park and it is this proximity that is the problem.

Background

The Interagency Bison Management Plan, organized in 2000 after 10 years of negotiations, describes itself as:

> . . . a cooperative, multi-agency effort that guides the management of bison and brucellosis in and around Yellowstone National Park. The plan was developed by the National Park Service, USDA-Forest Service, USDA-

Animal & Plant Health Inspection Service (APHIS), Montana Department of Livestock and Montana Fish Wildlife & Parks.

Added in 2009 are several Indian tribal organizations, namely the Confederated Salish & Kootenai Tribes (CSKT), Inter Tribal Buffalo Council (ITBC), and Nez Perce Tribe (NPT).

The IBMP's stated mission is to:

- Maintain a wild, free-ranging bison population;
- Reduce the risk of brucellosis transmission from bison to cattle;
- Manage bison that leave Yellowstone National Park and enter the State of Montana;
- Maintain Montana's brucellosis-free status for domestic livestock (Interagency News Release, 2015).

The estimated bison management expenditures for the combined federal and state agencies between the fiscal years 2002 to 2007 averaged $3 million annually (Yellowstone bison: Interagency plan and agencies' management need improvement to better address bison-cattle brucellosis controversy, 2008, p. 22).

Between 1,000 and 2,000 cattle graze on the perimeters of the park. This means that our state and federal governments are spending between $1,500 and $3,000 per head of cattle to protect them from co-mingling with bison, yet allow elk to come in contact with these same cattle, winking at the fact that elk are the primary vectors of the transmission of this disease to cattle. To call this disease control is laughable. To pawn it off as doing the job of brucellosis containment and to take public money for that valueless job is misrepresentation.

The activities of IBMP members are performed under the guise of wildlife conservation. APHIS outlines its commitment of maintaining a migratory bison herd, saying:

> While USDA is charged with eradicating brucellosis from the United States, it also remains committed to maintaining a viable and free-roaming bison herd in YNP . . . Eliminating brucellosis and managing a free-roaming bison herd at YNP are not incompatible goals, and achieving them will require a cooperative effort by all involved agencies (Brucellosis and Yellowstone Bison, 2012).

The NPS echoes this by proclaiming: "Our goal is to maintain this viable, wild, migratory population of bison" (Bison Management, 2015).

They jointly set out to accomplish this task by killing every single wild, migratory, free-ranging bison they can get their hands on that attempts to leave the park during the winter. Such actions belie their stated goal of preserving a viable, migratory herd.

Members of the IBMP do not do what they say they are going to do. They neither reduce the risk of brucellosis transmission to cattle, because they ignore the threat of transmission by elk, nor maintain a viable herd because they engage in large scale reductions of wild bison.

To claim otherwise is misrepresentation.

The IBMP partners know they can not eliminate the disease of brucellosis in the park, yet persist in engaging in make-work. After all APHIS's high-sounding words about its mission, it concludes: "This plan is a bison management plan, not a brucellosis elimination plan" (Bison Management, 2015).

How true. It manages bison, but not the disease.

The IBMP members know they are doing only half a job, which, when it comes to disease control, is no job at all**.** From the get-go the methodology of controlling the spread of *Brucella abortus* from wildlife in the park to cattle is fundamentally flawed. The National Park Service admits:

> . . . the reality is that eradication or even a substantial reduction of brucellosis in bison and elk is not attainable at this time without taking extremely intrusive management actions that would drastically affect their demography and behavior, and infuriate a large portion of the American public (Frequently Asked Questions: Bison Vaccination, 2014).

Despite this, IBMP continues its irrational and ineffective brucellosis-mitigation program of targeting bison only. It has been doing so for 15 years with no reduction of the disease in the park, with more than 20 incidents of elk infecting cattle occurring in the greater Yellowstone area since 2002, and with no infections from bison (Frequently Asked Questions: Bison Management, 2015).

This organization appears to be driven by a kind of groupthink mentality characterized by collective delusions similar to what led to the disasters involving the space shuttles Columbia and Challenger, as well as a number of organizational meltdowns resulting in disaster, such as Enron and WorldCom Inc.

Groupthink, documented in the official inquiries of the space shuttle tragedies, is defined as "a pattern of thought characterized by self-deception, forced manufacture of consent, and conformity to group values and ethics." Its cause can be traced to "information avoidance, repainting red flags green and overriding alarms," according to Roland Bénabou, professor of Economics and Public Affairs at Princeton, in *Groupthink: Collective Delusions in Organizations and Markets* (Bénabou, 2011).

The meltdown, in the case of IBMP's involvement in the YNP, is being currently experienced by the wild-type gene pool of the park's bison, as well as their learned adaptive behavior—the leaders who know the way out of the park are being eliminated. And it is all for nothing. All the brucellosis ranting when accompanied by no effective epidemiology is simply, to quote Shakespeare's Macbeth, "a tale told by an idiot, full of sound and fury, signifying nothing."

Knowing that the mission one *claims* is possible to accomplish is, in fact, *not* possible, knowing that what one is doing will not do the job and yet continuing to collect money for doing that job is misrepresentation.

Since wildlife can not be removed from the park or held captive there without destroying the ecosystem, by default this leaves removing cattle from the ecosystem as the only workable solution, one which would not harm the cattle industry as a whole. In fact, it would improve it by making it less subject to a biohazardous environment, that is, the Greater Yellowstone Ecosystem, the last place where animals have brucellosis in the United States, the last place because it is one of the last places in this nation that is still wild.

The IBMP should recast its mission and be renamed the Interagency Brucellosis Management Plan. Bovine brucellosis is the problem in the Greater Yellowstone Ecosystem, carried by numerous park species, especially the ungulates bison and elk. If only a portion of the disease-carriers in the park are controlled, the spread of the disease out of the park is not controlled at all.

We do not learn. In the early 1800s John James Audubon, ornithologist and painter, watched a mile-wide flock of migrating pigeons pass overhead, blocking the sun for three days. Within the span of a human life, this species went from three billion to zero, driven extinct by market hunting, wanton killing and habitat destruction (Biello, 2014).

The original members of the IBMP should take to heart what Ron Trahan, Tribal Council Chair of the Confederated Salish & Kootenai Tribes, said in his opening remarks at a meeting of the IBMP in 2014, a meeting that debated the fate of wild bison, resulting in the decision to reduce the herd in 2015 by 900 animals. After drummers chanted the “Calling Buffalo Song,” according to a summary of the meeting:

> Ron said that the drumming was a good way for good people—as all those assembled here were—to start the day. It is also good, he said, to work to bring back bison, the animal that has always protected and fed us (Bischke, 2014).

Bringing back bison does not mean industrialized killing by the government of hundreds upon hundreds of bison year in and year out as they express their wild instinct to migrate, then giving them as handouts to the Indian nations, as is done now. It means allowing bison the freedom to roam. It means giving the public the freedom to hunt them as wild animals without government assistance or interference. That is what has worked for 10 millennia on this continent. That freedom has kept wild bison wild.

Bison leave the park primarily from the north side near Gardiner, Montana, and from the west side near West Yellowstone to either escape the harsh winters of the park’s high elevation valleys or to calve during the spring. The exit route receiving the most attention lately by the IBMP is the northern one through Gardiner Basin, a migratory corridor that straddles the park’s boundary.

As mentioned, the National Park Service in 2014 announced that the IBMP's goal is to kill 900 bison this year, 2015, and 900 next year to bring the size of the herd down from 4,900 to 3,500 wild bison (Memorandum, 2014, p. 17). That amounts to wiping out almost a third of the herd in two years.

This year, the IBMP members didn't make their goal. The first reduction was by means of planned hunting, but even with rangers directing hunters standing on the border of Yellowstone National Park to places where bison were crossing into Gardiner Basin just outside the park and even with ~~protocols that allow helicopters to be used as~~ spotters, they could not shoot enough—maybe a few hundred.

So the mop-up team came into place. That place is called Zone 1. It is a killing zone established by the IBMP, which in 2000 was given the legal authority to stop wild bison from migrating into Montana. Zone 1 is one of three zones comprising the North Boundary Management zones. It is in Gardiner Basin. Its boundaries enclose a broad grassland of several square miles. Here the Stephens Creek capture facility operates on park property. It is into this facility that bison are herded and sent to slaughter.

The month of February is their busiest month. Herds of bison can be seen grazing on the grassland. Rising above are Electric Peak and the Gallatin and Absaroka ranges. They have wandered down from the mountains into Zone 1 for forage. Also here are park rangers and agents of the Montana Department of Livestock on horseback. They ride into the herd. The animals begin to move. Shouting out cattle calls, they drive the bison, steam rising from their nostrils, toward a line of fencing.

It is a long line of fencing. It stretches out from the Stephens Creek capture facility. From a distance, the complex of buildings has the look of a make-shift prison or concentration camp. As though woven by a giant funnel-web spider, the net of fencing fans out from it. It leads into an opening connected to a labyrinth of passages and paddocks walled by plywood sheeting and high fences of steel pipes supporting catwalks overhead. In the middle is a circular holding pen. The bison trot down chutes partitioned off by doors hinged at the top. Once they walk through, the doors slam shut, making return impossible. There is only one way out and that is into a livestock trailer parked at the other end.

A pickup truck operated by a ranger races across the meadow and heads into another group of bison. The animals start to run. They run ahead of the pickup toward the fencing. Trapped by the fence line, the wild bison run along it. They pass through a gate. They find themselves in the capture facility, a corral that has been constructed with progressively narrowing corridors. On the catwalks running the length of these passageways are rangers in dark uniforms silhouetted against the sky**.** They are poised on the scaffolding like black widow spiders, slowly manipulating lines of rope. They look down on the backs of the bison they have trapped here. With the ropes they open and close the steel gates affixed in the corridors below them. A gate creaks open and a bison bolts through, then bangs shut, successively trapping the animals that pour into the facility.

Through the slats in the fence, park personnel on the ground prod the bison with poles to keep them going. Some of the animals look through the slots. They have wild eyes. Hup! Hup! someone calls, striking the fence with a pole. From the catwalks above, other personnel slap the animals with long poles affixed at the ends with paddles. The animals amble ahead. Some of the personnel chuckle.

The rangers above on the catwalks operate the metal gates like puppeteers. As the bison travel on, the passage narrows to fit only one animal at a time. Some of the animals try to turn around, but the current of tons of flesh can not be battled and they turn back and continue on.

They progress up a ramp and through the open doors of a livestock trailer. They stand crowded in a metal compartment. They bang the sides of the trailer to try to get out. Some start to bleed from their self-inflicted wounds. A horn hangs from the head of one bison by a shred of flesh, detached from its bleeding skull by the impact of its charge. They urinate, defecate and abort from fear.

The truck's engine starts. They go for a long ride—part of a convoy of pickup trucks towing livestock trailers filled with members of the herd, an entire bison family, including calves and pregnant females—to a slaughterhouse, where they are processed and their heads, hundreds of them, lined against a wall, while their bodies are hung from hooks. Their guts, containing their wild-type genetics, as well as fetuses are tossed into the waste bins.

But they haven't killed enough—only 700. They are 200 short for this year's culling. This means that to reach their two-year goal of reducing the herd from 4,900 to 3,500 they have to kill a lot more next year—over a thousand. This could have genetically catastrophic consequences.

For bison, even with winter gone, the nightmare is not over. After the killing frenzy of the IBMP, a number of pregnant bison come down to the lowlands to calve, usually in the vicinity of Hebgen Lake near West Yellowstone. It is spring, but the IBMP is here, too. As the mother bison nurse their young, a posse is waiting for them. They have their job to do, they claim. The grassland just outside the park must be cleared of bison to make way for the cattle that will be trucked into this wildlife habitat in June, even though studies have predicted that such bison would return to the park anyway if left alone. Some of these grasslands no longer have cattle on them, but because the bison are in a no-tolerance region, hazing continues.

A typical hazing operation involves agents of the Department of Livestock and the Montana Fish, Wildlife & Parks riding on horseback, shouting, firing cracker rounds (explosives launched from shotguns) and snapping bullwhips as they head into a herd of bison, many of which have just given birth. They are sometimes assisted by riders in ATVs and by helicopters that buzz them to keep them moving. They try to get them onto a highway leading back into the park. Typically, the posse is joined by squad cars that follow the herd with lights blinking.

Often, calves suffer in this drive, which can last several days. Their ordeal is sometimes captured on video. Here are two examples of what one may view.

In May 2009 as a helicopter drones above, a calf with a broken leg is seen following its mother. The two are being hazed by an agent on horseback with the Montana Department of Livestock. A women bystander yells off-camera “Forget the macho game and leave her and her broken leg baby alone. You have done enough.” He pays no attention and keeps on driving the pair, the calf limping behind its mother (Montana Department of Livestock chasing baby buffalo with broken leg, 2009).

In May 2011 a newborn calf tries to keep up with its mother. It has been driven by riders on horseback for several days. It can barely proceed on wobbly legs down a highway. It staggers as though drunk. When the herd leaves the road and proceeds up a slope, the calf tries to follow its mother. It can not climb the snow bank that borders the road. It struggles, then collapses and dies beside the road as the herd goes on (Yellowstone Bison Calf Killed in Government Hazing Operation, 2011).

On the other hand, all along the perimeters of the park in the spring during calving season, such as along Watkins Creek in the Hebgen Lake region, elk calves are allowed to nurse and grow. They and their mothers are not hazed. But wild bison must be kept in their place at the back of the ecosystem. This is Montana law.

P.J. White, chief of wildlife resources, Yellowstone National Park, states that large scale culling can have detrimental consequences. In an article titled “Management of Yellowstone bison and brucellosis transmission risk: Implications for conservation and restoration,” he writes:

> Brucellosis risk management actions have been periodically implemented under the IBMP to reduce the numbers of bison attempting to move outside the park. However, more than 1000 bison (21%) were culled from the population during winter 2006 and 1700 bison (37%) were culled during winter 2008 because hazing was no longer effective at keeping them in the park or adjacent conservation areas, as required during step 1 of the IBMP. Frequent large-scale, non-random culls could have unintended effects on the long-term conservation of bison, similar to demographic side effects detected in other ungulate populations around the world (White, 2013).

Despite this warning, one coming from Yellowstone National Park’s lead scientist himself, IBMP continues its practice of large-scale culling.

Yellowstone National Park is a part of the National Park Service. The NPS is a member of the IBMP. Not putting into practice what one preaches is hypocrisy. If the preaching misrepresents and elicits an exchange of money from the misled, it has the appearance of misappropriation. Three million dollars a year from a duped public is a hefty sum.

The IBMP persists to operate contrary to the principles of the park. As stated in my 2015 petition:

> The IBMP is overseeing what amounts to a pest extermination program mounted against the Yellowstone bison, favoring the economic interests of the cattle industry in direct violation of the act founding the park, which states that the Secretary of the Interior "shall provide against the wanton destruction of the fish and game found within said park, and against their capture or destruction for the purposes of merchandise or profit" (Yellowstone Act, 1872; 2014).

The IBMP is part of an anti-wildlife ethos spearheaded by the cattle industry that has infected the Rocky Mountain States. Incredibly, the public is paying millions annually for these destructive activities to be carried out. This is ironic since one of the region's greatest sources of income is its wilderness.

Yellowstone National Park and the states it borders—Montana, Idaho and Wyoming—are at war with their wildlife. But it is more than that. They are also at war against local residents and the citizens of this nation, those who value wildlife as wild. The war they wage is the restraint of the natural movement of such wildlife as bison, elk and wolves that inhabit the park. They don't want them outside its borders.

Restraint comes in many forms. For bison, it is hazing when these animals attempt to migrate out of the park into Montana. Or it is death (called by the government "lethal removal").

For elk it is by means of feeding grounds or irrigated fields that skirt the Greater Yellowstone Ecosystem, promoting non-migratory behavior. Feed grounds have been instituted along the borders of the ecosystem to keep elk off the cattle ranges and to provide more elk for hunters.

For wolves, it is often open season on those that leave the park. In the last few years the US Fish and Wildlife Service, bowing to the cry from both cattlemen and elk hunters, has removed gray wolves from the federal list of threatened and endangered species for the states surrounding the park. Since then, wolves can not step across the border without the risk of getting shot—except for Wyoming. Initially it was part of the delisting, but because it adopted a radical kill-on-site policy, federal protection of the gray wolf has been reinstated by court order.

It is a vicious circle. Cattlemen don't want bison to migrate near their cattle nor elk to graze on the grasslands outside the park. Cattlemen don't want wolves around because they claim they prey on their cattle, yet it is these very wolves that are predators of bison, bison they want killed. And elk hunters want wolves killed because they claim wolves eat too many elk.

This interruption of movement within the ecosystem stagnates it and promotes crowding of animals within the park and around the feeding grounds, contributing to the increased incidence of brucellosis, the very disease the cattlemen are fighting. Close proximity promotes disease. Separation by means of dispersal, that is, by means of migration, reduces the incidence of disease.

However, under the present management of the IBMP, the exercise of that trait governing dispersal has become a liability for wild bison. The evolutionary force that molds the genetics of a species by means of the survival of the fittest has been turned on its head by this coalition of wildlife and livestock management. Migration once was protective. By descending to the lower grasslands, bison were able to survive the winters when forage in the high mountain valleys became inaccessible under deep snow and crusts of ice. Further, the resultant dispersal created a more disease-free environment. Now the fittest are those bison that don't migrate, for they are the ones that survive, that is, the ones that survive the IBMP.

By routinely selecting out migrating bison, at some point the elimination of that migratory trait will occur, bringing about the extinction of wild bison, for it is the migratory trait that makes wild bison wild.

Here operating on park property is an extinction factory—all because wild animals in the park have brucellosis, also called *Brucella abortus*, which was first introduced into the park by cattle in the early 1900s and which now can not be eradicated from the ecosystem. According to "Brucellosis and Yellowstone Bison-APHIS,"

> Brucellosis has caused devastating losses to farmers in the United States over the last century. It has cost the Federal Government, the States, and the livestock industry billions of dollars in direct losses and the cost of efforts to eliminate the disease.

Following years of eradication effort,

> As of March 1, 2002, 48 States have achieved brucellosis-free status with no known infection. The only known focus of *Brucella abortus* infection left in the nation is in bison and elk in the Greater Yellowstone Area (GYA). With respect to this area, APHIS is cooperating with State and Federal agencies to implement a bison management plan, in order to provide for a free ranging bison herd and to prevent exposure of cattle to potentially infected wildlife (Brucellosis and Yellowstone Bison-APHIS, 2015).

Notice the logical disconnect operating here. While the "only known focus of *Brucella abortus* infection left in the nation is in bison and elk in the Greater Yellowstone Area," the strategy to prevent exposure to cattle is "to implement a bison management plan . . ." Elk are not even mentioned.

Brucellosis seroprevalence among Yellowstone's wild bison under the decades-long management practices has hovered around 50 percent. All the years of culling bison has not reduced the incidence of that disease in the park's bison herds. The report states:

> Past and current culling practices (which have been largely nonselective and opportunistic) have not had an apparent effect on reducing overall bison herd seroprevalence (around 50%) (p. 33).

But it is increasing among elk. According to National Park Service's report "Yellowstone National Park: Monitoring and Research on Bison and Brucellosis," by P.J. White, chief, wildlife and aquatic resources; Rick Wallen, bison ecology and management program; and John Treanor, Yellowstone wildlife health program:

> Brucellosis seroprevalence in free-ranging elk increased from 0-7% in 1991-1992 to 8-20% in 2006-2007 in four herd units not associated with feed-grounds (p. 15).

The logical disconnect continues. In the NPS's online "Frequently Asked Questions: Bison Management" website, it asks "Has the Interagency Bison Management Plan (IBMP) been successful at accomplishing its goals?" Its answer, it claims, is yes:

> . . . there have been no incidents of Yellowstone bison infecting cattle with brucellosis, while more than 20 incidents of elk infecting cattle have occurred in the greater Yellowstone area since 2002 (Frequently Asked Questions: Bison Management, 2015).

That is success? *Brucella abortus* from elk good, but *Brucella abortus* from bison bad? No, the truth is transmission of *Brucella abortus* from either species is bad. Thinking otherwise is right out of George Orwell's *1984,* which introduced the concept of "doublethink" whereby a deluded public is indoctrinated to accept contrary opinions or beliefs at the same time.

The park's primary spokesman, Rick Wallen, lead wildlife biologist for the bison program at Yellowstone National Park since 2002, commented on the conundrum involving brucellosis in both bison and elk in an NPS video titled: "Why are elk managed differently than bison?" He said:

> Brucellosis infection in elk functions the exact same as brucellosis infection in bison, and brucellosis infection in livestock. So, biologically, there's really no difference in the transmission and infection cycles. Some of the details of how it works within each individual species is a little bit different, but the bottom line is that any of those three species could be transmission vectors to any of those three species. Many of our constituents ask**,** "Why do you treat elk differently than you treat bison?" Why do you treat elk differently than you do bison? Our state wildlife managers in Idaho, Wyoming, and Montana are more tolerant of elk and allow the elk from Yellowstone National Park to move freely back and forth across the boundary.

There you have it. Why are the two brucellosis-carrying species treated differently? Because of issues of tolerance and intolerance. Because they legally can be treated differently. Because, as its name states (Interagency *Bison* Management Plan) and as its credo states, (a "multi-agency effort that guides the management of *bison* and brucellosis") *bison*—but not elk or any other brucellosis-carrying animal—are its concern.

Brucellosis really has nothing to do with the issue. If it did, it would be addressed epidemiologically in both species. Both species would be prohibited from migrating and mingling with the cattle on the park's borders. Such biased treatment of species nullifies the disease control actions mounted against park bison. At the human level, it would be like banning entry into this country of a patient from nation A with Ebola, but allowing entry of a patient from nation B with Ebola. Such a practice would not contain the spread of the disease. Claiming it could would be double talk. Or bad science. Or both.

The NPS recognizes the differential treatment of the two species and that something should be done to correct this. It states:

> Bison are a migratory species and they move across a vast landscape. When they are inside Yellowstone, they have unlimited access to every square inch of habitat. But in the winter, when they migrate to lower elevations outside the park in search of food, the surrounding states and some private landowners don't offer the same habitat freedom. Wild bison are only allowed in limited areas outside of Yellowstone because some are infected with the disease brucellosis that can be transmitted to cattle. Interestingly, some elk that live across the ecosystem, as well as some elk in the park, also carry brucellosis, but their movements are not constrained. For long-term conservation, Yellowstone bison need similar access to habitat and tolerance that other wildlife species are given (Bison Management, 2015).

Stating that "Interestingly, some elk that live across the ecosystem, as well as some elk in the park, also carry brucellosis, but their movements are not constrained," indicates the NPS recognizes the disparity of treatment. But knowing this, yet participating in a program that has no disease-control value because of the differential treatment of elk and bison, indicates the NPS is engaging in lip service only.

One also questions the agency's candor. Claiming that when bison are inside Yellowstone, "they have unlimited access to every square inch of habitat" is simply not true. Zone 1, the killing zone comprising several square miles of grassland in which the Stephens Creek capture facility operates, is located inside the park.

But then, possibly there is a bit of truth to that statement. Bison do have access to Zone 1. The only trouble is that when they access it, they are killed. However you look at it, such speech is dissembling.

As one looks more closely at what the IBMP does and what its goals are, the entire logical framework crumbles. How can the NPS as a member of the IBMP participate in a program and advocate it when they realize its inability to control brucellosis transmission to cattle by allowing elk to mingle with cattle?

It just has to be done, the wildlife managers claim, to prevent a "mass migration" of wild bison into Montana. The only trouble is that they just can't get enough bison to migrate so they can kill them, even using riders on horseback, pickup trucks, snowmobiles, squad cars and helicopters to force them ~~into the range of hunters or~~ into capture facilities.

Elk were culled in large numbers by park personnel, just like bison, until 1968 when the practice was stopped. Now they mass migrate every year out of the park to the delight of hunters.

The IBMP members' stated goal of maintaining a viable, migratory wild bison herd is again lip service only. Its conduct at the park proves this, for it violates the very protocols it recommends to contain the disease of brucellosis. According to APHIS, whose self-described mission is to "protect the health and value of American agriculture and natural resources," control of brucellosis can be achieved by proper herd management strategies, such as maintaining closed herds. As outlined in my petition:

> Of particular interest is the method APHIS recommends to control the spread of brucellosis, namely, closed herds. Closed herd management restricts the introduction of animals and vehicles from livestock sources as well as contact with other herds and animals, according to the *Merck Veterinary Manual*. Open herds have a higher risk of introducing pathogens through such practices as introduction of purchased replacements, mingling of animals of different backgrounds or poor herd biosecurity (Hilton, 2014). Maintaining a closed beef herd includes eliminating fence line contact with other herds (Dahlen, 2015).
>
> By insisting on grazing cattle, whether open range or fenced, adjacent to a biohazardous area such as the GYE where wildlife is infected with brucellosis, is not practicing the protocols recommended by APHIS, which include closed herd management (Horsley, 2015).

Yet APHIS, as well as livestock and wildlife managers, allows open herd management on the borders of Yellowstone National Park.

But it disallows or discourages migratory behavior. What the wildlife and livestock managers operating in the GYE have done is to dramatically increase the probability of interspecies transmission of *Brucella abortus* in this region by such practices.

Both state and federal governments are making the park into a stockyard. Prohibiting dispersal makes animals captive of the park. This practice concentrates the herds, promoting disease transmission. That is why stockyards are disease-ridden. The majority of bison that attempt to escape the park via migration are trapped in capture facilities or sent to nearby quarantine facilities, where some abort or give birth. Due to the close proximity of the animals, confinement in these facilities exacerbates the transmission of brucellosis. Aerosols containing the bacteria may infect people or other animals coming near the facilities, promoting the contracting of brucellosis by means of inhalation. (Brucellosis-CDC, 2015).

And just as at a stockyard, these animals are shipped off to a slaughterhouse.

Elk are being artificially fed on the park's perimeters, and irrigated fields attract these animals, concentrating herds, discouraging migration and increasing disease transmission. As in a stockyard, here they are fattened up and just as in a stockyard, they experience greater incidences of disease.

While APHIS states that under these conditions the risk of disease spread from elk is increased, wildlife managers allow these practices to continue.

Wolves are shot as they leave the park, eliminating the ungulates' natural predators, further increasing the prevalence of disease, for wolves target the most vulnerable animals, included those suffering from brucellosis. This has come about in part because wildlife managers have recommended delisting.

Instead of wolves, however, we have the IBMP, the park's alpha predator, whose pack is capable of killing thousands in a few days. At a typical slaughtering facility, here is what happens.

Once at the slaughterhouse, the shaggy beasts go up a ramp and through a door. Behind that door, the animals proceed single file. They pass over a bar, their legs on both sides. The floor slowly drops away. As though on a conveyor belt, they are carried straddling the bar to a station where a man stands on a catwalk above.

He holds an object that looks like a power nail gun, a pneumatic device that is loaded with a metal bolt about the size and length of a thick pencil. He points it between the animals eyes and injects the bolt into its brain. Chains hanging from an overhead trolley are attached to its rear legs. Dangling from the chains it is conveyed to another station where a person sticks a long knife into its throat and cuts its aorta, bleeding the animal (Pollan, 2015).

This is the fate of migratory wild bison—selective slaughter at a meat processing plant, the end result of the stockyard management mentality that now pervades Yellowstone National Park.

The claim by NPS that "past and current culling practices" of wild bison have been "largely nonselective and opportunistic" is untrue and thereby distorts the real picture. It is because of the continuing practices of selectively killing only migrating bison that dispersal has been discouraged, artificially increasing the proportion of non-migratory bison within the park. Resident ungulate populations, as has been shown with regard to elk, have higher brucellosis seroprevalence.

Disease within Greater Yellowstone Ecosystem is increasing because those in charge of the park and the surrounding ecosystem are selecting against wild behavior. By prohibiting bison migration, by encouraging non-migration of both bison and elk, and by taking part in the delisting of wolves, wildlife managers are domesticating the ecosystem's wild ungulates. This makes a sick ecosystem.

And tragically, a non-wild, non-migratory bison is an extinct wild bison. All this ecological havoc is being promoted so that a few cattle—from 1,000 to 2,000 head, out of a total population in 2013 of 2.6 million cattle and calves in Montana—can munch the grassland habitat of migratory bison and elk next to the park. And this epidemiologically useless wild bison extinction factory costs the public millions a year to run.

Such decimation of wildlife and waste of tax-paid funds would normally outrage the public. However, a carefully laid plan of deception has been administered by the IBMP.

With the slaughter sometimes exceeding 1,000 animals annually, a rationale for such large-scale culling was needed by the IBMP to hoodwink the media and thereby the public into thinking such decimation of a species was needed. A study was found that would do the trick: a report by the National Academy of Sciences published in 1998.

Written by Norman F. Cheville and Dale R. McCullough, it is titled *Brucellosis in the Greater Yellowstone Area.* The authors studied whether such variables as snow level, temperature and bison population levels correlated with the numbers of bison moving out of the YNP. Regression analysis, a statistical process for estimating the relationships among variables, was used to make predictions about bison movement. SNOW is an acronym for "snow water equivalent." They asked:

> Given bison populations of more than 3,000, does winter severity influence the number of bison moving out of the park?

They found:

> Regression analysis of bison populations on various indexes of winter severity in years when there were more than 3,000 bison show that SNOW and snow index are strongly related to bison moving out of YNP . . .

Specifically,

> . . . for populations over 3,000, the number of bison moving out of YNP increases rapidly with increasing SNOW (on average, 68 bison for each inch of SNOW). Furthermore, on the average, no bison moved outside YNP when SNOW was 17 in. or less.

However, they noted:

> That average fails to capture the fact that historically some bison have moved outside the park even when the population was low (Meagher 1973) (Cheville, 1998, p. 57-59).

This analysis led to the establishment of 3,000 wild bison as the tolerable limit for the population in the park, as specified by the *Record Of Decision for Final Environmental Impact Statement and Bison Management Plan for the State of Montana and Yellowstone National Park,* published in 2000, the document that established the IBMP. It stated:

> As an additional risk management measure, the agencies would maintain a population target for the whole herd of 3,000 bison. This is the number above which the NAS (1998) report indicates bison are most likely to respond to heavy snow or ice by attempting to migrate to the lower elevation lands outside the park in the western and northern boundary areas (Record of Decision, 2000, p. 20).

There are several problems with this statement.

First, it is a culling edict that establishes a population limit for wild bison that is human-made and thereby entails artificial, not natural selection.

Secondly, it is purely utilitarian, completely ignoring whether this population limit preserves the wild genetics of the park bison.

Thirdly, this is a mathematically-derived prediction. In reality, historically, bison will move out of the park at any population number. In a recent update of the National Park Service's blog "Bison Management," a video is provided that asks "Why do bison leave the park, and why is that a problem?"

Wallen, Yellowstone's wildlife biologist, gives this answer:

> Bison move about on the landscape and leave the area that we designate as Yellowstone National Park for a couple of reasons. Population abundance alone could drive them to pioneer new areas, but, on top of that, bison will move anytime there's heavy snowfall winters. Even at really low population abundance, you should expect a lot of animals to leave the national park (Herbert, 2015).

When they do leave and are captured and slaughtered, to make their lethal removal seem more natural, another study has been used, this one by G.E. Plumb and co-authored by NPS's White and Wallen titled "Carrying capacity, migration, and dispersal in Yellowstone bison." Plumb states that in computer simulations of bison leaving the park, migration of bison is like animals moving into a "dispersal sink." He notes:

> This simulation can be thought of as representing a dispersal sink, wherein some bison would normally leave the higher elevation park landscape and not return. Dispersal movements and sinks are common in wildlife populations (Owen-Smith, 1983) and should be expected in nomadic, wide-ranging species such as bison (Plumb, 2009).

A dispersal sink is defined as habitat that is accessible to a potential disperser and that is at least good enough to support temporary survival. To what does Plumb equate a dispersal sink in the case of Yellowstone bison? Plumb tells us:

> . . . lethal brucellosis risk management in these areas can serve as a surrogate for the dispersal sink that would otherwise be an expected part of natural ecosystem processes (Plumb, 2009).

In other words, according to Plumb the Stephens Creek capture facility, the park's lethal removal operation, is just a substitute for a temporary place in which to survive, a place where "some bison would normally leave the higher elevation park landscape and not return."

Indeed, they do not return. That is because they are dead, slaughtered by the IBMP.

The trouble with this simulation is that the Stephens Creek capture facility is not a dispersal sink, but instead a literal dead end, a site of extinction. To qualify as a dispersal sink and to have evolutionary significance, some animals must return from it. Migrating lemmings have been observed dashing headlong into bodies of water, like a stream, and drowning, but many swim across to the other side, reaching a habitat that serves as a temporary refuge where they survive and from which they return, perpetuating this migratory race. This is a classic example of a dispersal sink.

But no bison can survive the habitat of the Stephens Creek capture facility, escape from it or return. The claim it mimics nature, when all animals that enter it perish, could serve as great dark humor if it were not such bad science in its application.

In another study, this one using Bayesian analysis, a statistical method that deals with the probability of an event happening in the future, based on the knowledge of prior events, Yellowstone biologists predicted that large-scale reductions of wild bison would not prevent large-scale migrations out of the park, and in addition, migration numbers would be much greater than originally thought at the time the IBMP was formed.

This study, funded by the National Park Service and led by Chris Geremia and co-authored by White and Wallen, titled "Predicting Bison Migration out of Yellowstone National Park Using Bayesian Models," stated:

> Yellowstone's restored bison herds have established migratory patterns that lead them to low elevation areas out of the park where they come into conflict with society. Our simulation results suggest scenarios that remove 50% of migrants similar to management policies outlined in the Interagency Bison Management Plan will not prevent future large-scale, recurrent migrations and numbers exiting park boundaries will be much greater than predictions underlying those policies. Thus, limiting bison numbers and allowing increased numbers of bison beyond park boundaries during severe climate conditions may be the only means of avoiding episodic, large-scale reductions to the Yellowstone bison population in the foreseeable future.

Even if bison abundance were reduced to lower numbers, it would only reduce the frequency of large-scale migrations, but doing so would come at a cost to the conservation of wild bison. The study concluded:

> Limiting bison abundance to lower numbers will likely reduce (but not eliminate) the frequency of large-scale migrations into Montana, but could also hamper the conservation of this unique population of wild, free-ranging bison by adversely affecting the population's resiliency to respond to environmental challenges, genetic diversity, and the ecological role of bison in the ecosystem . . .

Such large-scale reductions not only harm wild bison but also the ecosystem, for bison benefit it,

> . . . through the creation of landscape heterozygosity, nutrient redistribution, competition with other ungulates, prey for carnivores, habitat creation for grassland birds and other species, provision of carcasses for scavengers, stimulation of primary production, and opened access to vegetation through snow cover (Geremia, 2011).

With that said, the IBMP nevertheless plans to lethally remove under its present plan almost one-third of the herd in two years. A new *Record of Decision* will not be issued until the Fall of 2017. In the meantime, bison will continue to be managed under the present terms of the IBMP.

What bison population levels will retain genetic diversity? Writing in "Management of Yellowstone bison and brucellosis transmission risk: Implications for conservation and restoration," White warned against non-random culling:

> Thus, sporadic, nonrandom, large-scale culls of bison have the potential to maintain population instability (i.e., large fluctuations) by altering age structure and increasing the variability of associated vital rates. Longterm

> bison conservation would likely benefit from management practices that maintain more population stability and productivity.

However, White claims that if the bison population in the park can be maintained at above 3,000, adaptive capabilities and genetic diversity will be maintained. Providing four citations to support this claim, he states:

> . . . recent demographic and genetic analyses suggest that an average of more than 3000 bison total on a decadal scale is likely needed to maintain a demographically robust and resilient population that retains its adaptive capabilities with relatively high genetic diversity (Gross et al., 2006; Freese et al., 2007; Plumb et al., 2009; Pérez-Figueroa et al., 2010) (White, 2011).

This conclusion by White gives the bison population level of 3,000 the gloss of maintaining wild bison conservation. But it is only gloss. All the citations are studies about random culling.

For instance, the Pérez-Figueroa study involves three scenarios: random culling among all age classes, among calves and among adults. It concluded:

> Finally, our simulations suggest that the conservation of high allelic diversity (>95%) at loci with many alleles . . . will require the maintenance of a populations size greater than 3250 . . . and removal of mainly or only juveniles (Pérez-Figueroa, 2012).

But IBMP does not engage in the random removal of bison, whether in all age classes, adults or calves. It removes only migratory animals. This is non-random culling.

What the study recommends—removing mainly juveniles, that is, calves—is what wolves do. The IBMP pack is a dunce compared to wolves in maintaining genetic diversity, health and a balance of nature among ungulates in the ecosystem. Not only is it a dunce, but it is destructive in particular to the wild bison's genetic diversity and adaptive capabilities.

White's claim that keeping bison numbers just above 3,000 will maintain "relatively high genetic diversity" is irrelevant to what is actually going on in Yellowstone. Many studies warn of the harmful effects of large-scale culling of wild bison. But, no one knows at what population level genetic diversity is retained when only bison with the genetic trait of migration are selected for culling. No studies tell us, yet the senseless and uninformed culling continues for the simple fact that it benefits a few cattlemen.

This cessation of reason in the face of the Montana cattle industry affects multiple branches of the government. It pervades the member agencies of the Interagency Bison Management Plan. It even extends to the US Fish and Wildlife Service.

In my original petition to list the Yellowstone's wild bison as endangered or threatened, they were found to be a subspecies, a "distinct population segment" and worthy of protection. However, that petition was denied because the FWS claimed the park's bison were being successfully managed by the IBMP and because bison were still migrating.

Apparently, the only thing that will change their minds is when bison stop migrating due to the persistent removal of migrants. And then it will be too late, for when that happens, wild bison will be extinct.

Given the critical status presented to the wild genetics of the Yellowstone herd by the impending removal of almost a third of the wild bison population in two years (and already over 700 have been killed) it would seem prudent that an emergency listing be instituted while the merits of my petition filed in 2015 are being evaluated so that during this process no irreversible harm can come to wild bison. My petition pointed out numerous instances that the actions of the IBMP were deleterious to wild bison and could cause their immediate extinction as wild animals.

Emergency listing regarding the 2015 petition, however, was denied. Michael Thabault, Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Mountain Prairie Region, wrote:

> We reviewed the March, 2015 petition to determine if emergency listing is warranted for the Yellowstone bison. Emergency listing rules provide immediate protection of the Act with ". . . regard to any emergency posing a significant risk to the well-being of any species . . ." Protection provided by emergency listing is for 240 days while the normal rulemaking process is followed. Emergency rules are used only in extreme situations where expected losses during the normal listing process would risk the continued existence of the entire species, and if the immediate threat can be addressed by listing the species. The normal listing process from the time of receipt of the petition can take as little as two years. There is nothing in the petition that led us to conclude that there in an emergency facing the Yellowstone bison in which expected losses risking the continued existence of the species will occur within the normal listing process time-frame. The potential threats discussed in the petition and potential impacts to the species are not of a magnitude and imminence that would warrant emergency listing. As you are aware, we have reviewed the status of bison in the past (both the Yellowstone bison and the wild plains bison) and have no evidence of a decline or threat that would risk the continued existence of the entire species, as is the standard for an emergency. The Yellowstone bison is a heavily managed species with multiple entities tracking its status (Personal communication, April 1, 2015).

That this species was being managed by the government was the reason given for the denial of listing in my original petition submitted in 1999. Once again, because the wild bison are a "heavily managed species," they do not deserve listing, this time immediate listing. And now, once again, the very state and federal management that is "tracking its [the bison's] management" is itself the threat. But the FWS turns a deaf ear. The FWS is saying in effect, because the fox is managing the hen house, the chickens have nothing to fear.

Further, the 2015 petition was devoted to showing the potential for the decline of *migratory* bison under IBMP management and the threat this imposed to their continued existence as a wild species, yet such evidence was discounted with the dismissive "no evidence of a decline or threat that would risk the continued existence of the entire species," namely, the wild bison found in the park.

Even if a population of wild bison is increasing in abundance, if there is a progressive decline in migratory bison, the overall abundance is meaningless, for they will cease to be migratory animals at some point. For bison, the migratory instinct defines wildness.

Moreover, how do they know bison will mass migrate out of the park, as NPS warns? They kill all those bison that come down from the higher elevations to the portion of Gardiner Basin within the park called Zone 1, thereby destroying the evidence that would determine whether they would migrate out of the park. Further, ~~try as they might, with riders on horses flushing bison from the park's lower elevation grasslands and with helicopters buzzing them, they can~~ only ~~get~~ a few hundred ~~to~~ cross the park's border to be killed by hunters standing on that border. ~~Is forced outward migration mass migration? One would think not.~~

I replied to Thabault:

> Thank you for your response concerning how the FWS approaches the need to emergency list a species. You mention that emergency listing rules provide immediate protection by the Act with ". . . regard to any emergency posing a significant risk to the well-being of any species . . ." I would like your response to several questions regarding this:
>
> 1. As pointed out in my 2015 petition, the National Park Service warns that culling wild bison resulting in large-scale reductions or fluctuations in a population can have deleterious genetic consequences. With the Interagency Bison Management Plan's announced goal of lethally removing 900 wild bison this year and 900 the next year, would you not consider that a significant risk to the well-being of wild bison as a wild species, especially when you consider that the lethal removal is targeting only migratory bison? Would you not consider this reduction and fluctuation, which amounts to a 30 percent reduction, large-scale?
>
> 2. If that is true, then are we not faced with a crisis when you consider that this is all to be accomplished in a two-year time span and that already

one year has passed, with the removal of over 700 animals so far. This means that since IBMP is now short 200 removals for this year, to reach its goal of herd reduction from 4,900 to 3,500 animals by next year, a total of more than 1,000 animals must be removed.

Realistically, how long will it take to make a decision regarding the protection of wild bison? As you mention, the normal listing process "can take as little as two years." But it can also take much longer, as in my first petition to list the Yellowstone bison, which took from 1999 to 2007—eight years. Thus, is not an emergency listing warranted?

3. You mentioned that the FWS has "reviewed the status of bison in the past (both the Yellowstone bison and the wild plains bison) and have no evidence of a decline or threat that would risk the continued existence of the entire species, as is the standard for an emergency."

But as you must have noticed in your review of my 2015 petition, it is an extensive rebuttal of the FWS status review of both Yellowstone bison (my 1999 petition) and wild bison (the 2009 petition by James A. Bailey). Being that is the case, how can you say there is "no evidence of a decline or threat that would risk the continued existence of the entire species," as a basis for not making an immediate listing, when the petition challenges the very basis of those past decisions made by the FWS, citing studies and evidence why they are wrong?

In this regard, it appears that you are rejecting outright the findings of my 2015 petition, at least to the extent that they do not constitute grounds for an emergency listing. Is this the case?

4. You mention that "The Yellowstone bison is a heavily managed species with multiple entities tracking its status." This statement appears to be in support of your contention that an emergency listing is not required. Yet surely, you noticed in my 2015 petition that I claim it is this very management of the species by the multiple entities involved that is causing the extinction of wild bison. So how can this be a reason for not making an emergency listing? It would be like saying the reason the hen house does not need immediate protection is because the fox is in charge.

My question is this: what do you mean by the statement: "The Yellowstone bison is a heavily managed species with multiple entities tracking its status."?

5. Lastly, with regard to the IBMP's planned 30 percent reduction of the herd in two years, is the status of this species being tracked to determine the characteristics of the culled members of the wild bison herd vis-a-vis sex, age, pregnancy status, genetic status (degree of genetic diversity and heterozygosity), species status (whether plains or mountain bison),

> disease status (whether infected with brucellosis or having mitochondrial disease), or herd status (whether from the north or central herds, whether from the migratory or non-migratory herds)?
>
> If you can find no such evaluations being conducted with regard to the planned culling of 1,800 bison in two years, then how can FWS determine if the herd is being damaged by the practices of the IBMP or if an emergency does not exist? (Personal communication, April 7, 2015).

Not hearing back, I asked when I might receive a reply. Thabault responded:

> Mr. Horsley, I did get your response of April 7. While I appreciate your interest in Yellowstone bison, I was not intending to give you a point by point response in email. We stand by our decision that emergency listing is not warranted. We have the petition to protect Yellowstone bison and we will evaluate the petition on its merits as relayed in our previous correspondence to you.
>
> Thank you (Personal communication, April 13, 2015).

As mentioned, it took eight years, from 1999 to 2007, for my original petition to be reviewed. In reality, with immediate listing denied, how long will it take to make this evaluation and how much damage will be done to the wildness of wild bison during this wait? For the FWS it is not worth discussing. They have their minds made up.

Apparently, multiple foxes are in the hen house. What is needed is a watchdog. The most likely candidate is the Government Accountability Office (GAO). Often called the "congressional watchdog," GAO investigates how the federal government spends taxpayer dollars and advises Congress and the heads of executive agencies “about ways to make government more efficient, effective, ethical, equitable and responsive.” It “maintains FraudNET to facilitate reporting of allegations of fraud, waste, abuse, or mismanagement of federal funds” (About GAO, 2015).

Prior to this exchange of emails with FWS’s Thabault and following the submission of my 2015 petition, I had notified the Government Office of Accountability of a concern of mine that had formed in the process of doing the research and writing of the petition. It involved multiple instances of misrepresentation that had come up in my investigation. I wrote March 12 to the GAO FraudNet:

> This is a note concerning possible fraud involving the various agencies of the Interagency Bison Management Plan. After writing a 329-page petition to protect Yellowstone's wild bison from extinction (see news release below), it occurred to me that your agency might be interested in some of my findings.

To put it all in a nutshell, the IBMP is stopping the migration of wild bison out of the park, spending $3 million annually in state and federal funds, for the purpose of maintaining separation of wild bison from 1,000 to 2,000 cattle that graze on public land contiguous to Yellowstone National Park, focusing most of its efforts on the region comprising the north entrance to the park, the Gardiner basin.

The rationale for the separation is to prevent the transmission of brucellosis from bison to cattle. However, the greatest threat of such disease transmission is not by wild bison, but by elk, yet elk are allowed to migrate and comingle with cattle along the border of the park. This is highly ineffective disease control.

What makes this possibly rise to the level of fraud is that on various websites by participating members of the IBMP, the public is led to believe that the disease can be controlled and even eliminated by their actions when, in fact, it cannot. For instance, as I have pointed out on page 223 of the petition:

> APHIS alone has spent $7.5 million between 2002 and 2007. It has told the public, including taxpayers, that it can "work with the cooperating agencies to develop a plan to eliminate brucellosis from the GYA while ensuring a wild, free-roaming, and viable bison herd in Yellowstone."
>
> APHIS backs up this claim by stating:
>
> > Similar eradication efforts have been successful in other parks, including Wind Cave National Park and Custer State Park in South Dakota and Wichita Mountain Wildlife Refuge in Oklahoma (Brucellosis and Yellowstone Bison, 2012).
>
> Boyd, in her bison status report, stated bison in the Yellowstone National Park were "free-ranging," while the bison in Wind Cave National Park and Custer State Park in South Dakota and Wichita Mountain Wildlife Refuge in Oklahoma were captive (Boyd, 2003, pp. 170-183).

The only way to eliminate brucellosis in a given population is by keeping disease-carrying animals separate from healthy animals. Yellowstone National Park, of course, cannot be fenced. To state that the methods of disease control utilized at Wind Cave National Park and Custer State Park, which are either range-restricted or fenced, can be applied to Yellowstone National Park is simply untrue.

Further, in response to your 2008 review of the IBMP entitled "Yellowstone bison: Interagency plan and agencies' management need improvement to better address bison-cattle brucellosis controversy," a report was prepared in 2008 and updated in 2014 by P. J. White, Chief, Wildlife and

Aquatic Resources; Rick Wallen, Bison Ecology and Management Program and John Treanor, Yellowstone Wildlife Health Program, entitled "Yellowstone National Park: Monitoring and Research on Bison and Brucellosis."

As I point out from pages 166 to 173 in the petition, their high-sounding concerns as stated in their report for the protection of wild bison and the management of brucellosis is followed by actions totally contrary to evidence they cite. Here is just one example:

> *Page 18*: This study [by APHIS] indicates that elk play a predominant role in the transmission of B. abortus to cattle located in the greater Yellowstone area.
>
> *Contradictory action being taken:* Continue to target only bison for slaughter as a means of controlling brucellosis that tests show is being spread by elk, not bison.

The National Park Service in its website "Frequently Asked Questions: Bison Management" claims that 900 bison must be killed this year "to reduce population growth and the potential for a mass migration of bison into Montana." This is fear-mongering used to extort public support for their needless (and genetically harmful) slaughter and is not backed by competent scientific studies, as pointed out in the petition.

In sum, it appears that the agencies that make up the IBMP are deluding the public into thinking they are serving a useful purpose, when indeed, they are not, thereby wasting $3 million annually. As noted in the petition, the most effective way to promote biosecurity in the region of the park and nationally is to ban cattle from the Greater Yellowstone Ecosystem (Personal communication, March 12, 2015).

On April 30 I received a reply from the GAO, which is cited here in part:

> This responds to your March 12, 2015, message to the U.S. Government Accountability Office (GAO), FraudNet, which concerns the Department of Interior . . .
>
> GAO is responsible for assisting the Congress in carrying out its oversight responsibilities pertaining to government programs, activities and functions. Generally, this involves examining the programs and operations of federal departments and agencies, rather than reviewing singular allegations of wrongdoing. Because our resources are finite, we focus our evaluations on those federal programs and activities that Congress has requested us to review. We do not undertake reviews at the request of citizens or citizens groups.

The GAO FraudNet reviewed your information and found the situations you described are not within the scope of any on-going GAO work. Therefore, in accordance with GAO FraudNet policy to forward all reports of wrongdoing to executive agencies, we referred your information on April 22, 2015, to the Department of Interior, Office of the Inspector General (OIG), for their review.

On May 16, I sent the following reply:

Thank you for your response of April 30, 2015. You mentioned that "The GAO FraudNet reviewed your information and found the situations you described are not within the scope of any on-going GAO work."

How can this be so?

In 2008 the Interagency Bison Management Plan was reviewed by the Government Accountability Office. The GAO found the plan lacking, criticizing it in a report entitled “Yellowstone bison: Interagency plan and agencies’ management need improvement to better address bison-cattle brucellosis controversy.”

In response to that critical review, a report was prepared in 2008 and updated in 2014 by P. J. White, Chief, Wildlife and Aquatic Resources; Rick Wallen, Bison Ecology and Management Program and John Treanor, Yellowstone Wildlife Health Program, entitled “Yellowstone National Park: Monitoring and Research on Bison and Brucellosis.”

Do you not have an ongoing interest in the IBMP plan that you criticized? Are you not interested in the status of their monitoring of the IBMP? My petition titled “A Petition to Protect Yellowstone's Wild Bison from Extinction” outlines numerous instances concerning the White report whereby lip service only is given to rectify the deficiencies you have identified in your report. Their lack of adequate response appears to have risen to the level of fraudulent misrepresentation.

Your agency referred this matter to the OIG at the Department of the Interior. How can that department fairly appraise the conduct of an agency under its own umbrella, namely the National Park Service, concerning the areas addressed in your criticism of the IBMP? Further, APHIS and the U.S. Forest Service are also part of the IBMP. Why is this matter not also being referred to the OIG at their parent agency, the Department of Agriculture? (Personal communication, May 16, 2015).

To date, I have not received a reply. On May 20, I was notified that my complaint to the GAO had been forwarded to the OIG at the Department of the Interior. Adolph Benavidez wrote:

> The Office of Inspector General received your complaint from GAO concerning fraud involving various agencies of the Interagency Bison Management Plan. Our office is charged with addressing allegations of fraud, waste, and mismanagement in the U.S. Department of the Interior (DOI) and its programs.
>
> Your commitment in helping the DOI improve the effectiveness of its programs and operations benefits not only the Department but also the public we serve (Personal communication, May 20, 2015).

What is troubling is that the various agencies composing the IBMP are investigating themselves. Apparently, the foxes own the watchdog.

After all is said and done, what is presently going on in Yellowstone makes no sense. One diseased species is allowed to mingle with cattle, while another species is not, yet both species can equally transmit the disease to each other and to cattle. It is a disease-containment charade whose production costs the public $3 million annually.

But the cost is more than money. As mentioned, the cost is the vastly increased potential of the extinction of America’s last wild bison herd. The cost is the permanent elimination of a way of life that had been ongoing for millennia here in North America, namely the buffalo culture, as opposed to the European cattle culture—one culture being a system built on open access to wildlife for sustenance, the other on a closed system that excludes the common man and puts sustenance in the hands of only a few.

What is behind this pervasive lack of reason when it comes to wild bison? It is fear—fear of what is wild. It is fear of those who respect and want to protect what is wild. The arch symbols of wildness are the migratory bison and the wolf. Why? In part because they can not be controlled. They can not be dominated. They can not be owned. What can’t be owned can’t be caged or enslaved. What can’t be caged or enslaved can not generate money for the master—for it has no master.

The wild bison is a symbol of freedom. It wanders where it wants. The migratory bison does not stay behind fences. This means it is public property. It is adjudged a public animal by the very state that wants it controlled: Montana. It was this public animal that supported the culture of the American Indians. It was free access to it that was denied by our government originally as a means of subduing the Plains Indians by decimating it, and it is our government today that continues this practice of denial, denial of the freedom to hunt bison in a wilderness setting.

Controlling wild bison is an attempt to control the Indian nations and their culture that was originally based on wildlife. Wildlife are public animals. But in practice, this is not so when it comes to wild bison. Instead, they are being managed like cattle for the benefit of a few. By its actions, IBMP members are commanding wild bison not to be wild.

The real challenge is not only brucellosis containment, but a decision regarding a way of life. Can this North American populace once again base itself, at least in part, even a small part, on wild bison?

On November 1, 1998, the PBS wildlife television program *Nature* aired an episode called *American Buffalo: Spirit of a Nation*. Luther Standing Bear, an Oglala Lakota chief who died in 1939, described the Indian's attitude toward bison. In an online description of the program by PBS, he was quoted as saying:

> The Indian was frugal in the midst of plenty. When the buffalo roamed the plains in multitudes, he slaughtered only what he could eat and these he used to the hair and bones.

But there persisted a drumbeat against wild bison and the people who depended on them for survival. PBS explained how America lost bison as a staple food when they were almost exterminated in the 1870s and how people are trying to bring back the buffalo from the remnant that survived in Yellowstone:

> Some U.S. government officials even promoted the destruction of the bison herds as a way to defeat their Native American enemies, who were resisting the takeover of their lands by white settlers. One Congressman, James Throckmorton of Texas, believed that "it would be a great step forward in the civilization of the Indians and the preservation of peace on the border if there was not a buffalo in existence." Soon, military commanders were ordering their troops to kill buffalo—not for food, but to deny Native Americans their own source of food. One general believed that buffalo hunters "did more to defeat the Indian nations in a few years than soldiers did in 50." By 1880, the slaughter was almost over. Where millions of buffalo once roamed, only a few thousand animals remained. Soon, their numbers dwindled, with the largest wild herd—just a few hundred animals—sheltered in the isolated valleys of the newly created Yellowstone National Park. As *American Buffalo* shows, it is from this tattered remnant that people are today trying to rebuild the once mighty buffalo nation (Birnbaum, 1998).

The war against wild bison and thereby against the Indian nations and those with an Indian spirit toward wildlife goes on today. It is continued by denying people access to wild, migratory, free-roaming bison just outside Yellowstone National Park. ~~Driving bison into a hunter's range by helicopters and~~ [Use of] government spotters is not allowing bison to roam, but instead is just government slaughter under a different name. And government slaughter of an iconic animal that can benefit this nation by being free to migrate is contrary to the spirit of America.

Throughout Europe during the medieval period the practice of reserving areas of land for the sole use of the aristocracy was common. Such land, which usually included large areas of heath, grassland and wetland—anywhere that supported deer and other game—was referred to as royal forests. When an area was initially designated a royal forest, any villages, towns and fields that lay within it were also subject to forest law. This practice fostered resentment because local inhabitants were restricted in the use of land they had previously relied upon for their livelihoods (Royal forest, 2015).

Under the influence of the Montana Department of Livestock, the Greater Yellowstone Ecosystem has become a royal forest, and no one dares challenge their dominance. The cattlemen have been made king here—but only because our government agencies via the IBMP enable them. If they had to foot the bill themselves for the expenses associated with grazing cattle near such a high disease-risk environment, they could never afford the losses.

Archeological evidence reveals that American Indian tribes used the region of Yellowstone National Park as a kind of summer resort where they fished and hunted game, including bison. Outside the park there are buffalo jumps, cliffs over which the various tribes drove bison for the purpose of obtaining sustenance.

That once-common right has now been put under the total control of the IBMP, which slaughters most of the migratory bison coming from the park and orchestrates hunts that are merely extensions of is slaughtering arm.

Migratory bison should be public property, just as elk are. Fenced bison are either off limits to the public as far as hunting is concerned or are privately owned and thus barred from the public. Not allowing bison to leave the park is the same as fencing. Hunting that employs government agents ~~in helicopters and~~ on the ground ~~to force bison across the park's boundary so they can be shot~~ is not hunting but government culling. Shipping off wild bison to meat processing facilities or even to Indian reservations where wild bison are fenced quite obviously does not promote migration, does not promote the wildness of wild bison and does not promote genetic diversity because it does not allow the expression of the migratory instinct.

And what happens to all the meat, hides and horns from bison shipped to meat processing facilities? According to the website "Frequently Asked Questions: Bison Management":

> The NPS has proposed to periodically provide some Yellowstone bison to American Indian tribes and tribal organizations like the InterTribal Buffalo Council, for direct transfer to approved meat processing facilities.
>
> The distribution of meat, hides, horns, and other bison parts will be at the discretion of the American Indian tribes and tribal organizations to support their nutrition and culture.

This government dictated process does not support the American Indian tribes' culture. Instead, it is a slap in the face. They are the ones who for millennia were self-supporting because of their reliance on wild bison, which they hunted on their own, but which are now given to them by our government as a handout. That does not represent the American spirit. And we wonder why there are problems on the Indian reservations. It is because we have taken away their dignity by taking away their way of life. And a leader in this effort is the IBMP, submissive to cattle interests.

Around Yellowstone, cowboys rule. But they rule only under the protective arm of the government, both state and federal, which allows cattle to graze on the fringes of a biohazardous environment, the park, and underwrites expenses to the tune of millions upon millions of dollars in emergency response services directed at keeping the park's iconic species, wild bison, separate from the sacred cows.

The new plan

It should surprise no one that the proposed alternatives for a new Interagency Bison Management Plan are biased. They have been crafted by members of the IBMP, anti-wildlife sultans who are in charge and appear intent on remaining so by offering alternatives that are no alternative whatsoever to the present status quo.

According to the National Park Service:

> It's time to craft a new plan and find different ways for the public to get involved. The park and the state of Montana are working together to update the current bison management plan (IBMP). While the existing plan has been effective at preventing brucellosis transmission and maintaining a viable herd, we believe that we've outgrown it—new data about general biology and disease prevalence are available, and public opinion is shifting toward more tolerance for bison in Montana. We need a new paradigm that accommodates larger herd sizes and allows bison to move more freely on suitable public lands in the Greater Yellowstone Ecosystem. We look forward to engaging the public in this process and exploring new ways for people to make their voices heard (Bison Management, 2015).

The proposed new plan provides six alternatives for the public to comment on. All involve a range of bison population allowed in the park.

But why this bias? Nothing is mentioned about allowable elk populations in the park. Nothing is mentioned about allowable cattle populations in the ecosystem. Only bison.

The newsletter states that the alternatives presented may change:

> During this scoping period, the National Park Service and State of Montana are seeking comments on a range of preliminary draft alternatives. There is potential, based upon public comments received during the public scoping period, that some of the preliminary draft alternatives or alternative elements may change between now and the release of the draft plan/EIS. Therefore, if

> you have specific issues relating to the preliminary alternative concepts, please include those in your comments.

In addition to a call for comments about the alternatives provided, three questions were asked. My answers to the supplemental questions follow:

Question 1: What other alternatives, alternative elements, or management tools should be considered?

The "new data about general biology and disease prevalence" as mentioned by the NPS contradicts a claim that was a basis of the 2000 *Record Of Decision* that established the IBMP, namely, that elk were not a threat of brucellosis transmission to cattle. That foundation of the present plan has crumbled. According to the 2000 *Record of Decision*:

> Brucellosis also occurs in elk in the Greater Yellowstone Area. The National Academy of Sciences (1998) assessed elk transmission risk relative to that of bison. Unlike bison, elk tend to exhibit a "hiding" strategy during the calving period, separating themselves from the herd to calve. Elk also are meticulous at cleaning up afterbirth and soil and vegetation from calving sites. Both of these behaviors tend to reduce the opportunity for transmission of brucellosis among elk that are not artificially concentrated on feedgrounds (NAS 1998). This has probably contributed to the relatively low seroprevalence rate in the northern Yellowstone elk herd. This low seroprevalence rate of both the northern and the Madison-Firehole herds, despite occasional seasonal concentrations that result in densities similar to those found on winter feeding grounds (Ferrari 1999), suggests that the risk of transmission from those elk to cattle is lower than that of bison (NAS 1998) (Record of Decision, 2000, p.).

These claims originally made by the IBMP about elk versus bison disease prevalence have proven to be false.

Yet these finding are being disregarded as demonstrated by the limited range of alternatives proposed for consideration. As pointed out, only bison population is in question. Such disregard for new biological findings is disheartening, for a blind eye is being turned to the only meaningful solution for brucellosis disease control in the GYE.

While it may be the case that "public opinion is shifting toward more tolerance for bison in Montana" and that we "need a new paradigm that accommodates larger herd sizes and allows bison to move more freely on suitable public lands in the Greater Yellowstone Ecosystem," more tolerance for larger herds inside or outside the park has nothing to do with solving the problem of *Brucella abortus* transmission from wildlife to cattle in the ecosystem.

More tolerance will not magically make interspecies transmission go away. Further, herd size in and of itself has little to do with the problem. Rather, it is the degree of separation maintained between animals of different species that controls transmission. One bison or one elk with brucellosis can infect an entire herd of cattle with that disease, either by mingling with cattle or by shedding fetal material where cattle will be present. Increased elk or bison populations may increase the probability of transmission by increasing the probability of comingling, but if they do not come in contact with each other either physically of by means of shed brucellosis-infected birthing materials or inhalation of the bacteria, no infection will occur.

What is needed is *complete* separation of cattle from diseased-carrying ungulates at all times to effectively prevent transmission. That the spread of brucellosis probably will not happen, or might not happen, under this or that alternative that allows cattle in the ecosystem is not good enough.

With cattle grazing adjacent to the park, no bison herd size will prevent transmission except zero, and that would destroy the essence of the park and, of course, make wild bison extinct. But zero cattle in the ecosystem would work perfectly. The presence of cattle domesticates wildlife, bringing with it domestic diseases, such as bovine brucellosis, and dramatically increases the risk of interspecies infection.

But alternatives proposed for the new bison management plan do not include the option of removing cattle from the ecosystem. Instead, the public is given a range of acceptable bison population levels to ponder—as noted from 2,500 to less than 7,500. Why should any of these levels solve the problem of disease transmission? Who knows? The IBMP certainly does not, nor is the public ever told.

The alternatives now presented are problematic. For instance, if the alternative allowing a herd population of up to 7,500 is adopted**,** the probability of more contact with cattle will be increased. If this occurs, the potential for greater disease transmission to cattle will increase, elevating the biohazard risk. In the real world, one can not have his cake and eat it, too. One can not have cattle mingling with bison and elk, known carriers of brucellosis, and not run the risk of transmission of the disease**.**

Below is my table summary of the proposed six alternatives provided by the NPS and the state of Montana. Added to the table is alternative 7, banning cattle from the ecosystem, which is the only feasible alternative that would control the spread of brucellosis from the park *and* maintain a viable wild bison herd.

Table 13. Range of Preliminary Draft Alternative Concepts (with suggested alternative number 7 added)

Alternatives	1 Continue 2000 IBMP, as adjusted. No Action Alternative	2 Minimize Human Intervention	3 Limit Bison Migration into Montana	4 Suppress Brucellosis Transmission	5 Tolerance in Montana Linked to Overall Bison Abundance	6 Balance Bison Conservation and Brucellosis Transmission Risk	7 Ban cattle from park perimeters
Population goal	3,000	up to 7,500	3,000	3,000	3,000	2,500 to 4,500	Carrying capacity
Population control	Yes	None listed	Yes	Yes	Yes	Yes	None
Population management	Capture, holding, ship to slaughter	Natural processes	Capture, holding, ship to slaughter	Capture, holding, ship to slaughter	Capture, holding, ship to slaughter	Capture, holding, ship to slaughter	Natural processes
Physical separation of bison and livestock	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Haze back	Spring	Limited	Spring	None listed	Limited	Limited	None
Tolerance thresholds out of park	Yes	None listed	None listed	Yes	Yes	Yes	No threshold
Vaccination	Yes	No	No	Yes	No	No	No
* Terminal pastures	None listed	No	Yes	Yes	Yes	Yes	No
Adjustment of land use for cattle	No	No	No	Yes	No	No	Yes
Hunting	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wildlife management (e.g., habitat enhancement)	No	Yes	No	No	Yes	No	Yes

* ***Fenced areas within which bison would be harvested over time.***

Question 2: What issues should be considered when evaluating future management of Yellowstone-area bison?

The single most important issue that should be addressed in the future management of wild bison is the need for honesty with the public about the needs and status of wildlife in Yellowstone National Park and its surrounding environment, the Greater Yellowstone Ecosystem. This is sadly lacking now.

By dancing around the fact that elk are the greater vectors of the disease of brucellosis, by not facing the fact that bison are not the only potential disease transmitters to cattle, by trumping up studies that support culling bison at a population level of 3,000 in the park, by justifying claims that genetic diversity is maintained by culling when numbers are about 3,000 with studies that are not relevant, by citing studies that justify capture facilities as natural dispersal sinks when they are not, by pretending to meet the Plains Indian tribes' cultural needs by giving them a handout of government-killed bison, by offering only a restricted number of alternatives for a new bison management plan and on top of that, not allowing public comment on additionally selected alternatives recommended by the public, the IBMP only promotes a culture of deception.

If the IBMP were honest, it would face the facts and say what those facts are, instead of using scientists to mislead by manipulating facts. By not doing so they misrepresent. Since the program annually costs $3 million in state and federal funds to administer, IBMP is potentially opening itself up to being criticized with engaging in mismanagement, waste and fraud.

State and federal agencies have an implied contract with the public to perform in its best interests, to tell the truth about what they are doing and the impact such actions will have. Under contract law, a plaintiff can recover against a defendant on the grounds of fraudulent misrepresentation if (1) a representation was made; (2) that was false; (3) that when made, was known to be false or made recklessly without knowledge of its truth; (4) that was made with the intention that the plaintiff rely on it; (5) that the plaintiff did rely on it; and (6) that the plaintiff suffered damages as a result.

In this case, the plaintiff would be the public and the damages would be both in the needless expenditures incurred to carry out this pseudo brucellosis-mitigation program as well as the damage to the wild-type genetics of wild bison. The truth, that this double-standard of disease control has absolutely no epidemiological benefit, is being hidden from the public that is funding this boondoggle.

Since the program is for the commercial benefit of the cattle industry, compensation for damages should be paid for by the complicit members of that industry. Since this program has been ongoing since 2000 under the IBMP, with expenditures on the average of $3 million annually, monetary damages alone would amount to more than $45 million. And that does not count the cost of the extensive culling programs prior to 2000.

As noted, of special concern is that government partners comprising the IBMP promote the necessity of a biased wild-bison extermination program, claiming it will prevent the spread of the disease, while they do nothing to manage elk migration. By that fact alone their public statements in support of the program are misrepresentations.

NPS has stated that "the existing plan has been effective at preventing brucellosis transmission and maintaining a viable herd . . ." This self-appraisal is false. Under the existing plan more than 20 incidents of elk infecting cattle have occurred in the greater Yellowstone area since 2002 and none from bison. If containment of brucellosis spillover from wildlife in the park to cattle outside the park is the objective, then targeting only one species that carries the disease, when in fact two species carry the disease, has no disease-control value. This is true in principle and has been demonstrated by biological data collected since the inception of the IBMP.

Further, the viability of the herd has been severely compromised by killing thousands upon thousands of migratory bison under the management of the IBMP. This is artificial selection. The difference between natural selection and artificial selection is whether the difference in reproductive success is driven by naturally occurring processes or imposed by humans. Because those bison that do not migrate out of the park are the ones that are left behind to breed, a shift in the population is systematically occurring at the rim of the park, a population of non-migratory bison in the interior, as opposed to migratory.

This process of artificial selection is destroying the naturally occurring trait of migration, a trait that typifies wildness and under natural conditions is essential for survival. But both the IBMP, by its continued practice of large-scale reductions, and the FWS, by its denial of my 1999 petition's claim that such practices will eventually remove wild bison's migratory instinct, wink at this as a possibility. By their speech and by their acts, they are denying the reality of what Charles Darwin wrote in *The Variation of Animals and Plants under Domestication,* that "we may conclude that we have in selection, even if only occasionally practised, a potent means of modification" (Darwin, 1875).

The present herd is being modified into extinction. It is being set up for a collapse. Given a severe winter or given just the progression of time, with the systematic elimination of the migratory trait—a trait that brought these animals across the Bering Land Bridge to this continent over 10,000 years ago—wild bison will cease to exist.

By not squaring with the public about the detrimental consequences of killing only migratory bison, the IBMP is further misleading them. Selection, whether artificial or natural, determines the behavior and morphology of an animal. The park is a genetic bank of wild-type bison DNA. With the level of artificial selection now going on at the park against the genetic architecture of migration-related traits—such as those genes that regulate the timing of migration, the urge to disperse, aggressiveness and leadership—the park will become genetically bankrupt of those characteristics that make wild bison wild. The animals allowed to survive are the non-migratory, potentially the more docile, the more domestic, the more disease-prone. That is all that will be left. Sooner or later, wild bison will be no more.

Instead of doing the right thing—removing cattle from the perimeters of the park—the IBMP, backed by the cattle industry, continues to insist on conducting its destructive culling at public expense, claiming it has value, when in fact it does not. This is dishonest.

A second element that should be considered in the future management of wild bison is to investigate the possibility of preserving by means of cryopreservation the eggs and semen of wild migratory bison. This should be done in hopes that when the mania for killing migratory wild bison passes, we can avoid what several countries are now trying to do with regard to bringing back to life the now-extinct aurochs.

According to “Science and Scholarship in Poland” a public website on current achievements of Polish scientists:

> Using DNA from auroch remains held in museums, Polish geneticists from the Department of Biochemistry and Biotechnology of the Agricultural University in Poznan and the Institute of Human Genetics of the Polish Academy of Sciences (PAN) want to recreate the auroch—an animal, which in the middle ages was a symbol of Polish forests. The project has already gained the support of the Ministry of the Environment.
>
> The initiator and coordinator of this idea is the Polish Foundation for Recreating the Auroch (PFOT).

Reporter Katarzyna Czechowicz quoted one of the team’s leading researchers Ryszard Slomski on the importance of the project:

> “This project is not only the recreation of the species,” Prof. Slomski noted. “It is also understanding its history, studying its relation to other species, indicating its closest relatives, noting similarities and differences with domestic cattle. Therefore it is important to treat this recreation on a wider scale than simply leading to the birth of a living animal.” He also noted that this project helps us understand how many species are becoming extinct before our own eyes and perhaps will help devise methods for preventing this (Czechowicz, 2015).

While maybe some day Yellowstone National Park could provide the DNA for a Jurassic Park-like de-extinction research project, whereby an extinct wild bison is reborn via cloning, since the technology does not yet exist to obtain DNA suitable for cloning from old bones, we could preserve what we still have via cryopreservation: wild bison eggs and sperm from migratory animals, instead of washing it down a slaughterhouse drain.

Thirdly, with the abysmal failure of the IBMP in its management of bison in Yellowstone now well established, a new culture should be placed in charge, one that has a successful history of buffalo management for millennia , namely, the Plains Indians. They, as a group, should be given deciding powers on how to manage bison in the Greater Yellowstone Ecosystem. With cattle removed from the ecosystem, the Montana Department of Livestock would not need to participate. They should stick to what they do best, managing domesticated animals instead of involving themselves in the management of wildlife. Proper management would mean removing their livestock from a biohazardous environment.

Fourthly, with cattle removed from the borders of the park and ideally from the Greater Yellowstone Ecosystem, bison would thereby not be a brucellosis threat and would be free to migrate out of the park. With that barrier gone, the real problems in evaluating future management of Yellowstone-area bison could be addressed, such as what to do with wild bison in closer proximity to towns, private property, houses, highways and schools.

Question 3: What do you like and dislike about the preliminary alternatives?

The preliminary alternatives appear to be neither alternatives nor preliminary. The choices offered are just different versions of the status quo and the call for the public to suggest additional alternatives is meaningless, for it does not allow for public comment on the public's suggestions.

According to the newsletter that accompanied the announcement, the planning process entails the following steps:

Step 1. Define purpose and need/develop preliminary alternatives.
Step 2. Conduct external scoping.
Step 3. Refine alternatives.
Step 4. Identify environmental impacts and select preferred alternatives.
Step 5. Prepare draft plan/environmental document.
Step 6. Public review of draft plan/environmental document.
Step 7. Analysis of public comment.
Step 8. Prepare and release final plan/environmental document.
Step 9. Sign and implement Record of Decision.

As of this writing, the planning process is at step 2, namely, conducting the external scoping.

The newsletter mentioned that some of the alternatives may change based on input from the public concerning additional alternatives to be considered. If this statement is to have meaning, a second comment period should be provided for the public so comments can also be made on the newly proposed alternatives. If this is not done, the entire scoping effort would be disingenuous and further evidence of persistent misrepresentation.

How can the evaluation reach step 3, “refine alternatives,” and proceed to step 4, “identify environmental impacts and select preferred alternatives,” if the public is not given a chance to comment on the alternatives they have been asked to suggest?

For instance, the Buffalo Field Campaign recently proposed that alternative plans should include managing wild bison like wild elk, that is, by hunting (Geist, 2015). Is that alternative included for the public to comment on? No, and under the present scoping process outlined, it will not be. Is the alternative provided that would ban cattle from the Greater Yellowstone Ecosystem? No, and under the present scoping process outlined, it will not be. And thereby with those omissions the scoping effort will not represent the will of the public.

As the scoping alternatives are composed now, by proposing only limited, non-representative alternatives to comment on is tantamount to “leading the witness” in a court trial. Leading the witness is asking a question during a trial or deposition which puts words in the mouth of the witness or suggests the answer, which is improper questioning of a witness called by an attorney, but is proper in cross-examination or allowed if a witness is declared by the judge to be a hostile or adverse witness.

Without publishing the publicly-suggested alternatives and without allowing public comment on those additionally proposed alternatives, the public would be treated as hostile by members of the IBMP regarding the issue at hand.

By potentially eliminating key choices, the power to select the “preferred alternative” would be put into the hands of the evaluators, the NPS and the State of Montana, specifically, Montana Fish, Wildlife & Parks and the Montana Department of Livestock.

The foxes once again are misleading the public by such tactics. A misled public can not make adequate decisions.

The point is not how many bison to allow into the Greater Yellowstone Ecosystem, but how many cattle. If looked at monetarily, the answer is no cattle. If looked at ecologically, the answer is no cattle. It just does not make any sense to do so.

For references cited in “Comment on alternatives” see pages beginning at 696.

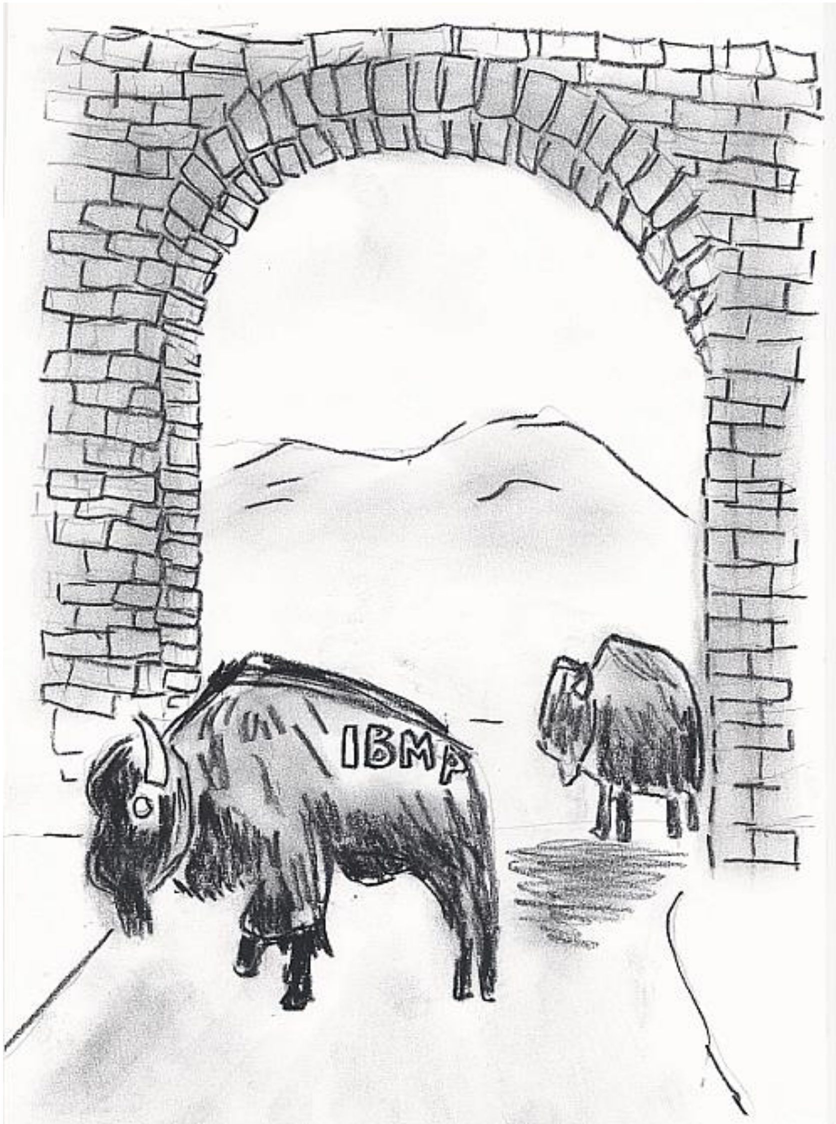

Figure 96. ENTERING THE KILLING ZONE. As though branded as the personal property of the IBMP, bison that attempt to exit the park are subject to lethal removal by this agency, in effect turning Yellowstone National Park into a stockyard and slaughterhouse. This duo is exiting the park through its North Entrance via Gardiner Basin. ***Above image released to the public domain by author James Horsley.***

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Solution: A cordon sanitaire

Wild bison are being held captive in Yellowstone National Park by our government at both the state and national levels. We have looked again and again at the many facets of problems cascading from such captivity. Like an avalanche, captivity is heading inevitably to one result: extinction of Yellowstone's wild bison. The captors, the members of the Interagency Bison Management Plan, are heading in the opposite direction from the direction that should be taken. They have operated under the cover of duplicity. They pretend that they are fighting the disease brucellosis by stopping wild bison in their tracks as they attempt to leave the park, thereby keeping this species locked in only part of the habitat they require to survive.

The mounting evidence of research shows that close proximity of animals, crowding and captivity cause the spread of brucellosis and that under these conditions disease can jump the "species barrier" and cause interspecies transmission.

That captivity promotes disease transmission is recognized even by those who hold wild bison hostage. Rick Wallen, Yellowstone National Park bison biologist, in an interview by Stephany Seay, Buffalo Field Campaign's media coordinator, confirmed that holding bison in pens, as they are currently doing, increases the risk of brucellosis transmission among bison due to crowding.

As shown on YouTube, the following exchange took place in 2010 in front of the Stephens Creek capture facility:

> Seay: "I have a question. This is a holding pen of the animals, of the pregnant females, females giving birth. All this mismanagement, I am going to call it, against wildlife, is supposedly due to brucellosis. Don't you feel that holding these animals during their calving, having abortions, causing abortions, giving

birth in close proximity, don't you feel you are exacerbating any potential of risk?”

Wallen: “The risk to transmission among the bison?”

Seay: “Among the buffalo.”

Wallen: “Yes, that is correct.”

Seay: “So you do feel you are increasing the risk?”

Wallen: “Yes” (Seay, 2011).

In the park, the proportional population densities between migratory and non-migratory bison is progressively being tipped more toward population growth of the non-migratory herds, as opposed to the migratory for the simple fact that only migratory bison are culled. This leaves behind an increased proportion of non-migratory breeding stock.

Where do these non-migratory bison, that is, those that do not leave the park in the winter, congregate? Many gather for survival around the thermal pools and the streams they feed into. Here the warm water keeps the pools and streams open and allows bison to forage sedges and other grasses along the banks.

Figure 97. WILD BISON CONGREGATE in the water and along the banks of Firehole River, which remains open all winter because of the warm water from the thermal pool region. ***Meagher, 1972, NPS Scientific Monograph No. 1.***

On October 15, 2014 I asked Rick Wallen:

> . . . have any studies been made that a source of brucellosis in the wild bison is from the fact that during the winter they congregate at the thermal pools for warmth and forage? It would seem that if that were the case, killing migratory bison would promote a bias toward the non-migratory herd and thus increase populations at the pools, such crowding creating conditions more favorable for *Brucella abortus* transmission.

He replied:

> I do not know of any such studies. I would suggest you review the transmission dynamics about how brucellosis persists in infected populations (Rick Wallen, personal communication, October 24, 2014).

Fair enough. I reviewed the literature on such transmission dynamics. According to the Center for Food Security and Public Health at Iowa State University, "some *Brucella* species have been detected in secretions and excretions, including urine, feces, hygroma fluids [such as in cysts], saliva, and nasal and ocular secretions." Further,

> *Brucella* can be spread on fomites [sources of contamination] including feed and water. In conditions of high humidity, low temperatures, and no sunlight, these organisms can remain viable for several months in water, aborted fetuses, manure, wool, hay, equipment and clothes. *Brucella* can withstand drying, particularly when organic material is present, and can survive in dust and soil. Survival is longer when the temperature is low, particularly when it is below freezing (Brucellosis, 2009).

Such sources of contamination and weather conditions exist routinely in the Yellowstone area, especially in the thermal pool regions where there are conditions of high humidity, low temperatures, water, aborted fetuses, contaminated forage, feces and urine. And crowding. These conditions can also persist at Gardiner Basin and Hebgen Basin.

By concentrating wild bison in capture facilities, by not allowing them to disperse via migration and by promoting dense populations in the thermal pool regions of the park, IBMP member agencies are creating the ideal environment for brucellosis transmission. Given all this evidence against the present plan, what is the solution? What is needed is a buffer around the Greater Yellowstone Ecosystem that includes the migratory habitat of wild animals, especially wild ungulates. But instead of a "no man's land" or a "no bison land," it would be a "no cattle land."

Mary Meagher, the renowned Yellowstone National Park biologist, advocates creating a "cordon sanitaire" around the park free of cow-calf operations. A 1996 study published in *Ecology* titled "The Population Dynamics Of Brucellosis in the Yellowstone National Park" determined that neither vaccinating bison nor culling were viable methods of controlling the transmission of brucellosis from bison to cattle. The study conducted by Andrew Dobson, department of ecology and evolutionary biology, Princeton University, and Meagher, National Biological Services, Midcontinent Ecological Center, Greater Yellowstone Field Station, Yellowstone National Park, found that sustained infections of brucellosis require bison herds in excess of 200-300 animals. Once a herd drops below this number brucellosis tends not to be present. The authors state:

> The removal of animals crossing the boundaries of the park is the present policy for bison in the Yellowstone ecosystem. The historical records that detail the relationship among stock, recruitment, and removals, and the relationship between population size and prevalence can be combined to examine the relationship between culling intensity and resultant prevalence . . . This analysis suggests one would need to almost eradicate the bison before one could produce significant reduction in prevalence. More significantly the levels of removal required to eradicate *Brucella* may be sufficient to also drive the bison to extinction.

They concluded that:

> The analyses presented here suggest that the best approach to brucellosis control would be to create a cordon sanitaire or buffer zone around the park. This could easily be done by allowing vaccinated or sterile cattle in areas around the park. There are two alternatives to pay for this program; government subsidies could pay for brucellosis vaccination scheme in cattle, or, present levels of subsidies could be reduced, or removed, from ranchers who continue to ranch cow-calf herds in this area. A complete transformation to either heifers and steers for an area within 30-80 km [about 20 to 50 miles] around the park should insure that brucellosis is contained within the area of the park (Dobson et al., 1996).

But would this be enough? According to APHIS, vaccinating cattle:

> . . . is not 100 percent effective in preventing brucellosis; it typically protects about 70-80 percent of the vaccinated cattle from becoming infected by an average exposure (Facts about brucellosis, 2015).

Nor would limiting the presence of cattle to spayed heifers and steers near the park reduce the risk of brucellosis transmission from bison to cattle to zero, which is the goal of the IBMP. Although they can not abort, they can become infected with brucellosis and spread the infection through exposure to multiple sources of contamination.

Instead of creating no-tolerance zones for bison in Gardiner Basin, Paradise Valley and the Hebgen Lake region, they should be designated as no-tolerance zones for cattle. Such a practice would comply with proper herd management strategies to aid in the avoidance of the disease as recommended by APHIS, namely, maintaining closed herds. Such separation of cattle from the source of disease, namely wildlife in the park, would assure that brucellosis would not be transmitted to cattle. It would allow bison to migrate unmolested in the winter to the most critical area, Gardiner Basin, at least up to the natural and man-made bottleneck of Yankee Jim Canyon, as well as into the Hebgen Lake region for calving in the spring, which is now being allowed for Horse Butte in Hebgen Basin. It would preserve the gene purity of the last wild herd of bison, preventing them from mating with cattle that now graze year around in the basin. And it would save taxpayers $3 million annually on IBMP's epidemiologically futile efforts.

It would also allow closure of the Stephens Creek capture facility. The wildlife park should not function as a stockyard. At present, every day when the facility is occupied and while the bison are being held there prior to slaughter, a green tractor rumbles through the fenced pasture, spreading hay from round bales as hundreds of wild bison run after it, pausing to catch mouthfuls of straw. This is wilderness?

No, because wildlife disease is promoted by captivity and the stresses of confined conditions, this is not wilderness but the breeding ground for brucellosis. This is a stockyard.

To preserve the genetic diversity of wild bison, no culling should be permitted. To keep the bison herd at range capacity and to maintain the balance of nature, only wolf predation and the hunting of bison as migratory animals, just like elk, should be allowed to remove bison from the Yellowstone habitat, while hunting of the wolf should be banned in the GYE.

The idea is to separate such wild animals as bison from cattle and other livestock spatially and temporally so they cannot occupy the same space at the same time. Livestock, whether caged, fenced or free-range, can act as vectors of zoonotic diseases and therefore should not occupy a wildlife ecosystem where such diseases can spill over. Hunting and wolf predation have a better chance of operating within the parameters of natural selection, where the less physically fit or the least fearful are easier prey. Such practices would help restore the wildlife integrity of the Greater Yellowstone Ecosystem as well as most efficiently and most economically promote the national security with regard to the transmission of such diseases as brucellosis, both in the same species and between species.

Using bison to generate income via hunting and other fees would appear to be more profitable than cattle and other livestock here in the GYE. What should be studied is just how to do this so that it would be fair to the public, private property owners, business operators and their employees.

Such a plan should be given time to develop so that data can be collected. With the potential of highly positive outcomes, both for wildlife and for the people either living in, near or visiting the Greater Yellowstone Ecosystem, patience in monitoring the outcome of allowing wild bison to migrate into such areas as Gardiner Basin and the Hebgen Lake region should be exercised so that adjustments could be made.

Such adjustments could entail compensation of persons who have suffered property loss or damage by migratory wild bison, lethal removal of specific individual animals that pose a risk or the fencing of property to prevent damage by keeping bison out. Where needed, the idea would be to protect or fence individual properties from bison damage, instead of the entire denial of bison from their migratory habitat by such methods as lethal removal or hazing. Dividing wild bison migratory habitat, either public or private, into various zones and sectors where bison can or can not occupy within this or that space of time has proven not only unworkable, but harmful to the wildlife of the ecosystem.

Recall that in a report written in 2008 and updated this year, the National Park Service wrote:

> Simulations of migrations over the next decade suggest that a strategy of sliding tolerance where more bison are allowed beyond park boundaries during severe climate conditions may be the only means of avoiding episodic, large-scale reductions to the Yellowstone bison population in the foreseeable future (White, 2008 and 2014).

Many members of the community have been working toward these objectives. Bison range expansion efforts have been ongoing. By means of government and private efforts to increase grazing habitat for bison outside the park in these regions, land has been acquired, creating a patchwork of areas where bison are allowed. However, the complexity of such land-use designations is hard for humans to understand and control. And of course it is incomprehensible to bison, which do not have the capacity to recognize invisible property lines.

Modifications to the presently existing plan (IBMP) have been under study by Montana’s Department of Livestock and Department of Fish, Wildlife and Parks because some of the contested habitat areas were no longer occupied by cattle and because some grazing allotments had been closed to cattle. Further, APHIS has adopted changes to longstanding brucellosis regulations so that if an outbreak occurs, a cattle producer is no longer required to depopulate an entire herd nor would a state be automatically downgraded from a Brucellosis Class Free status (Draft Joint Environmental Assessment: Year-round Habitat for Yellowstone Bison, 2013).

Proposed alternatives included using mountain crests as a dividing line for the Gardiner Basin area, with the only way out, other than crossing over the mountains, being Yankee Jim Canyon, where fencing and a cattle guard discourage further migration. In the Hebgen Lake region, terrain habitually used for calving by bison has been studied and as of 2016 year-round habitat for bison was granted by the governor of Montana for Horse Butte in the Hebgen Basin.

Over 100,000 comments from the public were received concerning the joint proposal by the Montana FWP and the Montana DOL to expand the tolerance zone for bison outside the park. However, that plan was tabled indefinitely by the Montana Board of Livestock (BOL) in May, 2014. It would have enabled bison to roam on as much as 421,000 acres of federal, state and private lands west and north of the park (Rice, 2014; Forrest, 2014). The status quo, lethal removal, by default remains the policy.

The NPS and the state of Montana are in the process of revising the IBMP through the writing of an environmental impact statement. Alternatives include allowing a range of bison populations in the park—from 2,500 to 7,500. However, no alternatives for removing cattle from the regions bordering the park are on the table, biasing the entire EIS.

Dr. Ralph Maughan, professor emeritus of political science at Idaho State University and president of the Wolf Recovery Foundation, commented in general about the conflict:

> It is the Montana Department of Livestock and certain politicians pushing us around and showing us their power by killing the bison that leave Yellowstone. It is a clash of cultural values and they kill bison to show who is really in charge in this area (Hudak, 2011).

Those who thought the conflict between cattle and bison could be solved by more habitat are learning that the central issue is a numerical one: the acceptable number of bison in the park. That number, according to the wild bison population gurus, is about 3,000. The balance of nature, which would limit bison populations by weather (such as winter kill), range capacity and predation (such as by wolves and disease), has been discounted. Instead, government has placed itself in the role of Mother Nature. It will have tragic consequences. It is just a matter of time.

At stake is not only the health of the herds, but also their unique identity and composition as distinct species. What is troubling is that the government, via its interagency coalition, has launched a culling program without knowing specifically what it is doing or its effects downstream. All it knows and all it cares about is what it wants: only cattle grazing on lands outside the park. No bison.

Treating wild bison like livestock to be owned and managed by the IBMP is not the answer. Clearly, the present management of the wild bison in Yellowstone National Park may be sufficiently off track, in the words of Meagher, to “drive the bison to extinction.”

The presence of the gray wolf within this cordon sanitaire is critical to restoring the balance of nature in the ecosystem. Protection of the wolf should be specifically required as an integral part of the protected habitat for bison. Wolves remove bison by means of natural selection, instead of the artificial selection now conducted by the IBMP. Their predatory activity would contribute to a more economical control of bison populations, as well as a means of preserving the genetic diversity of wild bison. For the same reason, bison hunting should be continued, as wild bison have coexisted with human populations hunting them for millennia, but it should be done on the basis of sustainability, not the despoliation of a wild species.

While listing wild bison under the Endangered Species Act would make it is unlawful for any person to take such species, the act provides that exceptions may be granted to enhance the propagation or survival of the affected species. Survival would be enhanced by hunting. Under the act, an applicant can request a permit to hunt wild bison, but must first submit a conservation plan that specifies such things as the impact likely to result from such taking and the funding available to implement such conservation steps (Endangered Species Act, 1972).

It would seem probable that an applicant such as a member or group from an American Indian tribe, as well as other hunters, could demonstrate that historically over the course of 10,000 years during pre-settlement times, wild bison evolved here in the presence of human hunters and were at the height of their population numbers and genetic diversity in such a hunting environment.

It should be obvious, however, that the hunting going on at Beattie Gulch, a few miles north of Gardiner, is not acceptable. It is merely an extension of the lethal removal policy of the IBMP. The Buffalo Field Campaign reported in January 2015:

> Snow has been accumulating in Yellowstone country, and buffalo are beginning to seek lower elevation habitat. Nine buffalo have been gunned down at the north boundary of Yellowstone National Park since our last writing, bringing this year's death toll to at least fifteen.
>
> Over the weekend, a group of thirteen buffalo approached Beattie Gulch, the boundary between Yellowstone National Park and Gallatin National Forest. We thought for sure that this whole family group would be wiped out. Hunters were literally lined up on the Forest Service side of the line, just waiting for them to cross. The hunters ended up waiting all day and the buffalo bedded down on the Park side of the Gulch. As the light waned, the hunters went away empty handed. The buffalo, sensing temporary safety, crossed in the middle of the night and were found on private property the next morning, where they could not be hunted.
>
> Over the course of the next few days, some buffalo eventually left the relative safety of private property, and one by one, they are being picked off. On Wednesday, treaty hunters hastily shot into a group of buffalo that had crossed into Montana at Beattie Gulch, killing a couple and wounding at least one. The buffalo that didn't die turned around and ran into Yellowstone National Park, where they cannot be pursued. BFC patrols have been monitoring one wounded adult female. If the Park Service spots her, they may "dispatch" her, and the hunter who shot her will still get to fill his "unused" tag.

> Hunters are swarming into the Gardiner Basin, just waiting for buffalo to step over the boundary. Tens of thousands of acres of habitat have recently, though temporarily, been opened to buffalo, but they never get a chance to access these new lands as they are gunned down before they make it very far. This firing line style of killing is another stark illustration that this so-called hunt is nothing more than a livestock industry-driven extermination program aimed to prevent wild, migratory bison from re-inhabiting even fractions of their native Montana landscape (Update from the field, 2015).

As Laura Lundquist reported recently for the *Bozeman Daily Chronicle*:

> Since hunters have to wait for the bison to leave the park, they wait for their chance in the open Forest Service land near Beattie Gulch, and the bison don't get much farther.

She wrote on Christmas Day, 2014 a story on the issues concerning wild bison migrating out of the park. She said:

> Four tribes—the Confederated Salish and Kootenai Tribes in Montana, and the Nez Perce, Umatilla and Shoshone-Bannock in Idaho—have treaty rights to hunt Yellowstone bison. Montana hunters also get a limited number of tags.
>
> With only two places to hunt—near Gardiner and West Yellowstone—hunters would like to stalk bison on a broader landscape.
>
> "Coming from a ranching family, I can see it from both sides. I can understand some of the concerns that ranchers have," said Kootenai wildlife manager Tom McDonald. "But what we really need to do is just allow bison to get out and express themselves on the landscape, and over time through our diligence, people can become accustomed to them on the landscape."
>
> But so far, ranchers' concerns have constrained wandering bison to bulges of land near the park, creating problems with gut piles, overgrazing and, ultimately, population control.
>
> As of this summer, about 4,900 bison lived inside the park. The northern herd, which migrates out near Gardiner during the winter, has 3,500, and the rest belong to the central herd, which trundles out near West Yellowstone.
>
> That's more than ranchers and the Montana Department of Livestock want.
>
> So during recent Interagency Bison Management Plan meetings, DOL representatives pushed for the removal of as many as 1,000 bison through hunting or capture-and-slaughter this winter.
>
> Last winter, about 650 animals were removed, half by hunters.
>
> The IBMP partners reached a tentative compromise of 900 for this year.
>
> But as of three weeks ago, the tribes were still trying to work that number down, worried that the cull would select against animals with migratory

> tendencies. Plus, a larger herd means more animals leave the park, providing more hunting opportunity.

Lundquist noted that steps are being taken for increased tolerance of wild bison outside the park:

> After a year's delay, more area around Hebgen Lake may open up to bison year-round.
>
> The DOL and FWP conducted an environmental study of a policy of allowing bison onto almost 422,000 acres of national forest land with no cattle in the upper Gallatin Basin.
>
> The majority of almost 120,000 public comments submitted in September 2013 supported the proposal.
>
> It stalled in May after the Board of Livestock refused to vote on the study, saying it would wait for a new Yellowstone bison management plan, which is only in initial development (Lundquist, 2014).

The bottom line is this: while elk are managed as wildlife and are allowed to move in and out of Yellowstone National Park, wild bison are managed as livestock and their movements outside the park are subject to prohibition. While both species carry the disease brucellosis and while cattle may contract the disease from both elk and bison, only bison are controlled.

A buffer zone around the park of 20 to 50 miles that excluded cattle, an invasive species, would allow bison to migrate as elk do out of the park, would put an end to this double standard, would contain brucellosis within the park and would restore the integrity of the ecosystem as a wildlife sanctuary.

In summation, to protect the wild herds of bison in Yellowstone from extinction a number of things must be done.

First and foremost, work toward restoring the health of the herds. This means allowing them to inhabit their full range so they can live in their "house," the ecosystem.

Work toward allowing the herds to restore their altitudinal migratory range, that is, up and down the Madison and Yellowstone Rivers. This is what most likely helped prevent the extinction of bison in the first place.

Work toward restoring the predator-prey relationships in the ecosystem. This is the only way to establish a healthy herd, for the wolf and other predators instinctively know which animals need to be culled, such as juveniles, the diseased, the undernourished, the injured, the old and those that stay behind. As a culler, IBMP makes an IDIOTIC wolf.

Allow the bison herds to cure themselves of the disease brucellosis under the care of Mother Nature by allowing the herds to disperse—and that again means restoring historical migratory habitat. That also means keeping the herds within healthy numbers, which only predators such as the wolf know how to do, along with regulated hunting. The more fearful bison, and thus the more genetically healthy, will make themselves less of a target to predators, both animal and human.

Instead of a sultan’s view of nature, which decimated the bison and the wolf in Eurasia, adopt the heart of the American Indian tribes toward bison and wolves and all other predators, such as bears and mountain lions. They are the ones who evolved successfully with these keystone animals.

Economically, wild bison can pay their own way, for they have been the staff of life for millennia. They can be of more profit to the local economy than cattle. Hunting of bison outside the park should be continued under the joint supervision of the government, a citizens group and Native American tribes.

The integrity of the GYE should be preserved. It is one of the last remaining large, nearly intact ecosystems in the northern temperate zone on earth and is one of the world's foremost natural laboratories in landscape ecology and geology. It is a world-renowned wildlife refuge, covering about 28,000 square miles. However, it cannot function in full health if it is fragmented.

In sum, to restore the balance of nature in this ecosystem, leave it alone. Allow wild bison to be wild. Within and on the borders of the Greater Yellowstone Ecosystem, remove invasive species such as cattle, make the culling of wild bison by government agents unlawful and ban the killing of wolves. Let Yellowstone be wild.

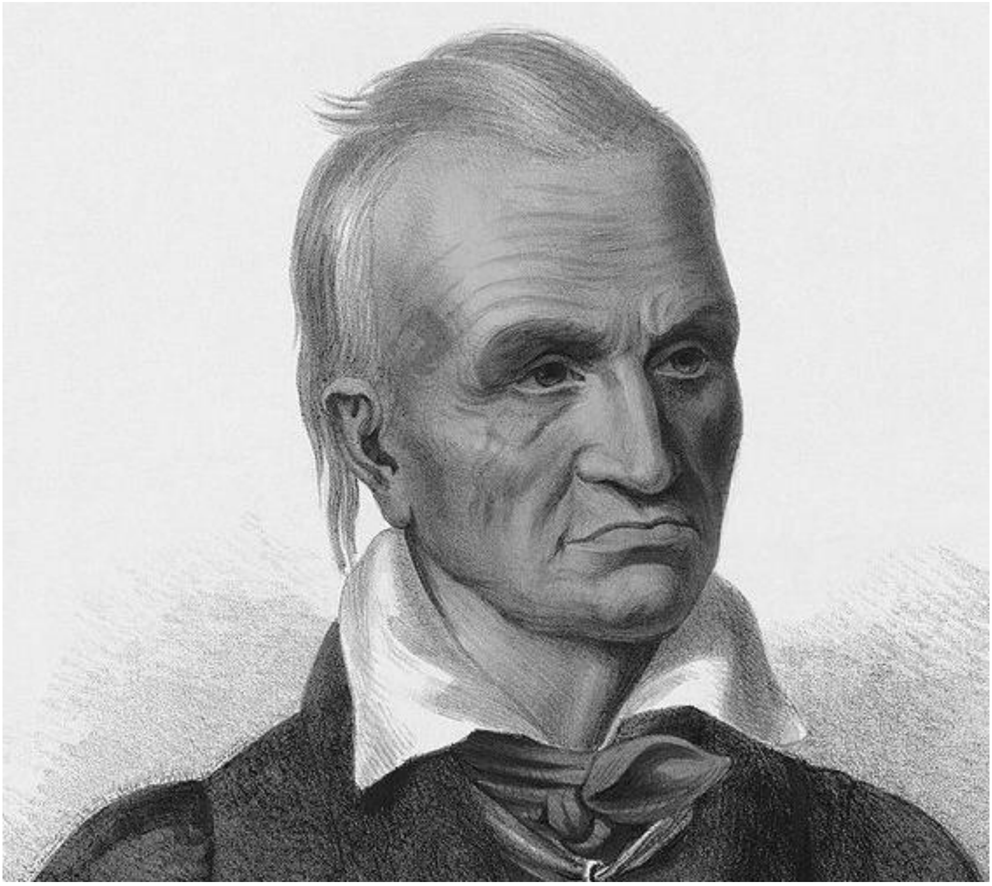

Figure 98. CHIEF RED JACKET (c. 1750–January 20, 1830). "The Great Spirit . . . created the buffalo, the deer, and other animals for food. He had made the bear and the beaver. Their skins served us for clothing. He had scattered them over the country, and taught us how to take them." ***From an 1835 lithograph by Henry Corbould, after a painting by Charles Bird King, printed by Charles Joseph Hullmandel, and published in History of the Indian Tribes of North America. This image is available from the United States Library of Congress's Prints and Photographs division.***

Conclusion

The impending extinction of Yellowstone's wild bison is the direct result of a culture war between those who value wildlife and those who value only domestic animals without considering the pivotal role and fragile status of wild animals in an ecosystem. A prime example of those who value wildlife historically is the American Indian tribes. European settlers brought with them a culture that valued domestication and cultivation, considering wild animals a threat, along with those that subsisted on them. This perceived threat led to the decimation of the tribes and their isolation onto reservations, extermination of wild animals by the millions, such as bison and wolves, and extinction of others, such as the passenger pigeon.

It could have been different, for the native tribes and the settlers could have lived together as friends, subsisting on bison, as they did together for over a century. It was the financial interests of a few, such as those funding the transcontinental railroad, that chose to clear the plains of the tribes—and to do that, destroyed the bison herds.

The governmental policy used to subjugate American Indians was from the beginning genocidal and remains genocidal today under the Interagency Bison Management Plan. To implement this policy in the past, the major focus of attack was to eliminate the tribes' food supply—wild bison—so as to shatter their health and starve them into compliance. This strategy continues with the IBMP's massive annual slaughter of wild bison that attempt to migrate out of the park in order to survive. This policy directed against the tribes' survival and wellbeing will lead to the extinction of wild bison. The American Indians know how to get along with nature and co-existed with it in a beneficially symbiotic relationship. Now in Yellowstone and elsewhere, we exterminate wildlife like pests. The bison herds in the GYE should be allowed to expand so as to be of value, instead of viewed as a pest to eliminate. This means encouraging wild bison to increase in number to feed the Indian nations and the common man. By bestowing value on bison, their survival as a wild species will be assured, for when something is valued, it is protected.

Only a token number of wild bison are now allowed to survive in the Greater Yellowstone Ecosystem—and for no good reason. As stated in this petition:

> In its attempt to mitigate brucellosis in the Yellowstone area by attacking wild bison only, the IBMP is engaging in showmanship—a display of dominance, a bluff—not science. And those who carry out this ritualistic culling activity and provide its rationale *know this*, but continue on anyway. P.J. White, chief of wildlife and aquatic resources at Yellowstone National Park, Rick L. Waller, the bison project leader at the park, and David E. Hallac, division chief of the Yellowstone Center for Resources at the park between 2011-2014, admit that culling wild bison does not adequately address the spread of brucellosis. They state in *Yellowstone Bison: Conserving an American Icon in Modern Society* (citations omitted):
>
>> However, surveillance during the past decade indicates brucellosis prevalence has increased from less than 5 percent to 8 to 25 percent in several elk populations in the northern portion of the Greater Yellowstone Area. These increases coincided with increasing elk numbers and/ or aggregations of elk on lower-elevation winter ranges, including a greater proportion of private land than 20 years ago. Many of these elk populations appear to support the disease independently of wild bison or feed-ground elk. Also, in recent years the distribution of elk testing positive for brucellosis exposure has expanded beyond the periphery of the Greater Yellowstone Area and now encompasses more than 20 million acres (8 million hectares). The estimated risk of brucellosis exposure to cattle from Yellowstone bison is insignificant (less than 1 percent) compared to elk (more than 99 percent of total risk) because elk have a larger overlap with cattle and are more tolerated by managers and livestock producers. Many of the approximately 450,000 cattle in the Greater Yellowstone Area are fed on private land holdings during winter and released on public grazing allotments during summer—but throughout the year they are allowed to mingle with wild elk. Thus, the risks of brucellosis transmission to cattle are primarily from wild elk, and management to suppress brucellosis in bison will not substantially reduce the far greater transmission risk from elk (White, P.J. et al., 2015).

Many of the 450,000 cattle that occupy the Greater Yellowstone Area are fattened on public grazing allotments in the summer. Brucellosis is carried by both bison and elk. Without cattle in the ecosystem, they are not a biohazard to cattle state-wide or nationally for the simple fact that what is not there can not contract disease nor transmit it. To promote the national security from the spread of brucellosis out of the park, a cordon sanitaire should be placed around the park, a buffer zone that disallows cattle so as to quarantine the park. Artificially limiting the bison population in the GYE, while promoting herds of cattle in the ecosystem, defeats the operation of natural selection and contributes to sickening the ecosystem.

Three million dollars is being knowingly spent annually on a failed task by members of the Interagency Bison Management Plan. That task is killing migratory bison. Doing so does not control brucellosis in the park. All it does is provide more land for grazing privately-owned cattle in national forests. Government-paid biologists are providing cover for these epidemiologically-ineffective actions through misleading and erroneous studies and reports. When a government agency or a group of agencies deludes the public to benefit private interests and money is involved, that is fraud; that is corruption.

By the government allowing permit holders of public grazing allotments to have first dibs on renewing their permits is making use of public land inheritable, which is unconstitutional.

In multiple usage of a national forest, the Multiple-Use Sustained-Yield Act favors output of resources and their sustained use. Such language would favor bison over cattle and other livestock on public land, for bison do not need human protection from disease or predators in an ecosystem.

The Fish and Wildlife Service has shown itself to be on the wrong side of this issue, validating anti-wildlife forces by denying petition after petition seeking to protect wild bison from extinction. The FWS is obligated under current circumstances to use its federal powers under the Endangered Species Act to protect the wild herd of bison in the Greater Yellowstone Ecosystem from extinction.

This means working to restore wild bison in sufficient numbers to sustain the Indian nations and hunters, as was the case in the past in this country. What is valued is protected. Protecting wild bison includes their listing or designating the species as a candidate for listing so that their wild, migratory genes are preserved, a necessary element in the survival of bison in the wild.

Remember the words of Red Jacket, the Seneca chief:

> Brother, listen to what we say. There was a time when our forefathers owned this great island. Their seats extended from the rising to the setting sun. The Great Spirit had made it for the use of Indians. He had created the buffalo, the deer, and other animals for food. He had made the bear and the beaver. Their skins served us for clothing. He had scattered them over the country, and taught us how to take them. He had caused the earth to produce corn for bread. All this He had done for his red children, because He loved them. If we had some disputes about our hunting ground, they were generally settled without the shedding of much blood. But an evil day came upon us. Your forefathers crossed the great water and landed on this island. Their numbers were small. They found friends and not enemies. They told us they had fled from their own

> country for fear of wicked men, and had come here to enjoy their religion. They asked for a small seat. We took pity on them, granted their request; and they sat down amongst us. We gave them corn and meat; they gave us poison in return.

What could this poison be? In the course of history, it could be a number of things: (a.) alcohol, (b.) duplicity in negotiating treaties, (c.) the military's strategy of wiping out a tribal village, such as at the Sand Creek Massacre, in retaliation for American Indians stealing cattle (Judis, 2014) for food, the cattle taken because non-Indians had killed a multitude of the tribes' bison and were occupying their hunting grounds, creating starvation, or (d.) the duplicity used by the military following the Civil War when it declared war on the Plains Indian tribes, inviting all tribes that wanted to stay out of the war to camp on the Washita River near Cheyenne, Oklahoma, then attacked those tribes, killing hundreds, crushing the Plains Indian nations (Horsley, James; Washita: Genocide on the Great Plains, unpublished manuscript for master's thesis, North Dakota State University, to be self-published 2018) and now, (e.) the decimation of the tribes' last remaining wild bison by our government by means of the IBMP. These latter instances are examples of genocide.

Instead of poison, return the kindness of those who invited our forefathers who "crossed the great water and landed on this island" to join them to share a seat in this country during its early settlement. Restore wild bison to the Indian nations and the hunter. Preserve this wild species.

To protect wild bison, a number of things must be done:

1. List wild bison as endangered or threatened (or as a candidate for listing), working with American Indian tribes, conservationists, hunters and ranchers toward restoring the health of the bison herds. This means dropping the population limit for wild bison in the park and allowing bison to inhabit their full range so that they can live in their "house," the ecosystem.

2. Work toward allowing the herds to restore their altitudinal migratory range, that is, up and down the Madison and Yellowstone Rivers. This is what most likely helped prevent the extinction of bison in the first place.

3. Work toward restoring the predator-prey relationship. This is the only way to establish a healthy herd, for the wolf instinctively knows which animals need to be culled, such as juveniles, the diseased, the undernourished, the injured, the old and those that stay behind. As a culler, IBMP has engaged in "Inept Decisions, Ignorance Or Thoughtlessness, In Combination." That is, the IBMP makes an IDIOTIC wolf.

4. Allow the bison herds to cure themselves of the disease brucellosis under the care of Mother Nature by allowing the herds to disperse—and that again means restoring historical migratory habitat. That also means keeping the herds within healthy numbers, which only the wolf knows how to do, along with regulated hunting. The more fearful bison, and thus the more genetically healthy, will make themselves less of a target to predators, both animal and human.

5. Instead of a sultan's view of nature, which decimated the bison (wisent) and the wolf in Eurasia, adopt the heart of the American Indian tribes toward bison and wolves and all predators. They are the ones who evolved successfully with these keystone animals. Economically, wild bison can pay their own way, for they have been the staff of life for millennia. They can be of more profit to the local economy than cattle. Hunting of bison outside the park should be continued under the joint supervision of the government, a citizens group and Native American tribes.

6. Conform to the precepts of the Multiple-Use Sustained-Yield Act, which would best be done by replacing cattle with wild bison in the Greater Yellowstone Ecosystem.

7. To help accomplish these goals, surround the Yellowstone National Park with a cattle-free zone, a cordon sanitaire. Cattle originally spread the disease of brucellosis to bison. Livestock in close proximity to wildlife promotes an unhealthy relationship. Creating a buffer zone around the park without cattle would eliminate the need of the IBMP as it exists today, contributing to saving the $3 million expenditure annually spent on its funding.

8. Close the Stephens Creek capture facility and other such capture facilities. Cease the bison vaccination program—it has no useful purpose. A wildlife park should not function as a stockyard or be managed like one.

9. Withdraw federal grazing permits that are inheritable, for granting such permits violates the constitutional prohibition of granting titles of nobility.

10. Tell the truth to the public. At present the members of the IBMP and its biologists are not doing so.

The integrity of the GYE should be preserved. It is one of the last remaining large, nearly intact ecosystems in the northern temperate zone on earth and is one of the world's foremost natural laboratories in landscape ecology and geology. It is a world-renowned wildlife refuge, covering about 28,000 square miles. However, it cannot function in full health if it is fragmented by dividing it into killing zones to accommodate cattle, a practice which sickens the ecosystem.

To restore the balance of nature in this ecosystem, leave it alone. Give the Indian nations back their historical mode of sustenance, wild bison. Allow wild bison to be wild. Within the Greater Yellowstone Ecosystem and on the borders of Yellowstone National Park, remove invasive species such as cattle, make the culling of wild bison by government agents unlawful and ban the killing of wolves, grizzly bears and mountain lions. Let America be America. Let Yellowstone be wild.

Listen. The sound of a drum. Boom. Boom. Boom. I hear chanting:

> The whole world is coming,
> A nation is coming, a nation is coming,
> The Eagle has brought the message to the tribe.
> The father says so, the father says so.
> Over the whole earth they are coming.
> The buffalo are coming, the buffalo are coming,
> The Crow has brought the message to the tribe,
> The father says so, the father says so.

Appendix A

Below is the original petition submitted by James Horsley, Jan. 5, 1999, to list the wild Yellowstone bison as endangered and as a distinct population segment.

James Horsley
Moorhead HealthCare Center
2810 2nd Ave. N.
Moorhead, MN 56560

FISH & WILDLIFE ENHANCEMENT
FEB 11 99

JAN. 5, 1999

MR. Bruce Babbitt
Secretary of the Interior
Department of the Interior
18th and "C" Street, N.W.
Washington, D.C. 20240

Dear MR. Babbitt:
of the United States, am
I, as a citizen
deeply concerned about the fate and
survival of the wild herd of buffalo
at the Yellowstone National Park.
This is a petition to list the herd at
Yellowstone National Park as endangered
pursuant to the Endangered Species Act
because it is endangered in a significant
portion of its range, the environs of
Yellowstone Nation Park. Petitioner also
requests that the region surrounding
Yellowstone National Park coterminous with
the migratory or quasi-migratory range of

that herd be designated a Critical Habitat. The Petitioner chooses the option of either listing the herd as a subspecies or as a distinct population group, or both. A suitable extension of their habitat would be the region North of the Yellowstone River, once a common hunting ground designated for the Blackfoot and Flathead nations under a treaty in 1855. Since the treaty provisions were modified unilaterally, without the consent of the Flathead nation, it would presumably be still in force.

The reasons for listing the Yellowstone herd as endangered are both biological and historical.

Prehistorical man followed the buffalo over the land bridge that once connected the Asian and North American continents. Stone points found near Obsidian Cliffs in the Yellowstone National Park link Native Americans with the buffalo back 11,000 years. Blood analysis indicates that blood found on the points includes bison blood. Campsites according to carbon analysis date the fires having burned 11,000 years ago.

③

The Yellowstone herd is the only wild, unfenced buffalo herd in the nation. Buffalo are now thought to have engaged in quasi-migration, moving according to where there was adequate forage and more suitable climate. There was not a massive north and south migration like waterfowl, but, instead, a fluctuation of a more regional nature, sometimes north, sometimes south, sometimes east, sometimes west. In the case of the Yellowstone herd, animal sometimes leave the park and head north, sometimes west, sometimes south. The migratory route is usually always down from the higher altitudes in winter to lower altitudes to escape harsh winter climates.

For this reason buffalo population groups evolved in relationship to the region with regard to their migratory habits.

These herds, protected by the mountains and by the Yellowstone National Park status as a national park, escaped the slaughter of the mid to late 1800s. A few score survived, creating in part a genetic pool responsible for the thousands of buffalo that now populate the United States.

Some scientists believe that because the herd inhabited mountainous regions that it consisted of Mountain Buffalo, often also called Wood Buffalo. It is this remnant herd that helped save the buffalo from extinction.

The herd grew from a few score to about 3,000 in 1996. Part of its growth stems from the introduction of Plains Buffalo into the Yellowstone National Park. The Mountain or Wood Buffalo as a pure species is now extinct in the United States. However, a hybrid or cross between the Mountain Buffalo and the Plains Buffalo may exist at Yellowstone, thus being the only such herd in the nation.

Over 1,000 animals of this unique group were shot or slaughtered by the Montana Department of Livestock as the animals crossed the border of the Park in 1997 to escape the severe winter.

On some of these animals were found with collars used by biologists to track their migratory paths. The collars were found on animals shot by the DOL. Information from these migratory studies would be useful in determining the critical habitat of the herd.

This is the last wild herd in the United States. Its Ancestors were responsible for enabling man to populate North America. The buffalo herds were followed by early man from Asia to the present day United States.

Half the herd is now gone due to their slaughter, their destruction attempting to interrupt their migratory movement. At present they are stopped at the Park border by state officals using rifles, trucks and helicopters. Some are shot. Some are hazed back into the Park. Due to the stress, some of the females abort. The animals were headed toward grass lands both public and private located at lower ~~l~~altitudes, grass lands occupied by non-native, old world cattle.

We, as a nation, are exercising a preference For ~~over~~ a world-wide abundant domestic species over the last wild herd of native buffalo in existance today in the United States. Some scientist believe that if more slaughtering occurs and if another severe winter comes, this herd will collapse, that is, cease to exist. Gone will be the last link between

⑥

man of North America and the major meat animal which early man followed here, the buffalo.

This is a distinct population group both historically and due to its unique migratory nature, its migratory habits being molded by the region which it occupies. It is the last unfenced herd. Fencing has a profound influence on the migratory habits of the species in that it blocks the natural expression of the herd's instincts.

At present several plans are being studied as to how best ~~to~~ manage these animals, from one plan allowing free ranging to one, a Senate bill, advocating the elimination or forcible return of all Yellowstone buffalo leaving the Park.

No plan involves the Native American, which seems to demonstrate a degree of racial arrogance, especially when you consider that the American Indian has had a 11,000 year association with the buffalo and was responsible for successfully herding the animals, which reached a population on the plains in excess of 30 million

7

A government policy favors the American Indian in relationship to the preservation of endangered species. Native Americans are given preference in the management of such things as habitat regarding endangered species.

It would thus make good common sense to include the Native American in any program aimed at stopping the destruction of this endangered distinct population group. As a possible solution to a tenable habitat, the region north of the Yellowstone River, historically set aside for the buffalo and its hunting by Plains and Columbia Basin Indians, should be studied.

We have had two relative mild winters, the next winter may not be so mild, pushing the buffalo onto the killing fields of the low land grass lands.

This last link between primative man and the animal that helped such people get to this continent and survive should be protected from extinction as a distinct population segment, namely the last wild buffalo herd in the nation, the Yellowstone buffalo.

The Petitioner urges that the Yellowstone herd be listed as an endangered species or distinct population segment, and, to assure its survival, study the migratory habits of the animal, allowing it free range so as to conduct the study. With such a study in hand, recommendations could be made as to critical habitat.

Based on the historical use of the region set aside for buffalo hunting for the American Indian tribes, namely the area north of the Yellowstone River, the Petitioner requests that this region be considered as a habitat, a reserve allowing the buffalo the expression of its migratory instinct. Further, the Petitioner requests that the Native American be involved in the management of the Yellowstone buffalo to assure their survival.

Sincerely,

James Horsley

James Horsley

cc.

Jill Parker, Endangered Species Chief, Denver

Appendix B

Computer script for migration scenarios 1 and 2 in the R language for calculations, chapter 26 (Ellner, personal communications, August 5, 2015).

```
########################################################################
#####
# Scenario 1: One locus controls migration and nothing else. Individuals
# with 2 copies of the "A" allele have 20% probability of migrating, and
# are culled. Individuals with 2 copies of the "a" allele don't migrate.
# Heterozygotes are exactly intermediate. Initial state is "A" allele at
# 99% frequency in the herd.
########################################################################
#####
mAA = 0.2; maa=0; h=0.5; # migration rate parameters
mAa = h*(mAA)+(1-h)*maa;

WAA = 1-mAA; WAa = 1-mAa; Waa = 1-maa; # fitnesses
pvals=numeric(100); pvals[1]=0.99; # frequency of allele "A"
for(j in 1:99) {
	pj=pvals[j];
	WbarA = pj*WAA + (1-pj)*WAa;
	Wbar =  (pj^2)*WAA + 2*pj*(1-pj)*WAa + ((1-pj)^2)*Waa;
	pvals[j+1]= pvals[j]*WbarA/Wbar;
}
mvals = (pvals^2)*mAA + 2*pvals*(1-pvals)*mAa + ((1-pvals)^2)*maa;


########################################################################
#####
# Scenario 2: Still one locus, but migration is assumed to be one aspect
# of a general tendency to seek greener pastures when local conditions are
# poor. Those who migrate out of the park are culled, but this is
# countered by selection for 'seek greener pastures' behavior within the
# park. As 'seekers' become rarer, the odds of a 'seeker' finding greener
# pastures goes up (because more of the herd stays where it's not so
# good). Thus, as the "a" non-migrant allele increases in frequency, the
# baseline fitness (fitness unrelated to culling) of the "A" allele goes
# up, leading to a stable polymorphism. The final frequency of "A" and "a"
# alleles could be anything - it's determined by the assumed relationship
# between 'non-seeker' frequency and the baseline fitness of 'seekers'.
########################################################################
#####
```

```
mAA = 0.21; maa=0; h=0.5; # parameters
mAa = h*(mAA)+(1-h)*maa;

pvals2=numeric(100); pvals2[1]=0.95; # frequency of allele "A"
for(j in 1:99) {
	pj=pvals2[j]; # frequency of the seeker "A" allele
   dj=1-pj; # frequency of individuals who don't seek when they should
   WAA = (1-mAA)*(1+0.6*dj); Waa = 1-maa; WAa = h*(WAA)+(1-h)*Waa; #
fitnesses
	WbarA = pj*WAA + (1-pj)*WAa;
	Wbar =  pj^2*WAA + 2*pj*(1-pj)*WAa + ((1-pj)^2)*Waa;
	pvals2[j+1]= pvals2[j]*WbarA/Wbar;
}
mvals2 = pvals2^2*mAA + 2*pvals2*(1-pvals2)*mAa + ((1-pvals2)^2)*maa;

## Plotting

graphics.off(); dev.new();
par(mfrow=c(2,1),bty="l",yaxs="i",mgp=c(2,1,0),mar=c(4,4,2,1))
matplot(1:100,cbind(pvals,pvals2),type="l", lty=c(1,2),
xlab="Years",ylab="Frequency",
main="Frequency of high-migration allele",col=c("blue","red")
,lwd=2,ylim=c(0,1));
legend("topright",c("Scenario 1","Scenario 2"), lty=c(1,2),
col=c("blue","red"),bty="n",lwd=2,inset=0.05,cex=1.2)

matplot(1:100,cbind(mvals,mvals2), type="l", lty=c(1,2),
xlab="Years",ylab="Frequency",
main="Fraction of population migrating",col=c("blue","red")
,lwd=2,ylim=c(0,0.2));
```

Appendix C

[Federal Register: August 15, 2007 (Volume 72, Number 157)]
[Proposed Rules]
[Page 45717-45722]
From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr15au07-33]

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition To List the Yellowstone National Park Bison Herd as Endangered

AGENCY: Fish and Wildlife Service, Interior.
ACTION: Notice of 90-day petition finding.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce a 90-day finding on a petition to list the Yellowstone National Park (YNP) bison herd as endangered under the Endangered Species Act of 1973, as amended (Act). On the basis of our review of the petition and information readily available in our files, we have determined that there is substantial information indicating that the YNP bison herd may meet the criteria of discreteness and significance as defined by our policy on distinct vertebrate population segments (DPS). However, we have also determined that there is not substantial information indicating that listing the YNP bison herd under the Act may be warranted throughout all or a significant part of its range. We will not initiate a status review in response to this petition. We ask the public to submit to us any new information that becomes available concerning the status of the YNP bison herd or threats to it or its habitat at any time. This information will help us monitor and encourage the conservation of the species.
DATES: The finding announced in this document was made on August 15, 2007. New information concerning this species may be submitted for our consideration at any time.

ADDRESSES: Data, information, comments, or questions concerning this petition finding should be submitted to the Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, 134 Union Boulevard, Suite 645, Lakewood, Colorado 80228. The petition finding and supporting information will be available for public inspection, by appointment, during normal business hours at the above address. The petition and finding are available on our Web site at http://r6.fws.gov/mammals/bison.

FOR FURTHER INFORMATION CONTACT: Michael Stempel, Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service (see ADDRESSES section) (telephone 303-236-4253; facsimile 303-236-0027).

SUPPLEMENTARY INFORMATION:

Background

Section 4(b)(3)(A) of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.), requires that we make a finding on whether a petition to list, delist, or reclassify a species presents substantial scientific or commercial information to indicate that the petitioned action may be warranted. We are to base this finding on information provided in the petition, supporting information submitted with the petition, and information otherwise available in our files at the time we make the determination. To the maximum extent practicable, we are to make this finding within 90 days of our receipt of the petition, and publish our notice of this finding promptly in the Federal Register.

Our standard for substantial information within the Code of Federal Regulations (CFR) with regard to a 90-day petition finding is “that amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted” (50 CFR 424.14(b)). If we find that substantial information was presented, we are required to promptly commence a review of the status of the species.

In making this finding, we relied on information provided by the petitioners and information otherwise available in our files, and evaluated that information in accordance with 50 CFR 424.14(b). Our process of coming to a 90-day finding under section 4(b)(3)(A) of the Act and section 424.14(b) of our regulations is limited to a determination of whether the information in the petition meets the “substantial information” threshold.

Mr. James Horsley of Moorhead, Minnesota, filed a petition dated January 5, 1999, with the Secretary of the Interior to list the “herd of buffalo at the Yellowstone National Park” “because it is endangered in a significant portion of its range.” Mr. Horsley requested that the Service list the herd as a subspecies or “distinct population group,” and to designate critical habitat in and adjacent to YNP. The Service received the petition on February 11, 1999. Action on this petition has been precluded until now because of higher priority listing actions. This finding does not consider critical habitat, which would only arise with a positive 12-month finding.

Biology and Distribution

The bison (also referred to as the American buffalo) is a member of the family Bovidae, which includes domestic cattle. Two subspecies of bison are currently recognized in North America—the plains bison (Bison bison bison) and the wood bison (Bison bison athabascae) (Boyd 2003, pp. 28-31). The species once ranged across central and western North America, but market hunting nearly extirpated the herds by the 1880s.

Numerous Federal, State, and private bison herds currently exist in the United States, but YNP is the only area in the United States where bison have existed in the wild state since prehistoric times (Gates et al. 2005, p. 92). Boyd (2003, p. 38) estimated the plains bison population in North America at 500,000, and identified 50 herds (containing approximately 19,200 head) currently being managed with clear conservation objectives.

Many of the numerous bison herds currently extant in the United States and Canada were reconstituted from stock that was used to develop bison-cattle hybrids (Boyd 2003, p. 23). Research on 11 Federal herds revealed that the bison herd in YNP was 1 of 3 that showed no evidence of genetic introgression with cattle (Halbert 2003, pp. 86-87) based on the alleles examined. (Introgression occurs when the genes of one species infiltrate the genes of another through repeated crossings.) The other two herds were Wind Cave National Park in South Dakota and Grand Teton National Park in Wyoming (Halbert 2003, p. 87), although the Grand Teton sample size was small so confidence in the results is lower than that for Wind Cave. More recently, the bison herd at Sully's Hill National Game Preserve in North Dakota has been sampled and is not known to be introgressed, although the sample size was small (Roffe 2005).

Halbert (2003, pp. 44-45) found only four of the Federal herds made positive contributions to overall bison genetic diversity (measured in terms of allelic richness and gene diversity). Those herds were: YNP, National Bison Range (Montana), Wichita Mountains National Wildlife Refuge (Oklahoma), and Wind Cave.

The winter 2005-2006 count of the YNP bison herd estimated the herd size at 3,546 bison (Geremia and Wallen 2006), and the most recent summer count estimated the herd size at 4,500 bison (Wallen 2007).

Subspecies

The bison in Yellowstone National Park are considered to be plains bison (Bison bison bison). As mentioned previously, Boyd (2003, p. 38) estimated the plains bison population in North America at 500,000, and identified 50 herds (containing approximately 19,200 head) currently being managed with clear conservation objectives. Given the abundance and management status of the subspecies, we have concluded that the petition has not presented substantial information indicating that its listing under the Act may be warranted.

Distinct Vertebrate Population Segment

The petitioner asked us to list the YNP bison herd as a “distinct population group.” We assume that the petitioner meant a Distinct Vertebrate Population Segment (DPS) for purposes of listing under the Act. Under section 3(15) of the Act, we may consider for listing any species, subspecies, or, for vertebrates, any DPS of these taxa. In determining whether an entity constitutes a DPS, and is therefore listable under the Act, we follow the Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act (DPS Policy) (61 FR 4722; February 7, 1996). Under our DPS Policy, we must address three analytical steps prior to listing a possible DPS:

(1) The discreteness of the population segment in relation to the remainder of the taxon; (2) the significance of the population segment to the taxon to which it belongs; and (3) the population segment’s conservation status in relation to the Act’s standards for listing (i.e., is the population segment, when treated as if it were a species, endangered or threatened) (61 FR 4722, February 7, 1996). This finding considers whether the petition states a reasonable case that the petitioned population may be a DPS.

Discreteness

Under the DPS Policy, a population segment of a vertebrate species may be considered discrete if it satisfies either one of the following two conditions: (1) It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation; or (2) it is delimited by international governmental boundaries within which significant differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist (61 FR 4722, February 7, 1996).

Information Provided in the Petition on Discreteness

The petitioner asserts that the YNP bison “herd is the only wild, unfenced buffalo herd in the nation,” but no specific citations are provided to support this conclusion. Information in our files support the conclusion that the YNP bison population is the only herd in the United States that has remained in a wild state since prehistoric times (Gates et al. 2005, p. 93). All other bison in the United States are reconstituted herds and are confined with fencing, or otherwise range restricted. Individuals from the Jackson bison herd in Grand Teton National Park and the National Elk Refuge have been known to migrate north into YNP, but this is a rare occurrence (Gates et al. 2005, p. 109). Therefore, we find that the YNP bison herd may be discrete from other members of the taxon Bison bison because of physical distance and barriers.

Significance

Under our DPS Policy, in addition to our consideration that a population segment is discrete, we consider its biological and ecological significance to the taxon to which it belongs. This consideration may include, but is not limited to: (1) Evidence of the persistence of the discrete population segment in an ecological setting that is unique or unusual for the taxon; (2) evidence that loss of the population segment would result in a significant gap in the range of the taxon; (3) evidence that the population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range; and (4) evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics (61 FR 4721; February 7, 1996).

Information Provided in the Petition on Significance

The petitioner asserts that the YNP bison herd is significant within the meaning of our DPS policy because it is the last wild, unfenced herd in the United States, and exhibits quasi-migratory behavior when members of the herd leave YNP during the winter in search of food. The petition also asserts that the herd may be a unique hybrid of the wood and plains bison, and the herd has historical and cultural significance to Native Americans. No citations are provided to substantiate these statements.

(1) Evidence of the persistence of the discrete population segment in an ecological setting that is unique for the taxon. The petitioner asserts that YNP is the only area in the lower 48 States where bison have existed in the wild state since prehistoric times. This statement is consistent with Gates et al. (2005, p. 245), and indicates that the YNP bison herd may exist in a unique ecological setting within the meaning of our DPS Policy.

The petitioner's assertion that the YNP bison were important to Native Americans also is supported by Gates et al. (2005, p. 77) (e.g., "The Lamar Valley and the Yellowstone River Valley north to Livingstone was an important area for bison and Native peoples throughout the Holocene."). We agree with the petitioner that the YNP bison herd has substantial cultural and historical value. However, the significance criteria in our DPS Policy are based on biological factors identified in the Act that show that the population is significant to the taxon, and not on human cultural or historical significance. Therefore, we did not evaluate cultural and historical significance in our DPS analysis, but rather relied solely on the scientific criteria in the DPS Policy.

The petitioner asserts that the YNP is significant because of its "quasi-migratory behavior." Gates et al. (2005, p. 160) concludes that YNP is a forage-limited system, and that, “Bison move beyond park boundaries in winter in response to forage limitation caused by interactions between population density, variable forage production (driven by spring/early summer precipitation), snow conditions, and herbage removal primarily by bison and elk.” Winter movement of large herbivores, such as bison and elk, in search of forage is normal behavior. The fact that bison and elk range outside the Park is not unusual. Based on this information, we would not consider the YNP bison herd movements to winter range outside the Park boundary as a unique behavior within the meaning of our DPS Policy.

(2) Evidence that loss of the population segment would result in a significant gap in the range of the taxon. The petition alleges that the YNP bison herd is the only remaining wild, unfenced bison herd. As discussed under “Biology and Distribution,” there are 3 other Federal bison herds that show no evidence of introgression with domestic cattle, based on sampling done to date. Because of the limited number and extent of bison herds that show no evidence of introgression with domestic cattle, we find that loss of the YNP bison herd might result in a significant gap in the current range of the taxon.

(3) Evidence that the population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range. The petition provides no specific information to indicate that the YNP bison herd would meet this criterion. As noted above, Gates et al. (2005, p. 245) indicate that YNP is the only area in the lower 48 States where bison have existed in a wild state since prehistoric times. Bison originally ranged across western North America; because numerous herds have been reintroduced in the historic range, we have determined that the YNP herd is not the only surviving natural occurrence within its range. Additionally, the species is not more abundant elsewhere outside its historic range.

(4) Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics. The petition alleges that the YNP bison herd may be a unique hybrid of the wood and plains bison. No citations are provided, but this conclusion was stated in Meagher (1973, pp. 14-16), who considered the “mountain” bison a separate species. This controversy has since been resolved, and YNP staff now considers the remnant population, as well as the introduced bison, as being of plains bison origin (Boyd 2003, pp. 182-183; Wallen 2006).

Additional information in our files compiled after this petition was submitted indicates that the YNP bison herd is one of three Federal herds that do not display genetic introgression with cattle. Maintenance of genetic diversity is an important long-term goal for management of species populations. Halbert (2003, p. 94), concluded her study by stating: “In conclusion, this study has assessed levels of domestic cattle introgression in 10 federal bison populations and identified at least 2 populations, Wind Cave and YNP, which at this time do not have any evidence of domestic cattle introgression and also have high levels of unique genetic variation in relation to other federal populations. As such, these populations should be given conservation priority * * *” Thus, we conclude that the YNP bison herd satisfies this genetic criterion of significance under the DPS Policy.

DPS Determination

The Grand Teton National Park/National Elk Refuge bison herd is separate from the YNP herd (Gates et al. 2005, p. 93), and there are less than a dozen other unconfined bison herds in the entire lower 48 States (Gates et al. 2005, p. 2). Therefore, the YNP herd is discrete from other members of the taxon. Recent genetic research confirms that the YNP bison herd is significant because of a lack of nuclear domestic cattle introgression. Although 3 other Federal herds exhibit this characteristic, the YNP bison are the only remnant population that has remained in a wild state since prehistoric times and, therefore, is important to the management of bison genetic diversity. Halbert (2003, pp. 44-45) found only four Federal herds that were sufficiently unique to contribute significantly to overall bison genetic diversity.

On the basis of the preceding discussion, we believe that there is substantial information to conclude that the YNP bison herd may be discrete and significant within the meaning of our DPS Policy, and therefore may constitute a DPS.

According to our DPS Policy, if a population of a species is found to be both discrete and significant, we then evaluate the conservation status of the population in relation to the listing factors found in section 4(a)(1) of the Act. Our assessment of the conservation status of the YNP bison herd, based on the information provided in the petition and our files, is provided in the “Conservation Status” section below.

Conservation Status

Pursuant to section 4(a) of the Act, we may list a species of a taxon on the basis of any one of the following factors: (A) Present or threatened destruction, modification, or curtailment of habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; © disease or predation; (D) inadequacy of existing regulatory mechanisms; or (E) other manmade or natural factors affecting its continued existence.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of the Species’ Habitat or Range

The petition asserts that the natural range of the YNP bison herd is being curtailed by the interruptions of its members’ attempts to move out of the Park. The petitioner alleges that in 1996 the herd numbered approximately 3,000 head, and that over 1,000 of these bison were “slaughtered” outside YNP in the winter of 1996-1997, which threatened the “quasi-migratory” behavior of the herd.

The petitioner is correct concerning the culling of YNP bison outside the Park in the winter of 1997. Since the 1920s, bison that venture out of YNP into Montana have been subject to various lethal and non-lethal measures to control brucellosis (Gates et al. 2005, p. 83), which is a contagious, costly disease of ruminant (cud-chewing) animals, such as bison, cattle, and swine. Since 1934, there has been a national Cooperative State-Federal Brucellosis Eradication Program, because the disease causes decreased milk production, weight loss in livestock, loss of young, infertility, and lameness (http://www.aphis.usda.gov/vs/nahps/brucellosis/). Culling of bison in interior YNP for population and brucellosis control ceased in 1968 (Gates et al. 2005, p. 87).

However, the population data for the YNP bison herd do not support the petitioner's assertion that the 1997 bison mortality in Montana threatens the herd or its range. Since the winterkill and lethal brucellosis control actions in Montana during 1997, the YNP bison herd has continued to grow despite culling for population and brucellosis control, and currently numbers approximately 4,500 head (Wallen 2007). Additional information on culling is provided under Factor B.

The petitioner's assertion that hazing and killing of bison outside the Park will affect the "quasi-migratory" behavior of the herd, and will result in a restriction of the range is not supported by information available in our files. Bison in YNP attempt to compensate for declining per capita food resources by range expansion (Gates et al. 2005, p. 131). In other words, bison move out of the Park in the winter in search of food, and this pattern has continued since implementation of the Joint Bison Management Plan (discussed in greater detail under Factor D) in 2000 (Clarke et al. 2005, p. 29). Therefore, the available information indicates that control actions have not affected the "quasi-migratory" ranging behavior of the YNP herd.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

As mentioned under Factor A, the petitioner alleges that in 1996 the herd numbered approximately 3,000 head, and that over 1,000 of these bison were "slaughtered" outside YNP in the winter of 1996-1997. The petition claims that "Half the herd is now gone due to their slaughter."

However, as stated under Factor A, the population data for the YNP bison herd do no support the contention that half the herd is now gone due to lethal control. In fact, since the winterkill and lethal brucellosis control actions in Montana during 1996-97, the YNP bison herd has continued to grow, and currently numbers approximately 4,500 head (Wallen 2006). Breeding success has been steady for at least 100 years, in spite of culling for population and brucellosis control (Fuller 2003, pp. 21-28). As part of the Joint Bison Management Plan, variable numbers of bison may be removed from the herd to maintain optimal population size and for brucellosis control. In addition, the Joint Bison Management Plan establishes that when the population drops to 2,300 bison, measures to protect bison will be increased. Management mortality would cease if the herd drops to 2,100 head. The herd may stabilize at about 3,500 to 3,800 head, but could fluctuate over time based on the severity of winter weather (USDI and USDA 2000, pp. 51-52).

Factor C. Disease or Predation

The petitioner provides no information on this factor, and we have no information in our files to indicate that the current conservation status of the YNP bison herd is affected by disease or predation. Although brucellosis is endemic to the herd, the disease does not appear to be a threat because the population continues to grow at a rate of between 5 and 8 percent (Fuller 2006, pp. 21-24). The Joint Bison Management Plan provides a detailed set of procedures for managing the YNP bison herd in conjunction with the brucellosis control program in Montana.

Gates et al. (2005, p. 51) concluded that predation may become increasingly important as reintroduced wolves learn how to kill bison, but there is no information in our files to indicate that predation is a threat at this time.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

The petitioner implies that existing regulatory mechanisms are inadequate to ensure protection of the YNP bison herd because some animals are killed outside the Park. We are assuming that, based on the information in our files, the petitioner is referring to lethal control of bison in conjunction with Montana's brucellosis control program.

During the 1990s, a Bison Management Plan for the State of Montana and YNP (Joint Bison Management Plan) was developed. A Final Environmental Impact Statement and Record of Decision on the plan was issued by the Department of the Interior and the Department of Agriculture on December 20, 2000 (available at http://www.planning.nps.gov/document/yellbisonrod%2Epdf). The Joint Bison Management Plan provides a detailed set of procedures for managing the YNP bison herd in conjunction with the brucellosis control program in Montana.

The Joint Bison Management Plan has a population target of greater than 2,100 bison (USDI and USDA 2000, pp. 51-52). The plan contains contingency measures to assure that the conservation status of the herd remains secure. If exigent circumstances arise during severe winters, the agencies agree to temporarily modify elements of the plan to mitigate total removal of bison. If the bison population declines to 2,300 within a single winter, the agencies will meet to evaluate modifications to the prevailing management prescriptions that could reduce the total management removal of bison from the population (USDI and USDA 2000, p. 52). If the bison population declines below 2,100 within a single winter, the agencies will, on a temporary basis for that winter, increase implementation of non-lethal management measures. One of the primary goals of the Joint Bison Management Plan is to provide for a "free-ranging bison herd" (USDI and USDA

2000, p. 6). The herd may stabilize at about 3,500 to 3,800 head, but could fluctuate over time based on the severity of winter weather (USDI and USDA 2000, pp. 51-52). This size range was identified by YNP staff as sufficient to protect the long-term status of the herd. The latest conservation genetics information indicates that a population in this range should be able to sustain the current level of genetic diversity indefinitely without the need for introducing immigrants from other populations (Wallen 2006).

The Joint Bison Management Plan Status Review Team recently completed an analysis of the adaptive management elements of the plan (Clarke et al. 2005, pp. 28-29). With regard to YNP bison population abundance, the team found that the abundance of bison has grown steadily since the implementation of the Joint Bison Management Plan (see Figure 1). The population reached almost 4,900 head in the summer of 2005, and now numbers around 4,500. Winter weather conditions have been mild to average during the first 5 years, and the population has not dropped below 2,300 bison. The late winter population has been above the population target and management decision threshold of 3,000 head in 4 of the 5 years of implementation (Clarke et al. 2005, p. 28). Management-related mortality has resulted in greater than 200 bison removed during 3 of the 5 winters, but the population continues to expand (Clarke et al. 2005, p. 28). Based on this information we concur with the Status Review Team that the Joint Bison Management Plan is working with regard to successful management of the YNP bison herd.

Factor E. Other Manmade or Natural Factors Affecting Its Continued Existence

The petitioner provided no information on this factor, and we have no information in our files to indicate that possible circumstances in this category affect the YNP bison herd.

Conclusion of the 5-Factor Analysis

As required by the Act, we considered the five potential threat factors to assess whether there is substantial information to indicate that the potential Yellowstone National Park (YNP) bison herd DPS may be threatened or endangered throughout all or a significant portion of its range. The first step in this assessment is to determine whether there is substantial information that the DPS may be threatened or endangered throughout all of its range. If this is the case, then we make a positive 90-day finding for the DPS in its entirety. If it is not the case, we must next consider whether there is substantial information that there may be any significant portions of its range that are in threatened or endangered.

On the basis of our review of the petition and other information readily available in our files, we have concluded that the petition does not present substantial information that listing the potential YNP bison herd DPS as threatened or endangered throughout all of its range may be warranted. The petition is based primarily on the threat of excessive killing of bison that venture outside YNP in order to prevent the spread of brucellosis to domestic livestock. However, we found no information to indicate that brucellosis control efforts, either previous or ongoing, threaten the continued existence of the potential YNP bison herd DPS. A large number of bison did die during the severe winter of 1996-97 due to the combined effects of natural causes and human control efforts, but the herd itself was not threatened by this mortality. A Joint Bison Management Plan for the YNP bison herd (USDI and USDA 2000), completed and implemented approximately one year after the petition was provided to the Service, provides mechanisms to address the impacts of brucellosis control actions on the herd while maintaining a self-sustaining bison herd in and adjacent to YNP. In addition, the population data for the YNP bison herd indicate that, since the winterkill and lethal brucellosis control actions in Montana during 1996-97, the YNP bison herd has continued to grow despite culling for population and brucellosis control, and currently numbers approximately 4,500 head.

Having determined that the potential YNP bison herd DPS does not meet the definition of threatened or endangered, we must next consider whether there are any significant portions of its range that where the herd is danger of extinction or is likely to become endangered in the foreseeable future. On March 16, 2007, a formal opinion was issued by the Solicitor of the Department of the Interior, "The Meaning of 'In Danger of Extinction Throughout All or a Significant Portion of Its Range' " (USDI 2007). We have summarized our interpretation of that opinion and the underlying statutory language below. A portion of a species' range (in this case, "species" refers to the potential YNP bison herd DPS) is significant if it is part of the current range of the species and is important to the conservation of the species because it contributes meaningfully to the representation, resiliency, or redundancy of the species. The contribution must be at a level such that its loss would result in a decrease in the ability to conserve the species.

The first step in determining whether a species is threatened or endangered in a significant portion of its range is to identify any portions of the range of the species that warrant further consideration. The range of a species can theoretically be divided into portions in an infinite number of ways. However, there is no purpose to analyzing portions of the range that are not reasonably likely to be significant and threatened or endangered. To identify only those portions that warrant further consideration, we determine whether there is substantial information indicating that (i) the portions may be significant and (ii) the species may be in danger of extinction there or likely to become so within the foreseeable future. In practice, a key part of this analysis is whether the threats are geographically concentrated in some way. If the threats to the species are essentially uniform throughout its range, no portion is likely to warrant further consideration. Moreover, if any concentration of threats applies only to portions of the range that are unimportant to the conservation of the species, such portions will not warrant further consideration.

If we identify any portions that warrant further consideration, we then determine whether in fact the species is threatened or endangered in any significant portion of its range. Depending on the biology of the species, its range, and the threats it faces, it may be more efficient for the Service to address the significance question first, or the status question first. Thus, if the Service determines that a portion of the range is not significant, the Service need not determine whether the species is threatened or endangered there; if the Service determines that the species is not threatened or endangered in a portion of its range, the Service need not determine if that portion is significant.

The terms “resiliency,” “redundancy,” and “representation” are intended to be indicators of the conservation value of portions of the range. Resiliency of a species allows the species to recover from periodic disturbance. A species will likely be more resilient if large populations exist in high-quality habitat that is distributed throughout the range of the species in such a way as to capture the environmental variability found within the range of the species. In addition, the portion may contribute to resiliency for other reasons— for instance, it may contain an important concentration of certain types of habitat that are necessary for the species to carry out its life-history functions, such as breeding, feeding, migration, dispersal, or wintering. Redundancy of populations may be needed to provide a margin of safety for the species to withstand catastrophic events. This does not mean that any portion that provides redundancy is a significant portion of the range of a species. The idea is to conserve enough areas of the range such that random perturbations in the system act on only a few populations. Therefore, each area must be examined based on whether that area provides an increment of redundancy is important to the conservation of the species. Adequate representation ensures that the species’ adaptive capabilities are conserved. Specifically, the portion should be evaluated to see how it contributes to the genetic diversity of the species. The loss of genetically based diversity may substantially reduce the ability of the species to respond and adapt to future environmental changes. A peripheral population may contribute meaningfully to representation if there is evidence that it provides genetic diversity due to its location on the margin of the species’ habitat requirements.

Applying the process described above for determining whether a species is threatened in a significant portion of its range, we next addressed whether any portions of the range of the potential YNP bison herd DPS warranted further consideration. According to Gates et al. (2005), most bison in the YNP herd are confined within Yellowstone National Park for all or most of the year. Rut takes place within YNP from around mid-July to mid-August (Meagher, 1973) in one of three rutting areas—the largest rutting aggregation is in the Hayden Valley, the second largest in the eastern Lamar Valley, and a small aggregation occurs in small high elevation grasslands on the Mirror Plateau and Cache/Calfee Ridge (Gates et al. 2005). Most bison remain in YNP during winter, especially in the geothermally-influenced central portion of the Park. Calves are born in April-May on the winter range (Meagher 1973). For these reasons we have determined that there is substantial information that Yellowstone National Park may constitute a significant portion of the range for the potential YNP bison herd DPS.

In late winter/early spring, varying numbers of bison may move outside the Park's boundaries into Montana near West Yellowstone and Gardiner looking for forage. Bison that move outside YNP usually return by late spring (YNP, 2007). The proportion of Yellowstone bison that move to winter ranges outside YNP varies from 3 to 30 percent per year, depending on conditions (YNP, 2007). Bison move beyond Park boundaries in late winter in response to forage limitation caused by interactions between population density, variable forage production, snow conditions, and grazing competition (Gates et al. 2005). The Gardiner basin has been considered important winter range for bison since at least the 1940s and is an important component of the Northern winter range; in contrast, the West Yellowstone area does not have unique ecological value as winter range according to Gates et al. (2005). For these reasons we believe there is substantial information that the Gardiner basin provides resiliency to the herd during harsh winters, and, therefore, may constitute a significant portion of the range for the potential YNP bison herd DPS.

On the basis of our review of the petition and other information readily available in our files, we have concluded that the petition does not present substantial information that the Yellowstone bison herd may be threatened or endangered in either of the potentially significant portions of the range as outlined in the two previous paragraphs. Management of the Yellowstone bison herd is guided by a Joint Bison Management Plan for the YNP bison herd (USDI and USDA 2000). Management of bison within the Park is the responsibility of the National Park Service. Culling of bison in interior YNP for population and brucellosis management stopped in 1968 (Gates et al. 2005). Population data for the YNP bison herd indicate that, since the winterkill and lethal brucellosis control actions in Montana during 1996-97, the YNP bison herd has continued to grow despite culling for population and brucellosis control, and currently numbers approximately 4,500 animals. We therefore conclude that the petition does not present substantial information indicating that listing the Yellowstone bison herd within YNP may be warranted.

Outside YNP, management of bison is primarily the responsibility of the State of Montana (USDI and USDA 2000). Bison that leave YNP are subject to hazing and lethal control as a part of the brucellosis control program, but the Joint Bison Management Plan provides conservation measures that eliminate the control program as a threat to the continued existence of the herd. We therefore conclude that the petition does not present substantial information indicating that listing the Yellowstone bison herd on the winter range outside YNP may be warranted.

In summary, we have determined that the petition has not presented substantial information indicating that the potential YNP bison herd DPS may warrant listing as threatened or endangered throughout all or any significant portion of its range. Although we will not be initiating a status review in response to this petition, we ask the public to submit to us any new information that becomes available concerning the status of the YNP bison herd or threats to it or its habitat at any time. This information will help us monitor and encourage the conservation of the species.

References

A complete list of all references cited herein is available on request from the Region 6 Endangered Species Program, U.S. Fish and Wildlife Service (see ADDRESSES section).

Author

The primary author of this document is Chuck Davis, Region 6 Endangered Species Program, U.S. Fish and Wildlife Service (see ADDRESSES section).

Authority

The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

Dated: August 6, 2007.
H. Dale Hall,
Director, U.S. Fish and Wildlife Service.
[FR Doc. E7-16004 Filed 8-14-07; 8:45 am]

Appendix D

Federal Docket No. FWS-R6-ES-2015-0123

90-DAY FINDING ON TWO PETITIONS TO LIST A DISTINCT POPULATION SEGMENT OF BISON IN ITS UNITED STATES YELLOWSTONE NATIONAL PARK RANGE AS THREATENED OR ENDANGERED UNDER THE ENDANGERED SPECIES ACT

Background

Section 4(b)(3)(A) of the Act requires that we make a finding on whether a petition to list, delist, or reclassify a species presents substantial scientific or commercial information indicating that the petitioned action may be warranted. We are to base this finding on information provided in the petition and supporting information submitted with the petition.

Our standard for substantial scientific or commercial information within the Code of Federal Regulations (CFR) with regard to a 90-day petition finding is "that amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted" (50 CFR 424.14(b)).

Petition History

On November 14, 2014, we received a petition dated November 13, 2014, from the Western Watersheds Project and Buffalo Field Campaign, requesting the Yellowstone National Park bison be listed as threatened or endangered under the Act. The petition clearly identified itself as such and included the requisite identification information for the petitioner, required at 50 CFR 424.14(a).

On March 2, 2015, we received a second petition dated March 2, 2015, from Mr. James A. Horsley, requesting that the Yellowstone National Park bison be listed as threatened or endangered under the Act. The petition clearly identified itself as such and included the requisite identification information for the petitioner, required at 50 CFR 424.14(a). In a March 24, 2015, letter to the petitioner, we responded that we reviewed the information presented in the petition and did not find that the petition warranted an emergency listing.

This finding addresses both above petitions as they request the same action for the same entity. The petition dated November 13, 2014 will be referred to below as the first petition and the petition dated March 2, 2015 will be referred to below as the second petition.

Evaluation of Petitions to List the YNP bison

Species and Range

Do the petitions identify an entity that may be eligible for listing (i.e., is the entity a species, subspecies, or DPS)?

☑Yes
☐ No

If yes, list common name, Scientific name, and Range. If no, please explain.

DPS:
Bison (population of *Bison bison bison*); Yellowstone National Park. Referred to below as "YNP bison".

In 2011, we made a not substantial 90-day finding on a petition to list the wild plains bison or each of four distinct population segments as threatened under the Act (FWS 2011, entire). In that finding, we determined that the YNP bison did not qualify as a DPS and, therefore, a listable entity under the Act (FWS 2011, pp. 10309-10310). The present finding evaluates new information provided by the petitioners that has become available since the 2011 decision, to determine whether the YNP bison may meet the discreteness and significance criteria needed to quality as a DPS.

First petition:

Discreteness:

Neither the first petition nor the sources it cites provide substantial scientific or commercial information indicating that the YNP bison may meet the discreteness criteria needed to qualify as a DPS.

Significance:

- Halbert *et al*. 2012, pp. 1-2

Second petition:

Discreteness:

- White and Wallen 2012, pp. 752-753

Significance:

- White and Wallen 2012, pp. 752-752
- Halbert *et al*. 2012, pp. 1-2

In summary, we find that the first and second petitions, together, provide substantial scientific or commercial information indicating the YNP bison may qualify as a DPS.

Information in the Petitions

Factor A

1. Do the petitioners claim the entity warrants listing based on the present or threatened destruction, modification or curtailment of the species habitat or range (Factor A)?

☑ Yes (both petitions)

First petition: Range curtailment, livestock grazing, development and infrastructure, and invasive species.

Second petition: Range curtailment and invasive species.

☐ No

a. If the answer to 1 is yes:

Do the sources cited in the petitions provide substantial information to support the claim?

☐ Yes

☑ No (both petitions)

If yes, indicate for which purpose(s) present or threatened destruction, modification or curtailment of the species habitat or range (e.g., logging, agriculture, overgrazing, etc.) is a threat and list the citations with page numbers for each purpose. If no, please indicate for which purpose(s) and explain.

Range curtailment

Both petitions correctly note that bison historically occupied approximately 20,000 km^2 including area within the northern Greater Yellowstone Area. Presently, 3,175 km^2 within the boundaries of Yellowstone National Park (YNP) serves as principle YNP bison habitat (Plumb *et al*. 2009, pp. 2377, 2379, both petitions; White *et al*. 2011, p. 1324, both petitions). In addition, movement of YNP bison beyond the boundaries of YNP is prevented during cattle grazing months in the spring and summer to prevent contact and the spread of disease between bison and cattle. Additional information on disease management is provided under Factor C.

The petitions state concerns regarding the restriction of movement into historical range outside YNP boundaries. However, given the current stable-toincreasing population status of the YNP bison herd, we do not find substantial information that restriction of range is likely a limiting factor for the continued existence of YNP bison. Since its conception in 2000, the Interagency Bison Management Plan (IBMP) has conducted annual winter culls that restrict YNP bison from occupying cattle grazing land outside YNP, while maintaining the conservation goal of 2,500 – 4,500 animals (Plumb *et al*. 2009, p. 2385, both petitions; National Park Service 2013, pp. 8, 14, first petition). Most recent population counts by the Park Service recorded 4,865 bison prior to the 2015 winter cull (Geremia *et al*. 2014, p. 1, second petition). Therefore, we find that the petitions do not present substantial information that range curtailment may be a threat to the YNP bison such that listing may be warranted.

Livestock grazing

The first petition argues that livestock grazing is directly and indirectly impacting bison through the alteration of plant communities, soil characteristics, and other habitat elements, as well as the development of infrastructure such as fencing and roads associated with livestock management. The area of land where YNP bison and livestock grazing range overlaps beyond the northern border of YNP is minimal, as most YNP bison range remains within YNP. Further, no information in the first petition or the sources it cites describe the extent of habitat degradation caused by livestock grazing in this area of overlap.

Lastly, the first petition notes concern for disease transmission from livestock to YNP bison and this potential threat is addressed under Factor C.

Development and infrastructure

The first petition states that the historical range of the bison has changed due to cultivation, cattle ranching, commercial bison ranching, natural resource extraction, and urban expansion. The petition lists a number of residential areas outside YNP, but within IBMP management zones, as well as the Stephens Creek Capture Facility inside YNP as examples of development that may reduce habitat for YNP bison. However, neither the first petition nor the sources it cites provide information on how these land use changes may cause direct or indirect adverse impacts on the YNP bison. Therefore, we find that the first petition does not present substantial information that development and infrastructure may be a threat to the YNP bison such that listing may be warranted.

Invasive species

The first petitioners claim that non-native plant invasions are a major threat to the Greater Yellowstone Ecosystem (Olliff *et al*. 2001, p. 347, first petition). As the first petitioners rightly note, non-native plants can alter native plant communities and soil properties, and impact ungulate foraging (Trammell and Butler 1995, p. 814, first petition). A number of non-native plants found in YNP were mentioned in the petition. However, only *Euphorbia esula* was cited as having a negative impact on foraging bison by reducing the foraging value of bison habitat in North Dakota (DiTomaso 2000, p. 257, first petition). Neither the petition nor the sources it cites provides information of the extent to which this plant or others mentioned may be a threat to foraging bison in YNP.

The second petition discusses the ecological impacts of stocking nonnative fish, such as lake trout, in YNP waters, however, the petitioner and sources cited do not provide information regarding the potential impacts of non-native fish stocking on YNP bison. Therefore, we do not find the petitioners present substantial information that non-native species may be a threat to the YNP bison such that listing may be warranted.

In summary, we find that the information provided in the petitions does not present substantial scientific or commercial information indicating listing of the YNP bison may be warranted due to Factor A.

b. If the answer to 1 is no:
Do sources cited in the petitions provide substantial information indicating the entity may warrant listing based on factor A, even though the petitioner does not make this claim?

☐ Yes

☐ No

If yes, indicate for which purpose(s) present or threatened destruction, modification or curtailment of the species habitat or range (e.g., logging, agriculture, overgrazing, etc.) is a threat and list the citations with page numbers for each purpose. If no, please explain.

c. Provide additional comments, if any.

Factor B

2. Do the petitioners claim the entity warrants listing based on overutilization for commercial, recreational, scientific, or educational purposes (Factor B)?

☑ Yes (both petitions)
☐ No

a. If the answer to 2 is yes, overutilization for which purposes do the petitioners claim are a threat such that listing may be warranted (check all that apply):

☐ Commercial
☑ Recreational (first petitions)
☑ Scientific (both petitions)
☐ Educational
☐ Other: Threat

b. If the answer to 2 is yes:
Do the sources cited in the petitions provide substantial information to support the claim?

☐ Yes
☑ No (both petitions)

If yes, indicate for which purpose(s) overutilization is a threat and list the citations with page numbers for each purpose. If no, please indicate for which purpose(s) and explain.

Hunting and culling

The first petition argues hunting and the annual winter cull are negatively impacting the YNP bison population by decreasing its genetic viability, selecting for genetic traits that will decrease its fitness, and altering its sex ratio (Halbert 2003, p. 133, first petition + Halbert *et al*. 2012, p. 9, both petitions). The second petition argues culling is negatively impacting the YNP bison in similar ways, but argues hunting of YNP bison should continue because "wild bison have coexisted with human populations hunting them for millennia," and YNP bison "survival would be enhanced by hunting."

YNP bison leave through the north and western boundaries of YNP during winter while seeking lower elevation areas where food is more abundant. This migration can lead to interaction with domestic cattle grazing in areas adjacent to YNP and the spread of brucellosis from YNP bison to cattle. Brucellosis and disease management are discussed further under Factor C. The State of Montana allows hunting of YNP bison typically between

November and February in the Gardiner Basin area just north of YNP (MFWP 2013, unpaginated). If population size goals based on conservation needs are not reached after the hunting season, the IBMP implements a cull using the Stevens Creek Capture Facility. Hunting in the State of Montana and culling by the IBMP are coordinated and implemented together to regulate the population and potential threats claimed by the petitioners apply to both activities. Therefore, hunting and culling are evaluated together as they relate to overutilization. Hunting bison is considered a recreational use of the animals. Culling though, may be considered a scientific use since it is controls the spread of wildlife disease and is meant to maintain the YNP bison population size at conservation goals, while remaining within the management capabilities of YNP.

The petitions claim genetic viability may be degraded by a loss of unique genetic qualities (particularly the ability to migrate) through disproportionate culling of migratory animals. The first petition states "culling migratory bison could reduce the overall health and resilience of the Yellowstone bison by favoring less migratory bison, which may also select for a mitochondrial gene defect that decreases their fitness…" Both petitions cites Pringle's (2011, entire, both petitions) findings, which suggest bison are predicted "significantly impaired in aerobic capacity, disrupting highly evolved cold tolerance, winter feeding behaviors, escape from predators and competition for breeding" (Pringle 2011, p. 1, both petitions). However, these impairments have not been connected to specific defects in the bison mitochondrial genome and Pringle's assertions are predicated on assumptions that bison mitochondrial defects are caused by not the same, but similar mutations observed in humans and dogs (Pringle 2011, p. 1, both petitions). Only one bison from YNP analyzed in Pringle's study had haplotypes that contain the possibly deleterious mutations (Pringle 2011, p. 14, both petitions). Further, these defects are thought to have arisen from the initial population bottleneck that reduced the North American bison population to 25 animals in YNP (Boyd and Gates 2006, p. 1, first petition). Therefore, any deleterious genetic effects of the bottleneck would have occurred at that time and would not necessarily be exacerbated by present culling management regimes.

Lastly, the second petition posits that "the genetic diversity of wild bison is not being maintained by the IBMP's actions of lethally removing migratory bison, but instead the herds' genetic composition is being altered by the artificial selection of bison with non-migratory and domestic animal traits." However, the second petition does not cite sources to support these claims and there is no evidence at this time that indicates culling animals migrating from YNP will eliminate a genetic basis for the migratory behavior. In addition, continual migration each year suggests this behavior persists.

Plumb *et al*. (2009, p. 2383, both petitions) suggests movement of YNP bison beyond YNP boundaries began when the Central/Western herd surpassed a population size of 1,500 and the Northern herd surpassed 550. These numbers are well below mean estimates of herd population sizes limited by food resources (~ 2,400 and ~3,800 for Northern and Central/Western herds, respectively). In addition, permanent movement out of YNP (i.e. dispersal) is thought to have naturally occurred in the absence of management regimes (Plumb *et al*. 2009, p. 2383, both petitions). Therefore, winter culling may actually be serving as a surrogate for a dispersal sink (permanent movement out of the population) that would occur as a natural part of the ecosystem process.

The first petition also indicates the ratio of bulls to cows killed each winter is not conserved through years. The first petition does not discuss particular threats related to unequal sex ratios, but the second petition cites White *et al*. (2011, p. 1330, both petitions), who indicate a decrease in male over-winter survival and increased intensity of male competitive interaction during the breeding season when sex ratios favor males. However IBMP annual culling guidelines involve taking approximately equal numbers of males and females and sex composition surveys are conducted so as to optimize culling goals for the current population structure (Geremia *et al*. 2014, pp. 2, 17, second petition).

Finally, the first petition suggests animals from the Central/Western herd are being hunted at a disproportionately high rate compared to their Northern counterparts, which “threatens the genetic viability of the Yellowstone bison and could result in the loss of unique genetic qualities, maternal lineages, and the loss of overall genetic diversity.” Halbert *et al*. (2012, p. 8, both petitions) indicate that the YNP bison consists of two subpopulations that are genetically distinct, but not isolated. The relatively large genetic variation among YNP bison may be attributed to the maintenance of distinct subpopulations and the comparatively large effective population size of the YNP population (Halbert *et al*. 2012, p. 9, both petitions). Therefore, the first petition claims that the two herds (subpopulations) should be managed in light of their unique genetic qualities. The IBMP sets annual population size goals for the two herds separately so that neither herd is reduced to such an extent that it may be at risk of losing important genetic qualities (Geremia *et al*. 2014, second petition). The first petition cites Hendrick (2009, p. 419, first petition) on the importance of maintaining an effective population size of 1000 animals (or less with substantial genetic exchange between smaller subpopulations) and that the YNP herd meets this standard. To date, there is no evidence that culling has impacted the long-term genetic viability or persistence of the YNP bison population (White *et al*. 2011, p. 1328, both petitions).

However, White and Wallen (2012, p. 751, second petition) assert that the observed population substructure and genetic differentiation was "substantially influenced by a human-induced bottleneck" and as a result, "there is evidence that the existing genetic substructure was artificially created." Since individuals from other herds were used to supplement the YNP bison in 1902, estimates suggest only approximately 30-40% of the YNP bison genetic makeup derive from the original 25 survivors (Hendrick 2009, p. 417, first petition). Thus, maintenance of subpopulation genetic differentiation and overall genetic diversity may not be crucial for preserving genes from the survivors of the historic bottleneck. Lastly, White and Wallen (2012, p. 752, second petition) conclude that the National Park Service should allow ecological processes to "influence how population and genetic substructure is maintained in the future rather than actively managing to perpetuate an artificially created substructure… it is the conservation of the ecological processes that is important, not the preservation of a population or genetic substructure that may or may not have been created and /or facilitated by humans."

In summary, we find that the information provided in the petitions does not present substantial scientific or commercial information indicating listing of the YNP bison may be warranted due to Factor B.

c. If the answer to 2 is no:
Do sources cited in the petitions provide substantial information indicating the entity may warrant listing based on factor B, even though the petitioners do not make this claim?

☐ Yes

☐ No

If yes, indicate for which purpose(s) overutilization is a threat and list citations with page numbers for each purpose. If no, please explain.

d. Provide additional comments, if any.

Factor C

3. Do the petitioners claim the entity warrants listing based on disease or predation (Factor C)?

☑ Yes (both petitions)
☐ No

a. If the answer to 3 is yes:
Which do the petitioners claim is a threat such that listing may be warranted
(check all that apply)

☑ Disease (both petitions)
☑ Predation (both petitions)

b. If the answer to 3 is yes:
Do the sources cited in the petitions provide substantial information to support the claim?

☐ Yes
☑ No (both petitions)

If yes, indicate which (disease, predation, or both) is a threat and list the citations with page numbers for each. If no, please indicate disease and/or predation and provide an explanation.

Disease

The first petition discusses the direct impacts of hemorrhagic septicemia and malignant catarrhal fever on bison herds in the past and argues that the diseases pose a threat to YNP bison. In 1965, an outbreak of hemorrhagic septicemia occurred among a herd of bison in Montana and following vaccination, there were no further signs of the disease (Heddleston and Wessman 1973, p. 306, first petition). However, as the petition notes, there have been no recent reported cases of hemorrhagic septicemia in YNP and no information in the petition or the sources it cites suggest an outbreak is imminent.

Malignant catarrhal fever has impacted bison herds in the past, causing high mortality rates; however, no outbreaks have occurred in YNP. The disease can be spread from sheep to bison and the petition cites concerns for YNP bisonsheep interactions because sheep are ranched within the northern Greater Yellowstone Ecosystem and 3 YNP bison bulls were seen comingling with domestic sheep in 2013 on private land approximately half a mile from the YNP boundary. Outbreaks of malignant catarrhal fever should be monitored closely to prevent its spread to YNP. However, no recent reports of the disease have been made concerning YNP bison or sheep in nearby ranches, so we do not consider the disease to be a threat to the YNP bison at this time.

Both petitions discuss direct and indirect impacts of brucellosis disease on YNP bison. Brucellosis is a bovine disease most known for causing pregnant females to abort and can be transmitted interspecies. Estimates of the percentage of YNP bison infect with brucellosis range widely from 10% to 70% depending on the type of testing technique (Meagher and Meyer 1994, p. 646, both petitions; Gates *et al*. 2010, p. 33, both petitions). It is generally considered to have only minimal direct effects on bison and the YNP bison population does not appear to suffer from a portion being infected as their numbers are stable or increase each year (Meagher 1973, p. 70, both petitions; Meagher and Meyer 1994, p. 646, both petitions; Geremia *et al*. 2014, p. 2, second petition).

The annual cull implemented by IBMP prevents the spread of brucellosis from YNP bison to domestic cattle grazing on adjacent land and is thus an indirect impact of disease on YNP bison. In the winter, YNP bison seek lower elevation areas where food sources are more abundant. These areas often extend beyond YNP boundaries into land used for cattle grazing. To avoid contact between YNP bison and cattle, which increases the risk of transmission of brucellosis, the YNP bison are removed from areas used for cattle grazing via hazing back into YNP, followed by, when necessary, capture, testing, and slaughter or release of captured bison, depending on brucellosis test results (USDI and USDA 2000, p. 6, first petition).

The first concern stated in the petitions with regards to culling as disease management is its limitation on YNP bison range and population size. However, the petitions do not provide evidence suggesting IBMP activities may be a threat to the species such that the species may warrant listing. Since the conception of IBMP in 2000, the YNP bison population size has remained within the recommended 2,500-4,500 range, with the exception of 2005 and 2007 years when numbers exceeded 4,500 (Plumb *et al*. 2009, p. 2385, both petitions; National Park Service 2013, pp. 8, 14, first petition). Disease management is often an important aspect of wildlife management and stable-to-increasing population trends do not indicate IBMP disease management is limiting the YNP bison population.

Other concerns listed in the petitions related to indirect impacts of IBMP disease management include loss of genetic viability and subpopulation integrity, and these impacts are discussed under Factor B.

Predation

The petitions state that bison have few predators other than man, citing only grizzly bear and gray wolves as natural predators. Neither the petitions nor the sources they cite provide information suggesting predation may be a threat to bison, and the first petition suggests grey wolf predation "is not considered a significant concern at this time."

In summary, we find that the information provided in the petitions does not present substantial scientific or commercial information indicating listing of the YNP bison may be warranted due to Factor C.

c. If the answer to 3 is no:
   Do sources cited in the petitions provide substantial information indicating the entity may warrant listing based on factor C, even though the petitioner does not make this claim?
   ☐ Yes check box?
   ☐ No
   If yes, indicate which (disease, predation, both) is a threat and list citations with page numbers for each. If no, please explain.

d. Provide additional comments, if any.

Factor D

4. Do the petitioners claim the entity warrants listing based on the inadequacy of existing regulatory mechanisms (Factor D)?
   ☑ Yes (both petitions)
   ☐ No

   a. If the answer to 4 is yes:
      Do the sources cited in the petitions provide substantial information to support the claim?
      ☐ Yes

☑ No (both petitions)

If yes, list the citations with page numbers. If no, explain.

The petitions assert that existing Federal and State regulatory mechanisms for YNP bison conservation are inadequate. They cite the IBMP, the National Park Service, the U.S. Forest Service, and legal designations by the State of Montana as examples of inadequate regulations where more could be done to protect YNP bison. The first petition also asserts that the IBMP "is not enforceable, and thus is not a regulatory mechanism for purpose of the ESA."

The legal status of bison in North America ranges from domestic livestock to wildlife among Federal, State, and provincial jurisdictions (Gates *et al*. 2010, p. 66, both petitions). In National Parks and National Wildlife Refuges, bison are managed as captive or free-ranging wildlife. In Montana, Idaho, Wyoming, and various other states, bison have dual status, meaning herds may be considered domestic livestock or wildlife, depending on whether they are commercial or conservation herds (Gates *et al*. 2010, pp. 68-69, 71, both petitions). Montana considers YNP bison to be wildlife under disease control management by the Montana Department of Livestock and hunting on lands adjacent to the park is managed by the Montana Department of Fish, Wildlife and Parks (Plumb *et al*. 2009, p. 2385, both petitions).

The petitioners claim the IBMP is a threat to the YNP bison because of its activities related to culling and disease management. The IBMP is a cooperative effort developed by the National Park Service, USDA-Forest Service, USDA Animal & Plant Health Inspection Service, Montana Department of Livestock, Montana Fish Wildlife & Parks, and Tribal groups. Since we evaluate the inadequacy of existing regulatory mechanisms with recognition of the other Factors, we address potential impacts of the IBMP under Factors B and C. Therefore, if there is not substantial information that listing YNP bison may be warranted due to another factor, then the regulations affecting that factor are not considered inadequate.

Therefore, we find that the information provided in the petitions does not present substantial scientific or commercial information indicating listing of the YNP bison may be warranted due to Factor D.

b. If the answer to 4 is no:

Do sources cited in the petitions provide substantial information indicating the entity may warrant listing based on factor D?

☐ Yes

☐ No

If yes, list citations with page numbers. If no, please explain.

c. Provide additional comments, if any.

Factor E

5. Do the petitioners claim the entity warrants listing based on other natural or manmade factors affecting its continued existence (Factor E)?

☑ Yes (first petition)

☐ No

a. If the answer to 5 is yes:
Identify the other natural or manmade factors claimed by the petitioners to be a threat such that listing may be warranted.

Genomic extinction (first petition)
Climate change (first petition)

b. If the answer to 5 is yes:
Do the sources cited in the petitions provide substantial information to support the claim?

☐ Yes

☑ No (first petition)

If yes, indicate for which other natural or manmade factors are a threat and list the citations with page numbers for each factor. If no, please indicate for which factor(s) and explain.

Genomic extinction

Genomic extinction refers to situations in which "hybrids are fertile and may displace one or both parental taxa through the production of hybrid swarms" (Allendorf and Luikart 2007, p. 429, second petition). The first petition states "bison are at extremely high risk of genomic extinction because of domestication and anthropogenic selection, and hybridization with cattle". However, Freese *et al*. (2007, p. 178, both petitions) remark that "while many public bison herds harbor evidence of domestic cattle nuclear gene introgression, the amount of introgression across the genome of each individuals herd appears to be fairly low, with introgression rates ranging from 0.56% to 1.80%." The petitions note that the YNP bison herd is one of only a few with no evidence of cattle introgression (Ward *et al*. 1999, p. 54, first petition; Ward 2000, p. 20, first petition; Freese *et al*. 2007, p. 178, both petitions; Halbert and Derr 2007, p. 5, first petition). This important characteristic of the YNP bison makes conservation of the herd important to the overall preservation of the bison genome. Geographic isolation and disease management practices currently preclude the introduction of bison from other herds with cattle gene introgression. Therefore, we find that YNP bison are not at risk of genomic extinction because there is no evidence of cattle introgression and potential introgression is monitored and prevented.

In addition, the first petition calls for "protection under the Endangered Species Act to avoid further loss of genetic diversity, loss of evolutionary potential, and [to] conserve potential genetic contributions to plains bison restoration" and these concerns as they relate to YNP bison are discussed under Factor B.

Climate change

The first petition argues that climate change will result in decreased precipitation, increased temperatures, widespread drought conditions, and reduced snow pack in YNP. However, we find that neither the petition nor the sources it cites presents substantial information indicating climate change may be a threat to YNP bison.

Koons *et al*. (2012, p. 479, first petition) indicates climate changes may alter density-independent and density-dependent factors that influence foraging and dispersal behaviors of bison in the Henry Mountains, Utah. Based on these findings, the petition suggests as the climate dries, more YNP bison will move out of the park. However, no evidence was provided in the petitions or the sources they cite that indicate, given the unique topography of YNP, that dispersal out of the park is likely as a result of drought conditions.

In addition, the first petition suggests decreased snow pack will lead to YNP bison dispersal south into Grand Teton National Park, joining the Jackson bison herd, and rendering YNP bison at risk of breeding with these cattleintrogressed bison. However, neither the petition nor the sources it cites indicate under what extent of snow pack reduction these dispersal patterns are likely to occur and if snow pack will reach those levels. Further, there is no evidence that migration occurs between the Jackson and YNP herds and this is likely due to their being separated by the Continental Divide and an expansive tract of coniferous forest (Gates *et al*. 2005, p. 77, both petitions). Reduction of snow pack is not likely to reduce this considerable span of unsuitable habitat and allow dispersal of YNP bison south.

Lastly, bison historically occupied an extensive range (from Canada to Mexico and from the Rockies to Florida to New York) and tolerated a variety of climatic conditions (Boyd and Gates 2006, p. 16, first petition). This suggests YNP bison are likely to be flexible with any climate changes that may occur in the future.

Therefore, we find that the information provided in the petitions does not present substantial scientific or commercial information indicating listing of the YNP bison may be warranted due to Factor E.

c. If the answer to 5 is no:
Do sources cited in the petitions provide substantial information indicating the entity may warrant listing based on factor E, even though the petitioner does not make this claim?
☐ Yes
☐ No
If yes, identify the other natural or manmade factor(s) and list citations with page numbers for each. If no, please explain.

d. Provide additional comments, if any.

Cumulative Effects

□ Yes
□ No (box checked)

a. If the answer to it is yes:
Do the sources cited in the petitions provide substantial information to support the claim?
□ Yes
□ No
If yes, indicate which threats the petitioner claims may have synergetic or cumulative effects and list the citations with page numbers. If no, please indicate which threats and explain.

b. Provide additional comments, if any.

Petition Finding

Based on our review of the petitions and sources cited in the petitions, we find that the petitions do not provide substantial scientific or commercial information indicating that the petitioned action may be warranted.

Author

The primary authors of this notice are the staff members of the Region 6 Ecological Services Regional Office, U.S. Fish and Wildlife Service.

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[signed]

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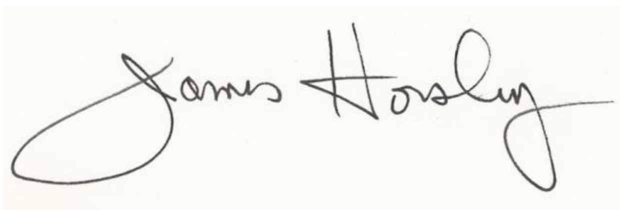

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