Yellowstone National Park
Idaho, Montana, Wyoming

U.S. Department of the Interior
National Park Service

Yellowstone National Park Bison Management Plan Draft Environmental Impact Statement

August 2023

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Draft Environmental Impact Statement

Lead agency: National Park Service (Yellowstone National Park)

Cooperating agencies: State of Montana (Governor's Office, Montana Department of Livestock, Montana Fish, Wildlife and Parks), Animal and Plant Health Inspection Service (Veterinary Services), US Forest Service (Custer Gallatin National Forest), InterTribal Buffalo Council, Confederated Salish and Kootenai Tribes of the Flathead Nation, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, and the Yakama Nation

The National Park Service (NPS) prepared this draft environmental impact statement (EIS) for a bison management plan at Yellowstone National Park to provide park staff with tools to manage bison that reflect the best available information and current circumstances. The purpose of taking action is to preserve an ecologically sustainable population of wild, migratory bison while continuing to work with partners to address brucellosis transmission, human safety, and property damage, and support tribal hunting outside the park.

The draft EIS presents three alternatives that consider various approaches and tools for managing bison within the park; it also describes actions common to all alternatives. The alternatives also consider external actions that could affect management efforts inside the park, while acknowledging the NPS does not have jurisdiction or control over actions beyond the park boundary, including public and tribal hunting, construction of capture or quarantine facilities, or tolerance for bison. Descriptions of external actions are not an endorsement or commitment from partners. The draft EIS analyzes the beneficial and adverse impacts on the human environment, including physical, natural, cultural, and socioeconomic resources, that would result from implementing the different alternatives. Upon conclusion of the decision-making process, either the no-action alternative will continue to be implemented or one of the other alternatives (or a combination of their elements) will be selected for implementation to provide park staff with the tools necessary to manage bison effectively using the best available information and adaptive management.

The review period for this document will end 45 days after publication of the US Environmental Protection Agency Notice of Availability in the *Federal Register*. Comments will be accepted during the comment period through the NPS Planning, Environment, and Public Comment website at https://parkplanning.nps.gov/YellowstonebisonEIS or in hard copy delivered by the US Postal Service or other mail delivery service or hand-delivered to the address below. Comments will not be accepted by fax, email, or in any other way than those specified above. Bulk comments in any format (hard copy or electronic) submitted on behalf of others will not be accepted. Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware the NPS might have to make your entire comment, including your personal identifying information, publicly available at any time. Although you may request to have your personal identifying information withheld from public review, we cannot guarantee we will be able to do so. For more information, visit https://parkplanning.nps.gov/YellowstonebisonEIS.

Mail or hand deliver written comments to: Park Headquarters, Superintendent, Attn: Bison Management Plan, P.O. Box 168, Yellowstone National Park, WY 82190.

Executive Summary

The National Park Service (NPS) manages Yellowstone bison in coordination with other federal, state, and tribal agencies pursuant to an Interagency Bison Management Plan (IBMP) signed in 2000 by the Secretaries of Agriculture and Interior and the Governor of Montana. The IBMP originated from concerns that bison migrating outside Yellowstone National Park (YNP or the park) would transmit the bacterial disease brucellosis to cattle and jeopardize interstate and international trade. Members of the IBMP include the Animal and Plant Health Inspection Service (APHIS; Veterinary Services), Confederated Salish and Kootenai Tribes of the Flathead Nation, US Forest Service (Custer Gallatin National Forest), InterTribal Buffalo Council, NPS (YNP), Nez Perce Tribe, and State of Montana (Department of Livestock [MDOL]; Fish, Wildlife and Parks [MFWP]).

Scope, Purpose, and Need

This draft environmental impact statement (EIS) focuses on actions the NPS may take to manage bison within YNP and consolidates various environmental compliance analyses conducted over the past two decades into a contemporary plan. Other tribal and governmental agencies have important roles and responsibilities in bison management outside the park, and the NPS intends to work cooperatively with these groups. The purpose of the plan is to preserve an ecologically sustainable population of wild, migratory bison while continuing to work with partners to address brucellosis transmission, human safety, and property damage and support tribal hunting outside the park.

Action is needed because new information obtained since the approval of the IBMP in 2000 indicates some of the premises regarding brucellosis transmission in the initial plan were incorrect or have changed over time. In addition, fewer cattle range near the park, and federal and state disease regulators have taken steps to reduce the economic impacts of brucellosis outbreaks in cattle. Since 2006, several American Indian tribes, including the Confederated Salish and Kootenai Tribes of the Flathead Nation, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, Yakama Nation, Blackfeet Nation, Shoshone-Bannock of the Fort Hall Reservation, Northern Arapaho Tribe, and Crow Nation have hunted bison on national forest lands adjacent to the park pursuant to long-standing treaties with the federal government.

Disputed issues on bison management raised by federal, state, and tribal agencies and the public during consultation, IBMP meetings, and scoping include: How many bison is too many (or too few)? Where and when will bison be tolerated outside the park? How, when, and where should hunting occur, while respecting tribal rights and the concerns of nearby residents, businesses, and other stakeholders? What should be done to preserve existing genetic diversity? How can Yellowstone bison be used to restore viable populations of bison on tribal and public lands? What should be done and what can be done to suppress brucellosis and/or reduce transmission risk to cattle? Should management of brucellosis in elk be considered in the plan? How intensive should management be to minimize risks to human safety and property? What intensity and types of management are appropriate for migratory wild bison whose core range occurs within a national park? Should humans intervene to manipulate habitat conditions or control bison numbers and grazing effects?

This analysis process will eventually result in a new Record of Decision (ROD) regarding how the NPS would manage bison within YNP. The NPS will continue to meet with the other federal, state, and tribal agencies under the existing framework for the IBMP to coordinate bison management and meet the goals identified in 2000. These goals include specific commitments related to the size of the bison herd; a clearly defined boundary line beyond which the agencies will not tolerate bison; provisions for public safety and the protection of private property; agency actions showing a commitment toward the eventual elimination of brucellosis in bison; protection of livestock from the risk of brucellosis; actions to help protect the brucellosis class-free status of Montana; and maintenance of a viable population of wild bison in biological, genetic, and ecological terms. The EIS discusses brucellosis transmission risk, bison

migration, cooperative management, and the importance of a bison population range that is healthy for the ecosystem. The planning process also allows the NPS to consider changed circumstances, such as fewer cattle near the park, federal and state disease regulators taking steps to reduce the economic impacts of brucellosis outbreaks in cattle, a warming climate, and tribes exercising treaty hunting rights on federal lands outside the park. Bison management is a complicated topic. Partners have long recognized the importance of learning, communication, and adjusting the plan to improve it over time. The IBMP includes the idea of adaptive management as one tool to address this complexity, including the use of protocols and agreements to codify adjustments to bison management over the last two decades. Adaptive management will continue to be an element of the bison program in the park.

Background

Bison are extremely adaptable and quickly respond to management actions and environmental changes. They also are prolific with high survival of calves compared to other ungulates in YNP and lower rates of predation due to their large body size and group defensive tactics. As a result, bison numbers can increase quickly when conditions are favorable. Most bison migrate to some extent along elevation gradients in response to forage production and snow accumulation or melting. In spring, they move upslope as snow melts and highly nutritious vegetation begins growing to spend summer in higher-elevation areas of YNP. When snow cover becomes deep, however, foraging efficiency in higher-elevation areas decreases, and bison generally move to lower elevations where less snow accumulates and more food is more accessible. Since YNP is primarily mountainous with limited areas of low-elevation winter range for ungulates, some of these migrating bison move across the park boundary into the State of Montana (Montana or the state). The timing and extent of these movements depend on snow conditions, available forage, and the density of bison in the park.

Brucellosis can be transmitted between bison, elk, and cattle. When the IBMP was negotiated during the 1990s, bison were believed to be the primary risk of brucellosis transmission to cattle and, as a result, Montana has limited tolerance for them. Bison are allowed to migrate from YNP during winter and spring into relatively small management (tolerance) areas in Montana adjacent to the northern and western boundaries of YNP. Given existing political and social constraints, however, it is unlikely these management areas will be increased substantially if bison numbers continue to increase. Thus, under the IBMP, NPS personnel have captured bison near the northern boundary of YNP during winter to reduce bison numbers and prevent movement outside the designated management areas in Montana. Captured animals have been shipped to slaughter facilities or placed in quarantine as part of a Bison Conservation Transfer Program (BCTP) to provide live, brucellosis-free bison to tribes for restoration on their lands.

Federal and state disease regulators initially thought elk played a minor role in brucellosis transmission to cattle, but elk have transmitted the disease to cattle more than two dozen times since 2000 (National Academies of Sciences, Engineering, and Medicine 2020). No transmissions to cattle have been directly attributed to bison, though they frequently mingle with elk and likely transmit brucellosis to them at times, and vice versa. The agencies involved with bison management have adjusted the 2000 IBMP many times through consensus decisions and annual operations plans to address these and other changes. This document updates new information and changed circumstances since 2000, describes adaptive management adjustments and environmental compliance implemented over time, and evaluates the effects of alternative approaches for preserving and managing bison. The alternatives were developed taking into consideration management actions that could occur on lands outside the park. Ideally, the plan would create opportunities to improve bison management in and outside the park. Expected outcomes of the process include an EIS and plan that incorporates new information, changed circumstances, and two decades of lessons learned; an enhanced ecological role for bison; increased hunting opportunities outside the park; and more brucellosis-free bison restored to tribal lands.

Per statute and policy, the NPS manages wildlife populations to sustain them in their natural condition, which is defined as what would occur in the absence of human dominance over the landscape. Thus, to

the extent feasible, the NPS would allow bison to move freely and unpursued within the interior of the park with their behaviors, movements, reproductive success, and survival primarily affected by their decisions and natural selection, more commonly known as survival of the fittest. Since 2013, bison numbers have ranged between 4,000 and 6,000 after calving, with consensus agreements among IBMP members on annual operations plans through 2020. However, numbers likely would increase with less intrusive management. Research indicates there is sufficient forage in the park to sustain about 10,000 bison during summer and 6,500 during winter although large variations in weather and grass production from year to year add complexity to this estimate. Near these estimates foraging efficiency and bison condition should decrease and more bison should migrate to lower-elevation areas in and outside the park.

Range of Alternatives

This document analyzes three alternatives for managing Yellowstone bison in the park, with numbers expected to range between about 3,500 and 7,000 bison after calving depending on the alternative. This range is sufficient to sustain the important ecological role bison play in terms of enhancing plant production; redistributing nutrients across the landscape; and providing meat for predators, scavengers, and decomposers. Based on current information, it is also sufficient to maintain the persistence of a genetically diverse bison population. Under all alternatives, some bison would continue to migrate outside the park where state agencies and the national forest have jurisdiction and work with private landowners to determine levels of tolerance, hazing, captures, and public hunting, and with tribes with treaty hunting rights to coordinate the location and extent of their hunting. Throughout this document, the term "harvest" refers to bison shot during hunts outside the park by members of tribes pursuant to long-standing treaties with the federal government and public hunters with permits from MFWP. The word "culled" refers to bison captured in the Stephens Creek Administrative Area for possible inclusion in the BCTP, shipment to slaughter, or shooting on-site. The word "removals" refers to the combined numbers of harvests and culls.

Alternative 1 (No Action)

This alternative prioritizes maintaining a negligible risk of brucellosis transmission from bison to cattle to assure other states and countries that management will prevent the transmission of brucellosis from bison to livestock (State of Montana 2000). The NPS would continue current management pursuant to the IBMP as adjusted and implemented since 2000 through consensus decisions and annual operations plans by the agencies involved with bison management. Bison numbers are expected to range between about 3,500 and 5,000 after calving. Bison could move to the park boundary and into established northern and western management areas in Montana where their numbers would be limited by captures in the park for the BCTP (quarantine) or shipment to slaughter, as well as public and tribal hunter harvests outside the park, primarily on national forest lands. Only bison testing negative for exposure to brucellosis are eligible for the BCTP, which could include bison of either sex, any age, and pregnant or non-pregnant bison. Within YNP, the management of bison, such as capture and quarantine, would generally occur near the north boundary. However, the NPS may work with partners outside the park, as requested and appropriate, to reduce conflicts with cattle, people, and property. Hazing in or outside the park would involve moving bison away from an area where they are not wanted, such as developed areas, highways, or private property, using people walking, on horseback, or in vehicles. Biologists would conduct brucellosis screening and subsequent testing on bison placed in the BCTP.

Park staff would capture some migrating bison inside the Stephens Creek Administrative Area near the northern boundary of the park and ship them to slaughter to decrease numbers (if desired) and provide meat to tribes. If space is available, some bison testing negative for brucellosis exposure would be placed in the BCTP to increase the number of live brucellosis-free animals relocated to the Fort Peck Indian Reservation in northeastern Montana and eventually to other tribal or public lands. If space is not available, these bison would be shipped to slaughter. The NPS is working with APHIS and nongovernmental organizations (NGOs) to increase the capacity of the BCTP and reduce the number of

animals sent to slaughter. These efforts included doubling the size of quarantine pastures near the Stephens Creek Administrative Area pursuant to the park's 2018 environmental assessment (EA) on *The Use of Quarantine to Identify Brucellosis-free Yellowstone Bison for Relocation Elsewhere* (USDOI, NPS 2016a). The NPS would continue to coordinate captures in the park with tribal and public hunter harvests outside the park to reduce the effects of capture on hunter harvest opportunities and continue discussions with the tribes and other agencies to improve communication, safety, and management.

Alternative 2

This alternative would prioritize the NPS's trust responsibilities to tribes by using the BCTP to restore bison to tribal lands and treaty hunting outside the park to provide tribes with access to traditional resources. The NPS expects bison numbers generally would be slightly higher than under Alternative 1 and are expected to range between about 3,500 and 6,000 bison after calving. Larger numbers could support bison movements into new areas of the park to enhance nutrient cycling, grassland health, and biodiversity across a larger area. Larger numbers also could occasionally result in larger migrations into designated management areas in Montana, including portions of the Custer Gallatin National Forest, that would support conservation and increase hunting opportunities. Management of bison within YNP would be like Alternative 1. The NPS would reduce shipments to slaughter but may use on-site killing of captured bison or haul bison to terminal pastures outside the park where they would be killed within an agreed-upon time in collaboration with the tribes to reduce numbers. The NPS would continue ongoing efforts to capture some bison migrating from the park to enter more animals into the BCTP for eventual transport to tribes. The NPS may collaborate with interested partners to establish additional quarantine facilities outside the park. The NPS would continue hunt-capture coordination with partners as described for Alternative 1 and could release animals not suitable for the BCTP due to previous brucellosis exposure to increase hunting opportunities if they subsequently migrate across the park boundary. As the BCTP expands and hunter harvests increase, the NPS would reduce captures for shipments to slaughter.

Alternative 3

This alternative would prioritize treating Yellowstone bison more like elk that have been exposed to brucellosis but are not subject to intense disease management like bison. Captures of bison for shipments to slaughter would immediately cease, with natural selection and public and tribal hunter harvests in Montana being the primary factors limiting bison numbers. The NPS would continue captures in YNP to maintain the BCTP, but release bison not suitable for the program. Bison numbers likely would be substantially higher than under Alternative 1 and are expected to range from 3,500 to 7,000 bison after calving. The NPS may haze bison within YNP when necessary to protect people and property. Montana could implement hazing outside the park at its discretion. There should be substantially more hunter harvest opportunities for tribes outside the park, provided members allow bison to distribute across a larger landscape before hunting them. The risk of brucellosis spreading from bison to cattle might increase compared to Alternative 1 as more bison migrate outside the park and potentially mingle with cattle if they surpass management efforts to keep them in the existing management area. If higher bison numbers threaten the efficacy of management efforts to keep them in the existing management areas, even with more hunting opportunities, the NPS would reinstitute shipments to slaughter as described for Alternatives 1 and 2, with large captures and hazing events occurring more frequently in Montana to reduce numbers and alleviate conflicts with property and improve safety.

Environmental Consequences

Inside the park, expected impacts from the implementation of bison management actions include potential changes in population structure and bison behavior from removals; maintenance of the ecological role provided by bison; potential for staff injuries related to bison management operations; potential impacts on vegetation from intense grazing in some areas (including outside the park); and potential impacts to visitor experience from closures and bison management operations in and around the capture and quarantine facilities. Outside the park, partners could collaborate in the construction of additional

quarantine facilities that could be used in partnership with the NPS, reducing the risk of private property damage, increasing the availability of bison for hunting opportunities, and increasing the availability of brucellosis-free bison to be sent to tribal lands. Due to mitigation measures currently in use among federal and state partners, there is generally a low risk of brucellosis transmission from bison to cattle outside the park.

Under all alternatives, the NPS would continue to meet the goals of the 2000 IBMP. Since 2012, the NPS and other IBMP partners have met these goals while averaging about 5,000 bison after calving. There has been no documented transmission of brucellosis from bison to cattle, fewer conflicts with people and property, high visitor enjoyment and economic contributions to gateway communities, increased hunting opportunities, and more brucellosis-free bison sent to tribal lands. If the risk of bison mingling with livestock increases in the future, the NPS would take more aggressive management actions in collaboration with other IBMP partners, such as increasing captures, hazing, hunting, and removals to reduce the risk of bison mingling with cattle. Montana uses these techniques to manage brucellosis transmission risk from elk mingling with livestock in the Paradise Valley and, for over two decades, the IBMP partners have demonstrated these same techniques work for bison.

Under all alternatives, the NPS would work with tribal partners to increase their hunting opportunities and the number of live bison sent to tribal lands through the BCTP given weather influences on the extent of migration each year. The NPS would continue engaging with tribes associated with Yellowstone bison to explore ways to increase the efficiency and safety of hunting outside the park and the restoration of brucellosis-free bison to tribal lands through the BCTP. Staff from other federal and state agencies could inform these discussions with the Custer Gallatin National Forest and MFWP participating in consultations about hunting and APHIS and the MDOL participating in consultations about the BCTP. The NPS also would work with partners to explore other management options outside the park, including streamlining testing protocols for the BCTP, more bison year-round on the Custer Gallatin National Forest per the 2022 Land Management Plan, and the construction of additional quarantine facilities and temporary capture facilities outside the park.

Adaptive management is a key concept incorporated into all alternatives to evaluate current conditions, identify undesired trends, implement management actions, monitor progress toward desired conditions or objectives, and adjust actions to improve progress. The NPS and other federal and state agencies and tribes involved with the IBMP have used this process to inform decision-making and adjust bison management. The NPS would continue to implement monitoring and research to obtain timely information and adjust preservation and management activities. Under the IBMP, operations plans have served as the main mechanism for describing and implementing commitments and agreements for the cooperative management of Yellowstone bison across jurisdictions. Under each alternative, the NPS would continue to meet with the other federal, state, and tribal agencies to coordinate bison management using the existing framework for the IBMP. The NPS would continue to prepare annual assessments of the status of the bison population and propose adjustments to adaptive management and operations plans based on the selected alternative resulting from this process.

When Yellowstone bison cross the boundary of the park into surrounding states, they are no longer under the jurisdiction of the NPS. Instead, their management is the prerogative of the respective state and the US Forest Service (USFS) on National Forest System lands. Hundreds of bison have occupied suitable winter range near the park boundary in Montana, with tolerance linked to the successful management of disease, property, and safety risks. Several tribes have rights reserved by treaties with the US government to harvest bison migrating outside the park onto portions of the Custer Gallatin National Forest. The NPS would continue to honor and support these rights reserved through treaties and work with the tribes and tribal organizations, US Department of Agriculture, Montana, NGOs, and private landowners to increase tolerance for bison on suitable lands outside YNP where a low risk of brucellosis transmission to cattle can be maintained.

Consultation and Coordination

Scoping is an essential component of the National Environmental Policy Act (NEPA) planning process. The formal scoping process for this draft EIS consisted of public scoping and consultation with federal and state agencies and tribal governments. The formal NEPA process and 30-day public scoping period was initiated on January 28, 2022, with the publication of a Notice of Intent in the *Federal Register* (87:4653). In addition to the Notice of Intent, preliminary information regarding the EIS was provided to the public and other interested parties through a press release and public scoping newsletter. During public scoping, the NPS hosted two virtual meetings and received more than 2,540 pieces of correspondence.

Agency consultation is the early involvement of federal and state agencies and tribal governments that may be affected by the federal action. This allows affected agencies or tribal governments to comment and contribute early to the decision-making process and helps the NPS to identify key issues or requirements to be considered in the NEPA process. Prior to and following the release of the Notice of Intent, the NPS had discussions with the cooperating agencies regarding their recommendations on bison management related to the actions being considered in this EIS. The following consultations will need to be completed prior to implementation of the selected action: Endangered Species Act, section 7 – US Fish and Wildlife Service (FWS); and National Historic Preservation Act (NHPA) section 106 consultation – Montana, Wyoming, and Idaho State Historic Preservation Officer. Section 106 of the NHPA requires that federal agencies consider their effects to historic properties. This process requires agencies to determine whether they have an undertaking that has the potential to cause effects to a historic property. The alternatives were reviewed for their potential to affect historic properties. The implementing regulations for section 106, 36 Code of Federal Regulations (CFR) 800, define an undertaking as, "... a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval" (36 CFR 800.16(y)). The management of bison is an undertaking according to this definition. The no-action alternative would result in the park continuing to manage bison in the same manner as they are currently managed. Both action alternatives consist of using existing facilities and are based on the number and frequency of bison captured or permitted to pass by the capture facility to be hunted by tribes and the state outside the boundary of the park. No new construction or other activities that would have the potential to cause effects to historic properties are part of this plan. Bison do not meet the definition of a historic property at 36 CFR 800.16(l)(1). The alternatives in this plan do not have the potential to cause effects to historic properties per 36 CFR 800.3(a)(1); therefore, no further section 106 review is needed. The NPS will continue to consult with American Indian tribes per other laws, policies, and regulations, given the significance of bison to the tribes.

Next Steps

The public review and comment period for this draft EIS will be 45 days. Written comments on the draft EIS will be fully considered and evaluated when preparing the final EIS. The final EIS will include responses to all substantive comments. The publication of the final EIS will initiate a 30-day waiting period after which either the no-action alternative will continue to be implemented or one of the other alternatives (or a combination of their elements) will be selected in a Record of Decision signed by the Intermountain Regional Director for Regions 6, 7, and 8.

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Acronyms and Abbreviations

Abbreviation/Acronym	Full Term/Description
APHIS	Animal and Plant Health Inspection Service
BCTP	Bison Conservation Transfer Program; quarantine
CDC	Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DNA	deoxyribonucleic acid
DSA	Designated Surveillance Area for brucellosis
EA	environmental assessment
EIS	environmental impact statement
et al.	and others
et seq.	and what follows
°F	degrees Fahrenheit
FONSI	Finding of No Significant Impact
GonaCon™	gonadotropin-releasing hormone immunocontraceptive vaccine
GYA	Greater Yellowstone Area
IBMP	Interagency Bison Management Plan
ITBC	InterTribal Buffalo Council
MCA	Montana Code Annotated
MDOL	Montana Department of Livestock
MFWP	Montana Fish, Wildlife and Parks
NEPA	National Environmental Policy Act
NGO	nongovernmental organization
NPS	National Park Service
RB51	*Brucella abortus* vaccine strain RB-51
park	Yellowstone National Park
ROD	Record of Decision
US	United States
USC	United States Code
USDA	US Department of Agriculture
USDOI	US Department of the Interior
USFS	US Forest Service
YNP	Yellowstone National Park

Chapter 1: Purpose and Need for Action

Introduction

This draft environmental impact statement (EIS) for a bison management plan at Yellowstone National Park (YNP or the park) analyzes the impacts that could result from implementing updated bison management actions on more than 1.1 million acres (4,450 square kilometers) of National Park Service (NPS) lands. This chapter describes the reasons the NPS is proposing to act by outlining the mission of the NPS and the purpose and significance of YNP, thereby giving context to the management framework for bison within the park. This chapter also describes the history of bison management, important changes in circumstances and new information, the purpose and need for action, the project location and area, and impact topics retained for further analysis.

This analysis process will eventually result in a new Record of Decision (ROD) regarding how the NPS would manage bison within YNP. The NPS would continue to meet with the other federal, state, and tribal agencies to coordinate bison management using the existing framework for the Interagency Bison Management Plan (IBMP), which has been in force since 2001. The new bison plan for YNP would continue to advance the primary goals of the IBMP.

Background

Purpose and Significance of Yellowstone National Park—Units of the national park system are established by Congress to fulfill specified purposes. A park's purpose provides the foundation for decision-making as it relates to preserving park resources and providing for the "enjoyment of future generations." Congress established YNP in 1872 to "dedicate and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people; … for the preservation, from injury or spoliation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition" (Park Protection Act of 1872; 16 United States Code [USC] 21 et seq., 17 Stat. 32).

On May 7, 1894, Congress passed *An Act to Protect the Birds and Animals in Yellowstone National Park, and to Punish Crimes in said Park, and for Other Purposes*. The April 4, 1894, House of Representatives Report that accompanied this Act, states "out of the vast herds of millions of buffaloes [bison] that a few years ago coursed the plains of America a few hundred only remain, and they are now all in the Yellowstone Park, and one of the purposes of setting aside this park has been to preserve this little herd." It also indicates "[a] few days ago, poachers entered the park and commenced the slaughter of these animals. Prompt action is necessary, or this last remaining herd of buffalo will be destroyed." As a result, section 4 of the 1894 Act established "[t]hat 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, is prohibited within the limits of said park."

In addition, the Organic Act of 1916 (54 USC 100101(a, b)) directed the Secretary of the Interior and the NPS to "conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations." This mission supports allowing natural processes to regulate wildlife numbers rather than human controls provided there is no evidence that ecological limitations on population growth, such as food limitation, predation, dispersal (range expansion), disease, and severe weather are inadequate (USDOI, NPS 2006a).

The park's purpose and significance are rooted in its enabling legislation; subsequent legislation; and current knowledge of its natural, cultural, and visual resources. Statements of a park's significance describe why the park is important within a global, national, regional, and ecosystem-wide context and are directly linked to the purpose of the park. YNP is significant because it is the world's first national park and preserves geologic wonders, including the world's most extraordinary collection of geysers and hot springs and the underlying volcanic activity that sustains them. The park preserves abundant and

diverse wildlife in one of the largest remaining intact and wild ecosystems on earth, supporting surrounding ecosystems and serving as a benchmark for understanding nature. It also preserves an 11,000-year continuum of human history, including sites, structures, and events that reflect a shared heritage. This history includes the birthplace of the national park idea—a milestone in conservation history. In addition, YNP provides for the benefit, enjoyment, education, and inspiration of this and future generations. Visitors have a range of opportunities to experience the essence of the park's wonders and wildness in a way that honors the park's value to the human spirit and deepens the public's understanding and connection to it (USDOI, NPS 2014a).

History of Bison Management—Tens of millions of plains bison once ranged across western North America. They were an important food source for American Indian tribes[1] living in, or traveling through, the Yellowstone area before colonization by European American settlers. After westward expansion by European Americans, treaties with the US government limited the use of lands within the Greater Yellowstone Area (GYA) by indigenous people (Nabokov and Loendorf 2002; Wallen et al. 2015b).

A few hundred bison survived commercial hunting and slaughter during the middle to late 1800s, with YNP providing refuge to about two dozen wild and free-ranging animals. Bison numbers increased after protection from hunting and poaching due to husbandry and the reintroduction of bison to various locations, including the northern and central portions of YNP. The NPS fed bison in the northern portion of YNP during winter at the Buffalo Ranch in the Lamar Valley and herded them to the Mirror Plateau and upper Lamar River area during summer (Meagher 1973). The remaining native bison spent winter in the Pelican Valley in central YNP but also moved to the Mirror Plateau and upper Lamar River area during summer. Bison numbers increased rapidly to about 1,100 by 1930 (Meagher 1973).

Managers stopped feeding and herding bison in the Lamar Valley in 1952, after which bison moved about freely. However, managers shot or captured and shipped about 3,500 bison from this herd between 1930 and 1966 to reduce numbers and take out individuals with the disease brucellosis. For similar reasons, managers removed about 1,000 bison from the central portion of YNP between 1954 and 1966. These removals reduced numbers to about 70 bison in the northern herd and 350 bison in the central herd by the winter of 1968 (Meagher 1973). Thereafter, managers stopped removing bison and allowed numbers to vary in response to forage availability, predation, and weather. Bison numbers increased rapidly to about 1,700 during the 1970s and 3,000 during the 1980s. By 1994, bison numbers increased to about 4,100, with almost 3,000 bison in central YNP and larger winter movements toward the park's northern and western boundaries (White et al. 2022b).

By the summer of 2005, about 3,500 bison were in central YNP and 1,500 bison were in northern YNP. Since then, there has been a large decrease in the number of bison in central YNP, a rapid increase in the number of bison in northern YNP, and more movements of bison from central to northern YNP (Wallen and White 2015). These movements were likely in response to high bison numbers in central YNP, intense hazing by the State of Montana (Montana or the state) along the western boundary to keep bison in the park, and groomed roads that allowed bison to rapidly travel north during winter (Wallen and White 2015). In addition, counts of elk in northern YNP decreased from about 19,000 in the mid-1990s to 3,915 elk by 2013 following the restoration of predators such as bears, cougars (mountain lions), and wolves. As elk numbers decreased, the number of bison in northern YNP increased from about 1,500 in 2005 to 4,000 in 2016-2017. In contrast, the number of bison in central YNP decreased from about 3,500 in 2005 to about 1,200 in 2018 (White et al. 2015c; Geremia 2022).

Today, Yellowstone bison are the largest wild population of plains bison. These bison have relatively high genetic diversity and move across a vast landscape where they are exposed to natural selection (also

[1] American Indian tribes include bands, nations, or other organized groups the Secretary of the Interior includes in the Federally Recognized Indian Tribe List Act of 1994, as amended (25 USC 5130-5131).

known as survival of the fittest) through competition for food and breeding opportunities, predation, and survival under challenging environmental conditions. As a result, they have adaptive capabilities that are continually honed compared to bison kept in fenced pastures with no predators and where older bulls are removed to simplify management. Many tribes have a deep relationship with Yellowstone bison because they are wild descendants of the huge herds of bison that once roamed across North America and provided their ancestors with food and other resources for centuries. As a result, public and tribal interest in the preservation and management of Yellowstone bison is substantial.

Brucellosis is a nonnative disease caused by the bacteria *Brucella abortus* that was introduced to the Yellowstone area when cattle were added to the landscape by the early 1900s (Meagher and Meyer 1994). Brucellosis can induce abortions in ungulates and be transmitted among bison, cattle, and elk if they contact infectious birthing tissues (amniotic fluids, fetus, placenta) or the newborn calf (National Academies of Sciences, Engineering, and Medicine 2020). Diagnosing brucellosis infection with a high level of certainty requires killing the animals and attempting to culture the bacteria from milk, lymphatic tissues, uterine discharges, and fetal tissues. Alternatively, serology is used to detect antibodies circulating in the blood that indicate past exposure to *Brucella* bacteria (Cheville et al. 1998). However, a positive serology test (seropositive) does not necessarily mean the animal is still infected or capable of transmitting the bacteria. For example, about 60% of adult female bison in YNP test seropositive for antibodies indicating previous exposure to *Brucella* bacteria, but only 10% to 15% of all adult female bison are infectious and could potentially shed live bacteria that spread the disease (Hobbs et al. 2015).

The Centers for Disease Control and Prevention (CDC) and the US Department of Agriculture, Animal and Plant Health Inspection Service (APHIS) consider the bacteria *Brucella abortus* a select agent and toxin because it has the potential to pose a severe threat to human and animal health, plant health, or animal and plant products (7 Code of Federal Regulations [CFR], Part 331, 9 CFR Part 121, and 42 CFR Part 73). Brucellosis is a zoonotic disease that can infect people, causing undulant fever with symptoms including intermittent fever, chills, night sweats, body and joint pain, poor appetite, and weakness. Brucellosis bacteria can infect people through breaks in the skin, mucous membranes, membranes in the eye, and respiratory and intestinal tracts. People consuming improperly handled or cooked meat or raw organs are at risk of a brucellosis infection. Proper handling and cooking completely kills the bacteria.

Brucellosis concerns livestock producers because, if cattle become infected, producers lose income from killing infected cattle, additional testing requirements, and possible restrictions on interstate transport and international trade (Bidwell 2010). These concerns have substantially influenced the management of Yellowstone bison and constrained their distribution across the GYA and elsewhere (White et al. 2015a,b). More bison began migrating into Montana during the 1990s as their numbers increased, and the higher prevalence of brucellosis exposure in bison (50% to 60%) than elk (less than 10%) suggested bison would be a higher risk of transmitting the disease to cattle (Cheville et al. 1998, State of Montana 2000).

In 1995, Montana sued the federal government due to concerns that bison infected with brucellosis bacteria that migrated outside YNP could jeopardize the state's brucellosis-free status for cattle and, in turn, interstate and international trade (State of Montana 2000, Franke 2005, Bidwell 2010). A brucellosis-free classification allows producers to export cattle to other states or nations without testing. Historically, the entire state lost this classification if regulators detected brucellosis in two or more livestock herds within a 2-year period or ranchers did not depopulate a livestock herd exposed to brucellosis within 60 days. This reclassification had significant adverse economic consequences on producers state-wide (USDA, APHIS 2014). As a result, Montana wanted to maintain a negligible risk of brucellosis transmission from bison to cattle to assure other states and countries that management would prevent the transmission of brucellosis from bison to livestock and reduce brucellosis prevalence. The state deemed "low risk" unacceptable because brucellosis transmission might still occur under certain circumstances. Because the state had few funds or personnel allocated for bison management, and bison could not transmit brucellosis to cattle if they remained in YNP, state officials rejected alternatives for bison to occupy suitable public lands elsewhere (State of Montana 2000).

In 1995, the federal government and Montana entered into a court-approved settlement agreement for issuing a final EIS and Record of Decision (ROD) regarding the management of Yellowstone bison (USDOI and USDA 2000b). Originating from concerns that bison migrating outside YNP would transmit brucellosis to cattle and, thereby, jeopardize interstate and international trade, staff for the Secretaries of Agriculture and the Department of the Interior (USDOI) and the Governor of Montana developed the IBMP. The ROD for this plan/EIS was signed in December 2000. There were "no court orders covering the issuance of this Record of Decision" (USDOI and USDA 2000b:38). The ROD indicated "[t]he Joint Management Plan meets the goals of the state and federal agencies identified in the draft and final environmental impact statements. Those goals included specific commitments relating to the size of the bison herd, both within and outside Yellowstone National Park; a clearly defined boundary line beyond which the agencies will not tolerate bison; provide for public safety and the protection of private property; agency actions showing a commitment toward the eventual elimination of brucellosis in bison; protection of livestock from the risk of brucellosis; actions to help protect the brucellosis class-free status of Montana; and maintenance of a viable population of wild bison in Yellowstone National Park from biological, genetic, and ecological terms. The plan is based on factual information, which recognizes that the scientific database is changing. Finally, the plan recognizes the need for coordinated management of natural and cultural values that are the responsibilities of the cooperating agencies" (USDOI and USDA 2000b). The NPS, APHIS, US Forest Service (USFS), Montana Department of Livestock (MDOL), Montana Fish, Wildlife and Parks (MFWP), Confederated Salish and Kootenai Tribes of the Flathead Nation, Nez Perce Tribe, and the InterTribal Buffalo Council (ITBC) coordinate to implement the IBMP (see appendix A for roles and responsibilities).

Negotiators of the IBMP chose a population target of 3,000 bison in late winter and early spring to reduce migration outside YNP, which equates to about 3,600 to 3,700 bison after calving during summer (Cheville et al. 1998, USDOI and USDA 2000b, Angliss 2003). Bison could only migrate into small areas adjacent to YNP during a short period in winter to "prevent the reestablishment of a free-ranging bison herd in places where bison have been absent for more than a century" (State of Montana 2000). The management of bison under the IBMP also includes actions such as capture, test-and-slaughter, vaccination, and hazing animals back into YNP to constrain their abundance and distribution while attempting to suppress brucellosis prevalence. The Montana Legislature imposed restrictions on the movements and relocation of Yellowstone bison (Montana Code Annotated [MCA], Titles 81 and 87). In 2009, the Confederated Salish and Kootenai Tribes of the Flathead Nation and the Nez Perce Tribe became members of the IBMP because of their treaty rights for hunting bison on unoccupied lands in southwestern Montana. The ITBC, which is recognized as a federally chartered Indian organization by the Bureau of Indian Affairs under Section 17 of the Indian Reorganization Act has about 83 member tribes and their primary mission is to restore buffalo to tribal lands. Many tribes have rights reserved through treaties with the federal government to hunt on unoccupied lands of the United States so long as game is found thereon. The word "unoccupied" denotes an area free of residence or settlement by non-Indians (*Herrera v. Wyoming*, 139 S. Ct. 1686 (2019)).

Between 2001 to 2023, the agencies and tribes successfully met the overarching goals of the IBMP by preserving a viable, wide-ranging population of plains bison while preventing the transmission of brucellosis from bison to livestock. However, several of the circumstances that influenced the derivation and implementation of the original IBMP changed, and scientific knowledge regarding bison and brucellosis improved substantially (appendix B). A few key changes are summarized here.

In 2006, the IBMP members clarified "a population of 3,000 bison is defined as a population indicator to guide implementation of risk management activities and is not a target for deliberate population adjustment" (IBMP Partner Agencies 2006). They also adjusted the operations plan to increase tolerance for bull bison in Montana because there is negligible risk of them transmitting brucellosis to cattle (Clarke et al. 2005).

Since 2006, several tribes have asserted their treaty rights to harvest bison migrating from YNP onto unoccupied national forest lands in Montana via hunting. Since 2009, livestock disease regulators have implemented the vaccination of livestock calves with high compliance in the brucellosis surveillance area in Montana. In 2010, APHIS changed regulations to deal with brucellosis outbreaks in cattle on a herd-by-herd basis without imposing unnecessary corrective actions and associated economic costs on the rest of the producers in the state (USDA, APHIS 2014). If outbreaks are investigated and contained by removing all cattle testing positive for brucellosis, the entire state or area is not reclassified or subject to corrective actions. In 2010, Montana designated a surveillance area (DSA) for brucellosis defined by occurrence of the disease in elk (MDOL 2011). To prevent brucellosis-infected livestock from being moved into other states, all calves within the DSA are vaccinated for brucellosis, all cattle are uniquely marked so relocations or sales can be traced, and all reproductive cattle are tested for brucellosis exposure prior to movement elsewhere. In 2015, Montana increased tolerance for more bison across a larger management area in the state (Bullock 2015).

In 2017-2018, the NPS, APHIS, and MDOL began the Bison Conservation Transfer Program (BCTP; quarantine) to identify brucellosis-free Yellowstone bison and transfer them to the Fort Peck Indian Reservation in northeastern Montana. Between 2019 and 2023, the NPS and APHIS sent 294 brucellosis-free Yellowstone bison to the Assiniboine and Sioux Tribes at Fort Peck for one year of assurance testing and eventual release. The ITBC transferred more than 170 bison of Yellowstone-origin from the Fort Peck Indian Reservation to 23 tribes across 12 states.

In 2016, genetic data indicated elk had infected cattle herds with brucellosis in the GYA, not bison. Elk exposed to brucellosis inhabited an area encompassing about 17 million acres (6.9 million hectares), whereas bison inhabited 1.5 million acres (607,000 hectares) near the core. Control measures in bison would not affect the dynamics of unrelated *Brucella abortus* strains in elk elsewhere (Kamath et al. 2016). In 2020, the National Academies of Sciences, Engineering, and Medicine concluded infected elk had transmitted brucellosis to livestock in the GYA at least 27 times since 1998 with no transmissions attributed to bison. The Committee recommended prioritizing efforts on preventing brucellosis transmission by elk, while maintaining separation between bison and cattle (see appendix E). The Committee also recommended not using aggressive control measures on bison until tools became available for an eradication program in elk.

In 2022, the Custer Gallatin National Forest adopted a new Land Management Plan. The selected alternative includes desired conditions supporting habitat improvement projects to create or connect suitable bison habitat with enough bison present and distributed year-round to provide a self-sustaining population on the national forest in conjunction with bison herds in YNP (USDA, USFS 2022).

The IBMP agencies addressed these changed circumstances and new information through adaptive management adjustments and environmental compliance evaluations described at http://ibmp.info/adaptivemgmt.php and in other sections of this document.

Purpose and Need for Action

The purpose of the plan is to preserve an ecologically sustainable population of wild, migratory bison while continuing to work with partners to address brucellosis transmission, human safety, and property damage and support tribal hunting outside the park. Other tribal and governmental agencies have important roles in bison management outside the park, and the NPS intends to work cooperatively with these groups to accomplish this purpose.

When complete, a new plan will update NPS actions identified in the current IBMP, as adjusted. The planning process will consider bison management actions likely to occur on lands outside the park in Montana, while acknowledging the NPS does not have jurisdiction or control over actions beyond the park boundary. Ideally, the plan would create opportunities to improve bison management in and outside the park. Expected outcomes of the process include continued interagency partnerships, a plan and an EIS

that reflects new information and changed circumstances and incorporates two decades of lessons learned, an enhanced ecological role for bison, increased hunting opportunities outside the park, more brucellosis-free bison restored to tribal lands, and fewer shipments of bison to slaughter.

Bison are prolific with high survival of calves compared to other ungulates in YNP and lower rates of predation due to their large body size and group defensive tactics. As a result, bison numbers can increase quickly when conditions are favorable (White et al. 2015c). Most bison migrate along elevation gradients in response to forage production and snow accumulation or melting. In spring, they move upslope as snow melts and highly nutritious vegetation begins growing to spend summer in higher-elevation areas of YNP. When snow cover becomes deep, however, foraging efficiency in higher-elevation areas decreases, and bison generally move to lower elevations where less snow accumulates and food is more accessible (Geremia et al. 2015a). Since YNP is primarily mountainous with limited areas of low-elevation winter range for ungulates, some of these migrating bison move across the park boundary into Montana. The timing and extent of these movements depend on snow conditions, available forage, and the density of bison in the park (Geremia et al. 2011, 2014).

When the IBMP was negotiated during the 1990s, bison were believed to be the primary risk of brucellosis transmission to cattle (Bidwell 2010). Bison are allowed to migrate out of YNP during winter and spring into relatively small management (tolerance) areas in Montana adjacent to the northern and western boundaries of YNP (Bullock 2015). Given existing political and social constraints, however, it is unlikely these management areas will be increased substantially if bison numbers continue to increase (White et al. 2015c). Thus, under the IBMP, NPS personnel have captured bison near the northern boundary of YNP during winter to reduce bison numbers and prevent movements outside the designated management areas in Montana. Captured animals have been shipped to slaughter facilities or placed in quarantine as part of the BCTP to provide live, brucellosis-free bison to tribes for restoration on their lands.

Action is needed because new information obtained since the approval of the IBMP in 2000 indicates some of the premises regarding brucellosis transmission in the initial plan were incorrect or have changed over time. Federal and state disease regulators initially thought elk played a minor role in brucellosis transmission to cattle, and bison migrating outside YNP would transmit brucellosis to cattle and jeopardize interstate and international trade. However, elk have transmitted brucellosis to cattle at least 27 times since 1998 with no transmissions attributed to bison. Circumstances also changed with fewer cattle near the park, and federal and state disease regulators taking steps to lessen the economic impacts of brucellosis outbreaks in cattle. In addition, since 2006 several tribes have hunted bison on national forest lands adjacent to the park pursuant to long-standing treaties with the federal government.

In recent years, concentrated tribal hunters on national forest lands near the park boundary have, at times, resulted in conflicts with nearby residents due to shooting near roads and houses, gut piles left on the landscape, shooting of elk and other ungulates, and occasional incidents of shooting toward other hunters, houses, and cars. The YNP Bison Management Plan/EIS will not resolve these issues. The NPS does not have regulatory authority or jurisdiction over hunts that occur outside YNP. The Custer Gallatin National Forest has taken some actions to address public safety and natural resource concerns associated with hunts on forest lands, but hunts conducted under permits through Montana or tribes exercising their treaty rights do not require authorization from the USFS (Erickson 2019).

Likewise, this bison management plan will not eliminate or substantially reduce the occurrence of brucellosis in the GYA. Brucellosis is spreading in elk throughout the region, and it has spread from elk to cattle at least 27 times since 1998. The eradication of brucellosis would require eliminating the disease in elk, which would involve attempting to capture, test, and vaccinate or slaughter tens of thousands of elk across the entire GYA, which most people consider unacceptable and impossible at this time (National Academies of Sciences, Engineering, and Medicine 2020). The NPS concluded in a previous final EIS that the park-wide vaccination of bison would not achieve desired results and could have unintended

negative effects to the population and visitor experience (USDOI, NPS 2014b). The NPS based this conclusion on the lack of an easily distributed and highly effective vaccine and limitations of current diagnostic and vaccine delivery technologies. Remote vaccination by darting or bio-bullet would result in injuries and changes in bison behavior that would negatively affect visitor experiences such as watching wild animals. In addition, elk that are also infected and widely distributed would re-infect bison.

Project Location and Analysis Area

YNP encompasses about 2.2 million acres (890,300 hectares) of Wyoming, Montana, and Idaho and is the core of the GYA, which is the largest and most nearly intact ecosystem in the contiguous United States. The area specifically subject to analysis for this plan includes approximately 1.1 million acres (4,450 square kilometers) in the central and northern portions of YNP and small adjacent areas in Montana. Bison in central YNP occupy the central plateau, extending from the Pelican and Hayden valleys with a maximum elevation of 8,200 feet (2,500 meters) in the east to the lower-elevation (6,570 feet [2,000 meters]) and geothermally influenced Madison headwaters area in the west (figure 1). Winters are often severe, with temperatures reaching -44 degrees Fahrenheit (°F) (-42 degrees Celsius) and snowpack exceeding 6 feet (1.8 meters) in some areas. Bison in central YNP congregate in the Hayden Valley for breeding. Afterward, most bison move between the Madison, Firehole, Hayden, and Pelican Valleys, but some travel to the Hebgen Basin in Montana or the northern region of the park before returning to the Hayden Valley for the subsequent breeding season. Bison in northern YNP and nearby areas of Montana primarily occupy the Yellowstone River drainage and surrounding mountains between the Lamar Valley and Mirror Plateau in the east (maximum elevation = 9,000 feet [2,740 meters]) and the lower-elevation Gardiner Basin in the west (5,300 feet [1,615 meters]). The northern region of YNP is drier and warmer than the rest of the park, with average snow depths ranging from about 3.5 feet (1 meter) at higher elevations to less than 1 foot (0.3 meter) at lower elevations. Bison in northern YNP congregate in the Lamar Valley and on adjacent plateaus during the breeding season.

The landscape of the analysis area is characterized by high-elevation shrub steppe and grasslands with well-defined riparian corridors surrounded by moderately steep slopes of the local mountain ranges and plateaus. The Gallatin and Absaroka Mountain ranges dominate the northwestern and eastern boundaries of the park. The Washburn Range, Central Plateau, Solfatara Plateau, and Mirror Plateau encompass the intervening high points within the analysis area. The Pelican Creek watershed is located at the southeast portion of the analysis area and drains directly into Yellowstone Lake. The Gibbon and Firehole Rivers (both tributaries of the Madison River) are key features of the south and west portion of the analysis area. Several other small watersheds occur in the area, including Duck and Cougar Creeks in the Madison Valley and Sedge Creek east of Mary Bay on Yellowstone Lake. Soda Butte and Slough Creeks drain into the Lamar River, which forms the Lamar Valley (6,693 feet [2,040 meters] in elevation) in the northeastern area of the park. The moderately hilly topography on top of Mount Everts and the Blacktail Deer Plateau is bounded on the north by the Black Canyon of the Yellowstone River and on the south by Folsom and Prospect Peaks. The Yellowstone River flows through a wide valley northwest of Gardiner, Montana, and is generally less than 5,495 feet (1,675 meters) in elevation. Resources outside the park may be described in subsequent sections if any of the proposed alternatives could potentially affect them.

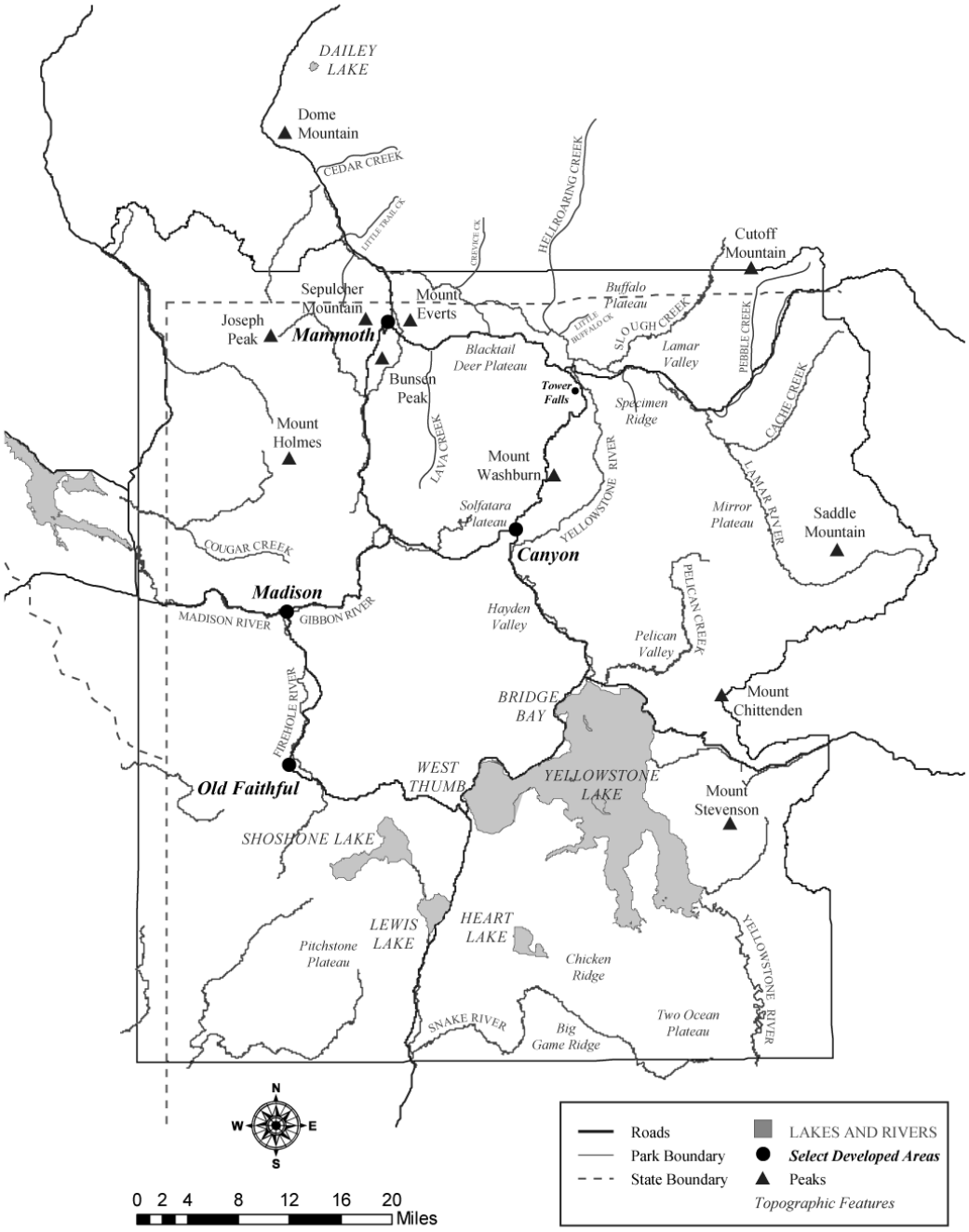


Figure 1. Yellowstone National Park and nearby areas of Montana with geographic features and place names

Impact Topics Retained for Further Analysis

The NPS identified a range of issues and impact topics to evaluate in this draft EIS for the Bison Management Plan. Several issues were also eliminated from further consideration. Issues and impact topics dismissed from detailed analysis, including the rationale, are provided in appendix C. Issues carried forward for detailed analysis fall under the following impact topics: Yellowstone bison; other wildlife; threatened animals and plants; American Indian tribes and ethnographic resources; health and human safety; socioeconomics; visitor use and experience; and vegetation. The ongoing effects of climate change are included in each impact topic's "Affected Environment" section to describe current conditions, forecasts, and the impacts of climate change on those resources. The proposed bison management alternatives would not affect climate change but could be affected by climate change.

Chapter 2: Alternatives

Introduction

The National Environmental Policy Act (NEPA) requires federal agencies to develop a range of alternatives and analyze the impacts those alternatives could have on the human environment. As prescribed by NEPA's implementing regulations, this EIS includes the alternative of no action (40 CFR § 1502.14). USDOI's NEPA Regulations define two options for the no-action alternative: (1) "no change" from a current management direction; and (2) "no project" for situations where a proposed activity would not take place, such as construction of a new facility (§ 46.30). The Council of Environmental Quality's (CEQ) 40 Most Asked Questions specifically notes that continuing current management applies to updating a land management plan initiated under existing legislation and regulations where an action will continue, even as new plans are developed. In these cases, the no-action alternative represents no change from current management or level of management activity, and the analysis provides a baseline of continuing with the present course of actions (CEQ 1981). Alternative 1 is identified as the no-action alternative and represents the continuation of current management.

Alternatives 2 and 3 represent the action alternatives providing detailed guidance for future management of bison in YNP. Action alternatives carried forward for detailed analysis must: (1) meet the purpose and need; (2) be technically and economically feasible; and (3) show evidence of common sense (CEQ 1981). This chapter also describes actions common to all proposed alternatives and alternatives considered but eliminated from further consideration (40 CFR §1502.14(a)). Relevant portions of the documents cited in this section are incorporated by reference into this draft EIS pursuant to 43 CFR 46.320. Alternative-specific mitigation measures are incorporated into each alternative description. Mitigations that apply to all alternatives and would be implemented as part of the project to avoid or minimize adverse effects to resources are described in the "Actions Common to All Proposed Alternatives" section.

Throughout this document, the term "harvest" refers to bison shot during hunts outside the park by members of tribes pursuant to long-standing treaties with the federal government and public hunters with permits from MFWP. The word "cull" refers to bison captured for possible inclusion in the BCTP, shipment to slaughter, or shooting on-site. The word "removals" refers to the combined numbers of harvests and culls.

Actions Common to All Proposed Alternatives

Under all alternatives, the NPS would continue to meet the main goals of the IBMP. Since 2012, the NPS and other IBMP partners have met these goals while averaging a population of about 5,000 bison after calving. In the GYA, there has been no documented transmission of brucellosis from bison to cattle, fewer conflicts with people and property, high visitor enjoyment and economic contributions to gateway communities, increased tribal and public hunting opportunities outside the park, and more brucellosis-free bison sent to tribal lands (White et al. 2015a,b; Geremia 2022). If the risk of bison mingling with livestock increases in the future, the NPS would take more aggressive management actions, such as increasing captures, hazing, hunting outside the park, and removals, in collaboration with other IBMP partners. Montana uses these techniques to manage brucellosis transmission risk from elk mingling with livestock in the Paradise Valley (Rayl et al. 2019) and, for over two decades, the IBMP partners have demonstrated these same techniques work for bison.

Bison Conservation Transfer Program (BCTP)—The NPS would continue to implement the BCTP in coordination with APHIS and MDOL to identify and transfer brucellosis-free Yellowstone bison to the Fort Peck Indian Reservation and other tribal and public lands. The NPS and partners would continue to use quarantine procedures to reduce the numbers of bison sent to slaughter and work to minimize the risk of brucellosis spreading from bison to livestock (USDA, APHIS et al. 2017). Following a 2018 decision, the NPS would continue the quarantine program for Yellowstone bison using facilities in and adjacent to

the Stephens Creek Administrative Area in YNP, north of the park in Corwin Springs, Montana (leased by APHIS), and at the Fort Peck Indian Reservation (USDOI, NPS 2018). Details of this program are incorporated by reference and can be found on pages 3-5 of the 2018 Finding of No Significant Impact (FONSI) for the project located here: https://parkplanning.nps.gov/documentsList.cfm?projectID=53793.

The NPS would continue to work with members of the Assiniboine and Sioux Tribes at Fort Peck (Fort Peck tribes), APHIS, Montana, and nongovernmental organizations (NGOs), such as the Greater Yellowstone Coalition, Yellowstone Forever, and Defenders of Wildlife, to double the input and output of bison in the BCTP and lower the number of test-negative animals (no antibodies for brucellosis exposure) sent to slaughter due to a lack of quarantine capacity. In 2022, the NPS increased the capacity of the quarantine pastures near the Stephens Creek Administrative Area in YNP to about 200 to 250 bison (approved in USDOI, NPS 2018). The NPS would continue the BCTP by:

- Coordinating efforts among federal, state, and tribal agencies to maximize holding capacity and testing efficiency.
- Providing young bison in family groups to establish or augment other bison herds.
- Providing some male-only groups to improve the genetic health of bison populations.
- Collecting data to improve testing procedures and, if possible, shorten testing timelines.
- Promoting low-stress handling and sorting of bison within the facility (low-stress handling is an "animal-centered, behaviorally-correct, psychologically-oriented, ethical and humane method of working animals which is based on communication, not coercion" [Hibbard 2021]). The low-stress handling techniques being implemented in YNP are described in Geremia (2021).
- Enhancing tribal involvement in stewardship and testing activities, including interns and the training of personnel.

The NPS anticipates APHIS would continue to lease two properties in Corwin Springs, Montana, for the stewardship and testing of up to 90 bison.

Prior to winter, the NPS would coordinate with the tribes and ITBC regarding the composition of bison they would like taken into quarantine (e.g., all males or family groups). The NPS would use passive capture techniques to the extent feasible by providing hay within the capture pens, allowing bison to enter, and closing the pen gates behind them. Personnel also may use low-stress hazing to encourage movements into the capture pens. The NPS would try not to influence bison movements outside the passive capture zone around the Stephens Creek Administrative Area capture facility, but this strategy may be adjusted to include more distant hazing depending on capture success. Animals that initially test negative for brucellosis exposure using blood serum, trap-side tests (tests specified by APHIS and Montana health officials), would be placed into the quarantine facility in groups based on age and sex. Their blood sera would be sent to diagnostic laboratories for comprehensive testing to confirm test results. Captured bison not eligible for the BCTP may be released so they are available for tribal hunters outside the park or shipped to slaughter if there is a need to reduce numbers substantially.

Bison would be tested according to the most up to date US Department of Agriculture cattle and bison rules for brucellosis eradication as specified by Code of Federal Regulations, which is currently the 2003 Uniform Method and Rules for Brucellosis Eradication, and Veterinary Services guidance documents (or any CFR or guidance that replaces the current documents). Presently, for groups of males to complete the quarantine process, the NPS would continue to ensure the entire group tests negative with the result confirmed 30 days later (phase I), which would generally take about 180 to 210 days. Thereafter, the entire group must test negative again 6 and 12 months later (phase II). After all males in the group reach 3 years of age, the group would be certified as brucellosis-free and transferred to an assurance testing facility. The group would then be retested at 6 and 12 months (phase III), after which they could be released or transferred to other areas.

For groups of non-pregnant females to complete the quarantine process, the entire group must test negative with the result confirmed 30 days later (phase I), which generally would take about 180 to 210 days. Thereafter, the females would be bred with a brucellosis-free male and must test negative via the culture of a uterine swab collected within 5 days of parturition. The entire group must test negative 30 to 90 days after each female gives birth and at least 6 months after the last female calved (phase II). The group would then be certified as brucellosis-free and transferred to an assurance testing facility for retesting at 6 and 12 months (phase III), after which they could be released or transferred to other areas. In summary, a test group of males would require about 20 months within a holding pen to complete the quarantine process, while a group of females would require about 34 months (USDA, APHIS 2003).

All bison completing quarantine in YNP would continue to be sent to Fort Peck tribes until other tribal facilities become available. The Fort Peck tribes would transfer about 70% of the bison that complete assurance testing on the reservation to ITBC for restoration to other tribal lands. The NPS would like the Fort Peck tribes and ITBC to continue to agree on the distribution of bison and, subsequently, work together to arrange transport, security, and facilities.

The NPS could collaborate with interested partners to establish additional quarantine facilities which could include terminal pastures outside the park and transfer bison to them each year as the capacity of these facilities and bison migrations allow. Federal rules (USDA, APHIS 2003) allow the transport of live bison from a population suspected to be infected with brucellosis to a terminal pasture where they would be killed within an agreed-upon time. Bison testing positive for brucellosis exposure could be placed in pastures within the DSA for brucellosis in Montana and killed within a few months. The fenced pastures would need to be separate and apart from any commercial livestock operation. The official identification and date of death for each bison harvested in the pasture would be provided to APHIS and the Montana State Veterinarian. Calves born and weaned in the pastures could be transferred to the BCTP.

The IBMP members would need to evaluate the design, cost, and potential locations for quarantine facilities or terminal pastures outside the park within the DSA for brucellosis. This evaluation would include the development of a management plan for transplanting Yellowstone bison onto suitable private or public lands (section 5 of §87-1-216 MCA), environmental compliance assessments, a cost-sharing agreement for building and maintaining the facilities, and an agreement for operating the facilities and conducting quarantine testing and terminal pasture operations. Additional facilities would enable the NPS to ship more bison initially testing negative for brucellosis exposure from the park to quarantine, thereby reducing the number of bison sent to slaughter and increasing the number of live bison sent to tribes.

Honor and Support American Indian Rights Reserved Through Treaties—The NPS would continue to:

- Sustain a wild population of bison capable of migrating and dispersing outside YNP onto adjacent USFS-managed lands so tribes can access this traditional food, cultural, material, and spiritual source.
- Support the rights of tribes to conduct hunts of bison migrating from YNP onto unoccupied lands in surrounding states pursuant to treaties with the federal government.
- Participate in hunt-capture coordination efforts to reduce the effects of capture operations on hunting opportunities (see the following section on “Hunt-Capture Coordination”).
- Provide tribes and tribal organizations with captured bison for processing and the distribution of meat, hides, and other resources to their members.
- Work with the tribes and Custer Gallatin National Forest to create or connect suitable bison habitat with enough bison present and distributed year-round to provide a self-sustaining population on the national forest in conjunction with bison herds in YNP (USDA, USFS 2022).
- Support the 2014 *The Buffalo: A Treaty of Cooperation, Renewal and Restoration* (Buffalo Treaty) and 2020 Bison Conservation Initiative in YNP by engaging with Buffalo Nations

associated with Yellowstone bison to explore ways to increase the efficiency and safety of hunting outside the park and increase the restoration of brucellosis-free bison to tribal lands through the BCTP. The NPS would continue to contribute to the Bison Conservation Initiative in YNP by preserving the largest wild, wide-ranging population of plains bison and relocating some brucellosis-free bison to establish additional populations on tribal lands.

Establish Collaborative Partnerships with American Indian Tribes for Bison Management—In September 2022, the NPS Director issued a policy memorandum describing how the NPS would ensure Tribal Nations play an integral role in decision-making related to the management of federal lands and waters through co-stewardship (USDOI, NPS 2022). Co-stewardship refers to collaborative partnerships for managing and preserving natural and cultural resources under the responsibility of federal land managers. It includes the sharing of expertise and information and combining capabilities to improve resource management, advance shared interests, and ensure tribal involvement when plans or activities may affect their interests, practices, or traditional use areas (USDOI, NPS 2022).

Additionally, in November 2022, the White House Office of Science and Technology Policy and the Council on Environmental Quality issued guidance for Federal Departments and Agencies on Indigenous Knowledge (OSTP and CEQ 2022). As described in the guidance, "Indigenous Knowledge" is generally used, but a variety of terms including Traditional Ecological Knowledge, Traditional Knowledge, Indigenous Traditional Knowledge and Native science may be preferred by different Tribes and Indigenous Peoples (OSTP and CEQ 2022). The guidance states that agencies should consult and collaborate with Tribal Nations and Indigenous Peoples to include Indigenous Knowledge in decision-making. Appropriately recognizing, considering, and applying Indigenous Knowledge requires growing and maintaining strong and mutually beneficial relationships between agencies and Tribes and Indigenous Peoples. Such relationships provide opportunities to identify shared values and goals, build trust and common understanding, and facilitate the exchange of information. The framework of the IBMP and the BCTP partnership provide meaningful and valuable discussions and consider tribal knowledge and recommendations in the management of Yellowstone bison (Stark et al. 2022). One example of this is the hunt-capture coordination described in the next section.

In January 2023, the Secretary of the Interior issued order 3410, *Restoration of American Bison and the Prairie Grasslands*, to enhance USDOI's work to restore wild and healthy populations of bison through collaboration with other federal agencies, states, tribes, and landowners. The order directs the NPS to increase the quarantine capacity for Yellowstone bison to further increase shared stewardship and the number of live bison transferred to tribes, which YNP would continue to do.

In addition, the NPS would incorporate the expertise of tribes into the following planning and resource management activities:

- The development of adaptive management adjustments and annual operating plans;
- The composition and distribution of bison captured at Stephens Creek Administrative Area (north of Mammoth near the north boundary and entrance to YNP) for the BCTP;
- The transfer of bison culled at Stephens Creek Administrative Area to slaughter facilities for processing;
- The processing of bison killed on-site at the Stephens Creek Administrative Area or in terminal pastures outside the park;
- The distribution of meat and other resources from culled bison to tribal members;
- The testing of bison in the BCTP to improve effectiveness and shorten timelines;
- The involvement of tribal interns and the training of personnel on bison management; and
- The implementation of lower-stress handling techniques with captured bison to reduce trauma.

The NPS would seek to ensure mutual benefits from increasing bison distribution and improving the coordination, efficiency, and safety of hunting practices outside the park. Likewise, the NPS would collaborate to transfer more brucellosis-free bison to augment or establish populations of plains bison on tribal lands elsewhere in North America to restore cultural, ecological, and spiritual relationships. These actions would facilitate bison recovery; improve hunting opportunities outside the park; enhance local, regional, and tribal economies; and enrich the experiences of tribal members, residents, and visitors.

Hunt-Capture Coordination—The NPS would use a variety of annual, weekly, and daily meetings during winter to coordinate the timing and extent of capture operations in the Stephens Creek Administrative Area with tribes that hunt bison on lands adjacent to the park to reduce the effects of capture operations on hunting opportunities. Each summer, representatives from tribes that hunt Yellowstone bison outside the park meet with representatives from Montana and the Custer Gallatin National Forest to discuss issues and concerns from previous hunts, safety concerns (such as no shooting zones), access, and enforcement, and to share hunter harvest data. The NPS would attend these meetings to provide information on the status of the bison population and discuss management objectives for the overall population and each breeding group (central, northern). During winter, the NPS would participate in weekly calls to inform other IBMP members and treaty hunting tribes about the timing and extent of bison migrations toward the boundary of YNP and coordinate with them regarding capture activities for the BCTP and slaughter to reduce effects on hunting opportunities outside the park. However, the NPS would continue to have no authority or jurisdiction over when, where, and how hunter harvests of wildlife occur outside the park.

The NPS would use passive capture techniques to the extent feasible by allowing bison to enter the capture pens at their own volition or providing minimal pressure to influence movements into the capture pens from an areas immediately adjacent to the capture pen perimeter. The NPS would coordinate with hunting tribes each morning and through weekly hunt calls to discuss capture operations. The NPS would not guarantee certain numbers of bison would be available for hunter harvest each day or control the fact that many bison in groups engaged by hunters return to the refuge of the park.

A series of relatively mild winters could result in little bison migration to the boundary and insufficient harvest and culling to stem population growth. As a result, bison abundance could increase above the anticipated or desired range. Under such circumstances, treaty hunting tribes and the NPS would coordinate to harvest and cull more bison during a subsequent severe winter with high migration to the boundary and into Montana to slow population growth and/or reduce abundance.

Adaptive Management—The NPS defines adaptive management as "a system of management practices based on clearly identified outcomes and monitoring to determine whether management actions are meeting desired outcomes; and if not, facilitating management changes that will best ensure that outcomes are met or re-evaluated" (43 CFR 46.30). More simply, adaptive management "refers to the process of learning by doing and then adapting or adjusting" (USDOI, NPS 2016b). It recognizes imperfect knowledge and the uncertainties in natural systems and allows managers to adapt to changing conditions and new information (learning) to progress toward objectives (Williams et al. 2007).

The agencies and tribes involved with the IBMP have used this process to inform decision-making and adjust bison management. The NPS would continue to evaluate current conditions, identify undesired trends, implement management actions, monitor progress toward desired conditions, and adjust actions to improve progress. The NPS would work with partners to explore other management options outside the park, including streamlining testing protocols for quarantine as part of the BCTP and the construction of additional quarantine facilities and capture facilities near the outer boundaries of management zones.

The NPS would manage for the following demographic and genetic objectives (Geremia 2022):

Sustain a Viable, Wild Population: A population viability analysis indicates Yellowstone bison should retain about 95% of existing allelic (genetic) diversity for neutral nuclear microsatellites ('genes') for centuries with total abundance averaging at least 3,000 to 3,500 bison, provided intermixing and gene

flow continue between bison in the two primary breeding herds (Pérez-Figueroa et al. 2012). However, more diversity is expected to be lost unless removals are mainly or only juveniles (Pérez-Figueroa et al. 2012). The NPS would continue to collect genetic information and revise population viability analyses, adjusting minimum numbers as dictated by best available science. In addition, per statute and policy, the NPS does not manage for minimum numbers of wildlife but, rather, to sustain populations in their natural condition, which was defined as "the condition of resources that would occur in the absence of human dominance over the landscape" (USDOI, NPS 2006a; 16 USC 21 et seq., 17 Stat. 32; 54 USC 100101a,b). Thus, to the extent feasible, the NPS would allow bison and other wildlife to move freely and unpursued within the interior of the park, with their behaviors, movements, reproductive success, and survival primarily affected by their decisions and natural selection (White et al. 2013a; White 2016).

Under any alternative, the NPS does not want bison abundance to decrease below 3,500 total in the population because this could substantially decrease genetic diversity (Halbert et al. 2012; Pérez-Figueroa et al. 2012; see *Alternatives and Alternative Elements Considered but Dismissed from Detailed Analysis*). This level could be adjusted based on future genetic analyses. The upper population estimates provided for each alternative are intended to guide the implementation of risk management activities; not as targets necessitating immediate population adjustment (IBMP Partner Agencies 2006). Bison abundance may exceed the upper estimate in each range at times due to a series of mild winters that limit migration and removals or because successful management based on the demographic, genetic, ecological, and social objectives in this section indicate bison can be sustained at a higher population level.

Maintain More than 1,000 Bison in the Central and Northern Breeding Herds: Bison breed in northern or central geographic regions of the park with some interchange of animals between breeding areas among years (Wallen and White 2015). The founding maternal lineages of the population are found in both breeding areas (Forgacs et al. 2016). The NPS would seek to maintain more than 1,000 bison in each breeding area to help protect any existing unique diversity or rare alleles (genes) within each area (Hedrick 2009). This would allow bison to be a meaningful component of the food web influencing energy and nutrient transfer across a broad geographic area of the park, as described under the ecological objectives (Geremia et al. 2019).

Maintain a Balanced Sex Ratio: The NPS would seek to maintain a balanced sex ratio of about 50% males and 50% females to support mate competition and allow natural selection to affect population genetics (Pérez-Figueroa et al. 2012; Geremia 2022).

Maintain an Age Structure of About 70% Adults and 30% Younger Animals: The NPS would seek to maintain an age structure of about 70% adults and 30% juveniles, which is based on the expected population composition given age-specific birth and survival rates (Geremia et al. 2015b; Hobbs et al. 2015; Geremia 2022).

Maintain Gene Flow Between Primary Breeding Herds and Preserve Existing Genetic Diversity: Yellowstone bison are currently a single intermixing population with breeding and gene flow between bison originating in central and northern YNP. To the extent possible, the NPS would allow ecological processes, such as natural selection, migration, and dispersal, to prevail and influence population and genetic substructure (White and Wallen 2012; Wallen and White 2015). The NPS would attempt to maintain existing allelic richness and diversity based on neutral nuclear markers.

The NPS would manage for the following ecological objectives:

Sustain the Role of Bison as Ecosystem Engineers: To the extent feasible, the NPS would allow bison to move unfettered in the interior of YNP so they can fulfill their ecological role. When bison roam without human constraints, they begin to engineer the landscape as described by Geremia et al. (2019, 2022).

Maintain Functional Grasslands: The NPS would strive to maintain functional grassland and sage-steppe communities. Plant communities would vary widely in their appearance and composition depending on differences in soil and weather conditions, land use and management histories, and historic and current

grazing intensities. Many communities would include invasive plants due to their previous spread. Ungulates would graze some areas intensely and others lightly, thereby providing a mosaic of conditions across the landscape to support a variety of plants and animals. However, each community should still maintain plant productivity, soil organic matter, and functioning energy, nutrient, and water cycles (Geremia and Hamilton 2019, 2022).

Sustain Bison as a Meaningful Component of the Food Web Influencing Energy and Nutrient Transfer through the Ecosystem: To the extent feasible, the NPS would manage bison with minimal intervention in the interior of YNP, so bison continue to provide a key food source for species ranging from wolves to magpies to beetles and bacteria in the soil that redistribute nutrients across the landscape (Wallen et al. 2015a). Bison carcasses contribute to nutrient surges that greatly enhance the productivity of nearby plants. Carcasses of bison dying from injuries or malnutrition could continue to provide about 25% of the meat wolves eat during winter. This scavenging has reduced predation on elk during winter from about 18 elk per wolf per year (based on kill rates during winter) to about 12 elk per wolf per year (Metz et al. 2020a,b).

The NPS would manage for the following social objectives:

Promote an Environment in YNP Where Wildlife Remain Uncontrolled and Visitors Could be Impressed and Inspired by Their Uninhibited Behaviors: The NPS would continue management strategies where wildlife in most of the park could remain uncontrolled, and visitors could be impressed and inspired by their uninhibited behaviors. As a retired park historian emphasized, the greatest value of YNP may be the "authenticity of its wildness—the opportunity for us to be awed and learn from nature making its own decisions" (Schullery 2010; White et al. 2013a,b; White 2016).

Manage Brucellosis Transmission Risk to Cattle: The NPS would work with Montana, APHIS, the Custer Gallatin National Forest, and private landowners to manage brucellosis transmission risk from bison to livestock by preventing mingling through hazing, hunting outside the park, fencing, removing attractants, and improving forage on public lands, like Montana manages risk from elk populations also chronically infected with brucellosis (National Academies of Sciences, Engineering, and Medicine 2020; Rayl et al. 2019).

Protect Human Safety and Property: The NPS would work with Montana, the Custer Gallatin National Forest, tribes, and private landowners to reduce and alleviate conflicts with livestock, people, and property using hazing, captures, and other tools when necessary (IBMP Agencies 2016; Geremia 2022).

Operations Plans—The NPS would continue to follow the framework of the IBMP, where annual operating plans are used to set out "specific expectations and areas of responsibility for personnel from each of the cooperating agencies" (USDOI and USDA 2000b:42). The NPS would continue to meet with IBMP partners each spring to evaluate operations from the prior winter, identify problems, and propose solutions. The following summer and autumn, the NPS and partners would review existing procedures to determine whether they need revision. The NPS would continue to meet with the other federal, state, and tribal agencies to coordinate bison management activities by the various parties. The NPS would continue to use the integrated population model it developed to support science-based management of the Yellowstone bison population. NPS would update the model with current data to estimate the abundance and composition of the population and identify a management strategy that meets population objectives (Geremia 2022). NPS biologists would provide this recommendation to the Superintendent and subsequently share it with the IBMP partners to inform their efforts to manage bison that migrate from the park and into Montana. The NPS would continue to assess the status of the bison population and propose adjustments to adaptive management based on the selected alternative in the ROD resulting from this process.

Population Abundance—The NPS would continue to use an integrated population model to estimate the abundance and composition of the bison population. The NPS would continue to conduct summer and winter counts using an airplane. The NPS would prepare a report on the status of Yellowstone bison for

the Superintendent with information on counts, classifications (age, sex), and trends for breeding herds in the central and northern portions of YNP. Each autumn, the NPS would convey this information to the other IBMP members and hunting tribes for their consideration (Geremia 2022). Park biologists may recommend removals of bison to the Superintendent based on scientific assessments of the demographics in each breeding herd and their movements, as well as the potential for conflicts with cattle, people, and property (see annual status reports at ibmp.info/Library/OpsPlans). As winter progresses, the NPS would conduct aerial and ground surveys and update the model to predict numbers of bison in the population. These assessments would support decision-making for management activities.

Forage Production and Grazing Research—Because there is considerable complexity around forage production estimates due to large variations in weather and grass production from year to year, scientists would continue to monitor and adapt these estimates to ensure sufficient forage is available in the park to sustain all grazers including bison, elk, pronghorn, mule deer, and bighorn sheep (Geremia and Hamilton 2019, 2022). The NPS would use both short, season-long, and multi-year exclosures across the migratory landscape used by bison to track grazing, plant productivity, soil organic matter, and nutrient cycling. The NPS would work with the Custer Gallatin National Forest to monitor grazing impacts in the Gardiner basin, as requested.

Monitor Genetic Diversity—The NPS would continue to work with the USDOI Bison Working Group to monitor genetic diversity based on existing microsatellite markers. The NPS would continue to evaluate new markers, such as Single Nucleotide Polymorphisms, and implement future monitoring based on the best available science. Future tissue sampling of bison would be conducted under oversight by an Institutional Animal Care and Use Committee of NPS veterinarians pursuant to an Animal Research Protocol Approval Long-term, Ongoing Research Project that is reviewed annually.

Habitat Conservation and Enhancement—The final EIS for the IBMP anticipated there would be changes to bison habitat and considered how to prepare for these changes (*Western Watersheds Project et al. v. Secretary of the Interior Salazar et al.*, 766 F.Supp.2d 1095 (2009), affirmed No. 11-35135 (9th Cir. 2012:3)). An opportunity exists to influence the distribution and movement of bison by protecting and enhancing habitat through conservation easements, fee purchases, closure of public grazing allotments, restoration of degraded habitats, and other activities. In 2022, the Custer Gallatin National Forest issued a decision on its Land Management Plan (USDA, USFS 2022). This long-term plan allows for expanded tolerance of bison on the national forest, including a desired condition to have a self-sustaining population of bison on the forest year-round. It also includes an objective to complete three habitat improvement projects every three years to create or connect suitable habitat for bison on the forest, while continuing to work with partners to reduce conflicts with livestock and private property. In addition, the plan allows the national forest to address potential barriers to bison on the landscape in areas under consideration for expanded tolerance by Montana. The NPS would continue to collaborate with the Custer Gallatin National Forest on implementation of the Land Management Plan.

Several agencies and tribes have suggested using prescribed burns to provide additional habitat with nutritious forage for bison. During the last 45 years, YNP has experienced about two dozen fires per year that burned an average of about 5,900 acres annually, excluding the massive fires during 1988 (Yellowstone Center for Resources 2018). Thus, habitat restoration to early seral stages would continue. The NPS would continue to allow natural disturbance processes such as fire, flooding, landslides, native insect outbreaks, and windthrow to occur in wilderness areas of YNP. In addition, the NPS would continue to conduct projects for weed removal and planting of native grasses, shrubs, and riparian trees to restore desired conditions (Yellowstone Center for Resources 2021). The NPS would continue to work with Montana, the Custer Gallatin National Forest, and NGOs to discuss conservation easements, livestock grazing plans, and fencing in certain places outside YNP to keep bison separate from livestock, people, and property.

Encourage More Tolerance for Bison in States Surrounding YNP—Bison would continue to migrate outside the park where state agencies and the national forest have jurisdiction and work with private landowners to determine levels of tolerance, hazing, and captures, and with tribes with treaty hunting rights to coordinate the location and extent of hunting outside the park. The NPS would work with the Custer Gallatin National Forest on projects to create or connect suitable bison habitat and allow bison to be present and distributed year-round on the national forest per the 2022 Land Management Plan (USDA, USFS 2022). This could involve exploring options for hazing, trailering, or otherwise releasing or relocating small family groups (10 to 20 bison) captured in the Stephens Creek Administrative Area to federal lands within the northern or western management areas.

Bison Health and Welfare—The NPS would continue to obtain veterinary assistance (when necessary), keep detailed records and documentation, and use low-stress handling methods to reduce bison discomfort, distress, or pain caused by management activities. The NPS would continue to implement a disease surveillance program of animals in the BCTP for diseases of high health concern, including brucellosis, bovine viral diarrhea, Johne's disease, and *Mycoplasma bovis*.

Brucellosis Research—As mentioned above, the CDC and APHIS consider the bacteria *Brucella abortus* a select agent and toxin because it has the potential to pose a severe threat to human and animal health, plant health, or animal and plant products (7 CFR, Part 331, 9 CFR Part 121, and 42 CFR Part 73). These rules restrict the use of the field strain of this bacteria in scientifically controlled laboratory research and large animal studies in outdoor containment spaces. In January 2021, the CDC issued a draft policy statement on Biosafety for Large Animal Study-Related Activities with *Brucella abortus* and *Brucella suis* Using Outdoor Containment Spaces (*Federal Register* 86:3987–3988, *Federal Register* 86:4079–4080). If this policy is adopted, research on brucellosis suppression techniques could occur in facilities outside YNP. The NPS may provide APHIS or other parties with some Yellowstone bison for such research. Any brucellosis suppression techniques developed during such research would not be implemented as part of operations on Yellowstone bison until they are proven effective without significant adverse effects, additional NEPA compliance is conducted, and tools become available to eliminate brucellosis in elk as recommended by the National Academies of Sciences, Engineering, and Medicine in a 2020 evaluation of brucellosis in the GYA (National Academies of Sciences, Engineering, and Medicine 2020).

Conservation Measures Pursuant to the Endangered Species Act—Table 1 lists the federally listed and proposed species and designated critical habitat in the action area. This list was obtained from the US Fish and Wildlife Service (FWS).

Table 1. Federally listed and proposed species and critical habitat in the action area

Species	Status	Potential to Occur	Critical Habitat	Status and Occurrence in the Action Area
Canada lynx *Lynx canadensis*	Threatened	Yes	Yes	Lynx are rare and typically occur in mature forests dominated by subalpine fir, Engelmann spruce, and lodgepole pine. Reproduction in YNP is limited.
Grizzly bear *Ursus arctos*	Threatened	Yes	No	About 150 to 200 grizzly bears are widely distributed throughout YNP, which provides core, secure habitat inside a 9,210-square-mile Primary Conservation Area where no net increase in development, livestock grazing, or roads can occur.

Species	Status	Potential to Occur	Critical Habitat	Status and Occurrence in the Action Area
Western glacier stonefly *Zapada glacier*	Threatened	Yes	No	Tens of thousands of nymphs live in about two dozen alpine streams formed from meltwater emanating from glaciers in Montana and Wyoming.
Whitebark pine *Pinus albicaulis*	Threatened	Yes	No	Whitebark pines occur on about 314,000 acres within YNP, typically at high subalpine elevations greater than 7,900 feet and often mixed with other conifers.
Wolverine *Gulo gulo*	Proposed	Yes	No	Wolverines are rare and sparsely distributed and primarily occur in areas with persistent snow and ungulates that provide carrion for food during winter.
Monarch butterfly *Danaus plexippus*	Candidate	Yes	No	Monarch butterflies are rare and sparsely distributed in YNP and primarily occur in upland, dry areas.

Conservation measures that will be implemented as part of the project to avoid or minimize adverse effects to threatened and candidate species include:

Canada Lynx and their Designated Critical Habitat, Grizzly Bears, and Wolverines:

Managers will ensure all participants, including contractors, collaborators, and volunteers, are trained on how to avoid disturbing or encountering bears and other wildlife, including regulations regarding vehicle speed limits, food storage, disposal of garbage and other attractants, and approaching or harassing wildlife.

Unless authorized, workers in YNP will avoid designated closure areas that have high historical use by grizzly bears during spring and summer, as well as closure areas around active bear dens, eagle nests, and wolf dens, to minimize wildlife disturbance and human-wildlife interactions.

When possible, managers will limit employee or contractor camps and equipment storage areas to existing support facilities.

During and after management activities, managers will take prevention and restoration measures to avoid the introduction of exotic invasive species and discourage the establishment of herbaceous foods such as clover.

If helicopters are used for management activities, staff will report all observations of grizzly bears, lynx, and wolverines to the pilot and project manager as soon as possible after observation.

Except when taking off and landing, or as necessary for management activities, helicopters will travel at least 500 feet above ground to reduce potential disturbance to wildlife below.

As feasible, helicopter landings will be restricted to pre-determined locations, and the number of landings will be minimized to reduce the duration and extent of disturbance.

If a grizzly bear, lynx, or wolverine is observed in or near (approximately 200 yards) a helicopter flight path or landing zone, the pilot will alter the flight path and landing zone to avoid the animal, including during future trips.

Western Glacier Stonefly:

Managers will avoid working in the upper-most extent of high-elevation streams that originate from glacial meltwater and could be inhabited by the western glacier stonefly.

Whitebark Pine:

Managers will attempt to avoid or minimize impacts to whitebark pines, especially mature cone-bearing trees and 'plus' trees that have some level of genetic resistance to whitebark pine rust and can survive infection.

Workers will avoid removing mature whitebark pine trees that have potential to bear cones and use nonlethal treatments or treatments that retain as many cone-bearing branches as possible.

Monarch Butterfly:

To the extent feasible, no nectar feeding plants or host plant species for monarch butterflies or caterpillars will be removed during management activities.

If habitat disturbance is necessary, project managers will try to adjust the timing of activities in areas containing plants used by monarchs to avoid interfering with breeding or feeding.

To the extent feasible, managers will avoid using pesticides or herbicides in monarch butterfly habitat that could result in direct mortality or eliminate host and nectar plants.

If pesticide application is necessary near monarch butterfly habitat, managers will select chemical formulations specific to the targeted pest, time applications to avoid monarch activity periods, establish buffers, and minimize drift to non-target areas by direct ground application.

Alternative 1 (No Action)

In addition to the actions described under "Actions Common to all Proposed Alternatives" above, under the no-action alternative, bison would continue to be managed under the IBMP, as described in the adaptive management and annual operations plans (http://ibmp.info/) and the EA for the *Use of Quarantine to Identify Brucellosis-free Yellowstone Bison for Relocation Elsewhere* (2018 EA and FONSI), completed in 2018 (USDOI, NPS 2016a, 2018).

This alternative prioritizes maintaining a negligible risk of brucellosis transmission from bison to cattle to assure other states and countries that NPS management of bison would prevent the transmission of brucellosis from bison to livestock (State of Montana 2000). Bison could migrate from the park into established northern and western management areas in Montana, and numbers and distribution would be limited by captures for the BCTP or shipment to slaughter, and public and tribal hunter harvests primarily on national forest lands near the park boundary. Within YNP, management of bison, such as capture, hazing, and quarantine, would generally occur near the boundary. Disease surveillance would be conducted on bison placed into the BCTP and some bison shipped to slaughter or harvested outside the park. The NPS would capture migrating bison in the Stephens Creek Administrative Area near the northern boundary of the park and use shipments of bison to slaughter to decrease numbers and provide bison to tribes. If space is available, some bison testing negative for brucellosis exposure would be placed in the BCTP to increase the number of live brucellosis-free animals relocated to the Fort Peck Indian Reservation and eventually other tribal lands. If space is not available, these bison would be transferred to tribal representatives at the capture facility for delivery to slaughter plants and subsequent distribution of meat.

Bison numbers are expected to range between about 3,500 and 5,000 after calving, consistent with consensus agreements among IBMP members on annual operations plans. During 2001 to 2011, which was prior to the IBMP members making adaptive adjustments to emphasize treaty hunting, bison summer counts averaged about 3,900 and ranged between 3,000 and 5,000. Numbers of bison in the central and northern breeding herds would continue to vary depending on movements, reproduction, and survival (including NPS capture and removal and hunter harvests outside the park).

Under the current adaptive management plan for the IBMP, bison would continue to migrate from YNP during winter and spring into established management areas north and west of the park in Montana. State personnel would continue to haze female and young bison from the northern management area back to YNP by May 1, but male bison could remain in this area year-round. Bison of both sexes could use the Eagle and Bear Creek areas and portions of the Absaroka-Beartooth wilderness north of YNP year-round (figure 2). In addition, bison of both sexes could use the Hebgen Basin west of YNP year-round, including Horse Butte and north along Highway 191 to the Cabin Creek Recreation and Wildlife Management Area, Monument Mountain Unit of the Lee Metcalf Wilderness, and the Taylor Fork drainage (figure 3). State personnel would continue to limit numbers of bison in the western management area to 250 from July through September, 450 from October through February, and 600 from March through June. From November 15 through April 15, up to 30 female bison (or a mixed group of 30 males and females) could use the Madison Arm. After April 15, up to 30 female/mixed group bison could be east of the Madison Arm Resort. After May 15, no females or mixed groups of bison could use the Madison Arm, and state personnel would haze them to nearby areas or remove them (IBMP Agencies 2016).

The NPS would continue to capture bison in YNP, and state personnel could continue to capture bison in nearby areas of Montana during winter to reduce bison numbers, prevent movements outside management areas in Montana, and test and remove bison previously exposed to brucellosis. Captures could occur at a facility in the Stephens Creek Administrative Area in the northern portion of YNP, which is closed to public access year-round. The NPS would capture bison before April. Bison generally migrate to this area over a period of 4 to 6 weeks. Larger captures would generally occur during more severe winters or persistent droughts when larger, earlier, and prolonged migrations occur (Geremia et al. 2011, 2014, 2015a). If the NPS decides to cull bison to limit abundance, personnel would primarily capture migrating groups of females and young that move to the boundary more frequently than adult males.

During capture, processing, and shipping operations in the Stephens Creek Administrative Area, the NPS would enact a temporary area closure that extends about 0.6 miles (1 kilometer) from the area and is about 3.5 miles (5.6 kilometers) long. Park staff would notice this temporary closure by posting signs at conspicuous locations along the perimeter and providing information at key visitor contact offices. The duration of the closure would be determined by bison migration to the park boundary and operational needs. This temporary closure would be implemented for public, staff, and bison safety and to ensure management operations are unimpeded. Once capture and/or herding actions begin, operations would be sporadic, dynamic, and unscheduled, leaving no time to ensure members of the public are absent from the operational area. Capture and herding events could involve many dozens of bison. The unanticipated presence of a person on the ground could disrupt operations and panic the bison, placing the public, staff, horses, and bison at risk of injury.

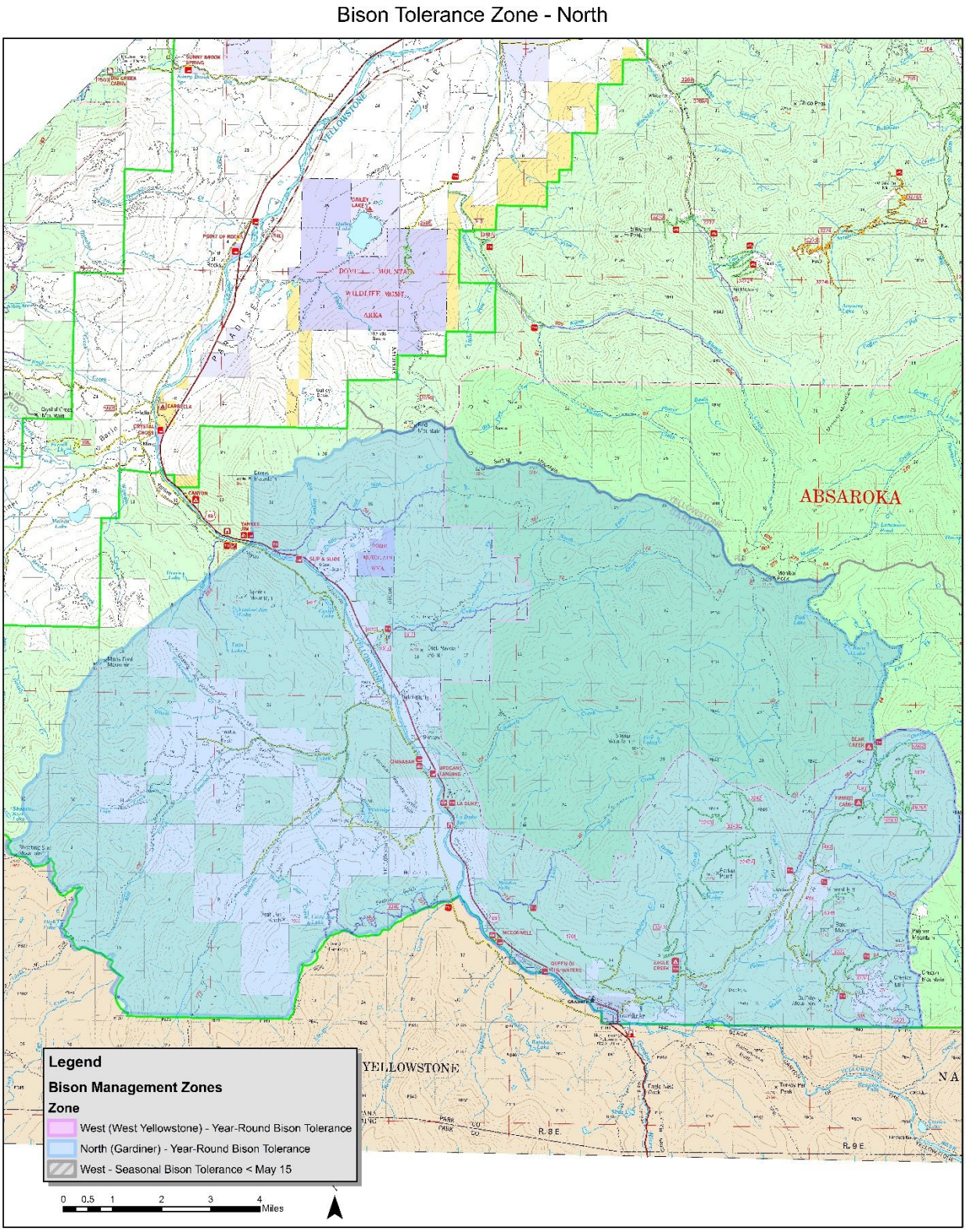


Figure 2. Northern management area in Montana for the Interagency Bison Management Plan (Randy Scarlett, Custer Gallatin National Forest, and Julie Anton Randall, Eco Mare Terra International)

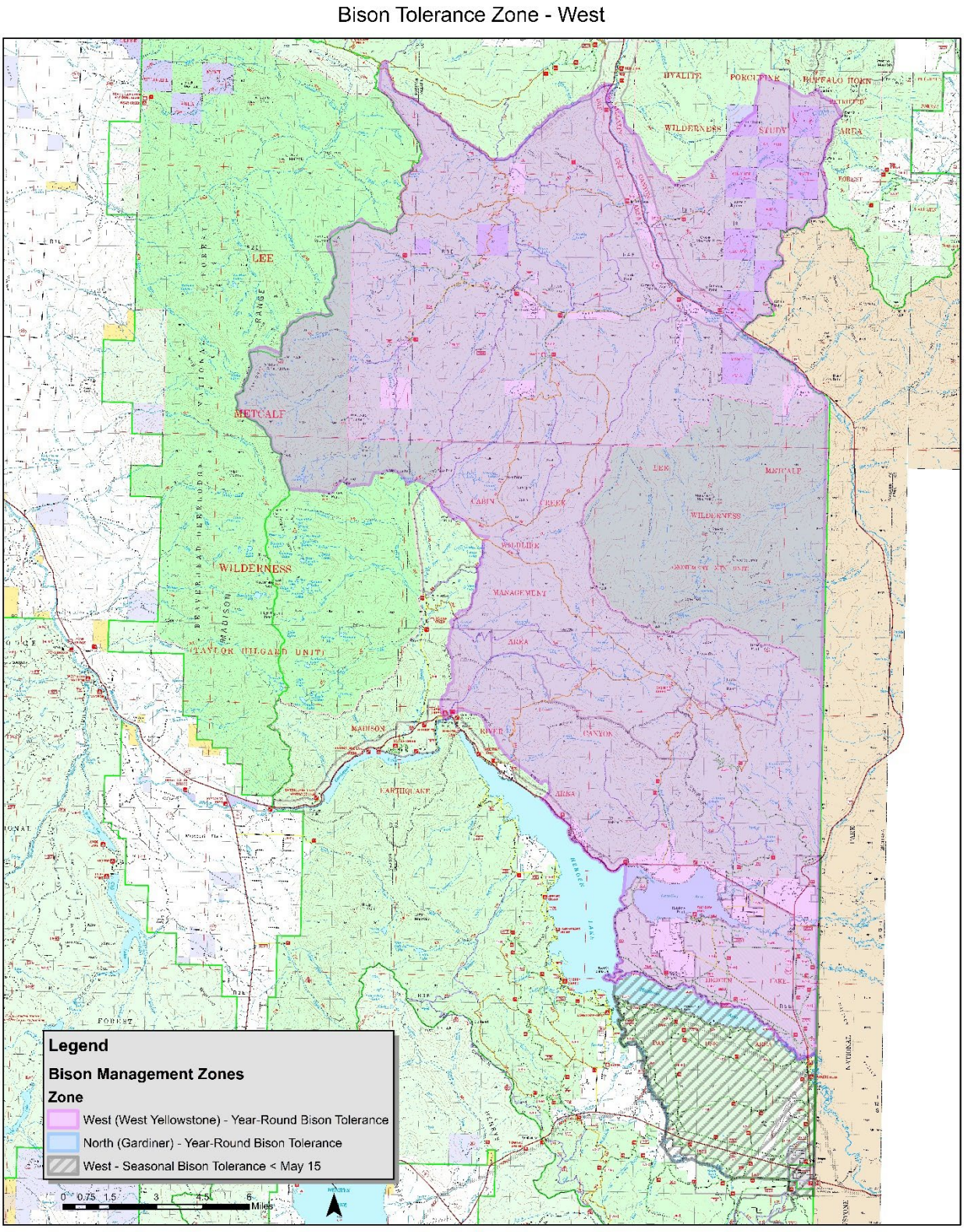


Figure 3. Western management area in Montana for the Interagency Bison Management Plan (Randy Scarlett, Custer Gallatin National Forest, and Julie Anton Randall, Eco Mare Terra International)

The general philosophy for capture and processing would be to apply as little pressure and stress as necessary to move bison into and through the facility. Bison would be captured in fenced pens either by leaving gates open with hay as an attractant or by deliberately herding them into the pens. Thereafter, NPS personnel would contact tribal and agency partners to schedule transport to the BCTP, slaughter, or research facilities. Based on these discussions, bison would be sorted into appropriately sized groups in various holding areas so they could be moved into quarantine pastures adjacent to the Stephens Creek Administrative Area or loaded onto trailers for shipment to other quarantine, slaughter, or research facilities outside the park. Local representatives from APHIS would certify the numbers, sexes, and age categories of bison loaded and secured in each trailer using Veterinary Services Form 1-27. The haulers would then chain and lock the trailer doors, and personnel from APHIS would put an official seal on the lock and chain and provide the hauler with a list of each bison on board the trailer. The NPS would continue its agreements with tribes to provide them with bison for shipment to meat processing facilities and subsequent distribution of meat, hides, and other resources to their members. The trailers would leave the Stephens Creek Administrative Area with law enforcement escorts and proceed directly to quarantine, slaughter, or research facilities.

The NPS would capture animals in the bison facility in the Stephens Creek Administrative Area to balance transferring live animals to tribal lands, providing carcasses of culled animals to tribes, supporting tribal hunting opportunities outside the park, lowering the number of animals exiting the park, and reducing population growth. The number of bison removed from the population each winter would continue to depend on the number of animals migrating to the northern park boundary, capacity for the live transfer of animals, hunter success outside the park, and level of conflicts outside the park (Geremia 2022). If few animals migrate, the NPS could passively capture animals throughout winter by baiting and rounding-up animals near the capture facility (Geremia 2021; Hibbard 2021). If space is available, some captured animals that test negative for brucellosis exposure would be placed in the BCTP for their eventual live release to tribes. Up to about 100 to 300 bison could be entered into the BCTP during most winters, which would require the capture of about 300 to 750 bison (Geremia 2022).

Animals that do not qualify for the program would continue to be provided to tribes for their meat and hides. Under the IBMP, shipments to slaughter have ranged between 0 and 1,304 each winter, and a similar range of shipments is expected under the no-action alternative. Other bison in the area are allowed to move toward park boundaries and support hunting opportunities outside the park. If more animals migrate, the NPS could capture bison to fill the capacity of the BCTP, and either release other animals or give them to the tribes for slaughter. Bison would be allowed to move past the facility throughout winter to support hunting opportunities outside the park. If the winter is severe and a mass migration to the northern park boundary could hinder the capacity of managers to keep bison and cattle separate, additional bison could be captured to reduce numbers (Geremia 2022). These bison could be held in the Stephens Creek Administrative Area facility for later release when conditions are suitable for bison to migrate to higher-elevation summer ranges in YNP.

Bison hunting in Montana would continue to occur outside the northern (Gardiner Basin) and western (Hebgen Basin) boundaries of YNP, with hunter harvests varying from year to year depending on how many bison move to the park boundary in response to forage production, snow depths, and forage availability in the higher mountains. The annual 90-day public bison hunt would continue from November 15 to February 15 on lands adjacent to the park. Also, tribal hunts outside the park would continue to generally occur from December through March, with each tribe determining its own regulations and seasons.

The NPS would haze bison in YNP when necessary for safety reasons, to protect property, or to move bison into the capture facility in the Stephens Creek Administrative Area, primarily from February to April. Details of hazing are discussed in the 2000 ROD and incorporated by reference as detailed earlier. To summarize, hazing in YNP would be conducted by people walking or on horseback. Before initiating hazing, personnel would assess the condition, size, and temperament of the herd, as well as the terrain

where the herd is located, potential paths along which to move the bison, and potential hazards along the path of hazing. Weather conditions would be considered because snow, ice, and mud negatively affect the footing of bison, horses, and people. Bison may not be amenable to moving very far, if at all, if they are already acting aggressive (e.g., bucking or butting), in poor condition, or have newborn calves. Furthermore, bison may resist moving after being hazed several times. Smaller groups of bison would generally be easier to move safely and efficiently than larger groups, which tend to fragment into several smaller groups as they move (Wallen and Keator 2012).

The general philosophy for hazing would be to apply as little pressure as necessary to move bison in the desired direction. Hazing would be initiated by approaching a group of bison at an angle (zig-zag pattern) from behind the direction of intended travel. Bison may initially trot in response to hazing but should calm down and move along in a somewhat slow, orderly manner if minimal pressure is applied. Hazing distances would be minimized to avoid undue stress to the bison, especially mothers with recently born calves. Also, if bison in the group become aggressive or resistant to hazing, staff would temporarily halt the operation and allow the bison to feed and rest. The snow cover and conditions in the area to which the bison would be hazed is important. If bison are hazed to an area with deep or hard packed snow, or with many bison already present, it is unlikely they would remain because forage would be inaccessible (Wallen and Keator 2012).

If bison approach set boundaries in management areas in Montana, the State Veterinarian would continue to evaluate the circumstances, including numbers of bison, their behavior, weather, snowpack, and time of year, to determine what management actions would be necessary to prevent bison from moving from the management area (IBMP Agencies 2013, 2016). Hazing by state and other officials outside the park in Montana would continue to be at the discretion of the state in cooperation with the national forest supervisor and private landowners to prevent the mixing of bison and cattle, to move bison away from private lands where they are not wanted, or to move bison away from homes and highways where they create safety or property issues. Hazing in Montana could be conducted by people walking, on horseback, on all-terrain vehicles, in trucks, or in helicopters. The NPS could assist state personnel with hazing bison in Montana by walking or on horseback, if requested and appropriate. Personnel from MFWP would continue to work with landowners who have safety and property damage concerns, as well as those who favor increased tolerance for bison, to allow bison to use suitable habitat while reducing conflicts. Helicopters have not been used for hazing bison in Montana since 2013 but could be used in the future with other methods if they are deemed necessary to move bison back to the park. This use should only be for 1 to 2 days and 4 to 6 hours per day (USDOI, NPS 2012a). Personnel have used cracker shells and rubber bullets when other types of hazing actions were not successful. Hunters or agency staff could shoot bison in Montana that do not respond to hazing (IBMP Members 2020).

Alternative 2

In addition to the actions common to all proposed alternatives listed above, this alternative would prioritize the NPS's trust responsibilities to tribes by using the BCTP to restore bison to tribal lands and treaty hunting outside the park to provide tribes with access to traditional food, cultural, and material sources. The NPS would work with tribal partners to increase their hunting opportunities and the number of live bison sent to tribal lands through the BCTP, given weather influences on the extent of migration each year. The NPS would shift away from shipments to slaughter and capture some bison migrating from the park to enter more animals into the BCTP for eventual transport to tribes.

The NPS expects bison numbers generally would be somewhat higher than under Alternative 1 and range between 3,500 and 6,000 after calving. During 2012 to 2022, which was after the IBMP members made adaptive adjustments to emphasize treaty hunting, bison summer counts averaged about 5,000 and ranged between 4,200 and 6,000. Bison abundance in the central and northern breeding herds would vary depending on movements, reproduction, and survival. Like Alternative 1, bison could use all wilderness and other undeveloped areas in YNP and leave the park into established management areas in Montana

where state agencies in cooperation with the national forest supervisor and private landowners would determine levels of tolerance for bison, which could remain similar to current conditions. The NPS expects tolerance in coming years to remain like Alternative 1. Under Alternative 2, more bison may be available to support movements into new areas of the park to enhance nutrient cycling, grassland health, and biodiversity across a larger extent of the park. More bison also could facilitate larger migrations to designated management areas in Montana to support conservation and increase hunting opportunities outside the park. The NPS may collaborate with interested partners to establish additional quarantine and assurance testing facilities outside the park.

The NPS could release captured animals not suitable for the BCTP. These released animals could increase hunting opportunities if they subsequently migrate beyond the park boundary. Management actions used within YNP would be the same as described for Alternative 1, but the NPS would decrease shipments to slaughter by using the expanded quarantine capacity near Stephens Creek Administrative Area to enter more animals into the BCTP for eventual transport to tribes. Details on the quarantine procedures near the Stephens Creek Administrative Area are provided in the 2018 EA and FONSI and are incorporated by reference (USDOI, NPS 2016a, 2018). The NPS would remove bison eligible for the BCTP as soon as feasible and release the remaining animals. Alternatively, the NPS could hold some or all ineligible animals when migrations are severe to reduce numbers of animals moving outside the park. The NPS would track the numbers of bison removed through all tribes and agencies and avoid reducing the late-winter population below 3,000 animals. Based on these contingencies, the NPS could transfer ineligible animals to slaughter, prioritizing the removal of brucellosis-exposed animals. The NPS could also release all ineligible animals back into the park in spring.

To reduce stress on animals from shipping them to slaughter or to address a lack of slaughter facility availability or capacity, NPS staff may cull some captured bison on-site by shooting them within the fenced pastures of the bison facility at Stephens Creek Administrative Area (Humane Slaughter Association 2018). The carcasses would be dressed, skinned, halved or quartered, and hung in trailers or other processing units to cool before transport to other locations for butchering and meat preparation. Members of tribes would participate in the processing of animals. About 5 to 20 bison per day could be processed depending on the number of people available to process, load, and transport bison. Unused parts from killed animals would be placed into a dump trailer or modified roll-off dumpster within a fenced area for later transport to a landfill or compost site. This process would involve collaborative management between the NPS and tribes to determine the timing of culling, number of tribal members on-site for processing, and options for carcass removal. The NPS would prefer the tribes and ITBC continue to reach agreement on the distribution of bison and work collaboratively to arrange processing, distribution, and carcass removal.

The NPS could collaborate with other IBMP members and treaty tribes to evaluate the need, design specifications, and potential location for temporary capture facilities in the northern management area. The 2000 final EIS (pages 123-136) and ROD (pages 17-18) for the IBMP indicated a capture facility could be established between the park boundary and Yankee Jim Canyon when management north of YNP emphasized hunting to help control bison numbers and distribution. The NPS would work with cooperators on additional facilities outside the park. The building of new capture or quarantine facilities outside the park, or acquisition of hunting (terminal) or quarantine pastures outside the park, may necessitate other agencies complete additional NEPA and/or Montana Environmental Policy Act assessments and compliance with federal and state agencies, respectively. Although the building of these facilities is not analyzed in this EIS, where appropriate, the use of these facilities and resulting effects on bison are analyzed. The NPS would request IBMP members and treaty tribes participate in the capture, handling, and shipping of bison from any future capture facilities in the northern management area. The successful use of such facilities would depend on IBMP members and other treaty tribes reaching agreements that regulate hunting permits, locations, and methods to allow bison to disperse in the management area.

Hunter harvests outside the park would be like those described for Alternative 1, and the NPS would continue engaging with tribes associated with Yellowstone bison, the Custer Gallatin National Forest, MFWP, residents, and NGOs to explore ways to increase the efficiency and safety of hunting outside the park. Hunting in Montana could become more effective over time if hunters move away from the park boundary and bison can distribute across the landscape year-round so hunting seasons and locations can be adjusted to more traditional autumn and early winter time periods in certain areas. Increasing the hunter harvest of bison outside the park in future years may require allowing bison to occupy some areas for longer periods of time, better access for hunters, and hunters adjusting their strategies in response to bison behavior and habitat use patterns. Bison ineligible for the BCTP due to age or prior brucellosis exposure could be released from the capture facility and be available for hunting opportunities if they move beyond the park boundary.

Like Alternative 1, bison could be enticed (hay) or hazed into the Stephens Creek Administrative Area capture facility using low-stress techniques such as people walking or on horseback slowly moving behind them to influence their direction. These techniques also could be used to haze bison away from the park boundary if necessary to reduce conflicts in the management areas in Montana. The NPS may haze bison within YNP when necessary to protect people and property. The NPS does not anticipate using vehicles or helicopters to haze bison within the park, but Montana could use a helicopter if it deems it necessary to move bison back to the park. The NPS anticipates hazing led by state and other officials outside the park in Montana to be like Alternative 1.

Alternative 3

In addition to the actions common to all proposed alternatives listed above, this alternative would prioritize treating bison more like other ungulates such as elk in the GYA, which also have been exposed to brucellosis but are not subject to intense disease management like bison. Captures of bison for shipments to slaughter would immediately cease, with natural selection and public and tribal hunter harvests outside the park in Montana being the primary factors limiting bison numbers. The NPS would work with tribal partners to increase their hunting opportunities and the number of live bison sent to tribal lands through the BCTP given weather influences or the extent of migration each year. The NPS would continue engaging with tribes and other IBMP members to explore ways to increase the efficiency and safety of hunting outside the park and increase the restoration of brucellosis-free bison to tribal lands through the BCTP. The NPS would continue captures to maintain the BCTP as described for Alternatives 1 and 2. The NPS may haze bison within YNP when necessary to protect people and property. Montana could implement hazing outside the park at its discretion.

Bison numbers likely would be substantially higher than under Alternative 1 and could range between 3,500 and 7,000 after calving. Biologists in YNP would continue to monitor demographic indices as bison density increases. Like Alternative 1, bison could use all wilderness and other undeveloped areas in YNP and leave the park into established management areas in Montana where state agencies in cooperation with the national forest supervisor and private landowners would determine levels of tolerance for bison in Montana. The NPS expects tolerance in coming years to remain like Alternative 1.

Larger hunter harvests would have to occur more frequently outside the park for this alternative to be effective, which may necessitate tribal and public hunters allowing bison to distribute across a larger landscape before hunting them. If higher bison numbers threaten the efficacy of management efforts to keep them in the existing management areas, even with more hunting opportunities, the NPS would reinstitute shipments to slaughter and the use of other tools as described for Alternatives 1 and 2. The risk of brucellosis transmission from bison to cattle in Montana may increase compared to Alternative 1 from more bison on the landscape and a broader distribution, which could increase the likelihood of contact with cattle. Disease surveillance would be conducted on some harvested bison. Captures for the BCTP would be like those described under Alternative 1. Large removals of more than 1,000 bison may need to

occur when bison numbers approach 7,000. Numbers and methods of removals would be like Alternative 1 until bison numbers are reduced.

State agencies, in cooperation with the national forest supervisor and tribes with hunting rights, would determine and coordinate the location and/or extent of hunting in Montana, outside the park. The NPS expects they would implement public and tribal hunting in coming years like Alternative 1. There would be more hunter harvest opportunities with bison and hunters distributed across a larger landscape due to the larger bison population size. Like Alternative 2, bison ineligible for the BCTP could be released from the capture facility to provide opportunities for hunter harvest if they move outside the park.

Like Alternative 1, bison could be hazed to the capture facility in the Stephens Creek Administrative Area for the BCTP using low-stress techniques such as people walking or on horseback slowly moving behind them to influence their direction. The NPS does not anticipate using vehicles or helicopters to haze bison within the park, but Montana could use a helicopter if it deems it necessary to move bison back to the park. The NPS anticipates hazing in Montana would be like Alternative 1.

Alternatives and Alternative Elements Considered but Dismissed from Detailed Analysis

Manage for a Target of 3,000 or Fewer Bison—In 1998, the National Academy of Sciences plotted population counts of Yellowstone bison from 1968 to 1997 against removals the following winter and found more bison moved to the boundary of YNP and were removed when there were more than 3,000 bison. The Academy then plotted (linear regression) snow water equivalent (density) against bison removals for eight winters during this period and concluded increasing snowpack exacerbated this trend. They concluded "above this population size [3,000], bison will move outside the park in all but the mildest winters" (Cheville et al. 1998:61). However, they also cautioned that this relationship was based on few data points with wide confidence limits and less certainty.

When the IBMP was negotiated during the 1990s, there was intense pressure at state and national levels to prevent cattle from being infected with brucellosis, thereby allowing their continued export without testing to facilitate interstate movements and trade agreements (Bidwell 2010). As a result, maintaining a negligible risk of brucellosis transmission from bison to cattle was prioritized in the court mediated IBMP. Montana deemed maintaining a low risk of transmission was insufficient because brucellosis transmission might still occur under certain circumstances and, purportedly, threaten the viability of the livestock industry (State of Montana 2000). In keeping with these objectives, a population target of 3,000 bison in "late winter/early spring" was chosen to reduce migrations outside YNP, rather than a target based on assessments of ecological or genetic viability (USDOI and USDA 2000b:32, 51; White et al. 2015a). Regardless, biologists in YNP count bison during summer after calving because these counts are more accurate than during winter given weather conditions and bison distribution (Hess 2002). A late winter/spring population of 3,000 bison would roughly equate to about 3,600 to 3,700 bison after calving depending on the composition and growth rate of the population (Angliss 2003).

This population target of 3,000 bison in spring (~3,600 to 3,700 bison after calving) did not prioritize tribal treaty hunting outside the park, which was not considered in the 2000 IBMP. In addition, tolerance for bison migrating into Montana was constrained to a short period during winter and small areas adjacent to YNP, which did not achieve the goal of a free-ranging population or further the restoration of wild bison (White et al. 2015b). Instead, the IBMP was intentionally designed to "prevent the reestablishment of a free-ranging bison herd in places where bison have been absent for more than a century," which essentially defined the park and small, nearby areas in Montana as "the acceptable limits for bison distribution" (State of Montana 2000:27-28, 32).

More recent analyses of data indicate the timing and magnitude of migrations are highly influenced by uncontrollable variables such as summer plant production and the onset and severity of snowpack, as well as herd size (central and northern). When the density of accumulated snowpack is well above average and plant production is well below average, more than 1,000 bison may migrate toward the boundary of YNP.

However, substantially fewer bison migrate under more moderate weather and productivity conditions, even when there are more than 5,000 bison, due to the logistic (non-linear) form of the migration response. Thus, potential migrations range from a few individuals to more than 1,000 bison in any given winter (Geremia et al. 2011, 2014, 2015a).

Maintaining 3,000 or fewer bison would require aggressive removals of bison migrating to the boundary of YNP, as well as in the interior of the park. These actions could substantially decrease genetic diversity and skew the age and sex composition of the population (White et al. 2011; Halbert et al. 2012; Pérez-Figueroa et al. 2012). Low numbers of bison would lessen the long-term viability of the population and raise concerns related to the Endangered Species Act. On June 6, 2022, the FWS announced it would conduct a 12-month status review to determine whether the population of Yellowstone bison should be listed as threatened under the Endangered Species Act (*Federal Register* 87: 34228–34231). Low numbers also would diminish the ecological role of bison at engineering habitats; redistributing nutrients; altering plant growth patterns; improving biodiversity; and providing meat for predators, scavengers, and decomposers. Low numbers of bison would eliminate most hunting opportunities in nearby areas of Montana due to a lack of migration outside the park. Such actions are not necessary given 20 years of experience managing bison at higher numbers with no brucellosis transmission to cattle and fewer property and safety conflicts. In summary, this alternative would not meet the purpose and need for action and would result in too great of an environmental impact since it would affect the long-term viability of the bison population and adversely affect treaty rights for tribes to hunt bison on lands (primarily national forests) outside YNP.

Implement a Previously Modified Alternative from the Original 2000 Record of Decision Called the Joint Management Plan or Modified Preferred Alternative—The 2000 Joint Management Plan was designed to adaptively progress through a series of management steps that initially tolerated only bison testing negative for brucellosis exposure on winter ranges outside YNP but would eventually tolerate limited numbers of untested bison on small winter ranges adjacent to the park when cattle were not present. During step 1, the agencies agreed to: (1) enforce spatial and temporal separation between bison and cattle; (2) use hazing by humans on horseback, all-terrain vehicles, or in helicopters to prevent bison from leaving the park; (3) if hazing was unsuccessful, capture all bison attempting to leave the park and test them for brucellosis exposure; (4) send test-positive bison to slaughter; (5) vaccinate all test-negative bison except adult females during the third trimester of pregnancy (mid-January through May); (6) temporarily hold all test-negative bison at the north boundary for release back into the park in spring; (7) release up to 100 test-negative bison at the west boundary and allow them to use habitat adjacent to the park until May 15; (8) conduct research on *Brucella* persistence in the environment to determine an adequate temporal separation period between bison and cattle; (9) conduct research on the safety and efficacy of strain RB51 vaccine; and (10) conduct research and development of a remote vaccine delivery system. Montana also agreed to encourage voluntary vaccination of cattle that might graze on bison-occupied winter ranges outside the park. If 100% voluntary vaccination was not achieved in one year, Montana agreed to make the vaccination of all female cattle greater than 4 months of age mandatory (USDOI and USDA 2000b; White et al. 2011).

Step 2 was to begin when cattle no longer grazed during winter on the Royal Teton Ranch adjacent to the north boundary of YNP, which was anticipated in winter 2003. Management actions initiated in step 1 would continue, except that up to 100 test-negative bison would be released at the north boundary and allowed to use habitat adjacent to the park until April 15, and any calf and yearling bison that could not be captured at the west boundary would be vaccinated using a remote delivery system. Step 3 was expected to begin by winter 2006 once the agencies had determined an adequate temporal separation period between bison and cattle; gained experience in managing bison in allowable zones outside the park; and initiated a vaccination program for all calf, yearling, and adult female bison in the population, including remote delivery vaccination inside YNP. The agencies would tolerate up to 100 untested bison to freely range in both the north and west boundary areas. The agencies would use capture facilities in these areas

to maintain the population near 3,000 bison, enforce tolerance levels (less than 100 bison), and ensure no bison were outside the park after the respective spring cut-off dates. The agencies could also pursue a quarantine facility to better manage bison by developing a process to certify test-negative bison as brucellosis-free (USDOI and USDA 2000b; White et al. 2011).

This Joint Management Plan was never completely implemented because changed conditions and new information indicated these intrusive methods could have adverse effects on the bison population and were not likely to be effective, feasible, or socially acceptable (White et al. 2011; Halbert et al. 2012; White et al. 2015a,b). These conclusions were supported by several environmental analyses by the IBMP partners, including the evaluation of a remote delivery vaccination program for bison in 2013 and 2014 by the NPS and MFWP; the State's decision regarding year-round habitat for bison in 2015; the establishment of the BCTP by APHIS, Fort Peck tribes, MDOL, and the NPS in 2017 and 2018; the National Academies of Sciences, Engineering, and Medicine evaluation of brucellosis and the potential for its spread in their 2020 report entitled *Revisiting Brucellosis in the GYA;* and the Custer Gallatin National Forest's decision on the Land Management Plan in 2022.

Implementing this alternative is not necessary given more than two decades of experience in managing bison with no direct transmissions of brucellosis to cattle and the changed circumstances and new information described in appendix B. The National Academies of Sciences, Engineering, and Medicine concluded in 2017 that infected elk had transmitted brucellosis to livestock in the GYA at least 27 times since 1998 with no transmissions attributed to bison. The Committee recommended prioritizing efforts on preventing brucellosis transmission by elk, while maintaining separation between bison and cattle. The Committee also recommended not using aggressive control measures on bison until tools became available for an eradication program in elk. State biologists indicated these intrusive methods of disease control are not likely to be effective, feasible, or politically or socially acceptable to implement on wide-ranging elk populations. Instead, they concluded the primary strategy for managing brucellosis transmission risk from more numerous elk to livestock is to prevent mingling by hazing, hunting, fencing or removing haystacks and other attractants, or improving forage on public lands (Rayl et al. 2019). For over two decades, the IBMP partners have demonstrated these same techniques work for bison. As a result, this alternative would not meet the purpose and need for action because some elements are technically infeasible (such as remote vaccination delivery to the entire bison population), and it would have too great of an environmental impact since it would adversely affect treaty rights for tribes to hunt bison on lands outside YNP.

Erect Physical Barriers or Supply Food to Keep Bison within YNP—While YNP provides a large amount of habitat for bison, it does not provide enough habitat for all of them when deep snow limits access to food at higher elevations. As a result, some bison move to lower-elevation habitats in and outside the park in search of food during winter and spring. These movements allow bison to access necessary resources for their survival like bighorn sheep, deer, elk, moose, and pronghorn. If bison were prevented from moving into Montana by capture or hazing, food availability in YNP would limit bison numbers with starvation occurring after numbers exceed food availability. Some members of the public have suggested fencing the northern and western boundaries of YNP to prevent bison movement into Montana. The NPS could erect fortified fences to limit bison movement, but fences would also impede or prevent the movement of bighorn sheep, deer, elk, moose, pronghorn, and other animals. Fencing can create a ranch or zoo-like atmosphere and is generally inconsistent with both state and NPS wildlife management principles, although some management and park units in other areas are fenced (USDOI, NPS 2006a). Continuous fencing along the YNP boundary would limit the movement of ungulates outside the park and concentrate them therein. In addition, adequate fences would be expensive to purchase, install, and maintain, and their installation could cause major adverse impacts to movement and use of habitats by wild animals in some areas. Bison movements from the park occur at several widely scattered locations, and bison have found ways through or around some existing fences (Meagher 1989; Geremia et al. 2015a). As a result, managers would need to maintain fences damaged by animals, falling trees, or other

events. In addition, fences could be less effective during winter if snow drifts over sections. Furthermore, bison could leave through unfenced public access gates of the park and across rivers during any time of year. In summary, this alternative would not meet the purpose and need for action, would have too great of an environmental impact on bison, and would conflict with general wildlife and national park management principles such that a major change in the management plan or policy would be needed. It also would adversely affect treaty rights by preventing tribes from accessing a traditional food source on lands outside the park.

Keep Bison within YNP to Avoid Impacts from Hunting on Residents and Businesses—During the past decade, concentrations of primarily tribal hunters on national forest lands near the park boundary have, at times, resulted in conflicts with nearby residents and businesses due to shooting near roads and houses, gut piles left on the landscape, shooting of elk and other ungulates, and occasional incidents of shooting toward other hunters, houses, and cars. The Custer Gallatin National Forest has taken actions to improve public safety and natural resource concerns associated with hunts on forest lands by moving shooting and carcasses farther away from residences in the area. However, shooting and bison offal remain a concern for business and property owners and some people have suggested no hunting in these areas to avoid impacts on nearby residences or businesses. The NPS does not have regulatory authority or jurisdiction over hunts that occur outside Yellowstone National Park and, as a result, cannot control when, where, and how these hunter harvests occur, or the number of bison harvested by tribal or state hunters.

Park staff could attempt to haze bison back into the park to prevent them from leaving. The amount of hazing required to keep bison from exiting the park in some winters would be extensive, prolonged, and require the use of vehicles, helicopters, and other aversive conditioning methods (e.g., cracker shells, rubber bullets) that are intrusive and result in noise and other impacts to wildlife and people. If bison were prevented from moving into Montana by capture or hazing, food availability in YNP would eventually limit bison numbers with starvation occurring after numbers exceed food availability. However, bison movements from the park occur at several widely scattered locations and bison likely will eventually find ways through or around people attempting to haze them and keep them in the park, especially at night or during severe inclement weather (Meagher 1989; Geremia et al. 2015a).

Moreover, the Supreme Court has held the tribal treaty right to fish must consist of something more than a right for tribal members "occasionally to dip their nets into the territorial waters" (Washington v. Washington State Commercial Passenger Fishing Vessel Association, 443 U.S. 658, 679). In other words, tribal fishing and hunting rights include more than just the right to attempt to harvest wildlife; tribes need to be able to obtain a share of the actual harvest of a resource (*Puyallup Tribe v. Department of Game of Washington*, 391 U.S. 392 (1968), 414 U.S. 44 (1973), 433 U.S. 165 (1977)). By completely restricting bison migration onto unoccupied lands adjacent to the park, the NPS would be adversely affecting the exercise of reserved treaty rights by several tribes. A similar argument would hold if the federal government eliminated tribal hunting on these lands, while the State of Montana still permitted public hunts. In summary, this alternative would not meet the purpose and need for action, would conflict with general wildlife and national park management principles (e.g., migration of a free-ranging and wild bison population) such that a major change in the management plan or policy would be needed, and would adversely affect treaty rights by preventing tribes from accessing a traditional food source on lands outside the park.

Remove Cattle from the Yellowstone, Madison, and Gallatin River Valleys—The purchase of grazing rights or private lands for the benefit of wild animals has been effective at protecting habitat for decades. Conservation incentives can provide greater tolerance for bison on private lands while maintaining separation with cattle. Conservation groups and government agencies have successfully used and are still pursuing this strategy with willing landowners. Efforts are ongoing to identify additional habitat and conservation areas for bison, develop fencing strategies with landowners that raise cattle or have property damage concerns, and identify opportunities for the enhancement of habitat while discouraging bison movements onto private lands with cattle. Substantially reducing the number of cattle operations in areas

adjacent to YNP would reduce the risk of brucellosis spreading from bison and elk to cattle and possibly contribute to more tolerance for wild bison. However, buying out most or all cattle producers in the Yellowstone, Madison, and Gallatin Valleys of Montana would be an enormously costly venture. The challenges of managing wild bison, including safety and property damage, are more diverse than simply preventing the mixing of bison with cattle. Moreover, buying out cattle operations would not decrease the occurrence of brucellosis in bison or elk.

The elimination of cattle ranching in valleys near YNP would not resolve the debate about the appropriate extent of the management area boundary for bison in Montana. If state agencies in cooperation with the national forest supervisor established a new tolerance boundary that included the Yellowstone, Madison, and Gallatin Valleys, bison would eventually expand in numbers and distribution to occupy these areas, and management would have to incorporate these new locations. Managers could relocate some bison elsewhere, but federal and state regulations prohibit movement of bison from an area where brucellosis occurs unless the animals have gone through quarantine to certify each animal is free of the disease (MCA 81-2-120, 87-1-216; 7 USC 8301 et seq.; USDA, APHIS 2003). Moreover, given existing political and social constraints, managers are unlikely to find additional habitat in Montana quickly enough to keep pace with increasing bison numbers (White et al. 2015c). Some members of the public have suggested requiring livestock producers to stop raising cattle, raise bison instead of cattle, or raise only steers. Livestock agencies use vaccinations and incentives to reduce the number of cattle susceptible to brucellosis but requiring producers to modify their operations or cease grazing is not within the jurisdiction of the NPS. In summary, this alternative would be beyond the scope of the NEPA review, would be outside NPS's jurisdiction, would not meet the purpose and need for action, and would be economically infeasible.

Bison Relocation Within the Park—Several agencies and tribes have suggested relocating bison to currently unoccupied areas within YNP to reduce densities. Bison congregate in two primary breeding herds during the rut. For the remainder of the year, they do not tend to stay in the same group or location for very long. Telemetry data show animals move widely across the land, often returning to the same areas about every two to three weeks (Geremia et al. 2015a, 2019). It may look like bison remain in the same place, but that is not the case. Bison currently use about 1.1 million acres of YNP and are free to move anywhere in undeveloped areas (99.3% of the park) based on their own decisions (White 2016). Thus, the NPS does not see a need to relocate bison to other areas of the park, which is contrary to the NPS mission and principles of preserving wildlife in their natural condition with minimal human intervention.

Restore Bison to the Great Plains—Some members of the public have suggested bison be recolonized across the plains of central and western North America. While the large-scale restoration of plains bison in North America is beyond the scope of this NEPA review, the alternatives under consideration in this EIS include providing live, brucellosis-free bison from the Yellowstone lineages for restoration efforts on tribal and public lands.

Mass Test-and-Slaughter or Depopulate YNP and Reintroduce Brucellosis-free Bison—Some members of the public have suggested eliminating brucellosis by capturing every Yellowstone bison, testing them for brucellosis, and removing animals testing positive. Similarly, the 2000 IBMP envisioned the capture and testing of all bison moving outside YNP, with positive animals sent to slaughter facilities and negative animals sent to the BCTP or released after vaccination (USDOI and USDA 2000a,b). About 60% of adult female Yellowstone bison test positive for antibodies in their blood, indicating previous exposure to the bacteria that causes brucellosis, but only 10% to 15% are infectious and could potentially shed bacteria and spread the disease to other bison, cattle, or elk (Hobbs et al. 2015). The remaining noninfectious bison may have cleared the bacteria after infection and could have some resistance to the disease (Treanor et al. 2011). Alternatively, the entire bison population could be killed, and a brucellosis-free herd reintroduced. However, brucellosis occurs in elk throughout the region, and federal and state agencies have no plans to eliminate or substantially reduce infection in these elk. As a result, it would be

ineffective and wasteful to remove two-thirds or more of the bison in YNP, only to have the remainder, or reintroduced bison, infected by elk over time. Moreover, a substantial reduction in bison numbers could negatively affect predators and scavengers, grasslands, and visitor experience. Large removals could alter age and sex composition, reduce the number of females and calves, and reduce genetic diversity (White et al. 2011; Halbert et al. 2012), thereby raising concerns related to the Endangered Species Act. Thus, this alternative would not meet the purpose and need for action and might require a major change to law, regulation, or policy, such as YNP's enabling legislation.

Manage Elk to Substantially Decrease or Eradicate Brucellosis and Prevent Mingling with Cattle—Brucellosis is spreading in elk throughout the GYA and has spread from elk to cattle at least 27 times since 1998 (National Academies of Sciences, Engineering, and Medicine 2020). In many areas, such as the Paradise Valley north of the Gardiner Basin, elk mix with cattle at times during the year, without managers testing them for brucellosis or shipping them to slaughter facilities (Tilt 2020). The eradication of brucellosis would require eliminating the disease in elk, which would require attempting to capture, test, and vaccinate or slaughter elk across the entire region, which would be extremely difficult or impossible (National Academies of Sciences, Engineering, and Medicine 2020). The NPS would continue to prioritize minimal management of elk inside YNP and let numbers and brucellosis occurrence vary from year to year based on competition, predation, habitat conditions, weather, and hunting and management actions outside the park. Elk age, sex, and genetic diversity will vary in response to these factors. Elk can move freely within YNP and across the park boundary. The NPS has no plans to decrease the occurrence of brucellosis in elk. Likewise, the MFWP Commission endorsed recommendations from a citizen working group regarding elk management where there are concerns about brucellosis spreading from elk to cattle. The group concluded the "eradication of brucellosis in elk is ultimately desirable, but it is not currently feasible, and current methods to achieve this goal, such as test-and-slaughter, are unacceptable" (MFWP 2013:3). Recommended actions to prevent or disperse concentrations of elk include hunting, altering habitat to promote separation between elk and cattle, and hazing and fencing to maintain separation (MFWP 2013, 2015; Rayl et al. 2019). This alternative would not meet the purpose and need for action, is technically infeasible, and is beyond the scope of the NEPA review.

Remote Delivery Vaccination of Bison—The 2000 ROD for the IBMP directed the NPS to evaluate whether to implement remote delivery vaccination of bison inside YNP to decrease the occurrence of brucellosis (USDOI and USDA 2000a). Many vaccines are modified or weakened versions of disease organisms, such as bacteria, that induce a weakened infection that is cleared by the immune system and leaves behind memory cells that enable an animal to fend against subsequent exposures to natural strains of the disease more effectively. These vaccines rarely provide complete protection against infectious diseases, especially organisms that invade the interior of cells such as *Brucella abortus* bacteria. However, vaccinations could contribute to brucellosis suppression by reducing the number of susceptible individuals, shedding of infectious bacteria, and rate of transmission (Treanor et al. 2010; Ebinger et al. 2011; Hobbs et al. 2015).

Currently, a vaccine (RB51) consisting of live, weakened strains of *Brucella abortus* bacteria is available to provide bison and cattle with some protection against infection and abortion (50%-60%), especially when they receive a booster vaccination (Olsen 2013). However, the vaccine does not prevent most bison or cattle from becoming infected (less than 15%) after exposure to infectious amounts of *Brucella* bacteria (Olsen 2013). Therefore, the primary reason for vaccinating bison would be to reduce the shedding of *Brucella* bacteria and the potential for further transmission after individuals become infected. These results highlight the need for better vaccines and emphasize vaccine RB51 may not be a viable option for brucellosis control in wild bison.

Efforts to reduce the prevalence of brucellosis in Yellowstone bison using vaccination would be most effective through a park-wide effort that consistently and reliably delivers vaccines to most bison each year over decades (Treanor et al. 2010; Ebinger et al. 2011). The most effective way to vaccinate bison is with a syringe so bison receive the intended dose in the correct site (just under the skin). Also, vaccinated

animals can be marked to facilitate monitoring of protective immune responses and reproductive events. Optimally, vaccine delivery should occur in autumn, at least 12 to 16 weeks before potential exposure to *Brucella* bacteria in late February or March, to develop a protective immune response (Plumb and Barton 2008). However, bison mating behavior, migration patterns, and hunting seasons make it difficult to vaccinate enough females each year to have a lasting effect on brucellosis suppression. During late summer, bison congregate for the rut (breeding season), and relatively large groups are sustained through autumn. Breeding behavior and larger groups make bison more difficult to approach and vaccinate. Also, even in winters with moderate snowpack, less than 50% of the bison in the population migrate to the boundary where capture facilities are located (Geremia et al. 2011, 2014). Most migrants tend to move to the boundary during late winter when pregnant females are late in gestation and should not be vaccinated because that could induce an abortion.

Approaches that target pre-reproductive females for vaccination, while removing reproductively active, likely infectious females, could reduce brucellosis transmission by reducing the shedding of the bacteria (Treanor et al. 2010; Ebinger et al. 2011). However, the selective vaccination of 50 to 100 pre-reproductive females and culling of 50 to 100 likely infectious females each year would require capturing and testing more than 650 bison, which is more bison than migrate to either the northern or western boundary of YNP in some winters. Also, staff would need to capture more bison each year to reach these goals as the prevalence of brucellosis decreased (Ebinger et al. 2011). In addition, vaccinated bison would need to be held in the capture pen for 21 days during hunting seasons due to concerns about consumption before the vaccine is cleared from the animal's system.

Delivering vaccines remotely using bio-bullets, darts, or bait is possible, but the effective range of bio-bullet or dart delivery via air rifle is approximately 33 to 44 yards (30 to 40 meters), which is ineffective for reaching bison inside the perimeter of a relatively large group. Also, it is uncertain whether each animal receives the intended dose, and there is no way to know because animals are not marked. Furthermore, there are recurrent issues with bio-bullet vaccine formulation and encapsulation, projectiles fracturing or being too soft to penetrate the skin, and poor immunologic proliferation. As a result, it is difficult to estimate the portion of the population that is effectively vaccinated. In addition, capture and handling and remote vaccination are likely unpleasant experiences for bison. Therefore, they may begin to avoid humans and, as a result, it will probably become more difficult to vaccinate a large portion of the bison population (USDOI, NPS 2014b).

The duration of vaccine-induced immune protection appears to be relatively short rather than life-long. Thus, booster vaccinations likely would be necessary (Olsen 2013). Furthermore, the extent of protective immune responses stimulated by vaccination may be reduced when vaccines are delivered to undernourished bison during winter (Treanor 2012, 2013). Like other ungulates in this northern mountain environment, bison are chronically undernourished by late winter from the limited availability of relatively low-quality forage, most of which is senescent (cured, dormant) and covered by snow. This seasonally poor body condition and nutrition increases the vulnerability of bison to attack or reemergence of infections and coincides with increasing reproductive demands during late pregnancy that curb the resources bison can allocate to immune defense. As a result, the vaccination of wild bison during winter may be relatively ineffective against brucellosis (Treanor 2012, 2013). Moreover, an effective vaccination program for bison would require that all possible routes of re-infection be treated or effectively separated from the vaccinated population. In the past decade, brucellosis prevalence in some elk populations in the GYA has increased and spread, independent of Yellowstone bison, with all detected transmissions of brucellosis to cattle traced to elk (Rhyan et al. 2013; Kamath et al. 2016). The potential for elk to maintain the disease and re-infect susceptible bison cannot be ignored.

A panel of scientists from federal, state, academic, and NGOs reviewed information about the vaccine-induced immune responses of bison and elk, as well as the benefits and limitations of existing tools and emerging technologies for reducing the occurrence of brucellosis in bison and elk. The panel evaluated whether it was feasible to decrease the occurrence of brucellosis substantially in bison without

significantly affecting their behavior or visitor experiences. The panel concluded management to maintain separation between cattle and bison was effective at preventing the spread of brucellosis between them. They also thought the vaccination of bison with available vaccines would not decrease brucellosis to a level that substantially reduced the need for the separation of bison and cattle. The panel suggested the remote delivery of vaccine to bison would be a cost-ineffective tool for preventing brucellosis spreading to cattle and could lead to shifts in the distribution of bison across the landscape that reduced the opportunity for visitors to observe bison (USDOI, NPS and MFWP 2013). Based on these assessments, the NPS decided not to implement park-wide remote vaccination.

In the 2014 *Final EIS for the Remote Vaccination Program to Reduce the Prevalence of Brucellosis in Yellowstone Bison*, the NPS concluded that the implementation of park-wide remote vaccination would not achieve desired results and could have unintended negative effects to bison and visitor experience such as injuries and changes in bison behavior that would negatively affect visitor experiences such as watching wild animals. The NPS based this conclusion on the lack of an easily distributed and highly effective vaccine and limitations of current diagnostic and vaccine delivery technologies. Bison nutrition, body condition, pregnancy, and lactation can reduce the protective immune responses from vaccination. In addition, elk that are also infected and widely distributed would re-infect bison (USDOI, NPS 2014b).

Following a review of brucellosis in the GYA, the National Academies of Sciences, Engineering and Medicine (2020) recommended not using aggressive control measures on bison until tools became available for an eradication program in elk. While Montana has implemented hazing and shooting efforts in recent years to disperse some elk in the Paradise Valley north of YNP, many elk still mingle with cattle during the brucellosis transmission period (Tilt 2020). No substantive efforts have been implemented to prevent transmission from elk to cattle like the measures (vaccination, culling, test-and-slaughter) Montana suggested the NPS take with bison in YNP (Rayl et al. 2019).

If an effective, reliable, and safe vaccine and delivery method were developed and demonstrated to be effective without significant adverse effects, park managers might consider it; however such techniques would not be implemented as part of operations until additional NEPA compliance, including public engagement, is conducted, and tools become available to eliminate brucellosis in elk, as recommended by the National Academies of Sciences, Engineering, and Medicine (2020). In summary, this alternative would not meet the purpose and need for action and would be technically infeasible.

Fertility Control of Bison—The transmission of *Brucella* bacteria during mating is not a significant route in cattle, and a recent study in bison did not detect *Brucella* bacteria in tissue cultures 6 months after intravaginal inoculation (Crawford et al. 1990; Uhrig et al. 2013). Bull bison can shed *Brucella abortus* bacteria in semen but likely are not capable of infecting females during spring due to low numbers of bacteria (Frey et al. 2013). Instead, brucellosis appears to be transmitted by female bison during birth. Younger female bison 3 to 5 years old are more likely than other bison to be infectious and capable of transmitting the bacteria through a contaminated aborted fetus, live calf, or reproductive materials (Treanor et al. 2011). Preventing these animals from conceiving and giving birth for several years could decrease the risk of brucellosis transmission and, over time, the prevalence of brucellosis in the population (Ebinger et al. 2011). Fertility control also would reduce birth rates, which could lead to less frequent population reductions.

Currently, there are no fertility control agents that meet the criteria necessary for use on Yellowstone bison. An effective, reliable, and safe fertility control vaccine for bison would need to be more than 80% effective and induce a consistent immune response with each dose. It would need to be effective for multiple years with a single dose, without unintended side effects. In addition, the effects of the vaccine would need to be reversible, not negatively affect behaviors and social interactions, and be cost-effective (Powers and Moresco 2015). Fertility control vaccines currently under investigation are most effective when injected by hand syringe. There is no oral vaccine for bison, and remote delivery via bio-bullet or dart is not feasible for most wild animals distributed across large areas. As a result, a big issue is how to

treat enough bison to obtain the desired effect in terms of reducing brucellosis or numbers. Effective vaccine delivery via syringe to appropriate numbers of female bison would require increasing the number of captures for several years or more, which would be challenging because bison would likely become harder to approach for repeated booster vaccination over time. In addition, captures would likely need to occur in many different locations in the park interior. Furthermore, fertility control vaccines could cause side effects such as inflammation, longer breeding seasons and life spans (which would complicate population regulation), and changes in reproduction and social behavior. They also could cause sterility, changes in age and sex composition, and reduced genetic diversity (Powers and Moresco 2015).

In 2012, APHIS began a six-year study of the effectiveness of the vaccine GonaCon™ at preventing gonadotropin-releasing hormone from initiating follicle growth and ovulation in Yellowstone bison, thereby resulting in infertility. The objectives were to determine whether GonaCon™ vaccine could prevent the shedding of brucellosis bacteria in young recently infected bison throughout the infection cycle. Researchers also wanted to determine whether bacteria that remain dormant in infected animals during fertility control would increase again during pregnancies after the effects of the vaccine decreased. This study ended during 2017, but data and findings have not been published or provided to the NPS for scientific peer review. Regardless, the testing of this or another fertility control method likely will take years to evaluate sufficiently.

Research on brucellosis suppression techniques, including fertility control, in bison may occur concurrent with, or after, similar efforts are initiated on elk populations in the GYA. Initial studies should take place outside YNP and be peer-reviewed for effectiveness by independent experts. Fertility control would reduce the number of young bison eligible for placement in the BCTP or available for treaty hunter harvests. If an effective, reliable, and safe fertility control vaccine and delivery method were developed and demonstrated to be effective without significant adverse effects, park managers might consider them; however such techniques would not be implemented as part of operations until additional NEPA compliance, including public engagement, is conducted, and tools become available to eliminate brucellosis in elk, as recommended by the National Academies of Sciences, Engineering, and Medicine (2020). In summary, this alternative would not meet the purpose and need for action, is technically infeasible, and would conflict with the basic policy objectives for the management of YNP (USDOI, NPS 2006a).

Establish a Brucellosis-Free Population using Assisted Reproductive Technologies—Scientists have used several techniques developed for commercial production and captive breeding to produce bison with genes from the Yellowstone lineage but no risk of *Brucella* infection, including artificial insemination and *in vitro* embryo production, cryopreservation, and embryo transfer (Barfield 2015; Benham et al. 2017). Brucellosis-free females could be inseminated with sperm collected from live or dead Yellowstone bison and separated from seminal fluid to remove any potential *Brucella* bacteria. Also, female Yellowstone bison could be stimulated with hormone injections to ovulate more than one egg at a time. After artificial insemination or breeding, technicians would collect and wash embryos to remove any *Brucella* bacteria before transferring them to the uterus of a brucellosis-free bison. Alternatively, technicians could collect ovaries and testes from bison sent to slaughter to fertilize the eggs and transfer the embryos to brucellosis-free bison (Barfield 2015; Benham et al. 2017).

Colorado State University and APHIS have used artificial insemination and embryo transfer to establish a small herd of brucellosis-free bison with Yellowstone genetics on the shortgrass prairie at Soapstone Prairie Natural Area and Red Mountain Open Space in Colorado. However, these techniques do not preserve the adaptive capabilities of Yellowstone bison that move across a vast landscape where they are exposed to natural selection through competition for food and breeding opportunities, predation, and survival under challenging environmental conditions. Even young bison in YNP likely have adaptive capabilities, such as antipredator behaviors, foraging strategies, and knowledge of suitable migration routes and seasonal use areas, which are absent or reduced in bison created through artificial insemination and embryo transfer and subsequently managed like livestock in fenced pastures and treated for diseases

with no predators and the removal of older bulls to simplify management. Populations established in captivity through assisted reproduction likely will be habituated to humans, naive of predators, and possess only a fraction of the genetic diversity present in the wild population due to collecting samples from relatively few bison in the population. In addition, many tribes have a special relationship with Yellowstone bison because they are descendants of the indigenous herds of bison that once roamed across North America and provided sustenance to them for centuries. As a result, there is substantial interest in obtaining wild bison directly from YNP for conservation and cultural purposes (USDOI, NPS 2016a). Thus, this alternative would not meet the purpose and need for action.

Hunt Bison Inside YNP—In 1970, Congress passed the General Authorities Act, and in 1978, the "Redwood Amendment" that clarified and reiterated that the predominant purpose of the NPS Organic Act is preservation. While the Organic Act gives the Secretary of the Interior the authority to destroy plants or animals for the purposes of preventing detriment to park resources, it does not give the Secretary authority to permit the destruction of animals for recreational or subsistence purposes. In 1984, after careful consideration of congressional intent with respect to hunting in national parks, the NPS promulgated a rule that allows public hunting in national park areas only where "specifically mandated by Federal statutory law" (36 CFR 2.2). The NPS re-affirmed this approach in its *Management Policies 2006* (USDOI, NPS 2006a). Congress prohibited hunting in YNP in 1894. To legally allow hunting at the park, the current NPS hunting regulation would have to be changed, and Congress would need to specifically authorize hunting in the park. The NPS has a legislative mandate to protect the natural and cultural resources within national parks to allow for their enjoyment by future generations.

The late-winter movement patterns of bison and firing lines of hunters near the park boundary limit the effectiveness of using hunting in Montana to manage the bison population and distribution during many winters. Thus, some tribes have suggested treaty hunting inside YNP. This proposal raises complicated and unresolved legal questions regarding treaty rights (Stark et al. 2022) because Congress prohibited all hunting in YNP (16 USC 26). Congress stated "[t]hat 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, is prohibited within the limits of said park." The NPS will not take a position on these legal questions in this EIS. However, because of this legislation and NPS policy, all hunting has been prohibited in the park for more than 120 years. As a result, this alternative was not carried forward for further analysis because it would be inconsistent with existing laws, policies, regulations, and case law regarding hunting in units of the NPS. It also would be inconsistent with long-standing basic policy objectives for NPS units where hunting is prohibited.

Administrative Shooting—Yellowstone bison management objectives are to promote preservation and restore ecological processes while minimizing conflicts with people and property. In addition, the NPS wants to support tribal treaty hunter harvests on lands outside the park and provide live brucellosis-free bison for restoration to tribal lands. Administering a "sharpshooter" program in YNP potentially could reduce bison numbers but would require a substantial increase in staff, time, and funding to manage bison operations and ensure the safety of visitors and staff by restricting access to certain areas of the park for extended periods. During winters when bison migration to the boundary is minimal, administrative shooting during autumn and early to mid-winter would need to occur in areas farther within YNP and away from roads to be effective—actions that could affect bison behavior and movements, other natural resources, and visitor experience. Over time, bison may attempt to avoid shooting teams by remaining in other areas of the park, which would further limit access to lower-elevation winter range. Thus, this alternative would not meet the purpose and need for action and would conflict with the basic policy objectives for the management of the area such that a major change in the policy would be needed.

Restore Hydrologic Functions in the Lamar Valley—Some members of the public suggested restoring the hydrology of the Lamar Valley in YNP that was indirectly altered by the eradication of wolves, subsequent exponential increase in elk numbers, and browsing on riparian vegetation that substantially

suppressed the recruitment of young aspen, cottonwood, and willow trees. This recommendation is beyond the scope of the NEPA review and would not meet the purpose and need for action.

Create a New National Park for Bison—Some members of the public suggested creating a new national park for bison from the Snowcrest, Gravelly, and Centennial Complex on the Beaverhead National Forest. While the creation of a new national park is beyond the scope of this NEPA review, the alternatives under consideration include providing live brucellosis-free bison from the Yellowstone lineages for restoration efforts outside YNP.

Capture Bison in the Interior of the Park—The 2000 ROD for the IBMP allowed the capture of bison attempting to leave the northern portion of YNP in the Stephens Creek Administrative Area for brucellosis testing and vaccination. However, the NPS concluded the repeated herding of bison into corrals in the interior of YNP for testing and shipment to slaughter would "detract from the wild free-ranging qualities of the bison population" and "could have a major adverse impact on the distribution of bison" (USDOI and USDA 2000a:414). It also would adversely affect the movements of other wild animals and negatively affect visitor experiences. Capturing bison in the interior of the park during October to March is impractical because it would require plowing roads to facilitate effective operations at various locations and allow for the transportation of bison from the park to quarantine, research, or slaughter facilities. The NPS developed a long-term regulation for winter recreation during 2013 that rejected plowing roads for wheeled vehicles in favor of an alternative that allows over-snow vehicles on interior park roads (USDOI, NPS 2013). In addition, capturing bison in the spring after calving during June to August would disturb mother-calf pairs and affect their nutrition during lactation due to stress and energetic costs. If later or impeded migrations due to climate warming, hunting, or other factors severely limit the effectiveness of managing bison abundance near the boundary, park managers may consider capturing bison farther inside the park. However, such actions would require a substantial increase in staff, time, and funding to capture, process, and distribute bison, as well as to ensure the safety of visitors and staff by restricting access to certain areas of the park for extended periods. Additional NEPA analyses would be required for these actions.

Compensate Ranchers for Bison Impacts—Some members of the public suggested compensating ranchers for brucellosis transmission, fencing, delayed allotment turn-on dates, rangeland fees, and retired cattle grazing allotments. Conservation incentives can provide greater tolerance for wildlife on private lands and NGOs and government agencies have successfully used and are still pursuing this strategy with willing landowners. Efforts are ongoing to develop fencing strategies with landowners that raise cattle or have property damage concerns and to identify opportunities for the enhancement of habitat while encouraging elk movements off private lands with cattle during the brucellosis transmission period (Rayl et al. 2019; Tilt 2020). Conservation organizations, such as the Greater Yellowstone Coalition, Defenders of Wildlife, Natural Resources Defense Council, and Sierra Club, have worked with MFWP to implement the Yellowstone Bison Coexistence Program. These groups offer financial and technical assistance to landowners interested in building exclusion fences on private property to keep bison from damaging gardens, landscaping, yards, or livestock pastures. They have completed more than 50 fencing projects in the Gardiner and Hebgen Basins of Montana and contributed more than $45,000 in reimbursements and materials (Greater Yellowstone Coalition 2022). In addition, the Custer Gallatin National Forest has worked with livestock producers on grazing allotments and turn-on dates in the Gardiner and Hebgen Basins (USDA, USFS 2022). However, compensating cattle ranchers for brucellosis transmission, property damage, or impacts to grazing allotments from elk in Montana is beyond the scope of this NEPA analysis and would not meet the purpose and need for action.

Manage Wild Bison Like Wild Elk—Some people have suggested managing bison like elk in Montana by allowing bison access to public lands; eliminating zone management (tolerance) areas; and ceasing captures, shipments to slaughter, and vaccination. Bison would only be hazed if there was an immediate threat to safety, property, or mingling with cattle on private land. In 2003, the Montana Legislature directed the Fish and Wildlife Commission to manage elk populations at or below sustainable population

numbers by 2009 based on habitat assessments (MCA 87-1-301, 87-1-323). The primary method used by the Commission and MFWP to reduce numbers of elk is regulated public hunter harvests in designated hunting districts. These hunter harvests are not always effective at limiting elk numbers as evidenced by the fact that more than 60% of hunting districts are over their objective and the entire state is 50,000 elk above objective (United Property Owners of Montana 2022). Despite these conditions, state biologists do not implement intrusive measures such as vaccination, culling, and test-and-slaughter to prevent mingling and brucellosis transmission from elk to cattle. Instead, they manage brucellosis transmission risk from elk to livestock by hazing, hunting, and fencing or removing haystacks and other attractants to prevent mingling (Rayl et al. 2019).

Before the IBMP, bison that migrated into Montana were shot, slaughtered, or hazed back into the park by Montana personnel where some bison died of starvation or other natural causes (USDI and USDA 2000a). This approach involved more hands-on management by Montana, including funding and staff, to mitigate possible land use conflicts. In contrast, management of bison under the IBMP has included more intrusive actions in the park, such as capture, test-and-slaughter, and vaccination to constrain their abundance and distribution. The Montana Legislature assigned primary management duties for Yellowstone bison to the Department of Livestock (MCA 81-2-120) and imposed restrictions on the movements and relocation of bison (MCA Titles 81 and 87). Thus, the ecological processes of bison migration and dispersal are restricted at or near the park boundary due to concerns about brucellosis transmission to cattle. Elk with the disease are allowed to move freely into Montana and managed much less intrusively even though they have transmitted brucellosis to cattle numerous times (White et al. 2015a).

For further recovery, bison need similar access to habitat that other wildlife species, such as elk, are given in the Yellowstone area, including year-round access to national forests and other public lands (White et al. 2015b). However, managers at YNP cannot preserve a viable population of bison on their own because when bison leave the park they are no longer under the agency's jurisdiction. Instead, their management becomes the prerogative of Montana in collaboration with the USFS on National Forest System lands. The NPS has worked with these agencies using adaptive management to increase tolerance for bison in their jurisdictions, including year-round in some areas (Bullock 2015). The Custer Gallatin National Forest recently issued a Land Management Plan that allows for expanded tolerance of bison on the national forest, including a desired condition to have a self-sustaining population of bison on the forest year-round (USDA, USFS 2022). Allowing bison to occupy more public lands would create new opportunities for hunting, bolster tourism, and enhance conservation.

Proposed Alternatives 2 and 3 would reduce intrusive management actions, such as capture for shipments to slaughter, vaccination, and hazing to constrain the abundance and distribution of bison. Alternative 3 would treat wild bison and elk similarly in YNP except for captures of bison near the north boundary for possible placement in the BCTP. The NPS believes this program is important for fulfilling its trust responsibilities to tribes and the public by restoring brucellosis-free bison to more portions of their historic range. Thus, implementing this recommended alternative does not meet the purpose and need for action, is duplicative in part with other alternatives, and implementation in Montana is outside the jurisdiction of the NPS.

Hunting Modifications—When bison cross the boundary of YNP into Montana, they are no longer under the jurisdiction of the NPS. Instead, their management, including public hunter harvests, is the prerogative of Montana in collaboration with the USFS on National Forest System lands. In addition, several tribes have rights reserved by treaties with the federal government to harvest bison migrating outside YNP onto portions of the Custer Gallatin National Forest. Thus, decisions about prohibiting hunting adjacent to YNP, having split seasons, increasing permits for residents, and fees for hunting are the prerogative of Montana and treaty tribes. The NPS would continue to honor and support rights reserved through treaties and work with the tribes and tribal organizations, Custer Gallatin National Forest, and Montana to increase the efficacy and safety of these hunts that provide access to a traditional food resource. Congress

prohibited hunting in YNP in 1894 (16 USC 26), and this prohibition includes the boundary lands area in northern YNP between Gardiner, Montana, and the northern boundary of the park at Reese Creek. Thus, this recommended alternative would be outside the jurisdiction of the NPS and inconsistent with existing laws, policies, regulations, and case law regarding hunting in units of the NPS. It also would be inconsistent with long-standing basic policy objectives for NPS units where hunting is not authorized.

Tribal Right of First Refusal for Bison—The ITBC requested tribal right of first refusal for all bison transferred from the park. The NPS provided all bison completing quarantine as part of the BCTP to the Fort Peck tribes for one year of assurance testing and eventual release. The ITBC transferred more than 170 bison of Yellowstone-origin from the Fort Peck Indian Reservation to 23 tribes across 12 states. Since 2012, all bison captured for shipment to slaughter have been transferred to Tribes for distribution of meat, hides, and other resources. Under the proposed alternatives, bison completing quarantine in YNP would continue to be sent to tribes for assurance testing and subsequent distribution. In addition, bison captured for slaughter would continue to be transferred to tribes for distribution of meat and hides.

The NPS has collaborated with several tribes associated with YNP and the ITBC through agreements and other avenues to benefit their interests. These collaborations have included involving tribes as partners in the management of Yellowstone bison; coordinating with tribes that hunt bison on National Forest System lands adjacent to the park to reduce the effects of capture operations on hunting opportunities; and expanding the BCTP to identify more brucellosis-free bison and transfer them to tribes for restoration on their lands. The NPS would continue to collaborate with tribes and the ITBC on these issues, as well as the composition and distribution of bison captured for the BCTP, the processing of bison killed at Stephens Creek Administrative Area, the creation of new quarantine and terminal pastures for Yellowstone bison, the testing of bison in the BCTP to improve effectiveness and shorten timelines, the involvement of tribal interns in bison management, and the implementation of lower-stress handling techniques with captured bison to reduce trauma. These collaborations may be implemented through cooperative agreements or other appropriate avenues.

The Superintendent, through the Secretary of the Interior and Director of the NPS, has the discretion to transfer or dispose of "surplus" animals (16 USC 36; 54 USC 100101, 100752). These responsible managers have the authority to enter into agreements and discussions with other federal, state, and tribal agencies, but they cannot wholly delegate their responsibilities to other entities not bound by the NPS Organic Act (*National Park & Conservation Association v. Stanton*, 54 F. Supp. 2d 7, 18 (D.D.C. 1999)). As a result, the Secretary of the Interior and responsible NPS managers will continue to collaborate with tribes and tribal organizations but must retain final reviewing and decision-making authorities about bison management and the transfer of "surplus" Yellowstone bison.

Construct Another Quarantine Facility (West Side of Park) to Avoid Conflicts with Hunts—The NPS has doubled the capacity of the BCTP in northern YNP (see the "Actions Common to All Alternatives" section). Currently, the agency does not have a need, funding, or staff to construct and implement quarantine operations on the west side of the park. Since 2017, NPS biologists have recommended no management removals or state and tribal hunter harvests of bison in the western management area in Montana. Bison migrating west of the park during winter are almost entirely from the central breeding herd, which has decreased in abundance since 2005. Management captures and removals have not occurred along the western boundary since 2010, but state and tribal hunter harvests continue in nearby areas of Montana. In addition, the NPS has indicated bison captured but not eligible for quarantine at the Stephens Creek Administrative Area could be released to increase hunting opportunities if they subsequently migrate to the park boundary. Regardless, the NPS has indicated it could collaborate with interested partners to establish additional quarantine facilities outside the park and transfer bison to them as the capacity of these facilities and availability of migrating bison allow. These partners would need to work with Montana and other IBMP members to evaluate the design, cost, and potential locations within the DSA for brucellosis, as well as the development of environmental compliance assessments and a management plan for transplanting Yellowstone bison onto suitable private or public lands in Montana

(Section 5 of §87-1-216 MCA). They also would need to develop agreements for building, maintaining, and operating the facilities and conducting quarantine testing. In addition to the reasons listed above, this alternative element would duplicate elements included in Alternative 2 and was therefore not carried forward for detailed analysis.

Changes to Quarantine Protocols—Though male bison can shed *Brucella abortus* bacteria in semen, they likely are not capable of infecting females due to low numbers of bacteria. Instead, brucellosis appears to be transmitted by female bison during parturition (Frey et al. 2013). About 13% of bison initially testing negative for exposure to brucellosis bacteria and placed into quarantine have subsequently tested positive within 250 days (USDA, APHIS 2022; Springer Browne et al. 2023). Per agreements with APHIS and Montana (USDA, APHIS et al. 2017), these bison are removed from quarantine to prevent any chance of transmission. This gives assurance to the Fort Peck tribes and livestock producers that all bison completing quarantine are brucellosis-free. The NPS is currently working with APHIS and Montana to evaluate testing data and assess whether timelines for the quarantine protocol can be shortened, especially for male bison.

In the FONSI for *The Use of Quarantine to Identify Brucellosis-free Yellowstone Bison for Relocation Elsewhere* EA (USDOI, NPS 2018), the NPS's selected action was to establish a quarantine program for Yellowstone bison using a combination of elements from Alternative 2 (Quarantine Facilities Within the Designated Surveillance Area for brucellosis) and Alternative 3 (Quarantine Facilities Outside the Designated Surveillance Area). The NPS envisioned using existing quarantine facilities in YNP (near the Stephens Creek Administrative Area), north of the park in Montana (Corwin Springs), and on the Fort Peck Reservation for the BCTP. The Deputy Administrator of Veterinary Services for APHIS indicated all these facilities met the structural specifications and biosecurity requirements for the quarantine of bison. However, Montana remained steadfast that the shipment of Yellowstone bison through Montana to the Fort Peck Reservation was not allowed before they completed quarantine and were certified as brucellosis-free by the State Veterinarian per MCA 81-2-120. In addition, APHIS maintained quarantine facilities for Yellowstone bison could only be established in the DSA for brucellosis per the 2003 *Brucellosis Eradication: Uniform Methods and Rules* (APHIS 91-45-013). The quarantine facility on the Fort Peck Reservation is located outside this surveillance area.

To initiate the BCTP without delays due to litigation and additional policy discussions, the NPS reached agreement with APHIS and the MDOL to implement quarantine in YNP and at Corwin Springs to identify brucellosis-free Yellowstone bison and then transfer them to the Fort Peck Indian Reservation for one year of assurance testing. The parties also agreed to evaluate testing data to assess the efficacy and timelines of the quarantine protocol (USDA, APHIS et al. 2017). The Fort Peck tribes did not sign this agreement, but more than 200 Yellowstone bison have entered the BCTP and undergone the three-phase testing regime. In 2022, APHIS and the NPS analyzed existing quarantine data to determine the number of days a group of bison needed to be held and tested in quarantine to ensure a negligible risk of one animal having brucellosis. A time-to-event model using this data predicted 95% of bison with brucellosis would seroconvert (test positive) within 210 days, 99% by 250 days, and 99.9% by 294 days. In other words, only 1 in 1,000 bison (0.0014 probability) with brucellosis bacteria would not be detected by 300 days and fewer than 4 in 10,000 bison would not be detected by 330 days. The results were similar for males and females. These findings suggest regulators could reduce testing timelines to allow animals to complete quarantine within one year with negligible risk of brucellosis transmission. Reducing the quarantine requirements (phases I and II) of bison to less than one year, while still using assurance testing (phase III) as an added safety measure, could nearly triple program capacity to graduating about eight groups totaling about 225 bison to assurance testing annually (USDA, APHIS 2022; Springer Browne et al. 2023). The NPS would continue to work with APHIS and Montana to shorten quarantine testing timelines, as feasible, which could involve modifying or eliminating the current three-phased testing approach. This recommended alternative was previously evaluated under a separate EA and is currently being implemented.

Chapter 3: Affected Environment and Environmental Consequences

Introduction

This chapter describes the current and expected future conditions of Yellowstone bison, other wildlife, threatened animals and plants, American Indian tribes and ethnographic resources, human health and safety, socioeconomics, visitor use and experience, and vegetation by implementing the alternatives described in chapter 2.

General Methodology for Assessing Impacts

This chapter is organized by impact topics, which represent specific resources. Under each impact topic, the "Affected Environment" is presented first and includes a discussion of the current state of each resource. The "Affected Environment" includes environmental trends and reasonably foreseeable actions, where appropriate. The "Environmental Consequences" section evaluates direct, indirect, and cumulative effects on the natural and human environment (i.e., physical, natural, cultural, and socioeconomic resources) from the implementation of each alternative.

Note that for most impact topics, the impacts of the no-action alternative (Alternative 1) are characterized in the "Affected Environment" section, because implementation of the no-action alternative would result in the same impacts and trends as are currently occurring. This approach takes into consideration direction from CEQ that EISs shall be analytic, concise, and no longer than necessary to comply with NEPA (40 CFR 1502.2) and is consistent with direction from CEQ that states that agencies "may contrast the impacts of the proposed action and alternatives with the current and expected future conditions of the affected environment in the absence of the action, which constitutes consideration of a no-action alternative" (85 FR 43323).

Yellowstone Bison

Affected Environment: Current Status and Expected Future Conditions

Population and Distribution—The NPS is meeting its demographic objectives, which were described previously in the "Adaptive Management" section of "Actions Common to All Alternatives" in chapter 2. The NPS counted between 2,900 and 6,000 Yellowstone bison after calving each summer between 2001 and 2022. Over the last five years, the sex ratio averaged 52% males and 48% females, which is near the objective, though males were overrepresented in the central herd with 108 males per 100 females (five-year average of 144:100) and slightly underrepresented in the northern herd with 83 males per 100 females (five-year average 98:100). The age structure of the population was also near the objective with about 28% juveniles and 72% adults over the past five years. Juveniles made up 30% of animals in the central herd (five-year average 24%) compared to 32% in the northern breeding area (five-year average 29%; Geremia 2022). Survival and birth rates have remained high as numbers increased, with the population maintaining an annual growth rate of about 14% after accounting for hunter harvests and management removals (Geremia 2022).

Bison roam relatively freely over an expansive landscape in YNP. Bison can use all wilderness and other undeveloped areas in YNP, which includes about 99.3% of the park's 2.2 million acres (8,900 square kilometers). Montana expanded management (tolerance) zones for bison in the state during 2015 (Bullock 2015), which should have enabled migration and expanded the range for bison to access additional resources and enhanced conservation and hunting opportunities. However, migratory and dispersal movements are often impeded by intense hunting near the park boundary that induces surviving bison to return to the park. When hunter harvests were not sufficient to limit population growth, park managers implemented captures and culling of bison (primarily for shipments to slaughter) to decrease numbers. The IBMP members have removed (through hunter harvests and culls) about 11,470 bison since 2001, which exceeds deaths from natural causes such as injuries, predation, and starvation. The NPS captured

and culled bison in the Stephens Creek Administrative Area during the winters of 1997, 2003, 2004, 2006, 2008, 2011, 2014 to 2020, 2022, and 2023. Public and tribal hunters harvested about 2,930 bison during winters from 2001 through 2022 (table 2), and around 1,175 bison in the winter of 2022-2023 outside the park. The NPS expects a similar range of harvests would continue under current management. Some bison move to lower-elevation ranges in Montana each winter, depending on food production and consumption, snowpack, and bison numbers (figure 4; Geremia et al. 2011, 2014). Thus, bison should continue to be available for harvests in Montana during many winters. In 2011 and 2023, the NPS held about 800 bison in captivity and fed them hay for several weeks to prevent a mass migration north of the park. These bison were released during spring, but confinement and feeding conflict with the management of bison as wildlife and could lead to food-conditioning, disease transmission during confinement, and disruption of traditional migratory patterns.

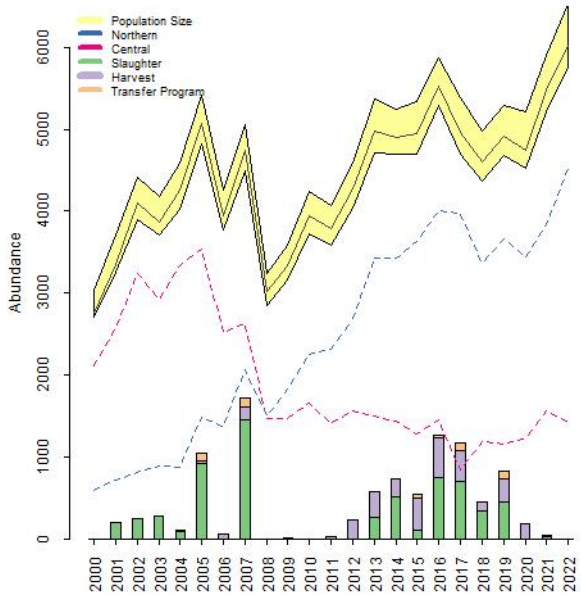
Following a summer count of about 6,000 bison in 2022, the NPS forecast a need to remove at least 800 bison to stabilize or slightly decrease numbers; more to slow population growth significantly (Geremia 2022; figure 5). The winter of 2022-2023 was the most severe of the IBMP era (2001-2023). Snow pack was about 199% at Tower Junction in northern YNP and snow water equivalent was about 156% at West Yellowstone, Montana (Geremia 2023). Bison survival and calving are lower during and after severe winters, respectively, with a population growth rate of less than 4% after severe winters in 2005-2006, 2007-2008, and 2010-2011 compared to an average growth rate of 15% during the IBMP era (Geremia 2023). However, numbers of Yellowstone bison increased during the IBMP era despite these severe winters and the removal of about 11,470 bison from 2001 through 2023 (Geremia 2022, 2023). The NPS expects this pattern to continue under current management.

Table 2. Numbers of bison removed from Yellowstone National Park or nearby areas of Montana from 1985 to 2023

	Number of Bison Counted Previous July-August			Sent to Slaughter/ Management Removals		Hunter Harvest[a]		Sent to Quarantine		
Winter	Northern Herd	Central Herd	Total	North Boundary	West Boundary	North	West	North	West	Total
1985	695	1,552	2,247	0	0	88	0	0	0	88
1986	742	1,609	2,351	0	0	41	16	0	0	57
1987	998	1,778	2,776	0	0	0	7	0	0	7
1988	940	2,036	2,976	0	0	2	37	0	0	39
1989	1058	2089	3147	0	0	567	2	0	0	569
1990	432	2,075	2,507	0	0	1	3	0	0	4
1991	818	2,203	3,021	0	0	0	14	0	0	14
1992	822	2,290	3,112	249	22	0	0	0	0	271
1993	681	2,676	3,357	0	79	0	0	0	0	79
1994	686	2,635	3,321	0	5	0	0	0	0	5
1995	1,140	2,974	4,114	307	119	0	0	0	0	426
1996	866	3,062	3,928	26	344	0	0	0	0	370
1997	860	2,724	3,584	725	358	0	0	0	0	1,083
1998	455	1,715	2,170	0	11	0	0	0	0	11
1999	489	1,622	2,111	0	94	0	0	0	0	94
2000	540	1,904	2,444	0	0	0	0	0	0	0
2001	590	2,118	2,708	0	6	0	0	0	0	6
2002	719	2,564	3,283	0	202	0	0	0	0	202

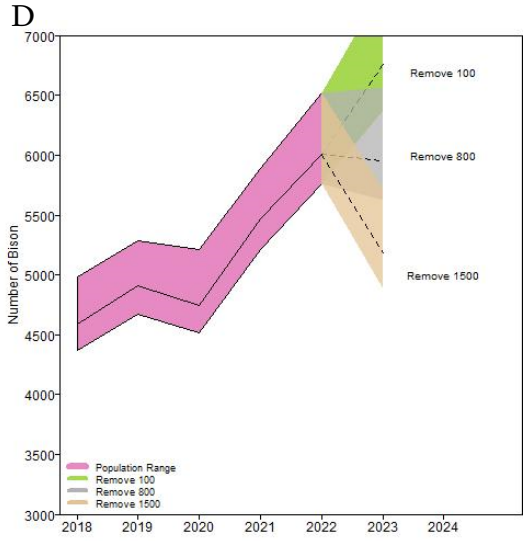
	Number of Bison Counted Previous July-August			Sent to Slaughter/ Management Removals		Hunter Harvest[a]		Sent to Quarantine		
Winter	Northern Herd	Central Herd	Total	North Boundary	West Boundary	North	West	North	West	Total
2003	805	4,230	4,045	231	13	0	0	0	0	244
2004	888	2,923	3,811	267	15	0	0	0	0	282
2005	876	3,339	4,215	1	96	0	0	0	17	114
2006	1,484	3,531	5,015	861	56	32	8	87	0	1044
2007	1,377	2,512	3,889	0	4	47	12	0	0	63
2008	2,070	2,624	4,694	1,288	160	59	107	112	0	1726
2009	1,500	1,469	2,969	0	4	1	0	0	0	5
2010	1,839	1,462	3,301	3	0	4	0	0	0	7
2011	2,245	1,653	3,898	6	0	unk	unk	53	0	59
2012	2,314	1,406	3,720	0	0	15	13	0	0	28
2013	2,669	1,561	4,230	0	0	148	81	0	0	229
2014	3,420	1,504	4,924	258	0	258	69	60	0	645
2015	3,421	1,444	4,865	511	0	201	18	7	0	737
2016	3,626	1,284	4,910	101	0	378	24	49	0	552
2017	4,008	1,451	5,459	753	0	389	97	35	0	1274
2018	3,969	847	4,816	697	0	285	90	99	0	1171
2019	3,337	1,190	4,527	348	0	109	3	0	0	460
2020	3,667	1,162	4,829	445	0	223	61	105	0	834
2021	3,437	1,243	4,680	0	0	153	34	0	0	187
2022	3,830	1,564	5,394	27	0	6	7	10	0	50
2023	4,507	1,432	5,939	94[b]	0	1,130	42	282	0	1,548

[a] Total bison shot by game wardens and hunters from 1973 through 1991, and state and tribal hunters after 2000 outside the park.
unk = unknown
[b] Total includes six bison that died in the capture pen.



Source: Geremia (2022)
Yellow polygons represent the 95% confidence range of the population after spring calving. Colored bars show numbers of bison rounded up and transferred to slaughter, harvested by state and tribal hunters, or entered in quarantine.

Figure 4. Numbers of migrating bison removed during winters from 2000 to 2022 and corresponding population sizes during the summer



Source: Geremia (2022)

Figure 5. Modeling estimates forecasted the removal of about 800 bison during winter 2022-2023 would stabilize to slightly decrease the number of bison in the population

The IBMP agencies made adaptive management adjustments to the IBMP in 2008 to decrease captures and shipments of bison to slaughter by increasing hunting opportunities outside the park. Management action 2.2.b indicates: “adjacent to YNP, emphasize management of bison as wildlife and increase the use of state and treaty hunts to manage bison numbers and demographic rates, limit the risk of brucellosis

transmission to cattle, and protect human safety and property" (Partner Agencies, IBMP 2008). The Citizens Working Group on Yellowstone Bison (2011) recommended making public and tribal hunting in Montana a primary method to decrease bison numbers rather than shipments to slaughter. The Working Group also recommended MFWP and the tribes set collective hunt targets and document hunter harvests. The IBMP agencies agreed to these recommendations, although some tribes objected to hunting limits. The IBMP agencies revised the adaptive management plan in 2011 to include "[o]bjective 1.4: recognize tribal treaty rights for hunting bison." Management action 1.4a is to "[a]llow bison to occupy National Forest System lands and other areas determined suitable within the designated tolerance area (Zone 2) and maximize timing and geographical extents to increase tribal hunt opportunities." Management action 1.4b is to "[c]oordinate management activities that could potentially impact opportunities for tribal members to exercise their treaty rights." The expansion of the management (tolerance) zones in Montana during 2015 (Bullock 2015; IBMP Agencies 2016) was an important step toward eventually reestablishing year-round bison presence to support treaty hunting on lands in these areas, as was the 2022 Land Management Plan supporting bison presence and distribution year-round on the Custer Gallatin National Forest (USDA, USFS 2022).

By 2013, the number of tribal members hunting in the Beattie Gulch area outside the northern park boundary had increased, leading to issues such as "firing lines" that prevented bison from distributing across the larger landscape, wounding of bison that returned to the park, concentrations of gut piles near roads and residences, and human safety issues. The Custer Gallatin National Forest worked with MFWP, hunting tribes, and private property owners to assess safety concerns associated with the hunt and implement management changes to address issues. In 2013, the Custer Gallatin National Forest issued a permanent shooting closure for a portion of Beattie Gulch between the Yellowstone River to the east, Old Yellowstone Trail South Road to the west, YNP to the south, and residential houses to the north. In addition, MFWP led efforts in 2013 to remove gut piles and other parts from bison harvested in Beattie Gulch to reduce the chance of grizzly bears congregating in the area.

In 2015, MFWP began requiring successful bison hunters to place unused parts of carcasses at least 200 yards (183 meters) from roads, trails, and homes, and to spread stomach contents on the ground to reduce attractions to scavengers. To decrease traffic congestion and carcasses along Old Yellowstone Trail South Road, the Custer Gallatin National Forest began allowing successful hunters access to the Beattie Gulch administrative road to retrieve bison. The hunting tribes agreed to a 150-yard (137-meter) buffer extending west from Old Yellowstone Trail South Road in Beattie Gulch where there would be no shooting, carcasses, or gut piles. The Custer Gallatin National Forest issued an official shooting closure for this area in 2016. These actions moved shooting and carcasses farther away from residences in the area but shooting and bison offal remain a concern for property owners.

In 2017, the Nez Perce Tribe, Confederated Salish and Kootenai Tribes of the Flathead Nation, Confederated Tribes of the Umatilla Indian Reservation, and Yakama Nation signed a memorandum of agreement to maintain a regular, predictable, safe, and respectful bison hunt in Beattie Gulch. The tribes agreed to closely coordinate and implement common hunt protocols; safety regulations; and enforcement to ensure the safety of hunters, wardens, and the surrounding community. The agreement limits the number of hunters from these tribes in the area to 25 or fewer at any time, with each hunting party having a designated lead hunter and law enforcement officer from each tribe remaining on-site to coordinate the hunts. The law enforcement officers hold a daily pre-hunt coordination meeting, meet with hunters to ensure safety, and issue citations as necessary. The lead hunter for each party is responsible for ensuring hunters follow the hunt protocols and safety regulations, coordinating with other parties to determine an orderly engagement and hunter harvest of bison, and ensuring a safe approach and shooting direction.

In 2019, a local organization named the Bear Creek Council asked the IBMP agencies to consider recommendations for a safer hunt with fewer impacts to residents in and near Gardiner, Montana. The IBMP agencies hosted a field trip to the hunting areas outside the park, discussed concerns with local citizens, reviewed the current shooting closures and hunting regulations, and agreed to continue work to

address these concerns while respecting tribal rights. In 2020, the Custer Gallatin National Forest proposed permanent firearm discharge closures, including bison hunting, on about 23 acres (9 hectares) for human safety near Beattie Gulch and the McConnell area north of Gardiner, Montana. In 2023, staff from the Custer Gallatin National Forest, State of Montana, and the FWS, and members of the Shoshone-Bannock Tribes, removed gut piles and other parts from bison harvested in Beattie Gulch to reduce the chance of grizzly bears congregating in the area (French 2023).

Ecological Role of Bison—Large groups of bison move freely across wilderness and other undeveloped areas in YNP, producing a mosaic of grassland conditions by grazing and wallowing, depositing and redistributing nutrients across the landscape, and competing with other ungulates for food and other resources (Geremia and Hamilton 2019, 2022; Geremia et al. 2019). Higher numbers of bison increased their function as a meaningful component of the food web, influencing energy and nutrient transfer through the ecosystem (Geremia and Hamilton 2019, 2022). Bison provide prey for predators, create a variety of habitats for plants and animals, provide carcasses for scavengers, and sustain the production of grasses and the health of soils (Geremia et al. 2022). Bison do not have substantial negative effects on other resources such as geothermal features, other ungulates, and vegetation, except for the recovery of aspen, cottonwood, and willow communities in some portions of northern YNP, such as the Lamar Valley (see the "Vegetation" section).

Bison in YNP usually select areas with high-quality foods, such as grasses with higher nitrogen content, and enhance grass quality by re-grazing productive sites and depositing urine and fecal material (Wallen et al. 2015a). Grazing by bison can alter the composition of grasslands by promoting a variety of plants and more variation across the landscape (Knapp et al. 1999). Fire can enhance and maintain these effects in some areas (Fuhlendorf and Engle 2004). Studies of bison in YNP indicate aggregations of large groups manipulate landscapes by intensely and repeatedly grazing some areas to keep plants in early spring-like conditions with a higher portion of nutritious material that improves diets through summer (Geremia et al. 2019). These intensively grazed areas make up a small portion of available summer habitats for bison and elk, while most summer ranges experience low to moderate grazing (Geremia and Hamilton 2019). Thus, a mix of grazing conditions is available across the landscape that supports a wider variety of plants and animals (Fuhlendorf et al. 2012).

The NPS is meeting the ecological objectives described in the "Adaptive Management" section in chapter 2. The NPS has increased the role of bison as ecosystem engineers (Geremia et al. 2019, 2022) and maintained a variety of functional plant groups in grassland communities supported by healthy soils and functioning water, energy, and nutrient cycles. The population remains below the predicted capacity based on forage production of more than 5,000 bison in the northern region of the park and 10,000 bison across the entire park. Grasslands sustained ecosystem function with higher bison numbers. Monitoring between 2015 and 2022 confirmed soil organic matter was stable; unchanged after a year-long grazing exclusion; and within ranges supporting nutrient cycling, water-holding potential, and physical structure. Communities intensively grazed by bison sustained plant production compared to those with a year-long grazing exclusion, although one area of the Lamar Valley showed a gradual decrease in production over time (Geremia and Hamilton 2019, 2022).

Adaptive Capabilities and Genetics—Yellowstone bison exhibit wild behaviors like their ancestors, competing for food and mates, using group defensive strategies to protect their young from predators, and moving widely to explore new areas. They are extremely adaptable and quickly respond to management actions and environmental changes. Virulent diseases that kill substantial numbers of animals currently are not affecting the bison population. In addition, bison can withstand severe winter conditions with poorer forage availability better than smaller ungulates due to their large four-chambered stomach that effectively digests plants high in fiber (Wallen and White 2015).

Yellowstone bison are one of a few populations that meet the viability guidelines recommended by scientists (Freese et al. 2007; Sanderson et al. 2008; Hedrick 2009; Dratch and Gogan 2010; Gross et al.

2010). Geneticist Dr. Philip Hedrick at the University of Arizona indicated "[i]ndividual herds or clusters [of bison] should have an effective population size of 1000 (census number of 2000-3000) to avoid inbreeding depression and maintain genetic variation. If it is not possible to have this primary herd in 1 location, then it could be in 2 or 3 locations with significant genetic exchange between them. Note that this is larger than any of the plains bison herds except for Yellowstone NP [National Park] and any of the wood bison herds except for Wood Buffalo NP and Mackenzie Bison Sanctuary in Canada" (Hedrick 2009:419). Although there is evidence of genetic differences between bison sampled in the central and northern breeding herds (Halbert et al. 2012), monitoring of radio-collared bison suggest Yellowstone bison are a single intermixing population during recent decades, with substantial movements, breeding, and gene flow between bison originating from central and northern Yellowstone (White and Wallen 2012; Wallen and White 2015; Forgacs et al. 2016). Thus, Yellowstone bison meet Dr. Hedrick's criteria for sustaining an effective population size and maintaining genetic variation.

The NPS is meeting the genetics objectives described in the "Adaptive Management" section in chapter 2. The NPS has allowed gene flow between the primary breeding herds, and the larger population size has helped maintain existing genetic diversity without genetic exchange from other bison populations. Bison breed in the northern or central geographic regions of the park with some interchange of animals between breeding areas among years (Wallen and White 2015). The founding maternal lineages of the population occur in both breeding areas. Maintaining more than 1,000 bison in each breeding area helps to protect any existing unique diversity or rare alleles. In addition, the NPS has maintained a balanced sex ratio to support mate competition and allow natural selection to influence population genetics.

Continuing current management should not reduce genetic diversity or change the genetic constitution of the population. In 2011–2012, geneticists identified 10 different mitochondrial deoxyribonucleic acid (DNA) haplotypes in Yellowstone bison and an overall haplotype diversity of 0.78, indicating a healthy, diverse population (Forgacs et al. 2016). Yellowstone bison should retain this diversity for centuries if numbers average at least 3,000 to 3,500 bison and there is intermixing and gene flow between bison from the two primary breeding herds (Pérez-Figueroa et al. 2012). Studies indicate a high portion of adults produce offspring during their lifetimes (Herman et al. 2014). Between two and five groups of related alleles based on neutral markers exist across the park, and allelic diversity, allele frequencies, and inbreeding levels remained similar over more than two decades based on 44 microsatellites across the bison genome (Geremia 2022). Also, bison from both the native and introduced lineages remain in the population in approximately equal distribution based on mitochondrial DNA (Forgacs et al. 2016).

Injuries and Trauma to Bison—Hazing imposes energetic costs on bison that, like all ungulates in the temperate, montane environments, are in poorer body condition during late winter. Hazing also contributes to occasional injuries and temporary behavioral changes, such as aggression like bucking or butting by some bison. Hazing may break up groups and some mother-calf pairs, causing flight behavior such as running, and prevent bison from stopping to feed, drink, or rest when they desire. The frequency and extent of hazing has decreased substantially since 2016 following adaptive management adjustments to provide more tolerance for bison in Montana, including year-round in some areas, and concentrated hunters along the park boundary impeding many bison from moving farther into Montana (Bullock 2015; IBMP Agencies 2016, 2020). In addition, IBMP members have not used helicopters for hazing since 2013.

The Stephens Creek Administration Area Plan addresses issues such as sprawl, visual impacts, exotic vegetation, and infrastructure to support the park's corral operation (USDOI, NPS 2006b). The administrative use of this area was capped at a 43-acre footprint and plans were developed and implemented to manage exotic vegetation, address visual impacts, and construct a barn for the park stock operations, which improved the health and safety of staff and livestock and the efficiency of these operations. Some bison in holding corrals could gore other bison, run into facility walls, or break horns on hard structures. In addition, physically restraining bison for brucellosis testing temporarily elevates their stress levels and makes injuries more likely. There could be stress and injuries to bison during loading or

transport in trailers due to crowding, fighting, or panic. The NPS checks captured bison daily and removes individuals showing signs of disease. The NPS consults with veterinarians and, if necessary, tests and treats affected bison. Thus, the potential impacts of disease outbreaks in capture and quarantine facilities are low.

Some people expressed concern about injuries or mortality from wildfires in the facilities at Stephens Creek because a fire burned through the fenced pasture on the Fort Peck Indian Reservation during 2012, killing 10 bison relocated from YNP after completing quarantine. Should fires become an issue, NPS personnel would minimize potential impacts to bison by fighting fires under existing wildfire management practices, relocating bison if necessary, repairing damage to fences, and providing food to the bison.

Since 2005, APHIS and the NPS have placed more than 600 Yellowstone bison in quarantine. The average time in quarantine was about 700 days (888 days for females and 660 days for males). The maximum time an animal was in quarantine before release was 1,356 days. The latest detections of brucellosis antibodies during testing in quarantine were at day 232 (male bison) and 259 (female bison), with 67 bison (11%) testing positive for brucellosis exposure while in a holding facility (USDA, APHIS 2022; Springer Browne et al. 2023). These bison were killed. All bison completing quarantine in YNP are and would continue to be sent to Fort Peck tribes unless and until other tribal facilities become available.

The effects of removing bison from the Yellowstone population each year for quarantine or through other methods, such as hunting or shipments to research or meat processing facilities, were evaluated in the final EIS and ROD for the IBMP (available at http://ibmp.info/library.php in the document library section) and in the 2018 quarantine EA and FONSI. Impacts to bison from capture, hazing, and disposition of bison at and near the Stevens Creek Administrative Area are detailed starting on page 55 of the 2018 quarantine EA and FONSI as well as in appendix F of the Final EIS and ROD, which provides a summary of bison management techniques that the NPS developed with veterinarians and members of the Humane Society of the United States. Both documents are incorporated by reference. Generally, impacts to bison from capture and hazing include energetic and physiological efforts that have variable costs depending on the duration of effort and stress. Capture and hazing result in occasional injuries and temporary behavioral changes such as aggression by some bison and in some instances death. Injuries and trauma during hazing, capture, handling, and transportation would affect a few localized individuals and would not impact population trends. Other actions in the winter that may continue to impact bison are the presence of over-snow vehicles in the interior of YNP. Details of these impacts are included in the *Final Winter Use Plan and Supplemental EIS* (SEIS). Generally, the presence of over-snow vehicles and related noise can temporarily displace bison and have the potential to increase heart rate and stress levels for bison. The SEIS and associated ROD establish a framework that allows the public to experience winter resources at YNP. This document, and additional details related to adaptive management are found here: https://www.nps.gov/yell/learn/management/winter-use-archive.htm.

Brucellosis Transmission—The proportion of adult females that test positive for brucellosis has remained at about 60% under the IBMP (Hobbs et al. 2015). Brucellosis testing of 347 bison captured in the Stephens Creek Administrative Area during 2019 detected positive exposure (antibodies) in 76% of adult males, 33% of yearling males, 4% of male calves, 65% of adult females, 35% of yearling females, and 11% of female calves (IBMP Agencies 2020). The NPS anticipates the prevalence of brucellosis would remain at approximately these levels under current management.

The NPS is meeting the goal to manage brucellosis transmission risk described in the "Adaptive Management" section in chapter 2. Brucellosis has not been transmitted from bison to cattle despite transporting almost 6,450 bison to slaughter in Montana and Idaho since 2001. Brucellosis has not spread from bison to cattle due, in part, to successful efforts by federal and state agencies to maintain separation. The NPS and other IBMP agencies would continue to contribute to the low risk of brucellosis spreading from bison to cattle by using hazing and other focused management to maintain separation.

Additional Trends and Planned Actions—Montana has increased its tolerance for bison adjacent to YNP to facilitate conservation and hunting, including year-round in some areas (Bullock 2015). The Custer Gallatin National Forest recently decided to allow a self-sustaining population of bison on its land. Public opinion is shifting toward more tolerance for bison in the region and, as a result, managers could sustain more bison and allow them to move more freely on suitable public lands. However, state and local governments and many private landowners do not support more tolerance for bison on public lands farther from the park. In addition, the continuing development of open space on private lands surrounding the park degrades and fragments habitat and movement corridors for wild animals, including bison.

Since 1970, the number of people in the GYA has doubled to about 473,000 and the number of homes has tripled, with about 31% of the area developed or used for agriculture (Hansen and Phillips 2018). Habitat destruction and fragmentation have mostly affected valley bottoms and floodplains with higher plant productivity and more moderate winter conditions. These areas, which are primarily located outside preserves and wilderness areas, are crucial for movements by many animals in this mountainous region. More than 75% of long-distance movement corridors for bison and other animals in the region have been lost or shortened (Berger 2004). Regional plans or zoning districts do not restrict potential uses for most undeveloped private lands. Thus, 30% to 40% of undeveloped private lands could convert to rural residential development (Gude et al. 2006, 2007). These impacts could increase disturbances to bison and losses of habitat.

Ongoing and reasonably foreseeable actions include multiple repairs and replacements to park roads and bridges (see appendix D). Three of six of these projects are a result of the catastrophic flooding in June 2022 that caused severe damage and loss of several sections of road and access. Bison may avoid or be excluded from small amounts of habitat at or near construction areas, slightly altering patterns in their distribution, movements, and behavior during the construction period for these projects. However, this would have negligible effects on the distribution of the ecological role bison play in nutrient cycling given the extensive habitat available in the park. The NPS does not anticipate impacts to bison genetics or adaptive capabilities from the temporary construction of these projects, given the extensive habitat available to bison and continued gene flow between breeding herds. The repair and replacement of park roads and bridges would temporarily reduce forage habitat availability in areas at and adjacent to construction sites, but these effects would be negligible given the ample forage habitat available within the park. There is potential for conflict between construction personnel/operations and bison. If bison travel near construction sites, there may be an occasional need for hazing to keep bison at a safe distance away for both their safety and the safety of personnel working in the area. Usually, the noise and presence of machinery and people keep bison at a distance and hazing is not necessary. There would be no increase in the risk of brucellosis transmission due to these projects. Additionally, none of the construction projects would result in an effect to population numbers beyond what is described under each alternative.

Evidence indicates there has been a substantial increase in the amount of carbon dioxide in the atmosphere over the past two centuries (Friedlingstein et al. 2019). Elevated carbon dioxide can increase plant growth by reducing water loss and facilitating photosynthesis. This increase may have indirectly contributed to more grass production and abundant forage for ungulates in YNP, especially in wetter areas where nonnative, cool-season grasses were planted for hay during the early 1900s and subsequently spread (Frank 2022). However, variations in precipitation and temperature strongly influence soil moisture, which can limit grass production (Knapp and Smith 2001; Frank et al. 2013 and references therein; Geremia and Hamilton 2019, 2022).

Average annual temperatures in the GYA increased about 2.3°F from 1950 to 2018, with a longer snow-free season (Hostetler et al. 2021). In northern YNP, these changes resulted in less snow at lower elevations, earlier snowmelt and plant growth, longer and drier growing seasons, and more frequent drought (Tercek et al. 2015; Thoma et al. 2015; Hansen and Phillips 2018; Yellowstone Center for Resources 2018). The regional warming trend is predicted to continue, with an increase in mean annual temperatures of about another 2°F across all seasons, milder winters with fewer days below freezing,

earlier spring vegetation green-up, and more frequent drought (Hostetler et al. 2021; Intergovernmental Panel on Climate Change 2022). However, there is uncertainty around these predictions and somewhat divergent outcomes are possible.

Continuing trends toward warmer and drier conditions with more frequent drought could worsen the spread of invasive plants, such as winter annuals, and threaten some native bunchgrass communities that provide food for bison in the warmest and driest areas and regions with historical (tilling/plowing) and contemporary (roads) soil disturbance. Fires should continue to be infrequent in grassland and shrubland areas, mostly moving rapidly at low intensity. However, an increased frequency in fires could make grassland communities more vulnerable to the spread of nonnative grasses. These changes could reduce plant production and the food-limited carrying capacity of the park to support bison and other wildlife, leading to larger migrations during some winters, with some animals being unable to obtain adequate fat and protein reserves for pregnancy and survival (Wilmers et al. 2013; Geremia et al. 2014; Middleton et al. 2018). Warmer temperatures have already resulted in lower snowpack and soil moisture at elevations between 5,000 and 7,000 feet (1,520 to 2,135 meters; Thoma et al. 2015; Hostetler et al. 2021), and bison may respond to less snow on their winter ranges by remaining longer at higher elevations in the park and migrating to lower elevations near the boundary later in the winter. Later migrations would reduce the time frame in which bison can be captured or harvested near the park boundary before they are late in pregnancy, which would limit the effectiveness of managing bison abundance and distribution in some winters.

If summers start earlier and are wetter than expected, the prolonged periods of warm and wet soils may increase decomposition rates and liberate soil carbon, nitrogen, and phosphorus. The longer periods of nutrient and water availability would naturally shift plant communities to faster-growing lifeforms, including rhizomatous and shallower rooted forms and nonnative annual plants. Plant production may increase, and more frequent wet years could enhance grazing feedbacks that further promote plant production, especially in higher-elevation wet areas. Grazing-tolerant, cool-season, nonnative cultivars would continue to spread in wet areas, with this spread enhanced by grazing. There could be an increase in body condition of bison and other ungulates by autumn, which would increase reproductive success and survival, resulting in increased population sizes for these species. More bison may remain in the park during winter due to increased forage availability, and earlier spring migrations to higher elevations would be timed with earlier snow melt (Yellowstone Center for Resources 2021).

If summers are hotter and drier than expected, plant production across grasslands and shrub steppe could decrease as a result of reduced soil moisture which, in turn, would limit absorption of water and nutrients by plants and indirectly lower soil decomposition rates. Shorter, ephemeral pulses of nutrient availability in wet grassland areas could promote the growth of drought-tolerant plants, including annuals, winter annuals, and slow-growing graminoids. Thus, shrub and bunchgrass-dominated plant communities in dry upslope areas on the Blacktail Deer Plateau, Little America, and the slopes of the Lamar Valley could convert to infestations of annual plants with hotter and drier conditions. Increased fire frequency and intensity in ungrazed and lightly grazed areas could facilitate these plant community changes. Under this scenario, the numbers of bison could decrease from lower landscape-level plant production, which would contribute to decreased body condition, pregnancy, and survival. More intense droughts would further limit forage availability in late summer and winter. There could be mass migrations of bison and other ungulates from the park during limited forage years, with more ungulates remaining outside the park on agricultural land (Yellowstone Center for Resources 2021).

Impacts of Alternative 1 (No Action)

Under alternative 1, current management would continue. As a result, impacts to bison would be like those described above in the “Affected Environment” section, which contains a description of the current and expected future conditions of current management.

Impacts of Alternative 2

Population and Distribution—This alternative could preserve a higher number of bison than Alternative 1, thereby sustaining a more viable, wide-ranging population and allowing for fluctuations in abundance, movements, and hunt success outside the park influenced by annual differences in weather and other factors. Larger numbers of bison should result in more sustained annual migrations and enable more consistent population regulation using hunter harvests outside the park, captures for the BCTP and, if necessary, shipments to slaughter. The NPS expects a small increase in conflicts between bison, cattle, and people compared to Alternative 1 from the larger number of bison on the landscape.

Bison movements within YNP and north and west of the park in Montana should be like those described for Alternative 1, while sustaining large breeding congregations in the central and northern regions of YNP. Larger numbers could induce some bison movements into new areas of the park and outside park management areas, including adjacent to the western park boundary. This would be beneficial for the ecological role of bison in the park and on the Custer Gallatin National Forest and would provide more hunting opportunities for tribes outside the park.

Some bison would move to lower-elevation ranges in Montana depending on food production and consumption, snowpack, and bison numbers. Slightly larger numbers of bison compared to Alternative 1 may induce some earlier and larger movements, especially during severe winters. Thus, more bison should be available for hunter harvests in Montana. Concentrations of hunters outside the park near the park boundary could continue to impede further bison movements within the management areas in Montana and result in many bison returning to the park. Increased tribal engagement could help address this issue and increase the efficacy of hunter harvests across a broader landscape.

At times, annual removals of 1,000 or more bison may be necessary to limit numbers. As shipments to slaughter decrease, more opportunities would be available for treaty and public hunting in Montana, outside the park, and for captures for the BCTP. Captures for culling bison would increase when desired to limit population growth. On-site culling at the Stephens Creek Administrative Area would have the same effects as described under the "Affected Environment" section and would incorporate the same best management practices described there.

Ecological Role of Bison—Like Alternative 1, large groups of bison would continue to move freely across wilderness and other undeveloped areas in YNP to provide prey for predators, provide carcasses for scavengers, and increase the production of grasses and health of soils. Expansion of bison into new areas could enhance the cycling of energy, nutrients, and water; grassland health; and biodiversity across a larger extent of the park and outside the park. There could be intense grazing in some areas, including wallowing and trampling of vegetation and soil, which could facilitate the spread of nonnative plants.

Adaptive Capabilities and Genetics—Yellowstone bison should retain existing genetic diversity because numbers would average more than 3,500 (Pérez-Figueroa et al. 2012). Hundreds of mature males would compete for breeding opportunities, and a high portion of adults would produce offspring during their lifetimes. A reduction in shipments to slaughter should help maintain genetic diversity by increasing numbers, maintaining balanced sex ratios, and increasing generation time.

Injuries and Trauma to Bison—A reduction in captures for shipments to slaughter and the increased use of low-stress handling techniques should reduce injuries and trauma to bison compared to Alternative 1. The impacts of hazing on bison within YNP would the same as current conditions. There may be a need for more hazing by Montana to prevent mixing with cattle or to protect people and property if more bison are moving into Montana. Like Alternative 1, Montana would continue to haze female and young bison in the north management area in the park by May 1, with impacts being like those described in the "Affected Environment" section.

Brucellosis Transmission—The NPS would not take actions to reduce the occurrence of brucellosis but would continue to monitor the disease and take actions to maintain separation between bison and cattle.

Like Alternative 1, the NPS would continue to support other IBMP agencies in maintaining the low risk of brucellosis spreading from bison to cattle by using hazing and other focused management to maintain separation. The NPS anticipates the prevalence of brucellosis would be similar to levels under Alternative 1 due to similar bison numbers and transmission risk.

Impacts of Alternative 3

Population and Distribution—This alternative would preserve the most bison with the least management. The NPS would treat bison more like other wild ungulates, such as elk populations also infected with brucellosis, with numbers varying in response to competition, habitat conditions, predation, weather, and hunting and other management actions outside YNP. Movements within YNP and north and west into Montana could increase with less management while maintaining large breeding congregations in the central and northern regions of YNP. In addition, bison could access the Eagle and Bear Creek areas, portions of the Absaroka-Beartooth wilderness, Cabin Creek Recreation and Wildlife Management Area, and Monument Mountain Unit of the Lee Metcalf Wilderness year-round (IBMP Agencies 2016). Under the IBMP, bison have not moved to the Cabin Creek and Monument Mountain areas, possibly due to intervening ranches with cattle and vehicle traffic along Highway 191. Such movements may occur with less management, such as hazing.

With higher numbers of bison, movements could occur earlier and be larger in some winters (Geremia et al. 2015a). Thus, more bison would be harvested in Montana. However, an annual removal of more than 1,000 bison within the park likely would be necessary during many winters to reduce bison numbers once they approach 7,000 animals. Captures, confinement, handling, testing, and transport of bison from YNP for the BCTP would occur until bison numbers approached 7,000 animals, at which point, shipments to slaughter would resume. If shipments to slaughter resumed, adverse impacts due to large capture and culling operations would be like those described for Alternatives 1 and 2 in terms of the tools that would be used and their impacts.

Like other migratory wildlife, bison numbers would vary from year to year under this alternative based on competition, habitat conditions, predation, weather, and hunting and other management actions outside the park. Bison age and sex ratios, breeding herd structure, and genetic diversity also would vary in response to these factors.

If cooperators build a new capture or quarantine facility outside the park, more bison could migrate into the management area north of YNP before capture operations take place, which would enhance hunting opportunities outside the park and alleviate current disputes about the effects of culling on hunter harvests. In addition, if bison migrate into the northern management area, some should, over time, learn refuges other than YNP, which should enhance conservation and hunting opportunities.

Ecological Role of Bison—Less management of bison could result in competition, grazing, and predation having a larger influence on bison numbers, genetic diversity, and vegetation communities. Very high numbers of bison could negatively affect vegetation, soils, geothermal features, and other ungulates if tolerance for bison outside the park does not increase and bison numbers exceed the food supply. With current numbers of elk, northern YNP produces enough vegetation to support at least 5,000 bison (Coughenour 2005; Plumb et al. 2009; Geremia and Hamilton 2019). There is a lot of uncertainty around this estimate, however, due to large variations in weather and grass production from year to year. Implementation of this alternative would increase the likelihood that die-offs of bison and other animals occasionally occur because of competition for a limited food supply interacting with severe weather. Carcasses would provide increased food for predators, scavengers, and decomposers.

Adaptive Capabilities and Genetics—Analyses suggest averaging more than 3,500 bison would preserve the existing diversity in Yellowstone bison for centuries with continued gene flow between the primary breeding herds (Pérez-Figueroa et al. 2012). Less management would favor wild behaviors and traits that increase reproduction and survival. Fewer removals of bison should allow the central and northern

breeding herds to increase in size and disperse onto the Custer Gallatin National Forest. Hundreds of mature males would compete for breeding opportunities, and a high portion of adults would produce offspring during their lifetimes. A reduction in shipments to slaughter should help maintain genetic diversity by increasing numbers, maintaining balanced sex ratios, and increasing generation time.

Injuries and Trauma to Bison—There should be fewer injuries and less trauma to bison because initially there would be far fewer captures, confinement, handling, restraint, testing, or transportation of bison except for the BCTP and to protect safety and property. The impacts of hazing on bison within YNP would be the same as current conditions. IBMP members would haze bison to prevent mixing with cattle or protect people and property. In addition, Montana would continue to haze female and young bison in the north management area back into the park around May 1, resulting in the same impacts as current operations.

Brucellosis Transmission— The NPS would not take actions to reduce the occurrence of brucellosis but would continue to monitor the disease and take actions to maintain separation between bison and cattle. A careful and managed increase in tolerance for bison in Montana should not substantially increase the risk of brucellosis spreading from bison to cattle if there is focused management to prevent mixing (Bullock 2015). However, severe winters when there are large numbers of bison could reduce food availability and trigger movements of bison to lower-elevation winter ranges outside the park (Geremia et al. 2015a). The movements of thousands of bison into Montana could require more and intense hazing, possibly using helicopters, to maintain separation between bison and cattle and protect people and property, which would stress the bison and could surpass the capabilities (staffing) and resources of managers to prevent mingling.

A wider distribution of bison in Montana near areas with cattle likely would increase the risk of brucellosis transmission, but the actual risk should still be relatively small compared to the greater risk from more abundant and widespread elk. Despite at least 27 brucellosis outbreaks in cattle traced to wild elk since 1998, the NPS is not aware of subsequent spread from the GYA to cattle herds in other geographic regions. This suggests current surveillance and prevention efforts in livestock are working and should work with bison on a larger landscape as well. Nor have there been economic sanctions or sustained efforts to restrict the numbers and distribution of elk in areas of Montana where brucellosis is prevalent and spreading (National Academies of Sciences, Engineering, and Medicine 2020).

Cumulative Impacts

The impacts of past, present, and reasonably foreseeable planned actions are described above in the "Affected Environment" section. Present and reasonably foreseeable actions include repairs and replacements to park roads and bridges (appendix D). Bison may avoid or be excluded from habitat at or near construction areas during the construction period for these projects. Under alternative 1 current management would continue, and there would be no new direct or indirect impacts beyond those described in the "Affected Environment" section. Overall, under alternative 1, impacts, including those from past, present, and reasonably foreseeable future actions, would result in conditions like those described in the "Affected Environment" section. As discussed above, bison management actions proposed under Alternative 2 could result in a higher number of bison in YNP compared to Alternative 1, which could result in more bison migrating out of the park and, in turn, more hunter harvest outside the park. An increase in bison numbers under Alternative 2 could increase grazing pressure in some areas of the park resulting in less forage available and the movement of bison to different areas and during different times than what is currently occurring. Alternative 2 would decrease the number of bison that are captured for shipment to slaughter, which would reduce stress to bison from capture and transport operations. When combined with the temporary loss of habitat from repairs and replacements to park roads and bridges and impacts of other past and present actions, the overall condition of the bison population is expected to improve to a small degree, compared to what is described in the "Affected Environment" section, with most changes resulting from implementation of Alternative 2.

Under alternative 3, a larger population of bison would be on the landscape, resulting in increased bison movements into new areas of the park and outside the park to other suitable grazing habitats. This would increase harvest by hunting outside the park. The NPS would treat bison more like other wild ungulates in the park and take a more restrained approach to management. Like Alternative 2, fewer captures, confinements, handling, restraint, testing, or transportation of bison would occur, which would reduce stress to individual bison. However, should the bison population approach 7,000 animals, removals of more than 1,000 bison would need to occur during many years to slow population growth, which would increase stress and could change herd compositions, density, and the ecological role bison play on the landscape. When combined with the temporary loss of habitat from repairs and replacements to park roads and bridges and impacts from other past and present actions, the overall condition of the bison population is initially expected to improve compared to Alternative 1 due to increased viability and an expanded ecological role. However, if frequent, large culls are needed to slow population growth when abundance approaches or exceeds 7,000 bison, then there could be adverse demographic and genetic effects (White et al. 2011; Halbert et al. 2012).

Other Wildlife

Affected Environment: Current Status and Expected Future Conditions

Seven ungulates other than bison use YNP and nearby areas seasonally or year-round, including elk, pronghorn, bighorn sheep, mule deer, moose, mountain goats, and white-tailed deer. Large predators in and near YNP include black and grizzly bears, cougars, and wolves. Historical narratives generally describe plentiful and widespread wildlife in the GYA during the 1880s prior to European American colonization (Whittlesey et al. 2018; Whittlesey and Bone 2020). Colonists and settlers drastically reduced numbers of large ungulates, predators, valuable fur-bearing mammals such as beavers, and plume-bearing birds such as trumpeter swans, in the region by the middle to late 1800s. Market hunters overharvested ungulates and poisoned, shot, or trapped predators to protect settlers and reduce livestock depredations. People eradicated wolves and decimated numbers of bears and cougars by the 1930s. Continued settlement with agriculture, logging, and mining degraded and fragmented habitats during the 1900s. The protection of animals and their habitats within YNP and surrounding areas gradually increased numbers of many animals to sustainable levels over the next century, but numbers of some large animals, such as pronghorn and predators, remained low (Whittlesey et al. 2018; Whittlesey and Bone 2020; White et al. 2022a). Other actions in the winter that may continue to impact other wildlife is the presence of over-snow vehicles in YNP. Details of these impacts are included in the *Final Winter Use Plan and Supplemental EIS (SEIS)*. This SEIS and associated ROD establish a framework that allows the public to experience winter resources at YNP. This document, and additional details related to adaptive management are found at https://www.nps.gov/yell/learn/management/winter-use-archive.htm. Generally, the presence of over-snow vehicles and related noise can temporarily displace wildlife and have the potential to increase the heart rate and stress levels of wildlife. Additionally, compacted over-snow vehicle routes may provide low energy winter travel routes for some species, reducing energetic expenditure.

The following summaries focus on ungulates and predators prevalent in the northern Yellowstone area where most bison management activities occur.

Elk—The northern Yellowstone elk population spends winter on more than 580 square miles (1,500 square kilometers) of grasslands, sagebrush steppe, and lodgepole pine forests adjacent to the Yellowstone River and its tributaries. About two-thirds of this winter range is within the northern portion of YNP, while the remainder is in Montana to the north. During the 2000s, predation, in combination with liberal hunter harvests in Montana and occasional severe weather, rapidly decreased numbers of northern Yellowstone elk by about 70% from a high count of more than 19,000 in the mid-1990s (White and Garrott 2005; Eberhardt et al. 2007). MFWP eliminated the late season hunter harvest of fertile, prime-aged female elk to increase adult female survival and reproduction and offset consistently lower

recruitment due to predation (Proffitt et al. 2014). In turn, numbers of elk increased to between 5,000 and 7,500 after a low count of 3,915 in 2013 (MacNulty et al. 2020b). A biologist from MFWP observed 6,651 elk in March 2023 (Northern Yellowstone Cooperative Wildlife Working Group 2022).

Northern Yellowstone elk are partially migratory with most animals moving seasonally between summer and winter ranges and others remaining on the same range year-round. Many elk spend winter in the lower-elevation Gardiner Basin and southern Paradise Valley, with numbers increasing during winters with deep snowpack at higher elevations (White et al. 2010, 2012). Spring migrations generally begin from late April to mid-May but vary among years based on the severity and duration of the previous winter which, in turn, affects snow melt and the growth of new forage (White et al. 2010). Elk initially follow the green-up of vegetation as snow progressively melts at higher elevations, with many elk migrating through the Sepulcher Mountain foothills, across Mount Everts, or along the Yellowstone and Gardner Rivers (White et al. 2010). Many female elk calve in these areas before moving between 6 and 93 miles (10 and 150 kilometers; straight-line distance) to a dozen different summer ranges throughout the park (White et al. 2010).

Autumn migration begins in late September to mid-October following snow accumulation, with two-thirds of movements starting within 72 hours of a major snowstorm on the summer range. For elk migrating to winter ranges inside the park, the autumn migration lasts about 7 days. For elk migrating to winter ranges outside the park, migrations last about 43 days (White et al. 2010). Many females with calves move to lower elevations in and outside the park where snowpack is lower and there are fewer predators and, in the 2000s, a larger portion (80% by 2020) of the smaller elk population began to migrate outside the park. Elk spending winter outside the park have higher survival and recruitment compared to elk spending winter inside the park where predator densities are much higher (White et al. 2012).

Pronghorn—During an aerial survey in April 2023, a biologist counted 341 pronghorn in the Yellowstone population. This count was lower than those made in 2022 (448), 2020 (416), and 2019 (476; no count in 2021), suggesting severe winter conditions in 2022-2023 contributed to a significant decrease in pronghorn numbers (Northern Yellowstone Cooperative Wildlife Working Group 2023). The population is partially migratory with all pronghorn spending winter in the Gardiner Basin and southern Paradise Valley, and about 80% of them migrating in spring to higher elevations in the park (White et al. 2007, 2022a). These movements enable pronghorn to use nutritious food when it is available and release the lower-elevation winter range from intensive use for a portion of the year (Barnowe-Meyer et al. 2017). Migrating pronghorn and their fawns have higher survival rates through summer than non-migrants that remain on the winter range year-round (Barnowe-Meyer et al. 2010, 2011). Non-migratory pronghorn remain in the Gardiner Basin during summer but increase their use of the foothills from Sepulcher Mountain and Electric Peak, as well as the northwestern portion of Mount Everts, including McMinn Bench. Most pronghorn use the same migration strategy and summer range each year (White et al. 2007, 2022a).

Migratory pronghorn gather at the southeastern end of the Gardiner Basin winter range in late March and early April on an open flat north of Mount Everts and on its slopes. As snow recedes, these animals travel southeast about 7 miles (11 kilometers) over Mount Everts, which separates their winter and summer ranges. Pronghorn travel along grassland-sagebrush passageways through gaps in surrounding conifer forests, most of which are less than 328 yards (300 meters) wide with occasional constricted areas of 22 to 66 yards (20 to 60 meters). Once spring migrants reach the southeastern end of Mount Everts, they disperse somewhat to travel to their individual summer ranges. Most pronghorn generally follow the Yellowstone River to summer ranges farther east, including the Blacktail Deer Plateau, slopes of Hellroaring Mountain, Little America and Specimen Ridge, and the Lamar Valley and Soda Butte area. Spring migrations occur over 1 to 2 months during mid-March to mid-May with most pronghorn reaching their summer ranges during April. Females migrate when vegetation green-up begins but before giving birth in late May and June. Autumn migrations occur over 1 to 2 months from mid-September to mid-November with all pronghorn crossing Mount Everts and most reaching the Gardiner Basin winter range

during October. Animals mostly migrate after breeding but before snow covers their summer ranges. Most animals migrate between their seasonal ranges in less than one week by moving 3 to 9 miles (5 to 15 kilometers) each day (White et al. 2007, 2022a).

In the 2000 final EIS and ROD for the IBMP, the NPS acknowledged the potential for moderate to major impacts from bison management operations on pronghorn that spend winter in the Gardiner Basin (USDOI and USDA 2000b). However, those impacts did not occur, and pronghorn numbers increased from about 200 to 500 during 2001 to 2018 (White et al. 2022a).

Bighorn Sheep—About a dozen bands of bighorn sheep in the northern portion of YNP and nearby areas of Montana appear to function as a metapopulation with periodic movements and gene flow among them. These bands are relatively small, slow growing, and low in productivity, with overall numbers remaining relatively stable over the past decade (White et al. 2008, 2021; White and Gunther 2013; Garrott et al. 2021). During a helicopter survey in March 2019, a biologist from MFWP counted 312 bighorn sheep from Point of Rocks in the southern Paradise Valley of Montana to Barronette Peak in the northeastern portion of YNP, which was slightly lower than the 10-year average of 358 sheep (Loveless 2019). The biologist observed a ratio of 14 lambs per 100 ewes, compared to an average of 28 lambs per 100 ewes during 1995 to 2017.

Most of the bighorn sheep in these bands are migratory and spend winter in lower-elevation areas before moving to higher-elevation summer ranges during May through October. However, some sheep remain resident year-round (Houston 1982; Keating 1982; Meagher et al. 1992; Legg 1996; Ostovar 1998). There is a group of bighorn sheep that spends winter on about 1,185 acres (480 hectares) of Mount Everts between the Yellowstone and Gardner Rivers (Keating et al. 1985). Counts have ranged between 36 and 110 bighorn sheep since 1995 (average = 63, with 65 counted in 2019; Loveless 2019). The core of this range is McMinn Bench, on the northwestern corner of Mount Everts, where bighorn sheep congregate for the breeding season (rut) from about mid-November to mid-December and continue to use the area through winter and spring green-up (Houston 1982; Garrott et al. 2021). Some bighorn sheep depart the Mount Everts winter range in late April or May, while others remain in the area through the year, including on McMinn Bench (Keating et al. 1985; Ostovar 1998). Lambing occurs in late May and early June (Lowrey et al. 2021).

Adult females that spend winter on Mount Everts have various lambing and summer ranges. Some ewes remain resident and give birth on McMinn Bench or Mount Everts. Others migrate south across Mount Everts, through the Blacktail Deer Plateau to Tower Junction, and then south along Antelope Creek and the Yellowstone River to Mount Washburn (28 miles; 45 kilometers). Most of these ewes give birth to lambs on cliffs along the Yellowstone River near Tower, Specimen Ridge, or the Grand Canyon of the Yellowstone before moving to Mount Washburn by middle to late June, where they spend the summer (Ostovar 1998). Another group crosses the flood-damaged North Entrance Road and Gardner River on or near the bridge by Eagle Nest rock in late May or early June and travels about 4 to 5 miles (6 to 8 kilometers) west to give birth on the east-facing cliffs of Sepulcher Mountain. Many of these ewes return with their lambs to McMinn Bench and Mount Everts in late June and early July (Ostovar 1998). A third group gives birth about 3 to 5 miles (5 to 8 kilometers) east of McMinn Bench on cliffs in the Black Canyon of the Yellowstone River before returning to spend summer on Mount Everts and nearby Rattlesnake Butte (Ostovar 1998).

Some adult males (rams) that spend winter on Mount Everts remain year-round. Others migrate about 18 miles (30 kilometers) southwest to the Gallatin Mountain Range during summer. These migrants travel south across Mount Everts, cross the Grand Loop Road near Bunsen Peak, and move west toward Quadrant Mountain, Little Quadrant Mountain, and Bannock Peak (Ostovar 1998). Other rams remain on Mount Everts during summer but then move northwest to the Electric Peak and Cinnabar areas (7 to 8 miles; 11 to 13 kilometers) or a few miles east to Deckard Flats for the autumn rut (breeding season) before returning to Mount Everts for the winter.

Mule Deer—During a helicopter survey in April 2019, an MFWP biologist counted 1,480 mule deer (287 fawns, 1,111 adults, 82 unclassified) in the Gardiner Basin area of Montana, compared to a range of 1,299 to 2,343 (average = 1,901) since 1995. A ratio of 26 fawns per 100 adults was observed, which compares to an average spring recruitment estimate of 40 fawns per 100 adults (range = 18 to 56) since 1995. Mule deer numbers have been relatively stable for the past three decades. This population is partially migratory, with about one-quarter remaining on the winter range year-round in the Gardiner Basin (including on the Sepulcher Mountain foothills and slopes of Mount Everts) and three-quarters migrating 6 to 65 miles (10 to 104 kilometers) to summer ranges in and near YNP. Migrants travel to summer ranges during late April to mid-June over a period of 2 to 40 days and tend to use the same winter and summer ranges each year (Gogan et al. 2019).

Some migratory deer that spend winter east of the Yellowstone River in the Gardiner Basin move east along the Yellowstone River to spend summer in the Hellroaring and Buffalo Creek drainages and the Slough Creek and Flint Creek drainages of the Lamar River. Other deer move south to the Firehole River drainage and Heart and Shoshone Lake areas (Gogan et al. 2019). Migratory deer that spend winter on the west side of the Yellowstone River primarily move south to spend summer in and near the Gibbon and Madison River drainages. Some migrants move through the Sepulcher Mountain foothills or over Mount Everts. Migrant deer begin traveling back to the winter range in the Gardiner Basin during mid-October (Gogan et al. 2019).

Bears—From the late 1950s through the 1970s, most black bear and grizzly bear mortality inside YNP was due to human causes, primarily management removals of bears involved in human-bear conflicts (White et al. 2017). Managers in YNP and surrounding national forests and states implemented changes to limit access to human foods by food storage orders, limit motorized access, retire livestock allotments, and prevent the loss of secure habitat. Over time, these actions increased the annual survival and abundance of bears in YNP (White et al. 2017). Most bear mortality in YNP from 1980 to present has been from natural causes, primarily old age and intra- and inter-specific strife (White et al. 2017; van Manen et al. 2021; Gunther 2022). Today, there are about 965 grizzly bears (range = 800 to 1,100) occupying more than 27,200 square miles (70,500 square kilometers) in the GYA, with enough reproductive females to sustain a viable population over the long term (van Manen et al. 2021, Interagency Grizzly Bear Study Team, unpublished data, 2023). In addition, there are between 150 and 275 black bears in northern YNP (Bowersock 2020). Black and grizzly bears rarely kill adult ungulates, but they are effective hunters of newborn calves and fawns, especially elk. They intensely search areas near female ungulates during the birthing season to locate calves and fawns in hiding. More information on grizzly bears is provided in the "Threatened Animals and Plants" section.

Cougars—Colonists and settlers decimated the number of cougars in and near the northern portion of YNP by the 1930s, but cougars reestablished a viable population by the mid-1980s and then continued to increase to as many as 50 animals during the 2000s (Murphy 1998; Ruth et al. 2019; Anton 2020). At least 8 adult cougars (3 males, 5 females) had a core range overlapping the Black Canyon of the Yellowstone River and Mount Everts during the winter of 2020–2021 (Stahler et al. 2021). Cougars are solitary hunters that stalk and ambush their prey. They are opportunistic and often select smaller prey to minimize the risk of injury during attacks (Ruth et al. 2019). About 55% of cougar diets in and near YNP consist of elk, primarily calves (65%) and adult females (34%). Cougars kill more elk calves as summer progresses and continue through winter as calves move around the landscape with groups of adult females (Stahler et al. 2020). After wolf restoration, cougars began killing more adult female elk, probably due to fewer available calves. Another 35% of their diet consists of mule deer, with the portion of this prey source increasing from 20% to 35% in recent years (Stahler et al. 2020).

Gray Wolves—Wolves were reintroduced to YNP between 1995 and 1997, and numbers increased to 174 wolves in as many as 16 packs over the next decade but have since stabilized between 80 and 123 wolves in 7 to 10 packs (Smith et al. 2020). There were 108 wolves in 10 packs in the park during December 2022, including 7 breeding pairs. Several packs used portions of the bison management area in and

outside northern YNP during 2022 and 2023, especially during winter and spring when many hundreds of ungulates spent winter in the Gardiner Basin and surrounding foothills. Wolves typically hunt in packs during winter and travel long distances through relatively flat grasslands close to rivers and streams. This strategy facilitates the detection of elk, their primary prey (80% to 95%), foraging in grasslands or near habitat transitions, such edges between grasslands and forests, and allows wolves to scan groups for individual elk susceptible to attack (MacNulty et al. 2007). About 7% to 12% of wolf kills during spring and summer are deer that migrate into the park. Wolves kill more bison (primarily calves) during spring (10%) but scavenge on bison carcasses frequently through the winter (Metz et al. 2020a,b; Stahler et al. 2020). Wolves also opportunistically kill some bighorn sheep and pronghorn (less than 1% of kills).

Disturbances—Many wild animals in the Gardiner and Hebgen Basins are used to the day-to-day activities of people and often feed, move, and rest near houses, roads, agricultural fields, and recreational areas. Animals adjust their behaviors and movements to recurring activities, though some unexpected disturbances may cause short-term movements. Some ungulates, such as deer, elk, and pronghorn, may be disturbed during bison hazing operations within or outside the park and move short distances away with minor energetic costs. These impacts are mitigated by avoiding, temporarily halting, or ceasing hazing if other ungulates are affected. There are no disturbances to other animals from the processing of bison because these activities occur within the capture facility area and pastures.

Bison Grazing Effects—With 3,500 to 5,000 bison and less than 10,000 elk present in YNP over the past decade, grazing intensities on grasslands in northern YNP during summer have varied across the landscape, with heavily grazed areas and nearly ungrazed areas, producing a variety of vegetation conditions (Geremia and Hamilton 2019, 2022). This increases the mosaic of habitats for other wild animals because some need various habitats, while others favor disturbed or undisturbed habitats (Fuhlendorf et al. 2012).

During the 2000s, numbers of elk decreased by more than 70% in YNP following the recovery of large predators such as wolves, bears, and cougars. A much greater portion (80%) of the smaller northern Yellowstone elk population now spends winter on lower-elevation areas with less snow outside the park (White et al. 2012). At the same time, bison numbers in northern YNP increased from about 600 in 2000 and 900 in 2005 to 4,500 in 2022 due to high survival and calving combined with movements of bison from the central to the northern part of the park. Bison began using grasslands in this area quite differently than elk during summer. They moved upslope as new vegetation growth occurred along the Yellowstone River corridor, but once they reached the Lamar Valley and surrounding areas, thousands stopped and repeatedly grazed portions of the valley and nearby areas through summer rather than continuing to higher or more distant summer ranges like elk (Geremia et al. 2019, 2022). Bison began using this winter range area for elk as a summer grazing area. In turn, far fewer elk now use this area during winter.

From 2012 through 2022, the NPS monitored the effects of bison grazing on grasslands after bison numbers in northern YNP increased from 2000 to 2022. Grasses in the Lamar Valley maintained net aboveground production under grazing intensities of 60 to 70% (Geremia 2022). Control plots that excluded grazing showed that current levels of grazing stabilized or enhanced net aboveground production of plants, especially when grazing intensities varied from 10 to 30%. Soil organic matter averaged 13% across sites, and ratios of carbon and nitrogen supported microbes that converted soil nutrients into plant-available forms (Geremia 2022). Intense grazing did not change soil health, which remained resilient due to increased nutrient turnover (feces, urine) that stabilized organic matter and preserved moisture. Intensively grazed areas made up a small portion (10%) of available grasslands in northern YNP. Most summer ranges and all winter ranges experienced low to moderate grazing (Geremia and Hamilton 2019, 2022).

Barriers to Movements—Wild animals in YNP and nearby areas of Montana are familiar with bison management operations and existing fencing patterns and routinely move around them. The facilities and operations do not hinder the movements of wildlife.

Food Web—Some bison culled from the population by the NPS might otherwise have died and become carrion for predators, scavengers, and decomposers. However, higher bison numbers during the IBMP period likely resulted in a greater potential for predation or scavenging. Continuing current management is expected to sustain the number of bison for predators, scavengers, and decomposers. Some wildlife may continue to consume brucellosis bacteria while scavenging bison carcasses, but this should not result in sickness, and they cannot spread brucellosis (Cheville et al. 1998; National Academies of Sciences, Engineering, and Medicine 2020).

Brucellosis Transmission—Cattle brought into the northern Yellowstone area infected wild bison and elk with the nonnative disease brucellosis by 1917 (Meagher and Meyer 1994). The prevalence of brucellosis in about 1,700 elk captured or shot in the northern Yellowstone area during 1961–1962 was less than 1% (Greer 1962). The northern Yellowstone elk population expanded its winter range north of the park and into the Paradise Valley of Montana during the late 1970s in response to increasing abundance and other factors (Lemke et al. 1998). The number of elk using this area increased after extensive fires in the park during the summer of 1988 and varied thereafter around 3,000 elk (Coughenour and Singer 1996; Singer et al. 1997; Taper and Gogan 2002). This range expansion resulted in the mingling of elk and cattle in the Paradise Valley during the potential abortion and birth period for elk from February through mid-June. Thus, the timing of spring migration and duration that elk remain on winter range north of the park affect the risk of brucellosis transmission to cattle. Risk is higher following winters with increased snowpack when elk initiate spring migrations later and spend the brucellosis transmission period in areas where mingling with cattle occurs (Cross et al. 2010; White et al. 2010, 2012).

From 1985 to 2009, the prevalence of brucellosis in about 2,900 elk harvested during the Gardiner late season hunt north of the park was 2% to 4% (Cheville et al. 1998; Lemke 2009). Brucellosis prevalence in 300 adult female elk captured inside YNP for radio-collaring from 2000 to 2020 was 8% (Barber-Meyer et al. 2007, 2008). However, the prevalence of brucellosis in elk harvested north of the park in hunting district 313 from 2010 to 2020 was about 13% to 15% and 20% to 30% farther north in the southern Paradise Valley (hunting district 317; MFWP 2018, 2020). Elk have become more concentrated in the Paradise Valley of Montana during the last several decades, in part, because of access to irrigated alfalfa fields. This nutritious, year-round forage source decreases the tendency for elk to migrate away from these areas during late winter and spring (Barker et al. 2019a,b). Many large groups, totaling thousands of elk, are spending more time in this area and mixing with cattle, which presents significant challenges for landowners and MFWP, including competition with livestock for forage and hay, damage to fences, and brucellosis transmission (Cross et al. 2010; Rayl et al. 2019; Tilt 2020).

Brucellosis is spreading in elk throughout the GYA, and genetic data indicate elk have infected cattle herds with brucellosis at least 27 times since 1998. Elk exposed to brucellosis now inhabit an area encompassing about 17 million acres, and the current spread is not linked to Yellowstone bison or elk, but rather other lineages in elk (Kamath et al. 2016). The eradication or suppression of brucellosis would require eliminating the disease in elk by attempting to capture, test, and vaccinate or slaughter many elk across the entire GYA, which most people consider unacceptable and impossible at this time (National Academies of Sciences, Engineering, and Medicine 2020). There is one lineage of *Brucella* (brucellosis) bacteria in bison and northern Yellowstone elk that range from YNP to the southern Paradise Valley. This lineage has not spread west of the park even though bison and elk mix in this area (Kamath et al. 2016). Continuing current management would not increase the risk of brucellosis spreading from bison to elk.

Hunting Harvests—Estimates of harvests by public hunters are provided by Montana Fish, Wildlife and Parks at https://myfwp.mt.gov/fwpPub/harvestReports. Hunting permits from some tribes authorize the harvest of other ungulates than bison outside YNP. Thus, tribal hunters sometimes harvest elk, bighorn

sheep, deer, or pronghorn outside YNP. The tribes do not consistently report numbers, ages, and sexes of ungulates harvested under these permits to federal and state biologists, but observations indicate tribal hunters took several dozen elk in most years; perhaps approaching or exceeding 100 during the winters of 2021 and 2023. These hunter harvests probably have minimal effects on elk population trends, but the NPS cannot completely assess them without better information.

Additional Trends and Planned Actions—As described in the previous section ("Yellowstone Bison"), the area around YNP has experienced rapid increases in numbers of people and land development that continue to damage habitat and movement corridors. These impacts could increase disturbances to wild animals and losses of habitat. Present and reasonably foreseeable actions include multiple repairs and replacements to park roads and bridges (see appendix D). Three of six of these repair and replacement projects are a result of the catastrophic flooding in June 2022 that caused severe damage and loss of several sections of road and access. Some wildlife may avoid or be excluded from habitat at or near construction areas, which could alter patterns in wildlife distribution, movement, and behavior during the construction period for these projects. The repair and replacement of park roads and bridges would temporarily reduce ungulate forage habitat availability in areas at and adjacent to construction sites. However, given the ample forage habitat available within the park, these temporary changes, lasting only while construction occurs and for a short duration after as revegetation occurs, are unlikely to impact forage habitat for these ungulate populations in a meaningful way. These projects will not change brucellosis prevalence beyond what is described under each alternative because they would not affect the risk of transmission. While replacement or repair of park roads and bridges could temporarily alter patterns in distribution, movement, and behavior, the NPS does not anticipate impacts to wildlife populations overall because none of the construction projects would result in an effect on population numbers beyond what is described under each alternative.

Climate change would affect forage production in the same ways described under the "Additional Trends and Planned Actions" section under "Yellowstone Bison." The regional warming trend is predicted to continue, with an increase in average annual temperatures of another 2°F across all seasons, milder winters with fewer days below freezing, and earlier spring vegetation green-up (Hostetler et al. 2021). With less snow and an earlier snow melt, the growing season could start about two weeks earlier during some summers, but there would be more hotter days and more frequent droughts (Gross and Runyon 2020; Yellowstone Center for Resources 2021). These changes will modify the timing and production of forage, as well as ungulate body condition, movement patterns, and demographic rates in complex and contrasting ways (Wilmers et al. 2013; Lachish et al. 2020). For example, shorter winters could increase the length of the growing season while hotter, drier summers could result in the senescence of vegetation earlier in the summer (Lachish et al. 2020). These conflicting changes could have substantial, but divergent, impacts on population trends by increasing and decreasing nutrition and body condition (Wilmers and Getz 2005; Lachish et al. 2020). Research on elk populations in the northwestern United States has already detected a decrease in recruitment from 1989 to 2010 due, in part, to changes in precipitation patterns and forage conditions (Lukacs et al. 2018).

Prior to wolf restoration, carcasses primarily were available in late winter when elk died from starvation (Stahler et al. 2020). Black and grizzly bears emerging from their dens after hibernating through the winter fed on these carcasses. However, wolves changed this pattern by killing elk throughout the year (Wilmers and Getz 2005; Metz et al. 2012, 2020b; Stahler et al. 2020). Wolves kill more adult elk in winter when bears are hibernating and fewer adult elk during summer, so fewer carcasses are available for scavenging by bears at that time (Wilmers and Getz 2005; Metz et al. 2012, 2020b; Stahler et al. 2020). As elk numbers decreased and bison numbers increased in northern Yellowstone, wolves began to scavenge on carcasses of bison that died during calving, from injuries sustained during the rut, starvation, or other causes (Tallian et al. 2017; MacNulty et al. 2020b; Metz et al. 2020a,b). Scavenging increased as bison abundance increased, and bison carcasses now make up about 25% of the meat that wolves eat

during winter (MacNulty et al. 2020b; Metz et al. 2020b). This scavenging reduced predation on elk from about 18 to 12 elk per wolf each year based on kill rates during winter (Metz et al. 2020a).

Following wolf reintroduction, predation studies between 1998 and 2006 found cougars increasingly used elk (74%) and relied less on deer (14%) and other prey (12%; Ruth et al. 2019; Stahler et al. 2020). Cougars sometimes lose kills to bears and wolves and need to kill more frequently, especially when they are raising kittens (Ruth et al. 2019; Stahler et al. 2020). As a result, their kill rates of elk increased after wolf restoration and are about twice the per capita kill rate of wolves (Ruth et al. 2019; Anton 2020; Stahler et al. 2020). From 2016 to 2022, cougar diets have shifted to less use of elk (49%) than prior decades, with increasing use of deer (35%) and about 16% other prey (Stahler et al. 2021). These patterns of prey selection through time are likely most influenced by changes in elk abundance and carnivore competition in northern Yellowstone (Stahler et al. 2020).

Impacts of Alternative 1 (No Action)

Under alternative 1, current management would continue. As a result, impacts on other wildlife would be like those described above in the "Affected Environment" section, which contains a description of the current and expected future conditions of other wildlife.

Impacts of Alternative 2

Disturbances—Like Alternative 1, animals would adjust their behaviors and movements to recurring activities, though some unexpected disturbances, such as hazing of bison, may cause short-term movements with minor energetic expenditures that have no impact on survival and reproduction.

Bison Grazing Effects—Grazing intensities and effects on grasslands in central and northern YNP during summer would be similar to those described for Alternative 1 due to similar numbers and distribution of bison. However, more bison could be on the landscape, which could increase grazing pressure in some areas. More bison likely would graze portions of the Lamar and Hayden Valleys during summer, as well as the Gardiner and Hebgen Basins during winter and spring. The grazed areas would make up a small portion of available habitat for bison and other ungulates in YNP and on the Custer Gallatin National Forest. Most summer ranges and all winter ranges generally experience low to moderate grazing during the summer growing season (Geremia and Hamilton 2019, 2022). Thus, it is unlikely grazing by bison would substantially affect the seasonal movement patterns or demographics of other ungulates such as bighorn sheep, deer, elk, and pronghorn. Numbers of ungulates in YNP have remained high for numerous decades, with many thousands of animals attaining adequate forage to sustain body condition, reproduction, and survival (Geremia and Hamilton 2019, 2022).

Barriers to Movements—Like Alternative 1, wild animals in YNP and nearby areas of Montana would become familiar with bison management operations and existing fencing patterns as they routinely move around them. For this reason, Alternative 2 is unlikely to impact any movement for other wildlife species.

Food Web—Shipping fewer bison to slaughter would result in higher bison numbers on the landscape than under Alternative 1, resulting in more carcasses for consumption by predators, scavengers, and decomposers. This should reduce predation on elk and other ungulates and result in higher survival and reproductive success of the consumers.

Brucellosis Transmission—The risk of brucellosis spreading from bison to elk would be similar to Alternative 1 but could increase slightly because the population range and distribution of bison could increase under this alternative.

Hunter Harvests—Estimates of harvests by public hunters are provided by Montana Fish, Wildlife and Parks at https://myfwp.mt.gov/fwpPub/harvestReports. The numbers of deer, elk, and pronghorn harvested by tribal hunters outside the park may increase somewhat with more tribes hunting bison in the area and hunters dispersed over a larger area, but these harvests would have little to no effect on population trends of other wildlife if small numbers of animals are harvested. The NPS in collaboration

with the Northern Yellowstone Cooperative Wildlife Working Group would continue to monitor population trends of these species.

Impacts of Alternative 3

Disturbances—Because the NPS may not manage bison as intensely under Alternative 3 as under Alternative 1, impacts from hazing beyond what is currently described under the "Affected Environment" section may be immeasurable initially. However, in years where bison numbers need to be reduced, hazing may be more prevalent. Like Alternative 1, animals would adjust their behaviors and movements to recurring activities, though some unexpected disturbances, such as hazing of bison, may cause short-term movements with minor energetic expenditures that have no impact on survival and reproduction.

Bison Grazing Effects—More bison likely would intensely graze portions of the Lamar and Hayden Valleys during summer, as well as the Gardiner and Hebgen Basins during winter and spring. Intensively grazed areas likely would still make up a small portion of available summer habitats for bison and other ungulates in YNP and on the Custer Gallatin National Forest. Most summer ranges and all winter ranges generally experience low to moderate grazing during the summer growing season (Geremia and Hamilton 2009, 2022). Thus, it is unlikely grazing by bison would substantially affect the seasonal movement patterns or demographics of other ungulates such as bighorn sheep, deer, elk, and pronghorn. Numbers of ungulates in YNP have remained high for numerous decades, with many thousands of animals attaining adequate forage to sustain body condition, reproduction, and survival (Geremia and Hamilton 2019, 2022).

Barriers to Movements—Like Alternative 1, wild animals in YNP and nearby areas of Montana would become familiar with bison management operations and existing fencing patterns as they routinely move around them.

Food Web—With higher numbers of bison than Alternative 1, more bison carcasses should be distributed over a larger area, providing more food to predators, scavengers, and decomposers. This should reduce predation on elk and other ungulates. These effects are still anticipated even if it is necessary to reinitiate shipments to slaughter when bison numbers approach food-limited carrying capacity.

Brucellosis Transmission— The risk of brucellosis spreading from bison to elk would likely be similar to Alternative 1 but could increase somewhat because the population range and distribution of bison could increase under this alternative.

Hunter Harvests—Estimates of harvests by public hunters are provided by Montana Fish, Wildlife and Parks at https://myfwp.mt.gov/fwpPub/harvestReports. The NPS does not anticipate the numbers, ages, and sex of elk and other ungulates harvested by tribal hunters would increase substantially compared to Alternative 1 due to more bison and the distribution of bison hunting opportunities over a larger area of Montana. The NPS in collaboration with the Northern Yellowstone Cooperative Wildlife Working Group would continue to monitor population trends of these species.

Cumulative Impacts

The impacts of past, present, and reasonably foreseeable planned actions are included above in the "Affected Environment" section. Present and reasonably foreseeable actions include repairs and replacements to park roads and bridges (appendix D). Wildlife may avoid or be excluded from habitat at or near construction areas during the construction period for these projects. Under Alternative 1, current management would continue, and there would be no new direct or indirect impacts beyond those described in the "Affected Environment" section. Overall, under Alternative 1, impacts, including those from past, present, and reasonably foreseeable future actions would result in conditions that are the same or similar to those described in the "Affected Environment" section.

As discussed above, bison management actions proposed under Alternative 2 could result in a slightly higher number of bison in YNP compared to Alternative 1, which could increase grazing pressure in some

areas of the park and result in less forage available for other ungulates and perhaps alter their behavior and movements somewhat. However, these effects should not adversely impact their population numbers. An increase in bison numbers under Alternative 2 would benefit predators, scavengers, and decomposers that consume bison by increasing bison carcasses on the landscape and providing more food than what is occurring now. This should reduce predation on elk and other ungulates. When combined with the temporary loss of habitat from repairs and replacements to park roads and bridges and impacts of other past and present actions, the overall conditions of wildlife populations are expected to remain the same or improve to a small degree compared to what is described in the "Affected Environment" section, with most beneficial impacts resulting from implementation of Alternative 2.

Under Alternative 3, a larger population of bison would be on the landscape, which would increase grazing pressure in some areas of the park and result in less forage available for other ungulates. This could alter their behavior and movements somewhat but is not expected to impact their overall populations numbers. A larger bison population under Alternative 3 would benefit predators, scavengers, and decomposers that consume bison by increasing bison carcasses on the landscape. This should reduce predation on elk and other ungulates. When combined with the temporary loss of habitat from repairs and replacements to park roads and bridges and impacts of other past and present actions, the overall conditions of the wildlife populations are expected to remain the same or improve compared to what is described in the "Affected Environment" section, with most beneficial impacts resulting from implementation of Alternative 3.

Threatened Animals and Plants

Affected Environment: Current Status and Expected Future Conditions

This section addresses the potential impacts of bison management on the threatened Canada lynx, grizzly bear, western glacier stonefly, and whitebark pine; critical habitat for lynx; proposed species listing for wolverine; and candidate species listing, including the monarch butterfly. The Endangered Species Act (16 USC 1531 et seq.) directs federal agencies to conserve threatened and endangered plants and animals and their habitats. Widespread human development has continued in the GYA in recent times, with accelerated climate warming and exotic species invasions (Cole and Yung 2010). Some areas around YNP have experienced rapid increases in numbers of people and rural residential development that continue to damage habitat and movement corridors. These changes likely increase disturbances to grizzly bears, lynx, and wolverines. The suppression of wildland fires over many decades in some areas has resulted in conditions where more frequent, bigger, and hotter wildfires could be unfavorable for whitebark pine survival and could reduce cone production and the likelihood of natural seedling establishment (Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee 2011; Greater Yellowstone Whitebark Pine Monitoring Working Group 2020). However, some studies suggest fire suppression has had minor impacts on the dynamics of most subalpine forests in the Yellowstone area (Meyer and Pierce 2003; Whitlock et al. 2003). Widespread loss of whitebark pine in the GYA occurred during the 2000s due to extensive mortality from native mountain pine beetles (Logan et al. 2010). The rapid expansion of pine beetles into high-elevation areas occupied by whitebark pine during the past two decades is unprecedented and probably a result of warmer temperatures and altered precipitation patterns from a warming climate (Logan et al. 2010; Shanahan et al. 2016, 2017).

In general, effects to grizzly bears, Canada lynx, and wolverines are insignificant from brief disturbances during bison management operations, including the processing of bison. Bison capture in the Stephens Creek Administrative Area typically occurs during January to mid-March. Few, if any, grizzly bears are in this area during winter. In addition, fewer hazing events of bison back to YNP have occurred in recent years because of the increased tolerance for bison in larger areas north and west of the park in Montana. The NPS does not expect lynx and wolverines to occupy the relatively low-elevation, high-desert, grassland area with sparse vegetation around the capture facility or quarantine pastures due to their preference for thick forest. In the event a grizzly bear, lynx, or wolverine encountered bison operations,

they would likely run a short distance away or move away from the area. Some bison removed from the population might otherwise have died and become carrion for grizzly bears, lynx and wolverines. However, higher numbers of bison have resulted in a higher potential for predation or scavenging across the landscape and continuing current management would not decrease the number of carcasses relative to the last 10 years. Grizzly bears, lynx, and wolverines may continue to consume brucellosis bacteria while scavenging bison carcasses, but this should not result in sickness, and they cannot spread brucellosis (National Academies of Sciences, Engineering, and Medicine 2020).

Other actions in the winter that may continue to impact threatened animals is the presence of over-snow vehicles in YNP. Details of these impacts are included in the *Final Winter Use Plan and Supplemental EIS (SEIS)*. This SEIS and associated ROD establish a framework that allows the public to experience winter resources at YNP. This document, and additional details related to adaptive management are found at https://www.nps.gov/yell/learn/management/winter-use-archive.htm. Impacts to Canada lynx and wolverines could include temporary disturbances to individual animals in areas where over-snow vehicles are present. These impacts would be rare, ephemeral, and have little metabolic cost. The SEIS and ROD did not identify any meaningful impacts to grizzly bears because impacts occur during the winter when bears are hibernating.

Grizzly Bear—The FWS designated the grizzly bear as threatened in the lower 48 states during 1975 due to low numbers (230 to 315) and low survival of adult females (Knight and Eberhardt 1985). Managers in YNP and surrounding national forests and states implemented changes to limit access to human foods by implementing food storage orders, limiting motorized access, retiring livestock allotments, and preventing the loss of secure habitat (White et al. 2017). Annual survival of adult females increased and has remained at 95% for three decades. In turn, substantial population growth occurred through the late 1990s, with range expansion continuing to present day. Lower survival of cubs and yearlings and a modest decrease in reproduction slowed population growth in the 2000s, and the population has been relatively constant thereafter, including the number of bears in YNP. The recent change in population trend apparently was associated with high bear densities in YNP and nearby portions of the ecosystem, rather than a decrease in food resources (van Manen et al. 2021). Most grizzly mortality in YNP from 1980 to present has been from natural causes, primarily old age and intra- and inter-specific strife (Gunther 2022).

Today, there are about 965 bears (range = 800 to 1,100) occupying more than 27,200 square miles (70,500 square kilometers) in the GYA, with enough reproductive females to sustain a viable population over the long term (van Manen et al. 2021, Interagency Grizzly Bear Study Team, unpublished data, 2023). With more grizzly bears occupying areas outside protected parks and wilderness areas where human influence and the potential for management conflicts are greater, the primary causes of mortality have shifted to management removals for livestock depredations, self-defense kills, hunting-related incidents, vehicle strikes, and poaching in range expansion areas (White et al. 2017, van Manen et al. 2021).

Whitebark pines occur on about 14% of the area occupied by grizzly bears in the GYA (Interagency Grizzly Bear Study Team 2013). Whitebark pine seeds are an important food for many bears in the GYA from mid-August through September, making up 50% to 80% of scat volume when cone production is good (Mattson et al. 1991). When cone production is poor and seeds are scarce, bears tend to forage in lower elevations, which increases the risk of conflict with humans and lowers the survival of bears (Schwartz et al. 2010, Costello et al. 2014). Annual cone production along 21 transects in the GYA monitored by the Interagency Grizzly Bear Study Team has averaged 17 cones per tree since 1980 (range = 1 to 50). Seventy-six percent of 190 monitored trees along the transects died between 2002 and 2009, with no mortality thereafter (Haroldson 2021). However, this mortality did not affect the home range sizes or demographic rates (reproduction, survival) of grizzly bears (Bjornlie et al. 2014; van Manen et al. 2016). Bears reduced their use of whitebark pine stands without increasing their movements, suggesting they obtained alternative foods in the area (Costello et al. 2014). Bears had similar levels of body fat

(nutritional condition) between years of good and poor whitebark pine production (Interagency Grizzly Bear Study Team 2013). Additional information on the status, biology, and threats to Yellowstone-area grizzly bears can be found in White et al. (2017).

Canada Lynx—The FWS designated the Canada lynx in the continental United States as threatened under the Endangered Species Act in 2000 due to inadequate regulatory protections for lynx or their habitats. The FWS designated critical habitat for lynx in 2009 that included YNP and surrounding lands in southwestern Montana and northwestern Wyoming. Lynx in the continental United States are part of a larger population whose core is in the northern forests of Canada. Historical information describes lynx as uncommon in YNP during 1880 to 1980. The NPS detected a few lynx near Yellowstone Lake and on the Central Plateau in YNP from 2001 to 2004 (Murphy et al. 2006). A photographer observed another lynx near the Indian Creek Campground in the northwestern portion of YNP during 2010, and reliable detections of lynx continue to occur in surrounding national forests. Lynx successfully reproduce in the region, though production is limited. In accordance with the Canada Lynx Conservation and Assessment Strategy, personnel from YNP mapped suitable lynx habitat, typically mature forests dominated by subalpine fir, Engelmann spruce, and lodgepole pine, and lynx habitat currently in an unsuitable condition, such as forests 1 to 20 years after disturbance. The NPS identified 20 Lynx Analysis Units in the northern and eastern portions of YNP. The NPS uses the Canada Lynx Conservation and Assessment Strategy to gauge the effects of projects on lynx (Ruediger et al. 2000). Few, if any, bison management activities occur in lynx habitat or analysis units, and bison management does not modify critical habitat for lynx. Additional information on the status, biology, and threats to lynx is available in the *Federal Register* (74:66937-66950; USDOI, FWS 2009a,b).

Wolverine—The FWS proposed to list the wolverine as a threatened species under the Endangered Species Act in February 2013, while finding that critical habitat was not determinable at that time (USDOI, FWS 2013). The wolverine is a wide-ranging mustelid (weasel family) that naturally exists at low densities, and the southern portion of its range extends into portions of Idaho, Montana, and Wyoming. They are adapted to cold temperatures and life in environments with snow on the ground for much of the year. Wolverines are opportunistic feeders that primarily scavenge on carrion and are sensitive to human disturbance from February to May when young are born and cannot travel far (Hornocker and Hash 1981; Magoun and Copeland 1998). Current threats include climate warming, human disturbance from recreational activities, and development and transportation corridors (USDOI, FWS 2013). Wolverines are rare and sparsely distributed in YNP and adjacent national forest areas (Beauvais and Johnson 2004; Inman et al. 2011). From 2005 to 2009, wolverines were captured or detected in the Absaroka-Beartooth wilderness along the north boundary of the park, the Thorofare region (southeast corner), and the adjoining Washakie and Teton wilderness areas (Murphy et al. 2011). No wolverines were captured or detected inside the park in the Gallatin Range (northwest), the Central Plateau and Washburn Range (central), the Madison Plateau and Bechler region (southwest), and the Snake River Range (south). No wolverines were detected in the North Absaroka wilderness and adjoining areas along the east boundary of the park, including the upper Lamar River. Radio-marked wolverines selected mountainous habitats above 8,000 feet (2,438 meters) with persistent snow cover and adequate ungulates during winter to provide carrion for food (Murphy et al. 2011). In YNP, reproductive rates were low, and survival rates were similar to other estimates for other populations in the conterminous United States. Dispersal from other areas in the region may be necessary to maintain wolverines in YNP, given low recruitment of offspring born to resident females (Murphy et al. 2011). Additional information on the status, biology, and threats to wolverines is available in the *Federal Register* (78:7863-7890; USDOI, FWS 2013).

Whitebark Pine—In December 2022, the FWS published a rule (87 *Federal Register* 76882–76917) to list whitebark pine as a threatened species under the Endangered Species Act. Whitebark pine is a long-lived, cold hardy, five-needle conifer that typically grows at high subalpine elevations greater than 7,000 feet (2,135 meters), often mixed with other conifers. It grows either as trees with a single trunk that extends

about 40 to 60 feet (12 to 18 meters) high or in short, dense mats (called krummholtz) at higher elevations exposed to high winds, cold temperatures with snow, and short growing seasons (Tomback et al. 2001). Trees grow and mature slowly and begin producing cones at 20 to 30 years of age; however, they do not produce large cone crops until 60 to 80 years of age. The long-term persistence of whitebark pine in the GYA is threatened by altered fire regimes, blister rust, bark beetles, and a warming climate (Shanahan et al. 2016; Greater Yellowstone Inventory and Monitoring Network 2022).

Whitebark pines occur on about 314,000 acres (127,000 hectares) within YNP, either as a dominant portion of forests above 8,400 feet (2,560 meters) or a mixed understory component in lodgepole pine forests from 7,000 to 8,400 feet (Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee 2011; USDOI, NPS 2012b). From 2004 to 2015, botanists monitored 5,215 whitebark pines taller than 4.5 feet (1.4 meters) on 176 transects throughout the GYA. Across all age classes, about 26% of monitored trees died, with the highest mortality in trees greater than 4 inches (10 centimeters) diameter at breast height. Most mortality occurred from 2008 to 2011 after the abundance of native mountain pine beetles increased substantially due to above-average temperatures from 2006 to 2008 (Shanahan et al. 2016). The beetle outbreak appeared to wane after 2011. About 14% to 26% of whitebark pine trees were infected by white pine blister rust (caused by a nonnative fungus), with smaller diameter trees experiencing higher mortality (Shanahan et al. 2016, 2017; Greater Yellowstone Whitebark Pine Monitoring Working Group 2020).

The mortality of whitebark pine from 2008 to 2011 shifted the age and size distribution from larger to smaller diameter trees, which lowered reproduction due to fewer seeds and decreased survival (Shanahan et al. 2016; Yellowstone Center for Resources 2018; Greater Yellowstone Whitebark Pine Monitoring Working Group 2020). About 26% of trees greater than 4.5 feet tall were cone-producing, and the density of understory saplings and seedlings averaged 51 trees per 5,280 square feet (500 square meters). Unfortunately, 43% of the reproducing trees were infected with blister rust and 16% had signs of pine beetles; less than 1% of the smaller trees had blister rust infection (Shanahan et al. 2017). Counts of seedlings and saplings varied from zero to 521 per transect, and 447 trees grew to more than 4.5 feet tall by the end of 2015 and were recruited into the population (Shanahan et al. 2017). Few, if any, bison management activities occur in whitebark pine habitat, and no trees have been adversely affected. Additional information on the status and biology of whitebark pine is available in the *Federal Register* (85:77408-77424; USDOI, FWS 2020).

Monarch Butterfly—In December 2020, the FWS published a proposed rule (85 *Federal Register* 81813) to list the monarch butterfly as a threatened species under the Endangered Species Act. Threats to monarchs include the loss and degradation of habitat, widespread use of herbicides and insecticides, logging at overwintering sites in Mexico, incompatible management of overwintering sites in California, urban development, drought, and effects of climate warming. The migratory western population in North America has been decreasing over the last 20 years due, in part, to decreases in the availability of milkweed and nectar resources. Smaller populations are more vulnerable to catastrophic events, such as extreme storms at the overwintering sites, and the number of days and the area in which monarch butterflies will be exposed to unsuitably high temperatures will increase with climate warming. Protection and restoration of habitat is a primary component of monarch butterfly conservation (USDOI, FWS 2020).

Naturalists working with the park's non-profit partner, Yellowstone Forever, have conducted annual counts of butterflies in northern YNP on a single day in mid-July for 18 years (2004 to 2021) as part of the North American Butterfly Association's July Butterfly Count. The counts were taken within a 15-mile (24-kilometer) diameter circle centered on the intersection in Mammoth, Wyoming, near the hotel. This area includes wetlands, sagebrush, ponds, forests, creeks, grasslands, and geothermal terraces between elevations ranging from about 5,000 feet at the northern park boundary (Reese Creek) to 11,000 feet on Electric Peak. During these surveys, only one monarch butterfly was detected during 2013. Other sightings of monarchs have occurred at Storm Point and the Nine Mile trailhead along the shoreline of

Yellowstone Lake and in the Hayden Valley (Bumann, pers. comm. 2022). Naturalists have only observed a handful of monarch butterflies in upland, dry areas of YNP where they seem to be transitory and feed on pollen from plants like rabbitbrush. Naturalists are not aware of any milkweed-specific associations with monarchs in YNP despite some milkweed presence and its importance as a host plant for monarch caterpillars (Bumann, pers. comm. 2022). There have not been any meaningful adverse impacts to monarch butterflies from current bison management activities. Additional information on the status, biology, and threats to monarch butterflies is available in the *Federal Register* (85:81813–81822; USDOI, FWS 2020).

Additional Trends and Planned Actions—As described in the "Yellowstone Bison" section, the area around YNP has experienced rapid increases in human population and land development that continue to damage habitat and movement corridors and could cause increased disturbances to grizzly bears, lynx, and wolverines. Present and reasonably foreseeable actions include multiple repairs and replacements to park roads and bridges (see appendix D). Some threatened species will avoid or be excluded from habitat at or near construction areas while other species, such as bears, may be attracted to construction areas. Construction could alter patterns in distribution, movement, and behavior for the term of these projects. Overall, NPS does not anticipate impacts to threatened species populations because none of the construction projects would result in an effect to population numbers beyond what is described under each alternative.

Warmer and drier conditions will enable more mountain pine beetles to survive winter, produce multiple broods, and spread. Warmer temperatures also could facilitate the transmission and spread of white pine blister rust or root diseases at higher elevations (Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee 2011, Jewett 2011). Blister rust has been found in the GYA since at least 1945, but warmer temperatures with higher humidity provide more conducive conditions for its spread (Kendall and Keane 2001; Newcomb 2003; Thoma et al. 2019). Climate change is anticipated to result in direct and indirect effects to whitebark pine, leading to habitat loss across their range (USDOI, FWS 2018). A migration rate of at least a magnitude higher (3,280 feet [1,000 meters]) per year is estimated to be necessary for tree species to be capable of tracking suitable habitats under projected warming trends (Malcolm et al. 2002). Latitudinal migration rates on this scale may significantly exceed the migration abilities of many plant species, including whitebark pine (Malcolm et al. 2002; McKenney et al. 2007).

Whitebark pine faces major threats from climate change and habitat loss from fire-suppression activities. Habitat loss is expected across the entire range of whitebark pine, with additional habitats becoming unsuitable from the direct and indirect impacts of climate warming. Fire is an important natural disturbance process within high-elevation forests of the GYA. It can kill all life stages of whitebark pine and affect forest succession. Researchers anticipate there will be significant habitat loss as temperatures exceed the thermal tolerance of whitebark pine in many areas. Warmer temperatures favor other conifer species, and they outcompete whitebark pine in high-elevation habitats, and the frequency and intensity of disturbances such as fire and disease are altered to such an extent that whitebark cannot persist. The pace of predicted climate warming could outpace the ability of whitebark pine to adapt and respond to expected warming temperatures in previously cool, high-elevation habitats (USDOI, FWS 2021).

Impacts of Alternative 1 (No Action)

Under Alternative 1, current management would continue. As a result, impacts to threatened animals and plants would be like those described above in the "Affected Environment" section, which contains a description of the current and expected future conditions of threatened animals and plants.

Impacts of Alternative 2

Impacts to grizzly bears, lynx, wolverines, and whitebark pine under this alternative would also be similar to those described above in the "Affected Environment" section. With slightly more bison on the

landscape, there could be more carcasses for grizzly bears, lynx, and wolverines, which would have a minor, beneficial effect by providing more food and increasing nutrition for a limited time.

During December 2012, the FWS concurred with the NPS's determination of not likely to adversely affect for potential impacts to grizzly bears from bison hazing operations, including helicopters. Hazing operations would not increase beyond those identified under Alternative 1 and, therefore, would have the same impacts. Similar to Alternative 1, few, if any bison management activities occur in whitebark pine habitat, and no trees would be adversely affected. There would be insignificant effects to monarch butterflies from bison management operations, such as the rare, inadvertent trampling of forage plants and larvae by bison, horses, or people.

Impacts of Alternative 3

Impacts to grizzly bears, lynx, wolverines, and whitebark pine under this alternative would be similar to those described above in the "Affected Environment" section. With more bison on the landscape, there should be more carcasses distributed over a larger area for grizzly bears, lynx, and wolverines, which would have a greater beneficial effect by providing more food. More hazing may need to occur, and larger hazing operations may be needed in Montana if larger numbers of bison attempt to leave the existing management areas. However, many grizzly bears would still be denning, and few bears, lynx, and wolverines are observed at this time of year in areas when hazing would occur. Thus, the chance of disturbances would be small and ephemeral. Like Alternative 1, few, if any bison management activities occur in whitebark pine habitat. A larger bison population may result in the inadvertent trampling of some seedlings, but this would have a negligible effect on recruitment. There should be insignificant effects to monarch butterflies from bison management operations, such as the rare, inadvertent trampling of forage plants and larvae by bison, horses, or people.

Cumulative Impacts

The impacts of past, present, and reasonably foreseeable planned actions are included above in the "Affected Environment" section. Present and reasonably foreseeable actions include repairs and replacements to park roads and bridges (appendix D). Threatened animal species may avoid or be excluded from habitat at or near construction areas during the construction period for these projects. Under Alternative 1, current management would continue, and there would be no new direct or indirect impacts beyond those described in the "Affected Environment" section. Overall, under Alternative 1, impacts, including those from past, present, and reasonably foreseeable future actions would result in conditions that are like those described in the "Affected Environment" section.

As discussed above, bison management actions proposed under Alternative 2 could result in a slightly higher number of bison in YNP compared to Alternative 1. This could result in more bison carcasses for grizzly bears, lynx, and wolverines, which would have a beneficial effect to these species from increased food sources. Alternative 2 is unlikely to meaningfully impact whitebark pine or the monarch butterfly as described above in the impact analysis. When combined with the impacts from past, present, and reasonably foreseeable planned actions, the overall condition of threatened animal and plant species is expected to improve to a small degree compared to what is described in the "Affected Environment" section, with most changes resulting from Alternative 2.

Under Alternative 3, the population of bison on the landscape would be larger, resulting in more carcasses available for threatened animals. Bison hazing operations may increase in Montana if larger numbers of bison attempt to leave the existing management areas. Many grizzly bears would still be denning, and few bears, lynx, and wolverines are observed at this time of year in areas where hazing would occur. Thus, the chance of disturbances would be small and ephemeral. Alternative 3 is unlikely to meaningfully impact whitebark pine or the monarch butterfly as described above in the impact analysis. When combined with the impacts from past, present, and reasonably foreseeable planned actions, the overall condition of

threatened animal and plant species is expected to improve compared to what is described in the "Affected Environment" section, with most changes resulting from Alternative 3.

American Indian Tribes and Ethnographic Resources

Affected Environment: Current Status and Expected Future Trends

Twenty-seven tribal governments are associated with YNP through ancestral ties to the landscape as well as a historical presence within YNP (figure 6; Nabokov and Loendorf 2002; Tarka 2008; Smith 2009; USDOI, NPS 2014b; Wallen et al. 2015b). Associated tribes include the Assiniboine and Sioux Tribes, Blackfeet Tribe, Cheyenne River Sioux Tribe, Coeur d'Alene Tribe, Comanche Tribe of Oklahoma, Confederated Salish and Kootenai Tribes, Confederated Tribes of the Colville Indian Reservation, Confederated Tribes of the Umatilla Indian Reservation, Crow Tribe, Crow Creek Sioux Tribe, Eastern Shoshone Tribe, Flandreau Santee Sioux Tribe, Gros Ventre and Assiniboine Tribes, Kiowa Tribe of Oklahoma, Little Shell Chippewa Tribe, Lower Brule Sioux Tribe, Nez Perce Tribe, Northern Arapaho Tribe, Northern Cheyenne Tribe, Oglala Sioux Tribe, Rosebud Sioux Tribe, Shoshone-Bannock Tribes, Sisseton–Wahpeton Sioux Tribe, Spirit Lake Sioux Tribe, Standing Rock Sioux Tribe, Turtle Mountain Band of the Chippewa Indians, and Yankton Sioux Tribe.

YNP maintains its connection to these tribes through collaboration to include Indigenous Knowledge in management and decision-making, ethnographic research, interviews with tribal elders, and ongoing government-to-government consultations. Detailed information about tribal affiliations and the importance of YNP to tribes is available in the ethnographic summary *American Indians and Yellowstone National Park* (Nabokov and Loendorf 2002).

The Executive Office of the President defines Indigenous Knowledge as a body of observations, oral and written knowledge, innovations, practices, and beliefs developed by Tribes and Indigenous Peoples through interaction and experience with the environment (OSTP and CEQ 2022). A group of scholars and researchers in the NPS developed a working definition of Indigenous Knowledge or Traditional Ecological Knowledge: [Traditional Ecological Knowledge] refers to the ongoing accumulation of knowledge, practice and belief about relationships between living beings in a specific ecosystem that is acquired by indigenous people over hundreds or thousands of years through direct contact with the environment, handed down through generations by cultural transmission, and used for life-sustaining ways. This knowledge includes the relationships between people, plants, animals, natural phenomena, landscapes, and timing of events that are used for activities such as hunting, fishing, trapping, agriculture, and forestry. It encompasses the world view of indigenous people, which includes ecology, spirituality, human and animal relationships, and more (Ramos et al. 2016). Appropriately recognizing, considering, and applying Indigenous Knowledge requires growing and maintaining strong and mutually beneficial relationships between the NPS and Tribes and Indigenous Peoples. Such relationships provide opportunities to identify shared values and goals, build trust and common understanding, and facilitate the exchange of information (OSTP and CEQ 2022). Through this planning process, the NPS will continue to consult and collaborate with Tribal Nations to include Indigenous Knowledge in the management of Yellowstone bison.

The NPS defines ethnographic resources as the traditional sites, structures, objects, landscapes, and natural resources that are significant to the present way of life for a particular group (USDOI, NPS 2002). According to NPS cultural resource management guidelines, ethnographic resources are documented by applied cultural anthropologists, whose research is reviewed and approved by the communities they study (USDOI, NPS 2002). Yellowstone's ethnographic resources represent important religious, historical, and/or cultural concepts, such as tribes' creation stories or the birth of the NPS system and the conservation movement. Ethnographic resources are associated with several groups, including tribes, explorers, trappers, soldiers, miners, concessionaires, neighboring communities, and park visitors.

Figure 6. The associated American Indian tribes of Yellowstone National Park

In the twentieth and twenty-first centuries, land use practices such as road construction and maintenance, fencing, transmission line corridors, cultivation, grazing, and the application of herbicides have affected tribes and ethnographic resources in YNP and the GYA. Changes in land use have resulted in disturbance to or removal of cultural objects and historical structures. Adverse impacts to tribes and ethnographic resources include, but are not limited to, restricted access to ethnographic resources, impeding traditional uses; increased public access to areas used for traditional purposes, and reduced quantity and distribution of biotic resources, such as plants and animals. With the passage of federal cultural resource protection laws, projects are often designed and routed to avoid impacts on cultural resources. Ethnographic resources within YNP remain important to the tribes' sense of themselves and in maintaining their traditional practices. Yellowstone bison are culturally significant to many tribes because they are perhaps the only remaining link to the indigenous herds that once roamed the area (Smith 2009; Wallen et al. 2015b).

People have occupied the Yellowstone area for more than 11,000 years. Archeological, ethnographic, and historical evidence shows bison have been an important resource throughout the span of human occupation of the GYA, including the present-day YNP. Native cultures relied on bison for food, shelter, clothing, tools, and fuel, and bison held significant spiritual value for such groups (Nabokov and Loendorf 2002; Smith 2009; Wallen et al. 2015b). European American settlement significantly impacted the relationship between American Indians and bison. The wide-scale slaughter of bison in the late nineteenth century deprived tribes of a key component of their economy and culture. European American expansion affected both indigenous traditional territories and Indian reservations. Treaties with the federal government limited native use of lands in the region, and early YNP administrators discouraged tribes from using areas in the park (Nabokov and Loendorf 2002; Wallen et al. 2015b).

The NPS recognizes the importance of Yellowstone bison to many tribes. These bison represent a connection to the plentiful, wide-ranging bison herds that were central to the lifeways of their native ancestors (Wallen et al. 2015b). Bison are considered sacred to many tribes (Smith 2009). Throughout history and today, bison play a crucial role in the cultural, ceremonial, and spiritual practices of many tribes (Tarka 2008; Smith 2009). To ensure this connection continues, the ITBC was created to restore bison to tribal lands and share knowledge about bison management. As of 2015, 20 of the tribal governments associated with YNP were members of the ITBC (USDOI, NPS 2014b; Wallen et al. 2015b).

Tribal representatives have informed managers at YNP about many issues concerning Yellowstone bison, and many tribes have been critical of the modern management of Yellowstone bison (Wallen et al. 2015b). Commenting on the refusal of the ITBC to receive slaughtered bison from YNP, an Assiniboine tribal member equated the treatment of these bison to that of livestock (Smith 2009). Some tribes believe the management of Yellowstone bison reflects the history of the United States' treatment of tribes (USDOI, NPS 2014b; Wallen et al. 2015b). The 2014 final EIS by YNP on the brucellosis remote vaccination program listed several issues identified by tribal representatives during government-to-government consultations (USDOI, NPS 2014b). These issues included management policies, such as herd movement, infectious disease control, vaccination, and termination practices. In addition, tribal representatives indicated the involvement of tribal members in bison management programs and the protection of cultural resources related to bison were important (USDOI, NPS 2014b). The Confederated Salish and Kootenai Tribes of the Flathead Nation and Nez Perce Tribe, and the ITBC, joined the IBMP in 2009 (IBMP Agencies 2011). The tribal entities have since participated in the development of adaptive management strategies and operational plans for bison. Other tribes with treaty hunting rights for bison, such as the Shoshone-Bannock Tribes of the Fort Hall Reservation, Confederated Tribes of the Umatilla Indian Reservation, Yakama Nation, and Blackfeet Nation, also participate in some IBMP meetings. In addition, the NPS has continued government-to-government consultation with tribes historically associated with bison in the GYA. Additional information on tribal involvement in the preparation of this EIS are included in chapter 4.

Beginning in 2014, 28 Indian tribes signed The Buffalo: A Treaty of Cooperation, Renewal and Restoration to honor and recognize their relatives, the bison, as wild free-ranging animals and an essential partner in the natural world. The treaty describes their intertwined and interdependent relationship with bison and conveys their collective intention to provide a safe space and environment in North America so bison can once again lead them in nurturing the land, plants, and other animals. The signatories of the treaty committed to restoring bison to their rightful place in their respective cultures and territories so future generations can realize the bison ways culturally, materially, and spiritually. This significant action to preserve and restore their sacred web of relationships with the natural world also provided USDOI with an opportunity to partner more effectively with them to address interests of mutual benefit, such as restoring sustainable populations of bison to tribal and public lands, conserving habitat for bison and other wildlife, and supporting treaty rights. In 2016, the Buffalo Treaty Nations provided the Secretary of the Interior with a resolution supporting the BCTP and partnership with the Fort Peck tribes.

In 2020, USDOI released a Bison Conservation Initiative committed to five overarching goals: (1) conserving bison as healthy wildlife; (2) restoring gene flow among conservation herds; (3) sharing stewardship with states, Tribes, and other stakeholders; (4) establishing and maintaining large wide-ranging bison herds on appropriate large landscapes; and (5) restoring cultural connections to honor and promote the unique status of bison as an American icon. The Buffalo Treaty Nations communicated their support for the Bison Conservation Initiative to the Secretary of the Interior, indicating it was an important step toward better health, ecological and cultural recovery, and continent-wide reconciliation. They agreed to collaborate with USDOI and others through shared stewardship to make this vision a reality.

The NPS has committed to continue fulfilling its trust responsibilities (USDOI and USDA 2021) to tribes by sustaining a large population of bison that supports hunter harvests outside the park and restoring more brucellosis-free bison to tribal lands. The transfer of brucellosis-free Yellowstone bison to suitable tribal lands has a beneficial impact on federal-tribal trust relationships. Tribes use transferred bison to establish or supplement tribal herds for conservation, hunting, nutrition, and cultural purposes. The continued movements of Yellowstone bison onto public lands in Montana would benefit some tribes by enabling the hunting and harvest of several hundred bison in many winters. A range of 3,500 to 6,000 bison has resulted in movements to the park boundary during most winters that, in combination with year-round tolerance for bison in some adjacent areas of Montana, would sustain or increase tribal hunting opportunities and hunter harvests of Yellowstone bison. The Confederated Salish and Kootenai Tribes of the Flathead Nation, Nez Perce Tribe, Shoshone-Bannock Tribes of the Fort Hall Reservation, Confederated Tribes of the Umatilla Indian Reservation, Yakama Nation, Northern Arapaho Tribe, Blackfeet Nation, and Crow Nation hunt bison on unoccupied lands outside the park pursuant to their own regulations and seasons. Yearly hunter harvest levels vary based on the movement of Yellowstone bison onto these lands (USDOI, NPS 2014b). Other tribes historically associated with bison in the Yellowstone area are not members of the IBMP and have not exercised treaty rights to hunt bison migrating from YNP onto unoccupied national forest lands in Montana. As a result, these tribes are less frequently involved with the management of Yellowstone bison. However, many of these tribes are members of ITBC.

Since 2013, the NPS has provided several tribes and a tribal organization with more than 3,000 bison for transfer to processing facilities and distribution of meat, hides, and horns to their members (Geremia 2002). Biologists from the NPS and APHIS have transferred 294 brucellosis-free Yellowstone bison to the Fort Peck tribes since 2019. The NPS expanded the quarantine facility near the Stephens Creek Administrative Area during 2021-2022, thereby increasing the number of animals that enter the BCTP. The Fort Peck tribes built a quarantine facility and currently receive brucellosis-free Yellowstone bison for assurance testing and eventual release on tribal lands. Under current management, YNP would continue to implement the BCTP with the expanded quarantine facility. The NPS has involved tribal interns in these operations. The Fort Peck tribes have agreed to transfer approximately 70 percent of the bison that complete testing to ITBC for restoration on tribal lands elsewhere. Since 2020, the ITBC has

transferred about 170 bison of Yellowstone-origin from the Fort Peck Indian Reservation to at least 23 other tribes in 12 states.

Additional Trends and Planned Actions—Present and reasonably foreseeable actions impacting tribes and ethnographic resources include multiple repairs and replacements to park roads and bridges (see appendix D). Construction of these projects may involve several project elements that could result in adverse effects to tribes and bison, as an ethnographic resource. Project elements resulting in potential adverse effects may include, but are not limited to, ground disturbance and the presence of people in the area, which could cause bison to avoid such areas, and temporary changes in access and traditional uses in areas where construction would occur. The exact nature of the adverse effects will not be known until project designs are developed and consultation with tribes is completed. The duration of the adverse effects are expected to occur until construction is completed. Climate change may result in an increase in the severity and/or frequency of temperature changes, precipitation changes, flooding, droughts, and wildfires (Rockman 2015). These factors could affect the way tribes interact with the environment and cause impacts to ethnographic resources from disruptions to the greater Yellowstone ecosystem. Climate change may also result in changes to vegetation that could lead to changes in bison distribution across the landscape as they seek different areas to graze. This could affect the ability of some tribes to hunt on areas adjacent to park if bison change movement patterns.

Impacts of Alternative 1 – No Action

Under Alternative 1, current management would continue. As a result, impacts to tribes and ethnographic resources would be the same or similar to what is described above in the "Affected Environment" section, which describes the current and expected future conditions of current management.

Impacts of Alternative 2

Under Alternative 2, the NPS would continue to emphasize tribal trust responsibilities to help improve the efficiency and safety of hunting outside the park and increase the restoration of brucellosis-free bison to tribal lands through the BCTP. These efforts would support tribal rights and collaborative partnerships with tribes to augment or enhance bison populations with Yellowstone genetics. The NPS would work directly with treaty tribes and IBMP partners to improve coordination and reduce conflicts when bison are captured; thus, reducing stress on bison and improving the condition of this ethnographic resource. The NPS would transition from slaughtering animals testing positive for brucellosis exposure to releasing them to increase hunting opportunities in Montana; thereby, helping to restore more bison to the landscape that would be available for hunting by tribes. This would improve conditions for tribes. As numbers of bison removed through hunting outside the park and the BCTP increase, the NPS would reduce captures for shipments to slaughter. Fewer captures for slaughter and more opportunities for hunter harvests may be beneficial to several tribes. However, other agencies may initiate more intensive management outside the park, with increases in hazing and removals of bison, if there are increases in conflicts with cattle, people, and property. The NPS would continue to work with treaty tribes and IBMP partners to implement measures to improve communication and safety, which would benefit tribes.

Impacts of Alternative 3

The NPS would continue government-to-government consultation with tribes historically associated with bison in the GYA. Tribes would have continued involvement in decision-making regarding the management of Yellowstone bison. Tribes with treaty rights would continue to hunt bison on unoccupied lands pursuant to their own regulations and seasons, and more tribes may assert and implement their rights. Initially, the NPS would cease capturing bison for shipments to slaughter but captures for the BCTP would continue. Hence, tribes could still establish or supplement herds with Yellowstone bison for conservation, hunting, nutrition, and cultural purposes.

More bison could result in larger and earlier movements outside YNP, which in combination with year-round tolerance for bison in some adjacent areas of Montana, could enhance tribal hunting opportunities

and hunter harvests of Yellowstone bison. The NPS would not capture bison for slaughter except if numbers approach 7,000 bison. Many tribes may support this minimal management approach. Other agencies may conduct more intensive management outside the park with increases in capture, hazing, and lethal removals. If bison distribute over larger portions of existing management areas in Montana, there would be more hunter harvest opportunities and, likewise, more tribal members could participate in hunts, which would be a beneficial impact to American Indian cultures. However, increased hunting and hunter harvest opportunities for tribes are contingent on best practices for human safety and minimization of conflicts with nearby residents due to shooting near roads and houses, gut piles left on the landscape, shooting of elk and other ungulates, and occasional incidents of shooting toward other hunters, houses, and cars.

Cumulative Impacts

The impacts of past, present, and reasonably foreseeable planned actions are described above in the "Affected Environment" section. Present and reasonably foreseeable actions include repairs and replacements to park roads and bridges (appendix D). Project elements resulting in potential adverse effects would include ground disturbance, the presence of people in the area, which could cause bison to avoid such areas, and temporary changes in access and traditional uses in areas where construction would occur. Under Alternative 1, current management would continue, and there would be no new direct or indirect impacts beyond those described in the "Affected Environment" section. Overall, impacts including those from past, present, and reasonably foreseeable actions would result in conditions that are the same or similar to those described in the "Affected Environment" section.

Alternative 2 would have a beneficial impact to tribes and ethnographic resources by providing more opportunity for treaty hunter harvests, fewer shipments to slaughter, and expansion of the BCTP. When the impacts of Alternative 2 are added to the impacts of past, present, and reasonably foreseeable actions, a near-term, adverse cumulative impact would occur to tribes and ethnographic resources from construction-related intrusions on the landscape. This adverse impact would cease once the construction of these projects is completed. Over the long term, there would be a cumulative beneficial effect through improved trust relationships with tribes and more bison on the landscape, with most impacts resulting from Alternative 2.

As discussed under Alternative 3, a larger bison population and fewer captures would enhance hunting opportunities and result in a beneficial impact to ethnographic resources and trust relationships with tribes. However, an increase in the number of tribal members hunting in the Beattie Gulch area outside the northern park boundary could increase issues such as "firing lines" that prevent bison from distributing across the larger landscape, wounding of bison that returned to the park, concentrations of gut piles near roads and residences, and human safety issues. When the impacts of Alternative 3 are added to the impacts of past, present, and reasonably foreseeable actions disclosed in the affected environment, a near-term, adverse cumulative impact would occur to tribes and ethnographic resources from construction-related intrusions on the landscape. This adverse impact would cease once the construction of these projects is completed. Over the long term, there would be a cumulative beneficial effect through improved trust relationships with tribes and more bison on the landscape compared to both current conditions and Alternative 2, with most impacts resulting from Alternative 3.

Human Health and Safety

Affected Environment: Current Status and Expected Future Conditions

Brucellosis is a zoonotic disease that can infect people, causing undulant fever with the symptoms described previously. Cattlemen, slaughterhouse workers, veterinarians, wildlife biologists, and hunters careless in field dressing their game may be most at risk for accidental exposure (Luce et al. 2012). The CDC indicates most infected people respond favorably to antibiotic therapy, but symptoms can be painful and persistent (CDC 2012).

Some residents near Gardiner, Montana, support hunting bison but believe subsistence hunts are sometimes not safe and result in more wounding loss and too many carcasses, gut piles, and other remains. The Bear Creek Council and others have indicated carcasses could increase the transmission of brucellosis from bison to elk; attract predators such as grizzly bears that create the potential for conflicts; and attract scavengers such as eagles, magpies, and ravens that fly off with pieces of carcasses and drop them near homes; thereby creating a risk of disease transmission to people and pets (Nara 2019). Some residents characterize carcasses left close to public roads and homes as a visual blight to residents and visitors. In April 2019, the IBMP agencies met with the Bear Creek Council (2019a) and other residents for a field trip to the Beattie Gulch and Eagle Creek areas and more discussion the following day. Residents shared concerns about the hunt, and attendees brainstormed solutions to increase the safety of hunters and residents. In July 2019, the Bear Creek Council presented recommendations to the IBMP agencies for consideration. These recommendations included requiring hunters to remove carcasses from Beattie Gulch, expanding the zone where no carcasses are allowed deeper into Beattie Gulch, and creating no-carcass zones along portions of the roads in the Eagle Creek area. The recommendations included increasing residents' awareness of the bison hunt, increasing hunter awareness about resident's concerns and educating them in safe practices, and reducing parking congestion and trash along Old Yellowstone Trail Road (Bear Creek Council 2019b).

The IBMP agencies considered these recommendations and have taken several actions in response, including closing areas near residences and roads to hunting and requiring hunters to place unused parts of carcasses at least 150 yards (137 meters) from roads and homes. Hunters also are instructed to spread stomach contents on the ground to reduce attractions to scavengers. Other risk mitigation methods, such as incineration of remains and trucking remains to local landfills, are being considered by IBMP members and NGOs (Drimal 2020; IBMP Subcommittee 2020). In 2023, staff from the Custer Gallatin National Forest, State of Montana, and the FWS, and members of the Shoshone-Bannock Tribes, removed gut piles and other parts from bison harvested in Beattie Gulch to reduce the chance of grizzly bears congregating in the area (French 2023). In addition, there is coordination among hunting parties, oversight by law enforcement officers, and the designation of a "lead hunter" in each party to implement safe practices and good decision-making in tribal hunting groups. These actions should reduce the likelihood of injuries to hunters, residents, or visitors traveling on Old Yellowstone Trail South Road.

Injuries—Bison may appear tame but are wild and unpredictable. They can be more dangerous to humans during the rut (mating season) and when they perceive danger to calves. Bison generally injure five or fewer visitors to YNP each year by butting, goring, or tossing them. In most incidents, the visitor approached to within 25 yards (23 meters) of the animal, which park regulations prohibit (Cherry et al. 2018). Handouts by YNP and IBMP members include warnings to residents and visitors about approaching bison.

Biologists and bison managers sometimes need to approach Yellowstone bison as part of their duties to preserve and manage them (e.g., for hazing to protect people and property, and counting, classifying, and collaring animals to monitor movement and population dynamics). Physical injuries to these employees are possible and occasionally occur, such as employees spraining ankles or falling from horseback. These are occupational hazards for fieldwork not unique to bison handling. On surrounding lands, federal and state employees may sometimes need to approach bison to alleviate conflicts with cattle or people and move them away from private property. This work is often done on foot, from horseback, or in a vehicle. Landowners in the Gardiner and Hebgen Basins also occasionally haze bison off private property.

As mentioned under the "Affected Environment" section for "Yellowstone Bison," the Stephens Creek Administration Area Plan included construction of a barn for corral operations that improved the health and safety of staff and livestock and the efficiency of these operations (USDOI, NPS 2006b). Safe practices and training keep the risk of severe injuries to employees engaging in bison management activities low.

Brucellosis Infection—With the pasteurization of milk and near eradication of brucellosis in livestock, the occurrence of undulant fever in the United States is rare. Infected bison and elk are a minor health risk for people who properly handle animal carcasses or birth tissues (Luce et al. 2012). The NPS provides protective equipment such as gloves, masks, and eyewear, in addition to training, to minimize the risk of exposure of employees to brucellosis bacteria during activities such as sampling animals at slaughter facilities and conducting laboratory analyses. The NPS also has screened employees involved with bison management for brucellosis exposure. No employees disclosed a positive test. With the use of safe practices, training, and protective equipment, the risk of exposure to brucellosis bacteria among NPS employees and bison managers is low, including during on-site processing of bison in the Stephens Creek Administrative Area. The NPS expects few, if any, cases.

Limited bison migration outside the park occurs during most winters, with most migration in late winter; however, migration increases substantially during severe winters. Hunting occurs in the Hebgen and Gardiner Basins, and portions of carcasses often remain on the landscape; especially on national forest lands in Beattie Gulch, Corwin Springs, and Eagle Creek. The Custer Gallatin National Forest and Montana have implemented actions to reduce the risk associated with carcasses and brucellosis transmission. There is no evidence gut piles from bison have increased the transmission of brucellosis to elk, with prevalence much higher in the Paradise Valley where bison are not allowed (see the *"*Other Wildlife*"* section; Barber-Meyer et al. 2007, 2008; MFWP 2018, 2020). Actual infection rates in elk are not known. There also is low risk that residents and visitors would contract the disease and subsequently transmit it from person to person if they do not approach and handle offal from bison or elk. Avian scavengers have flown off with pieces of carcasses and dropped them by nearby homes; thereby creating a risk of disease transmission to pets. Residents are aware of this risk, which also occurs throughout the area during more widespread and dispersed hunts of elk each autumn, but some infections of pets have occurred.

Additional Trends and Planned Actions—Present and reasonably foreseeable actions include multiple repairs and replacements to park roads and bridges (see appendix D). Three out of six of these repair and replacement projects are a result of the catastrophic flooding in June 2022 that caused severe damage and loss of several sections of road and access. NPS staff and contractors would follow all best management practices for construction to minimize and avoid injury. Therefore, it is unlikely that the health or safety of personnel involved in the repairs and replacement would be impacted.

Impacts of Alternative 1 (No Action)

Under Alternative 1, current management would continue. As a result, impacts to human health and safety would be like those described above in the "Affected Environment" section, which describes the current and expected future conditions of current management.

Impacts of Alternative 2

Injuries—Like Alternative 1, the NPS would continue safe practices, use of protective equipment, and training. Thus, injuries to staff should continue to be rare and not life threatening. Injuries to visitors when people approach bison too closely would occur at a similar rate to Alternative 1 but may increase slightly if more bison are on the landscape. Migrations into Montana could increase with more bison and a reduction in captures for slaughter. In turn, state employees or county officials may implement more bison management actions, such as moving bison off private property, preventing bison from mingling with cattle, or initiating capture operations. Increased management beyond the park could raise the risk of injury for employees of other agencies and landowners when attempting to move or prevent bison from moving into certain areas.

Brucellosis Infection—Like Alternative 1, safe practices with protective equipment and training would continue along with testing of higher-risk employees. The already low risk of infection would decrease even more due to a reduction in captures and handling. However, beyond the park, more bison

management activities may occur such as moving bison off private property or preventing bison from coming in direct contact with cattle. However, transmission risk during management activities would be negligible with proper training and procedures.

More bison moving outside the park could result in more hunting in nearby areas. Carcasses and other remains could increase on the landscape, especially near Beattie Gulch and Eagle Creek. Increased exposure to brucellosis could occur from individuals that hunt bison and individuals in these areas who interact with carcasses and other remains. However, federal, state, and tribal agencies would continue to educate hunters on how to reduce their risk of brucellosis exposure by properly field dressing bison and how to cook and handle bison to ensure the bacteria is killed.

Impacts of Alternative 3

Injuries—Like Alternative 1, the NPS would continue safe practices, use of protective equipment, and training. Thus, injuries to staff should continue to be rare and not life threatening. However, more bison in the park could result in more injuries to visitors, although exact causal relationships are difficult to quantify because most injuries result from visitors approaching bison too closely rather than the total number of bison in the park. With more bison, migrations should increase, and more bison management actions could be required beyond the park, such as situations where state employees or county officials are called to move bison off private property, prevent bison from mingling with cattle, or for capture operations. Calls for assistance from private citizens could increase substantially, which could affect the ability of federal and state staff to promptly respond to conflicts with people and cattle. Increased management beyond the park would raise the risk of injury for employees of other agencies and neighboring landowners.

Brucellosis Infection—Like Alternative 2, safe practices with protective equipment and training would continue along with testing of higher-risk employees. The already low risk of infection would decrease even more due to less capture and handling. However, beyond the park, more bison management activities may occur (e.g., moving bison off private property or preventing bison from coming in direct contact with cattle). The number of calls for assistance may surpass the abilities of federal and state staff to respond promptly. However, transmission risk during management activities would remain low with proper training and procedures.

More bison moving outside the park could result in more hunting in nearby areas. Carcasses and other remains could substantially increase on the landscape, especially near Beattie Gulch and Eagle Creek. Increased exposure to brucellosis could occur from individuals who hunt bison and individuals in these areas who interact with carcasses and other remains. However, federal, state, and tribal agencies would continue to educate hunters on how to reduce their risk of brucellosis exposure by properly field dressing bison and how to cook and handling bison to ensure the bacteria is killed. Thus, the overall probability of transmission would remain low.

Cumulative Impacts

The impacts of past, present, and reasonably foreseeable planned actions are described above in the "Affected Environment" section. Present and reasonably foreseeable actions include repairs and replacements to park roads and bridges (appendix D). Construction projects have the potential to impact human health and safety; however, NPS staff and contractors would follow all best management practices for construction to minimize and avoid injury. Under Alternative 1, current management would continue, and there would be no new direct or indirect impacts beyond those described in the "Affected Environment" section. Overall, impacts including those from past, present, and reasonably foreseeable actions would result in conditions that are the same or similar to those described in the "Affected Environment" section.

Alternative 2 could minimally affect human health and safety because of the limited potential for injuries to visitors, NPS staff, and other agency staff when in proximity to bison, and because of the low potential

for potential brucellosis transmission. When combined with the unlikely impacts from repairs and replacements to park roads and bridges and other past and present actions, impacts to human health and safety overall are expected to be the same as those described under the "Affected Environment" section.

The effects on human health and safety from Alternative 3 would be similar to those described for Alternative 2 but there could be a limited increase in injuries to visitors compared to what is described in the "Affected Environment" section because more bison would be on the landscape. Because fewer bison would be captured for shipment to slaughter, interactions between NPS staff and bison would be reduced compared to what is described in the "Affected Environment" section. When combined with the unlikely impacts from repairs and replacement to park roads and bridges and other past and present actions, impacts to human health and safety are expected to remain similar to what is described in the "Affected Environment" section, with a lower overall potential for injuries related to bison handling associated with the implementation of Alternative 3.

Socioeconomics

Affected Environment: Current and Expected Future Conditions

YNP is primarily located in the northwestern corner of Wyoming (Park and Teton Counties) but extends into Montana (Gallatin and Park Counties) and Idaho (Fremont County). The affected area for this analysis focuses on Gallatin and Park Counties in Montana because few bison currently migrate into Wyoming and Idaho.

Population Characteristics and Trends—According to the 2020 US Census, the population in the study area was about 136,150 people. Most people in Gallatin and Park Counties identify as white (89% and 93%, respectively; US Census Bureau 2000, 2010, 2020). Although only 1% of people in Gallatin and Park Counties identify as American Indian and Alaska native, the park is significant to American Indians. Before the park was established, American Indians hunted, fished, gathered plants, and used the waters for religious and medical purposes (see the "American Indian Tribes and Ethnographic Resources" section).

Between 2000 and 2020, the population increased by 63%, and during the same period, the population of Gallatin County, the most populated of the two study area counties, increased by 75%. Gallatin County is currently the fastest growing county in Montana. If the county's population continues to grow at the projected 2.75 annual growth rate, the number of people could increase to 200,000 by 2040. As a result of the county's population increase, residential development has also expanded into wildland-urban interface areas, degrading habitat and contributing to conflicts with wildlife. The wildland-urban interface is defined as "any area where the combination of human development and vegetation have a potential to result in negative impacts from wildfire on the community" (Gallatin County 2021).

Residential development has grown along with population increases. Montana's Census and Economic Information Center provides county-level population projections, produced by Regional Economic Models, Inc. Between 2000 and 2020, the population of Park County increased by 10% and is projected to be around 17,800 by 2036. Park County's Growth Policy notes conflicts could arise as the population and subsequent development increase (Park County 2017). More private property owners could experience increased interactions with bison in the Gardiner and Hebgen Basin portions of the study area as the human population increases.

Industry and Tourism—Although livestock farms continue to be a large and vital part of Montana's economy, there have been trends away from cattle ranching, partly attributed to recent improvements in animal productivity, health, and live-weight gain rates, which allow ranchers to graze fewer cattle or have a smaller herd size while still ensuring profitability (Herrero 2016). In 2020, there were more than 26,000 farms and ranches in the state across 58 million acres, which is 62% of the state's total acreage. This number is down 7% from more than 28,000 farms and 60 million acres in 2011. In economic terms,

revenue from livestock has dropped 32% from a 10-year high of $2.2 billion in 2015 to $1.5 billion in 2020 (USDA 2021b).

The benefits of cattle production to the ranching community include selling land access for hunting and wildlife viewing, amenity values, wildlife conservation, and ranching legacy across multiple generations. However, brucellosis transmission to cattle, especially from elk, poses a risk to the ranchers' economic welfare. A 2016 cost-benefit analysis of reducing elk brucellosis prevalence found that it could cost a rancher an estimated $150,000 to quarantine a herd of 400 cattle from one positive brucellosis case (Boroff et al. 2016). The cost can significantly increase if the disease spreads beyond the affected area, especially if infected cattle move to new high-risk areas. The potential economic costs of brucellosis include a decrease in profits stemming from a decline in the productivity of ranches infected by the disease, which ultimately leads to a reduction in market values of goods and services. Additionally, costs can increase related to consumers' concerns about infection and from activities associated with risk mitigation and adaptation (National Academies of Sciences, Engineering, and Medicine 2020). Continuing to maintain separation between bison and cattle would maintain a very low risk of brucellosis transmission. Point conflict is still expected, requiring state and federal employees to respond, which comes with an economic cost.

In 2010, APHIS changed its regulations and reduced the risk of Montana losing its brucellosis-free status and experiencing associated economic costs. The new regulations allow livestock producers to deal with brucellosis outbreaks in cattle on a case-by-case basis and eliminated the need to remove whole herds and test cattle across the entire state (USDA, APHIS 2014). MDOL (2011) estimated these regulations with the designation of a brucellosis surveillance area provided a net annual benefit of at least $5.5 million to producers. In 2013, Montana evaluated allowing a greater distribution of wild bison on lands near the park (MFWP and MDOL 2013) and concluded it would not increase the risk of bison spreading brucellosis to cattle or result in trade sanctions by other states or nations (Bullock 2015). Given the change in livestock regulations outside the park, however, culling of entire herds due to a potential infection would be avoided, minimizing the economic impact of an unlikely transmission. No brucellosis transmission has occurred from bison to cattle and therefore, the risk of these economic effects is minimal when compared to elk.

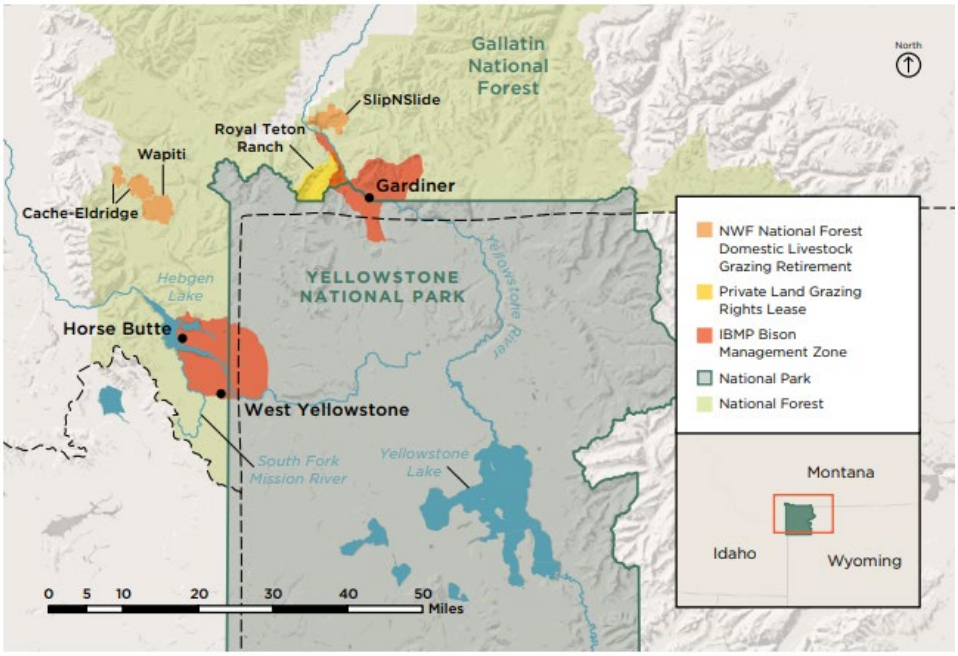
Over the past two decades, the GYA's economy has diversified from a focus on commodity extraction to include more recreation, tourism, and service-related industries (USDOI and USDA 2000a). Recreation and tourism-related jobs are reflected in the retail trade and service sectors. Recreation and tourism are important contributors to the economy of Gallatin and Park Counties. Outdoor recreation accounted for 4% of Montana’s gross domestic product last year, a higher percentage than any other state (Bureau of Economic Analysis 2021). In 2017, outdoor recreation resulted in $4.7 billion in economic impact in the state (Sage et al. 2018). In the 2018 summer visitor survey for YNP, respondents rated viewing wildlife a as a motivating factor in their visit to the park (USDOI, NPS 2019).

In 2020, park visitors spent approximately $444 million in local gateway regions of YNP. Gateway regions are the areas directly surrounding YNP, and gateway economies include the cities and towns where visitors typically stay and spend money while visiting (Cullinane and Koontz 2021). The revenue from visits to YNP and the surrounding area supported 6,110 jobs, $194 million in labor income, $326 million in value-added, and $560 million in economic output. The lodging and restaurant sectors had the largest share of labor income from visitor spending at the park, accounting for $44 million (23%) and $26.7 million (14%), respectively (Cullinane and Koontz 2021). Between 2011 and 2021, Gallatin and Park Counties experienced a drop in unemployment rates. In 2011, the unemployment rate in Gallatin County was 6% and decreased to 2% in 2021. The 2011 unemployment rate in Park County was 8% and by 2021, it had decreased to 4% (US Bureau of Labor Statistics 2021). Tourism and recreation will continue to be a vital part of the economy, currently in the range of 13% to 15% and growing, delivering billions of dollars in revenue and employment in the region. Maintaining current bison management practices is not expected to impact that trend, and long-term, beneficial impacts would continue.

Increased tourism, hunting, and other recreation does bring additional costs, including the need to build and maintain infrastructure, protect private lands, and respond to law enforcement calls for assistance.

Managing Migration and Limiting Conflicts—Due to harsh winter weather, cattle grazing is limited in the Hebgen Basin to the west and Gardiner Basin to the north from October to June when bison are most likely to migrate outside park boundaries (Kilpatrick et al. 2009). In 1999, the Rocky Mountain Elk Foundation assigned 1,508 acres of lands on the Royal Teton Ranch located north of YNP between Devil's Slide and Beattie Gulch to the Gallatin National Forest for administration as a conservation easement. USDOI Funds ($1,799,270) were used to acquire this land. The conservation easement was designed "to aid and assist in the preservation of the Yellowstone National Park bison and other wildlife by setting aside a portion of its lands, in perpetuity, thereby providing in the natural world, a safe haven for the bison." The easement was intended "to facilitate the use, movement, or migration of the surface estate by bison, elk, bighorn sheep, pronghorns, grizzly bear, black bear or mule deer, and to avoid destruction or impairment of the natural habitat." In 2008, MFWP purchased the grazing rights on the Royal Teton Ranch for a 30-year period. The NPS provided $1.5 million to implement the initial payment.

In another case, the National Wildlife Federation and USFS entered into an agreement with grazing permit holders at Horse Butte that transferred their rights to the nearby Targhee National Forest, where there are no significant livestock/wildlife conflicts (National Wildlife Federation 2003). These and several other examples shown on figure 7 have reduced the number of livestock grazing in the private lands immediately adjacent to the park in the Gardiner and Hebgen Basins and provided a natural connection for migration of bison between the park and the Custer Gallatin National Forest. Ultimately, this connection has reduced the potential for conflicts between migrating bison and livestock grazing.



Source: National Parks Conservation Association (2015)
Note: NWF = National Wildlife Federation

Figure 7. Examples of conservation efforts that reduced the number of livestock grazing adjacent to the Park and provided corridors for migration of bison between the park and the Custer Gallatin National Forest

Private Property—The risk of brucellosis transmission to cattle increases if bison move onto private properties or public lands where cattle graze during the parturition season. The risk of human injury and private property damage would increase as bison move into populated areas. In recent years, human habitation and development have significantly increased outside the park's northern and western boundaries, and this trend is expected to continue. Gallatin County spans over 2,600 square miles (6,734 square kilometers), with about 1,250 square miles (3,238 square kilometers) of public land. Fifty-three percent of the county's 1,685,617 acres is privately owned (Gallatin County 2021).

MFWP is responsible for addressing public safety, property damage, and hazing calls. According to the 2021 IBMP annual report, MFWP spent more than 1,000 hours managing bison, including responding to complaints and dealing with injured or sick bison. In 2021, MFWP responded to 29 calls in the West Yellowstone and Gardiner areas. MFWP and the Montana Highway Patrol also reported a one-vehicle collision resulting in the bison's death. Additionally, another bison-vehicle crash resulted in a traffic backup. Seven incidents of bison threatening private property or public safety were also reported to MFWP in 2021. Only one report of property damage occurred; it involved a picnic table at a privately run campground (IBMP Agencies 2021). Several programs designed with the focus of helping reduce conflict between landowners and wild bison that roam beyond park borders also focus on addressing the socioeconomic impact of these interactions. For example, the Yellowstone Bison Coexistence Program offers financial and technical assistance to property owners who would like to build fences to prevent property damage. Since the organization's founding in 2011, it has completed more than 50 fencing projects in the Gardiner and Hebgen Basins and provided more than $45,000 in reimbursements and materials and additional project expenses such as staff time and travel. While programs exist to help mitigate private property owners that come in conflict with bison, private property owners in Montana ultimately accept the responsibility of dealing with wild animals. The Supreme Court of Montana ruled in 1940 (*State v. Rathbone*. 110 Mont. 225 (Mont. 1940) 100 P.2d86) that wildlife is a natural part of the landscape, and the rights and privileges of private property ownership also come with the challenge and benefits associated with having wildlife on the landscape.

There would be no noticeable change in calls for assistance from private citizens or increased management beyond the park or increases in the risk of injury for employees of other agencies and landowners if current management continues. Proactive strategies to educate the public on safe engagement of bison, hunting practices, and improved fencing and other practices for ranchers and private owners would continue and would reduce the potential for more serious impacts. Incidents of bison causing injuries to visitors should remain at or near current levels (fewer than five incidents per year). Property owners should not see increased costs associated with bison management or lost income from reduced cattle and other livestock grazing. The already limited livestock grazing that occurs in the winter when bison are migrating outside the park is trending downward and is unlikely to result in increased economic costs. The risk of injury to landowners and federal and state employees because of bison migration outside the park should not change from existing conditions.

Food Insecurity—According to the USDA, more than 38 million people, including 12 million children, in the United States are food insecure (USDA 2021a), and 9,400 people in Park and Gallatin Counties are identified as food insecure due to incomes below the poverty line (Feeding America 2020). The meat yield of a single bison averages 50% of its weight, meaning a single 1,000-pound female bison can yield 500 pounds (227 kilograms) of meat, or the equivalent of 2,000 quarter-pound bison patties. Some tribes would continue to benefit by receiving meat from bison harvested or shipped to slaughter that are made available to their families or other tribal members, including seniors, diabetics, Head Start centers, school lunch programs, homeless shelters, and cultural and traditional ceremonies. In addition, bison completing the BCTP are available to tribes for conservation, cultural, and nutritional purposes.

Additional Trends and Planned Actions—Present and reasonably foreseeable actions include multiple repairs and replacements to park roads and bridges (see appendix D). Three of six of these repair and replacement projects are a result of the catastrophic flooding in June 2022 that caused severe damage and

loss of several sections of road and access. These actions are anticipated to benefit socioeconomics over the long term by either reestablishing travel corridors into the park that were damaged during the flooding or improving the circulation of visitors on existing park roads, and possibly increasing visitation to gateway communities.

Climate change has the potential to impact socioeconomics through changes in visitor use patterns that could increase visitation to national parks, which could benefit local gateway communities, and through changes to the landscape that could preclude visitors from coming to national parks, such as the 2022 flooding at YNP. The NPS published research on the temperature-visitation relationship in 340 units of the US national park system in 2015. Researchers evaluated the historical relationship between long-term average monthly air temperature and visitation (1979–2013) and modeled potential future visitation (2041–2060) based on two warming climate scenarios and two visitation-growth scenarios across the national park system, parks varied widely in the historical relationship between long-term average monthly visitation and temperature. Temperature was a significant predictor of visitation at 95% of parks (324 of 340), and temperature explained 12% to 99% (average = 79%) of the variation in visitation at these individual parks. The historical visitation-temperature relationship at YNP was very strong (Fisichelli et al. 2015; USDOI, NPS 2016d).

Potential visitation changes for YNP based on air temperature and a potential growth maximum could be a 16% to 52% increase in annual visitation, a 12% to 35% increase in peak season visitation (three busiest contiguous months), a 36% to 103% increase in shoulder season visitation (two months prior and two months after peak season), a 29% to 53% decrease in low season visitation (three contiguous months with least visitation), and a 15- to 45-day expansion of the visitation season (defined as beginning on the date when 10% of historical cumulative visitation was achieved and ending on the date when 10% of historical cumulative visitation remained for the year). An increase in visitation to YNP because of changes in air temperature resulting from climate change could benefit local gateway communities, particularly the tourism industry through increased visitor spending in these communities.

In June 2022, four days of rain and snowmelt caused devastating flooding and mudslides in and adjacent to YNP. Some experts suggest the frequency of these types of events could increase in the future due to warming temperatures caused by climate change (Ripple et al. 2022). Following the flood event in 2022, the NPS closed the north and northeast entrance roads for several months to implement repairs and develop alternate routes, which contributed to decreased visitation to the northern area of the park. This decrease affected the local economies of the gateway communities, including Gardiner and Cooke City, Montana.

Impacts of Alternative 1 (No Action)

Under Alternative 1, current management would continue. As a result, impacts to socioeconomics would be the same or similar to what is described above in the “Affected Environment” section, which describes the current and expected future conditions of current management.

Impacts of Alternative 2

Industry and Tourism—Alternative 2 would likely have a positive impact on the tourism and recreation industry by increasing opportunities for wildlife viewing, hunting outside the park, tour guides, and other associated goods and services both inside and outside the park. The higher population of bison on the landscape would allow more tribal hunting and economic activities outside the park. Wildlife would continue to be a major draw for visitors to the region, and a higher bison population would support these opportunities at higher levels.

Park and Gallatin Counties are home to 1,698 farms with 1.4 million acres of land that yields approximately $65 million in revenue annually from livestock. A considerable percentage of that revenue stems from the 78,000 head of cattle in these counties (USDA 2021b). Under Alternative 2, brucellosis transmission risk would remain very low because bison and cattle would continue to be separated.

Beyond the park, more bison management activities may occur, such as moving bison off private property or preventing bison from leaving management areas; however, those activities would not increase the risk of brucellosis transmission or associated economic costs.

Managing Migration and Limiting Conflict—Under Alternative 2, nominal increases may occur in calls for assistance from private citizens and increased management by state and federal wildlife agencies beyond the park. The risk of injury for employees of other agencies and landowners could increase slightly because there may be slightly more bison on the landscape than under Alternative 1.

Private Property—Private property owners adjacent to the park and within the tolerance zones may see limited adverse impacts from increased bison on their property, including reduced ability to lease their property for cattle grazing and damages to fences and fields that may require repairs and other improvements to prevent further damage. Bison migration outside the park results in calls for assistance to MFWP and MDOL, which would likely increase as the number of bison increases. Under adaptive management, there would be limited damage to private property when bison migrate outside the park with minimal costs associated with fence repair and other improvements—the same as alternative 1. There also would be isolated incidence of damage to property inside the park, such as bison rubbing against vehicles or puncturing car tires, which may be associated with a higher bison population compared to existing conditions.

Food Insecurity—There should be an increase in the amount of bison meat available to help address food insecurity with more bison on the landscape. Increased coordination with the tribes under this alternative would have long-term benefits because additional bison would be available as a resource.

Impacts of Alterative 3

Industry and Tourism—Alternative 3 would likely have a long-term, beneficial impact on the tourism and recreation industry by substantially increasing opportunities for wildlife viewing, hunting outside the park, guides, and other associated goods and services both inside and outside the park from an increased presence of bison in the park. This benefit would be counteracted somewhat because a higher density of bison is more likely to result in conflicts, injuries, and property damage. Exact causal relationships are difficult to quantify because most injuries are a result of visitors approaching bison too closely rather than the total number of bison in the park, but Alternative 3 would increase the potential for these conflicts. Implementing Alternative 3 would increase the number of bison leaving the park due to the overall increase in the bison population. However, bison would still be kept separate from cattle within the existing management areas. Therefore, the risk of brucellosis transmission would still be small and associated economic costs would not be expected to increase.

Managing Migration and Limiting Conflict—With more bison, migration of bison outside the park would increase, and more bison management actions would be required beyond the park, such as situations where state employees or county officials are called to move bison off private property or to prevent bison from leaving the management area. Calls for assistance from private citizens could increase which, could affect the ability of federal and state staff to promptly respond to conflicts with people and cattle. Increased management beyond the park would raise the risk of injury for employees of other agencies and neighboring landowners.

Private Property—Under Alternative 3, there would be greater potential for damage to private property when bison migrate outside the park, including additional costs associated with fence repair and other improvements. There also would be greater incidence of damage to property inside the park, such as bison rubbing against vehicles or puncturing car tires.

Food Insecurity—Compared to Alternatives 1 and 2, more bison meat would be available to help address food insecurity because more bison would be on the landscape. Increased coordination with the tribes under this alternative would have long-term benefits because additional bison would be available as a resource.

Cumulative Impacts

The impacts of past, present, and reasonably foreseeable planned actions are described above in the "Affected Environment" section. Present and reasonably foreseeable actions include repairs and replacements to park roads and bridges (appendix D). These projects are anticipated to benefit socioeconomics over the long term by either reestablishing travel corridors into the park that were damaged during the flooding or improving the circulation of visitors on existing park roads, possibly increasing visitation to gateway communities. Under Alternative 1, current management would continue, and there would be no new direct or indirect impacts beyond those described in the "Affected Environment" section. Overall, impacts including those from past, present, and reasonably foreseeable actions would result in conditions that are the same or similar to those described in the "Affected Environment" section.

Alternative 2 would increase the number of bison on the landscape, which would benefit the growing outdoor culture, recreation, and the tourism industry that has increased the number of visitors, created jobs, launched and supported businesses, and resulted in increased revenue and tax collection for the region. These positive socioeconomic impacts would be countered in part by the growing pressure that tourism places on legacy agriculture industries by reducing public land for livestock. Increased bison numbers on the landscape would slightly increase impacts from traffic congestion and strains on infrastructure associated with higher populations and visitors. When combined with the impacts of past, present, and reasonably foreseeable actions, there could be a slight beneficial impact to socioeconomics in the GYA, resulting from more opportunities for outdoor recreation and tourism, with implementation of Alternative 2 contributing most of the beneficial impacts.

Alternative 3 would have similar impacts to Alternative 2, but the impacts would be greater because there would be more bison on the landscape. When combined with the impacts of past, present, and reasonably foreseeable actions, there would a greater beneficial impact to socioeconomics compared to Alternatives 1 and 2, with implementation of Alternative 3 contributing most of the beneficial impacts.

Visitor Use and Experience

Affected Environment: Current Status and Expected Future Conditions

The purpose of YNP is to preserve the scenery, cultural heritage, geothermal wonders, and plants and animals for the benefit and enjoyment of people (USDOI, NPS 2014a). The 1894 *Act to Protect the Birds and Animals in Yellowstone National Park, and to Punish Crimes in said Park, and for Other Purposes* prohibits hunting in the park but allows fishing (16 USC 26). Visitors experience natural wonders, scenery, wildness, solitude, unpolluted air, and dark night skies, while their needs and expectations are accommodated and adverse impacts to natural and cultural resources are minimized. Over half the visits to YNP each year occur during summer with an increasing number in spring and autumn. Overall visitation has increased by more than 40% since the early 2000s. Most visitors see wildlife viewing, including bison, as a fundamental part of their experience. About 80% of visitors surveyed during 2016 rated bison as one of the most important resources in the park, equivalent to Old Faithful Geyser (Resource Systems Group 2017). During a similar survey in 2018, 91% of visitors listed wildlife viewing as extremely important or very important to their visit. Other features in the park, such as seeing geysers and thermal features, viewing scenery, and experiencing a wild place are also important to visitors (USDOI, NPS 2019).

Traffic congestion due to people stopping their vehicles to watch wild animals, known as animal jams, is common along the park's major roadways. Bison jams occur because visitors stop or slow their vehicles to view bison near roads or because bison are crossing or moving along roadways. While common, bison jams are not a major source of visitor frustration (USDOI, NPS 2019).

Visitation is lowest during winter when wheeled-vehicle travel is limited to the far northern portion of YNP, and access to the interior is only via snowmobile, snow coach, skiing, or snowshoeing. Winter

visitation depends on snow conditions and are governed by a cap on the total number of transportation events each day. As a result, winter visits during 2008 through 2014 were limited to fewer than 43,000 (USDOI, NPS 2013). Most visitors on snow machines enter YNP through the entrance near West Yellowstone, Montana. In winter, visitation by automobile only occurs between Gardiner and Cooke City, Montana, by way of the North and Northeast Entrance Roads; no other roads are plowed or maintained for automobiles.

Bison are widely distributed over the park landscape and often visible from roadways and developed areas. Some bison are collared for tracking and other scientific purposes. During summer in the Hayden and Lamar Valleys, bison tend to gather in large herds of several hundred animals or more. Grasses dominate both valleys and trees are sparse at lower elevations; as a result, visitors have expansive views of bison on the landscape. Both valleys are cut by rivers with the Lamar River running through its namesake valley and the Yellowstone River running through the Hayden Valley. Watercraft of any type are not allowed on either river. In the Lamar Valley, there are few roads, one developed camping area (Pebble Creek Campground), and the Lamar Buffalo Ranch, which is primarily used for administrative and educational purposes. The Hayden Valley contains no campgrounds or major developments. Because of the combination of factors described above, the Lamar and Hayden Valleys are prime areas for bison viewing during spring, summer, and autumn. In both valleys, visitors can view large herds of bison in an expansive natural environment, which is a unique opportunity available in few areas of North America.

During July, average daily traffic in the Hayden Valley is 7,540 vehicles, which equates to 19,604 visitors per day in the road corridor. The average per day for the same period in the Lamar Valley is 2,030 vehicles, or 5,278 visitors (USDOI, NPS 2019). In winter, many bison move to the Gardiner (north) and Hebgen (west) Basins because these areas are at lower elevations, have less snow, and more readily accessible forage. The Stephens Creek Administrative Area is in the Gardiner Basin near the northern boundary of the park. This area (about 50 acres; 20 hectares) is closed to visitors year-round. During spring, 1,977 acres (800 hectares) of hills and prairie around the Stephens Creek Administrative Area are closed to visitors for bison operations.

Bison Viewing—Some bison are radio collared, which is noticeable to visitors. Valleys and non-wooded areas, such as the Hayden and Lamar Valleys and geyser basins, offer excellent opportunities for bison viewing. During summer and autumn, visitors can see large herds of bison grazing in the Hayden and Lamar Valleys. During winter, visitors in automobiles can see groups of bison in the Lamar Valley, on the Blacktail Deer Plateau, and in the Gardiner Basin. Bison jams occur frequently, especially during summer. Exact locations and extent of jams vary based on bison distribution and traffic volumes. Grassland areas with relatively high traffic volumes have the highest potential for bison jams. However, previous visitor survey results do not indicate bison jams negatively impact the visitor experience.

Visitor Perceptions—Few visitors see bison operations because of area closures in the Gardiner Basin and Stephens Creek Administrative Area. Also, visitation is comparatively low during winter and early spring, and there are no major visitor destinations along Old Yellowstone Trail South Road. The NPS conducts bison processing activities, such as quarantine and brucellosis testing, out of public view. However, some visitors may observe hazing operations or hear noise from vehicles or helicopters used by officials outside the park if they are used near the park boundary. Some visitors do not support the NPS capturing and processing wild bison even if they do not observe these operations, while others support decreasing bison numbers and the prevalence of brucellosis. On-site shooting of captured bison by park staff (not hunting) would occur within pastures in the Stephens Creek Administrative Area, which is already closed to visitors. Firearms would be used in the pastures to cull bison that would then be transferred to interested tribes for processing and distribution. The sound of gunfire may be audible to visitors traveling on Old Yellowstone Trail South Road and Highway 89. Knowing that animals are being shot and killed inside the park would not be supported by some visitors.

Viewing Scenery—Bison management facilities are concentrated in the Stephens Creek Administrative Area, which is away from busy travel corridors like Highway 89 and the Grand Loop Road. No additional facilities are planned for construction in areas of high visitor use. Overall, visitors do not experience impacts to opportunities to view scenery. As noted above, bison jams occur frequently, especially during summer. Exact locations and extent of jams vary based on bison distribution and traffic volumes. Grassland areas with relatively high traffic volumes have the highest potential for bison jams. However, previous visitor survey results do not indicate bison jams negatively impact the visitor experience.

Restrictions on Visitor Access—Park visitors cannot access about 1,977 acres (800 hectares) of the Gardiner Basin during bison management operations. The NPS closes the Stephens Creek Administrative Area, where bison capture and quarantine facilities are located, to the public year-round to ensure public safety and protect government property, equipment, and buildings. The NPS also closes surrounding lands when operating the facility. However, this area has sparse vegetation and, as a result, visitors can view wild animals in the area from a distance, such as from the Old Yellowstone Trail South Road and Highway 89, which parallels the park boundary.

Hunting Outside the Park—During hunting seasons, there is a significant chance that visitors driving along Old Yellowstone Trail South Road or Highway 89 may hear gunshots beyond the park boundary. However, there are no major visitor destinations in this area, so visitor use is low. Due to cold temperatures, most visitors drive through the area with windows up, which reduces the audible noise of gunfire. Consequently, the indirect effects of hunting outside the park, such as hearing gunfire from a distance, have minimal adverse effects on visitor experience.

Additional Trends and Planned Actions—Visitors from around the world will continue to travel to YNP to experience its geothermal wonders, wild animals, inspiring scenic views, cultural heritage, and spectacular wilderness (USDOI, NPS 2014a). Annual visits to YNP averaged fewer than 500,000 until the 1940s but increased to more than 2 million during the 1960s and 1970s, about 3 million during the 1990s and 2000s, and 4 million in recent years (Gunther et al. 2015). The NPS will continue to provide high-quality educational opportunities, and visitor enjoyment and satisfaction are high according to recent surveys. However, many facilities are aging, and roads, trails, and campsites are in continual need of maintenance (USDOI, NPS 2014a). These maintenance activities would continue to temporarily impact visitors through closures and disturbances in localized areas but would improve the visitor experience overall. In addition, increasing visitation has resulted in traffic congestion in some areas, conflicts between people and wild animals, vehicle strikes, and wild animals becoming habituated or too comfortable around people (Gunther et al. 2015). Diseases or parasites may occasionally be transmitted from wild animals to visitors using the same areas (USDOI, NPS 2014a). Visitation and recreation in the GYA are also increasing, resulting in additional pressures on facilities, roads, and resources.

Present and reasonably foreseeable actions include multiple repairs and replacements to park roads and bridges (see appendix D). As noted previously, three of six of these repair and replacement projects are a result of the catastrophic flooding in June. These actions are anticipated to benefit the visitor experience at YNP over the long term by either reestablishing travel corridors that were damaged during the flooding or improving the experience and circulation of visitors on existing park roads. There may be short-term, adverse impacts to the visitor experience during construction if traffic patterns change or from the noise and presence of construction-related vehicles in the area.

Climate change is expected to affect visitation patterns. Where, when, and how many people visit parks is likely to change with continued warming. For example, visitors may avoid extremely warm months in low-latitude parks, and the visitation season may extend across additional weeks to months at northern parks. Whether park visitors track climate change and shift their behavior would depend on multiple environmental and socioeconomic factors, which are described in the “Socioeconomics” section.

Impacts of Alternative 1 (No Action)

Under Alternative 1, current management would continue. As a result, impacts to visitor use and experience would be like those described above in the "Affected Environment" section, which describes the current and expected future conditions of current management.

Impacts of Alternative 2

Bison Viewing—More opportunities would be available for visitors to see more bison under this alternative. Excellent viewing opportunities would continue in the Hayden and Lamar Valleys during summer and autumn, and the Lamar Valley, Blacktail Deer Plateau, and Gardiner Basin during winter. Some bison would continue to be radio collared, which is noticeable to visitors. The total number and duration of bison jams could increase with more bison, especially in busy travel corridors with grasslands on either side of the roadway. Bison jams would continue to slow traffic in the immediate area and could slow overall travel through the park, though visitors do not report high levels of frustration with animal jams.

Visitor Perceptions—Visitors that oppose intensive bison management, such as capture, slaughter, and vaccination, would benefit from a reduction in capture operations and the use of low-stress management of bison. These visitors may see more bison on the landscape and be less likely to see active management while inside the park. However, they could see more intensive management just beyond the park boundary if Montana decides to conduct capture or hazing operations. In contrast, not attempting to reduce the prevalence of brucellosis or bison numbers may concern visitors who support Montana's cattle industry or are worried about their safety and property damage. Some visitors would continue to object to hazing, capture, and processing of Yellowstone bison, even if they do not observe these operations, while others would continue to support decreasing brucellosis and bison numbers.

Viewing Scenery—Under this alternative, there would be no change to where bison management occurs. For this reason, impacts would be the same as those described for Alternative 1.

Restrictions on Visitor Access—Like Alternative 1, park visitors would not be able to access about 1,977 acres (800 hectares) of the Gardiner Basin during bison management operations. This action could reduce the ability of visitors to see some bison in the area. However, the area has sparse vegetation, and visitors can view most wild animals in the area from Old Yellowstone Trail South Road and Highway 89.

Hunting Outside the Park—During hunting seasons, there is a significant chance visitors driving along Old Yellowstone Trail South Road or Highway 89 would hear gunshots beyond the park boundary, with similar or slightly greater impacts than described for Alternative 1. However, there are no major visitor destinations in this area so visitor use is low, and due to cold temperatures, most visitors would likely be driving through the area with windows up. Thus, implementation of this alternative would increase the chance visitors may hear gunfire from a distance, but this would have little if any negative effect on the visitor experience.

Impacts of Alternative 3

Bison Viewing—Under this alternative, many more bison could be on the landscape compared to the last decade, and visitors would have more opportunities to see bison in the park. Grasslands in the Hayden and Lamar Valleys and the geyser basins would continue to offer excellent opportunities for bison viewing. During summer and autumn, visitors would see large herds of bison grazing in the Hayden and Lamar Valleys. Herd sizes may increase under this alternative, with a small beneficial impact on visitor experience. During winter, visitors in automobiles would likely see groups of bison in the Lamar Valley, on the Blacktail Deer Plateau, and in the Gardiner Basin with increased frequency, a small beneficial impact on the visitor experience. Like Alternative 2, the total number and duration of bison jams could increase, especially in busy travel corridors. Bison jams would continue to slow traffic in the immediate

area and could slow overall travel through the park. However, an increase in the total number and duration of bison jams is unlikely to measurably improve or degrade the visitor experience.

Visitor Perceptions—Like Alternative 2, visitors that oppose intensive bison management, such as capture and slaughter, would benefit from far fewer capture operations and less intensive management. These visitors may see more bison on the landscape and would be less likely to see active management while inside the park. However, they may see more intensive management near the northern park boundary if the park or Montana eventually decide to conduct capture or hazing operations. Not attempting to reduce bison numbers or brucellosis to lower levels may concern visitors who support Montana's cattle industry or are worried about their safety and property.

Viewing Scenery—Abundant bison may overgraze some areas of the park, which may affect viewscapes for visitors. if overgrazing occurs in some areas, it could result in die-offs of some animals, resulting in more carcasses on the landscape compared to Alternative 1, which some visitors may perceive as a negative impact.

Restrictions on Visitor Access—Park visitors would not have access to the Stephens Creek Administrative Area but could readily view wild animals in the surrounding area. The annual closure of 1,977 acres (800 hectares) in the Gardiner Basin may be shortened with fewer bison capture operations for slaughter. There are no major visitor destinations in this area, so lifting or shortening this closure would not measurably change visitor use patterns. The NPS expects few visitors would enter the area for hiking or other purposes.

Hunting Outside the Park—Hunting beyond the park boundary likely would increase with implementation of this alternative. When hunting occurs, there is an increased chance compared to Alternative 1 that visitors driving along Old Yellowstone Trail South Road or Highway 89 would hear gunshots beyond the park boundary. However, there are no major visitor destinations in this area so visitor use is low, and due to cold temperatures, most visitors would likely be driving through the area with windows up. Thus, implementation of this alternative would increase the chance visitors may hear gunfire from a distance, but this would have little if any negative effect on the visitor experience.

Cumulative Impacts

The impacts of past, present, and reasonably foreseeable planned actions are described above in the "Affected Environment" section. Present and reasonably foreseeable actions include repairs and replacements to park roads and bridges (appendix D). These actions are anticipated to benefit the visitor experience at YNP over the long term by either reestablishing travel corridors that were damaged during the flooding or improving the experience and circulation of visitors on existing park roads. There may be short-term, adverse impacts to the visitor experience during construction if traffic patterns change or from the noise and presence of construction-related vehicles in the area.

Under Alternative 1, current management would continue, and there would be no new direct or indirect impacts beyond those described in the "Affected Environment" section. Overall, impacts including those from past, present, and reasonably foreseeable actions would result in conditions that are the same or similar to those described in the "Affected Environment" section.

Alternative 2 would slightly increase opportunities for visitors to view bison with more bison on the landscape but could increase bison jams related to such viewing. For those visitors who oppose intensive park management of bison, this alternative would improve their experience. Bison hunting outside the park could increase under this alternative, which could impact visitor experience when they are near the park boundary or when they exit the park. When combined with the impacts from past, present, and reasonably foreseeable actions, the overall experience of park visitors is expected to improve slightly compared to existing conditions, with most changes resulting from implementation of Alternative 2.

Alternative 3 would have similar impacts to Alternative 2 but to a greater degree because there would more bison on the landscape and even less management by NPS staff. When combined with the impacts from past, present, and reasonably foreseeable actions, the overall experience of park visitors is expected to improve to a greater degree than under Alternatives 1 and 2, with most changes resulting from implementation of Alternative 3.

Vegetation

Affected Environment: Current and Expected Future Conditions

YNP and nearby areas of Montana support a variety of plant communities due to variable topography, soils, and weather. About 1,150 native plants occur in YNP, including 3 plants found only in or near the park (Ross's bentgrass, Yellowstone sand verbena, and Yellowstone sulfur wild buckwheat) and 97 other rare plants. Vegetation is composed primarily of typical Rocky Mountain plants in montane forests, sagebrush steppe, alpine meadows, wetlands and riparian areas, and geothermal communities. Vegetation in the Lamar and Hayden Valleys, where there are large seasonal congregations of bison, is primarily composed of sagebrush steppe, with native and nonnative grasses on the slopes and in the valley bottoms. The NPS introduced many of the nonnative grasses present in the Lamar Valley prior to 1960 as bison forage. The riparian zone along the Lamar River in Lamar Valley contains sparse stands of cottonwood trees with increasing densities of lodgepole, Douglas fir, and willow in the Lamar Canyon and near the Lamar-Yellowstone confluence. Nonnative plants, including cheatgrass and Canadian thistle, are present in both valleys.

Bison graze on native and nonnative vegetation in the park. Overgrazing (or overbrowsing) occurs when widespread, repeated foraging removes so much leaf tissue that plant productivity and regrowth decrease considerably, and soils become compacted and unproductive with fewer available nutrients. Excessively grazed areas are vulnerable to erosion and invasion by nonnative plants due to less plant litter and more bare ground. Signs of overgrazing include changes in the variety (composition) of plants, the spread of nonnative plants, and poor body condition and lower productivity in ungulates (Crawley et al. 2021). Overgrazing usually occurs when the abundance of ungulates is kept artificially high by supplying supplemental food during the season of scarcity, such as winter in temperate climates, or importing animals during the plant growing season. These effects are usually observed in human-managed livestock, not unmanaged wildlife populations, though impediments to migration or other barriers could increase the density of wildlife and lead to overgrazing (Coughenour 2008; Crawley et al. 2021).

Most management activities in YNP to reduce bison numbers occur in the high-desert environment of the Gardiner Basin. This basin is not a particularly favorable winter range for bison because of its relatively poor soils on active mudflows, low annual precipitation, high winds, and heavy historical use by livestock and native ungulates (Whittlesey 1995, Rush 1932). An account from the Langford-Washburn-Doane Expedition of 1870 (Secretary of War 1871) describes native vegetation in the Gardiner Basin as "[t]his desert region, inclosed [sic] by mountains covered with verdure, and on the banks of a large stream, is one of the anomalies common in the West, where the presence of limestones or sandstones, in horizontal strata especially, almost always mean want of water, and consequent desolation. We camped at the mouth of Gardiner's [sic] River, a large stream coming in through a deep and gloomy canyon from the south. This was our first poor camping place, grass being very scarce." This area has had relatively sparse vegetation since that time (Whittlesey 1995; USDOI, NPS 2006b). Congress added a 7,600-acre (243-hectare) portion of the basin to YNP during 1925 to 1941, primarily to provide lower-elevation habitat for elk, pronghorn, and other animals during winter (Whittlesey 1995). Previously, settlers homesteaded, tilled and irrigated, ranched, or hunted for wild animals, primarily ungulates, on most of this area (Whittlesey 1995). This area was overgrazed with nonnative grasses, such as cheatgrass, and erosion of the topsoil by the 1920s due to heavy use by cattle and horses prior to 1905 (Rush 1932).

Today, invasive nonnative plants infest much of the Stephens Creek Administrative Area, where the bison capture facility is located. Native vegetation is sparse because of historical uses and, more recently, from

the horse corrals, bison capture and quarantine facilities, equipment storage, barn and associated buildings, and nursery operations. Planted vegetation includes cottonwoods, chokecherries, and a few conifers. Nonnative plants include crested wheatgrass, mustard, Kochia, Russian thistle, cheatgrass, and Canadian thistle. The surrounding area consists of foothills with widespread nonnative plants and a mixture of native vegetation, including sagebrush, rabbitbrush, greasewood, juniper, cottonwoods, willow, Douglas fir, and a variety of forbs and grasses. There are also terraces near the Yellowstone River and Reese and Stephens Creeks that ranchers cultivated before being included in YNP. Nonnative plants including crested wheatgrass and mustard dominate the vegetation in these areas. Botanists found no rare plants during a survey in the Stephens Creek Administrative Area (USDOI, NPS 2006b).

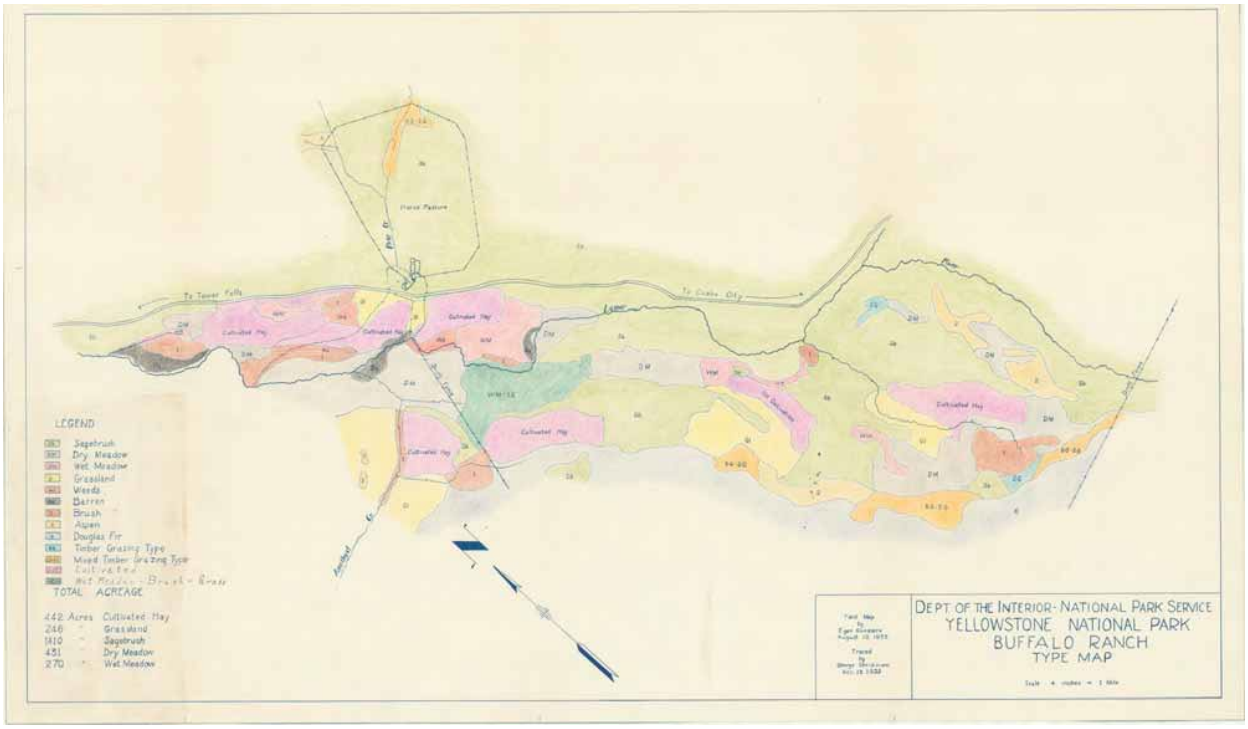
Facilities or activities that disturb areas of potential bison habitat only affect a small portion of the total habitat in the region. Technicians apply herbicide treatments to reduce noxious weeds, and staff from the NPS confine and feed horses and mules within the Stephens Creek Administrative Area. Current management does not have meaningful effects on vegetation in the bison capture facility or quarantine pastures in and near the Stephens Creek Administrative Area because these areas are already denuded. Past expansion of quarantine pastures involved construction of new fences near the Stephens Creek Administrative Area with limited vegetation disturbance and loss of native vegetation. This disturbance was not significant because native plants were sparse in the area and previous land uses had already resulted in widespread disturbance. Grazing intensities on grasslands in central and northern YNP during summer vary across the landscape with heavily grazed areas and nearly ungrazed areas (Plumb et al. 2009; Geremia and Hamilton 2019, 2022).

In July 2020, independent researchers sampled indicators of bison use and riparian vegetation condition along eight streams in northeastern YNP from the Blacktail Deer Plateau to the Lamar Valley. They reported high levels of bison use were positively correlated with exotic species and negatively correlated with species richness, native species diversity, cover, and wetland species (Kauffman et al. 2023). More than 70% of their sampling plots in the Lamar Valley had the lowest stubble heights (standing crop) and the most stream bank disturbance. Exotic species dominated sites intensely grazed by bison, which these biologists interpreted as bison having a dominant influence on plant composition. These biologists suggested the grazing intensity of large ungulates in northern YNP is at a historical high as bison have replaced elk as the principal large ungulate. Based on range management indicators, they concluded this intensity of use exceeded recommended utilization thresholds for livestock to avoid degradation of streams and riparian zones (Kauffman et al. 2023).

The findings are not surprising given the history of northern YNP. There were vibrant, tall willow communities with beavers from Blacktail Deer Plateau to the upper Lamar Valley during the late 1800s and early 1900s (Meagher and Houston 1998). However, the establishment of willows decreased after the 1930s, and beavers disappeared which, over time, led to the incision (downcutting) of stream channels and a lower water table across the floodplains (Wolf et al. 2007). Much of northern YNP was characterized as “badly overgrazed” by the 1930s from as many as 3,000 horses on the Blacktail Deer Plateau and increasing numbers of elk in the Lamar Valley (Rush 1932). The horses were removed, and from 1935 to 1968, tens of thousands of elk were removed from the population via hunting in Montana, shooting in the park, and capture and culling in the park (Houston 1982). After these removals ceased, counts of northern Yellowstone elk increased rapidly, with the biomass of all ungulates in northern Yellowstone stabilizing around 4 million kilograms during the 1980s and 1990s (Geremia and Hamilton 2019). Elk dominated the ungulate guild, with more than 20,000 animals in the 1980s and 1990s. Aspen, cottonwood, and willow were extensively browsed, with little to no recruitment (Wolf et al. 2007). During severe winters in 1989 and 1997, large die-offs of elk suggested they were near a food-limited carrying capacity on the winter range, which included the Blacktail Deer Plateau to Lamar Valley area (Coughenour and Singer 1996; Singer et al. 1997; Taper and Gogan 2002). During the twentieth century, many riparian communities in northern Yellowstone transitioned from a beaver-willow state to an elk-

grassland state and browsing by elk is widely accepted as a primary cause of this transition (Hobbs and Cooper 2013; Peterson et al. 2020).

In addition, nonnative grass species, including Kentucky bluegrass and timothy, were already prevalent in the grassland-dominated sites in the Lamar Valley by the 1930s from cultivating and feeding hay (Rush 1932; Skinner et al. 1942; White et al. 2022c). Between 1904 and 1952, about 575 acres (233 hectares) in the Lamar Valley were cleared of native vegetation and cultivated with nonnative grasses, including oats, smooth brome, clover, dandelion, and timothy, to grow hay in support of bison restoration (figure 8; Rush 1932; Skinner et al. 1942). These cool-season exotics grow best when the weather is moist and cool because they inefficiently use water. Thus, they are well adapted for the cool, wet, nitrogen-rich habitats of the mid- to high-elevations of northern YNP. Moreover, they thrive when grazed and are often more productive than native bunchgrasses (Geremia and Hamilton 2019, 2022). As a result, these cultivars displaced native plants in wet areas across much of northern YNP and now dominate plant communities from Tower Junction to the upper Lamar Valley (Geremia and Hamilton 2019, 2022).



Source: Goodacre (1933)

Figure 8. Map of cultivated hayfields and other vegetation types in the Lamar Valley, 1932-1933

Predation from recovered large carnivores, liberal harvests of antlerless elk migrating into Montana, and food limitations from a 10-year drought decreased large ungulate biomass in northern YNP to between 2 and 3 million kilograms through the 1990s and early 2000s (Vucetich et al. 2005; White and Garrott 2005; Geremia and Hamilton 2019). As a result, elk density and browsing intensity decreased, especially in the areas sampled by Kauffman et al. (2023). Willow heights increased slowly from 2001 to 2016, but growth was especially slow in many areas where water tables were low due to stream channel incision, and willows could not access sufficient groundwater (Beyer et al. 2007; Painter and Ripple 2012). As a result, riparian communities have not recovered to their historical tall distributions (Hobbs and Cooper 2013; Peterson et al. 2020).

Bison numbers increased rapidly in northern YNP after 2005 due, in part, to dispersal of bison from central to northern YNP. The exact causes are unknown but potential contributing factors include: (1) high bison densities, intense grazing in some areas, and severe winters (1997, 2006, 2008) in central YNP that limited forage availability; (2) intense hunting during the 1980s and hazing of bison during the 1990s and 2000s along the western boundary to keep them in the park; (3) roads groomed (packed snow) for over-snow vehicles that facilitated rapid travel by bison to the north during winter; (4) higher wolf densities and predation of bison in central YNP during the early 2000s; and (5) a 50% decrease in numbers of elk spending winter in northern YNP by 2006 and a 75% decrease by 2013 (Becker et al. 2009; Wallen and White 2015; White et al. 2015c; Tallian et al. 2017). As a result, ungulate biomass in northern YNP again increased to near 4 million kilograms (Geremia and Hamilton 2019, 2022).

Unlike elk, which tend to feed in relatively small groups scattered throughout a variety of habitats (McNaughton 1985), bison form large groups during summer and repeatedly re-graze areas, including some of the areas sampled by Kauffman et al. (2023). Herds of many hundreds of bison graze in the Lamar Valley through summer, whereas most elk move through this area to more distant summer ranges (White et al. 2010; Geremia et al. 2015a). Bison are ecosystem engineers that move and graze across the land to intentionally create areas of high grazing, which improves their own food quality (Geremia et al. 2019). They create grazing lawns, like those found in the savanna systems of the Serengeti, with areas of particularly intense, repetitive grazing, which resets plant growth and allows them to continue to eat high-quality foods longer through the summer (Geremia et al. 2019). Research since 2012 indicates the cool-season cultivars in this area have healthy soil, water, and nutrients necessary for them to regrow (Geremia and Hamilton 2019, 2022). Plants do not just regrow from the bitten-off grass tips; they also produce entirely new shoots off the root crown, the part of the plant immediately below the soil surface (Frank et al. 1998). This process of tillering, growing new shoots from the crown, creates the short, dense mats of vegetation (with little stubble/standing crop) that characterize grazing lawns in the Lamar Valley. New, young tillers are high in nutrients and low in indigestible matter. When bison return to bite off the new tillers, they eat the equivalent of newly growing spring vegetation (Geremia and Hamilton 2019, 2022). In contrast, the communities dominated by willow/alder on the Blacktail Deer Plateau are little used by bison during summer, which is likely why Kauffman et al. (2023) found little evidence of herbivory when they conducted their sampling in July. Rather, this area serves primarily as a winter range for bison in northern YNP after the plant growing season has ended (Geremia et al. 2015a).

Based on their July 2020 sampling, Kauffman et al. (2023) concluded high densities of bison in northern YNP are contributing to biotic impoverishment through the loss of ecosystem services provided by native riparian plant communities. As described previously, many riparian communities in northern YNP transitioned from a beaver-willow state to an elk-grassland state during the twentieth century due to elk browsing, well before the substantial increase in bison numbers during the last 15 years. Certainly, abundant bison likely are suppressing the regeneration of some riparian habitat in northern YNP that was extensively degraded by elk herbivory (Ripple et al. 2010; Painter and Ripple 2012; Peterson et al. 2020). However, it also appears the recovery of beaver populations may be necessary to raise the water table for widespread recovery of willows to occur in many areas on the Blacktail Deer Plateau and Lamar Valley (Hobbs and Cooper 2013; Peterson et al. 2020). Some colonization by beavers has occurred, but the elk-grassland state may prevail unless they recolonize a much greater portion of northern YNP (Peterson et al. 2020; Tyers 2020).

Kauffman et al. (2023) suggest current levels of bison may be exacerbating climate change effects by shifting the composition of riparian plant assemblages toward those adapted to warmer and drier conditions and inducing warmer microclimates and lower soil water-holding capacities by removing riparian cover. The climate of northern YNP has warmed and dried significantly since the 1980s, and this trend is forecast to continue (Tercek et al. 2015; Thoma et al. 2015; Hostetler et al. 2021). This warming has already changed the composition and distribution of vegetation and facilitated the spread of winter annuals in many areas, which likely will continue and could preclude a transition of most grasslands back

to a willow-beaver state (Peterson et al. 2020). Warm-season nonnatives, including desert alyssum and cheatgrass, are gradually invading the warm and dry low-elevation range habitat types and have the potential to displace native plants and unbalance the functional integrity of plant communities (Renkin 2022; Wacker 2022). These plants grow in dry soils, where there is intense competition for moisture. Winter annuals can outcompete native plants by sprouting in the fall, with already germinated annuals then monopolizing early spring pulses of water (Renkin 2022; Wacker 2022). The abundance and distribution of winter annuals will likely depend on how much northern YNP warms and dries in the future. Under some climate scenarios, these plants could disrupt plant communities throughout the low- and mid-elevation valley slope habitat types in northern YNP (Geremia and Hamilton 2019, 2022).

Another uncertainty is the long-term effects of the record-breaking flooding events of June 2022 across northern Yellowstone that almost certainly changed the hydrology and vegetation along each stream sampled by Kauffman et al. (2023) in 2020. This flooding was considered a 1-in-500-year event. Northern parts of the park received 2 to 4 inches of rain in a 24-hour period, together with at least 5.5 inches of snow melt. This flood event caused extensive erosion along river corridors, realigned waterways in many places, and deposited extensive sediment (sand, silt) in many previously vegetated areas along river banks and on floodplains (figure 9).

The photograph depicts extensive flooding outside the main channel of the Lamar River, with channel realignment in several places and widespread sediment deposition on previously productive grasslands in the flood plain (National Park Service photograph by Jacob W. Frank).

Figure 9. A portion of the Lamar Valley across from the Buffalo Ranch (background) after the June 12-13, 2022, flooding events

The effects of this sediment deposition on the Lamar Valley floodplain used by the northern breeding herd of Yellowstone bison are still being investigated. In the short term, this sediment deposition may have inhibited grassland production in some areas and contributed somewhat to bison changing their distribution on the landscape. Although grass growth in surrounding areas was good during the relatively

wet summer, by mid-August most bison had moved from the Lamar Valley to other areas, such as Slough Creek, Specimen Ridge, and the Mirror Plateau. Hot summer temperatures and previous experience likely contributed to this behavior. It is common for bison to explore less frequently used, but still productive, areas in late summer and autumn (Geremia et al. 2015a). In the long term, the deposited sediment should provide a substrate for the regrowth of cool-season grasses, forbs, and riparian plants like cottonwoods and willows. However, there also is the potential for the spread of less nutritious, nonnative winter annuals, such as annual wheatgrass, cheatgrass, and desert alyssum, into these disturbed areas, especially if conditions become drier. Recurrent and prolonged drought would lower soil moisture and organic matter, which could support the proliferation of winter annuals, particularly given the high concentration of plant-available nitrogen in the soil (Geremia and Hamilton 2019, 2022). It will take many years of monitoring and research to determine the forthcoming trend and whether a state transition is occurring in the vegetation communities across northern YNP.

Grasslands dominate valleys in northern YNP, and flowering plants, including grasses, grass-like plants, and showy flowers, dominate grassland communities. Flowering plants make up the overwhelming bulk weight of vegetation in these valleys and most of ungulate diets. Elk primarily feed on flowering plants, which make up more than 95% of summer and 75% of winter diets, while woody riparian vegetation makes up less than 1% of summer and about 2% of winter diets. Bison also prefer flowering plants, which make up about 97% of their diets (Geremia et al. 2019, 2022). Monitoring and research from 2015 to 2022 by park biologists and collaborators confirmed soil organic matter was stable; unchanged under year-long grazing exclusion; and within ranges supporting nutrient cycling, water-holding potential, and physical structure. Grazed plant communities maintained primary production compared to year-long grazing exclusion, although one area of the Lamar Valley had a gradual decline in production over time (Geremia and Hamilton 2019, 2022). As described previously, there is substantial uncertainty about the long-term dynamics of these grasslands given climate warming and the potential spread of winter annuals. As a result, this monitoring will continue.

Additional Trends and Planned Actions—The desired condition for grasslands in northern YNP is to try to maintain communities with functional groups of grasses, forbs, and shrubs, healthy soils, and functioning water, energy, and nutrient cycles (Geremia and Hamilton 2019; Yellowstone Center for Resources 2021). Many communities will include widespread nonnative plants due to their previous spread throughout much of YNP. In addition, variable grazing intensities will produce an assortment of vegetation conditions across the landscape ranging from lightly to intensively grazed areas. This mosaic will support a diversity of animals and plants because some need a variety of different areas, while others rely on either disturbed or undisturbed areas (Fuhlendorf et al. 2012; National Research Council 2013).

Present and reasonably foreseeable actions include multiple repairs and replacements to park roads and bridges (see appendix D). As noted previously, three of six of these repair and replacement projects are a result of the June 2012 catastrophic flooding, which caused severe damage and loss of several sections of road and access. Because these projects are repair and replacement of previous infrastructure, most would occur in previously disturbed areas. Mitigation measures and best management practices would be implemented to reduce erosion and soil damage, revegetate, and to prevent the spread of nonnative plants.

In addition to the potential effects of climate warming on vegetation and bison under different scenarios previously discussed in the “Affected Environment” section under “Yellowstone Bison,” warmer temperatures are accelerating the melting of mountain glaciers; reducing snowpack; and changing the timing, temperature, and amount of streamflow. These changes are expected to result in the loss or relocation of native species, altered vegetation patterns, and reduced water availability in some regions. Wildfire seasons have expanded, and fires have increased in severity, frequency, and size. More acres burned in the fire season of 2016 than in any year in the last century, except for 1988. Conditions that favor outbreaks of pests, pathogens, disease, and nonnative species invasion occur more frequently than in the recent past (USDOI, NPS 2023a).

The Intergovernmental Panel on Climate Change predicts that overall forest growth in North America will likely increase 10% to 20% from extended growing seasons and elevated carbon dioxide during the next century but with important spatial and temporal variations. Forests in the Rocky Mountain/Columbia Basin region are expected to have less snow on the ground, a shorter snow season, a longer growing season due to an earlier spring start, earlier peak snowmelt, and about two months of additional drought. Despite a longer growing season, Yellowstone forests will likely be less dense, patchier, and have a more diverse age structure. In fact, experts project less tree cover in much of the park as well as potential migration of new species like Ponderosa pine. Complicating matters, increased drought stress and higher temperatures may increase the likelihood of widespread die-offs of some vegetation.

The integrated runoff response from the Yellowstone River has been toward earlier spring runoff peaks, which suggests most of the park is experiencing shorter winters and longer summers due to snowpack changes. Changes in these seasonal patterns will likely disrupt vegetation growth and development, causing plants to bud, flower, fruit, and die at different times of the year than they do now. Those changes, in turn, would alter or seriously disrupt wildlife migrations, one of the key resources for which YNP is globally treasured (USDOI, NPS 2023b).

Impacts of Alternative 1 (No Action)

Under Alternative 1, current management would continue. As a result, impacts to vegetation would be like those described above in the "Affected Environment" section, which contains a description of the current and expected future conditions of current management.

Impacts of Alternative 2

Under Alternative 2, more bison likely would continue to intensely graze portions of the Lamar and Hayden Valleys during summer, and the Gardiner and Hebgen Basins during winter and spring. Like Alternative 1, intensively grazed areas would still compose a small portion of available summer habitats for bison and other ungulates in YNP. Since 2012, total numbers of bison have ranged between 4,200 and 6,000, with between 2,600 and 4,500 in the northern breeding herd. If overgrazing occurred, there should have been a decreasing trend in bison abundance and palatable plant species (Crawley et al. 2021). To the contrary, numbers of bison in the northern breeding herd remained high, grasses in the Lamar Valley maintained production under intense grazing, and soil organic matter and nutrients in grazed areas varied little from year to year (Geremia and Hamilton 2019, 2022; Geremia 2022). The plant community contains the same native species occurring at the same sites compared to what grew there in the 1980s, although the composition has shifted somewhat (Frank 2022). These findings are indicative of a highly resilient grazing community of interacting plants and ungulates (Crawley et al. 2021). However, intense grazing may occur in more areas if higher numbers of bison remain in the park and the spread and density of nonnative plants in grasslands increases. Impacts to riparian vegetation would be similar to conditions discussed in the Affected Environment section, with bison continuing to have a dominant influence on plant composition in these areas. There would be no additional impacts from disturbance of soil in the Stephens Creek Administrative Area where most operations occur because this area is already denuded of native vegetation.

Impacts of Alternative 3

Many more bison likely would intensely graze portions of the Lamar and Hayden Valleys during summer, and the Gardiner and Hebgen Basins during winter and spring. Intensively grazed areas likely would still compose a small portion of available summer habitats for bison and other ungulates in YNP. However, concerns about overgrazing may increase in some areas if much higher numbers of bison remain in the park. Clipping experiments with nonnative, cool-season grasses found on the Lamar Valley floor indicated the removal of up to 80% of plant material did not reduce production, even though less leaf and stem material remained at the end of summer. In addition, greenhouse studies of the dominant grasses in the Lamar Valley found that they maintained growth while being grazed and transferred resources to root

production during wet years (Geremia and Hamilton 2019, 2022). Thus, these grasslands may withstand somewhat more grazing by bison. However, if management areas in Montana remain the same and the bison population increases to the upper end of the population range as defined by food availability, the risk of overgrazing grasslands in some parts of Lamar and Hayden Valleys, and impacts to riparian vegetation, would be highest compared to other alternatives with increased likelihood of measurable change in plant regrowth, soil productivity, and erosion. In overgrazed areas, changes in plant variety (composition) would be measurable with increased spread and density of nonnative plants in grasslands. There would be no additional impacts from disturbance of soil in the Stephens Creek Administrative Area where most operations occur because this area is already denuded of native vegetation

Cumulative Impacts

The impacts of past, present, and reasonably foreseeable planned actions are included above in the "Affected Environment" section. Present and reasonably foreseeable actions include repairs and replacements to park roads and bridges (appendix D); most of which would occur in previously disturbed areas. The long-term effects of the recent sediment deposition on vegetation will take many years to investigate; therefore, impacts to vegetation are unknown at this time.

Under Alternative 1, current management would continue, and there would be no new direct or indirect impacts beyond those described in the "Affected Environment" section. Overall, impacts including those from past, present, and reasonably foreseeable actions would result in conditions that are the same or similar to those described in the "Affected Environment" section.

Under Alternative 2, the number of bison on the landscape would increase, and biologists would continue to monitor the effects of grazing on the landscape. Vegetation in the Stephens Creek Administrative Area has already been denuded and nonnative plants have infested the area, with no additional impacts associated with Alternative 2. When combined with the impacts from past, present, and reasonably foreseeable planned actions, vegetation would remain in the same or similar condition as described in the "Affected Environment" section.

Alternative 3 would have similar impacts to vegetation as Alternative 2, but to a slightly greater degree because there would be more bison on the landscape. Like Alternative 2, there would be no impact to vegetation at the Stephens Creek Administrative Area because this area has already been denuded and nonnative plants infest this area. When combined with the impacts of past, present, and reasonably foreseeable actions, vegetation would remain in a state that is substantially similar to what is described in the "Affected Environment" section.

Chapter 4: Consultation and Coordination

Scoping is an essential component of the NEPA planning process. The formal scoping process for this draft EIS consisted of public scoping and consultation with federal and state agencies and tribal governments. The formal NEPA process and 30-day public scoping period was initiated on January 28, 2022, with the publication of a Notice of Intent in the *Federal Register* (87 FR 4653). In addition, preliminary information regarding the EIS was provided to the public and other interested parties through a press release and public scoping newsletter. During the public scoping period, the NPS hosted two virtual public meetings on February 9 and 10, 2022.

The NPS received approximately 2,540 public comments during the scoping period. The NPS received additional comments from federal, state, and tribal governments and organizations, as well as several NGOs. Public comments included suggestions for changes to the proposed alternatives presented in the Notice of Intent and new alternatives and alternative elements for consideration. Those suggestions ranged from expanding bison tolerance areas in Montana, protecting bison migration routes, modifying hazing operations within and outside YNP, changing hunting rules, updating brucellosis management, changing the BCTP, modifying bison slaughter and hunter harvest, and combining elements of Alternatives 2 and 3. Comments included information for review such as references to specific reports and data on topics such as hydrology, brucellosis and disease management, bison population dynamics and genetics, socioeconomics, and human health and safety.

Agency consultation is the early involvement of federal and state agencies and tribal governments that may be affected by the federal action. Like the public scoping process, this process allows affected agencies and tribal governments to comment and contribute early to the decision-making process and helps the NPS identify key issues or requirements to be considered in the NEPA process. During development of the draft EIS, NPS conducted agency consultation with the regulatory and consulting agencies described below regarding their recommendations on bison management related to the actions being considered in this EIS.

Section 106 of the NHPA requires that federal agencies consider their effects to historic properties. This process requires agencies to determine whether they have an undertaking that has the potential to cause effects to a historic property. The alternatives were reviewed for their potential to affect historic properties. The implementing regulations for section 106, 36 CFR 800, define an undertaking as, "...a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval" (36 CFR 800.16(y)). The management of bison is an undertaking according to this definition. The no-action alternative would result in the park continuing to manage bison in the same manner as they are currently managed. Both action alternatives consist of using existing facilities and are based on the number and frequency of bison that are trapped or permitted to pass by the capture facility to be hunted by tribes and the state outside the boundary of the park. No new construction or other activities that would have the potential to cause effects to historic properties are part of this plan. Bison do not meet the definition of a historic property at 36 CFR 800.16(l)(1). The alternatives in this plan do not have the potential to cause effects to historic properties per 36 CFR 800.3(a)(1); therefore, no further section 106 review is needed. The NPS will continue to consult with American Indian tribes per other laws, policies, and regulations, given the significance of bison to the tribes. On February 15, 2022, the NPS held a virtual consultation meeting, which was attended by representatives of the Comanche, Nez Perce, and Shoshone-Bannock Tribes of the Fort Hall Reservation Tribes.

Specific comments were received from some cooperating agencies. The Chairman of the Nez Perce Tribal Executive Committee submitted comments to the Superintendent of YNP on March 9, 2022, indicating recognition of treaty rights should be an action common to all alternatives. The Tribe supported adaptive

management and requested inclusion in the development of adaptive components. The Tribe tentatively supported Alternative 3 and asked the NPS to identify actions that would facilitate migration and dispersal of bison from the park and predict short- and long-term migrant numbers. The Tribe requested more information about the carrying capacity models and bison habitat and asked the park to consider climate change and its impacts.

The Chairman of the Fort Hall Business Council for the Shoshone-Bannock Tribes of the Fort Hall Reservation sent a letter dated March 22, 2022, to the Superintendent requesting a meeting to discuss working together to protect and preserve the Tribe's interests and treaty rights. Specific interests included identifying areas of importance for spiritual and cultural activities, creating an inventory of cultural and natural resources used by the tribes, managing resources for treaty rights, gathering of cultural resources, transferring surplus lands to tribes, preserving bison moving from YNP to Aboriginal lands of the tribes, and business and employment opportunities in YNP.

The President of the ITBC provided comments to the NPS on February 28, 2022, requesting an expansion of and adjustments to the BCTP, tribal rights of first refusal for all bison transferred from the park, limitations on APHIS' involvement in the BCTP to its statutory role, an exemption for bison in YNP or on tribal lands from state laws, the NPS develop its own protocols for quarantine with changes to (or elimination of) various phases of the testing program, construction of another quarantine facility on the west side of YNP, an end or substantially decrease of shipments of bison to slaughter, the IBMP tribes operate temporary capture facilities within the northern tolerance area to ensure hunting is not disturbed, the NPS release bison testing positive for brucellosis exposure for tribal hunting opportunities, and the NPS not haze bison within YNP.

The Governor of Montana provided comments to the NPS on February 28, 2022, requesting the NPS withdraw the Notice of Intent and engage in consultation to identify mutually acceptable alternatives, clarify how the NPS's new NEPA efforts will fit with the 2000 NEPA effort (IBMP), and examine and commit to specific population management or disease suppression measures. The Governor indicated Montana's tolerance for bison dispersal in areas around YNP is limited, food-limited carrying capacity was not an acceptable foundation for bison population targets, and a true no-action alternative would reflect the modified preferred alternative described in the 2000 ROD.

Upon publication of the notice of availability of the draft EIS in the *Federal Register*, electronic notification will be provided to the media, federal departments/agencies, state and county governments, elected officials, tribal governments, organizations, businesses, and interested individuals via the NPS mailing list. An electronic copy of the draft EIS will be distributed to US Environmental Protection Agency Region 8.

List of Preparers

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Appendix A: Roles and Responsibilities of Agencies Involved with Bison Management

Under the Interagency Bison Management Plan, the National Park Service (NPS) has lead responsibility for implementing bison management actions inside Yellowstone National Park (YNP). The NPS is charged with preserving park resources unimpaired and in their natural condition for the benefit and enjoyment of people (16 United States Code [USC] 21, 54 USC 100101 et seq.). Bison and other wildlife generally move freely and unpursued within the interior of the park (16 USC 26, USDOI, NPS 2006a). *An Act to Protect the Birds and Animals in Yellowstone National Park, and to Punish Crimes in said Park, and for Other Purposes* passed by Congress in 1894 prohibits hunting and the harassment, possession, or removal of birds and animals from YNP (16 USC 26). However, the Superintendent, through the Secretary of the Interior and Director of the NPS, has the discretion to transfer or dispose of 'surplus' animals (16 USC 36; 54 USC 100101, 100752).

In Montana, the Fish, Wildlife and Parks Commission (MFWP) typically sets policies for the protection, management, and public use of wildlife (Montana Code Annotated [MCA] 87-1-201). However, in 1994 the Montana Legislature assigned the management of Yellowstone bison to the Department of Livestock due to the population's chronic exposure to brucellosis (State of Montana 2000). The Department can remove Yellowstone bison moving into Montana if they jeopardize programs to control livestock diseases (MCA 81-2-120, Montana Attorney General 2016). Pursuant to a plan approved by the Governor, the Department contains bison in areas near YNP and keeps them separate from livestock (Bullock 2015, Legislative Audit Division 2017). MFWP cooperates in this management paradigm, focusing on public hunting and preventing damage to property (MCA 87-1-216, MCA 87-2-730, Montana Attorney General 2016).

The US Forest Service (USFS) manages national forests pursuant to a multiple-use mandate, whereby renewable resources are used to best meet the needs of the American people (16 USC 528, 1604). Forest Supervisors have an obligation to conserve and manage wildlife on national forests and cooperate with states in planning and implementing management actions, including harvests that conform with state laws (36 Code of Federal Regulations [CFR] § 241). Comprehensive forest plans are prepared to sustain wildlife populations and their habitats, with the management of wildlife often primarily conducted by the respective states (16 USC §§ 528, 1604). If necessary, the USFS can preempt or supersede state laws and policy to meet its statutory and trust obligations regarding issues such as public safety and natural resource protection after consultation with the states (43 USC § 1732). In 2022, the Custer Gallatin National Forest adopted a new Land Management Plan. The selected alternative includes components supporting habitat improvement projects to create or connect suitable bison habitat with enough bison present and distributed year-round to provide a self-sustaining population on the national forest in conjunction with bison herds in YNP (USDA, USFS 2022).

The mission of the Animal and Plant Health Inspection Service (APHIS) is to protect the health, quality, and productivity of American agricultural resources. The Secretary of Agriculture establishes regulations to prevent the interstate or international spread of livestock diseases, including the quarantine of animals. Under the Animal Health Protection Act (7 USC § 8301 et seq.), the Veterinary Services section of APHIS administers the National Brucellosis Eradication Program in cooperation with the states. The *Uniform Methods and Rules for Brucellosis Eradication* (USDA, APHIS 2003) describes standards for surveillance, testing, and interstate transport of livestock and domestic bison and contains a protocol for the quarantine of bison from YNP to determine whether animals are brucellosis-free.

American Indian tribes retain Aboriginal rights over lands within their Aboriginal territories and exercise rights reserved by treaties with the US government. Each tribe exists as a sovereign nation with self-governing authority with an emphasis on preservation of cultures and traditional ways of life. Tribal sovereignty is recognized in the US Constitution and protected by US Supreme Court decisions.

The Confederated Salish and Kootenai Tribes of the Flathead Nation have treaty-reserved hunting and fishing rights both on and off the Flathead Reservation pursuant to the Treaty with the Flathead, etc., 12 Statute 975 (Hellgate Treaty of 1855). The Aboriginal territory of the Salish and Kootenai Tribes includes the Yellowstone area, where the Tribal Council has reestablished a wild bison hunt for member hunters. The treaty bison hunt is conducted pursuant to the laws, regulations, and conditions set by the Tribal Council, with enforcement by tribal game wardens and any applicable federal authorities.

The Nez Perce Tribe has treaty-reserved hunting and fishing rights both on and off their Reservation in north-central Idaho pursuant to the Waiilatpu (Walla Walla) Treaty Council of 1855. The Aboriginal territory of the Nez Perce Tribe includes the Yellowstone area, where the Tribal Executive Committee and General Council have reestablished a wild bison hunt for member hunters. The treaty bison hunt is conducted pursuant to the laws, regulations, and conditions set by the Tribal Executive Committee, with enforcement by tribal game wardens and any applicable federal authorities.

The InterTribal Buffalo Council, a federally chartered Indian organization pursuant to the Indian Reorganization Act, comprises approximately 82 member tribes from 20 states. The Council has transferred bison of Yellowstone-origin to at least 23 tribes in at least 12 states to reestablish bison on Indian lands.

Appendix B: Changed Circumstances and New Information

Changed Circumstances

- 2003: The Animal and Plant Health Inspection Service (APHIS) issued the *Uniform Methods and Rules for Brucellosis Eradication* that describes standards for surveillance, testing, and interstate transport of livestock and domestic bison and contains a protocol for the quarantine of bison from Yellowstone National Park (YNP) to determine whether animals are brucellosis-free and can be relocated elsewhere.
- 2004: Montana Fish, Wildlife and Parks (MFWP) prepared a *Final Bison Hunting Environmental Assessment* and *Decision Notice* with concurrence from the Montana Department of Livestock (MDOL; MFWP 2004; MFWP and MDOL 2004).
- 2005: The Interagency Bison Management Plan (IBMP) agencies completed a five-year status review that led to adaptive management adjustments allowing more bison on winter ranges outside YNP to provide opportunities for Montana-licensed hunters (Clarke et al. 2005; Linfield 2005).
- 2005: MFWP established a 90-day public bison hunt between November 15 and February 15 each year on lands adjacent to YNP. These hunts have continued to present.
- 2005: The National Park Service (NPS), US Forest Service (USFS), and Center for Invasive Plant Management convened a group of restoration specialists to develop recommendations for restoring native plant associations to about 1,200 acres (485 hectares) of former agricultural fields in YNP and nearby areas of the Custer Gallatin National Forest. The USFS implemented weed treatments, barley planting, prescribed burning, and native grass seeding in the Beattie Gulch and Cutler Meadow areas until 2013.
- 2006: The IBMP members clarified "a population of 3,000 bison is defined as a population indicator to guide implementation of risk management activities and is not a target for deliberate population adjustment" (IBMP Partner Agencies 2006:1).
- 2006: The IBMP members adjusted the operations plan to increase tolerance for bull bison in Montana because there is negligible risk of them transmitting brucellosis to cattle (Clarke et al. 2005).
- 2006: American Indian tribes asserted their treaty rights to harvest bison migrating from YNP onto unoccupied national forest lands in Montana. These hunts have continued to present.
- 2008: MFWP signed a 30-year livestock grazing restriction and bison access agreement with the owners of the Royal Teton Ranch north of YNP. The NPS provided the federal government's $1.5 million share of the total $3 million cost (MFWP 2008a,b). As a result, there are fewer cattle adjacent to YNP.
- 2008: The NPS initiated native vegetation restoration projects on about 48 acres (19 hectares) between Landslide and Reese Creeks in northern YNP, divided into four fenced plots to exclude ungulates. The NPS removed fencing around 26 acres (10 hectares) during 2019–2021 after successful restoration. Additional restoration projects on more than 75 unfenced acres (30 hectares) are ongoing.
- 2009: IBMP members began trying to reduce shipments of bison to meat processing (slaughter) plants by using alternate tools such as hazing, hunting, and increased tolerance in Montana (IBMP Agencies 2011).
- 2009: Livestock disease regulators implemented calf-hood vaccination of cattle with high compliance in the brucellosis surveillance area in Montana. This vaccination program has continued to present.
- 2009: Two tribes and a tribal organization became involved with the management of Yellowstone bison, including developing an annual operating plan, conducting hunts, relocating brucellosis-

free bison to tribal lands, and distributing meat and other bison resources from culled animals to their members.

- 2010: APHIS changed regulations to deal with brucellosis outbreaks in cattle on a herd-by-herd basis without imposing unnecessary corrective actions and associated economic costs on the rest of the producers in the state (USDA, APHIS 2014). If outbreaks are investigated and contained by removing all cattle testing positive for brucellosis, the entire state or area is not reclassified or subject to corrective actions.
- 2010: The State of Montana established a designated surveillance area for brucellosis defined by occurrence of the disease in elk (MDOL 2011). To prevent brucellosis-infected livestock from being moved into other states, all calves within this area are vaccinated for brucellosis, all cattle are uniquely marked so relocations or sales can be traced, and all reproductive cattle are tested for brucellosis exposure prior to movement elsewhere.
- 2011: A Citizens Working Group on Yellowstone Bison provided recommendations that the IBMP partners largely adopted, including allowing bison more access to habitat and increasing the use of hunting as a management tool.
- 2011: IBMP members adjusted the operations plan to substantially increase spatial and temporal tolerance for bison migrating north and west of YNP during winter (IBMP Agencies 2011, 2012).
- 2011: Actions such as the strategic hazing of bison from conflict areas to suitable habitat and financial aid for fencing from nongovernmental organizations began being implemented to reduce conflicts with landowners and livestock operators.
- 2012: The NPS consulted with the US Fish and Wildlife Service (FWS) on the hazing of Yellowstone bison and its potential effects on threatened grizzly bears. The agencies concluded the infrequent occurrence of people walking or in vehicles, on horseback, or in a helicopter causing a few grizzly bears to run short distances during hazing operations was not likely to adversely affect grizzly bears.
- 2012: The NPS began implementing agreements with a tribal organization and several tribes to provide them with captured bison for shipment directly to meat processing facilities and subsequent distribution of meat, hides, and horns to their members.
- 2013: The Custer Gallatin National Forest issued a permanent shooting closure for a portion of Beattie Gulch between the Yellowstone River to the east, Old Yellowstone Trail South (county road) to the west, YNP to the south, and residential houses to the north.
- 2015: MFWP began requiring successful bison hunters to place unused parts of carcasses at least 200 yards (183 meters) from roads, trails, and homes, and spread stomach contents on the ground to reduce attraction to scavengers.
- 2015: Montana increased tolerance for more bison across a larger management area in the state, including year-round in some areas, especially for bull bison because of their lower risk of brucellosis transmission. The Governor of Montana concluded this decision would not increase transmission risk to cattle or result in trade sanctions by other states or nations (Bullock 2015).
- 2016: The Custer Gallatin National Forest issued an official shooting closure, renewed annually, for a 150-yard (137-meter) buffer extending west from Old Yellowstone Trail South Road in Beattie Gulch where there would be no shooting, carcasses, or gut piles to move shooting and carcasses farther away from property owners.
- 2017: The Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes and Bands of the Yakama Nation, Nez Perce Tribe, and Confederated Salish and Kootenai Tribes of the Flathead Nation signed a memorandum of agreement to maintain regular, predictable, safe, and respectful bison hunts in Beattie Gulch, with common hunt protocols, safety regulations, and enforcement to ensure the safety of hunters, wardens, and the surrounding community.
- 2017: The NPS, APHIS, and MDOL agreed to implement a quarantine program (Bison Conservation Transfer Program; BCTP) to identify brucellosis-free Yellowstone bison and transfer them to the Fort Peck Indian Reservation in northeastern Montana.

- 2018: The Intermountain Regional Director, NPS, issued a decision to conduct quarantine with Yellowstone bison near the Stephens Creek Administrative Area in the northern portion of YNP and on the Fort Peck Indian Reservation. APHIS agreed to continue quarantine operations with Yellowstone bison on leased pastures in Corwin Springs, Montana, north of YNP.
- 2019: A local organization, the Bear Creek Council, worked with the IBMP agencies on recommendations for a safer hunt with fewer impacts to residents in and near Gardiner, Montana. The IBMP agencies discussed concerns with local citizens, reviewed current shooting closures and hunting regulations, and agreed to address these concerns while respecting treaty rights.
- 2019: The Fort Peck tribes agreed to transfer 70% of Yellowstone bison that complete the BCTP to the InterTribal Buffalo Council (ITBC) for restoration on Indian lands elsewhere. The tribes also have an agreement to provide Montana with brucellosis-free Yellowstone bison for restoration on public lands.
- 2019–2023: The NPS and APHIS sent 294 brucellosis-free Yellowstone bison to the Assiniboine and Sioux Tribes at Fort Peck for one year of assurance testing and eventual release.
- 2020–2023: The ITBC transferred more than 170 bison of Yellowstone-origin from the Fort Peck Indian Reservation to 23 tribes across 12 states.
- 2020: The Custer Gallatin National Forest proposed permanent firearm discharge closures on about 23 acres (9 hectares) near Beattie Gulch and the McConnell area north of YNP for safety.
- 2021–2022: The NPS partnered with Yellowstone Forever and the Greater Yellowstone Coalition to double the capacity of the BCTP, increase the number of live brucellosis-free bison transferred to tribes, and lower the number of animals testing negative for brucellosis exposure sent to slaughter.
- 2022: The Custer Gallatin National Forest issued a decision on a new Land Management Plan. The selected alternative includes components supporting habitat improvement projects to create or connect suitable bison habitat with enough bison present and distributed year-round to provide a self-sustaining population on the national forest in conjunction with bison herds in YNP (USDA, USFS 2022).

Improved Knowledge

- 2002: A review of grazing and grasslands by the National Academy of Sciences concluded northern YNP was not overgrazed, and the NPS could continue to allow numbers of ungulates to fluctuate in response to predators, resource limitations, weather, and hunting outside the park (National Research Council 2002).
- 2005: An evaluation of the food-limited carrying capacity for Yellowstone bison and elk predicted there could be more than 8,000 bison with about 5,000 elk, and about 6,200 bison with 20,000 elk (Coughenour 2005). Currently, there are about 7,000 northern Yellowstone elk, 80% of which spend winter outside YNP.
- 2005–2018: The number of bison in the central portion of YNP decreased substantially while the number of bison in northern YNP increased exponentially due, in part, to dispersal of bison from central to northern YNP. The exact causes are unknown but potential contributing factors include: (1) high bison densities, intense grazing in some areas, and severe winters (1997, 2006, 2008) in central YNP that limited forage availability; (2) intense hunting during the 1980s and hazing of bison during the 1990s and 2000s along the western boundary to keep them in the park; (3) roads groomed (packed snow) for over-snow vehicles that facilitated rapid travel by bison to the north during winter; (4) higher wolf densities and selection of bison in central YNP during the early 2000s; and (5) a 50% decrease in numbers of elk spending winter in northern YNP by 2006 and a 75% decrease by 2013.
- 2007–2015: Biologists reported significant changes in bison movement patterns and distribution, with more bison migrating and dispersing to the northern portion of YNP (Fuller et al. 2007a; Bruggeman et al. 2009; Geremia et al. 2011, 2014, 2015a).

- 2007: Research indicated females with brucellosis had lower pregnancy rates across all ages than unexposed bison. Exposure to brucellosis lowered survival because the NPS and Montana culled these bison when they attempted to leave YNP due to concerns about transmission to cattle (Fuller et al. 2007b; Geremia et al. 2009).
- 2007: Geneticists found Yellowstone bison retained high levels of diversity despite a severe reduction in numbers (bottleneck) in the late 1800s when colonists almost extirpated bison. Yellowstone is the only wild population with an effective size high enough to avoid inbreeding depression and to maintain genetic variation (Halbert and Derr 2007, 2008; Hedrick 2009).
- 2009: An evaluation by NPS biologists suggested maintaining a bison population that varies on a decadal scale between 2,500 and 4,500 animals should satisfy collective long-term interests 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 (Plumb et al. 2009).
- 2009: Evidence emerged that elk play a predominant role in the transmission of brucellosis to cattle, and the risk of transmission from bison to cattle is minute in comparison (Bienen and Tabor 2006; Beja-Pereira et al. 2009; Kilpatrick et al. 2009; Schumaker et al. 2010, 2013; Higgins et al. 2012; Rhyan et al. 2013b; Kamath et al. 2016; Brennan et al. 2017).
- 2010: Evidence accumulated that brucellosis is maintained independently in elk, increasing in prevalence, and spreading through the Greater Yellowstone Area (GYA; Cross et al. 2010; Kamath et al. 2016; O'Brien et al. 2017).
- 2010: Biologists estimated the timing and location of bison parturition events that may shed tissues infected by *Brucella abortus* and concluded the risk of brucellosis transmission to cattle in Montana should not increase due to separation (Jones et al. 2010). *Brucella* bacteria placed on fetal tissues, soil, and vegetation persisted for 21 to 81 days depending on ambient temperatures and exposure to sunlight (Aune et al. 2012).
- 2010: Biologists analyzed conditions facilitating contact between bison and elk on a shared winter range in YNP and found levels of elk exposure to *Brucella abortus* (2% to 4%) similar to those in other elk populations that did not commingle with bison (Proffitt et al. 2010).
- 2010: A five-year quarantine feasibility study successfully concluded, with the surviving bison and their offspring being declared brucellosis-free (Clarke et al. 2014). Montana relocated 87 bison completing quarantine to the Green Ranch in Montana in 2010 and sent another 61 bison to the Fort Peck Indian Reservation in 2012, for five years of assurance testing (MFWP 2011). In 2014, Montana sent the original quarantined bison plus 25% of the offspring (139 total) at the Green Ranch to the Fort Peck tribes (MFWP 2014).
- 2010: Researchers used individual-based epidemiological models to assess the relative efficacies of various vaccination strategies, sterilization, and test-and-removal for reducing brucellosis prevalence in Yellowstone bison (Treanor et al. 2010; Ebinger et al. 2011).
- 2011: Studies indicated many older bison testing positive for brucellosis exposure may be resistant to the disease if re-exposed and not infectious (Treanor et al. 2011).
- 2011: A technical committee for the IBMP completed an assessment of suitable bison habitat in the Gardiner and Hebgen Basins and explored new areas where there could be increased tolerance for bison to accommodate additional hunting opportunities.
- 2011: Analyses indicated shipments of large numbers of bison to slaughter could affect demographic (reproduction, survival) rates and genetic diversity if removals result in large variations in numbers, skewed sex ratios, or different influences on bison in the central or northern breeding herds (White et al. 2011; Halbert et al. 2012).
- 2012: Monitoring of radio collars detected substantial movements and breeding (gene flow) between bison originating from central and northern portions of YNP in recent decades, making Yellowstone bison a single intermixing population (White and Wallen 2012; Wallen and White 2015; Forgacs et al. 2016).

- 2012: A population viability analysis indicated Yellowstone bison should retain existing genetic diversity for centuries with total abundance averaging at least 3,000 to 3,500 bison (Pérez-Figueroa et al. 2012).
- 2012: APHIS began a six-year study of the effectiveness of the vaccine GonaCon™ at preventing gonadotropin-releasing hormone from initiating follicle growth and ovulation in Yellowstone bison—thereby resulting in infertility and preventing the shedding of brucellosis bacteria in infected bison.
- 2013: A technical committee for the IBMP evaluated ways to distribute bison migrating north of YNP to prevent conflicts with private property owners, increase opportunities for bison to occupy portions of the Gardiner Basin, and provide additional hunting opportunities.
- 2013: The NPS discussed the applicability and feasibility of using fertility control as an ungulate management tool. A review of pertinent scientific information with presentations by experts in fertility control technologies, wildlife population modeling, and moral and ethical considerations preceded the discussion (Powers and Moresco 2015).
- 2013: Experimental studies suggested bull bison likely are not brucellosis transmission vectors (Frey et al. 2013; Uhrig et al. 2013).
- 2013: Geneticists investigated natural resistance to brucellosis in Yellowstone bison by attempting to identify resistant and susceptible genotypes using the prion protein gene but failed to find a significant association with bison testing positive for *Brucella* exposure (Herman 2013).
- 2013: Brucellosis experts from around the world contributed articles to *Brucellosis: Recent Developments Towards 'One Health*' by the World Organization for Animal Health to support finding practical and effective solutions for addressing brucellosis at local, regional, and global levels (Plumb 2013).
- 2013: Several evaluations concluded that the substantial suppression of brucellosis through vaccination would be extremely difficult with existing vaccines and delivery technologies (USDOI, NPS and MFWP 2013; White et al. 2013b; USDOI, NPS 2014b).
- 2014: Geneticists found quarantined bison had genetic diversity similar to the overall population, resulting in low risk of genetic loss in relatively small populations (50 to 100 animals) started from bison completing the BCTP (Herman et al. 2014).
- 2015: Researchers assessed the effects of brucellosis on the Yellowstone bison population and used five-year forecasting to evaluate the ability of different actions, such as test-and-slaughter and vaccination, to meet management goals relative to taking no action (Hobbs et al. 2015).
- 2015: Social scientists conducted interviews with residents from the Gardiner and West Yellowstone, Montana, communities to understand their attitudes toward migratory wildlife, including bison, and their experiences living near migratory wildlife (Metcalf et al. 2016).
- 2015: NPS biologists and colleagues published a book entitled *Yellowstone Bison—Conserving an American Icon in Modern Society* with chapters summarizing existing information about brucellosis, seasonal distributions, reproduction and survival, nutritional ecology, ecological role, adaptive capabilities and genetics, cultural importance, and management (White et al. 2015c).
- 2016: Genetic data indicated elk infected cattle herds with brucellosis in the GYA, not bison. Elk exposed to brucellosis inhabited an area encompassing about 17 million acres (6.9 million hectares), whereas bison inhabited 1.5 million acres (607,000 hectares) near the core. Control measures in bison would not affect the dynamics of unrelated strains in elk elsewhere (Kamath et al. 2016).
- 2016: Genetic analyses indicated Yellowstone bison consist of two independent lineages in about equal proportions, representing the native bison remaining in central Yellowstone by 1900 and the bison introduced into northern and central portions of YNP from the Pablo-Allard herd in the early 1900s (Forgacs et al. 2016).
- 2017 and 2020: The National Academies of Sciences, Engineering, and Medicine concluded infected elk had transmitted brucellosis to livestock in the GYA at least 27 times since 1998 with

no transmissions attributed to bison. The Committee recommended prioritizing efforts on preventing brucellosis transmission by elk, while maintaining separation between bison and cattle. The Committee recommended not using aggressive control measures on bison until tools became available for an eradication program in elk.

- 2018: The NPS and APHIS completed assessments of the risk of transferring bison completing quarantine to the Fort Peck Indian Reservation for one additional year of assurance testing and subsequent release.
- 2018: Historians evaluated thousands of first-hand accounts of animals in the Yellowstone area during the 1800s, including before settlement by colonists. Some accounts described plentiful and widespread bison making long-distance seasonal movements from high-elevation summer ranges to lower-elevation winter ranges (Whittlesey et al. 2018; Whittlesey and Bone 2020).
- 2022: Geneticists at Texas A&M University published findings indicating all North American bison have some level of cattle introgression, including Yellowstone bison (Stroupe et al. 2022).
- 2022: The NPS and APHIS assessed existing data from quarantine and assurance testing to see if the testing timelines could be shortened while still maintaining negligible risk of not detecting an infected bison (USDA, APHIS 2022; Springer Browne et al. 2023).
- 2023: Biologists have monitored the effects of bison grazing on grasslands in YNP since 2012. Bison created grazing lawns of dense, short-statured plants in some areas through intense and repeated grazing. This grazing strategy sustained highly nutritious food through summer by prolonging new plant growth and stimulating nutrient cycling and water-holding potential. The deposition of feces and urine into the soil released plants from nitrogen limitation, and precipitation became the primary factor influencing plant growth (Geremia and Hamilton 2019, 2022; Geremia et al. 2019).
- 2023: A time-to-event model developed by the NPS and APHIS based on data from quarantine predicted 99.9% of bison with brucellosis would seroconvert (test positive) by 294 days. Only 1 in 1,000 bison with brucellosis bacteria would not be detected by 300 days, and fewer than 4 in 10,000 bison would not be detected by 330 days. The results were similar for males and females and suggest regulators could reduce testing timelines to allow animals to complete quarantine within one year with negligible risk of brucellosis transmission (Springer Browne et al. 2023).

The IBMP agencies addressed these changed circumstances and new information through adaptive management adjustments and environmental compliance evaluations described at http://ibmp.info/adaptivemgmt.php and in other sections of this document.

Appendix C: Issues and Impact Topics Not Carried Forward for Detailed Analysis

Introduction

The National Park Service (NPS) did not analyze the following topics in this environmental impact statement (EIS) due to a lack of potential significant impacts to resources and values (Council of Environmental Quality [CEQ], 40 Code of Federal Regulations [CFR] Parts 1500-1508; NPS Director's Order 12).

Environmental Justice

Executive Order 12898, *General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires federal agencies to identify and address disproportionately high and adverse health or environmental effects of their programs and policies on minorities and low-income communities. Federal agencies must also follow rules set under the Environmental Justice Guidance released by the Environmental Protection Agency in 1998. The bison management alternatives in this environmental impact statement may impact American Indian tribes. Detailed information and an impact analysis are included in the "American Indian Tribes and Ethnographic Resources and Human Health and Safety" sections of chapter 3 of the EIS. None of the alternatives proposed in this document would have negative health or environmental effects on other minority or low-income communities.

Archeological Resources

The 1998 *Cultural Resource Management Guidelines* for the NPS define archeological resources as the remains of past human activity and records documenting the scientific analysis of these remains. None of the alternatives proposed for the management of Yellowstone bison would affect archeological resources. Personnel with the NPS have inventoried areas where bison capture, processing, and quarantine facilities are located and avoided archeological resources.

Historic Structures

The 1998 *Cultural Resource Management Guidelines* for the NPS define historic structures as "material assemblies extending the limits of human capability." There are hundreds of historic structures within Yellowstone National Park (YNP), but none of the proposed management alternatives would affect them. The NPS has used a small cabin (Historic Structure-0101) in the Stephens Creek Administrative Area of YNP for storing equipment and testing blood samples from bison, but this structure is not eligible for the National Register of Historic Places. In 2008, the University of Montana inventoried cultural resources in the area impacted by the bison capture, processing, and quarantine facilities in and near the Stephens Creek Administrative Area. They did not find any historic properties impacted by operations. In addition, NPS staff did not find any potential negative effects to historic properties from bison behavior such as rubbing on buildings or modifications to the bison capture and processing facilities in 2015.

Cultural Landscapes

The 1998 *Cultural Resource Management Guidelines* for the NPS define cultural landscapes as settings people have created in the natural world. During the 1920s and 1930s, a private corporation called the Game Preservation Company bought land west and north of Gardiner, Montana, and operated the Game Ranch. Staff irrigated agricultural fields near the Stephens Creek Administrative Area using water from springs and creeks to grow hay to feed elk and pronghorn. Congress included the Game Ranch in YNP in 1932 and, afterward, the NPS used lands in and near the Stephens Creek Administrative Area for a nursery, horse corral operations, equipment storage, log building, a firing range, bison capture and quarantine facilities, and native plant restoration efforts. In 2006, the NPS completed a cultural landscape inventory and identified the Game Ranch Cultural Landscape. This area is a functioning ranch and is

eligible for listing in the National Register of Historic Places as a historic district. The bison capture, processing, and quarantine facilities are outside the Game Ranch Cultural Landscape. Based on previous consultations for the construction of bison quarantine facilities, the NPS and Montana State Historic Preservation Office consider these activities and facilities a historically compatible land use because they convey the area's association with ranching and the conservation of wildlife.

Trust Resources

Trust resources include land, water, minerals, timber, or other natural resources held in trust by the US government for the benefit of a tribe or individual tribal member. Some tribes have asserted bison in YNP are a trust resource that the federal government must manage for their benefit. These tribes contend the federal government must consult with tribes with recognized treaty rights for hunting bison before removing them to slaughter, research, or quarantine facilities. Such removals affect the numbers of bison moving outside YNP where tribal hunters could harvest them. In the 2000 final EIS for the Interagency Bison Management Plan (IBMP) and the Record of Decision, the NPS indicated bison are important to many tribes but not defined as a trust resource in a formal, legal, property-based manner that would trigger a federal responsibility (USDOI and USDA 2000a; USDOI and USDA 2000b). The NPS has not managed Yellowstone bison as a trust resource for one or more specific tribes. Instead, it has collaborated with numerous tribes through agreements and other avenues to benefit their interests as described in the following paragraphs (USDOI, NPS 2016c).

The NPS has a unique relationship with tribes, which is founded in law and strengthened by a shared commitment to stewardship of the land and resources. The NPS will honor its legal responsibilities to these tribes as required by the US Constitution, treaties, statutes, and court decisions. The formal legal rationale for the relationship between the NPS and tribes is augmented by the historical, cultural, and spiritual relationships that tribes have with park lands and resources. The NPS *Management Policies 2006*, section 1.11, indicate "[a]s the ancestral homelands of many tribes, parks protect resources, sites, and vistas that are highly significant for the tribes. Therefore, the Service will pursue an open, collaborative relationship with tribes to help tribes maintain their cultural and spiritual practices and enhance the Park Service's understanding of the history and significance of sites and resources in the parks. Within the constraints of legal authority and its duty to protect park resources, the Service will work with tribal governments to provide access to park resources and places that are essential for the continuation of traditional American Indian cultural or religious practices."

Under the IBMP, the NPS and other federal and state members have taken the following actions to benefit the tribes:

- Recognized tribal rights to conduct hunts of bison migrating from YNP onto national forest lands in Montana pursuant to treaties with the federal government;
- Involved tribes as partners in the management of Yellowstone bison, including the development of adaptive management and annual operating plans;
- Adjusted the IBMP to substantially increase spatial and temporal tolerance for bison migrating north and west of YNP, in part, to facilitate tribal hunts and access a traditional resource;
- Provided tribes with captured bison for shipment to meat processing facilities and subsequent distribution of meat, hides, and other resources to their members;
- Coordinated with tribes that hunt bison on National Forest System lands adjacent to the park to reduce the effects of capture operations on hunting opportunities;
- Implemented and expanded a Bison Conservation Transfer Program (BCTP; quarantine) to identify brucellosis-free bison and transfer them to tribes for restoration on Indian lands; and
- Implemented lower-stress handling techniques to reduce trauma to captured bison.

The NPS will continue to integrate consideration of tribal treaty and reserved rights early into decision-making and regulatory processes to ensure agency actions are consistent with constitutional, treaty,

reserved, and statutory rights (Advisory Council on Historic Preservation et al. 2021). In addition, the NPS will implement the *Joint Secretarial Order on Fulfilling the Trust Responsibility to Indian Tribes in the Stewardship of Federal Lands and Waters* to ensure all decisions relating to federal stewardship of lands, waters, and wildlife under its jurisdiction include consideration of how to safeguard the interests of any tribes such decisions may affect (USDOI and USDA 2021). NPS officials will work directly with appropriate tribal government officials whenever plans or activities may directly or indirectly affect tribal interests, practices, and/or traditional use areas such as sacred sites. The NPS would ensure tribal governments play an integral role in decision-making related to the management of federal lands and waters by engaging them in meaningful consultation at the earliest phases of planning, considering their expertise and Indigenous Knowledge, and giving due consideration to tribal recommendations on the management of public lands.

Geology and Topography

Congress established YNP, in part, to protect natural wonders such as its geologic formations. Bison management actions would have negligible effects on the surface topography or underlying geology of YNP.

Natural Soundscapes

The NPS must protect, maintain, or restore natural sounds in areas affected by inappropriate or excessive noise sources (Director's Order 47). Soundscapes are inherent components of the scenery and natural historic objects protected by the NPS Organic Act. Occasional use of aircraft, such as helicopters and planes, and vehicles, such as trucks , is necessary for bison management both in and outside the park. Any vehicle use would be limited to front-country areas, where visitor automobile traffic on park roadways is the predominant source of human-caused sounds. Therefore, bison management in YNP would have no measurable effect on soundscapes in the park and would therefore have no related effects on other wildlife and threatened and endangered species. However, the sound of gunfire may be audible to visitors traveling on Old Yellowstone Trail South Road and Highway 89. This impact is analyzed in the "Visitor Use and Experience" section of chapter 3 of the EIS.

Paleontological Resources

Bison management activities in YNP would not disturb any known paleontological resources and would involve minimal ground disturbance. Thus, impacts to paleontological resources from these activities would be negligible.

Floodplains and Wetlands

Executive Orders 11988, *Floodplain Management*, and 11990, *Protection of Wetlands*, require federal agencies to examine the potential effects of critical actions on floodplains and wetlands. Few bison management activities occur within or adjacent to floodplains or wetlands, and there is minimal disturbance where they occur. The alternatives in this EIS do not propose construction of bison management facilities in or adjacent to wetlands. As a result, these impacts would not constitute critical actions as defined in the NPS floodplain management guides. Some riparian communities in the northern portion of YNP changed to grasslands during the 1900s due, in large part, to intense browsing by more than 19,000 elk (Hobbs and Cooper 2013). Elk counts have decreased by about 70% since 1994, and riparian communities are recovering in several areas; though browsing by abundant bison is suppressing recruitment in some areas (Painter and Ripple 2012; Painter et al. 2015). These effects are evaluated under "Vegetation" in chapter 3 of the EIS.

Aquatic Resources

Most management activities with bison in YNP take place in and near the Stephens Creek Administrative Area in the Gardiner Basin, where the bison capture facility and quarantine pastures. The Yellowstone River flows through the Gardiner Basin about 0.8 miles (1.3 kilometers) northeast of the bison capture

facility and quarantine pastures. At this point, the river is about 200 feet (61 meters) lower in elevation than the facilities. The primary native fish in this river are mountain whitefish and Yellowstone cutthroat trout, as well as nonnative brown trout and rainbow trout. Stephens Creek is a tributary of the Yellowstone River and flows by the bison capture facility about 0.4 miles (0.6 kilometer) to the southeast. Historically, this creek provided water for a residence (Rife House) and irrigation ditches in and near the Stephens Creek Administrative Area. This practice ceased sometime between 1984 and 1996, and the irrigation ditches are no longer functional. There are no fish in the creek.

Reese Creek is a tributary of the Yellowstone River that constitutes a portion of the boundary of YNP about 1.5 miles (2.4 kilometers) northwest of the bison capture facility in the Stephens Creek Administrative Area. Historically, managers diverted some water from this creek into irrigation ditches in and near the Stephens Creek Administrative Area, but these ditches are no longer functional. Fish from the Yellowstone River move into the lower reaches of this creek. Existing water rights claims historically made Reese Creek an over-appropriated stream, where demand at times exceeded available water due to private irrigation demands adjacent to YNP. In 2018, an agreement for the lease of water rights from Reese Creek between Trout Unlimited, Inc. and a landowner near the park was reached to maintain instream flows through the year while supporting irrigation through a new diversion intake structure and pipeline (Trout Unlimited 2018).

Water for people, livestock (horses, mules), captured or quarantined bison, nursery operations, and landscaping in and near the Stephens Creek Administrative Area comes from Wilson Springs, which is located approximately 0.3-miles (0.5-kilometers) west in the Sepulcher Mountain foothills. There are no plans to make irrigation ditches operational or divert water from the Yellowstone River or Reese or Stephens Creeks for bison management. Thus, the alternatives in this document would have negligible impacts on aquatic resources.

Prime and Unique Farmlands

In 1980, the CEQ directed federal agencies to assess the effects of their actions on farmland soils classified by the US Department of Agriculture's Natural Resources Conservation Service as prime or unique. Prime farmland has the best combination of physical and chemical characteristics for producing food, feed, fiber, and oilseed crops. Unique farmland is land other than prime farmland used for production of specific high-value food and fiber crops. Lands affected by the proposed alternatives for bison management activities do not meet these criteria.

Energy Requirements and Conservation Potential

Implementing the proposed bison management alternatives would involve using some machinery and motorized vehicles but not a substantial use of national energy resources.

Natural or Depletable Resource Requirements and Conservation Potential

None of the bison management alternatives would deplete natural resources. Bison in YNP have hundreds of calves each spring that can replenish numbers removed during captures, harvests, and natural mortality—including the removal of more than 1,000 bison during several winters and more than 13,000 bison since 1985. Large aggregations of bison repeatedly and intensively graze vegetation at some sites through the summer, which tends to create lawns of dense, short-statured plants. This grazing strategy sustains highly nutritious food by prolonging and intensifying new plant growth but reduces the amount of plant material available at the end of the growing season. Repeated grazing by large groups of bison generally has positive effects on plant growth by increasing the availability of nutrients such as nitrogen and improving water-holding potential, which supports higher grass growth through summer (Geremia and Hamilton 2019, 2022; Geremia et al. 2019). These effects are evaluated under "Yellowstone Bison" in chapter 3 of the EIS.

Possible Conflicts with Land Use Plans, Policies, or Controls

Facilities for bison capture, processing, and quarantine already exist in YNP and nearby areas of Montana, and they do not restrict the movements of other animals. The capture and confinement of bison conflicts with the NPS's biological principle of minimizing disturbances by people (USDOI, NPS 2006a), but the NPS sometimes reduces bison numbers because of limited tolerance for them in surrounding states. On adjacent US Forest Service (USFS) lands in Montana, the Custer Gallatin National Forest Land Management Plan (2022) is the overarching plan that provides broad goals for land use, management areas, and wildlife management, including bison. For lands under the jurisdiction of Montana, the 2015 *Year-Round Habitat for Yellowstone Bison Environmental Assessment* is the overarching land use and management document related to bison. This plan defines the geographic extent of bison tolerance in the Gardiner and Hebgen Basins, which are located within the Designated Surveillance Area for brucellosis. Environmental consequences and the comparative analysis between alternatives are based on the existing management areas and land use as defined in the USFS and Montana plans. The NPS would continue to sustain a viable population of wild, wide-ranging Yellowstone bison. The potential impacts of bison on cattle and people through brucellosis transmission, injuries, or property damage are discussed in chapter 3 of the EIS.

Air Quality

The 2006 *Management Policies* and 2010 *Climate Change Response Strategy* for the NPS encourage park managers to engage partners and use the best available science to inform planning and the implementation of cooperative solutions. However, the NPS is not responsible for adverse impacts such as emissions from sources outside YNP over which it has no control. Bison management requires the occasional use of machinery, aircraft, and vehicles, such as staff driving vehicles to the Stephens Creek Administrative Area, operating facilities, and pens; truck use for transporting bison; and fixed-wing flights for bison surveys. Because these activities are limited in number, and a tiny fraction of machinery and vehicle use in the park, they would have no measurable effect on emissions in the park.

Wilderness

The Wilderness Act of 1964 established the National Wilderness Preservation System, which defines wilderness as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain … an area of undeveloped Federal Land retaining its primeval character and influence … which is protected and managed so as to preserve its natural conditions" (16 US Code [USC] 1131, et seq.). In 1972, the Secretary of the Interior recommended to the president of the United States that 91% of YNP (2 million acres; 809,370 hectares) be designated as wilderness. This proposal was submitted to Congress for approval in 1978, but Congress has yet to act on this recommendation. Per NPS Management Policies, recommended wilderness is managed as wilderness to protect wilderness resources and values. As a result, the area proposed for wilderness designation in YNP is managed "for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness" (16 USC 1131 section 2[a]). The Stephens Creek Administrative Area, where management activities with bison currently occur, is not inside the park's recommended wilderness. Road corridors and adjacent lands in the Hayden and Lamar Valleys are not included in wilderness. Some counts and classifications of bison may be conducted in wilderness and have ephemeral, insignificant effects on wilderness character.

Appendix D: Ongoing and Reasonably Foreseeable Actions

Proposed Yellowstone Park Road Reconstruction and Maintenance in Park and Teton Counties, Wyoming (2008-2028)—This plan describes the process of reconstructing, repairing, and maintaining paved and gravel roads and bridges to promote human safety and visitor enjoyment in Yellowstone National Park (YNP). Park roads were not designed to handle the weight, size, number of vehicles, and the longer seasonal periods of use that began in the latter part of the twentieth century. The poor quality sub-base materials drain poorly and retain moisture, resulting in severely rutted, cracked, and pot-holed roads. Moisture contributed to accelerated erosion, pavement failure, and heaving during the spring thaw. Erosive, high-water events have affected road stability along some segments. The project is reconstructing, overlaying, and repairing primary and secondary park roads and bridges and maintaining and repairing gravel and unimproved park roads. Primary roads include the Grand Loop and the entrance roads; secondary roads are all other paved roads.

Yellowstone River Bridge Replacement (2020)—This project would replace the Yellowstone River Bridge located on the Northeast Entrance Road in YNP. The selected alternative will replace the existing Yellowstone River Bridge (605 feet long) with a new bridge (1,175 feet long) on a new alignment approximately 500 feet south of the existing bridge. Just over 1 mile of the Northeast Entrance Road will be shifted several hundred feet south of its existing alignment on either side of the bridge to line up with the new bridge. Traffic will be carried on the existing bridge while the new bridge and road is under construction. Once construction is complete, the existing Yellowstone River Bridge, and approximately 1.5 miles of the existing Northeast Entrance Road will be removed. Temporary work bridges will be constructed adjacent to the alignment of the new and existing bridges to facilitate their construction and deconstruction. These work bridges will be removed prior to completion of the project. Construction is anticipated to last three years with most construction occurring during the months of April-November (starting as early as 2023), though no restrictions on winter work will occur if weather allows. In addition to replacing the bridge, the project would reconfigure and expand the Yellowstone River picnic area, improve turnouts for vehicles along the road, and reduce traffic hazards to visitors when feasible to do so.

Emergency Activities for Improvements to the Old Gardiner Road Project (2022)—Following the June 2022 flooding, this project initially consisted of widening the 5.26-mile Old Gardiner Road to two lanes and paving the road to accommodate year-round access. Additional improvements to the Old Gardiner Road (now called the Temporary North Entrance Road) were proposed and executed in autumn 2022. These additional improvements included flattening of dangerous curves and a slight realignment of approximately 1 mile of the southernmost end of the road (as it approaches Mammoth Hot Springs). The paved surface was intended to provide a durable, plowable, all-season driving surface for the duration of the use of the road as temporary access. The curve widening/flattening and realignment near Mammoth allows for safer vehicle travel during winter months and use by oversized vehicles (or vehicles pulling trailers) year-round. The lifespan of the Old Gardiner Road as temporary access is anticipated to be 5 to 10 years, while the permanent North Entrance Road is reconstructed. The road was surfaced with crushed aggregate and paved to ensure durability and increase ease/safety of plowing for daily/regular use by passenger vehicles and some oversized service vehicles during all months of the year. There will continue to be certain vehicle size restrictions for the road, and traffic volume will be less than what was normally present on the North Entrance Road due to the width and slope of the Old Gardiner Road, even after improvements.

Emergency Activities for Improvements to the Northeast Entrance Road (2022)— Following the June 2022 flooding, this project consisted of emergency activities to temporarily repair damaged sections of the Northeast Entrance Road to reestablish vehicular access between Silver Gate and Cooke City, Montana, and Mammoth Hot Springs, Wyoming, resulting from the 2022 flooding. Work will be done in two phases, autumn of 2022 and summer of 2023. The proposed repairs will provide vehicular access along this route for the next 5 to 10 years and will be in use until the entirety of the Northeast Entrance Road is

permanently reconstructed. The first phase of repairs were completed in autumn 2022 to provide a plowable, all-season road for essential services, and reestablished resident, employee, and visitor access.

Permanent North Entrance Road Reconstruction (TBD)—The North Entrance Road requires reconstruction after catastrophic flooding in June 2022 caused severe damage and loss of several sections of the road. This project is in the early planning stages, but construction/reconstruction work on a permanent road connecting the North Entrance (Gardiner, Montana) and Mammoth Hot Springs, Wyoming, is anticipated to begin as early as 2025. The Temporary North Entrance Road (see above) was constructed to reestablish vehicular access between these locations for a period of approximately 5 to 10 years and was not intended to serve as a long-term access route. A permanent road will need to be established and completed before the end of the life cycle of the temporary road to ensure safe year-round access for employees, visitors, and residents of the area. The permanent North Entrance Road alignment will be designed to minimize or avoid impacts to natural and cultural resources, and design will incorporate climate resiliency measures to protect the infrastructure from future extreme weather events (such as floods, wildfire, earthquakes). As the project is in the early stages of planning, proposed alignment and design alternatives are in the process of being developed. Potential alignments may use and improve portions of the existing road infrastructure.

Appendix E: Revisiting Brucellosis in the Greater Yellowstone Area, National Academies of Sciences, Engineering, and Medicine Recommendations

The following recommendation are excerpted from the 2020 Revisiting Brucellosis in the Greater Yellowstone Area publication from the National Academies of Sciences, Engineering and Medicine, pages 2–9.

Recommendation 1: To address brucellosis in the GYA, federal and state agencies should prioritize efforts on preventing *B. abortus* transmission by elk. Modeling should be used to characterize and quantify the risk of disease transmission and spread from and among elk, which requires an understanding of the spatial and temporal processes involved in the epidemiology of the disease and economic impacts across the GYA. Models should include modern, statistically rigorous estimates of uncertainty.

Recommendation 2: In making timely and data-based decisions for reducing the risk of *B. abortus* transmission from elk, federal and state agencies should use an *active* adaptive management approach that would include iterative hypothesis testing and mandated periodic scientific assessments. Management actions should include multiple, complementary strategies over a long period of time and should set goals demonstrating incremental progress toward reducing the risk of transmission from and among elk.

Recommendation 3: Use of supplemental feedgrounds should be gradually reduced. A strategic, stepwise, and science-based approach should be undertaken by state and federal land managers to ensure that robust experimental and control data are generated to analyze and evaluate the impacts of feedground reductions and incremental closure on elk health and populations, risk of transmission to cattle, and brucellosis prevalence.

Recommendation 4: Agencies involved in implementing the IBMP should continue to maintain a separation of bison from cattle when bison are outside YNP boundaries.

> Removal of bison for population management purposes could target B. abortus-infected individuals if further reducing the prevalence of brucellosis is a goal; however, until tools become available that would simultaneously allow for an eradication program in elk, additional aggressive control measures in bison seem unwarranted.

Recommendation 5: In response to an increased risk of brucellosis transmission and spread beyond the GYA, USDA-APHIS should take the following measures:

> 5A: Work with appropriate wildlife agencies to establish an elk wildlife surveillance program that uses a modeling framework to optimize sampling effort and incorporates multiple sources of uncertainty in observation and biological processes.
>
> 5B: Establish uniform, risk-based standards for expanding the DSA boundaries in response to finding seropositive wildlife. The use of multiple concentric DSA zones with, for example, different surveillance, herd management, biosecurity, testing, and/or movement requirements should be considered based on differing levels of risk, similar to current disease outbreak response approaches.
>
> 5C: Revise the national brucellosis surveillance plan to include and focus on slaughter and market surveillance streams for cattle in and around the GYA.

Recommendation 6: All federal, state, and tribal agencies with jurisdiction in wildlife management and in cattle and domestic bison disease control should work in a coordinated, transparent manner to address brucellosis in multiple areas and across multiple jurisdictions. Effectiveness is dependent on political will, a respected leader who can guide the process with goals, timelines, measured outcomes, and a sufficient budget for quantifiable success. Therefore, participation of leadership at the highest federal (Secretary)

and state (Governor) levels—for initiating and coordinating agency and stakeholder discussions and actions and in sharing information—is critical.

Recommendation 7: The research community should address the knowledge and data gaps that impede progress in managing or reducing risk of *B. abortus* transmission to cattle and domestic bison from wildlife.

7A: Top priority should be placed on research to better understand brucellosis disease ecology and epidemiology in elk and bison, as such information would be vital in informing management decisions.

7B: To inform elk management decisions, high priority should be given to studies that would provide a better understanding of economic risks and benefits.

7C: Studies and assessments should be conducted to better understand the drivers of land use change and their effects on B. abortus transmission risk.

7D: Priority should be given to developing assays for more accurate detection of B. abortus-infected elk, optimally in a format capable of being performed pen-side to provide reliable rapid results in the field.

7E: Research should be conducted to better understand the infection biology of B. abortus.

7F: To aid in the development of an efficacious vaccine for elk, studies should be conducted to understand elk functional genomics regulating immunity to B. abortus.

7G: The research community should (1) develop an improved brucellosis vaccine for cattle and bison to protect against infection as well as abortion, and (2) develop a vaccine and vaccine delivery system for elk.