National Park Service
U.S. Department of the Interior

Yellowstone National Park
Idaho, Montana, Wyoming

The Use of Quarantine to Identify Brucellosis-free Yellowstone Bison for Relocation Elsewhere

Environmental Assessment

January 14, 2016

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Summary

Yellowstone bison (*Bison bison* or *Bos bison*) were infected with the nonnative disease brucellosis by cattle or wild elk in the early 1900s. This bacterial disease causes abortions and can be transmitted back to cattle and elk if they contact infectious tissues. If cattle become infected there are economic costs from killing infected animals, additional testing requirements, and possibly, restrictions on interstate and international trade. The distribution of Yellowstone bison has been limited to Yellowstone National Park and portions of adjacent winter ranges in Montana and their dispersal or relocation elsewhere has been precluded primarily because of concerns regarding brucellosis transmission to cattle; though competition with cattle for grass, human safety, and property damage are also issues.

Many scientists consider Yellowstone bison to be the only ecologically and genetically viable population of plains bison within their original range in North America. To preserve the species, there is a need to establish additional wild, wide-ranging populations that are subject to forces of natural selection. Yellowstone bison are a valuable source population for restoration efforts because they represent a unique genetic lineage, have high genetic diversity compared to many other populations, are one of only a few bison populations with no evidence of interbreeding with cattle, have adaptive capabilities honed by natural selection factors such as competition for food and mates, predation, and survival under substantial environmental extremes, and have special significance to many Native American Tribes as the last living link to the indigenous herds of bison which once roamed across North America.

Yellowstone bison are managed pursuant to the Interagency Bison Management Plan, as adjusted, which was signed in December 2000 by the Secretaries of Agriculture and Interior and the Governor of Montana. Under this plan, numbers of Yellowstone bison are supposed to be managed towards an end-of-winter guideline of 3,000 animals. The bison population is prolific, however, with high reproduction and survival. As a result, the harvest and culling of bison is necessary to decrease abundance toward this guideline. Currently, many culled bison are shipped to meat processing facilities; a practice which managers would like to curtail.

The National Park Service is developing a plan to consider a quarantine program for Yellowstone bison at one or more new quarantine facilities, which could be located within Yellowstone National Park, on tribal lands, or elsewhere. The purpose of quarantine would be to (1) augment or establish new conservation and cultural herds of plains bison, (2) enhance the culture and nutrition of Native Americans, (3) conserve a viable, wild population of Yellowstone bison, (4) maintain the low risk of brucellosis transmission from bison to cattle, and (5) reduce the shipment of Yellowstone bison to meat processing facilities.

A decision regarding whether to implement quarantine is needed because:

- The Interagency Bison Management Plan indicated additional analyses of quarantine processes and facilities would be conducted if the agencies later determined quarantine was a desirable component of the bison management program.
- The National Park Service would like to reduce the number of Yellowstone bison shipped to meat processing facilities under current management.
- A recently completed quarantine feasibility study conducted with Yellowstone bison demonstrated that bison repeatedly testing negative for brucellosis exposure through pregnancy and calving could be considered brucellosis-free.
- The Secretary of the Interior directed the National Park Service to explore options for quarantine for Yellowstone bison.

This Environmental Assessment includes both programmatic and site-specific analyses, consistent with guidance issued by the Council on Environmental Quality in 2014. The evaluation of a quarantine program is conducted at a broad, programmatic level of detail and the evaluation of potential quarantine locations is conducted at a site-specific level of detail for two sites. If an alternative is selected under which the National Park Service would implement a quarantine program, the site-specific analyses of two quarantine locations would allow the agency to implement quarantine at one of those locations without additional National Environmental Policy Act review.

The preferred alternative is to establish a quarantine program for Yellowstone bison and send bison testing negative for brucellosis exposure to the facility on the Fort Peck Reservation for further testing pursuant to the criteria and best practices described herein. This alternative would cause minimal damage to the environment, while conserving and enhancing cultural and natural resources. The risk of brucellosis transmission from bison to livestock, people, or other wildlife would be negligible.

Public Comment

If you wish to comment on the Environmental Assessment, you may post comments online at http://parkplanning.nps.gov/BisonQuarantine, hand-deliver during normal business hours to the mailroom in the Park's Administration Building, or mail comments to: Quarantine Relocation Program for Yellowstone Bison, P.O. Box 168, Yellowstone National Park, Wyoming 82190. This Environmental Assessment will be on public review for 30 days. All comments must be received by February 15, 2016. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware your entire comment – including your personal identifying information – may be made 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. Comments will not be accepted by fax, e-mail, 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.

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Purpose and Need

The National Park Service (NPS) is developing a plan to consider a quarantine program for Yellowstone bison at one or more new quarantine facilities, which could be located within Yellowstone National Park (YNP), on tribal lands, or elsewhere. The purpose of quarantine would be to (1) augment or establish new conservation and cultural herds of plains bison, (2) enhance the culture and nutrition of Native Americans, (3) conserve a viable, wild population of Yellowstone bison, (4) maintain the low risk of brucellosis transmission from bison to cattle, and (5) reduce the shipment of Yellowstone bison to meat processing facilities.

A decision regarding whether to implement quarantine is needed because:

- The Interagency Bison Management Plan (IBMP) indicated additional analyses of quarantine processes and facilities would be conducted if the agencies later determined quarantine was a desirable component of the bison management program (U.S. Department of the Interior [USDI], NPS and U.S. Department of Agriculture [USDA], U.S. Forest Service [USFS] and Animal and Plant Health Inspection Service [APHIS] 2000a,b).
- The NPS would like to reduce the number of Yellowstone bison shipped to meat processing facilities under current management (IBMP Agencies 2014).
- A recently completed quarantine feasibility study conducted with Yellowstone bison demonstrated that bison repeatedly testing negative for brucellosis exposure through pregnancy and calving could be considered brucellosis-free (Clarke et al. 2014).
- The Secretary of the Interior directed the NPS to explore options for quarantine for Yellowstone bison (Salazar 2012).

During 2014, there were numerous requests to receive Yellowstone bison, which suggests there is sufficient demand for at least several decades to justify the consideration of a quarantine program. Also, 27 locations managed by the Bureau of Land Management, NPS, and Fish & Wildlife Service (USFWS) were identified as potentially suitable for bison restoration (USDI 2014). In addition, leaders of 11 tribes from Montana and Alberta, Canada signed an alliance to restore bison to areas of the Rocky Mountains and Great Plains (Associated Press 2014).

The purposes of this Environmental Assessment are to determine whether the NPS should establish a quarantine program for Yellowstone bison, and evaluate potential locations to quarantine bison. As a result, this Environmental Assessment includes both programmatic and site-specific analyses, consistent with guidance issued by the Council on Environmental Quality (2014). The evaluation of a quarantine program is conducted at a broad, programmatic level of detail and the evaluation of potential quarantine locations is conducted at a site-specific level of detail for two sites. If an alternative is selected under which the NPS would implement a quarantine program, the site-specific analyses of two quarantine locations would allow the agency to implement quarantine at one of those locations without additional National Environmental Policy Act (NEPA) review.

There is another ongoing planning process to complete an Environmental Impact Statement on the future management of Yellowstone bison (USDI, NPS 2015a; see http://parkplanning.nps.gov/projectHome.cfm?parkID=111&projectID=50877). The quarantine

alternatives evaluated in this Environmental Assessment could be implemented under the existing authority and management of the IBMP before the Environmental Impact Statement on future bison management is completed. Such implementation would not preclude the consideration of alternatives for the future management of Yellowstone bison during the new planning process, which is expected to take several years and may include additional discussions of whether to use quarantine. If a decision is reached to implement a new bison management plan, any new information or changed circumstances regarding quarantine would be updated in that document and associated evaluations.

Background

Introduction

Tens of millions of plains bison (also known as buffalo) once ranged across western North America (Shaw 1995).[1] A few hundred survived commercial hunting and slaughter during the middle to late 1800s, with YNP providing refuge to about 23 wild and free-ranging animals (Meagher 1973). This near eradication led to efforts to save the species by a few individuals, the American Bison Society, the Bronx Zoo, the federal government, and Native American tribes (Plumb and Sucec 2006). Bison numbers increased after protection from hunting and poaching due to husbandry and the reintroduction of bison to various locations (Cahalane 1944, Coder 1975). Today, about 400,000 plains bison live in conservation, cultural, and commercial herds across North America (Freese et al. 2007, Hedrick 2009).[2]

Despite this success, fewer than 20,000 bison are in conservation herds and fewer than 7,500 bison have no genes from inter-breeding with cattle (Freese et al. 2007). Instead, most bison are contained in small fenced pastures, where they are protected from predators and raised for meat production (McDonald 2001, Lott 2002, Gates et al. 2010, Bailey 2013). As a result, wild bison no longer have a prevalent influence on most western landscapes through transferring nutrients, converting grass to animal tissue, competing with other grazers, and providing sustenance for predators, scavengers, and decomposers (Knapp et al. 1999, Lott 2002, Freese et al. 2007, Sanderson et al. 2008, Bailey 2013).

The largest conservation population of plains bison lives in and near YNP. These bison are one of the only populations whose ancestors continuously occupied portions of their current distribution (Franke 2005, Plumb et al. 2009, Bailey 2013). Yellowstone bison move across a vast landscape where they are exposed to natural selection[3] through competition for food and breeding opportunities, predation, and survival under challenging environmental conditions (Plumb et al. 2009, Wallen and White 2015). As a result, they have adaptive capabilities that are potentially reduced in bison managed like livestock in fenced pastures, with no predators and the removal of older bulls to simplify management (McDonald 2001, Lott 2002, Franke 2005, White

[1] The information in this section is from *Yellowstone bison—Conserving an American icon in modern society* (White et al. 2015b,d).

[2] Conservation herds are established to promote wildness, genetic integrity, and ecosystem processes, while cultural herds primarily contribute communal, educational, nutritional, and spiritual benefits. Commercial herds are raised primarily to earn profits or recoup costs, though there may also be conservation and cultural benefits.

[3] A a glossary of terms related to bison, brucellosis, and wildlife management can be found in the book *Yellowstone bison—Conserving an American icon in modern society*, which is available to download at http://www.nps.gov/yell/learn/nature/bisonrefs.htm.

and Wallen 2012, Bailey 2013). Many scientists consider Yellowstone bison to be the only ecologically and genetically viable population of plains bison within their original range (Freese et al. 2007, Sanderson et al. 2008, Hedrick 2009, Gates et al. 2010).

Given this, there is a need to establish additional wild, wide-ranging populations of plains bison elsewhere in North America to preserve the species and its adaptive capabilities across suitable portions of its historic range (Freese et al. 2007, Sanderson et al. 2008, Gates et al. 2010). A 2014 telephone survey of 500 registered voters in Montana indicated they strongly supported managing bison as wildlife similar to other ungulates, restoring wild bison populations on public and tribal lands, and relocating bison from YNP to start new populations in the state (Tulchin Research 2015). Yellowstone bison are considered a valuable source population because they have high genetic diversity compared to many other populations of plains bison and are one of only a few bison populations with no evidence of interbreeding with cattle (Halbert and Derr 2007, Hedrick 2009, Derr and Dobson 2012, Herman et al. 2014). Also, Yellowstone bison have special significance to many Native American tribes because they are the last living link to the indigenous herds of bison which once roamed across North America and provided sustenance to them for centuries (Plumb and Sucec 2006, Wallen et al. 2015b). As a result, there is substantial interest in obtaining Yellowstone bison for conservation and cultural purposes.

Brucellosis

Yellowstone bison were infected with brucellosis by domestic cattle or wild elk (*Cervus elaphus*) in the early 1900s (Meagher and Meyer 1994; M. Meagher, personal communication).[4] This nonnative disease is caused by the bacteria *Brucella abortus*, which can induce abortions and be transmitted back to cattle and elk if they contact infectious birthing tissues (Cheville et al. 1998). Brucellosis concerns livestock producers because there are economic costs from killing infected cattle, additional testing requirements and, possibly, restrictions on interstate transport and international trade if cattle become infected (Plumb et al. 2009, Bidwell 2010, U.S. Animal Health Association 2012). These concerns have substantially influenced the management of bison and constrained their conservation and distribution across the Greater Yellowstone Ecosystem (GYE) and elsewhere (Keiter and Froelicher 1993, Bidwell 2010).

To diagnose brucellosis infection with a high level of certainty, it is necessary to kill animals and attempt to culture the bacteria from milk, lymphatic tissues, uterine discharges, and fetal tissues (Cheville et al. 1998). Alternatively, serology is used to detect antibodies circulating in the blood which indicate past exposure to *Brucella* bacteria. However, a positive serology test (i.e., 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 (Rhyan et al. 2009, Treanor et al. 2011).

Cattle in the United States were declared free of brucellosis by 1991, but the disease was subsequently detected in more than 20 cattle or domestic bison herds in the GYE during 2002 to 2015 (U.S. Animal Health Association 2012, Rhyan et al. 2013). These outbreaks were traced to wild elk using epidemiology and genetic tests, and apparently occurred due to increases in

[4] The information in this section is from *Yellowstone bison—Conserving an American icon in modern society* (White et al. 2015a).

brucellosis prevalence in elk and more frequent contacts between elk and cattle on winter ranges (Cross et al. 2010, 2013; U.S. Animal Health Association 2012, Rhyan et al. 2013). To date, no cases of brucellosis transmission from Yellowstone bison to cattle have been detected, likely because intensive management successfully limits bison mingling with cattle. Also, most bison calving occurs in April and May, which is before cattle are released on summer ranges (Kilpatrick et al. 2009, Jones et al. 2010, Rhyan et al. 2013, Schumaker 2013).

Interagency Bison Management Plan

Yellowstone bison are managed differently than other wildlife migrating or dispersing outside YNP because the Secretaries of Agriculture and Interior and the Governor of Montana signed a court-mediated agreement (IBMP) in 2000 with guidelines limiting bison abundance and distribution in Montana (USDI, NPS and USDA, USFS and APHIS 2000a,b).[5] This plan was generated because bison began to migrate during winter towards areas occupied by cattle in Montana as their numbers increased during the 1970s to the mid-1990s (Meagher 1989, Meagher et al. 2002). Idaho and Wyoming were not included in the plan because few Yellowstone bison currently migrate from YNP into these states.

The NPS, APHIS, USFS, Montana Department of Livestock (MDOL), and Montana Fish, Wildlife & Parks (MFWP) were originally responsible for implementing the IBMP. In 2009, the Confederated Salish and Kootenai Tribes of the Flathead Nation and the Nez Perce Tribe became involved due to their treaty hunting rights for bison on open and unclaimed federal lands in southwestern Montana. Also, the InterTribal Buffalo Council became involved due to their mission of restoring bison to tribal lands. The Shoshone-Bannock Tribes and the Confederated Tribes of the Umatilla Reservation have recognized treaty rights to harvest bison in southwestern Montana, but do not regularly participate in IBMP discussions and management operations.

The IBMP was primarily designed to ensure brucellosis was not transmitted from bison to cattle, while conserving about 3,000 bison and attempting to reduce the prevalence of brucellosis in bison through test-and-slaughter and vaccination (USDI, NPS and USDA, USFS, APHIS 2000a). The federal, state, and tribal agencies involved with the IBMP have conducted an assortment of management and monitoring activities to work towards these objectives. Details regarding the current implementation of the IBMP can be found in the annual operations plan (IBMP Members 2014), which is available at <http://ibmp.info>.

Yellowstone National Park includes a large amount of habitat used by bison, but many of the lower-elevation winter ranges needed by these animals when deep snow limits access to forage at higher elevations are outside the park (Plumb et al. 2009, White et al. 2013b, 2015c). Yellowstone bison have high reproductive and survival rates for a wild population living with numerous predators and in challenging environmental conditions (Geremia et al. 2015a,b). Thus, the abundance and distribution of bison increase rapidly when conditions are favorable, with bison eventually attempting to migrate into areas (e.g., Paradise Valley in Montana) occupied by many hundreds of cattle. Because some of these bison are infected with brucellosis, there is a need to prevent them from mingling with cattle.

[5] The information in this section is from *Yellowstone bison—Conserving an American icon in modern society* (White et al. 2015c).

When bison cross the boundary of YNP their management is determined by the surrounding states, in collaboration with the USFS on National Forest System lands (16 USC [United States Code] 1604). The state of Montana has allowed many hundreds of bison to migrate onto suitable winter ranges, but mass migrations have, at times, upset state regulatory agencies, local governments, and private landowners and cattle operators (MFWP and MDOL 2012, IBMP Agencies 2014). Since bison are prolific and tolerance for them in Montana is limited, the harvesting and culling of many bison is necessary in some winters to limit their abundance and distribution (White et al. 2015d). Hunting in YNP is prohibited by Congress (16 USC 26) and total harvest outside the park in Montana has only exceeded 300 bison (322) in one winter (2013-2014) due to logistical and social constraints (White et al. 2015d). As a result, in some years some bison are captured near the park boundary and removed from the population via shipment to research or meat processing facilities (IBMP Members 2014, Geremia et al. 2015a).

The shipment of bison to meat processing facilities is not favored by the NPS and is unpopular with many members of the public, some of whom have brought legal challenges to various aspects of implementation of the IBMP. Also, there have been requests to relocate these bison instead of killing them. However, livestock regulatory authorities consider exposed or untested Yellowstone bison a factor increasing the overall risk of brucellosis transmission to livestock (Keiter and Froelicher 1993, Bidwell 2010, Clarke et al. 2014).

Designated Surveillance Area for Brucellosis

The APHIS changed brucellosis regulations in 2010 to allow livestock producers in the GYE to eliminate outbreaks in cattle on a case-by-case basis, without imposing unnecessary corrective actions and associated economic costs on the rest of the producers in the state (USDA, APHIS 2010, 2014).[6] A "brucellosis-free" classification allows producers to export cattle to other states or nations without testing (Keiter and Froelicher 1993, Bidwell 2010). Historically, this classification was removed for the entire state if brucellosis was detected in two or more herds within a 2-year period or a single herd exposed to brucellosis was not depopulated within 60 days. This reclassification had significant adverse economic consequences on producers state-wide (USDA, APHIS 2010, 2014). Today, as long as outbreaks are investigated and contained by removing all cattle testing positive for brucellosis exposure, the entire state or area is not reclassified or subject to corrective actions (USDA, APHIS 2010, 2014). In fact, brucellosis transmission from wild elk to livestock herds in Idaho, Montana, and Wyoming occurred numerous times during 2009 through 2015, without any state-wide corrective actions being implemented (U.S. Animal Health Association 2012, Rhyan et al. 2013, MDOL 2014).

In response to these regulatory changes, the Departments of Livestock in Idaho, Montana, and Wyoming designated surveillance areas where elk populations chronically infected with *Brucella* bacteria could potentially transmit brucellosis to livestock (Barton 2013, Logan and Correll 2013, Zaluski 2013). The combined Designated Surveillance Area (DSA) covers approximately 30,954 square miles (80,170 square kilometers) in eastern Idaho, southwest Montana, and western Wyoming (Figure 1). 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

[6] The information in this section is from *Yellowstone bison—Conserving an American icon in modern society* (White et al. 2015a).

exposure prior to movement elsewhere. Producers within the DSA are reimbursed for testing costs, with no unnecessary testing elsewhere (Barton 2013, Logan and Correll 2013, Zaluski 2013). These measures provide a net annual benefit of at least $5.5 million to producers in Montana (MDOL 2013).

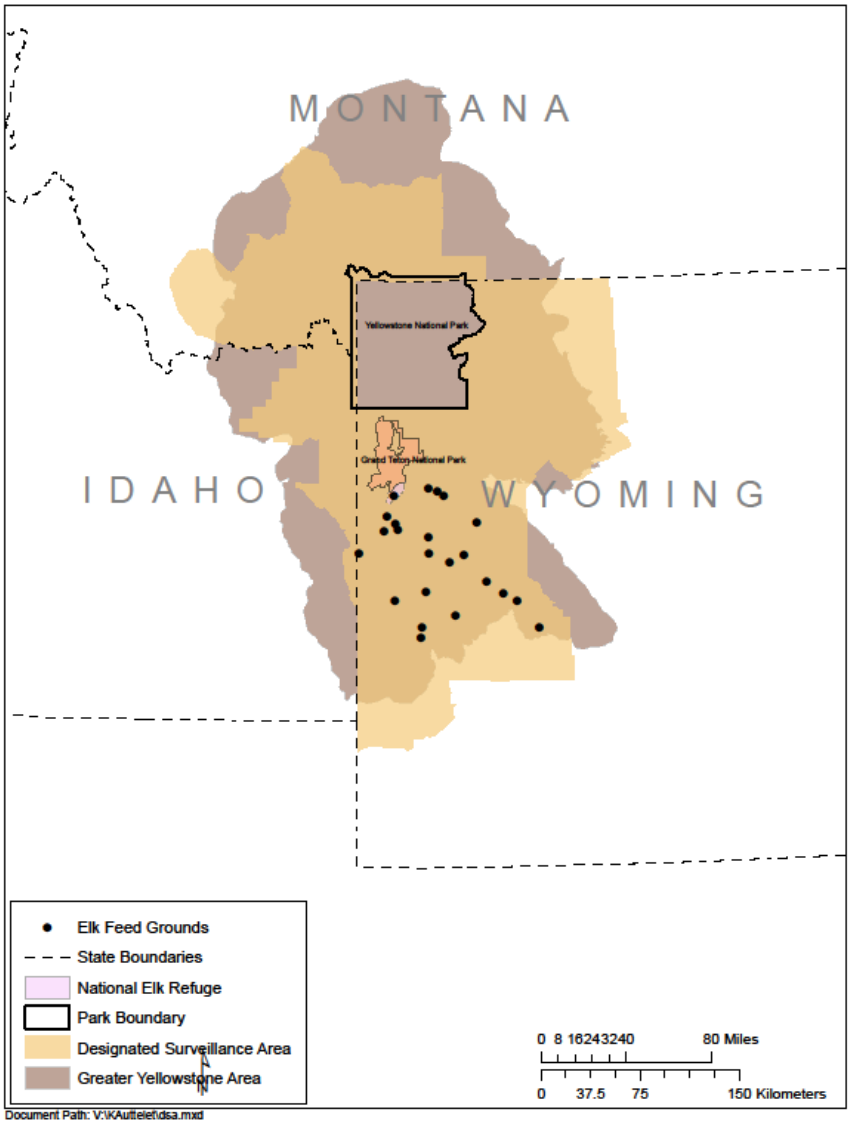

Figure 1. The Designated Surveillance Area for brucellosis in portions of Idaho, Montana, and Wyoming (adapted from White et al. 2015a).

Quarantine Feasibility Study

The MFWP and USDA, APHIS (2006) conducted a quarantine feasibility study in Corwin Springs, Montana during 2006 through 2010 with 214 bison calves from YNP initially testing negative for brucellosis exposure. All of these bison were held at a research facility north of YNP and tested repeatedly to evaluate if they would remain free of brucellosis through at least their first pregnancy and calving. The testing protocol followed the framework described in the

USDA, APHIS (2003) brucellosis eradication uniform methods and rules (Clarke et al. 2014). Blood was collected from bison every 30 to 45 days for serological and culture tests for evidence of *Brucella abortus* bacteria. Bison testing positive for *Brucella* antibodies or bacterial infection were killed until all remaining bison had undergone two consecutive tests with negative results.

Thirty-six of the 214 bison converted from test-negative to test-positive for brucellosis exposure during quarantine. Eighty-five percent of these conversions occurred within 120 days and none occurred after 205 days (7 months; Clarke et al. 2014). About one-half of the remaining test-negative bison were killed and their tissues were cultured for *Brucella* bacteria to confirm there was no latent infection. *Brucella abortus* was not cultured from tissue samples taken from these 88 bison (Clarke et al. 2014). The remaining bison were bred and their blood was tested at least twice per year during pregnancy. Also, these females and their 67 calves (solitary births; no twins) were tested immediately after calving and 6 months later for evidence of *Brucella* antibodies and bacteria. None of these females or their calves tested positive for brucellosis exposure or latent infection (Clarke et al. 2014).

As a result, the quarantine feasibility study was deemed successful and the surviving original bison and their offspring were considered brucellosis free by APHIS and the state of Montana (MFWP 2011, 2014; Clarke et al. 2014). In February 2010, 87 bison were transferred from the quarantine feasibility study to the Green Ranch in Montana owned by Turner Enterprises, Inc. for five years of additional surveillance. Another 61 bison from the study were transferred to the Fort Peck Reservation in Montana during March 2012 for five more years of surveillance (MFWP 2011). In November 2014, the original quarantine bison plus 25 percent of the offspring (139 total) at the Green Ranch were transferred to the Fort Peck Reservation (MFWP 2014).

Following the completion of the quarantine feasibility study, the APHIS and MDOL leased the facilities and pastures until 2017 for research on fertility control with bison (USDA, APHIS 2012). Thus, there is currently no operational quarantine facility for Yellowstone bison.

Previous Environmental Analyses of the Relocation of Yellowstone Bison

In 2011 and 2014, MFWP released environmental assessments regarding the relocation of Yellowstone bison completing quarantine, pursuant to the Montana Environmental Policy Act [MEPA] (75-1-102(1-3), Montana Code Annotated, 2001). These assessments described the affected environment and predicted environmental consequences of confining bison at the Fort Peck Reservation. They also described the effects of releasing brucellosis-free Yellowstone bison from quarantine onto the Fort Peck Reservation (MFWP 2011, 2014). MFWP concluded potential impacts to the environment would be minimal or neutral (i.e., no change) because these locations have been grazed for decades and already have the infrastructure to contain, support, and handle bison. In addition, bison at Fort Peck would be managed well below the capacity of the range to support them. We have reviewed these documents, found that they comply with relevant provisions of the Council of Environmental Quality regulations, cited the original assessments herein, and ensured public involvement requirements have been met. Therefore, pursuant to 43 CFR [Code of Federal Regulations] 46.320, we have incorporated portions of these environmental assessments into this document by reference. Where these documents are cited, we provide a brief summary of the relevant content or conclusions and a website where the documents can be accessed.

In March 2015, the Bureau of Indian Affairs released a Decision Record and Finding of No Significant Impact for a *Programmatic Environmental Assessment for Fort Peck Agricultural Leasing* (USDI, Bureau of Indian Affairs 2015; see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). Under this plan, the Assiniboine and Sioux Tribes at Fort Peck will conduct leasing, permitting, and agricultural improvements on more than 1.1 million acres of tribal and allotted (trust) lands, with oversight from the Bureau. The decision included expanding the tribes' two wild bison herds (business/commercial and cultural/conservation) on the Reservation from 2015 through 2025. The cultural/conservation herd consists of Yellowstone bison from the quarantine feasibility study and their descendants that were brought to the Reservation due to their cultural and spiritual significance, to benefit the tribes economically, and to restore a native wildlife species. The Bureau concluded conducting the proposed action would not result in significant adverse environmental impacts. The project would increase income to the tribes and private landowners, not adversely affect listed or candidate species, or result in significant impacts to cultural/historical resources or waters of the United States. We have reviewed this document, found it complies with relevant provisions of the Council of Environmental Quality regulations, determined that it adequately assesses the environmental effects of the proposed action, and referenced the original assessment herein. Therefore, pursuant to 43 CFR 46.120, we have incorporated portions of that environmental assessment into this document by reference. Where this document is cited, we provide a brief summary of the relevant content or conclusions and a website where the document can be accessed.

In June 2015, Montana Fish, Wildlife & Parks released a draft Environmental Impact Statement regarding bison conservation and management in Montana (MFWP 2015; see http://fwp.mt.gov/fishAndWildlife/publicComments/2015/draftEisBisonConservAndMgmtInMT_draftEIS.html). The purpose of this programmatic document is to determine if bison restoration is appropriate, but no specific potential locations are mentioned or analyzed. Instead, the document generally describes programmatic alternatives on public, private, and tribal lands and gives case studies of populations managed under similar scenarios in other states and provinces. The decision resulting from this evaluation will not identify a site within Montana where bison restoration will occur, but could identify potential opportunities and guidelines for restoration. A site-specific Environmental Assessment will be developed to evaluate potential impacts if there is a decision to move forward with some restoration alternative.

Authorities, Policies, and Regulations

The legal framework for the NPS decision resulting from this Environmental Assessment is defined by, among other things, the enabling legislation for YNP and NPS policy. The alternatives in this Environmental Assessment were intended to comply with all legislative requirements and policy directives.

The YNP Protection Act of 1872 protected about 2.2 million acres (890,300 hectares) in what would later become the states of Idaho, Montana, and Wyoming as a public park for the benefit and enjoyment of people (16 USC 21 *et seq*.). The park preserves most of the world's geysers

and hot springs, historic buildings and sites that reveal the unique heritage of the first national park, and the core of one of the largest temperate ecosystems in the world (USDI, NPS 2014b).

The NPS Organic Act (54 USC 100101(a)) directs the Secretary of the Interior and the NPS to "to conserve the scenery, natural and historic objects, and wild life in the [units of the National Park System] and to provide for the enjoyment of the scenery, natural and historic objects, and wild life in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." The NPS must conduct its actions in a manner ensuring no "derogation of the values and purposes for which the System units have been established, except as directly and specifically provided by Congress" (54 USC 100101(b)).

Management policies for the NPS (2006a) provide direction regarding decision-making in the administration of the NPS and its programs. Areas of policy applicable to this planning effort include animal population management, protection of native animals, and removal of nonnative species already present (e.g., *Brucella abortus* bacteria). Park managers are directed to minimize human impacts on native animals and plants, and whenever possible, rely on natural processes to influence fluctuations in the population sizes of these species (NPS 2006a). Managers are also directed to prevent the introduction of nonnative species (which could include some bacterial diseases) and develop plans to manage these species where they are established (NPS 2006a).

Director's Orders provide specific instructions, requirements, or standards applicable to NPS functions, programs, and activities, as well as delegate authority and assign responsibilities. Director's Order #12 (Conservation Planning, Environmental Impact Analysis and Decision-making) and its implementing handbook (NPS 2011, 2015) direct the planning process under NEPA. Natural Resource Management Reference Manual #77 offers comprehensive guidance to NPS employees responsible for managing, conserving, and protecting the natural resources found in National Park System units.

The NPS is obligated to consult with tribes on a government-to-government basis based on the U.S. Constitution and Federal treaties, statutes, executive orders (e.g., Executive Order 13175 *Consultation and Coordination with Indian Tribal Governments*), and other applicable Secretarial orders or policies, as described in the *Department of the Interior Policy on Consultation with Indian Tribes* (USDI 2012).

As mentioned previously, the culling of some Yellowstone bison is necessary at times to limit their abundance and distribution until greater tolerance is achieved in surrounding states. The following authorities provide the Secretary of the Interior with broad discretion to transfer these bison or otherwise dispose of them: 54 USC 100101 *et seq*.; 54 USC 100752; and 16 USC 36.

Scoping

Scoping is conducted to determine the range of issues to be addressed and identify significant issues related to the proposed action (40 CFR 1501.7). Internal scoping was conducted with appropriate staff at YNP during an interdisciplinary planning team meeting on August 14, 2014. Attendees discussed the purposes and need for action, project objectives, issues and impact

topics, stakeholders and other interested parties, public participation, project coordination and communication, and the project schedule.

External scoping was initiated on June 5, 2014, when letters were mailed to various federal and state agencies, 26 associated tribes and InterTribal Buffalo Council, local governments, and local news organizations. The letters provided information on the scope, purposes and need, description of the proposed action, and process for providing comments, including dates and times for public meetings. Scoping postcards with similar information were mailed on July 29, 2014, to groups, individuals, and organizations that have expressed interest in past projects involving Yellowstone bison and related cultural and natural resources.

A 45-day scoping period was initiated on July 30, 2014, with a press release from YNP's public information office announcing the quarantine planning process and the dates and locations for public meetings. The press release included instructions on how to submit comments at public meetings, by mail, at the park's headquarters, or through an automated comment form on the project website (http://parkplanning.nps.gov/BisonQuarantine). On August 14, 2014, the scoping meetings and notice were also posted as an event on the park's facebook page (https://www.facebook.com/YellowstoneNPS). In addition, scoping information was posted on the NPS' Planning, Environment, and Public Comment (PEPC) site.

The NPS conducted public scoping meetings in Gardiner, Montana on August 18, 2014, and Bozeman, Montana on August 19, 2014. About 35 individuals attended these open-house format meetings, engaged in discussion with park staff, and provided comments. The scoping period ended on September 12, 2014. During the 45-day scoping period, a total of 572 comments were received from 301 individuals and stakeholder groups. Environmental issues and concerns identified during scoping are listed in Appendix A, with the corresponding impact topic or location in this Environmental Assessment where the topic is analyzed further.

Impact Topics Retained for Further Analysis

Impact topics represent park resources and values that could be affected by actions under consideration in this Environmental Assessment. Impact topics that were carried forward for detailed analysis include: Yellowstone Bison; Other Wildlife; Special Status Species; Ethnographic Resources; Human Health and Safety; Visitor Use and Experience; Vegetation; and Water/Aquatic Resources.

Impact Topics Dismissed from Further Analysis

Council on Environmental Quality regulations (40 CFR Parts 1500-1508) and Director's Order #12 indicate topics may be dismissed from analyses if there is no potential for significant impacts. The following topics are not analyzed in this Environmental Assessment for the reasons stated below.

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 human health or environmental effects of their programs and policies on minorities and low-income populations and communities. Federal agencies must also follow rules set under the Environmental Justice Guidance released by the Environmental Protection Agency in 1998. None of the alternatives proposed for the quarantine of Yellowstone bison would have disproportionate adverse health or environmental effects on minorities or low-income populations or communities as defined in the Executive Order or guidance.

Archeological Resources

The NPS Cultural Resource Management Guideline (NPS 1998) defines 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 quarantine of Yellowstone bison would have significant adverse impacts to archeological resources. The areas where facilities would be located have been inventoried for archeological resources and although some archeological resources are present in the area they will be avoided. Quarantine facility construction and operation at Stephens Creek in YNP would not disturb known archeological sites, involve minimal ground disturbance, and occur in areas already disturbed by agriculture (USDI, NPS 2006, 2015b).

In 2008, the University of Montana performed a cultural resources inventory for the area of potential effects for the bison capture and confinement facilities in the Stephens Creek Administrative Area (MacDonald 2009). The survey encompassed the area where quarantine operations could potentially occur. No archeological sites were recorded within the area of potential effects. Archeological sites 24YE170 and 24YE180 are adjacent to, but outside, the area of potential effects and will not be impacted by these activities (Wenk 2015). The Montana State Historic Preservation Office concurred with this assessment on August 1, 2015.

Likewise, the Bureau of Indian Affairs released a Decision Record and Finding of No Significant Impact indicating there would be no significant impacts to cultural or historical resources from expanding wild bison herds on the Fort Peck Reservation. Bison would provide a living context for some archeological resources, particularly stone features involved with the hunting of bison (USDI, Bureau of Indian Affairs 2015; see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf).

In accordance with the National Historic Preservation Act, the NPS will submit a copy of this Environmental Assessment to the Montana State Historic Preservation Office to allow for consultation as required by Section 106. This will occur during the public review period of this Environmental Assessment.

Historic Structures

The NPS Cultural Resource Management Guideline (NPS 1998) defines historic structures as "material assemblies extending the limits of human capability." There are hundreds of historic structures within YNP, but none of the proposed quarantine alternatives would affect these structures in a manner differently than they are currently used. HS-0101 is a small cabin in the Stephens Creek area of YNP that is used for laboratory (blood) testing during bison handling, meetings for coordinating bison operations, and as a warming hut for staff operating the bison capture facility. This structure has been moved several times and is not eligible for the National

Register of Historic Places (USDI, NPS 2006). The structure would continue to be used in this area and receive periodic maintenance.

In 2008, the University of Montana performed a cultural resources inventory for the area of potential effects for the bison capture and confinement facilities in the Stephens Creek Administrative Area (MacDonald 2009). The survey encompassed the area where quarantine operations could potentially occur. No historic properties were recorded within the area of potential effects. Also, in 2015 the NPS conducted an assessment of potential effects to historic properties from proposed improvement projects to the bison capture and confinement facilities in the Stephens Creek Administrative Area (USDI, NPS 2015b). While tribes have reported all of YNP contains ethnographic resources, none specific to the project area were identified. Thus, the assessment concluded no historic properties would be adversely affected (Wenk 2015). The Montana State Historic Preservation Office concurred with this assessment on August 1, 2015.

In accordance with the National Historic Preservation Act, the NPS will submit a copy of this Environmental Assessment to the Montana State Historic Preservation Office to allow for consultation as required by Section 106. This will occur during the public review period of this Environmental Assessment.

Cultural Landscapes

The NPS Cultural Resource Management Guideline (NPS 1998) defines cultural landscapes as settings humans have created in the natural world. During the 1920s and 1930s, a private corporation called the Game Preservation Company purchased land west and north of Gardiner, Montana and operated what became known as the Game Ranch (Whittlesey 1995). Agricultural fields in the Stephens Creek area were irrigated using water from springs and creeks to grow hay to feed elk and pronghorn (*Antilocapra Americana*; Whittlesey 1995). The Game Ranch lands were transferred to YNP in 1932 and the Stephens Creek portion of this area was subsequently used for various purposes, including a nursery (1935 to 1942; 1987 to present), horse corral operations (1962 to present), equipment storage area (numerous decades), log building construction (2004 to present), law enforcement firing range (1960s to present), bison capture facility (1996 to present), and native revegetation enclosures (2008 to present; Whittlesey 1995). These activities led to alterations in some landscape features and patterns, including changes to the irrigation ditches, changes in the nursery, moving structures in and out of the area, and construction of new facilities (USDI, NPS 2006).

In 2006, the NPS completed a Cultural Landscape Inventory for the Stephens Creek Administrative Area and identified the Game Ranch Cultural Landscape due to its significance with Yellowstone's historic wildlife management operations and philosophies, as well as the cultivation of native plants (NPS 2006b). This area is a functioning ranch and is eligible for listing in the National Register as a historic district (USDI, NPS 2006). The bison capture and confinement facilities, including the area where quarantine operations could potentially occur, are outside the Game Ranch Cultural Landscape. However, these activities and facilities are considered a historically compatable land use, conveying the cultural landscape's association with ranching and wildlife conservation (Wenk 2015). The Montana State Historic Preservation Office concurred with this assessment on August 1, 2015.

Likewise, the Bureau of Indian Affairs released a Decision Record and Finding of No Significant Impact indicating there would be no significant impacts to cultural resources from expanding wild bison herds on the Fort Peck Reservation. Bison would provide a living context for some cultural resources, particularly stone features involved with the hunting of bison. Also, the attraction of tourism and harvest of bison would provide opportunities for broader public understanting of the culture of the Assiniboine and Sioux Tribes (USDI, Bureau of Indian Affairs 2015; see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). Thus, impacts to historic structures from the proposed implemention of quarantine would be negligible.

In accordance with the National Historic Preservation Act, the NPS will submit a copy of this Environmental Assessment to the Montana State Historic Preservation Office to allow for consultation as required by Section 106. This will occur during the public review period of this Environmental Assessment.

Trust Resources

Trust resources include land, water, minerals, timber, or other natural resources held in trust by the United States for the benefit of a Native American Tribe or individual tribal member. Some tribes have asserted bison are a trust resource the federal government must manage for their benefit (NPS, YNP and the Bureau of Indian Affairs 2012; Whitman 2012). They contend the federal government must consult with tribes with recognized treaty rights for hunting bison on open and unclaimed federal lands before removing bison to meat processing, research, or quarantine facilities because such removals could affect the number of bison migrating outside YNP where they could be harvested by tribal hunters (Whitman 2012). In addition, some tribes have suggested brucellosis-free bison completing quarantine should be relocated to open and unclaimed federal lands where tribes with recognized treaty rights can hunt them.

In the 2000 Final Environmental Impact Statement for the IBMP (see the <http://ibmp.info> website in the *Document Library* section), the NPS concluded bison are important to many tribes, but they are not defined as a trust resource in a formal, legal, property-based manner that would trigger a federal responsibility (USDI, NPS and USDA, USFS and APHIS 2000a). Thus, the NPS has not managed Yellowstone bison as a trust resource for one or more specific tribes. The NPS does, however, consult with tribes on bison management issues and acknowledges the special significance of Yellowstone bison to the tribes.

The alternative proposed for the quarantine of Yellowstone bison on the Fort Peck Reservation would not have significant adverse impacts to trust resources because a quarantine facility already exists (MFWP 2011). The Fort Peck Assiniboine and Sioux Tribes could benefit from having genetically pure Yellowstone bison by restoring viable herds for communal and cultural purposes, and providing bison to other tribes for new conservation and cultural projects (MFWP 2011).

Geology and Topography

Geologic formations were one of the natural wonders protected through the establishment of YNP. The construction of a quarantine facility at Stephens Creek would have negligible effects on the surface topography or underlying geology of YNP. On the Fort Peck Reservation, grazing

by bison should not negatively affect native grasslands, soils, and topography because the number of bison will be maintained well below the capacity of the range to support them (MFWP 2011; USDI, Bureau of Indian Affairs 2015). Also, these range units would be inspected annually to monitor their condition. Thus, impacts to geology and topography from the proposed implemention of quarantine would be negligible.

Natural Soundscapes

The NPS is mandated by Director's Order 47 to protect, maintain, or restore the natural soundscape in a condition unimpaired by inappropriate or excessive noise sources. Soundscapes are inherent components of the scenery and natural historic objects protected by the NPS Organic Act. None of the alternatives proposed for the quarantine of Yellowstone bison would significantly impact soundscapes. The construction and operation of a quarantine facility at Stephens Creek would have negligible impacts because machinery and vehicles would be used for a short time period to install fences and feed bison. Likewise, there would be limited use of machinery or vehicles to manage bison on the Fort Peck Reservation, resulting in temporary and negligible impacts (USDI, Bureau of Indian Affairs 2015).

Paleontological Resources

Quarantine facility construction and operation at Stephens Creek in YNP would not disturb any known paleontological resources, involve minimal ground disturbance, and occur in areas already disturbed by agriculture (USDI, NPS 2006). On the Fort Peck Reservation, grazing by bison should not negatively affect native grasslands or soils because the number of bison will be maintained well below the capacity of the range to support them (MFWP 2011). Likewise, the Bureau of Indian Affairs released a Decision Record and Finding of No Significant Impact indicating there would be no significant impacts to paleontological resources from expanding wild bison herds on the Fort Peck Reservation because proper measures would be taken to assure their preservation if such resources were discovered (USDI, Bureau of Indian Affairs 2015; see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). Thus, impacts to paleontological resources from the implemention of quarantine 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. Quarantine facilities would not occur within or adjacent to floodplains or wetlands and, as a result, would not constitute critical actions as defined in the NPS floodplain management guides.

Prime and Unique Farmlands

In 1980, the Council on Environmental Quality directed federal agencies to assess the effects of their actions on farmland soils classified by the USDA Natural Resources Conservation Service as prime or unique. Prime farmland has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. Unique farmland is land other than prime farmland used for production of specific high-value food and fiber crops. Lands considered in the proposed quarantine alternatives do not meet these criteria or are already being used for other purposes (USDI, NPS 2006; MFWP 2011).

Energy Requirements and Conservation Potential
The implementation of the proposed quarantine alternatives would entail the expenditure of energy through the limited use of machinery and motorized vehicles, but this expenditure is not considered a substantial use of national energy resources.

Natural or Depletable Resource Requirements and Conservation Potential
None of the alternatives would involve the use of depletable (consumptive) resources. The Yellowstone bison population could recover rapidly from small decreases in abundance due to culling animals to limit population growth (White et al. 2011, Geremia et al. 2015a,b).

Possible Conflicts with Land Use Plans, Policies or Controls
Quarantine operations in or near the Stephens Creek area would not harm the integrity of cultural and natural resources and values in YNP. A bison capture facility and pastures already exist in this area and expansion or construction of new pastures for quarantine would not restrict migration or other activities of wildlife. The capture and confinement of bison conflicts with the NPS' biological principle of minimizing human intervention (NPS 2006a). However, bison numbers sometimes needs to be reduced due to a lack of tolerance for them in surrounding states. Quarantine would provide an option for some animals to eventually be relocated elsewhere rather than sent to processing facilities. The NPS would continue to conserve a viable population of wild, wide-ranging Yellowstone bison and other native species, including the ecosystem processes necessary to sustain them.

MFWP (2011) evaluated the impacts of conducting quarantine operations on the Fort Peck Reservation (see http://fwp.mt.gov/news/publicNotices/environmentalAssessments/speciesRemovalAndRelocation/pn_0055.html). They concluded quarantine operations would not affect neighboring farming and ranching operations, while the establishment of a herd of brucellosis-free Yellowstone bison could draw visitors to the area and stimulate tourism-based businesses such as hotels, grocery stores, gas stations, and restaurants (MFWP 2011). In addition, the Bureau of Indian Affairs (2015) evaluated the impacts of expanding wild bison herds on the Fort Peck Reservation (see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). They concluded an increase in wild bison would not impact land use because the additional bison would graze in range units already being grazed by bison. There would be no impacts to residential land uses on the Reservation (USDI, Bureau of Indian Affairs 2015).

Climate Change
The NPS Management Policies (2006a) and NPS Climate Change Response Strategy (2010) encourage managers to engage partners and use the best available science to inform planning and the implementation of cooperative solutions. However, managers are not responsible for adverse impacts such as emissions from external sources over which managers have no control.

The average temperature in the GYE increased by about 0.6 degree Celcius (1.1 degree Fahrenheit) during the past century, with a pronounced increase in minimum temperatures during spring and summer since 1980 (Chang and Hansen 2013). Climate change scenarios for YNP and nearby areas of southwestern Montana suggest there could be a 1 to 3 degrees celsius increase in average temperature over the next century, especially at higher elevations (McWethy

et al. 2010). As a result, some areas could become slightly more arid, with lower spring snow pack, reduced stream runoff, and warmer stream temperatures during spring and summer (Chang and Hansen 2013).

Climate warming might result in milder winters, leading to increased survival of bison (Wilmers et al. 2013). Also, earlier spring green-up of new grasses could improve nutrition for bison during late gestation and lactation, resulting in increased birth weight, growth, and survival of calves (Frank et al. 2013, Wilmers et al. 2013). Conversely, warmer temperatures at higher elevations could result in an early decrease in food quality and quantity during late summer and autumn, with lactating females entering winter with marginal fat reserves for pregnancy and survival (Wilmers et al. 2013).

It is unknown precisely how temperatures and precipitation patterns in the GYE and elsewhere (e.g., Fort Peck Reservation) will change as the earth warms (McWethy et al. 2010). Also, it is difficult to forecast the eventual consequences of climate warming on Yellowstone bison due to the opposing potential effects described previously (Wilmers et al. 2013). Thus, it would be speculative to predict localized changes in temperature, precipitation, the length of winter, vegetation green-up and senescence, or changes in bison nutrition, condition, and demography due to the many variables not fully understood or currently defined. Furthermore, the minimal greenhouse gas emissions associated with the proposed quarantine alternatives would not have a measurable contribution to climate change. Therefore, the topic of climate change was dismissed from further consideration in this document.

Socioeconomics

The social and economic implications of implementing the IBMP were evaluated and disclosed in the Final Environmental Impact Statement for the IBMP (see the <http://ibmp.info> website in the *Document Library* section) and are incorporated by reference in this Environmental Assessment. Implementation of the IBMP was predicted to have a negligible to minor positive impact on the regional economy due to hunting; a minor to moderate positive impact from the donation of bison and carcasses to people with low incomes; and a minor to moderate adverse impact on social values due to intensive management of bison near the boundary of YNP and shipments of bison to processing facilities (USDI, NPS and USDA, USFS and APHIS 2000a).

Public constituencies are divided in their opinions about bison management in the Yellowstone area and bison restoration elsewhere in Montana; though a recent survey of registered voters indicated strong support for protection and restoration (Duffield et al. 2000a,b; Tulchin Research 2015). Concerns about bison in Montana include brucellosis transmission to livestock, competition with livestock for grass, property damage, threats to human safety, and funding for management (Boyd 2003, Plumb et al. 2009). These concerns will remain regardless of the alternative chosen through this quarantine evaluation process, and were disclosed in the Final Environmental Impact Statement for the IBMP (USDI, NPS and USDA, USFS and APHIS 2000a).

The implementation of quarantine would likely have negligible additional impacts on social and economic factors, including those affecting the livestock industry. For example, during 2006 to 2012, when the quarantine feasibility study was completed and brucellosis-free Yellowstone

bison from this program were transferred elsewhere in Montana, the gross annual income from cattle sales in Montana surpassed $1 billion five times and there have been record high cattle prices since 2010 (Lutey 2014). In addition, MFWP (2011; see http://fwp.mt.gov/news/publicNotices/environmentalAssessments/speciesRemovalAndRelocation/pn_0055.html) concluded the impacts to communities and economies from brucellosis testing and/or releasing bison on the Fort Peck Reservation would be neutral and negligible to positive, respectively. The agency concluded these actions would not affect neighboring ranching operations and could attract visitors and stimulate tourism-based businesses (MFWP 2011).

Likewise, the Bureau of Indian Affairs released a Decision Record and Finding of No Significant Impact indicating there would be no significant adverse impacts to agricultural resources from expanding wild bison herds on the Fort Peck Reservation (USDI, Bureau of Indian Affairs 2015; see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). Grazing and crop production are already the primary agricultural-based activities, on the Reservation providing a substantial portion of annual income to the Tribes and individual landowners. The proposed action would likely provide more income (USDI, Bureau of Indian Affairs 2015).

Wilderness

The Wilderness Act of 1964 established the National Wilderness Preservation System. NPS Management Policies (2006a) require wilderness remain unimpaired. There are no established wilderness areas within YNP, but portions are proposed for wilderness designation. Currently, there is not an approved backcountry/wilderness plan for YNP. The Stephens Creek capture facility in YNP and existing quarantine facilities on the Fort Peck Reservation are not in wilderness areas.

Alternatives

This chapter describes alternatives addressing the purposes and need for action. These alternatives were developed to explore the possible effects of a range of reasonable actions and economically and technically feasible strategies. Alternatives were considered if they met the project purposes and need, while conserving the bison population and other natural resources of YNP. This chapter also includes a description of mitigating measures, alternatives considered but eliminated from further consideration, and a description of the preferred and environmentally preferable alternatives (40 CFR §1502.14e; Federal Register 73:61292-61323).

Alternative 1: No Action

Under this alternative, bison would continue to be managed under the IBMP, as described in the Record of Decision and the annual operations plan (see the <http://ibmp.info> website in the *Document Library* section).[7] Currently, there is no quarantine program, and as a result, no bison testing negative for brucellosis exposure would be transferred to facilities for additional monitoring and eventual release elsewhere. The demographic objectives for the Yellowstone bison population include an end-of-winter abundance trending towards 3,000 bison, similar proportions of males to females, an age structure of about 70% adults and 30% juveniles,

[7] Much of the information in this section is taken from the *Operating Procedures for the IBMP* (IBMP Members 2014; White et al. 2015c).

breeding herds in the central and northern regions of YNP, and maintaining the processes of migration and dispersal within the conservation area (Geremia et al. 2015a).

Each summer, NPS biologists would conduct counts and classifications (age, sex) of bison in the central and northern regions of YNP. They would then use long-term weather forecasts and population and migration models to predict bison abundance, composition, and movements during the upcoming winter (Geremia et al. 2015a). Biologists would recommend removal objectives for bison based on abundance, distribution (region), and demographic (age, sex) goals (Geremia et al. 2015a). Sport and subsistence hunts in Montana, and the capture and shipment of bison to meat processing or research facilities, would be used to reduce bison numbers towards the guideline of 3,000 (IBMP Members 2014). By agreement, if the number of bison in the population decreased to 2,100, the agencies involved with bison management would cease lethal removals of bison, including hunting (USDI, NPS and USDA, USFS and APHIS 2000a,b; Partner Agencies, IBMP 2008).

Hunting would be used to manage the abundance and distribution of bison outside the northern and western boundary of YNP, while providing sporting and subsistence food gathering opportunities (IBMP Members 2014). Montana Fish, Wildlife & Parks sets a quota for state-licensed hunters with permits to harvest bison between November 15 and February 15. Also, the Confederated Salish and Kootenai Tribes of the Flathead Nation, Nez Perce Tribe, Confederated Tribes of the Umatilla Reservation, and Shoshone-Bannock Tribes conduct subsistence hunts on open and unclaimed federal lands, consistent with treaty language.

Bison may be captured if the population size needs to be reduced towards 3,000. Bison removals are currently implemented based on management practices for highly productive populations with high survival and low predation rates. The culling of bison only occurs during winter after dozens or more bison move outside YNP to provide harvest opportunities for public and treaty hunters. The NPS maintains a capture and handling facility in the Stephens Creek area of the Gardiner basin in the northern portion of YNP (Figure 4), while the state of Montana could maintain or erect one or more capture and handling facilities outside YNP (USDI, NPS 2006; IBMP Members 2014). Bison would be hazed into capture facilities or enticed with weed-free hay.

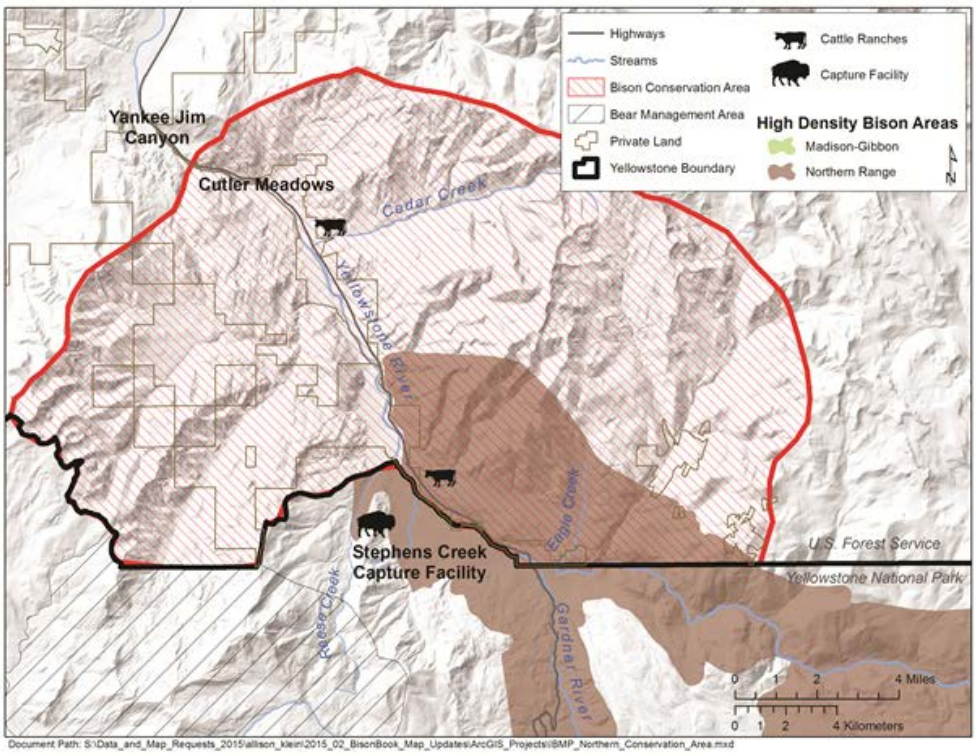

Figure 2. Northern management area for the Interagency Bison Management Plan as adjusted during 2012 (adapted from White et al. 2015c).

Bison captured for removal from the population would be transferred in trailers to research or meat processing facilities as soon as practical (IBMP Members 2014). The NPS has signed agreements with several tribes and a tribal organization to provide them with bison for direct transfer to processing facilities and subsequent distribution of meat, hides, horns, and other bison parts. Captured bison not sent to research or meat processing facilities would be released in spring or earlier to provide operational space and shorten confinement. Calf, yearling, and nonpregnant adult female bison may be vaccinated for brucellosis with strain RB51 vaccine, regardless of their brucellosis testing status (IBMP Members 2014). Vaccinated bison would be held within the capture facility for at least 21 days if hunting is ongoing so they are not harvested and consumed before the vaccine has been cleared from the body (USDI, NPS 2014a). If likely infectious bison need to be held in captivity, they would be separated from susceptible bison until the risk of brucellosis transmission has abated after calving (IBMP Members 2014).

The State Veterinarian has the authority and discretion to determine the numbers and distribution of bison migrating into Montana due to their chronic exposure to brucellosis (81-2-120 Montana Code Annotated 2011). Bison are supposed to be allowed on National Forest System and other lands north of YNP and south of Yankee Jim Canyon each winter and spring (Figure 2; IBMP Members 2014). Also, bison are allowed to migrate west of YNP onto the Horse Butte peninsula at the east end of Hebgen Lake and other nearby areas (Figure 3; IBMP Members 2014). In addition, bison could occupy the Eagle Creek/Bear Creek area, Cabin Creek Recreation and Wildlife Management Area, Monument Mountain Unit of the Lee Metcalf Wilderness, and portions of the Absaroka-Beartooth wilderness year-round (USDI, NPS and USDA, USFS and

APHIS 2000a,b). Bison attempting to move outside of these areas would be hazed to available habitat within the conservation area, captured, or lethally removed (IBMP Members 2014).

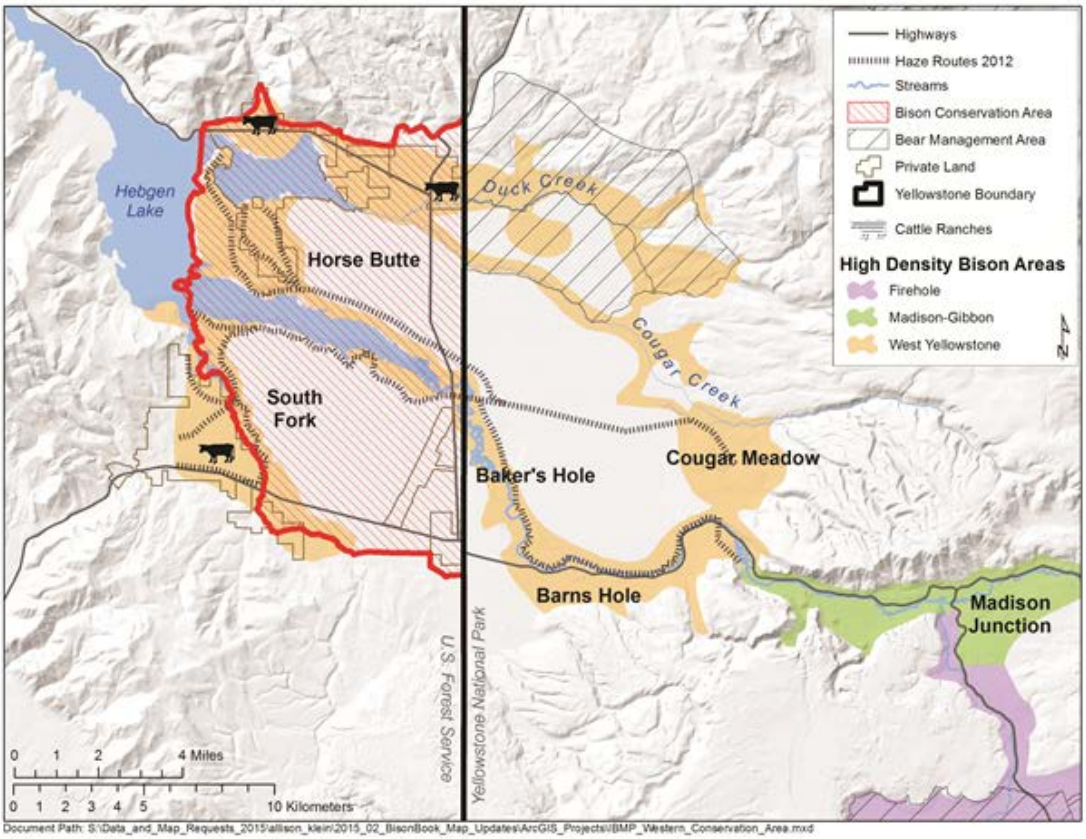

Figure 3. Western management area for the Interagency Bison Management Plan (adapted from White et al. 2015c).

Figure 4. Bison capture facility in the Stephens Creek area of Yellowstone National Park.

Personnel from federal and state agencies would haze bison to prevent dispersal beyond boundaries where bison are tolerated in Montana, prevent the shedding of *Brucella* bacteria in areas occupied (or soon to be occupied) by cattle, move bison away from private lands where they are not wanted, or move bison away from areas such as homes and highways where there are safety or property issues (IBMP Members 2014). Hazing would be conducted using all-terrain vehicles, horses, snowmobiles, and/or helicopters, and may include the use of cracker shells or rubber bullets. Each spring, bison would be hazed back into YNP near May 1 in the northern management area (Gardiner basin) and May 15 in the western management area (Hebgen basin). These operations may occur earlier if forage and other conditions at higher elevations in YNP are suitable or later if conditions impede safe and effective movements of bison to habitats with adequate snow melt or vegetation green-up (IBMP Members 2014).

Tolerance, which refers to areas where Yellowstone bison are allowed to access available habitat in Montana, could be adjusted based on evaluations of available habitat, new conservation easements or land management strategies, reduced brucellosis prevalence in bison, and new information or technology that reduces the risk of brucellosis transmission (Partner Agencies,

IBMP 2008). Bison management agencies and nongovernmental organizations would continue to discuss options with willing landowners, including conservation easements, livestock grazing plans, and strategic fencing to separate bison from livestock, people, or property (Partner Agencies, IBMP 2008).

Under this alternative, agencies, organizations, tribes, or individuals wanting brucellosis-free bison with Yellowstone genetics could request bison that completed the quarantine feasibility study (or their progeny) from the Fort Belknap or Fort Peck Tribes. Potential recipients could also request bison from other existing herds established using bison from YNP, including the Book Cliffs and Henry Mountain herds in Utah and the herd on Turner Enterprises' Vermejo Ranch in New Mexico. Alternatively, bison from lineages other than Yellowstone with relatively high genetic diversity could be relocated to augment or establish new herds.

Programmatic Actions Common to All Action Alternatives

The NPS would implement a quarantine program for Yellowstone bison under both action alternatives. With the exception of introducing a quarantine program, the NPS would continue to manage bison as described under Alternative 1 – No Action, with the same demographic goals and the use of hazing, hunting, and capture and handling for meat processing and research in addition to quarantine.

The quarantine program would entail testing bison captured to reduce abundance and segregating some bison testing negative for brucellosis exposure from other bison. These test-negative bison would be tested repeatedly over time using established protocols to evaluate if they remain free of brucellosis (USDA, APHIS 2003; Clarke et al. 2014). Animals that remain test-negative for brucellosis through these protocols would be sent alive to other public, tribal, or private lands for conservation, cultural, or commercial purposes. Animals not selected for quarantine would be released or sent to terminal pastures[8], meat processing facilities, or research facilities.

The NPS would implement best management practices adapted from the protocol used during the quarantine feasibility study (USDA, APHIS 2003; Clarke et al. 2014) to implement a quarantine program. These best management practices are described through the remainder of this section.

<u>Proposals to Receive Yellowstone Bison</u>

The NPS may request proposals from tribes and other interested parties to receive Yellowstone bison for quarantine and brucellosis testing. Some tribes, such as the Fort Peck Assiniboine and Sioux Tribes, have already indicated they want Yellowstone bison for quarantine and provided this information to the NPS, MFWP, and other agencies to demonstrate their commitment and readiness to implement quarantine and manage bison (Fort Peck Assiniboine and Sioux Tribes Turtle Mound Buffalo Ranch 2014, MFWP 2014; USDI, Bureau of Indian Affairs 2015; Fort Peck Assiniboine and Sioux Tribes, no date). Other applicants wanting Yellowstone bison to undergo quarantine and/or be placed in a terminal pasture would need to submit a proposal with information describing how they would meet the criteria and implement the best practices

[8] Terminal pastures are double-fenced enclosures from which bison are harvested, but no live bison are allowed to leave the pasture except to go to approved meat processing (test-positive for brucellosis exposure), quarantine (test-negative), or research (either) facilities.

described in the subsequent *Quarantine Facility Guidelines; Brucellosis Testing Requirements; Requirements, Roles and Responsibilities; and Terminal Pastures* sections of this document.

The NPS would review the submitted information to ascertain the readiness of potential recipients to successfully conduct quarantine and/or terminal pastures, and prioritize where bison would be sent—not to maintain operational involvement in the process. The strongest consideration would be given to proposals ultimately providing the greatest conservation benefits to plains bison populations and/or cultural benefits to tribes by enabling them to augment or establish their own herds. Quarantine facilities and/or terminal pastures would be developed, and bison would be tested for brucellosis exposure, using the criteria and best practices described in the *Quarantine Facility Guidelines; Brucellosis Testing Requirements; Requirements, Roles and Responsibilities; and Terminal Pastures* sections of this document as a foundation. Before bison would be transferred to a recipient for shipment to a quarantine facility or terminal pasture, the recipient would be required to sign a bison transfer agreement with the NPS stipulating the criteria and best practices the recipient would adhere to regarding facility development, maintenance, operations, and brucellosis testing. Other federal and state health and wildlife agencies may require the recipient to sign additional agreements.

Capture of Bison for Quarantine

The management of Yellowstone bison was evaluated under the IBMP, including the harvest and culling of bison to maintain abundance near a guideline of 3,000. Quarantine was evaluated as a tool to supplement other methods used to manage bison abundance and reduce the frequency and magnitude of bison shipments to meat processing facilities (USDI, NPS and USDA, USFS and APHIS 2000a,b). Migration by Yellowstone bison is an ecological process driven by their density, forage availability, the timing and extent of snow pack, learning, and other factors (Geremia et al. 2011, 2015b). Analyses indicate many hundreds of bison may migrate to the northern boundary of YNP to support capture for quarantine operations, in addition to public and tribal hunting in Montana, during about one-third to one-half of winters; primarily from December through March (Geremia et al. 2011). As a result, the number of bison available for quarantine and/or terminal pastures would vary from year-to-year depending on their abundance, distribution, and movements to the north boundary of YNP; not external demand for brucellosis-free bison.

The NPS would establish bison transfer agreements with qualified recipients using the criteria and best practices described in the *Quarantine Facility Guidelines; Brucellosis Testing Requirements; Requirements, Roles and Responsibilities; and Terminal Pastures* sections of this document as a foundation. If there is no demand for Yellowstone bison or ready recipients to implement quarantine, then any bison managers decide to cull from the population in addition to harvest would be sent to meat processing facilities, research facilities, and/or terminal pastures.

NPS biologists would count and classify bison in YNP each summer. Based on these results, they would recommend removal objectives for bison during the coming winter to progress toward the abundance, distribution, and demographic goals described for alternative 1 (Geremia et al. 2015a). Bison would only be placed in quarantine and/or terminal pastures when population numbers are above the agreed-upon guideline (currently 3,000) and managers decide to cull bison to limit population growth. The intent would be to reduce the number of bison

shipped to meat processing facilities by placing some test-negative bison into quarantine and test-positive or untested bison into terminal pastures. If the population guideline for Yellowstone bison is increased in the future through adaptive adjustment of the IBMP or the development of a new bison management plan, then the timing and extent of culling and placing some bison into quarantine and terminal pastures could be adjusted to reflect this higher level.

Captures of migratory bison would be implemented as nonselectively as possible based on brucellosis status, with biologists hazing or enticing animals from some groups moving past the capture facility. Bison testing negative for brucellosis exposure could be sent to quarantine, while bison testing positive could be sent to terminal pastures and meat processing or research facilities. This method would lessen the chances of artificially allowing brucellosis to act as a key selective force because approximately equal numbers of test-negative and test-positive bison would be removed from the population (USDI, NPS and MFWP 2013; Geremia et al. 2015a).

Some bison from both of the primary breeding regions would be captured and placed into quarantine. Bison from northern Yellowstone migrate towards the northern boundary of the park during winter, while bison from central Yellowstone migrate to both the northern and western boundaries. Thus, a portion of the culls in the northern management area consists of bison from central Yellowstone, which likely averages more than 10% under current population conditions (Geremia et al. 2015a). Each winter biologists use radio telemetry, ground observations, and aerial distribution surveys to track the movements of bison and attempt to differentiate animals from the central and northern regions when they approach the northern boundary of YNP (White and Wallen 2012). This approach does not provide absolute certainty with respect to region of origin, but it has been relatively effective for estimating the portion of culls from bison breeding in each region (White et al. 2011, Geremia et al. 2015a).

Quarantine Facility Guidelines

The quarantine facility must be separate and apart from any domestic livestock operation. The quarantine facility may be separate, but adjacent to, a terminal pasture to accommodate moving animals converting to test positive for brucellosis during quarantine to the pasture to be killed.

The perimeter of the quarantine facility must be enclosed by two fences (one at least 7 to 8 feet tall [2 to 2.5 meters]) located at least 10 feet (3 meters) apart. The fences must be constructed to prohibit ingress and egress of animals susceptible to brucellosis infection. Corrals and working areas must be adequate to safely contain, restrain, and handle bison.

All construction personnel would be given orientation on how to avoid or minimize disturbances to wildlife, including information about food storage, disposal of garbage and other attractants, and not to approach or harass wildlife.

If any cultural materials (e.g., bone, ceramic, glass, obsidian) are discovered during construction or quarantine activities, crews must stop work immediately and contact the appropriate federal, state, or tribal archeologist and/or historic preservation officer for assistance.

If human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered during construction or quarantine activities, the provisions outlined in the Native American Graves Protection and Repatriation Act (25 USC 3001) will be followed.

All gates to the quarantine facility would be locked. Paddocks where the bison are held would be observed on a daily basis. Signs would be posted at the perimeter of the quarantine facility stating it is a restricted area and people need approval before entering the facility.

Brucellosis Testing Requirements

The intent of quarantine is to confine and test bison for the minimum time necessary to ensure they are brucellosis free. Initially, bison would be quarantined for the minimum periods recommended by USDA, APHIS (2003) for various age, pregnancy, and sex categories of bison (Table 1). However, no bison in the quarantine feasibility study converted from test-negative to test-positive after 205 days (7 months). Also, no latent infections were detected in test-negative bison, and no calves born to any of the bred females tested positive for brucellosis exposure (Clarke et al. 2014). Thus, the minimum time periods and testing requirements to release bison from quarantine may be adjusted after further experience and consultation with APHIS. Bison completing the minimum quarantine periods and remaining negative for tests of brucellosis exposure would be considered brucellosis-free (USDA, APHIS 2003; Clarke et al. 2014).

Table 1. Minimum negative tests for brucellosis required to release bison from quarantine (adapted from USDA, APHIS 2003).

	Minimum tests for release	Minimum test intervals	Minimum quarantine periods
Sexually mature males	3	1st: Start of quarantine period 2nd: At least 180 days after first test 3rd: At least 12 months after first test	1 year
Pregnant females	5	1st: Before calving 2nd: Between 30 and 90 days after each animal has calved during 1st and 2nd calvings Last: Six months after last animal has calved during 1st and 2nd calvings	1½ years
Nonpregnant sexually mature females	3	1st: Before bred 2nd: Between 30 and 90 days after each animal has calved Last: Six months after last animal has calved	1½ years
Immature males	3	1st: Start of quarantine period 2nd: At least 180 days after first test 3rd: At least 12 months after the first test	1 year
Immature females	3	1st: Before bred 2nd: Between 30 and 90 days after each animal has calved Last: Six months after last animal has calved	2½ years

Requirements, Roles and Responsibilities[9]

Handling of Bison:

Bison would be handled humanely during all phases of operations, including capture, confinement, handling, testing, and transport. Veterinarians would be on site or available for consultation by phone during bison handling and testing.

Confined bison would be observed frequently and individuals showing signs of disease would be segregated. Biologists or wranglers would consult with veterinarians, and if necessary, test and treat or cull the affected bison.

Actions would be taken to limit discomfort, distress, or pain to individual animals. Biologists, wranglers, or veterinarians would use anesthetic and pain-killing drug combinations approved by the Federal Drug Administration to immobilize bison needing medical examination or treatment. The immobilization drugs would be used in accordance with standard wildlife administration techniques, and vital signs of immobilized bison would be monitored during examination, treatment, and recovery.

Cost, Record Keeping, and Animal Tracking:

The NPS would not charge the recipient a fee for the bison provided to them. The NPS cannot guarantee a specific number of bison to recipients each year.

Prior to transferring bison to the recipient, the NPS would notify the respective Governor's office(s), State Veterinarian(s), and local representative(s) with APHIS of the pending transfer.

All bison would be tested for brucellosis exposure prior to transfer and the NPS would provide the State Veterinarian(s), APHIS representative(s), and the recipient with the results of testing for brucellosis from each bison transferred to the recipient.

Each bison transferred to the recipient would be marked with two individually identifiable, ear tags. These tags need to remain on the bison during quarantine or while in a terminal pasture.

The NPS would allow local representatives of the state and/or APHIS to certify the numbers, sexes, and age categories of bison loaded and secured in each trailer. APHIS Veterinary Services Form 1-27 would be completed for all shipments unless bison have completed quarantine and are considered brucellosis free. Copies of the form would be provided to the recipient as documentation indicating the recipient has ownership of the bison before they leave capture facilities or local quarantine facilities in or near YNP.

The recipient would allow personnel from APHIS or the respective Department of Livestock to certify the bison are delivered to the quarantine facility and/or terminal pasture.

[9] Many of these guidelines are adapted from the USDA, APHIS (2003) *Brucellosis Eradication Uniform Methods and Rules* for livestock, including domestic bison.

The recipient would develop a system for keeping records sufficient to identify the original bison transferred to quarantine and/or terminal pasture, their offspring, deaths and additions, escapees, and all procedures done to each animal (9 CFR Part 122 and 42 CFR Part 73). The recipient would make records available to the NPS, APHIS, and/or the respective State Veterinarian(s) within 10 business days upon request.

Brucellosis Testing:

The NPS would test bison in the capture facility at YNP or holding facilities elsewhere for brucellosis exposure one or more times using the fluorescent polarization assay. Bison must test negative prior to being transported to a quarantine facility.

The recipient would hold the bison and any newborn offspring in fenced pastures during the quarantine testing period, isolated from domestic livestock, and make brucellosis testing records available for review by the NPS, APHIS, and/or the respective State Veterinarian(s) within 10 business days upon request.

The recipient would agree that test-negative bison captured during a single season and entering the quarantine facility would be placed in one or more holding pens until they can be sorted and penned separately into individual test groups. The holding pens and pens for individual test groups should be separated by at least two fences a minimum of 10 feet (3 meters) apart.

The recipient must agree to test all bison for brucellosis exposure within 30 days of arriving at the quarantine facility to ensure they still test negative. The recipient would serologically (blood serum) test every bison during the quarantine period for antibodies indicative of brucellosis exposure pursuant to the criteria provided in Table 1 or as subsequently adjusted based on experience and consultation with APHIS.

Upon entry into the quarantine facility, it is recommended, but not required, for serological tests to be conducted on every bison every 30 to 45 days while they are in a holding pen or individual test groups until all animals that convert to test positive for brucellosis exposure have been removed and all remaining animals test negative. If the testing results in any bison being classified as positive for brucellosis exposure, then a subsequent test must be conducted on the remaining animals in the individual test group at least 30 days later.

If one or more bison in an individual test group test positive for brucellosis exposure, then the recipient must kill those animals, conduct necropsies, and collect specimens for culture. All animals testing positive for brucellosis exposure would be immediately held in isolation and removed from the quarantine facility within 5 days of being identified.

Disposition of Bison:

The recipient would agree that any aborted fetus, stillborn animal, or animal dying in the quarantine facility for any reason would be necropsied, serologically tested, and its tissues and other appropriate specimens cultured for *Brucella*. The recipient would report all aborted fetuses and bison dying of unknown causes during the quarantine period to the respective State

Veterinarian's office within 24 hours, and submit them to a diagnostic laboratory for necropsy, immune and reproductive tissue collection, and *Brucella* culture.

Any live bison removed from the quarantine facility before completing the requirements to qualify for release must be moved either to an approved research facility, terminal pasture, or meat processing facility.

Each individual test group should qualify for release from quarantine following the procedures listed in Table 1 before any individual bison within the group may be released. Any culture and/or serologically test-positive animal found in an individual test group would cause the entire group to restart the quarantine requirements.

When the quarantine period ends (Table 1), the bison would be considered brucellosis free and further brucellosis surveillance would not be required. However, it is recommended the bison be retested for brucellosis exposure approximately one year later to verify they remain test negative. The recipient should vaccinate bison before they are released from the quarantine facility.

After the quarantine period, bison can be rounded-up as needed for transport to other areas or parties. The distribution and management of bison completing quarantine would be at the discretion of the recipient, who may be required to complete other environmental compliance and permits by other federal or state agencies before transporting these bison elsewhere.

Herd Management and Liability:

The recipient would agree that personnel with access to the quarantine facility and/or terminal pasture would be advised of potential hazards (e.g., brucellosis), trained on the proper containment and security procedures, trained in the safe handling of bison, and wear personal protective equipment for all activities involving potentially infected birth materials or bison.

The recipient would agree to develop a written procedure for locating, capturing, and/or removing bison that escape the quarantine facility and/or terminal pasture. The recipient would be responsibile for capturing escaped bison immediately and repairing the fence where they got out. Lack of successful containment would impact a recipients' likelihood of receiving bison in the future.

The recipient would be responsible for damage to crops, fencing, and property caused by escaped bison, and they would agree to purchase and keep liability insurance at their own expense from a responsible company or companies.

The recipient should develop a comprehensive management plan to address population management, distribution, management of wildlife conflicts, and habitat management for areas where bison completing quarantine would be relocated. All bison restoration projects must comply with environmental regulations and import requirements of recipient jurisdictions.

Terminal Pastures

Bison removed from the Yellowstone population and testing positive for brucellosis exposure could be sent to terminal pastures instead of meat processing facilities. These pastures may be separate, but near, quarantine facilities outside YNP to accommodate moving animals converting to test positive for brucellosis during quarantine to the terminal pasture, where they would be killed. Bison in terminal pastures could be killed onsite (e.g., captive bolt, shooting) for field dressing or processing in a mobile meat harvesting unit, or transferred to an approved meat processing facility. Females late in pregnancy testing positive for brucellosis exposure could be placed in a terminal pasture, where they could remain through calving and nursing. Any calves born in the terminal pasture and testing negative for brucellosis exposure could be transferred to the quarantine facility after they are weaned rather than being killed.

Best practices for the use of terminal pastures or shipment of bison to meat processing facilities would be as follows:

The recipient would hold the relocated bison and any newborn offspring in fenced pastures, isolated from domestic livestock, until they are harvested for food or ceremonial purposes. Live bison would not leave these terminal pastures for any reason except to be transported directly to approved meat processing (test-positive bison), quarantine (test-negative bison), or research (either) facilities.

The perimeter of the terminal pastures must be fenced with double fences (one at least 7 to 8 feet [2 to 2.5 meters] tall) spaced 10 feet (3 meters) apart. The fences should be constructed to prohibit ingress and egress of animals susceptible to brucellosis.

The recipient would provide written notice to the NPS and State Veterinarian of the individual identifier and date each bison was killed in the terminal pasture.

Bison would be killed within the terminal pasture by shooting or using a captive bolt in a squeeze chute, or shipped to an approved meat processing facility. The distribution of meat, hides, horns, and other bison parts would be at the discretion of the recipient.

The recipient must develop a written procedure for locating, capturing, and/or removing escaped bison. The recipient is responsible for capturing escaped bison immediately and repairing fencing where they got out.

The recipient would be responsible for damage to crops, fencing, or property caused by escaped bison, and they would agree to purchase and keep liability insurance at their expense from a responsible company or companies.

The recipient would lock all gates to the terminal pastures. Paddocks where the bison are held would be observed by the recipient on a daily basis. The recipient would post signs at the perimeter of the terminal pastures stating they are restricted areas and unauthorized people are not allowed in the pastures.

The recipient would agree personnel with access to the terminal pastures would be advised of potential hazards (e.g., brucellosis), trained on the proper containment and security procedures, trained in the safe handling of bison, and wear personal protective equipment for all activities involving potentially infected birth materials or bison.

The recipient would agree to maintain records documenting all procedures done to each bison (9 CFR Part 122 and 42 CFR Part 73) and any escapes. The recipient would agree to make records available to the NPS, APHIS, and the State Veterinarian within 10 business days upon request.

Corrals and working areas must be adequate to safely contain, restrain, and handle the bison. Drainage should be contained within the perimeter fence to prevent run-off into surrounding pastures or areas. The recipient must clean and disinfect any birth sites within 24 hours.

Alternative 2: Quarantine Facilities Within the Designated Surveillance Area for Brucellosis
This alternative includes a site-specific proposal and the programmatic actions common to all action alternatives described earlier. The bison conservation and brucellosis risk management actions described under alternative 1 would continue, including hazing, hunting, capture, and handling. In addition, quarantine and/or terminal pasture operations would be initiated inside YNP at the Stephens Creek area in the northern portion of YNP or elsewhere within the DSA.[10] Any operations inside YNP would be led by the NPS, while operations elsewhere could be conducted by the NPS or other independent parties using Yellowstone bison provided by the NPS. If the NPS decided to conduct quarantine at other facilities or locations outside YNP, then the agency would complete additional NEPA and National Historic Preservation Act reviews as appropriate at that time.

Suitable double fencing would be erected around one or more areas near the bison capture and handling facility (Figure 4) in the Stephens Creek area of YNP to create pastures where confined bison would remain separated from horses, mules, or wild bison being temporarily held in the facility. The existing facility includes numerous pens and alleys for staff to move captured bison into progressively smaller, funnel-shaped paddocks and a narrow alleyway leading to a squeeze chute where bison can be safely and efficiently handled and tested for brucellosis exposure. Facility development needs at Stephens Creek could include:

- Upgrading existing pastures (e.g., exterior and pasture fences; gates) and/or fencing new areas to improve bison containment capabilities and ensure separation between confined bison and other wildlife or livestock;
- Developing cross fencing within pastures as necessary to maintain separation between various test groups of quarantined bison;
- Improving the handling equipment inside the existing bison capture facility and/or developing other handling areas for quarantined bison;
- Installing a security system with cameras placed at key locations to monitor the perimeter of the facility;
- Posting signs along the perimeter of the facility stating people need authorization before entering;

[10] Technically, YNP is not within the Designated Surveillance Area (DSA). However, proposed actions within the park are included in this alternative because the park is surrounded by the DSA.

- Improving and extending water delivery systems and/or using or transferring existing water rights to ensure reliable and sufficient water for sustaining bison year-round;
- Installing systems for forage production and/or storage in or near the Stephens Creek area, which could include an irrigation system for hay production; and
- Making drainage improvements to prevent water runoff from the facility and direct outside water flows away from the facility.

The necessary size of a quarantine facility to adequately care for the animals depends on the number of bison that would be consigned to quarantine and the length of time they remain in quarantine (Appendix B). Placing 250 bison per year into quarantine would require a large area (315+ acres or 128+ hectares) for pastures due to the rapid increase to about 630 bison in the facility within three years due to the relatively lengthy testing requirements for females. Even accepting 150 bison per year into quarantine would necessitate a facility large enough to hold almost 400 bison within four years. Adding 100 or 50 bison to a quarantine facility each year would require a facility large enough to contain about 250 and 125 bison, respectively.

The number of bison available for placement in quarantine would depend, in part, on the number of bison migrating to the north boundary of YNP each year when the population size is above the agreed-upon 3,000 bison guideline. Bison responses to the timing and extent of snow accumulation are a key driver of migration, and as a result, fluctuations in weather result in high variation in migration behavior (Appendix C). Since 2001, more than 500 bison have migrated to the north boundary of YNP in about 40% of the winters (i.e., 2004, 2006, 2008, 2011, 2013, 2014, and 2015). More than 900 bison migrated to the north boundary in five of these winters. Managers decided to remove more than 600 bison (range = 640 to 1,726) from the population during each of these winters to limit population growth (Geremia et al. 2015a). Thus, enough bison may migrate to the northern boundary to support a modest level of quarantine operations (e.g., 50 to 150 bison) in addition to public and tribal hunting (300 to 400 bison) in up to one-half of forthcoming winters.

Given this background, it may be feasible to place 50 to 150 bison every year or two into quarantine. As a result, this is the number that was used to determine the size/capacity of quarantine facilities for the purposes of analysis in this Environmental Assessment. This scale would be similar to the quarantine feasibility study and could eventually graduate about 60 to 200 bison in a given year (Clarke et al. 2014). This level of removals would not be sufficient in combination with hunting to regulate population growth at higher bison densities, but it would reduce the numbers of bison shipped to meat processing facilities. Bison testing negative for brucellosis exposure and placed in quarantine would be segregated from other bison in the capture facility to prevent exposure to abortions or infectious live births. Bison in quarantine would be tested for brucellosis exposure using the criteria and best practices described in the *Quarantine Facility Guidelines*; *Requirements, Roles and Responsibilities; and Terminal Pastures* sections of this document as a foundation. Bison testing positive could be sent to terminal pastures and meat processing or research facilities.

Selecting calves 6 to 12 months old for quarantine would minimize the likelihood of potential field exposure of bison to *Brucella abortus*, and their likelihood of converting from test-negative to test-positive in quarantine, because they have not been exposed to abortions and other

transmission events following their birth (Clarke et al. 2014). Older bison have a higher likelihood of exposure to these events and testing positive for brucellosis exposure and/or infection (Rhyan et al. 2009, Treanor et al. 2011). Thus, obtaining a sample of older bison testing negative for evidence of *Brucella* bacteria would require capturing substantially more animals. Also, placing older bison in quarantine would likely result in higher conversion rates, with more bison eventually testing positive and being killed, which would prolong the quarantine period for bison remaining in the test group. However, older female bison which have completed at least one parturition event prior to being placed in quarantine and still test negative for brucellosis exposure can complete the quarantine testing regimen more quickly because they are less likely to convert from test-negative to test-positive for brucellosis exposure (USDA, APHIS 2003; Clarke et al. 2014).

If desired, managers could attempt to retain socially banded groups of bison from various age and sex classes through quarantine. However, if groups of bison are removed from the population for possible quarantine without respect to brucellosis status, then about one-half of the captured bison would likely test positive for brucellosis exposure and need to be shipped to meat processing facilities or terminal pastures. Also, another 3 to 10% of the bison entering quarantine could convert from test-negative to test-positive for brucellosis exposure and need to be killed (Clarke et al. 2014). Monitoring and research would be conducted on a decadal scale to assess the maintenance of existing genetic diversity and improve understanding of the potential genetic effects of various alternative strategies for culling bison, including the consequences of removing family groups (USDI, NPS and MFWP 2013). If genetic diversity decreases, bison from populations established through quarantine could be reintroduced into the Yellowstone population to restore rare alleles.

Brucellosis-free bison completing quarantine in YNP would preferably be transferred to public or tribal lands within the historic range of plains bison for conservation and cultural purposes. The intent of restoration would be to augment numbers and genetic diversity in existing wild herds or establish new herds of plains bison and subsequently increase abundance beyond those founding numbers. If this is not possible, for whatever reason, then the NPS would consider alternatives contributing to educational displays on tribal lands, federal or state lands, lands managed by nongovernmental conservation organizations, and zoos or similar facilities. Consignment of bison to private citizens, corporations, or tribes proposing to manage bison in an agricultural manner could be considered if none of these options are available. Pursuant to 36 CFR Part 10, Yellowstone bison transferred by the federal government to individuals and private institutions cannot be shipped to meat processing facilities or released without adequate protection from premature hunting. The NPS would inform individuals and private institutions of this regulation prior to transferring bison. Also, potential recipients would need to agree to coordinate with other federal and state agencies to complete necessary environmental compliance and obtain necessary permits prior to bison transfer.

Alternative 3: Quarantine Facilities Outside the Designated Surveillance Area for Brucellosis
This alternative includes a site-specific proposal and the programmatic actions common to all action alternatives described earlier.[11] The bison conservation and brucellosis risk management

[11] Much of the information in this section is taken from Montana Fish, Wildlife & Parks' Environmental Assessments and decision notices regarding the relocation of Yellowstone bison completing the quarantine

actions described under alternative 1 would continue in YNP and nearby areas of Montana, including hazing, hunting, capture, and handling. In addition, quarantine operations would be conducted by independent (non-NPS) parties using Yellowstone bison provided by the NPS. Specifically, the NPS would provide Yellowstone bison testing negative for brucellosis exposure to the Assiniboine and Sioux Tribes to undergo quarantine on the Fort Peck Reservation in northeastern Montana. If the NPS decided to conduct quarantine at other facilities or locations outside the DSA, then the agency would complete additional NEPA reviews as appropriate at that time.

The Fort Peck Community currently manages two separate herds of wild bison. A business/commercial herd is managed on Range Units 56, 57, and 58 located east of State Highway 13 and approximately 31 miles northeast of Wolf Point in Roosevelt County, Montana. In addition, a cultural/conservation herd is managed on Range Units 62, 63, and 67 located about 25 miles northeast of Wolf Point (Figure 5). This herd originated from Yellowstone bison that completed the quarantine feasibility study (Clarke et al. 2014), and consisted of about 186 bison in March 2015 (USDI, Bureau of Indian Affairs). Yellowstone bison were brought to the Reservation due to their cultural and spiritual significance, to benefit the tribes economically, and to restore a native wildlife species (USDI, Bureau of Indian Affairs 2015). The tribes are allowing wild bison numbers to increase, mainly using a hands-off policy for management, until the cultural/conservation herd numbers about 300 bison. Thereafter, the tribes plan to cull the herd approximately annually to a 60% female and 40% male ratio (USDI, Bureau of Indian Affairs 2015). Culling would be conducted by Tribal Fish and Game staff, with the meat distributed to tribal programs for seniors, diabetics, Head Start centers, school lunch programs, homeless shelters, and cultural and traditional ceremonies (Fort Peck Assiniboine and Sioux Tribes Turtle Mound Buffalo Ranch 2014).

The Fort Peck Community partnered with the InterTribal Buffalo Council, World Wildlife Fund, and Ranch Advisory Partners to construct a 320-acre (130-hectare) surveillance facility with two separate monitoring pens within Range Unit 62 to receive Yellowstone bison testing negative for brucellosis exposure to undergo the quarantine process (Figures 5 and 6; Fort Peck Assiniboine and Sioux Tribes Turtle Mound Buffalo Ranch 2014; Fort Peck Assiniboine and Sioux Tribes, no date). The facility meets the specifications described in the *Quarantine Facility Guidelines* section of this document and is similar to the pastures used for the quarantine feasibility study in Corwin Springs, Montana. The facility has capacity for 300 to 500 bison. The tribes have hired a bison manager and a wrangler to conduct brucellosis testing and monitor the bison and perimeter fencing to minimize the potential for escapes, private property damage on adjacent lands, and bison mingling with livestock (Fort Peck Assiniboine and Sioux Tribes, no date). An emergency response plan for the potential outbreak of brucellosis has been adopted and the tribes carry liability insurance on their bison in case problems arise (Fort Peck Assiniboine and Sioux Tribes Turtle Mound Buffalo Ranch 2014).

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feasibility study and subsequent 5-year assurance testing period (MFWP 2011, 2014). Additional information is taken from the Bureau of Indian Affairs' Programmatic Environmental Assessment for Fort Peck Agricultural Leasing. This decision document provides for expanding the Tribes' wild bison herds on the Reservation (USDI, Bureau of Indian Affairs 2015).

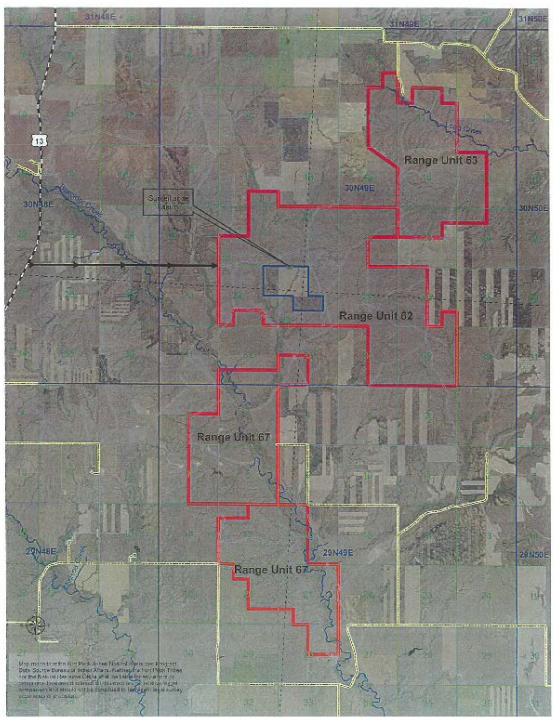

Figure 5. Bison management range units (red polygons) and the quarantine facility (blue polygon) on the Fort Peck Reservation in Montana (R. Magnan, Director, Fish and Game Department, Fort Peck Reservation, Wolf Point).

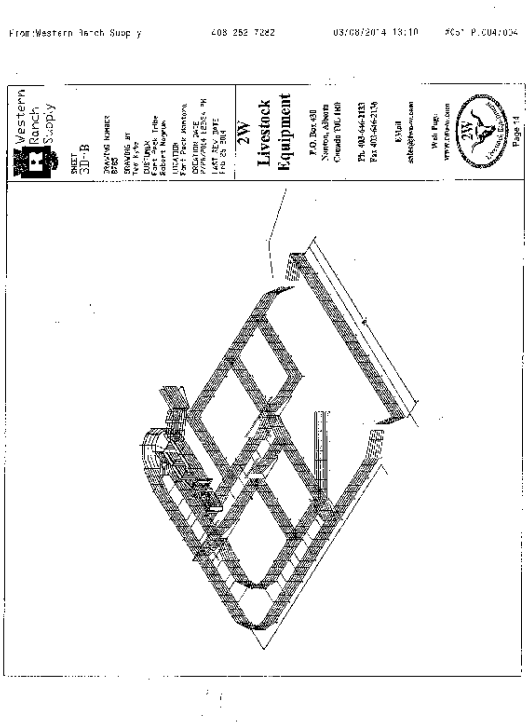

Figure 6. Quarantine facility design in Range Unit 62 on the Fort Peck Reservation in Montana (R. Magnan, Director, Fish and Game Department, Fort Peck Reservation, Wolf Point).

The Fort Peck Assiniboine and Sioux Tribes prepared a 5-year business and management plan for the business and cultural bison herds during 2014 through 2019 (Fort Peck Assiniboine and Sioux Tribes, no date). This plan included the following site-specific measures to reduce environmental impacts from the wild bison (buffalo) herds (USDI, Bureau of Indian Affairs 2015, pages 2-14 to 2-16; see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf):

- "Any damage to crops, fencing, or property caused by buffalo that have escaped from their range units would be addressed by the tribes.
- The tribes have developed a memorandum of understanding with the State of Montana and the Animal, Plant, Health, Inspection Service on testing buffalo that came from Yellowstone National Park and have developed a written procedure for capturing, and/or removing any Yellowstone buffalo that escape their range units. The tribes will be responsible for capturing escaped buffalo immediately and repairing fence where they got out.
- Buffalo are susceptible to most diseases carried by cattle. The four most important diseases include brucellosis, bovine tuberculosis, blue tongue, and anthrax. All these diseases have been introduced into North America and can cause serious problems if buffalo are exposed to them. The former two diseases are considered regulatory diseases, and surveillance may be required by the US Department of Agriculture (USDA) or Montana Department of Livestock. In addition, buffalo are extremely susceptible to malignant catarrhal fever; a herpes virus carried by domestic sheep and always fatal to buffalo. Measures to prevent any spread of disease from the buffalo or to the buffalo from other livestock and wildlife would be implemented and include the following:
    - All buffalo in private and public herds within the US outside of the Yellowstone National Park ecosystem are now considered by the USDA to be free of brucellosis. Monitoring for brucellosis, although no longer required, can be accomplished through collection of blood samples from field slaughtered animals, from blood taken from calves prior to shipping, and from animals slaughtered at packing plants. Calves scheduled for interstate shipping should be tested for tuberculosis.
    - The tribes have developed a foreign animal disease emergency preparedness plan to respond to the outbreak of any foreign disease on any domestic and wildlife species on the Reservation and an emergency response plan to minimize the spread of any foreign disease on the Reservation.
    - All lessees operating a buffalo herd shall participate in the Montana State Brucellosis Eradication Program.
    - The BIA [Bureau of Indian Affairs] Provision No. 19 of lease Form 5-180 requires that breeding cattle being transferred into Indian lands covered by lease or permit must originate (1) from herds in a Modified Certified or Certified Free area not under quarantine for brucellosis; or (2) from herds which have tested negative to the blood test within the past 12 months, and the animals moving into the area have tested negative to the blood test no more than 30 days prior to entry; or (3) are officially vaccinated female animals under 30 months of age, and from a herd not under quarantine.

- Develop a range management program that considers buffalo ecology and behavior, including their forage resources.
- Restrict grazing on drainage and side hills during the growing season.
- During years of below average forage production, supplemental feed would be provided to the buffalo as needed to maintain healthy herds. (Buffalo food habits studies have consistently shown that their diet is about 90 percent grass, 5 percent forbs, and 5 percent shrubs.)
- Use live sale or trade of buffalo to maintain genetic diversity of the buffalo herds and generate cash income.
- When culling large mature bulls, use a field slaughter method (rather than corralling and shipping) to prevent stress on the animal and damaged equipment.
- Develop a buffalo educational display for public perception of buffalo and to familiarize people with the cultural significance of buffalo, buffalo biology, and their ecological role.
- Develop a detailed long-range management plan subjected to public comment. A long-range management goal would provide guidance on buffalo restoration on Reservation lands in a manner that does not interfere or conflict with tribal member cattle operators.
- Maintain optimal herd management practices to provide economic returns to the tribes, while maintaining the buffalo as a wild animal in a functional prairie environment."

The Fort Peck Assiniboine and Sioux Tribes' business and management plan also included the following site-specific measures to mitigate potential impacts to threatened, endangered, and proposed species (USDI, Bureau of Indian Affairs 2015, pages 2-16 to 2-17; see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf):

- "To avoid impacts to pallid sturgeon (*Scaphirhynchus albus*), consultation with US Army Corps of Engineers (USACOE) would be required if additional irrigation pumps along the Missouri River are proposed.
- To avoid impacts to greater sage-grouse (*Centrocercus urophasianus*), many of the grazing practices and range management recommendations identified in the EO [Executive Order] No. 10-2014 (established core area stipulations for rangelands [State of Montana 2014]) are already being practiced by the tribes and include the following (note that tribal and federal actions within the FPIR [Fort Peck Indian Reservation] are not required to follow the state's EO):
    - Sage-grouse initiative grazing practices and range management recommendations (encouraged in *Core and Connectivity Areas and General Habitat* of EO No. 10-2014) consisting of:
        - *Rotating livestock to different pastures, while resting others to establish a diversity of habitat types.* This measure is currently adhered to, per existing measures identified in Section 2.2
        - *Changing seasons of use within pastures to ensure all plants have the ability to reproduce.* This measure is currently adhered to, per existing measures identified in Section 2.2
        - *Leaving residual cover (grass from the past season) to increase hiding and nesting cover for sage grouse.* This measure would be implemented within 0.6 mile surrounding the sage-grouse leks under the Proposed Action

        - *Managing the frequency and intensity of grazing to sustain native grasses, wildflowers, and shrubs.* This measure is currently adhered to, per existing measures identified in Section 2.2
        - *Managing livestock access to water to ensure healthy livestock and healthy watersheds.* This measure is currently adhered to, per existing measures identified in Section 2.2
    - *Range management structures should be designed and placed to be neutral or beneficial to sage grouse.* This measure would be implemented within 0.6 mile surrounding the sage-grouse leks under the Proposed Action.
    - *Structures that are currently contributing to negative impacts to either sage grouse or their habitats should be removed or modified to remove the threat.* Structures that are currently contributing to negative impacts to either sage-grouse or their habitats would be evaluated and either removed or modified to remove the threat, if applicable, near the sage-grouse leks (0.6 mile).
    - *Mark fences that are in high risk areas for collision with permanent flagging or other suitable device to reduce sage grouse collisions.* A program to mark fences, which are in high risk areas for sage grouse collision, with permanent flagging or other suitable devices to reduce sage-grouse collisions is also in place by the Fort Peck Game and Fish Department (Gust 2014).
    - *Identify and remove unnecessary fences.* A program to remove fences that are in high risk areas for sage grouse collision, is also in place by the Fort Peck Game and Fish Department (Gust 2014; Magnan 2014a).
    - *Placement of new fences and livestock management facilities (including corrals, loading facilities, water tanks, and windmills) should consider their impact on sage-grouse and, to the extent practicable, be placed at least 0.6 mile from active leks.* The avoidance of existing leks by 0.6 mile has not been adhered to, to date; however, this measure will be complied with under the Proposed Action.
    - These measures would also be adhered to for any additional leks that are identified by the Fort Peck Tribes Fish and Game Department under the Proposed Action.
- To avoid impacts to Sprague's pipits, (*Anthus spragueii*), on range units and pasture leases where known nesting Sprague's pipit locations are present, the tribes would ensure monitoring and continue to require a low-moderate stocking rate."

Bison completing quarantine would be considered wildlife and managed to maintain their wild character and genetic diversity (MFWP 2014). The business/commercial herd and the cultural/conservation herd would not be allowed to intermix, though eventually, some bulls from the cultural/conservation herd could be placed in the commercial herd to reduce inbreeding and contribute to genetic diversity (MFWP 2014). The goal is for the tribes to become self-sufficient for their bison needs with large, wild, wide-ranging herds. Thereafter, up to 70% of bison successfully completing quarantine could be distributed to other tribes, public agencies, or organizations (Fort Peck Assiniboine and Sioux Tribes Turtle Mound Buffalo Ranch 2014, MFWP 2014).

Mitigation Measures

The NPS would continue to conserve a viable population of wild Yellowstone bison, while implementing management actions in coordination with other IBMP members to maintain

separation between wild bison and livestock during the likely transmission period for brucellosis (Partner Agencies, IBMP 2008). Human intervention would also be necessary at times to manage wild bison conflicting with human society in Montana (MFWP and MDOL 2012, 2013). These management actions would be tempered to avoid unintended consequences to the bison population such as altered gender structure, dampened productivity, and reduced genetic diversity (Partner Agencies, IBMP 2008, White et al. 2011).

Invasive weed species may be detected in some areas following the feeding of hay and/or soil and vegetation disturbance by bison (MFWP 2011). As a result, all quarantine alternatives would involve efforts to prevent the establishment or control noxious weeds such as spotted knapweed (*Centaurea maculosa*) and leafy spurge (*Euphorbia esula*). Properly prescribed herbicides may be used to suppress noxious weeds and prevent their spread to adjacent areas. Mechanical methods may be used if chemicals are inappropriate. The NPS and bison recipients would monitor the distribution of noxious weeds and, as necessary, coordinate control efforts with adjacent landowners and appropriate County Weed Control Boards (MFWP 2011).

Alternatives Considered and Dismissed from Detailed Analysis

The IBMP, bison management in other national parks, brucellosis in wildlife and the consequences of suppression actions, coordination and jurisdictional issues over Yellowstone bison and brucellosis management, and the removal of cattle from historic bison habitat are beyond the scope of this assessment and were dismissed from further consideration.

The Use of Other Quarantine Protocols

The only quarantine protocol that has been rigorously tested and proven completely effective at identifying wild Yellowstone bison that were brucellosis free is the framework described in the USDA, APHIS (2003) brucellosis eradication uniform methods and rules (MFWP 2011, 2014; Clarke et al. 2014). Thus, these criteria and best practices regarding the requirements, roles, and responsibilities for the development and implementation of quarantine facilities and brucellosis testing were adapted into the *Programmatic Actions Common to All Action Alternatives* section of this document. State veterinarians, APHIS representatives, and wildlife agencies should consider bison completing this protocol to be brucellosis free (MFWP 2011, 2014; Clarke et al. 2014). The use of other, untested protocols were not considered in this assessment because bison completing quarantine under such protocols may not be accepted as brucellosis free.

Capturing Bison in the Interior of YNP

Under the IBMP, the NPS considered but eliminated alternatives for capturing bison in the interior of YNP (USDI, NPS and USDA, USFS and APHIS 2000a,b). Thus, bison would not be captured for culling, including placement in quarantine and/or terminal pastures, except when they migrate to the boundary of YNP during winter.

Quarantine of Elk in Addition to Bison

Brucellosis is endemic in elk populations in the GYE and has been transmitted from elk to cattle numerous times during the past two decades (Rhyan et al. 2013). However, elk are managed and treated differently than bison due to the tradition and economic value of sport hunting for elk in this region (Cross et al. 2013, White et al. 2015a). In many areas, elk are allowed to mingle with cattle throughout the year, without being tested for brucellosis exposure or being shipped to meat

processing facilities (Schumaker et al. 2012, Schumaker 2013). Regardless, the quarantine of elk would not meet the purposes and need of this assessment. Also, during 1892 to 1967 more than 14,000 elk were relocated from YNP to federal, private, state, and tribal lands throughout the continental United States to restore populations of this species (YNP archives Box N-64, Heritage Research Center, Gardiner, Montana). These restoration efforts were extremely successful and the NPS has no interest in, or need to, conduct quarantine with elk from YNP.

Restoring Free-ranging Bison Populations with No Human Intervention

Restoring completely free-ranging bison populations with no containment or management in modern society would be difficult, if not impossible, at this time (Brown 2014, White et al. 2015d). Furthermore, attempting to meet this standard would impede, if not preclude, the restoration of bison on most tribal or public lands due to opposing legislation, litigation, or political disagreements. This conclusion is reinforced by the small number of unfenced, wide-ranging populations of plains bison today (Book Cliffs, Henry Mountains, Jackson, Wrangell-St. Elias, Yellowstone), as well as the controversy sparked when animals from these populations move beyond areas of human tolerance (White et al. 2015d). Thus, some level of fencing or commitment to containment is generally necessary to achieve tolerance for bison in new areas (Brown 2014).

Alternative Summaries

In accordance with the requirements of NEPA (42 USC 4321 et seq.), Table 2 compares each alternative with the project objectives and Table 3 summarizes the impacts of each alternative on resources and values.

Table 2. Comparison of alternatives and objectives for the quarantine of Yellowstone bison.

Objectives	Alternative 1 (Current Management with No Quarantine Facility)	Alternative 2 (Quarantine Within the Designated Surveillance Area)	Alternative 3 (Quarantine Outside the Designated Surveillance Area)
Augment and/or establish new conservation and cultural herds of plains bison	Bison would likely be available from some established herds without disease issues, but not YNP.	If the NPS was involved, the agency would prioritize sending brucellosis-free bison to public and tribal lands. Otherwise, the party conducting quarantine with Yellowstone bison would determine priorities for relocating brucellosis-free animals.	The Fort Peck Tribes have indicated they would use quarantine to augment their cultural/conservation herd from Yellowstone bison lineage and also propagate bison for relocation to other public and tribal lands.
Enhance the culture and nutrition of Native American Tribes	Meat from bison transferred to the tribes for shipment to processing facilities would be distributed by the tribes. Treaty subsistence harvests of bison would continue near YNP.	If the NPS was involved, the agency would prioritize sending brucellosis-free bison to tribes to help them augment or establish sustainable herds. Otherwise, the party conducting quarantine would determine priorities for relocating brucellosis-free bison.	The Fort Peck Tribes have established a quarantine facility on their lands to develop a sustainable cultural/conservation herd of Yellowstone bison. Some bison from quarantine would be culled for food, while some bison would be relocated to other tribal lands.
Conserve a viable, wild population of Yellowstone bison	This alternative would maintain a wild, wide-ranging population of 3,000+ bison with high genetic diversity and minimal human intervention in the interior of YNP.	The NPS would maintain a wild, wide-ranging population of 3,000+ bison with high genetic diversity. Bison would only be placed in quarantine when the population is culled to limit abundance. New populations of this lineage would be established.	The NPS would maintain a wild, wide-ranging population of 3,000+ bison with high genetic diversity. Bison would only be placed in quarantine when the population is culled to limit abundance. New populations of this lineage would be established.
Maintain the low risk of brucellosis transmission from bison to cattle	The risk of transmission would remain low because managers would continue to maintain separation.	The risk of transmission near YNP would remain low. Quarantine would not add to this risk.	The risk of transmission from quarantine would be negligible based on the results of the quarantine feasibility study and subsequent assurance testing (10 years total).
Reduce the shipment of Yellowstone bison to meat processing facilities	Bison removed from the population to limit abundance would be shipped to meat processing or research facilities.	Some bison testing negative for brucellosis exposure would be placed in quarantine when the population is culled. Otherwise, these animals would be killed in terminal pastures or shipped to meat processing or research facilities.	Some bison testing negative for brucellosis exposure would be placed in quarantine when the population is culled. Otherwise, these animals would be killed in terminal pastures or shipped to meat processing or research facilities.

Table 3. Comparison of environmental impacts by alternative.

Impact Topics	Alternative 1 (No Action)	Alternative 2 (Quarantine Within the Designated Surveillance Area)	Alternative 3 (Quarantine Outside the Designated Surveillance Area)
Site-specific Impacts to Quarantined Bison			
Injuries and trauma from hazing, capture, transport, confinement, physical restraint, and testing	Minor, adverse, local impacts could result in the short- and long-term from injuries, infection, and stress.	Minor adverse impacts include those disclosed for alternative 1. The length of captivity would be longer, with more chance for injury at higher bison densities. Injuries and trauma may occur during loading and transport to facilities outside YNP.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Disease transmission in captivity	Minor, adverse, local impacts could result in the short- and long-term from bison experiencing stress and chronic undernutrition being more susceptible to disease exposure.	Minor adverse impacts from this alternative include those disclosed for alternative 1. The length of captivity would be longer, with more chance for disease exposure.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Confinement will lead to domestication	Minor, adverse, local impacts could result in the short- or long-term from confinement. There is no evidence confinement and feeding for weeks or a few months has led to domestication.	Minor adverse impacts from this alternative include those disclosed for alternative 1. The length of captivity would be longer, with more chance of bison becoming food-conditioned and habituated to people.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Quarantine will lead to an unnatural social structure	Minor, adverse, local impacts could result in the short- and long-term from animals being segregated during confinement and female-calf pairs becoming separated.	Minor adverse impacts from this alternative include those disclosed for alternative 1. Young animals in quarantine without adult leadership may require more time to develop natural behaviors.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Founder effect (chance loss of genetic variation) from the smaller number of bison placed in quarantine	Bison calves placed in the quarantine feasibility study had high genetic diversity similar to the entire population.	Minor, adverse, local impacts could result in the short- and long-term from chance loss of genetic variation when animals are chosen for quarantine.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Programmatic Impacts to Yellowstone Bison			
Effects of removals on population dynamics	Moderate, adverse, regional impacts could result in the short-term from irregularly removing several hundred bison from the population. The population has recovered from removals of more than 500 bison during several winters and about 8,000 bison since 1985.	Negligible to minor adverse impacts from this alternative include those disclosed for alternative 1. Bison placed quarantine or terminal pastures would otherwise be sent to meat processing or research facilities.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Retention of genetic diversity	Yellowstone bison have been culled	Minor, adverse, regional impacts could	Impacts from this alternative include

Impact Topics	Alternative 1 (No Action)	Alternative 2 (Quarantine Within the Designated Surveillance Area)	Alternative 3 (Quarantine Outside the Designated Surveillance Area)
	since the 1920s and still retain high genetic diversity. This diversity should be maintained for centuries with a population size averaging 3,000 to 3,500 bison. Bison placed in the quarantine feasibility study retained high genetic diversity similar to the overall population.	result in the short- and long-term from culling bison. Migratory bison would be culled in an unselective manner without allowing brucellosis or other factors to act as key selective forces. Bison testing negative for brucellosis exposure would be sent to quarantine; test-positive bison would be killed.	those disclosed for alternatives 1 and 2.
Tolerance for bison in the GYE	Tolerance is the prerogative of the states surrounding YNP. The IBMP has been adjusted several times to allow more bison in Montana during winter.	Negligible impacts would result from quarantine because operations would not impinge on efforts to increase conservation and tolerance areas in suitable portions of the GYE.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Retention of the ecological role of bison	Bison are managed as unfenced, wide-ranging wildlife subject to natural selection factors such as competition, predation, and survival in challenging environmental conditions.	Negligible impacts would result from placing some bison in quarantine because operations would not alter the NPS paradigm of minimal management of bison in the interior of YNP.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Reduction in shipments of bison to meat processing facilities	There would be no reduction because no quarantine facilities or terminal pastures are operational.	Minor to moderate, beneficial, local impacts could result in the short- and long-term from sending some bison testing negative for brucellosis exposure to quarantine and/or some bison testing positive to terminal pastures.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Increasing brucellosis prevalence in the population	Brucellosis is widespread in the bison population, with about 60% of adult females exposed to *Brucella* bacteria at some time in their lives.	Minor, adverse and beneficial, local to regional impacts could result in the short- and long-term on brucellosis prevalence and transmission. Bison would be culled in an unselective manner with regards to brucellosis. Some bison testing negative for exposure would be sent to quarantine; test-positive animals would be killed.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Programmatic Impacts to Plains Bison			
Conservation benefits	There is a need to establish additional populations of wild plains bison, including from the Yellowstone lineage. Some bison could be obtained from existing herds established using relocated, brucellosis-free Yellowstone	Moderate to major, beneficial, regional impacts could result in the long-term from establishing new populations from the Yellowstone lineage or enhancing the genetic diversity of other wild populations using bison from	Impacts from this alternative include those disclosed for alternatives 1 and 2.

Impact Topics	Alternative 1 (No Action)	Alternative 2 (Quarantine Within the Designated Surveillance Area)	Alternative 3 (Quarantine Outside the Designated Surveillance Area)
	bison. No quarantine facilities are operational to provide additional bison.	quarantine. Access to available habitat would continue to be the major impediment to bison restoration.	
Genetic benefits	Yellowstone bison have a unique lineage, high genetic diversity, and no cattle genes. Some bison could be obtained from herds established using previously relocated Yellowstone bison. No quarantine facilities are operational to provide additional bison.	Moderate to major, beneficial, regional impacts could result in the long-term from creating new populations from the Yellowstone lineage or enhancing the genetic diversity of other wild populations with bison from quarantine.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Cultural and nutritional benefits	The NPS has agreements with the several tribes to provide them with bison for transfer to approved meat processing facilities and subsequent distribution of meat to their members. There are no operational quarantine facilities to provide additional bison.	Moderate to major, beneficial, regional impacts could result in the long-term from tribes establishing or augmenting their herds to meet cultural and nutritional needs.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Other Wildlife			
Disturbance and displacement	Minor, adverse, local impacts could result in the short-term from hazing, capture, and shipping of bison in or near the Stephens Creek area of YNP.	Minor adverse impacts from this alternative include those disclosed for alternative 1. Additional impacts could occur during quarantine construction and operation, but affect a minute portion of the landscape.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Quarantine facilities and terminal pastures will be a barrier to movements	No quarantine facilities or terminal pastures are operational. Wildlife routinely feed near and move by the capture facility at Stephens Creek in YNP.	Minor, adverse, local impacts could occur in the short- to long-term because facilities would enclose a minute portion of overall habitat that other wildlife could easily bypass.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Effects of removing bison on predators and scavengers	The abundance of bison, and the potential for predation or scavenging, has been higher during the IBMP period. No negative consequences of culling bison were detected on grizzly bear demographic measures.	Negligible impacts would result from quarantine operations because bison placed in facilities would otherwise be shipped to meat processing or research facilities to limit population growth.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Brucellosis transmission	There were no bison escapes during transport, the quarantine feasibility study, or subsequent assurance testing on private and tribal lands during 2005 to 2015. There was no brucellosis transmission from quarantined bison to	Negligible impacts would result from bison quarantine because operations would not increase risk. Bison would be securely contained during transport and quarantine to prevent contact with livestock and other wildlife.	Impacts from this alternative include those disclosed for alternatives 1 and 2.

Impact Topics	Alternative 1 (No Action)	Alternative 2 (Quarantine Within the Designated Surveillance Area)	Alternative 3 (Quarantine Outside the Designated Surveillance Area)
	livestock or other wildlife.		
Special Status Species			
Disturbance and displacement	In 2000, the Fish & Wildlife Service concurred IBMP operations were not likely to adversely affect the Canada lynx, gray wolf, or grizzly bear. In 2012, the agency again concurred that bison hazing operations were not likely to adversely affect the grizzly bear.	Negligible impacts would result from bison quarantine because lynx are unlikely to use the areas, bison capture operations occur while most bears are denning, and wolf use of the areas is ephemeral. Facilities would affect a minute portion of the landscape.	Impacts from this alternative include those disclosed for alternatives 1 and 2. Quarantine would not effect the endangered black-footed ferret; may affect, but is not likely to adversely affect the endangered least tern, endangered pallid sturgeon, and threatened piping plover.
Brucellosis transmission	There were no bison escapes during transport, the quarantine feasibility study, or subsequent assurance testing on private and tribal lands (2005 to 2015). There was no brucellosis transmission from bison to livestock or other wildlife.	Negligible impacts would result from bison quarantine because operations would not increase risk. Bison would be securely contained behind fences and prevented from contacting other wildlife.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Ethnographic Resources			
Native American culture	Negligible to minor from construction of a quarantine facility as directed in the IBMP. Some native people are also opposed to the capture, confinement, and shipment of bison. However, the NPS has agreements with several tribes to provide them with bison for transfer to processing facilities and subsequent distribution of meat to their members.	Minor, adverse, local impacts could result in the short-term from temporarily confining wild bison. Minor to moderate, beneficial, regional impacts could result in the long-term if bison completing quarantine are distributed to public and tribal lands to provide communal, spiritual, and conservation benefits. No other known ethnographic resources would be impacted by quarantine.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Human Health and Safety			
Injuries	A few state employees have been injured during bison hazing activities. No bison have escaped during transport or confinement.	Minor, adverse, local impacts could result in the short-term from accidents during bison quarantine activities.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Brucellosis infection	We are not aware of any transmission of brucellosis to humans from handling captured Yellowstone bison.	Minor, adverse, local impacts could result in the short-term from exposure during bison quarantine activities. Nearly all patients exposed to *Brucella* bacteria respond to appropriate antibiotic therapy.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Visitor Use and Experience			

Impact Topics	Alternative 1 (No Action)	Alternative 2 (Quarantine Within the Designated Surveillance Area)	Alternative 3 (Quarantine Outside the Designated Surveillance Area)
Disturbance	Minor, adverse, local impacts could result in the short-term to visitors that are disturbed or offended by bison management activities.	Minor adverse impacts from this alternative include those disclosed for alternative 1. Minor to moderate, beneficial, regional impacts could occur if bison completing quarantine are relocated to public or tribal lands.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Vegetation			
Native plants and soil	Negligible impacts. Vegetation in the capture facility has already been denuded. Weeds are sprayed periodically to prevent spread.	Minor, adverse, local impacts could occur in the short- and long-term due to removing habitat and compacting and disturbing soil during the construction and operation of a quarantine facility and/or terminal pasture.	Impacts from this alternative include those disclosed for alternatives 1 and 2.
Water/Aquatic Resources			
Availability and use	Negligible impacts. Water obtained from Wilson Springs is currently sufficient for existing uses in the Stephens Creek area, including for hundreds of bison held for weeks or months in the capture facility during some winters.	Minor, adverse, local impacts could occur in the short- and long-term due to tapping or developing additional water supplies to support bison year-round in a quarantine facility.	Impacts from this alternative include those disclosed for alternatives 1 and 2.

Environmentally Preferable Alternative

The environmentally preferable alternative is the alternative developed and analyzed during the NEPA process "that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources" (43 CFR 46.30). Based on this definition, the environmentally preferable alternative would implement a quarantine program in a location where appropriate facilities already exist or need little modification. Though the quarantine of wild bison conflicts with the NPS's general principle of minimizing human intervention to native populations and the processes sustaining them, it would contribute to restoring plains bison populations while still preserving a viable Yellowstone bison population (NPS 2006a). Bison sent to quarantine would otherwise be shipped to processing or research facilities because current regulations preclude their transfer elsewhere due to chronic exposure of the population to the disease brucellosis.

Conducting quarantine inside the facility on the Fort Peck Reservation, which is located outside the DSA (alternative 3), is the environmentally preferable alternative. This alternative would cause minimal damage to the environment, while conserving and enhancing cultural and natural resources. The risk of brucellosis transmission from bison in quarantine to livestock, people, or other wildlife would be negligible provided the criteria and best practices described in the *Quarantine Facility Guidelines* and *Requirements, Roles and Responsibilities* sections of this document were followed. The Fort Peck Tribes have already demonstrated their ability to conduct brucellosis testing and manage bison originating from YNP (MFWP 2014).

Preferred Alternative

The agency's preferred alternative is the alternative the agency believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors (Question 4a of the Council of Environmental Quality's "Forty Most Asked Questions Concerning Council of Environmental Quality's NEPA Regulations" (1981)).

The NPS has concluded implementing a quarantine program for some bison testing negative for brucellosis exposure is preferred to shipping all bison culled to limit population growth to meat processing or research facilities. The preferred alternative would be to conduct quarantine inside the facility on the Fort Peck Reservation (alternative 3). This alternative would benefit the restoration of plains bison by augmenting a new population recently established on the reservation using Yellowstone bison. It would also enhance the culture, nutrition, and self-sufficiency of the tribes. The risk of brucellosis transmission from bison in quarantine to livestock, people, or other wildlife would be negligible provided the criteria and best practices described in the *Quarantine Facility Guidelines* and *Requirements, Roles and Responsibilities* sections of this document were followed. The Fort Peck Tribes have already demonstrated their ability to conduct brucellosis testing and manage bison originating from YNP (MFWP 2014).

Affected Environment and Environmental Consequences

This chapter describes the physical, biological, and human environment potentially affected by the implementation of any of the alternatives. The resource descriptions in this chapter serve as

the baseline from which to compare the potential effects of management actions with respect to a bison quarantine program. In addition, this chapter describes the methods and assumptions used to analyze impacts from implementing the no action and action alternatives. The results of the analyses for each alternative are described for each impact topic.

The generalized approach for analyzing each impact topic is to define the issues of concern as discovered through scoping and consultation, identify the area of potential effects to resources, NPS values, and visitor experiences, and disclose those effects likely to occur under the scenarios described by each of the proposed alternatives. Potential impacts are characterized from a variety of perspectives, including type (beneficial or adverse), context (local or regional), duration (short- or long-term, seasonal or continuous), and intensity (negligible, minor, moderate, or major). The following definitions were applied for all impact topics:

- *Beneficial impact*—a positive change in the condition or appearance of the resource or a change moving the resource toward a desired condition.
- *Adverse impact*—a negative change in the condition or appearance of the resource or a change moving the resource away from a desired condition.
- *Site-specific impact*—the action would affect a relatively small area, centered on where the action takes place.
- *Local impact*—the action would affect areas within the quarantine facility boundary and the quarantined bison themselves.
- *Regional impact*—the action would affect resources within the quarantine facility boundary, on lands adjacent to the facility, and in surrounding communities.
- *Short-term impact*—consequences of the action would be short in duration and not detectable after a resource returns to the pre-implementation condition.
- *Long-term impact*—consequences of the action would result in a lasting or nearly permanent change in resource conditions.

The magnitude of effect is categorized into four levels of intensity: negligible, minor, moderate, and major. Definitions for these four categories are described in each impact section based on management objectives, consultation with tribal officials and regulatory agencies, the public scoping process, and conversations with subject matter experts.

Yellowstone Bison

Affected Environment

Yellowstone bison are noteworthy because the population faced extinction just over a century ago, but today thousands of individuals roam relatively freely over an expansive landscape (Franke 2005, Plumb and Sucec 2006, Freese et al. 2007, Bailey 2013).[12] These unfenced bison exhibit wild behaviors reminiscent of prehistoric populations, with large congregations of individuals to compete for food and mates, group defensive strategies to protect their young from predators, and migration and pioneering movements to explore new areas (Meagher 1973, Blanton et al. 2015, Geremia et al. 2015b,c).

[12] The information in this section was reproduced from *Yellowstone Bison—Conserving an American Icon in Modern Society* (Blanton et al. 2015, Geremia et al. 2015b,c; Wallen and White 2015, Wallen et al. 2015a, White et al. 2015d).

Yellowstone bison are an important genetic lineage of plains bison, with high diversity and no evidence of interbreeding with cattle (Halbert and Derr 2007, 2008; Hedrick 2009). However, they are geographically isolated from other bison populations and have moderate to high variance in reproductive success due to a polygamous mating system in which dominant males breed most of the females in a given year (Pérez-Figueroa et al. 2012). Also, more than 1,000 bison have been sporadically culled and harvested from the population several times during the past two decades to reduce migratory movements to winter ranges outside YNP where there is limited acceptance for wild bison due to disease, property, and human safety issues (White et al. 2011). These large culls, combined with intervening periods of rapid population growth, resulted in substantial fluctuations in bison population size and generated concerns about possible reductions in genetic variation (White et al. 2011, Halbert et al. 2012).

However, geneticists recently identified 10 different mitochondrial DNA haplotypes and an overall haplotype diversity of 0.78, indicating a healthy, diverse population. There was no sign of population subdivision, but mitochondrial haplotypes indicated two independent lineages in approximately equal proportions from the endemic bison originally in central Yellowstone and the bison introduced into northern Yellowstone from the Pablo-Allard herd (Forgacs et al. 2015). The population should retain this genetic diversity for centuries with a fluctuating population size averaging at least 3,000 to 3,500 bison (Pérez-Figueroa et al. 2012). Currently, more than 1,000 bison congregate in both the central and northern regions of YNP during the breeding season, where hundreds of mature males compete for breeding opportunities (Hedrick 2009, Dratch and Gogan 2010, Gates et al. 2010). Parentage analyses indicate a high portion of adults contribute offspring to the population during their lifetimes (Herman et al. 2014). Also, bison are exposed to natural selection through competition, predation, and extreme environmental conditions (Wallen and White 2015).

Female bison typically reach sexual maturity and conceive their first calf at 2 or 3 years of age (Meagher 1973, Gogan et al. 2013). Males typically do not breed until they are 5 or 6 years old because older, larger males dominate opportunities (Meagher 1973). Mature female bison generally produce one calf every one or two years for their entire lives (Meagher 1973, Gogan et al. 2013, Geremia et al. 2015b). Calves are born during March through June, with 80% of births occurring during late April and May (Jones et al. 2010). Bison are long-lived, with some females living 20 or more years (Udevitz and Gogan 2010). Survival rates for adult females have been high (0.88 to 0.98) during recent decades (Geremia et al. 2015b). Adult males have lower survival and rarely live past 12 years of age, which is probably related to the intense and prolonged competition for mates during the breeding season (Meagher 1973). Bison calves have surprisingly high survival rates (0.65) given the high densities of predators such as grizzly bears (*Ursus arctos*) and wolves (*Canis lupus*) in YNP (Geremia et al. 2015b).

Yellowstone bison are considered migratory because most animals move back and forth between seasonal ranges to better access grasses, sedges, and other grass-like plants that comprise more than 90% of their diets through the year (Meagher 1973, Plumb et al. 2009, Gates and Broberg 2011). Bison move from higher-elevation summer ranges to lower elevations during autumn through winter, until returning to summer ranges in June. Bison in northern Yellowstone primarily occupy the Yellowstone River drainage and surrounding mountains between the Lamar

Valley and Mirror Plateau in the east and the lower-elevation Gardiner basin in the west (Geremia et al. 2011, 2015c). They congregate in the Lamar Valley and on adjacent plateaus during the breeding season (Meagher 1973). Bison in central Yellowstone occupy the central plateau, extending from the Pelican and Hayden valleys in the east to the lower-elevation and geothermally influenced Madison headwaters area in the west (Meagher 1973). They congregate in the Hayden Valley for breeding and afterwards move between the Madison, Firehole, Hayden, and Pelican valleys (Meagher 1973). Also, some bison travel to the northern region of YNP during winter before returning to the Hayden Valley for the subsequent breeding season (Geremia et al. 2011, 2015c).

Migration by Yellowstone bison is driven by their density, forage availability, the timing and extent of snow pack, learning, and other factors (Geremia et al. 2011, 2015c). While YNP provides a large amount of habitat for bison, it does not include many lower-elevation valleys used by these animals when deep snow limits access to grasses in the mountains (Plumb et al. 2009, White et al. 2013b). As a result, many hundreds to thousands of bison migrate outside the boundary of YNP during about one-third to one-half of winters (Geremia et al. 2011, 2015c). However, large portions of the valleys historically used by these bison are no longer available due to agricultural and residential development (Gude et al. 2006, 2007). Also, there is little tolerance for bison in these areas due to concerns about human safety and property damage, competition with livestock and elk for grass, and brucellosis transmission to cattle (Lott 2002, Boyd 2003, Franke 2005, Bailey 2013). As a result, substantial numbers of bison may be culled and harvested when abundance is above 3,000 bison. Human removals have been the primary cause of mortality since 1985, with more than 8,000 bison removed (Geremia et al. 2015b).

Under the IBMP, counts of bison in central Yellowstone increased from 1,900 in 2000 to 3,500 in 2005 due to high reproduction, survival, and recruitment rates. Counts then decreased to 1,300 bison by 2015 due to culls of about 1,000 bison during 2006 and 1,560 bison during 2008 (White et al. 2011). Conversely, counts of bison in northern Yellowstone increased from about 500 in 2000 to 3,600 in 2015 (White et al. 2011, Geremia et al. 2015a). This rapid increase was enhanced by immigration of bison from central Yellowstone and, possibly, reduced competition as counts of northern Yellowstone elk decreased from about 19,000 in 1994 to 4,850 in 2015 following the recovery of grizzly bears and wolves (Frank et al. 2013, Wallen et al. 2015a).

The overall abundance of Yellowstone bison during the IBMP period (2001 to 2015), based on summer counts, was between 2,432 and 5,015 (average = 4,088). For comparison, the overall abundance of Yellowstone bison during the pre-IBMP period (1991 to 2000), based on summer counts, was between 1,892 and 4,114 (average = 2,900). Culls of bison for population and brucellosis control were higher (3,693) during the first 10 years the IBMP was implemented than during the 10 years prior to the IBMP (2,353; White et al. 2011), in part due to larger overall abundance of bison. The bison population has shown resiliency to recover from culling and harvesting, with a count of almost 4,900 bison in summer 2015 despite the removal of about 5,587 bison from the population since 2001 (Blanton et al. 2015, Geremia et al. 2015a).

Methodology and Intensity Level Definitions

The thresholds of change for the intensity of impacts to Yellowstone bison are defined as follows:

Negligible: Yellowstone bison would not be affected or changes would be either undetectable or, if detected, would have effects considered slight and short term.

Minor: Temporary displacement of a few localized individuals or groups of bison, but mortality or culling of individuals would not impact population trends. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Effects to Yellowstone bison would be readily detectable, long term, and regional, with consequences affecting population trends. Mitigation measures needed to offset adverse effects would be extensive, but likely successful.

Major: Effects to Yellowstone bison would be obvious, long term, and have substantial consequences to the population, with mortality or culling of a number of individuals subsequently jeopardizing the viability of the population. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

Impacts of Alternative 1 – No Action

The effects of implementing the IBMP on Yellowstone bison were evaluated in a Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) (see the <http://ibmp.info> website in the *Document Library* section). The analysis envisioned captures and shipments of bison to processing facilities as the primary method to limit bison abundance and distribution. The impact thresholds used in the FEIS were different than those used here, but comparable in terms of population level effects. It was anticipated that the implementation of the modified preferred alternative and the selected action would have a moderate adverse impact to the bison population in terms of overall removal of animals. But modeling predicted this removal would not measurably affect the age and sex distribution or reproductive rates of the population based on removing 246 bison each year to limit the total population size to about 3,000 animals. Since the implementation of the plan, the population has recovered from removals (harvests plus culls) of more than 500 bison during several winters and almost 6,000 bison since 2001. Thus, the effects of continuing current management would have no additional impacts beyond those previously disclosed in the FEIS and ROD on bison populations. For the purposes of analyzing impacts to individual bison in this EA under the no action alternative, there could be minor, adverse, and local impacts related to injuries, trauma, disease transmission, and stress from confinement activities occurring under the existing IBMP.

Impacts of Alternative 2 – Quarantine Facilities Within the Designated Surveillance Area for Brucellosis

Impacts to Yellowstone bison from actions under alternative 2 would include those described for alternative 1 due to current operations under the existing IBMP.

Programmatic Impacts to Yellowstone Bison and the Species

Conservation.—Sending Yellowstone bison testing negative for brucellosis exposure to quarantine for eventual relocation elsewhere would enhance the conservation of plains bison. Currently, Yellowstone bison comprise the only wild, wide-ranging population with several thousand bison and hundreds of mature males competing for breeding opportunities each year (Blanton et al. 2015, Wallen and White 2015). Yellowstone bison completing quarantine could be used to augment existing populations of wild bison to increase their numbers, genetic diversity and, as a result, viability. Bison from quarantine could also be used to establish new

populations of wild bison with Yellowstone genetics that, over time, could be augmented or proliferated to increase viability. These benefits would be moderate to major, regional, and long-term.

Ecological Role.—Yellowstone bison would retain their ecological role because they would be managed as wildlife in multiple large herds moving across extensive portions of the landscape within and near YNP. Thousands of bison would continue to exist on this landscape with a full suite of native ungulates and predators, transferring nutrients, altering the diversity and productivity of grasslands, and providing food for predators, scavengers, and decomposers (Wallen et al. 2015a). Thus, the potential impacts of quarantine operations on the ecological role of Yellowstone bison would be negligible.

There are some concerns the culling of bison for quarantine may hinder bison movements outside YNP. Removals of bison for quarantine would be in lieu of captured bison being shipped to meat processing or research facilities. As a result, the placement of some bison in quarantine would not affect bison migration outside YNP beyond what is already occurring in alternative 1 (i.e., current management). The capture and removal of bison from the population has occurred during about one-half of the winters under the IBMP (2001 to 2015), and during these winters, other groups of bison continued to move or remain outside YNP. Thus, the effects of placing some bison culled to limit the abundance and distribution of Yellowstone bison into quarantine on bison movements outside YNP could be adverse, minor, short-term, and local.

Genetics.—Yellowstone bison would be a valuable source population for augmenting or establishing populations of plains bison elsewhere due to their high genetic diversity, lack of cattle genes, and adaptive capabilities (Dratch and Gogan 2010, USDI 2014). Impacts to plains bison from restoration projects with Yellowstone bison could be beneficial, moderate to major, regional, and long-term. Also, infusing Yellowstone bison genes into some conservation, cultural, and private herds could reduce inbreeding and hinder the emergence of infectious diseases (Kubinak et al. 2015). Low diversity in immune system genes may enable parasites and pathogens to replicate more quickly and become more virulent (Kubinak et al. 2015). Having more genetic diversity within a single herd or population may counter the ability of diseases to adapt and replicate quickly (Kubinak et al. 2015).

The genetic effects of removing several hundred bison from the Yellowstone population in a given year for quarantine or through other methods were evaluated in the Final Environmental Impact Statement and Record of Decision for the IBMP (see <http://ibmp.info> website in the *Document Library* section). Modeling predicted bison abundance would average 3,700 under the IBMP, with no compromise in the genetic integrity and viability of the population (USDI, NPS and USDA, APHIS and USDA 2000a,b). Also, the NPS collaborated with the University of Montana to address the potential effects of population fluctuations and alternate culling strategies on the genetic diversity of Yellowstone bison (Pérez-Figueroa et al. 2012). Findings indicated this high genetic diversity should be maintained for centuries with a fluctuating population size averaging 3,000 to 3,500 bison. Large fluctuations in bison numbers did not accelerate the loss of genetic variation when population size was more than 3,250 bison. Also, the removal of several hundred young bison each year resulted in longer generation intervals, which maintained more genetic diversity after 200 years than removing adults (Pérez-Figueroa et al. 2012).

Overall, the effects of culling some Yellowstone bison on genetic diversity could be adverse, negligible to minor, short- and long-term, and regional.

There are some concerns that culling bison for quarantine would inadvertently remove some animals with natural genetic resistance to infection; thereby decreasing resistance against the disease in the Yellowstone population. Natural disease resistance is the ability of an animal to fight infection by a disease organism. It is found in all animals and can be passed from parent to offspring (Adams and Schutta 2010). Natural resistance to brucellosis is likely a complex trait with several genes interacting to contribute to innate resistance mechanisms (Adams and Schutta 2010). These mechanisms may involve seizing or isolating the disease organism, limiting its reproduction by altering the environment within cells, or clearing the organism from the animal's body (Adams and Schutta 2010). The 3′UTR of the candidate solute carrier gene, *SLC11A1*, may provide some degree of natural resistance to brucellosis in ruminants such as cattle and water buffalo, but findings from several studies are contradictory (Adams and Schutta 2010). Also, Seabury et al. (2005) reported an association between the prion protein gene exon 3 and *Brucella* antibodies in bison; suggesting this gene may be involved with natural resistance to brucellosis infection. However, other scientists were unable to identify resistant and susceptible genotypes in Yellowstone bison using this prion protein gene as a screening tool (Herman 2013). Thus, while removing bison testing negative for brucellosis exposure could inadvertently remove some animals with some level of natural genetic resistance, further investigation is necessary to identify these brucellosis-resistant bison based on genetic screening (Adams and Schutta 2010, Herman 2013). Regardless, few bison with innate immunity characteristics would likely be removed from the Yellowstone population if 50 to 100 bison are culled in a given year for quarantine. These effects are likely to be adverse, minor, short-term, and regional.

A population created from a relatively small number of animals selected from a larger population contains less genetic variation than the original, larger population—known as the founder effect (Allendorf and Luikart 2007). Thereafter, chance losses of genetic variation may continue due to genetic drift or inadequate gene flow with other populations. Over time, these losses could reduce the abilities of animals to adapt to new environmental challenges (Allendorf and Luikart 2007). Yellowstone bison experienced a population bottleneck in the late 1800s due to human exploitation (Plumb and Sucec 2006). There were about 23 indigenous bison in YNP by 1902, all in the central region of the park (Pelican Valley). This population persisted at relatively low numbers (less than 100 bison) for many decades (Meagher 1973). Likewise, the northern herd was created by reintroducing 21 bison from northern Montana and Texas (Cahalane 1944). However, Yellowstone bison do not show the effects of inbreeding and they have retained high genetic diversity despite propagating from low numbers of animals in the early 1900s (Allendorf and Luikart 2007, Hedrick 2009, Halbert et al. 2012, Hermin 2013).

In addition, evaluations of microsatellite loci in Yellowstone bison selected for the quarantine feasibility study during 2005 to 2010 indicated these bison retained high genetic diversity similar to the overall population (Derr and Dobson 2012, Herman et al. 2014). Thus, there is little risk of inbreeding and these bison provide a robust genetic foundation for augmenting or establishing new herds to conserve the species (Derr and Dobson 2012, Herman et al. 2014). There is no reason to anticipate future herds established from relatively small numbers of Yellowstone bison completing quarantine would experience inbreeding and genetic drift, especially if most adult

animals are allowed to breed and their numbers increase relatively quickly. Thus, any adverse founder effects could be negligible to minor, short- and long-term, and local.

Population Dynamics.—The effects of removing several hundred bison from the Yellowstone population in a given year for quarantine or through other methods (e.g., hunting; shipments to research or meat processing facilities) were evaluated in the Final Environmental Impact Statement and Record of Decision for the IBMP (see <http://ibmp.info> website in the *Document Library* section). Modeling forecasts suggested the population would average about 3,700 bison and range between 3,100 and 4,215 bison under the IBMP (USDI, NPS and USDA, APHIS and USDA 2000a,b). In reality, the population averaged about 4,000 bison and ranged between 3,200 and 5,000 bison since 2001 (Blanton et al. 2015).

More recent analyses demonstrate the population is still resilient and viable in the long term despite removals through harvests or culling. During 2013 through 2015, wildlife biologists at YNP used population and migration models with demographic, movement, and environmental information to predict future population dynamics under various management alternatives (Geremia et al. 2015a). Without management removals (i.e., harvests, culls), bison numbers were predicted to increase to approximately 6,000 by 2016. Even with the removal of about 600 to 1,000 bison during the next several winters, abundance would still remain above 3,000 (Geremia et al. 2015a). In addition, biologists at YNP and Colorado State University developed a model to compare different management actions to a no harvest or culling alternative (Hobbs et al. 2015). Simulations predicted a steady increase in bison population size without removals. Removals of up to 200 adult and young females per year for five years decreased the population size toward 3,500 bison, but not below (Hobbs et al. 2015).

Occasionally capturing several hundred bison from the Yellowstone population and sending them to quarantine and terminal pastures instead of meat processing facilities would not have any additional effects on population demographics or dynamics. The population is reproductively prolific and has shown remarkable resiliency to recover rapidly from previous decreases in abundance due to culling or natural mortality—including the removal of more than 500 bison during several winters and almost 8,000 bison from the population since 1985 (White et al. 2011, Geremia et al. 2015b). Overall, the effects of capturing and removing bison from the population for quarantine could be negligible to minor, short- and long-term, and regional.

It is uncertain whether periodically sending some bison testing negative for brucellosis exposure to quarantine would provide a longer-term tool for reducing abundance in the Yellowstone population. The minimum quarantine periods and testing requirements recommended by APHIS (Table 1) are logistically difficult and relatively expensive to implement over several years. Also, it is likely many parties receiving brucellosis-free bison from quarantine would eventually reach saturation of their facilities and lands through subsequent breeding of these animals. Thereafter, new herds formed from brucellosis-free bison would only need the occasional infusion of a few additional bison to maintain their existing genetic diversity. Already there are hundreds of brucellosis-free bison from the Yellowstone lineage at the Fort Belknap and Fort Peck Reservations, Book Cliffs and Henry Mountains in Utah, and the Vermejo Ranch in New Mexico that potentially could be used for restoration efforts. Thus, quarantine would not be a continuous or permanent process, though it may run for several decades if there is sufficient

demand by parties attempting to accumulate large populations. Overall, the potential impacts of quarantine on regulating numbers of bison in the Yellowstone population could be beneficial, minor to moderate, regional, and short- and long-term.

Tolerance in the GYE.—There is some concern quarantine operations would detract from efforts to obtain expanded habitat and spatial and temporal tolerance for wild bison in portions of the GYE outside YNP; thereby limiting their distribution and migration. As a result, hunting, hazing, capture, and culling are used to limit the abundance and distribution of bison, while building acceptance for them in modern society (Western Watersheds Project et al. v. Salazar et al.; U.S. District Court for the District of Montana, Missoula Division; Case No. CV 09-159-M-CCL [2011]). The NPS would continue to support increased tolerance for wild bison in suitable portions of the GYE whether or not quarantine is implemented. Thus, quarantine operations would not impinge on efforts to increase the conservation and hunting areas for bison near YNP and elsewhere; potential impacts would be negligible.

Shipments of Bison to Meat Processing Facilities.—The use of quarantine facilities could reduce the number of bison shipped to meat processing facilities, which is highly controversial and socially polarizing. Bison selected for removal from the population and testing negative for brucellosis exposure could be sent to quarantine, while bison testing positive could be sent to meat processing plants, research facilities, or terminal pastures. This partitioning would reduce the number of bison sent to meat processing facilities, especially late in pregnancy, which is an objective of bison managers (Partner Agencies, IBMP 2008; IBMP Members 2014). However, quarantine is unlikely to eliminate shipments at higher population sizes because more bison may need to be removed from the population to reach abundance objectives than could be accommodated by available quarantine facilities. Also, test-positive bison would still need to be sent to meat processing plants, research facilities, or terminal pastures. Overall, the potential impacts of quarantine on reducing the number of bison shipped to meat processing facilities could be beneficial, minor to moderate, local, and short- and long-term.

Brucellosis.—Culling only Yellowstone bison testing negative for brucellosis exposure for quarantine would not reduce, but could increase, brucellosis prevalence in the population and could have some unintended consequences to breeding herd and age structure. This should not be an issue because bison would be culled from the population in an unselective manner with regards to brucellosis exposure, with some test-negative bison going to quarantine and test-positive bison being killed (USDI, NPS and MFWP 2013). Bison removals primarily occur at the northern boundary of YNP because there is no permanent capture facility operated on west-side of YNP. Thus, segments of the population migrating to the northern boundary would be disproportionately reduced in numbers during some winters.

Ebinger et al. (2011) conducted modeling exercises to compare the potential effectiveness of various management activities for potentially decreasing brucellosis prevalence in Yellowstone bison. When prevalence is high and there is some immunity (resistance) to infection in the population, either as a result of previous infections, innate traits, and/or vaccination, then abortion events should result in less transmission than when the population has a higher proportion of susceptible animals. Conversely, rapid large increases in prevalence could potentially occur if prevalence and resistance are decreased in the population (Ebinger et al.

2011). In other words, larger brucellosis transmission events could become more likely if more resistant animals are removed and naïve animals make up a larger portion of the population. This should not be a substantial concern if bison are culled from the population in an unselective manner with regards to brucellosis exposure.

Capturing and holding bison in captivity can increase the risk of brucellosis transmission to other bison if an abortion or infectious live birth occurs (White et al. 2013b). As a result, bison testing negative for brucellosis exposure and placed in quarantine would be segregated from other bison in the capture facility to prevent exposure to abortions or infectious live births. It is highly unlikely any bison would escape during transport or quarantine, or that there would be transmission of brucellosis from transported or quarantined bison to nearby livestock. No bison have escaped during processing at Stephens Creek or transport to meat processing, research, or quarantine feasibility study facilities since IBMP activities began in 2001. Also, there were no bison escapes from the pastures used for the quarantine feasibility study during 2005 to 2010 and a fertility control study thereafter (MFWP 2011; USDA, APHIS 2012). In addition, there were no bison escapes from the pastures used for assurance testing of bison completing the quarantine feasibility study during 2010 through 2015 (MFWP 2014). Furthermore, there has not been any transmission of brucellosis from bison transported to these destinations to nearby livestock or other wildlife. Overall, the potential impacts of quarantine on brucellosis prevalence and transmission in the Yellowstone bison population could be beneficial, minor, local to regional, and short- and long-term.

Additional Site-specific Impacts to Quarantined Bison

Injuries and Trauma.—The environmental impacts of capturing, confining, handling, restraining, testing, and transporting bison from the Yellowstone population to quarantine facilities and/or other destinations were previously assessed in the Final Environmental Impact Statement for the IBMP (see the <http://ibmp.info> website in the *Document Library* section). Appendix F of that document provides a summary of bison management techniques the NPS developed with veterinarians and members of the Humane Society of the United States, including during hazing, capture, handling, transport, and euthanasia. These techniques have been used since 1997 to lessen injuries and trauma to bison (USDI, NPS and USDA, APHIS and USFS 2000a).

Under this alternative, bison could be hazed to the Stephens Creek capture facility or other temporary capture facilities in or near YNP. Hazing is a form of harassment that disrupts bison distribution and, in this case, migratory or dispersal movements. Hazing imposes direct, adverse, minor, and short-term energetic and other physiological costs on bison which, like all ungulates in this temperate mountainous environment, are chronically undernourished (i.e., poorer body condition) during late winter (Treanor 2013). Hazing also contributes to occasional injuries and temporary behavioral changes such as aggression (e.g., bucking, butting) by some bison, disruption of group cohesion and some mother-calf pairs, flight behavior such as running, and impeding bison from stopping to feed, drink, or rest as they may desire.

Some captured bison congregated in holding paddocks could become injured by running into facility walls or other bison, or by aggressive behavior toward other individuals. Injuries may

include breaking horns on hard structures or being gored by other bison. Also, capture operations usually occur during winter months when bison energy reserves are low and snow conditions limit forage availability. Some captured bison may be more susceptible to injury during mid- to late-winter because of decreases in their physical condition (Treanor 2013). In addition, physically restraining bison for brucellosis testing temporarily elevates their stress levels and makes them more susceptible to injury. There could be stress and injuries to bison during loading or transport in trailers to the quarantine facility due to crowding, fighting, or panic. Injuries and trauma during hazing, capture, handling, and transport would affect a few localized individuals or groups of bison, but not population trends. Thus, these impacts are expected to be direct, adverse, minor, local, and short- to long-term.

Quarantined bison would be observed daily and individuals showing clinical signs of disease would be segregated while biologists consult with veterinarians and, if necessary, test and treat or cull the affected bison. Thus, the potential impacts of disease outbreaks in the quarantine facility should be minor. There is some concern about injuries or mortality from fires in a quarantine facility because during 2012 a fire burned through the fenced pasture on the Fort Peck Reservation, killing 10 of the Yellowstone bison relocated from the quarantine feasibility study. However, potential impacts would be minimized by fighting any fires, temporarily relocating the bison if necessary, repairing damage to infrastructure, and providing supplemental feed to the bison if necessary. Thus, potential impacts should be negligible.

Captivity and Domestication.—There are some concerns confining wild bison in captivity for months or years during quarantine would lead to domestication similar to private livestock. Furthermore, maintaining brucellosis-free bison in fenced pastures with human management after relocation from quarantine is considered a violation of the public trust by some people because confinement is not a natural state for wildlife. Bison in northern Yellowstone were confined, fed, herded, and protected for about five decades to proliferate their numbers before managers decided they should live in a more natural state (Cahalane 1944, Meagher 1973). Thereafter, these bison have been wild, wide-ranging, and subject to forces of natural selection and, today, their descendants are considered an excellent example of wild bison (Freese et al. 2007, White et al. 2015d). This successful restoration suggests there is no reason bison completing quarantine in a few years or less would not retain or redevelop their wild behaviors, and no reason they should not be used to augment or establish wild herds of bison in appropriate areas. Video tapes of managers at the Fort Peck Reservation attempting to capture Yellowstone bison relocated from the quarantine feasibility study indicate released animals are not docile or habituated (Rather 2014). Furthermore, judicial evaluations have concluded that Yellowstone bison completing quarantine are wild animals under state law (Citizens for Balanced Use et al. v. Director Maurier, Montana Department of Fish, Wildlife & Parks et al.; Montana Seventeenth Judicial District, Blaine County; Cause No. DV–2012-1 [2012, 2014], overturned No. DA 12-0306 [Montana Supreme Court 2012]). The adverse effects of captivity and husbandry during quarantine could be minor, short- or long-term, and local.

Social Structure.—The Fort Peck Tribes noticed Yellowstone bison they received from the quarantine feasibility study in 2012 initially followed the largest bull in the herd, as opposed to maintaining a matrilineal family group structure (with mature bulls segregated) as seen in the wild population (Fort Peck Assiniboine and Sioux Tribes Turtle Mound Buffalo Ranch 2014).

All of these bison originated from cohorts of calves with no adult leadership or social structure while in quarantine or following their release. However, it is reasonable to expect bison released from quarantine onto a large landscape would, over time, necessarily redevelop behaviors and social groupings that contribute to their survival and reproduction. In fact, the Yellowstone bison at Fort Peck are now exhibiting more of a matrilineal family group structure (R. Magnan, Director, Fish and Game Department, Fort Peck Reservation, Wolf Point, Montana). Likewise, similar changes in group dynamics and social structure were observed over time in some bison restored to the American Prairie Reserve (D. Austin, Reserve Supervisor, Malta, Montana). Alternatively, managers could retain socially banded groups of bison from various age and sex classes through quarantine or include brucellosis-free or sterilized adults to provide leadership for young animals and teach them social skills. Thus, any adverse effects of quarantine on the social structure of relocated bison should be minor, short- or long-term, and local.

Impacts of Alternative 3 – Quarantine Facilities Outside the Designated Surveillance Area for Brucellosis

Impacts to bison from this alternative would be similar to those described for alternative 2 and are incorporated herein. In addition, the site-specific environmental impacts of transferring Yellowstone bison from the quarantine feasibility study to the Fort Peck Reservation were evaluated by MFWP (2011, 2014). These evaluations and decisions are incorporated herein by reference (see *Bison Quarantine Program* documents, *Environmental Assessments*, and *FWP, Fort Peck & Fort Belknap Reservations Bison MOUs* at http://fwp.mt.gov/fishAndWildlife/management/bison/). These Environmental Assessments considered placing variable numbers of brucellosis-free bison at several sites and analyzed the benefits, costs, and impacts to physical and human environments, as well as funding, infrastructure, and management provisions (MFWP 2011, 2014). The evaluations included facility designs and management plans to minimize the potential for bison escapes, quickly capture any escaped bison, avoid private property damage on adjacent land, and ensure bison did not mingle with livestock. The quarantine requirements and brucellosis surveillance testing for bison relocated to the Fort Peck Reservation from the quarantine feasibility study were similar to the prior containment and testing of these bison within the DSA.

MFWP (2011, 2014) concluded quarantine and the translocation of Yellowstone bison to the Fort Peck Reservation would positively impact plains bison and grassland habitats by restoring a genetically pure and viable population of an important keystone species. The beneficial impacts of transferring bison for quarantine could cumulatively become moderate to major in scope depending on how long quarantine operations provided brucellosis-free bison for relocation to new areas. The beneficial impacts are due to creating a source of genetically diverse bison to assist in the conservation of the species, reducing social conflict over killing bison at processing facilities, and supporting the culture and nutrition of native peoples.

Other Wildlife

Affected Environment

Yellowstone National Park has a diverse fauna, with at least 10 species of reptiles, 11 species of amphibians, 19 species of fishes, 81 species of mammals, and 337 species of birds. Seven ungulate species other than bison use YNP and nearby areas seasonally or year-round, including

bighorn sheep (*Ovis canadensis*), elk, moose (*Alces alces*), mountain goats (*Oreamnos americanus*), mule deer (*Odocoileus hemionus*), pronghorn, and white-tailed deer (*Odocoileus virginianus*). Large carnivores in and near YNP include black bears (*Ursus americanus*), coyotes (*Canis latrans*), grizzly bears, mountain lions (*Felis concolor*), and wolves. Predation on bison by grizzly bears is infrequent and elk are the primary prey for wolves; though more bison are killed by wolves during winter (Geremia et al. 2015b). Other species scavenge bison carcasses, and as a result, could be affected by their management, including badgers (*Taxidea taxus*), bald and golden eagles (*Haliaeetus leucocephalus, Aquila chrysaetos*), magpies (*Pica hudsonia*), ravens (*Corvus corax*), red foxes (*Vulpes vulpes*), and numerous carnivorous insects.

The area surrounding the Stephens Creek capture facility is an important migration corridor and provides winter or year-round habitat for ungulates and other wildlife. The slopes of Sepulcher Mountain located south and west of the facility are frequently occupied by hundreds of elk during winter, and thousands of elk may migrate through this area each year (White et al. 2010). These slopes are also a major calving area for elk during mid-May to mid-June. As a result, the NPS manages this area to confine development and limit disturbances to wildlife and their habitat (USDI, NPS 2006). Elk and mule deer are primarily observed early in the morning or late in the day around the Stephens Creek area, while coyotes, small mammals, and various bird species may be present at any time of day (USDI, NPS 2006). These species have habituated to day-to-day activities, but irregular, higher-intensity activities cause short-term displacement (USDI, NPS 2006).

The area surrounding the Stephens Creek capture facility is important year-round habitat for Yellowstone pronghorn, especially during winter due to low snow cover. Large groups of more than 70 pronghorn are frequently seen within 0.3 miles (0.5 kilometer) of the Stephens Creek facility during winter. Also, pronghorn fawning occurs in rabbitbrush (*Chrysothamnus*), sagebrush (*Artemisia*), and grass-sagebrush habitats in the area. Pronghorn have apparently habituated to lower intensity, day-to-day activities (e.g., stock and corral operations, nursery operations, equipment storage, horsemanship training) and vehicle traffic since they are routinely observed feeding and bedding adjacent to the Stephens Creek facility and access road while such activities are ongoing. However, irregularly scheduled higher-intensity activities (e.g., bison hazing and processing, weapons training, log building construction) at or near the facility can displace some pronghorn more than 0.6 mile (1 kilometer) away. These displacements are temporary because pronghorn have been observed foraging in habitats adjacent to the facility less than 60 minutes after bison processing operations cease (USDI, NPS 2006).

Wildlife species elsewhere in the Gardiner basin were described by MFWP (2011) and include those mentioned previously for YNP.[13] Hundreds of resident elk inhabit this area during summer and autumn and are joined by larger numbers of migratory elk from YNP and outlying areas in late autumn and early winter. Migrant elk typically remain on their winter ranges until May or June and then return to higher-elevation summer ranges (White et al. 2010). Likewise, migratory mule deer occupy the Gardiner basin from late November to early May. Several bands of bighorn sheep in the Gardiner basin typically spend summer at higher elevations until middle

[13] Much of the information in the sections for within and outside the Designated Surveillance Area is taken from Montana Fish, Wildlife & Parks' 2011 decision notice regarding the interim translocation of bison (MFWP 2011).

to late October, then move down to lower elevations until early May. These wildlife species are familiar with the existing fencing patterns and the presence of bison on the landscape.

The plains grasslands on the Fort Peck Reservation in northeastern Montana are used by bison, mule deer, pronghorn, white-tailed deer, and some elk, as well as a variety of other wildlife species which were described in MFWP (2011; see http://fwp.mt.gov/news/publicNotices/environmentalAssessments/speciesRemovalAndRelocation/pn_0055.html) and the Bureau of Indian Affairs (2015; see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). .

Methodology and Intensity Level Definitions

The thresholds of change for the intensity of impacts to other wildlife are defined as follows:

Negligible: Other wildlife would not be affected or changes would be either undetectable or, if detected, would have effects considered slight and short-term.

Minor: Temporary displacement of a few localized individuals or groups of animals, with mortality of individuals not altering population trends. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Effects to wildlife would be readily detectable, long-term, and regional, with consequences affecting the population levels of species. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.

Major: Effects to wildlife would be obvious, long-term, and have substantial consequences to populations in the region, with mortality of a number of individuals that subsequently jeopardizes the viability of the resident population. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

Impacts of Alternative 1 – No Action

The effects of implementing the IBMP on other wildlife species were evaluated in a Final Environmental Impact Statement and Record of Decision (see the <http://ibmp.info> website in the *Document Library* section). The effects of the no action alternative to other wildlife would be negligible to minor, local and adverse in the short term from distrubance and displacement due to hazing, capture, and shipping of bison in or near the Stephens Creek area. In the FEIS and ROD for the IBMP, the NPS acknowledged the potential for moderate to major impacts on the pronghorn population which spends winter in the Gardiner basin, however those impacts were not realized in the implementation of the existing IBMP as pronghorn abundance has increased from about 200 to 440 during 2001 to 2015; minor beneficial impacts to scavengers due to winterkilled carcasses in areas where bison were tolerated in Montana; and negligible impacts associated with bison grazing and changes in behavior (USDI, NPS and USDA, APHIS and USDA 2000a,b). Continuing current management would have no additional effects beyond those previously disclosed.

Impacts of Alternative 2 – Quarantine Facilities Within the Designated Surveillance Area for Brucellosis

Impacts to wildlife species from site-specific actions under alternative 2 would include those described for alternative 1 due to current operations under the existing IBMP. The construction of a quarantine facility with associated pastures would remove about 50 acres (20 hectares) to 200 acres (81 hectares) of habitat for other wildlife. Most construction (primarily fencing) for

quarantine operations would be conducted during the summer and autumn, when deer, elk, and many other migratory species are more likely to be occupying habitats at higher-elevations. However, some construction activities and the operation and maintenance of a quarantine facility would occur year-round. Wildlife species in the Stephens Creek area are familiar with the existing fencing patterns and bison management operations during winter. Construction of a quarantine facility would not impede wildlife migration through the area because wildlife would quickly adapt to the locations of any new fenced pastures and travel around them.

Most wildlife in the Gardiner basin have habituated to low to moderate intensity, day-to-day activities of humans since wild animals are frequently observed feeding, moving, and resting near residential, recreational, and agricultural developments and transportation corridors. Wildlife species in this area have already adjusted their behaviors, distributions, and movements to these long-term uses; though human activities often cause short-term displacement of wildlife. In addition, quarantine would not increase the risk of brucellosis being transmitted from bison to other wildlife. *Brucella* bacteria currently occur in some wildlife moving through the Gardiner basin. Bison in quarantine would be securely maintained behind double fences and prevented from contacting other wildlife to maintain their brucellosis-free status. Some people expressed concern that the quarantine of bison would set a precedent for initiating quarantine with other wildlife species. The NPS has no plans to capture and quarantine other wildlife species.

Some bison removed from the population and placed in quarantine might otherwise have died and become carrion for predators, scavengers, and decomposers. However, quarantine would not remove potential carrion from the system compared to alternative 1 (i.e., current management) because these bison would otherwise be shipped to meat processing or research facilities. Overall, quarantine facilities and operations in the Gardiner basin within the DSA could potentially have minor, adverse, direct, local, and short-term impacts on wildlife.

Impacts of Alternative 3 – Quarantine Facilities Outside the Designated Surveillance Area for Brucellosis

Impacts to wildlife species from site-specific actions under alternative 3 would include those described for alternative 1 due to current operations under the existing IBMP. For quarantine operations occurring at Fort Peck, MFWP (2011) evaluated similar impacts and concluded such operations would not significantly impact other wildlife. Wildlife species living on the Fort Peck Reservation have habituated to low intensity, day-to-day, human activities and adjusted their behaviors, distributions, and movements. Additionally, the resident or transient wildlife species in the area are already familiar with bison being on these lands. Wildlife encountering the fenced quarantine facility would be able to move around it to seasonal habitats in the area. Furthermore, quarantine operations would not increase the risk of brucellosis transmission to other wildlife because bison would be securely maintained behind fences to prevent them from contacting other wildlife.

The Bureau of Indian Affairs (2015) evaluated the actions of expanding wild bison herds on the Fort Peck Reservation (see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). They concluded the increase in numbers of bison could potentially degrade (overgrazing, trampling, increased erosion) riparian and grassland habitats also used by other wildlife, but these effects could be avoided or lessened by maintaining relatively low

densities and adequate water sources. Also, brucellosis could be introduced from Yellowstone bison relocated to the Reservation, but measures are in place to detect, eliminate, and prevent the spread of this disease (USDI, Bureau of Indian Affairs 2015). Quarantine facilities and operations could have minor, adverse, direct, local, and short-term impacts to wildlife.

Special Status Species

Affected Environment

Section 7(a)(2) of the Endangered Species Act of 1973 (16 USC 1531 *et seq*.) directs all federal agencies to use their existing authorities to conserve threatened and endangered species and, in consultation with the Secretary of the Interior and/or Secretary of Commerce, ensure their actions do not jeopardize listed species or adversely modify proposed or designated critical habitat. This section summarizes available scientific information for federally listed species and critical habitat in and near YNP.

Canada Lynx

Lynx require cold boreal and montane conifer forests with dense understories and snowshoe hares (*Lepus americanus*), the lynx's principal prey (USDI, USFWS 2000). The distinct population segment of lynx in the contiguous United States was listed as threatened under the Endangered Species Act in 2000 because existing regulatory mechanisms in USFS Land and Resource Management Plans were inadequate to protect lynx or lynx habitat (USDI, USFWS 2000). Critical habitat for lynx was designated in YNP and surrounding lands in southwestern Montana and northwestern Wyoming (Unit 5; USDI, USFWS 2009a).

Lynx in the contiguous United States are considered part of a larger metapopulation whose core is located in the northern boreal forest of Canada. Lynx disperse from Canada into the United States and help bolster populations in the northern Rocky Mountains and North Cascades range (McKelvey et al. 2000). Three lynx populations occur from western Montana to Washington, but survey data are not sufficient to estimate population sizes or trends (USDI, USFWS 2000).

Historical information suggests lynx were present, but uncommon, in YNP during 1880 to 1980 (Murphy et al. 2004). The presence and distribution of lynx in YNP was documented during 2001 to 2004, when several individuals were detected in the vicinity of Yellowstone Lake and the Central Plateau (Murphy et al. 2004, 2006). Another lynx was photographed near the Indian Creek Campground in the northwestern portion of YNP during 2010, and reliable detections of lynx continue to occur in surrounding National Forest System lands. Evidence suggests lynx successfully reproduce in the GYE, though production is limited (Murphy et al. 2004, 2006).

In accordance with the Canada Lynx Conservation and Assessment Strategy (Ruediger et al. 2000), personnel from YNP mapped suitable lynx habitat—typically late successional or mature forests dominated by mesic subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmanni*), and lodgepole pine (*Pinus contorta* var. *latifolia*)—and lynx habitat currently in an unsuitable condition (successional forests one to 20 years after disturbance). Twenty Lynx Analysis Units were identified. These units were primarily associated with andesitic and sedimentary soils in the northern and eastern portions of YNP. No Lynx Analysis Units were

identified in the central and west-central portions of YNP where dry lodgepole pine stands predominate. Lynx Analysis Units typically occurred in the backcountry of YNP, though seven were transected by major roads.

Managers use the standards and guidelines provided in the Canada Lynx Conservation and Assessment Strategy to gauge the effects of projects on lynx. Under the strategy, projects occurring outside Lynx Analysis Units have no effects on lynx. Projects inside Lynx Analysis Units may affect lynx, but not adversely, if the location occurs outside of lynx habitat, in habitat currently unsuitable for lynx foraging, or in lynx foraging habitat, but ample suitable habitat is otherwise available. No bison quarantine operations would occur in lynx habitat or analysis units.

Gray Wolf

Gray wolves were eliminated by humans from the northern Rocky Mountains by the 1930s. In 1978, the USFWS published a rule (USDI, USFWS 1978) listing them as an endangered species throughout the conterminous 48 states and Mexico (except for Minnesota where the gray wolf was reclassified to threatened). In November 1994, the USFWS designated unoccupied portions of Idaho, Montana, and Wyoming as two nonessential experimental population areas for the gray wolf under section 10(j) of the Endangered Species Act (USDI, USFWS 1994). This designation enabled the reintroduction of 41 wolves from southwestern Canada into YNP during 1995 to 1997. Wolves rapidly increased in abundance and distribution and achieved distributional, numerical, and temporal recovery goals for the GYE by the end of 2002 (USFWS et al. 2003).

The northern Rocky Mountain population of gray wolves was designated a distinct population segment and wolves in Idaho and Montana were removed from the List of Endangered and Threatened Wildlife in 2009 following legislation by Congress and the reissuance of regulations (USDI, USFWS 2009b). At the time, the USFWS determined Wyoming's wolf management plan was inadequate to meet delisting recovery requirements under the Endangered Species Act. Wyoming revised its statutes and regulations pertaining to wolves, and in 2011, the USFWS issued regulations and subsequently delisted the species in the state (USDI, USFWS 2012). However, in September 2014, a District Court judge concluded it was unreasonable for the USFWS to determine it was necessary for Wyoming to manage for more than 10 breeding pairs and 100 wolves as a condition for delisting, but then accept a plan not including a requirement for a buffer above this minimum management target. Thus, the judge ordered the reinstatement of rules to govern the management of wolves in Wyoming as threatened pursuant to the Endangered Species Act (Defenders of Wildlife et al. v. Salazar et al.; U.S. District Court for the District of Columbia; Case 1:12-cv-01833-ABJ [2014]).

In December 2014, at least 94 wolves in 11 packs occupied YNP and nearby areas (Smith et al. 2014). Suitable habitat appears to be saturated with resident wolf packs, and conflict among packs appears to be limiting abundance (Smith et al. 2014).

Grizzly Bear

Grizzly bears were listed as a threatened species in the lower 48 states during 1975 (USDI, USFWS 2005) because the population in the GYE had been reduced to between 229 and 312 bears due to low adult female survival (Knight and Eberhardt 1985). The grizzly bear population

in the GYE is discrete from other populations, has markedly different genetic characteristics, and consumes terrestrial mammals as their primary source of nutrition (Mattson 1997, Miller and Waits 2003, USDI, USFWS 2005). Abundance has increased 4 to 7% per year since the early 1990s and between 660 and 820 grizzly bears now live across more than 13 million acres (5.3 million hectares) in and near the GYE (van Manen et al. 2014). There are sufficient numbers of reproductive females distributed throughout the GYE to provide a high likelihood a viable population would remain in this ecosystem for the foreseeable future (Haroldson et al. 2015).

In 2007, the USFWS established a distinct population segment of the grizzly bear in the GYE and removed it from the Federal List of Endangered and Threatened Wildlife (USDI, USFWS 2007). However, in 2009 the District Court of Montana reversed this action (Greater Yellowstone Coalition v. Servheen, No. CV 07-134 [2009]). This decision was challenged before the Ninth Circuit Court of Appeals, but the threatened status for grizzly bears in the GYE was sustained (665 F.3d 1015 [2011]).

Grizzly bears in the GYE eat a great diversity of plant and animal species, including more than 175 plants, 37 invertebrates, and 34 mammals, as well as fungi, birds, and fish (Gunther et al. 2014). This diet flexibility enables bears to occupy diverse habitats across large landscapes and cope with short- and long-term changes in the abundance of preferred foods (Gunther et al. 2014). The population growth of grizzly bears in the GYE has slowed during recent years due to lower survival of young as density approached carrying capacity (van Manen et al. 2015). However, the number of female grizzly bears that produced litters annually, the total number of cubs produced annually, and estimates of the total grizzly bear population have all increased during the IBMP period (Haroldson et al. 2015). While there has been a slight decrease in average litter size during the IBMP period, the grizzly bear population has continued to increase in numbers and expand in occupied range (Bjornlie et al. 2014, Haroldson et al. 2015, van Manen et al. 2015).

Fort Peck Reservation

Sensitive species that may be present on the Reservation include the endangered black-footed ferret (*Mustela nigripes*); least tern (*Sternula antillarum*), pallid sturgeon (*Scaphirhynchus albus*), piping plover (*Charadrius melodus*), greater sagegrouse (*Centrocercus urophasianus*), and Sprague's pipit (*Anthus spragueii*). Descriptions of these species, their status, and their habitats are provided by the Bureau of Indian Affairs 2015; see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf).

Methodology and Intensity Level Definitions

The thresholds of change for the intensity of impacts to special status species are defined as follows:

Negligible: Special status species would not be affected or changes would be either undetectable or, if detected, would have effects considered slight and short-term.

Minor: Temporary displacement of a few localized individuals or groups of special status species, with mortality of individuals not affecting population trends. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Effects to special status species would be readily detectable, long-term, and regional, with consequences affecting the population level(s) of one or more species.

Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.

Major: Effects to special status species would be obvious, long-term, and would have substantial consequences to populations in the region, with mortality of a number of individuals that subsequently jeopardizes the viability of the resident population. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

Impacts of Alternative 1 – No Action

The effects of implementing the IBMP on special status species were evaluated in the 2000 Final Environmental Impact Statement and Record of Decision (see the <http://ibmp.info> website in the *Document Library* section). The agencies concluded displacement and disturbance from bison management activities and slight changes in the availability of bison carrion would have negligible impacts on bald eagles, Canada lynx, gray wolves, and grizzly bears (USDI, NPS and USDA, APHIS and USDA 2000a,b). On July 20, 2000, the USFWS concurred with the determination in the NPS' March 15, 2000 biological assessment that the IBMP may affect, but was not likely to adversely affect, the threatened Canada lynx, gray wolf, and grizzly bear. The implementation of the IBMP does not affect designated critical habitat for lynx. Since that time, the typical timeframe for annual bison hazing has shifted and now occurs during May and June more often than in the past, which could cause effects to grizzly bears emerging from their dens that were not considered in the 2000 biological assessment. In addition, new information suggested a decrease in whitebark pine (*Pinus albicaulis*) seed production and cutthroat trout (*Oncorhynchus clarkii bouvieri*) numbers could impact the nutritional status of grizzly bears and make ungulate meat more important to their well-being.

As a result, the NPS prepared a biological evaluation of possible impacts to grizzly bears resulting from these changes (Wenk 2012). On December 3, 2012, the USFWS concurred with the determination that hazing operations conducted under the IBMP may affect, but are not likely to adversely affect grizzly bears. They also concurred there is no evidence to demonstrate (1) mortality to whitebark pine trees and decreases in cutthroat trout during the past decade have significantly decreased the nutritional status or demographic rates of grizzly bears in the GYE, or (2) the number of bison carcasses available to grizzly bears is substantively less than prior to the implementation of the IBMP (Wilson 2012). The grizzly bear population has continued to recover under the IBMP, with bears in the park thought to be near carrying capacity, and an ecosystem-wide population of about 700 bears across 13 million acres (Bjornlie et al. 2014, Haroldson et al. 2015, van Manen et al. 2015).

Likewise, wolves released in YNP increased in abundance and distribution from 21 released in the northeastern part of the park in 1995 to 174 throughout the park, and hundreds more in surrounding states, by 2003 (Smith et al. 2003). Thus, wolves were considered biologically recovered (USDI, USFWS 2012). No lynx have been observed during bison management activities and evidence suggests they are still rare in YNP, primarily in the central portion or transient (Murphy et al. 2004, 2006). Thus, the effects of continuing current bison management should have no additional effects on special status species beyond those previously disclosed.

Impacts of Alternative 2 – Quarantine Facilities Within the Designated Surveillance Area for Brucellosis

Impacts to special status species under alternative 2 would include those analyzed for alternative 1, implementation of the current IBMP (USDI, NPS and USDA, APHIS and USDA 2000a,b; Wenk 2012, Wilson 2012). In accordance with the Endangered Species Act, the NPS will submit a copy of this Environmental Assessment to the Fish & Wildlife Service to allow for consultation as required by Section 7 of the Endangered Species Act. This will occur during the public review period of this Environmental Assessment.

Negligible impacts from ephemeral disturbances to Canada lynx, critical habitat for lynx, grizzly bears, and wolves are expected from quarantine operations due to grizzly bears denning during most bison capture operations, spatial separation between capture and quarantine facilities and lynx use areas, and ephemeral use of the Stephens Creek area by wolves. Bison capture in the Stephens Creek facility typically occurs during January to mid-March. Few, if any, grizzly bears are likely to be in this area at this time. Wolves occasionally hunt ungulates in lower-elevation portions of the Gardiner basin, but little activity occurs adjacent to the capture facility or pastures. No lynx are expected to occupy habitats near the capture facility or pastures due to their preference for thick forest. There is no designated lynx critical habitat in the Gardiner basin. In the unlikely event a lynx, grizzly bear, or wolf encountered quarantine operations at Stephens Creek or elsewhere, they would likely move quickly through the area and not attempt to enter the pastures. Overall, quarantine facility and operations would affect a minute portion (less than 300 acres) of the Gardiner basin.

The NPS has determined that quarantine construction and operations may affect, but are not likely to adversely affect, the threatened Canada lynx, gray wolf, and grizzly bear in the DSA. These activities will not affect designated critical habitat for lynx.

Impacts of Alternative 3 – Quarantine Facilities Outside the Designated Surveillance Area for Brucellosis

Impacts to special status species from site-specific actions under alternative 3 would include those described for alternative 1 due to current operations under the existing IBMP. MFWP (2011) evaluated the impacts of conducting quarantine operations on the Fort Peck Reservation and concluded they would not significantly impact special status species. The resident or transient wildlife species in these areas are already familiar with bison on the landscape and could readily move around the quarantine facility. There is no designated lynx critical habitat in the area. Overall, a quarantine program would affect a small area of the Fort Peck Reservation and have no to negligible impacts on special status species through ephemeral disturbances.

Likewise, the Bureau of Indian Affairs determined the expansion of wild bison herds on the Fort Peck Reservation would have no effect on the endangered black-footed ferret; may affect, but not likely to adversely affect the endangered least tern, endangered pallid sturgeon, and threatened piping plover (USDI, Bureau of Indian Affairs 2015). The agencies also determined the expansion would not likely contribute to the future listing of candidate greater sagegrouse (*Centrocercus urophasianus*) and Sprague's pipit (*Anthus spragueii*; see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). The Fish

& Wildlife Service concurred with these determinations on February 11, 2015 (USDI, USFWS 2015).

The NPS concurs with the determinations by the Bureau of Indian Affairs that quarantine construction and operations will have no effect on the endangered black-footed ferret and may affect, but are not likely to adversely affect the endangered least tern, endangered pallid sturgeon, and threatened piping plover (USDI, Bureau of Indian Affairs 2015).

Ethnographic Resources

Affected Environment

The Great Plains and Rocky Mountains were home to numerous tribes who hunted bison as they moved across the landscape. Humans have occupied the GYE for more than 11,000 years and the Blackfeet, Crow, Eastern Shoshone, Nez Perce, Northern Arapaho, Northern Cheyenne, Salish and Kootenai, Shoshone-Bannock, and 16 other tribes lived in, hunted in, or were otherwise associated with the Yellowstone area (Table 4; Nabokov and Loendorf 2004).[14] Bison traditionally provided clothing, food, fuel, shelter, and tools to the tribes and, as a result, were central to their culture. However, colonizing Euro-Americans altered this symbiotic relationship and resulted in decimated, localized populations of both (Isenberg 2000). Thereafter, treaties with the federal government limited the use of lands within the GYE by native peoples. In fact, early administrators of YNP actively discouraged native peoples from using the area; thereby ensuring their influence waned (Nabokov and Loendorf 2004).

Many tribes consider Yellowstone bison the last living link to the indigenous herds of bison that once roamed across North America. As a result, they view these bison as inextricably linked to their existence and survival as indigenous peoples (Plumb and Sucec 2006). Native Americans accurately point out that Yellowstone bison are managed differently (e.g., hazing, capture, culling) because some individuals have brucellosis, while individuals of other wildlife species such as elk are also infected but not subject to similar actions (USDI, NPS 2010a). In turn, some native people believe what happens to Yellowstone bison reflects sentiments towards, and the treatment of, Native Americans (Franke 2005, Stone 2013). Likewise, some native people do not support the quarantine of bison because they consider it a process of confining and domesticating them (Little Thunder and Geist 2014).

Tribal representatives have informed managers at YNP about many issues important to them concerning Yellowstone bison, including respectful treatment of bison, allowing bison to roam freely without fencing or hazing, transferring brucellosis-free bison to the tribes after they have completed quarantine, distributing meat, skulls, and hides of culled bison to the tribes, preservation of wickiups, stone alignments, and other cultural features associated with bison, and employment of tribal interns in management programs (USDI, NPS 2010a). The long-term goals for several tribes are to establish self-sustaining and economically viable herds with sufficient numbers of bison and high genetic diversity (Hatfield et al. 2013). The Fort Peck Assiniboine and Sioux Tribes have indicated they intend to increase the sizes of their herds over time and

[14] The information in this section is taken from *Yellowstone Bison—Conserving an American Icon in Modern Society* (Wallen et al. 2015b).

relocate bison to other tribes and public agencies to establish or augment other conservation and cultural herds (MFWP 2014).

Methodology and Intensity Level Definitions

The thresholds of change for the intensity of impacts to ethnographic resources are defined as follows:

Negligible: The impact to ethnographic resources would not be measurable or perceptible.

Minor: The impact to ethnographic resources would be measurable and perceptible, but would not appreciably alter resource conditions, access to resources by tribal members, or traditional practices and beliefs.

Moderate: The impact to ethnographic resources would be apparent and would alter resource conditions or interfere with access to the resource by tribal members. The relationship between the resource and the beliefs and practices of tribal members may be altered, but the practices and beliefs would still be largely intact.

Major: The impact to ethnographic resources would be substantial and alter the conditions of the resource considered important, access to the resource by tribal members, and the relationship between the resource and the practices and beliefs of the tribal members to the extent the survival of those practices and beliefs would be jeopardized.

Table 4. Native tribes associated with the Yellowstone area.

Native Tribe	Historic Area
Assiniboine and Sioux Tribes at Fort Peck (Assiniboine; Santee - Sisseton and Wahpeton; and Metis)	Northeast Montana, Dakotas, Minnesota, Canada
Blackfeet Tribe	North and Central Montana
Cheyenne River Sioux Tribe - (Mnikoju, Itazipco, Siha Sapa, and Oo'henampa)	Western Dakotas, Eastern Wyoming, Southeast Montana, Northwest Nebraska
Coeur d'Alene Tribe	Eastern Washington, Northern Idaho
Comanche Tribe of Oklahoma	Southeast Colorado, Southwest Kansas, West Oklahoma, North Texas
Confederated Tribes of the Colville Reservation	Northeast Washington
Confederated Tribes of the Umatilla Reservation	Southeast Washington, Northeast Oregon
Confederated Salish and Kootenai Tribes of the Flathead Reservation	Western Montana
Crow Tribe	Northern Wyoming, Southern Montana
Crow Creek Sioux Tribe - (Sisseton and Wahpeton; and Yankton and Yanktonai)	Eastern Dakotas and Minnesota
Eastern Shoshone Tribe, Wind River Reservation	Western Wyoming, Southeast Idaho
Flandreau Santee Sioux Tribe	Western Dakotas, Eastern Wyoming and Montana
Gros Ventre and Assiniboine Tribes at Fort Belknap	North and Central Montana
Kiowa Tribe of Oklahoma	Southeast Colorado, Southwest Kansas, West Oklahoma, North Texas
Lower Brule Sioux Tribe - (Sicangu)	Dakotas, Eastern Wyoming and Montana
Nez Perce Tribe	North Idaho, Southeast Oregon, Northeast Washington
Northern Arapaho Tribe, Wind River Reservation	Southeast Wyoming, Northeast Colorado, Northwest Kansas, Southwest Nebraska

Northern Cheyenne Tribe	Southeast Wyoming, Northeast Colorado, Northwest Kansas, Southwest Nebraska
Oglala Sioux Tribe	Northeast Wyoming, Southeast Montana, Dakotas, Northwest Nebraska
Rosebud Sioux Tribe - (Sicangu or Upper Brule)	Dakotas, Eastern Wyoming and Montana
Shoshone-Bannock Tribes at Fort Hall	Southeast Idaho, Northern Utah
Sisseton-Wahpeton Sioux Tribe - (Isanti - Mdewkanton, Wahpetowan, Wahpekute, and Sissetowan)	Eastern Dakotas, Minnesota, Wisconsin, Iowa
Spirit Lake Sioux Tribe, Fort Totten - (Isanti - Mdewkanton, Wahpetowan, Wahpekute, and Sissetowan)	Eastern Dakotas, Minnesota, Wisconsin, Iowa
Standing Rock Sioux Tribe - (Hunkpapa, Black Feet [Siha Sapa], Hunkpatinas, and Cuthead Band of Yanktonai)	Dakotas, Eastern Wyoming and Montana
Turtle Mountain Band of the Chippewas	North Dakota, Minnesota, Canada
Yankton Sioux Tribe - (Yankton and Yanktonai)	Eastern Dakotas, Minnesota

Impacts of Alternative 1 – No Action

The effects of implementing the IBMP on ethnographic resources were evaluated in the Final Environmental Impact Statement and Record of Decision (see the <http://ibmp.info> website in the *Document Library* section). In the evaluation, the NPS concluded the construction of a quarantine facility at some unspecified location in the Gardiner basin may disturb archeological resources and cultural landscapes, but would have negligible to minor impacts with mitigation measures (e.g., subsequent surveys and environmental analyses). The increased tolerance for Yellowstone bison would have a major beneficial impact in preserving the cultural significance of a wild, wide-ranging bison population (USDI, NPS and USDA, APHIS and USDA 2000a,b). The evaluation indicated provisions outlined in the Native American Graves Protection and Repatriation Act (25 USC 3001) would be followed in the unlikely event human remains, funerary objects, sacred objects, or objects of cultural patrimony were discovered during bison management activities.

The NPS consulted with several tribes affiliated with lands in and near YNP, including the Blackfeet, Crow, Eastern Shoshone, Nez Perce, Northern Arapaho, Northern Cheyenne, Salish and Kootenai, and Shoshone-Bannock (USDI, NPS and USDA, APHIS and USDA 2000a). These dialogues indicated increased tolerance for Yellowstone bison in Montana could have a major beneficial impact on the cultural significance of this population by enabling more effective subsistence harvests by tribes with treaty hunting rights across more open and unclaimed lands (USDI, NPS and USDA, APHIS and USDA 2000a). Also, many tribes have been promoting a more traditional, bison-based diet and the NPS has agreements with the InterTribal Buffalo Council and several tribes to periodically provide them with bison for transfer to processing facilities and distribution of meat, hides, and horns to their members. The bison capture facility and the manner in which bison are confined and handled remains an issue of concern for several Tribes (USDI, NPS and USDA, APHIS and USDA 2000a).

Impacts of Alternative 2 – Quarantine Facilities Within the Designated Surveillance Area for Brucellosis

Impacts to ethnographic resources from site-specific actions under alternative 2 would include those described for alternative 1 due to current operations under the existing IBMP.

A quarantine facility could potentially have minor, adverse, direct, local, and short-term impacts by disturbing or temporarily confining wild bison which are an ethnographic resource to tribes. However, several tribes support quarantine because it would enable the establishment of tribal herds and allow their members to reconnect with an animal core to their culture (NPS, YNP and the Bureau of Indian Affairs 2012). Many tribes have a special relationship with Yellowstone bison because these bison are descendants from one of the few indigenous herds which remained wild and continuously occupied portions of their original distribution (Wallen et al. 2015b). In addition, some tribes are interested in using Yellowstone bison to initiate a return to a more traditional, bison-based diet. The quarantine of Yellowstone bison could enable tribes to become more self-sufficient at meeting these cultural and nutritional needs (USDI 2014). Therefore, a quarantine facility could potentially have minor to moderate, beneficial, regional, and long-term impacts if brucellosis-free bison completing quarantine are distributed to public and tribal lands to demonstrate the important role bison play in Native American culture and our national conservation ethic, in addition to providing communal (e.g., nutrition), spiritual (e.g., hunting), and conservation benefits.

Impacts of Alternative 3 – Quarantine Facilities Outside the Designated Surveillance Area for Brucellosis

Impacts to ethnographic resources from site-specific actions under alternative 3 would include those described for alternative 1 due to current operations under the existing IBMP, and alternative 2 if bison are distributed to tribal lands. A cultural survey was conducted by the Cultural Resources Department for the Fort Peck Assiniboine and Sioux Tribes in September 2014 for the bison quarantine project on the Reservation. The survey included a historic property evaluation for architectural, archeological, cultural, or historical significance, as well as a site inspection for cultural resources. Two cultural sites, a geothermal pond and wild mint, were recorded in the area. However, the Tribal Historic Preservation Office concluded no cultural resources would be inadvertently affected by the project, which would not adversely affect the cultural integrity of the Fort Peck Tribes (Youpee 2014).

MFWP (2011) evaluated the impacts of conducting quarantine operations on the Fort Peck Reservation. They noted a portion of Snake Butte, which is a cultural and spiritual site, is within the fenced bison pasture. However, the northeastern portion of the butte is not inside the pasture and is accessible to members. Also, MFWP concluded quarantine operations would allow tribal members to continue to teach their children the important role bison play in native culture and provide other communal and conservation benefits. The quarantine of Yellowstone bison will never meet all the nutritional needs of the tribes, but it could help them promote a more traditional, bison-based diet (Hatfield et al. 2013).

The Bureau of Indian Affairs (2015) evaluated the impacts of expanding wild bison herds on the Fort Peck Reservation (see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). They concluded the increase in numbers of bison provide a living context for some cultural resources, particularly stone features involved with the hunting of bison. Also, the attraction of tourism and harvest of bison would provide opportunities for broader public

understanding of the culture of the Assiniboine and Sioux Tribes. In addition, an increase in wild bison would result in more buffalo available for hunts, local live meat sales, and/or bison sales to livestock markets, all of which would bring more income to the tribes with long-term benefits (USDI, Bureau of Indian Affairs 2015).

Human Health and Safety

Affected Environment

Biologists and bison managers from the IBMP members and at the Fort Peck Reservation sometimes need to approach Yellowstone bison as part of their duties to conserve and manage them. These bison may appear tame, but are wild, unpredictable, and dangerous. Bison can be a physical threat to humans if agitated and a few visitors to YNP have been gored by bison. Bison are most easily agitated during the breeding season and when protecting calves. Handouts by YNP and IBMP members include warnings to residents and visitors about approaching bison.

Brucella bacteria can infect humans through breaks in the skin, mucous membranes, conjunctival membranes in the eye, and respiratory and intestinal tracts (Luce et al. 2012). Human occupations most at risk for inadvertent exposures to *Brucella* bacteria include cattlemen, slaughterhouse workers, veterinarians, and wildlife biologists (Luce et al. 2012). Also, hunters careless in field dressing their game may be at risk. Most infected people respond to antibiotic therapy, with fewer than 10% relapsing (Centers for Disease Control 2005).

Methodology and Intensity Level Definitions

The thresholds of change for the intensity of impacts to health and safety are defined as follows:

Negligible: The impact to visitor, NPS, and recipient staff safety would not be measurable or perceptible.

Minor: The impact to visitor, NPS, and recipient staff safety would be measurable and perceptible and would involve a large number of individuals in a localized area.

Moderate: The impact to visitor, NPS, and recipient staff safety would be measurable and perceptible and would involve a large number of individuals in many areas.

Major: The impact to visitor, NPS, and recipient staff safety would be substantial and regional in occurrence. Accident rates in areas usually limited to low accident potential would be expected to substantially increase in the short- and long-term and impacts to the safety of individuals would be readily apparent.

Impacts of Alternative 1 – No Action

The effects of implementing the IBMP on human health and safety were evaluated in the Final Environmental Impact Statement and Record of Decision (see the <http://ibmp.info> website in the *Document Library* section). The NPS concluded the risk of brucellosis transmission to bison managers and hunters would be negligible to minor if safe practices and training were implemented; moderate if not (USDI, NPS and USDA, APHIS and USDA 2000a,b). Safe practices and training have been implemented and no direct injuries or transmissions of brucellosis to NPS employees engaging in bison management activities have occurred. However, a few employees from agencies participating in bison hazing activities have been injured due to falls from horses.

Safe practices, training, baseline and periodic testing of higher-risk employees, and testing of employees disclosing illness following handling potentially infected wildlife would continue to be implemented. Employees working for the Bison Ecology and Management and Wildlife Health Programs at YNP have been periodically tested for *Brucella* exposure since 2002 by having blood samples drawn and submitted to diagnostic laboratories. Employees working in this program have been tested several times (6 staff in 2002, 7 staff in 2005, 4 staff in 2007, 6 staff in 2008, 6 staff in 2011, and 10 staff in 2014/2015) for *Brucella* exposure, and no employees have disclosed being notified of a positive test for *Brucella* antibodies (USDI, NPS 2014a). Thus, the effects of continuing current management would have no additional effects on human health and safety beyond those previously disclosed.

Some minor, beneficial, regional, and short- to long-term benefits to human health could result from current management because meat from bison culled from the population and sent to processing facilities is distributed to tribal members and food banks.

Impacts of Alternative 2 – Quarantine Facilities Within the Designated Surveillance Area for Brucellosis

Impacts to human health and safety from site-specific actions under alternative 2 would include those described for alternative 1 due to current operations under the existing IBMP. Access to the Stephens Creek Administrative Area is restricted by the NPS during bison management operations (which would include quarantine); thereby eliminating interactions between the general public and bison infected by *Brucella* bacteria.

Given the facility guidelines and best practices described in the *Programmatic Actions Common to All Action Alternatives* section of this document, there would be little risk of injury or brucellosis exposure to personnel involved in quarantine operations. Staff would have the necessary experience and training to conduct capture, chemical immobilization, evaluations of bison behavior, marking, restraint, brucellosis testing, and sample collection. Best practices would include safe and humane handling of bison, safe collection and handling of samples, and safe handling and proper disposition of potentially infected tissues. Phones, radios, and first aid kits would be available for emergency contacts and responses. Immobilization and reversal drugs would be properly stored to prevent unauthorized access, but available for use as needed.

Given the facility guidelines and best practices described in the *Programmatic Actions Common to All Action Alternatives* section of this document, it is highly unlikely any bison would escape during quarantine and threaten human safety through physical contact or transmission of brucellosis. No bison have escaped during processing at Stephens Creek or transport to meat processing, research, or quarantine study facilities since IBMP activities began in 2001. No bison escaped from the pastures used for the quarantine feasibility study during 2005 to 2010 and a fertility control study thereafter. Furthermore, there has not been any detected transmission of brucellosis to humans from bison captured, handled, and transported to these destinations. Thus, potential impacts to personnel involved in bison quarantine operations could be negligible to minor, adverse, direct, local, and short-term.

Potential impacts on human health from bison quarantine could be minor to moderate, beneficial, regional, and short- to long-term if brucellosis-free bison completing quarantine are distributed

to public and tribal lands to provide communal (e.g., nutrition) and spiritual (e.g., hunting) benefits. Bison meat from terminal pastures associated with quarantine facilities could be distributed to tribes and food banks.

Impacts of Alternative 3 – Quarantine Facilities Outside the Designated Surveillance Area for Brucellosis

Impacts to human health and safety from site-specific actions under alternative 3 would include those described for alternative 1 due to current operations under the existing IBMP, and would be similar to those described in alternative 2 for bison containment and handling. MFWP (2011) evaluated the impacts of conducting quarantine operations on the Fort Peck Reservation (http://fwp.mt.gov/news/publicNotices/environmentalAssessments/speciesRemovalAndRelocation/pn_0055.html). They concluded more bison on the reservation would provide increased support for communal nutritional programs, with meat distributed to tribal programs for seniors, diabetics, Head Start centers, school lunch programs, homeless shelters, and cultural and traditional ceremonies (Fort Peck Assiniboine and Sioux Tribes Turtle Mound Buffalo Ranch 2014). The quarantine of Yellowstone bison will never meet all the nutritional needs of the tribes, but it could help them promote a more traditional, bison-based diet (Hatfield et al. 2013).

Visitor Use and Experience

Affected Environment

There were more than 4 million visits to YNP during 2015, mostly concentrated in the summer months. Old Faithful is the most popular destination, with about 90% of visitors stopping at this area. Most summer visitors also visit Mammoth Hot Springs (69%) and Canyon Village (64%; Manni et al. 2007). During winter, wheeled-vehicle travel is limited to the far northern portion of YNP; access to the interior is only via snowmobile, snow coach, skiing, or snowshoeing. Thus, winter visitation depends on snow conditions and regulations, which combined to limit visitors during 2008 through 2014 to fewer than 43,000 (USDI, NPS 2013). The majority of these visitors enter YNP through the entrance near West Yellowstone, Montana.

Yellowstone National Park plays a large economic role in the tourism industry of the GYE, with visitors to YNP providing substantial economic activity to surrounding gateway communities. Approximately 3.5 million visitors to YNP during 2014 spent an estimated $421 million in nearby communities, which supported about 6,660 jobs and had a collective benefit of about $544 million to the area's economy; Cullinane Thomas et al. 2015). Over 90% of visitors indicated YNP was the primary reason for their trip to the area (Stynes 2008).

The most common activities by visitors to YNP are sightseeing and watching wildlife (Manni et al. 2007). Ninety-five percent of visitors participate in wildlife viewing during their visit, which exceeds geyser viewing (87%), hiking (39%), camping (27%), and fishing (13%; Duffield et al. 2000a). About 50% of summer visitors and 90% of winter visitors indicated seeing bison was an important factor in their decision to visit (Duffield et al. 2000a,b; Freimund et al. 2009). Relatively few visitors travel through or use the Stephens Creek area for recreational activities such as hiking, biking, and wildlife watching. Access to the Stephens Creek Administrative Area is restricted by the NPS during bison management operations; thereby precluding the use of this area for recreation by visitors.

All visitors to YNP travel through the DSA, which encompasses portions of Idaho, Montana, and Wyoming surrounding the park. These areas offer visitors premier opportunities for hunting, recreation, and wildlife viewing. More information is provided at <http://www.visitidaho.org/> for Idaho, <http://visitmt.com/> for Montana, and < http://www.wyomingtourism.org/> for Wyoming. The portions of these states outside the DSA offer similar opportunities, as described at their tourism websites.

Recreational activities on the Fort Peck Reservation include outdoor activities such as boating, camping, fishing, hunting, and cultural and community events (USDI, Bureau of Indian Affairs 2015). Bison can be viewed from County Road 2046 (MFWP 2011). Supervised hunts of wild bison in the business herd are available year-round for tribal and non-tribal members. In 2014, 214 people applied for 40 bison hunts, which were awarded by lottery at costs ranging from $1,000 to $6,000 per animal. There is currently no hunting of the cultural/conservation herd (USDI, Bureau of Indian Affairs 2015).

Methodology and Intensity Level Definitions

The thresholds of change for the intensity of impacts to visitor use and experience are defined as follows:

Negligible: Management actions would result in barely detectable impacts, or would occasionally affect the experience of few visitors in the applicable setting.

Minor: Management actions would result in slight but detectable negative impacts affecting the experience of some visitors in the applicable setting.

Moderate: Management actions would result in readily apparent and negative impacts affecting the experience of many visitors in the applicable setting.

Major: Management actions would result in impacts that would be highly negative, affecting the experience of a majority of visitors in the applicable setting.

Impacts of Alternative 1 – No Action

The effects of implementing the IBMP on visitor use and experience were evaluated in the Final Environmental Impact Statement and Record of Decision (see the <http://ibmp.info> website in the *Document Library* section). The NPS concluded there could be minor, adverse and local impacts on bison viewing depending on whether bison numbers increased or decreased over time (USDI, NPS and USDA, APHIS and USDA 2000a,b).

Impacts of Alternative 2 – Quarantine Facilities Within the Designated Surveillance Area for Brucellosis

Impacts to visitor use and experience from site-specific actions under alternative 2 would include those described for alternative 1 due to current operations under the existing IBMP. Fencing and other construction activities at Stephens Creek would likely last less than 4 to 5 months during summer and autumn. Also, construction and quarantine operations would occur in a portion of the Stephens Creek Administrative Area that visitors generally do not access. In addition, relatively few (thousands rather than millions each year) visitors travel through the Gardiner basin on the dirt road (Old Yellowstone Trail) that passes near the Stephens Creek. The quarantine facility would likely be located in an area not viewable from this dirt road transecting

the area. Thus, impacts to visitors from bison quarantine facilities at Stephens Creek could potentially be negligible to minor, adverse, direct, local, and short-term.

Impacts of Alternative 3 – Quarantine Facilities Outside the Designated Surveillance Area for Brucellosis

Impacts to visitor use and experience from site-specific actions under alternative 3 would include those described for alternative 1 due to current operations under the existing IBMP. MFWP (2011) evaluated the site-specific impacts of conducting quarantine operations on recreation at the Fort Peck Reservation (http://fwp.mt.gov/news/publicNotices/environmentalAssessments/speciesRemovalAndRelocation/pn_0055.html). They concluded there would be little to no change to the aesthetic values or the view shed if more bison were placed on tribal lands since infrastructure and fencing are already installed (MFWP 2011).

The Bureau of Indian Affairs (2015) evaluated the impacts of expanding wild bison herds on the Fort Peck Reservation (see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). They concluded an increase in wild bison could result in more bison hunts per year, particularly in the business herd, which would benefit interested hunters and be a major, long-term, positive impact to recreation. Also, the presence of more wild bison roaming within the Reservation as they did historically would be an important visual impact because it provides a potential long-term cultural connection between the observer and the bison (USDI, Bureau of Indian Affairs 2015).

Overall, impacts to visitors on tribal lands from bison quarantine could potentially be minor, adverse, direct, local, and short-term. Conversely, potential impacts to visitors from bison quarantine could be minor to moderate, beneficial, regional, and short- to long-term if brucellosis-free bison completing quarantine are distributed to public or tribal lands to provide conservation, spiritual, sport hunting, and wildlife viewing benefits.

Vegetation

Affected Environment

The high-desert environment of the Gardiner basin has had relatively sparse vegetation since at least the 1870s due to relatively poor soils on active mud flows, low annual precipitation, high winds, and heavy use by native ungulates (Secretary of War 1871, Whittlesey 1995; USDI, NPS, YNP, the USFS, Gallatin National Forest, and the Center for Invasive Plant Management 2005; USDI, NPS 2006). A 7,600-acre (243-hectare) portion of the Gardiner basin was added to YNP during 1925 to 1941, primarily to provide lower-elevation habitat for elk, pronghorn, and other animals during winter (Whittlesey 1995). Previously, most of this area was homesteaded, tilled and irrigated, ranched, or hunted for wild animals; primarily ungulates (Whittlesey 1995).

Today, much of the Stephens Creek Administrative Area, where the bison capture facility is located, is infested with invasive nonnative plant species and has sparse native vegetation due to historical uses and, more recently, from the horse corrals, bison capture facility, equipment storage, barn and associated buildings, and nursery operations (Whittlesey 1995, USDI, NPS

2006; USDI, NPS, YNP, the USFS, Gallatin National Forest, and the Center for Invasive Plant Management 2005). Planted vegetation includes cottonwoods, chokecherries (*Prunus virginiana*), and a few conifers. Nonnative plant species that have invaded the area include crested wheatgrass (*Agropyron cristatum*), mustard (*Allysum* spp.), Kochia (*Kochia scoparia*), Russian thistle (*Salsola kali*), cheatgrass (*Bromus tectorum*), and Canadian thistle (*Cirsium arvense*).

The surrounding area consists of foothills with widespread nonnative plants and a mixture of native vegetation including sagebrush, rabbitbrush (*Chrysothamnus nauseosus, Chrysothamnus viscidiflorus*), greasewood (*Sarcobatus vermiculatus*), juniper (*Juniperus scopulorum*), cottonwoods, willow, Douglas fir (*Pseudotsuga menziesii*), and a variety of forbs and grasses (USDI, NPS 2006). There are also a series of open terraces along and near the Yellowstone River and Reese and Stephens creeks that were cultivated before this land was annexed into YNP. Vegetation in these areas is currently dominated by nonnative species including crested wheatgrass and mustard (USDI, NPS 2006). A rare plant survey was conducted in the Stephens Creek area using the Montana Natural Heritage Program's list of species of special concern and no rare plants were found (USDI, NPS 2006).

Land cover types on the Fort Peck Reservation are predominantly human use (52%), grasslands (32%), wetland/riparian (5%), and other (USDI, Bureau of Indian Affairs 2015). The vegetation on the grasslands in the bison pastures is primarily composed of western wheatgrass (*Pascopyrum smithii*), plains reedgrass (*Calamagrostis montanensis*), green needlegrass (*Stipa viridula*), bluebunch wheatgrass (*Pseudoroegneria spicata*), little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), threadleaf sedge (*Carex filifolia*), plains muhly (*Muhlenbergia cuspidata*), needle and thread (*Hesperostipa comata*), and clubmoss (Lycopodiaceae). There are small wetlands at numerous locations (MFWP 2011).

Methodology and Intensity Level Definitions

The thresholds of change for the intensity of impacts to vegetation are defined as follows:

Negligible: No rare plant species or uncommon plant communities would be affected. Individual native plants might be affected, but impacts would be localized, short-term, and of no consequence to the species. No nonnative vegetation was found in the area.

Minor: Native vegetation would be affected, but impacts would occur in a relatively minor portion of the species' occurrence(s). Mitigation measures to offset adverse effects would be proposed. Rare plants or uncommon plant communities could be present and individual plants could be affected, but proposed mitigation measures to avoid adverse impacts to the species or community would be effective. Nonnative vegetation is found in the area, but is being managed under an active management plan.

Moderate: A sizeable segment of native vegetation would be affected, and proposed mitigation measures would be extensive. Rare plant species or uncommon plant communities could be affected, and proposed mitigation measures to offset adverse effects could be extensive. Nonnative vegetation is found in the area and is not being managed under an active management plan.

Major: Effects on native vegetation, potentially including rare plants or uncommon plant communities would be extensive and long term. Proposed mitigation measures to offset the adverse effects would be extensive, and success of the mitigation measures would not

be guaranteed. Nonnative vegetation is found extensively in the area and is not being managed under an active management plan.

Impacts of Alternative 1 – No Action

The effects of implementing the IBMP were evaluated in the Final Environmental Impact Statement and Record of Decision (see the <http://ibmp.info> website in the *Document Library* section). The areas of potential habitat that would be occupied by facilities or disturbed by activities are only a minute portion of the total habitat in the GYE (USDI, NPS and USDA, USFS and APHIS 2000a). The effects of continuing current management would have no additional effects since vegetation in the bison capture facility at Stephens Creek is already denuded, therefore the impacts would be negligible. Horses and mules used by NPS staff have been confined and fed within the Stephens Creek Administrative Area for many decades, including in some pens used for bison capture during some winters (USDI, NPS 2006). The area has been treated with approved herbicides for many years to reduce the amount of noxious weeds, and treatments would continue (USDI, NPS 2006).

Impacts of Alternative 2 – Quarantine Facilities Within the Designated Surveillance Area for Brucellosis

Impacts to vegetation from site-specific actions under alternative 2 would also include those described for alternative 1 due to current operations under the existing IBMP. The primary additional impacts associated with a quarantine facility include vegetation (mostly nonnative) and soil damage resulting from the use of equipment to construct fences, as well as subsequent grazing and trampling by confined bison. These actions could result in a reduction in available winter habitat in the Gardiner basin for bison of about 50 acres (20 hectares) to 200 acres (81 hectares) depending on the size of the facility. Bison in the confined area could compact the soil or cause erosion by reducing vegetation cover. In turn, these impacts could lead to a higher risk of nonnative species invading the pastures. These impacts could be mitigated by limiting the density of bison, rotating them through several pastures, providing supplemental feed when necessary, and treating weeds with herbicides (USDA, APHIS 2012). Overall, quarantine facility and operations would affect a minute portion (less than 300 acres) of the approximately 70,000 acres available to bison in the Gardiner basin. Nonnative plant species have already invaded, and currently dominate, the Stephens Creek Administrative Area and other portions of the Gardiner basin (USDI, NPS 2006). Thus, quarantine operations could potentially have negligible to minor, adverse, direct, local, and short- to long-term impacts on native vegetation.

Impacts of Alternative 3 – Quarantine Facilities Outside the Designated Surveillance Area for Brucellosis

Impacts to vegetation from site-specific actions under alternative 3 would also include those described for alternative 1 due to current operations under the existing IBMP. MFWP (2011) evaluated the site-specific impacts of conducting quarantine operations outside the DSA on the Fort Peck Reservation (http://fwp.mt.gov/news/publicNotices/environmentalAssessments/speciesRemovalAndRelocation/pn_0055.html). They concluded quarantine operations and/or the release of brucellosis-free Yellowstone bison would have minimal impacts to vegetation because the tribes plan to limit bison density below the food-limited carrying capacity of the pastures, establish a multiple-pasture, rest-rotation grazing program for all bison use areas, construct watering holes or water

troughs to distribute bison movements throughout the pastures, and provide supplemental feed as necessary. Wallows and trails have already been established by existing bison herds. The addition of bison to pastures not grazed recently would help to reduce the fuels and wildfire risks.

The Bureau of Indian Affairs (2015) evaluated the impacts of expanding wild bison herds on the Fort Peck Reservation (see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). They concluded the increase in numbers of bison could cause minor, negative impacts to vegetation such as the introduction and spread of invasive weeds, potential for overgrazing, and an increase in surface disturbance. However, these impacts would be lessened by mitigation measures such as the development and implementation of a range management program (USDI, Bureau of Indian Affairs 2015).

Overall, quarantine facilities and operations would affect a minute portion of the Reservation, but could potentially have negligible to minor, adverse, direct, local, and short- to long-term impacts on vegetation.

Water/Aquatic Resources

Affected Environment

Water for humans, livestock (horses, mules), captured bison, nursery operations, and landscaping in the Stephens Creek Administrative Area of YNP is obtained from Wilson Springs, which is located approximately 0.3 mile (0.5 kilometer) west and upslope in the Sepulcher Mountain foothills (USDI, NPS 2006). Water from the spring is collected in a small concrete tank and piped to the Stephens Creek Administrative Area. This spring has been used as a water source since at least 1933, but there are no historic records regarding the volume of use. Probably less water has been drawn from this source in recent years because a leaky pipe was replaced, gardens are no longer planted in the area, and the nursery is smaller (USDI, NPS 2006).

The Yellowstone River flows through the Gardiner basin about 0.8 mile (1.3 kilometer) northeast of the bison capture facility in the Stephens Creek area. At this point, the river is about 200 feet (61 meters) lower in elevation than the bison capture facility (USDI, NPS 2006). The primary native fish in this river are mountain whitefish (*Prosopium williamsoni*) and Yellowstone cutthroat trout (*Onchorhynchus clarkii*), as well as nonnative brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*). Stephens Creek is a tributary of the Yellowstone River and flows by the bison capture facility about 0.4 mile (0.6 kilometer) to the southeast (USDI, NPS 2006). Historically, some water from this creek was used to provide water for a residence (Rife House) and irrigation ditches in the Stephens Creek area (USDI, NPS 2006). This practice ceased sometime between 1984 and 1996 and the irrigation ditches no longer functional (USDI, NPS 2006). No fish are found in this 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 at Stephens Creek. Historically, some water from this creek was diverted into irrigation ditches in the Stephens Creek area, but these ditches are no longer functional (USDI, NPS 2006). Existing water rights claims have made Reese Creek an over-appropriated stream, where demand at times exceeds

available water due to private irrigation demands adjacent to YNP (Teets and Mahoney 2013). As a result, stream flows in Reese Creek are monitored approximately weekly by NPS staff during April 15 to October 15 and, as necessary, NPS staff ask private landowners to reduce their diversions when flows decrease below the NPS allocation (Teets and Mahoney 2013). Fish from the Yellowstone River move into the lower reaches of this creek.

The pastures for Yellowstone bison at Fort Peck have numerous small seasonal creeks traversing the property and two natural springs providing a year-round source of water. Also, the tribes have installed three wells with stock tanks and a stock dam (MFWP 2011). Agricultural activities, primarily livestock grazing, have reduced water quality, caused bank erosion, and degraded riparian habitat quality on some portions of the Reservation (USDI, Bureau of Indian Affairs 2015).

Methodology and Intensity Level Definitions

The thresholds of change for the intensity of impacts to water/aquatic resources are defined as follows:

Negligible: The action would cause no change in existing water resources and water quality or function.

Minor: The action would result in a change requiring considerable scientific effort to measure and have barely perceptible consequences to water resources and water quality function.

Moderate: The action would change existing water resources and water quality, but the impact could be mitigated by water quality measures. The action would have a measurable effect on water resources and water quality, but all resources would remain indefinitely viable.

Major: The action would have drastic and permanent consequences for existing water resources and water quality and could not be mitigated. Water resources and water quality dynamics would be upset, and resources would be at risk of degradation.

Impacts of Alternative 1 – No Action

The effects of implementing the IBMP were evaluated in the Final Environmental Impact Statement and Record of Decision (see the <http://ibmp.info> website in the *Document Library* section). The effects of continuing current management would have no additional effects because water obtained from Wilson Springs is currently sufficient for humans, livestock (horses, mules), captured bison, nursery operations, and landscaping in the Stephens Creek Administrative Area (USDI, NPS 2006). Water use may increase slightly over time, but the supply should still be adequate to meet needs. The use of low-flow toilets and drip-line irrigation for existing vegetation should help mitigate any increased use (USDI, NPS 2006). Thus, the impacts would be negligible. There are no plans to make irrigation ditches operational or divert water from Stephens Creek or Reese Creek for bison management. Thus, there would be no additional impacts to these creeks under this alternative.

Impacts of Alternative 2 – Quarantine Facilities Within the Designated Surveillance Area for Brucellosis

Impacts to water and aquatic resources from site-specific actions under alternative 2 would include those described for alternative 1 due to current operations under the existing IBMP. At

Stephens Creek, the availability of water from Wilson Springs is limited by the relatively small volume of the concrete collection box, and when the tank is drawn down, there is little to no water in the pipeline until inflow again accumulates in the collection box (USDI, NPS 2006). However, this supply should be sufficient for sustaining hundreds of bison year-round in a quarantine facility in or near the Stephens Creek area. The construction of facilities for quarantine, including new fences and a water delivery system, will not affect springs, waterways, or aquatic resources. Overall, quarantine facility and operations would affect a minute portion (less than 300 acres) of the approximately 70,000 acres available to bison in the Gardiner basin, but could potentially have negligible to minor, adverse, direct, local, and short- to long-term impacts on water and aquatic resources.

Impacts of Alternative 3 – Quarantine Facilities Outside the Designated Surveillance Area for Brucellosis

MFWP (2011) evaluated the site-specific impacts of conducting quarantine operations on the Fort Peck Reservation (see http://fwp.mt.gov/news/publicNotices/environmentalAssessments/speciesRemovalAndRelocation/pn_0055.html). They concluded quarantine operations and/or the release of Yellowstone bison would have minimal impacts to existing water resources because the springs, troughs, and watering holes are already established and being used by bison or cattle. No additional watering locations would be needed.

The Bureau of Indian Affairs (2015) evaluated the impacts of expanding wild bison herds on the Fort Peck Reservation (see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). They concluded the increase in numbers of bison was not likely to further impact water resources because bison are less likely to graze near water.

Overall, quarantine facilities and operations would affect a minute portion of the Reservation, but could potentially have negligible to minor, adverse, direct, local, and short- to long-term impacts on water and aquatic resources.

Cumulative Impacts Analysis

Cumulative impacts are the total incremental effects of human activity on an ecosystem, resource, or human community. These impacts may result from singularly minor, but collectively significant, actions taken by humans over time. Cumulative impacts are evaluated by combining the likely effects of a proposed action with other past, present, and reasonably foreseeable future actions within a particular area and timeframe, regardless of whether the actions are implemented by federal, local, private, state, or tribal governments or entities (40 CFR 1508.7). These combined impacts are compared to an environmental baseline or reference condition that is ecologically sustainable, supports biological processes, maintains productivity and resiliency, and functions with minimal human intervention (Environmental Protection Agency 1999).

The temporal scope for the duration of effects from implementing a quarantine program is likely about 30 to 50 years into the future because quarantine is anticipated to last for several decades, with the recovery of augmented or newly established populations continuing thereafter. The

geographic scope that encompasses the cumulative effects of implementing a quarantine program within the DSA for brucellosis or elsewhere includes the GYE (alternative 2) and the Fort Peck Reservation (alternative 3) for all impact topics. As illustrated in Figure 1, the DSA surrounds YNP and overlaps much of the GYE. When the direct and indirect impacts of the action alteratives are the same, they are analyzed together for each impact topic; where the impacts are different, they are analyzed separately. Direct and indirect impacts are summarized in this cumulative analysis; the reader can refer to the complete analysis for each impact topic earlier in this chapter for more details.

The pre-settlement baseline or reference conditions of these areas can be used to characterize the environment and its processes before serious human alterations. However, it would be impossible to recreate pre-settlement conditions prior to the establishment of YNP or the Fort Peck Reservation given subsequent changes that cannot be easily reversed, including the massive slaughter of many wildlife in the late 1800s, increasing human population growth and land use, and invasions by non-native species (Cole and Yung 2010, White et al. 2013a).

The GYE is the largest temperate ecosystem in the continental United States, encompassing at least 19 million acres (7.7 million hectares). About two-thirds of this area is public land, including portions of five national forests (32%), Bureau of Land Management lands (19%), two national parks (7%), and state lands, wildlife refuges, and other federal lands (6%; Keiter and Boyce 1991). Near the center of this area are Yellowstone and Grand Teton National Parks, where native species and ecological processes, including migration and dispersal, are allowed to function with minimal human intervention. Likewise, there are extensive wilderness areas in the eastern half of the ecosystem on the Bridger-Teton, Custer, Gallatin, and Shoshone National Forests. Historians at YNP recently evaluated thousands of first-hand accounts of wildlife in the GYE during 1796-1881, when the area was largely unaltered by Euro-American colonists and in a pre-settlement or early development stage. They concluded wildlife was plentiful and widespread in the ecosystem, with many ungulates making long-distance seasonal migrations from high-elevation summer ranges to lower-elevation winter ranges (Whittlesey et al. 2015).

The Fort Peck Reservation encompasses about 2.1 million acres (849,840 hectares) in Roosevelt County in northeastern Montana. Approximately 56% of trust lands on the Reservation are used for grazing bison, cattle, or horses, while 16% of trust lands are used for crops such as alfalfa, barley, lentils, and wheat (USDI, Bureau of Indian Affairs 2015). Bison and many other wildlife species were native to the area now encompassed by the Reservation, though the precise numbers are unknown (USDI, Bureau of Indian Affairs 2015). Native peoples significantly modified environments in this region for thousands of years through fires, harvests, and other activities (Wallen et al. 2015b).

Planning or development activities currently being implemented or likely to be implemented in the reasonably foreseeable future that have some relation to Yellowstone bison and their management and could contribute to cumulative impacts are listed and briefly described in Appendix D. The following sections contain evaluations of cumulative impacts for each impact topic and alternative analyzed in this Environmental Assessment. Feasible, realistic mitigation measures are proposed to lessen the proposed project's contribution to cumulative impacts and reverse the trend in degradation from impacts caused by other activities (Environmental

Protection Agency 1999). The Bureau of Indian Affairs (2015) previously evaluated the cumulative impacts related to expanding wild bison herds on the Fort Peck Reservation (see http://www.nps.gov/yell/learn/nature/upload/FtPeck_PEA_AL-WBM_-Program.pdf). They provided information regarding the incremental direct and indirect effects from this action, as well as summaries of the overall cumulative impacts of past, present, and reasonably foreseeable actions. The Bureau of Indian Affairs (2015) concluded an increase in numbers of bison on the Reservation would result in a continuation of the status quo for most resources, with more emphasis on protection of the environment such as threatened and endangered species and water resources. That information has been incorporated into this analysis by reference, with brief summaries of relevant content or conclusions provided for each impact topic.

Yellowstone Bison

Accounts from 1796-1881 suggest bison were plentiful and widespread in the GYE prior to Euro-American colonization (Whittlesey et al. 2015). However, the number of bison that spent time in the mountainous area now encompassed by YNP is unknown. Based on the timing of historical observations and the current behavior of bison and other ungulates such as deer, elk, and pronghorn, it is likely many bison in the area migrated seasonally between productive grasslands in the mountains during summer and lower elevation valleys in outlying areas during winter (Plumb et al. 2009, Geremia et al. 2015c). Therefore, the environmental reference point for evaluating cumulative impacts is one where animals roam freely within a conservation area large and heterogeneous enough to sustain ecological processes such as migration and dispersal, has sufficient animals to mitigate the loss of existing genetic variation, and is subject to the forces of natural selection (White et al. 2015d). In this context, wild bison can be characterized as untamed, free-roaming animals living in an environment not dominated by humans and whose behaviors, movements, survival, and reproductive success are primarily affected by their own daily decisions and natural selection (White 2015).

Plains bison were nearly extirpated during the middle to late 1800s as millions were shot by Euro-Americans colonizing western North America. Only about two dozen bison remained in the Yellowstone area by 1900, all within the newly created (1872) national park (Schullery and Whittlesey 2006). Also, the bacterial disease brucellosis that causes abortions was inadvertently introduced into bison and elk in the Yellowstone area during the early 1900s when humans brought domestic cattle for meat and milk (Meagher and Meyer 1994). However, the dedicated protection and restoration of this population over the next century gradually increased numbers to about 5,000 bison inside YNP by 2005. These bison are considered the only sustainable, wild population of plains bison due to their large numbers, high genetic diversity, and adaptive capabilities (Freeze et al. 2007, White et al. 2015d). Unfortunately, bison were not allowed to migrate or disperse to outlying areas in the ecosystem due to concerns about brucellosis transmission back to livestock and adverse economic impacts to the industry. Also, there were concerns about human safety, property damage, and competition with livestock for grass (Boyd 2003). Thus, the population was not restored regionally throughout the GYE.

In 2000, the federal government and the state of Montana created the IBMP to limit Yellowstone bison abundance and distribution to the park and nearby areas of Montana, thereby lessening the probability bison would mingle with cattle and transmit brucellosis (USDI, NPS and USDA, USFS, APHIS 2000a). The principal method used to reduce abundance and contain bison is

capturing them inside the park near the boundary and shipping them to meat processing facilities (White et al. 2011). Public and tribal hunting of bison also occurs along the park boundary. These ongoing activities have limited the distribution of bison to YNP, where they are allowed to move freely and access any and all of the habitats therein. However, the mountainous park does not contain substantial low-elevation habitats typically used by ungulates during winter when deep snow pack limits access to forage at higher elevations. As a result, some bison attempt to migrate to valleys outside of the park in search of forage, primarily into the state of Montana at present. However, federal and state employees confine these bison to relatively small areas adjacent to the park, unlike every other species of migratory wildlife. Many of these bison are killed to limit abundance and, as a result, the processes of migration and dispersal have not been fully restored. This containment and culling hinders further recovery of bison across the GYE.

More than 3,500 wild bison should be maintained in the Yellowstone population because this is the only ecologically and genetically viable population of plains bison in existence (Freese et al. 2007, Hedrick 2009, Pérez-Figueroa et al. 2012). The population has high reproduction and survival and numbers increase rapidly when conditions are good. However, Montana currently has little tolerance for bison and Idaho and Wyoming have indicated they do not want wild bison outside preserves. These states have traditionally exercised primary management authority over wildlife on the extensive National Forest System lands (16 USC 528) in the GYE, including the hazing of bison from these lands back into YNP each spring. Conversely, the management of a population of more than 4,500 bison may not be sustainable in the long-term if they are prevented from migrating and required to forage year-round almost entirely within YNP. If migrating bison are forced to remain within the park and relatively small nearby areas, then numbers would be regulated by food availability within this area and bison would reach high densities before substantial starvation occurs. These high densities of bison could cause significant deterioration to other park resources such as vegetation, soils, geothermal features, and other ungulates as the bison population overshoots the park's capacity to provide adequate forage (Plumb et al. 2009).

Given existing conditions and technologies, it is not feasible to cost-effectively and substantially reduce brucellosis in wild bison and elk in the GYE. Region-wide test-and-slaughter and vaccination are unacceptable and infeasible, and these wildlife species are critical to the culture, ecological health, economy, and recreation of the region (White et al. 2015a). Therefore, it is unlikely additional tolerance for bison on public lands in the states surrounding YNP will keep pace with the current prolific growth of this population given the extremely high survival of calves and adults (Geremia et al. 2015b, White et al. 2015d). As a result, it is foreseeable that Yellowstone bison will need to be continually culled and harvested from the population to limit abundance and distribution which will, in turn, limit recovery. The incremental impact of the no action alternative would not alter this containment or culling that occurs pursuant to the IBMP; these actions would continue. Likewise, the incremental impact of implementing quarantine with bison inside YNP (alternative 2) or at the Fort Peck Reservation (alternative 3) would not alter this containment or culling. However, some bison removed from the population for quarantine would be used to augment or establish populations of plains bison elsewhere. This simulated dispersal or emigration could contribute to the recovery of the species in North America.

For long-term conservation and further recovery in the GYE, Yellowstone bison need mitigation measures such as similar access to habitat that other wildlife species such as elk are given without human intrusion, including year-round access to many National Forest System and other public lands in the ecosystem that are outside the NPS's jurisdiction. Montana has allowed more tolerance for bison adjacent to YNP to facilitate hunting and is considering allowing bison in some of these areas year-round to improve hunting and conservation. Also, the park and the state of Montana are working together to update the current bison management plan (IBMP). Public opinion is shifting toward more tolerance for bison in the GYE (Tulchin Research 2015) and, as a result, a new paradigm is needed to accommodate larger numbers and allow bison 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 further from the park. Also, the continuing development of open space on private lands surrounding the park degrades and fragments habitat and migration corridors for wildlife, including bison.

Only a few other unfenced, wide-ranging populations of plains bison exist in the United States (e.g., Book Cliffs, Henry Mountains, Grand Teton, Wrangell-St. Elias). All of these populations are relatively small with less than 1,000 bison. Furthermore, most other conservation herds of bison on public lands also have low population sizes, along with limited distributions, protection from natural selection factors like large predators, and skewed sex and age ratios maintained to ease management (McDonald 2001). Additional wild, wide-ranging populations subject to the forces of natural selection need to be augmented or established at other sites to preserve the species. This would reduce the reliance on Yellowstone and a few other populations to preserve the species in the wild. To accomplish this goal, in 2011 the Director of the National Park Service instituted a Call to Action Initiative for restoring and sustaining three wild bison populations across the central and western United States in collaboration with tribes, private landowners, and other public management agencies (USDI, NPS 2011). To date, Yellowstone bison from the quarantine feasibility study have been relocated to the Fort Belknap and Fort Peck Reservations to initiate new wild, wide-ranging populations.

In summary, the impacts of past, present, and reasonably foreseeable future actions on Yellowstone bison have been to recover a viable, wild population in YNP from near extirpation in the late 1800s, but not allow migration and dispersal elsewhere to fully recover the species throughout the GYE or elsewhere. Collectively, all of these uses and activities have had and would continue to have major, long-term, adverse, cumulative impacts on Yellowstone bison.

As described earlier, under the no action alternative, bison would continue to be managed under the IBMP and annual operations plan; therefore impacts under the no action alternative would reflect those described in the IBMP FEIS. As previously discussed, the impact thresholds used in the FEIS for the IBMP were different than those used here, but comparable in terms of population level effects. As disclosed in the FEIS, it was anticipated that the implementation of the modified preferred alternative and the selected action would have a moderate adverse impact to the bison population in terms of overall removal of animals. But modeling predicted this removal would not measurably affect the age and sex distribution or reproductive rates of the population based on removing 246 bison each year to limit the total population size to about 3,000 animals. In addition, since the implementation of the plan, the population has recovered from removals (harvests plus culls) of more than 500 bison during several winters and almost

6,000 bison since 2001. Thus, the effects of continuing current management would have no additional impacts to the bison population beyond those previously disclosed as moderate and adverse in the FEIS and ROD for the IBMP. For the purposes of analyzing impacts to individual bison in this EA under the no action alternative, there could be minor, adverse, and local impacts related to injuries, trauma, disease transmission, and stress from confinement activities occurring under the existing IBMP.

As previously described, the direct and indirect impacts of the action alternatives on Yellowstone bison would be negligible to minor because bison placed quarantine or terminal pastures would otherwise be sent to meat processing or research facilities to limit population growth. However, effects to plains bison as a species could be beneficial, moderate to major due to augmenting or establishing new populations from the Yellowstone lineage.

When the effects of any one of the alternatives are combined with other past, present, and reasonably foreseeable future impacts, the total cumulative impact on Yellowstone bison would continue to be major, long-term, and adverse. The incremental impacts of the no action or either action alternative would contribute slightly to, but would not substantially change, the adverse cumulative impacts that are already occurring. Additionally, even though both action alternatives would contribute some beneficial effects, those effects would not be large enough to meaningfully change the adverse impacts already occurring.

Other Wildlife

Narratives from the GYE during 1796-1881 suggest other wildlife species were plentiful and widespread prior to Euro-American colonization (Whittlesey et al. 2015). Therefore, the environmental reference point for evaluating cumulative impacts is one where animals roam freely within a conservation area large and heterogeneous enough to sustain ecological processes such as competition, dispersal, and predation; have sufficient animals to mitigate the loss of existing genetic variation; and are subject to the forces of natural selection. In this context, wildlife can be defined as untamed, free-roaming animals that live in an environment not dominated by humans and whose behaviors, movements, survival, and reproductive success are predominantly affected by their own daily decisions and natural selection (White 2015).

Populations of large ungulates, predators, valuable fur-bearing mammals (e.g., beavers), and plume-bearing birds (e.g., trumpeter swans) in the GYE and other areas of Montana (e.g., Fort Peck area) were decimated by colonists and settlers during the middle to late 1800s (Whittlesey et al. 2015). Habitat was destroyed and fragmented by continued settlement, agriculture, and resource extraction activities during the 1900s. However, the protection and stewardship of animals within YNP and elsewhere in the GYE and other areas of Montana gradually increased numbers of many species over the next century (Lonner et al. 2009). Populations of other animals remained low or were actively suppressed (e.g., large predators).

The GYE has been experiencing rapid human growth and changes in land use, with a 58% increase in population to over 370,000 residents and a 350% increase in the development of rural land during 1970 to 1999 (Gude et al. 2006, Hansen and DeFries 2007, Hansen 2009). Habitat modification, destruction, and fragmentation have primarily affected valley bottoms and flood plains with higher plant productivity and more moderate winter conditions (Hansen 2009). These areas, which are primarily located outside preserves and wilderness areas, are crucial for

the migration and seasonal use by many species in this mountainous environment (Hansen and DeFries 2007). More than 75 percent of migration routes for deer, elk, pronghorn, and other wildlife in the GYE have been lost, and many of those remaining are disrupted or shortened (Berger 2004).

Potential uses for most undeveloped private lands are not restricted by regional plans or zoning districts (Gude et al. 2007). Thus, 30 to 40% of the private lands are forecast to convert to rural residential development (Gude et al. 2006, 2007). Likewise, continuing agricultural, oil and gas, and residential development are expected to increase the total amount of developed land and reduce the total amount of undisturbed land on the Fort Peck Reservation (USDI, Bureau of Indian Affairs 2015). These impacts could result in increased disturbance to wildlife and a degradation and loss of habitat.

In summary, the impacts of past, present, and reasonably foreseeable future actions on wildlife were to substantially reduce numbers and distribution, though viable, wild populations of many species have been recovered in the GYE and other areas of Montana. Collectively, all of these uses and activities have had and would continue to have major, long-term, adverse, cumulative impacts on other wildlife.

As previously discussed, the impacts of the no action alternative to other wildlife would be negligible to minor, local and adverse in the short term from disturbance and displacement due to hazing, capture, and shipping of bison in or near the Stephens Creek area. In the FEIS and ROD for the IBMP, the NPS acknowledged the potential for moderate to major impacts on the pronghorn population which spends winter in the Gardiner basin, however those impacts were not realized in the implementation of the existing IBMP as pronghorn population abundance has increased from about 200 to 440 during 2001 to 2015; minor beneficial impacts to scavengers due to winterkilled carcasses in areas where bison were tolerated in Montana; and negligible impacts associated with bison grazing and changes in behavior (USDI, NPS and USDA, APHIS and USDA 2000a,b). Continuing current management would have no additional effects beyond those previously disclosed.

The incremental impact on other wildlife of implementing quarantine operations inside YNP (alternative 2) or at the Fort Peck Reservation (alternative 3) would be negligible to minor and adverse due primarily to disturbance and displacement.

When the effects of any one of the alternatives are combined with other past, present, and reasonably foreseeable future impacts, the total cumulative impact on other wildlife would continue to be major, long-term, and adverse. The incremental impacts of the no action or either action alternative would contribute slightly to, but would not substantially change, the cumulative impacts that are already occurring.

Special Status Species

Narratives from the GYE during 1796-1881 suggest gray wolves and grizzly bears were plentiful and widespread prior to Euro-American colonization. Mentions of lynx were rare (5 accounts), though they were apparently present in greater abundance and distribution than today (Whittlesey et al. 2015). Therefore, the environmental reference point for evaluating cumulative

impacts is one where animals roam freely within a conservation area large and heterogeneous enough to sustain ecological processes such as competition, dispersal, and predation; have sufficient animals to mitigate the loss of existing genetic variation; and are subject to the forces of natural selection. In this context, wildlife can be defined as untamed, free-roaming animals that live in an environment not dominated by humans and whose behaviors, movements, survival, and reproductive success are predominantly affected by their own daily decisions and natural selection (White 2015).

Wolves were eliminated from the GYE by the 1940s by settlers, soldiers, and others that feared them and loathed them for killing livestock and wildlife species needed for sustenance such as elk. However, wolves were reintroduced to YNP during 1995 to 1997 and numbers and distribution increased from 21 to 174 within the park by 2003, and hundreds more in surrounding states (USDI, USFWS 2009b). Grizzly bears were isolated and threatened with extinction in the GYE by the mid-1970s due to conflicts with humans and habitat loss. There were fewer than 220 grizzly bears and numbers were decreasing. However, decades of protection and innovative management reversed this trend and today there are more than 700 grizzly bears inhabiting more than 13 million acres in the GYE (Bjornlie et al. 2014, Haroldson et al. 2015). Lynx remain rare, but are reproducing in the GYE and elsewhere in Montana (Murphy et al. 2004, 2006).

As described in the previous section (Other Wildlife), the GYE has been experiencing rapid human growth and changes in land use that continues to modify, destroy, and fragment habitat and migration corridors. These impacts could contribute to increased disturbance to special status species. However, the incremental impact of the no action alternative on special status species would be negligible to minor and adverse due primarily to disturbance and displacement. Likewise, the incremental impact of implementing quarantine operations inside YNP (alternative 2) or at the Fort Peck Reservation (alternative 3) would be negligible to minor and adverse due primarily to disturbance and displacement. Quarantine facilities in YNP (alternative 2) would affect a minute portion of the landscape and Canada lynx would be unlikely to use these areas. Also, bison capture operations in YNP would occur while most grizzly bears are denning, and wolf use of this area is ephemeral. Currently, grizzly bear and wolf populations in the GYE appear to be varying near the capacity of the environment to support them (van Manen et al. 2015; USDI, USFWS 2012). Efforts to reduce conflicts with people and preserve habitat for dispersal and, eventually, connectivity with other populations will be essential for further restoration. Quarantine operations on the Fort Peck Reservation (alternative 3) would not affect the black-footed ferret and are unlikely to affect the least tern, pallid sturgeon, and piping plover (USDI, Bureau of Indian Affairs 2015).

In summary, the impacts of past, present, and reasonably foreseeable future actions on special status species were to substantially reduce numbers and distribution, though viable, wild populations of grizzly bears and wolves have been recovered in the GYE and other areas of Montana. Collectively, all of these uses and activities have had and would continue to have major, long-term, adverse, cumulative impacts on special status species.

As previously described, the impacts of the no action alternative on special status species would include displacement and disturbance from bison management activities and slight changes in the availability of bison carrion and would likely be negligible to the bald eagle, Canada lynx, gray

wolves, and grizzly bears (USDI, NPS and USDA, APHIS and USDA 2000a,b). On July 20, 2000, the USFWS concurred with the determination in the NPS' March 15, 2000 biological assessment that the IBMP may affect, but was not likely to adversely affect, the threatened Canada lynx, gray wolf, and grizzly bear. The implementation of the IBMP does not affect designated critical habitat for lynx. Since that time, the typical timeframe for annual bison hazing has shifted and now occurs during May and June more often than in the past, which could cause effects to grizzly bears emerging from their dens that were not considered in the 2000 biological assessment. In addition, new information suggested a decrease in whitebark pine (*Pinus albicaulis*) seed production and cutthroat trout (*Oncorhynchus clarkii bouvieri*) numbers could impact the nutritional status of grizzly bears and make ungulate meat more important to their well-being.

As a result, the NPS prepared a biological evaluation of possible impacts to grizzly bears resulting from these changes (Wenk 2012). On December 3, 2012, the USFWS concurred with the determination that hazing operations conducted under the existing IBMP may affect, but are not likely to adversely affect grizzly bears. They also concurred there is no evidence to demonstrate (1) mortality to whitebark pine trees and decreases in cutthroat trout during the past decade have significantly decreased the nutritional status or demographic rates of grizzly bears in the GYE, or (2) the number of bison carcasses available to grizzly bears is substantively less than prior to the implementation of the IBMP (Wilson 2012). The grizzly bear population has continued to recover under the IBMP, with bears in the park thought to be near carrying capacity, and an ecosystem-wide population of about 700 bears across 13 million acres (Bjornlie et al. 2014, Haroldson et al. 2015, van Manen et al. 2015).

Likewise, wolves released in YNP increased in abundance and distribution from 21 released in the northeastern part of the park in 1995 to 174 throughout the park, and hundreds more in surrounding states, by 2003 (Smith et al. 2003). Thus, wolves were considered biologically recovered (USDI, USFWS 2012). No lynx have been observed during bison management activities and evidence suggests they are still rare in YNP, primarily in the central portion or transient (Murphy et al. 2004, 2006). Thus, the effects of continuing current bison management should have no additional effects on special status species beyond those previously disclosed.

As previously discussed, the incremental impact on special status species of implementing quarantine operations inside YNP (alternative 2) or at the Fort Peck Reservation (alternative 3) would be no effect to not likely to adversely affect due primarily to disturbance and displacement.

When the effects of any one of the alternatives are combined with other past, present, and reasonably foreseeable future impacts, the total cumulative impact would continue to be major, long-term, and adverse. The incremental impacts of the no action or either action alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring.

Ethnographic Resources

YNP preserves a unique history of ethnographic resources spanning more than 11,000 years and including material collections, associations with 26 tribes, and insights into the birth of the NPS

system and the conservation movement. These resources are associated with a variety of cultures, including those of Native Americans, explorers, trappers, soldiers, miners, concession staffs, neighboring communities, and park visitors (USDI, NPS 2014b). Likewise, thousands of cultural resources, as well as traditional cultural properties, have been identified and documented on the Fort Peck Reservation. Recorded resources on the Reservation include archaeological sites dating approximately 7,500 to 2,000 years before present, a historic Indian Agency, a historic district, and historic churches, schools, and other structures (USDI, Bureau of Indian Affairs 2015). Yellowstone bison are culturally significant to the Assiniboine and Sioux Tribes because they are the last living link to the indigenous herds that once roamed the area and provided food, clothing, fuel, tools, shelter, and spiritual value (Wallen et al. 2015b). Therefore, the environmental reference point for evaluating cumulative impacts is one where wild, wide-ranging bison from YNP would be restored to the Reservation and other public and tribal lands, while protecting and preserving other cultural, historical, and archeological resources within YNP and the Reservation.

The massive slaughter of bison by colonizing Euro-Americans contributed to the decimation of native peoples and rapid cultural change. By the late 1800s, most tribes were disorganized and trying to survive Euro-American expansion on reservations where they had been forced to relocate and concentrate most of their activities (Wallen et al. 2015b). The Fort Peck Agency was established in 1871, and relocated to its present location in 1878, to serve the Assiniboine and Sioux Tribes. Bison were eradicated from the region by 1881 and disease and starvation substantially reduced numbers of people in the tribes by the late 1880s. The modern boundaries of the Reservation were established in 1888 (http://fortpecktribes.org/tribal_history.html). Tribes were excluded from YNP shortly after its establishment, thereby ensuring the influences of native peoples on the landscape disappeared (Nabokov and Loendorf 2004).

Cultural resources in YNP, the GYE, and at the Fort Peck Reservation have been adversely affected by ground-disturbing activities such as the construction of roads, fences, pipelines, and transmission lines. Also, there have been changes in land use that resulted in the disturbance or removal of cultural objects and historic structures. In addition, grazing by cattle and native wildlife have resulted in the excessive removal of vegetation and soil erosion in some areas, particularly along trails and near water sources. Adverse impacts to cultural landscapes, historic districts, and traditional cultural properties have occurred by impeding traditional uses, increasing public access to areas used for traditional spiritual purposes, and reducing the abundance and distribution of certain medicinal and spiritual plants through cultivation, grazing, and the application of herbicides (USDI, Bureau of Indian Affairs 2015).

The condition of archeological sites, cultural landscapes, ethnographic resources, historic properties, material collections, and oral history programs within YNP and the Fort Peck Reservation varies from poor to good. Continued development (e.g., oil and gas and agricultural) in and around the Fort Peck Reservation could impact cultural resources through inadvertent disturbance or damage. However, the discovery of these resources could also have a positive impact by generating information about the location and nature of cultural resources (USDI, Bureau of Indian Affairs 2015). Development, flooding, visitation, and wildfires are forecast to increase in the GYE and elsewhere in Montana during coming decades, which could adversely impact archeological, historic, and ethnographic resources, including cultural

landscapes. Also, some cultural resources in YNP located on geothermally active ground or adjacent to dynamic hydrothermal systems are at risk (USDI, NPS 2014b).

In summary, the impacts of past, present, and reasonably foreseeable future actions have severed the interdependent relationship between bison and native peoples. Collectively, all of these uses and activities have had and would continue to have major, long-term, adverse cumulative impacts on ethnographic resources.

As previously described earlier, the impacts of the no action alternative on ethnographic resources would be negligible to minor and adverse, primarily from continuing to capture, confine, and ship wild bison to slaughter, which many tribes oppose. Also as previously described, the impact from implementing quarantine operations inside YNP (alternative 2) or at the Fort Peck Reservation (alternative 3) would be minor to moderate and adverse due to temporarily confining wild bison in quarantine facilities and, eventually, distributing them to public and tribal lands to provide communal, spiritual, and conservation benefits. However, expanding wild herds of bison would provide a living context for the lives of native peoples that largely depended on hunting bison. Also, the attraction of tourism and harvests of bison would enable a broader public understanding of the culture of native peoples (USDI, Bureau of Indian Affairs 2015).

When the effects of any one of the alternatives are combined with other past, present, and reasonably foreseeable future impacts, the total cumulative impact on ethnographic resources would continue to be major, long-term, and adverse. The incremental impacts of the no action or either action alternative would contribute slightly to, but would not substantially change, the adverse impacts that are already occurring. Additionally, even though both action alternatives would contribute some beneficial effects, those effects would not be large enough to meaningfully change the adverse impacts.

Human Health and Safety

Bison were central to the diets of many native peoples that lived in the Great Plains and Rocky Mountains and hunted bison as they moved across the landscape. These native peoples ate unprocessed foods, drank water, and participated in frequent and vigorous physical activities. Bison meat is lean and nutritious; high in minerals (e.g., iron, zinc), protein, and vitamins (e.g., B6, B12); and low in calories, fats, and sugars. As a result, these native peoples were healthy with no diabetes, heart diseases, or high blood pressure (http://www.itbcbuffalo.com/node/24). Therefore, the environmental reference point for evaluating cumulative impacts is one where health and safety would be a culture in YNP and the Fort Peck Community, with residents, staff, and visitors exercising and eating nutritious foods; taking feasible precautions to prevent accidents and serious injuries; and making sure any illnesses and injuries are properly treated.

After the near extirpation of bison by colonizing Euro-Americans, most native peoples were relocated to reservations and forced to adopt a more sedentary lifestyle and less nutritious diet higher in calories, fats, and sugars. As a result, diabetes is 4 to 8 times more common in Native Americans than the rest of the population in the United States. Also, heart disease is the leading cause of death for Native Americans (http://www.itbcbuffalo.com/node/25). In addition, bison and subsequently humans were exposed to the nonnative disease brucellosis, which was likely introduced into the GYE by cattle during the late 1800s (Meagher and Meyer 1994). *Brucella*

bacteria can be transmitted from bison to humans through mucous membranes such as the eyes, through an open wound, or by direct contact with skin. In humans, the disease is known as undulant fever and can be treated with antibiotic therapy (Luce et al. 2012).

In recent years, the frequent occurrence of diabetes in Native Americans has motivated a return to a more-traditional, bison-based diet (Wallen et al. 2015b). Meat from bison culled inside YNP is distributed primarily to tribes. Also, several tribes conduct subsistence hunts for bison on open and unclaimed federal lands adjacent to the park in Montana (Wallen et al. 2015b). With the pasteurization of milk and near eradication of bovine brucellosis in livestock, the occurrence of undulant fever in the United States is rare. Thus, infected bison in the GYE are a minor health risk for people. Those who are most susceptible either improperly handle animal carcasses or may be exposed to birth tissues (Luce et al. 2012).

In summary, the impacts of the past, present, and reasonably foreseeable future actions resulted in Yellowstone bison being chronically exposed to the nonnative disease brucellosis and Native Americans being forced to adopt a more sedentary lifestyle and less nutritious diet without bison meat and higher in calories, fats, and sugars. Collectively, all of these uses and activities have had and would continue to have major, long-term, adverse cumulative impacts on human health and safety.

As previously described, the impacts of the no action alternative would be negligible to minor to human health and safety. The incremental impact of the no action alternative on human health and safety would continue to be negligible to minor and adverse due to occasional injuries.

Likewise, the incremental impact from implementing quarantine operations inside YNP (alternative 2) or at the Fort Peck Reservation (alternative 3) would be minor and adverse due to occasional injuries or exposures, as well as the return to a more-traditional, bison-based diet for some tribal members. To mitigate impacts from brucellosis exposure, NPS and tribal bison management staff would wear appropriate personal protective gear and implement best management practices. If an exposure occurs, nearly all patients respond to appropriate antibiotic therapy (Centers for Disease Control 2005).

When the effects of any one of the alternatives are combined with other past, present, and reasonably foreseeable future impacts, the total cumulative impact would continue to be major, long-term, and adverse. The incremental impacts of the no action or either action alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring.

Visitor Use and Experience

The purpose of YNP is to share the geothermal wonders and preserve and protect the scenery, cultural heritage, wildlife, and geologic and ecological systems for the benefit and enjoyment of present and future generations (USDI, NPS 2014b). The YNP Protection Act (also known as the original Lacey Act) of 1894 prohibits hunting in the park, but allows angling by hook and line under rules and regulations promulgated by the Secretary of the Interior (16 USC 26). In contrast, visitation is not a primary purpose for the Fort Peck Reservation, which was established to serve the Assiniboine and Sioux Tribes. However, many thousands of visitors each year are

attracted for camping, fishing, hunting, and native culture and traditions (USDI, Bureau of Indian Affairs 2015).

Therefore, the environmental reference point for evaluating cumulative impacts is one where visitors would be provided with opportunities to experience natural wonders, scenery, wildness, solitude, unpolluted air, and dark night skies, while accommodating their needs and expectations, but ensuring adverse impacts to natural and cultural resources are minimized. In this manner, YNP and the Fort Peck Reservation can motivate the preservation and stewardship of cultural and natural resources and build a deeper understanding of the significance of Yellowstone bison to Native American culture and our national conservation and sporting ethics, which are still considered models for the rest of the world.

Visitors from around the world travel to YNP to experience its geothermal wonders, wide-ranging wildlife, inspiring scenic views, cultural heritage, and spectacular wilderness character (USDI, NPS 2014b). Annual visits to YNP averaged less 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 3.5 million thereafter (Gunther et al. 2015). Yellowstone has nine visitor centers, nine hotels and lodges, 12 campgrounds, over 460 miles of roads, and about 1,000 miles of trails. The park maintains high quality interpretive and educational opportunities to meet visitor expectations, and enjoyment and satisfaction are generally high based on recent surveys. However, many facilities are aging and roads, trails, and campsites are in continual need of maintenance (USDI, NPS 2014b). Also, the continual and escalating visitation has contributed to an increase in congestion, wildlife-human interactions, vehicle strikes, and the habituation of wildlife (Gunther et al. 2015). Zoonotic diseases could be transmitted between wildlife and visitors using the same areas (USDI, NPS 2014b).

Tribal members and non-tribal members with proper tribal licenses and stamps may fish or hunt (bison, pronghorn, upland game birds) on the Fort Peck Reservation (USDI, Bureau of Indian Affairs 2015). Many visitors camp on or near the Manning Lake Wetland Complex and Tribal Wildlife Refuge. Also, there are events to celebrate native culture and traditions, including the Poplar Indian Days Pow wow, Red Bottom Celebration, Badlands Celebration, Fort Kipp Celebration, and the Wadopana Celebration. In addition, the Fort Peck Assiniboine and Sioux Culture Center and Museum include exhibits of tribal heritage, arts, and crafts (USDI, Bureau of Indian Affairs 2015).

The trends for visitation and recreational activities in the GYE and the Fort Peck area are generally increasing, resulting in additional pressures on facilities, roads, and resources. Congestion occurs during summer near commercial services, campgrounds, parking areas, and pull-outs. Also, human-wildlife interactions can result in traffic congestion, safety concerns, and off-road parking during wildlife watching (USDI, NPS 2014b). In addition, encroachment and development outside YNP and the Reservation could impact visitor experience.

In summary, the impacts of the past, present, and reasonably foreseeable future actions have been continual and escalating visitation which, in turn, has increased congestion, wildlife-human interactions, vehicle strikes, and the habituation of wildlife. Collectively, all of these uses and

activities have had and would continue to have major, long-term, adverse cumulative impacts on visitor use and experience.

As previously described, the impacts from the no action alternative on visitor use and experience would be minor, adverse and local due to some visitors being disturbed or offended by ongoing bison management activities. Also, as previously described, the impact on visitor use and experience from implementing quarantine operations inside YNP (alternative 2) or at the Fort Peck Reservation (alternative 3) would be minor to moderate and adverse depending on whether visitors are upset by bison management activities or pleased to see Yellowstone bison relocated to additional public or tribal lands. Key issues to understand include the effects of increased visitation and changing visitation patterns, human-wildlife interactions, and pedestrian/automobile safety concerns in developed areas. Mitigation measures could include increased messaging and education, continuing to incorporate new research into management decisions, and taking measures to improve visitor safety and bison management, while providing a desired visitor experience and protecting resources (USDI, NPS 2014b)

When the effects of any one of the alternatives are combined with other past, present, and reasonably foreseeable future impacts, the total cumulative impact would continue to be major, long-term, and adverse (habituation) and beneficial (enjoyment). The incremental impacts of the no action or either action alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring.

Vegetation

An account from the Langford-Washburn-Doane Expedition of 1870 (Secretary of War 1871) describes native vegetation in the Gardiner basin (where quarantine of bison is proposed in YNP) as follows:

> *"From this point to the mouth of Gardiner's River, a distance of 12 miles, the valley was full of original drift. The boulders were of Quincy granite, and, wherever found, were worn off smooth as if by the action of water. The ground rose rapidly as we proceeded, passing from a dead level alkali plain to a succession of plateaus, covered slightly with sterile soil, through which the limestones cropped out constantly. In many places deep ravines were worn down in the strata by the waters from the melting snows; numerous springs were seen far up on the mountain sides, but their waters sank among the arid foothills without reaching the river. This desert region, inclosed 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 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 …"*

Therefore, the environmental reference point for evaluating cumulative impacts is one where vegetation in the Gardiner basin is a native shrub-grass plant association with functioning water, soil properties, and energy and nutrient cycles—similar to the site potential described during the 1870 expedition. Likewise, the desired conditions for vegetation elsewhere in the GYE and on the Fort Peck Reservation would be sustainable native plant communities with functioning water, soil properties, energy and nutrient cycles, and disturbance dynamics (e.g., fires, floods, insects).

Nonnative plant species have already invaded and, in many places, currently dominate landscapes in the Gardiner basin and other portions of the GYE (USDI, NPS 2006). Also, ongoing agricultural activities and oil and gas and residential developments in and around the Fort Peck Reservation have impacted native vegetation by disturbance and the introduction and proliferation of noxious weeds (USDI, Bureau of Indian Affairs 2015). There is evidence of increases in temperature and changes in precipitation in YNP, the GYE, and elsewhere in surrounding states over the past century (Rodman et al. 2015). Forecasts for the northern portion of YNP suggest warmer, drier summers with more frequent drought and earlier peaks in the growing season followed by earlier curing of vegetation. Such changes could continue the proliferation of nonnative plants and alter the composition of plant communities and associated disturbance regimes (e.g., fire, insect outbreaks; McWethy et al. 2010; USDI, NPS 2014b).

In summary, the impacts of the past, present, and reasonably foreseeable future actions have resulted in nonnative plant species already invading and currently dominating many areas in the GYE and portions of the Fort Peck Reservation. Collectively, all of these uses and activities have had and would continue to have major, long-term, adverse cumulative impacts on native vegetation.

As previously described, the impacts of the no action alternative on vegetation would be negligible because construction of the Stephens Creek facility has already occurred and existing conditions are already degraded. Thus, the incremental impact of the no action alternative on vegetation would continue to be negligible because vegetation in the capture facility has already been denuded and non-native plants are pervasive in the area. The incremental impacts from implementing quarantine operations inside YNP (alternative 2) or at the Fort Peck Reservation (alternative 3) would be minor and adverse due primarily to removing habitat and compacting and disturbing soil during the construction and operation of quarantine facilities and/or terminal pastures. All quarantine alternatives would involve mitigation efforts to prevent the establishment or control noxious weeds. Also, the NPS and the Fort Peck Tribes will continue to monitor the status of native and nonnative species and stressors to the ecosystems to identify drivers and consequences of changes and best practices for managing plant communities (USDI, NPS 2014b; USDI, Bureau of Indian Affairs 2015). Also as previously described, the impacts on vegetation from implementing quarantine operations inside YNP (alternative 2) or at the Fort Peck Reservation (alternative 3) would be minor.

When the effects of any one of the alternatives are combined with other past, present, and reasonably foreseeable future impacts, the total cumulative impact would continue to be major, long-term, and adverse. The incremental impacts of the no action or either action alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring.

Water/Aquatic Resources

When YNP was established in 1872, aquatic systems were generally in their natural state. The waterways in and near the park originate primarily from deep snows that accumulate in the mountains and release water as they melt during spring and summer (Tercek et al. 2015). About 40 percent of the waterways in YNP developed and persisted without fish for thousands of years

(Evermann 1892). More than 200 waterfalls isolate certain drainages or watercourses from the rest of the watersheds and fish located further downstream. Eleven fish species are native to YNP, including arctic grayling (*Thymallus arcticus*), cutthroat trout, longnose dace (*Rhinichthys cataractae*), longnose sucker (*Catostomus catostomus*), mottled sculpin (*Cottus bairdi*), mountain sucker (*Catostomus platyrhynchus*), mountain whitefish (*Prosopium williamsoni*), redside shiner (*Richardsonius balteatus*), speckled dace (*Rhinichthys osculus*), Utah chub (*Gila atraria*), and the Utah sucker (*Catostomus ardens*; Varley and Schullery 1998).

There are seven major drainages within and near the Fort Peck Reservation, including Big Porcupine Creek, Little Porcupine Creek, Wolf Creek, Tule Creek, Poplar River, Smoke Creek, and the Big Muddy River. The Big Muddy River, Poplar River, Smoke Creek, and Wolf Creek are perennial, while the others are seasonal and intermittent. All of these creeks and rivers are tributaries to the Missouri River, which borders the southern boundary of the Reservation. Water levels in the flowing creeks and rivers peak after snow melt and during flooding events. Twenty-eight fish species are native to this stretch of the Missouri River, including paddlefish (*Polyodon spathula*), sauger (*Sander canadensis*), and pallid sturgeon (USDI, Bureau of Indian Affairs 2015).

The conditions of many of waterways in and near YNP and the Fort Peck Reservation have been drastically altered over time, which precludes restoring them to their historic, primitive states. However, the park and adjacent National Forest System lands protect the headwaters of major rivers in the ecosystem, which substantially reduces habitat degradation from construction, development, extraction, pollution, and water diversion (Franke 1997). As a result, streams and lakes in YNP are designated Outstanding Natural Resource Waters under the Clean Water Act. Therefore, the environmental reference point for evaluating cumulative impacts is one where (1) water quality is maintained or restored without further degradation, (2) native aquatic communities are reconstructed where feasible to conditions more closely resembling their historic state, and (3) sustainable angling and fish watching experiences are provided.

After YNP was established in 1872, many of the fishless waters were stocked with nonnative trout to increase angling opportunities and diversity for visitors. Nonnative trout were also released into rivers and streams inhabited by native fish. More than 310 million fish were stocked in park waters through the 1950s, with nonnative trout becoming well-established in most of the lakes and watercourses (Varley and Schullery 1998). By the late 1950s, the fishery began to wane under increasing angling pressure. Managers stopped stocking nonnative fish and changed angling regulations to protect native fish populations and promote catch-and-release fishing instead of harvest (Varley and Schullery 1998). However, threats to native fishes remained due to competition, diseases, hybridization, and predation by nonnative fish. Thus, fisheries biologists developed a Native Fish Conservation Plan to restore the ecological role of native fishes by isolating, suppressing, or removing nonnative fish from certain waters, and then restoring native fish (USDI, NPS 2010b). Efforts to suppress nonnative fish have been intensified in some areas, with native fish restored to several drainages (Koel et al. 2015).

Water quality in YNP is generally good, with more than 99% of surface waters designated as Outstanding Natural Resource Waters. However, Soda Butte Creek, Reese Creek, and the Yellowstone River near Gardiner, Montana are listed as impaired under the Clean Water Act due

to low pH values caused by tailings downstream of the McLaren mine and acidic runoff from thermal features (Koel et al. 2015). Since 1942, temperatures have risen and precipitation has decreased in YNP, which has resulted in a drier landscape and less recharge for hydrologic systems (USDI, NPS 2014b). Forecasts suggest warmer, drier summers with more frequent drought, warmer winters, and earlier snowmelt. Such changes could alter disturbance regimes (fire, flooding) and the distribution, movement, and quality of water (McWethy et al. 2010). They could also facilitate the continued invasion and proliferation of aquatic invasive species. In addition, developments in and near YNP for infrastructure, geothermal, oil, gas, and water could reduce groundwater recharge and increase impacts to water resources. Furthermore, structures (e.g., roads, bridges), diversions, and hardening of water channels would continue to impact the natural movement of water (USDI, NPS 2014b).

The principal uses of surface water resources on the Fort Peck Reservation are for irrigation, livestock, domestic water supply, and recreation. Agricultural activities such as livestock grazing have reduced water quality and degraded riparian habitat on the Reservation through stream bank erosion and increased nutrient and sediment inputs. Water flow in the Missouri River is moderated by several reservoirs, the closest of which is approximately 3 miles southwest of the Reservation. The Missouri River and its tributaries are managed for wild fisheries, which includes at least 21 introduced species, including nonnative predatory fish such as northern pike (*Esox lucius*), smallmouth bass (*Micropterus dolomieu*), and walleyes (*Sander vitreus*). These species are likely disrupting native species, communities, and ecological functions. Water quality Big Muddy Creek, Missouri River, Poplar River, and Porcupine Creek is considered impaired due to effects from agriculture, grazing in riparian or shoreline zones, loss of riparian habitat, oil and gas development, pollution from spills and discharges, and regulation of water flows. The consumptive use of water, industrial discharge, and sewage will increase with population growth (USDI, Bureau of Indian Affairs 2015).

In summary, the impacts of the past, present, and reasonably foreseeable future actions have degraded water quality, altered natural water flows, and severely disrupted native aquatic communities. Collectively, all of these uses and activities have had and would continue to have major, long-term, adverse cumulative impacts on water and aquatic resources.

As described earlier, the impacts of the no action alternative on water quality would be negligible. The incremental impact of the no action alternative on water and aquatic resources would continue to be negligible because water availability is currently sufficient for existing uses in the Stephens Creek area. The incremental impacts from implementing quarantine operations inside YNP (alternative 2) or at the Fort Peck Reservation (alternative 3) would be minor and adverse due to tapping or developing additional water supplies to support bison year-round in a quarantine facility. Natural waterways within the areas where quarantine operations would be conducted do not support fisheries. To lessen impacts, the Fort Peck Reservation is attempting to remedy water quality problems by implementing pollution control projects (USDI, Bureau of Indian Affairs 2015). Also, the NPS is working with adjacent landowners to restore natural flow regimes on Reese Creek. The NPS and the tribes are working to conserve water use in developed areas (USDI, NPS 2014b).

The impacts on water and aquatic resources from implementing quarantine operations inside YNP (alternative 2) or at the Fort Peck Reservation (alternative 3) would be minor.

When the effects of any one of the alternatives are combined with other past, present, and reasonably foreseeable future impacts, the total cumulative impact would continue to be major, long-term, and adverse. The incremental impacts of the no action or either action alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring.

Consultation and Coordination

Agency Coordination

The Record of Decision for the IBMP designated APHIS as the lead agency for undertaking "a NEPA process to determine the design, location, and operation procedures of a bison quarantine facility" (USDI, NPS and USDA, USFS and APHIS 2000b:13). As indicated previously, APHIS conducted a feasibility study during 2005 to 2010 to evaluate the design and operation procedures for a quarantine facility (MFWP and USDA, APHIS 2006). However, they informed the NPS during December 2012 that it was uncertain whether they would conduct further NEPA to implement a quarantine facility (R. Clarke, APHIS, Veterinary Services, Belgrade, Montana).

On June 5, 2014, the Superintendent of YNP sent letters (L7617[YELL]) to the partners of the IBMP and the Governor of Wyoming informing them YNP was developing a plan to consider a quarantine process for Yellowstone bison at one or more new quarantine facilities, which could be located within YNP, on tribal lands, or elsewhere.

On July 2, 2014, the Superintendent of YNP invited the Rocky Mountain Region of the Bureau of Indian Affairs to be a cooperating agency in the planning effort for quarantine of Yellowstone bison (Letter D18[YELL]xN1615). The Acting Regional Director accepted this invitation via a letter dated July 15, 2014.

On July 3, 2014, the Director of the Wyoming Game and Fish Department indicated the establishment of a quarantine facility or populations of bison may place additional areas at risk for the expansion of brucellosis and private property. In addition, the Director related concerns that other agencies would not be able to adequately fund disease surveillance, equipment, management and personnel. The Director did not support the establishment of wild bison populations or quarantine facilities outside national parks and refuges (Talbott 2014).

On September 12, 2014, MFWP indicated there must be close coordination between the NPS and potential recipients of Yellowstone bison with MFWP, and possibly additional analyses and planning, if a quarantine facility was developed outside YNP in Montana (McDonald 2014). Furthermore, MFWP indicated the relocation of any brucellosis-free bison "… within Montana outside of tribal boundaries would be considered a wild bison transplant, regardless of land ownership, and would be subject to 87-1-216, MCA [Montana Code Annotated], MEPA [Montana Environmental Policy Act], and FWP Commission approval. … Because of their statutory designation as wildlife and as a species in need of disease management in Montana,

transport of quarantine program bison and graduates across the state, even if from YNP to tribal lands, will require a transport permit.[15] … Quarantine offers solutions that address several social and cultural issues, but must be closely coordinated with state wildlife and animal health officials to ensure all applicable laws and rules are clearly understood and followed" (McDonald 2014).

Tribal Consultation

On October 15 and 16, 2012, staff from YNP and the Bureau of Indian Affairs consulted with members of tribes associated with YNP during two conference phone calls regarding possible transfers of Yellowstone bison to the tribes and the establishment of quarantine facilities on tribal lands (NPS, YNP and the Bureau of Indian Affairs 2012). The Confederated Salish and Kooetenai, Fort Peck Assiniboine and Sioux, and Nez Perce Tribes expressed some interest in establishing quarantine facilities, but indicated financial assistance would be needed for infrastructure and bison management. The Eastern Shoshone, Northern Arapaho, and Northern Cheyenne Tribes expressed interest in obtaining brucellosis-free Yellowstone bison, but indicated they were not interested in establishing quarantine facilities. The Salish-Kootenai, Nez Perce, Shoshone-Bannock, and Umatilla Tribes, who have rights reserved by treaty to hunt bison on open and unclaimed federal lands in southwestern Montana, expressed concerns about quarantine taking bison away from tribal hunters and, as a result, making sure bison released from quarantine were moved to areas where the treaty tribes would still have an opportunity to hunt them.

The Superintendent and other cultural and natural resource managers from YNP made trips to Rapid City, South Dakota on July 23, 2013 and Helena, Montana on July 25, 2013 to meet with many Tribes historically associated with the Yellowstone area and shared information about the management of bison and brucellosis. The Tribes indicated they want access to live, brucellosis-free Yellowstone bison and/or meat from bison shipped to meat processing facilities.

On February 26, 2013, the Fort Peck Assiniboine and Sioux Tribes notified the Secretary of the Interior they had developed 7,100 acres (2,873 hectares; fencing, water, holding facilities) to restore Yellowstone bison on the Fort Peck Reservation. The Tribes indicated they wanted to receive more Yellowstone bison and establish a quarantine facility and surveillance pastures for Yellowstone bison on the reservation.

Biologists from YNP met with several tribes, environmental organizations, and the InterTribal Buffalo Council in Mammoth, Wyoming on February 25, 2014 to discuss interest in and options for establishing a quarantine program for Yellowstone bison. Tribal members from the Fort Peck Reservation, Crow Nation, Cherokee Nation, and the Northern Arapaho Nation indicated they were interested in obtaining brucellosis-free Yellowstone bison, and were either currently constructing, or considering constructing, quarantine facilities and pastures. There was also

[15] In 2011, the Governor of Montana signed an executive order prohibiting the transport of live fish and wildlife in Montana to or from any USDI-managed lands or facilities (Schweitzer 2011). This order remains in effect and the NPS has agreed to notify the Governor before such shipments occur from YNP. However, the NPS did not concede the state of Montana regulates interstate commerce (i.e., transport) or that the Governor's permission is needed to transport live fish and wildlife into or through Montana, including to sovereign tribal lands.

discussion of forming “buffalo treaties” between tribes to distribute brucellosis-free bison completing quarantine.

On June 5, 2014, the Superintendent of YNP sent letters (L7617[YELL]) to 81 tribal representatives from 26 tribes and the InterTribal Buffalo Council informing them the NPS was developing a plan to consider a quarantine process for Yellowstone bison at one or more new quarantine facilities, which could be located within YNP, on tribal lands, or elsewhere. The Superintendent requested to know if each Tribe or tribal organization was interested in obtaining brucellosis-free Yellowstone bison and/or establishing a quarantine facility on tribal lands. He also requested comments on the guidelines for implementing quarantine with Yellowstone bison.

On June 24, 2014, the Chairman of the Nez Perce Tribal Executive Council in Lapwai, Idaho indicated the Tribe supported quarantine provided efforts do not affect the number of bison available for treaty hunting or the prevalence of brucellosis in the population. The Chairman indicated quarantine should be used to establish tribal or public herds, and reduce the number of bison shipped to meat processing facilities. The Tribe expressed interest in receiving live, brucellosis-free Yellowstone bison, but indicated it does not currently have the capacity to quarantine bison on their lands. The cost of building and operating a quarantine facility could be prohibitive without funding.

On August 12, 2014, the Superintendent of YNP sent follow-up letters (L7617[YELL]) to 81 tribal representatives from 26 tribes and the InterTribal Buffalo Council reminding them YNP was considering a quarantine program for Yellowstone bison and requesting input. He also notified the tribes that YNP would hold a consultation meeting in the park during October 2014 with discussions of bison management and the quarantine planning effort.

A government-to-government consultation meeting was held with tribes associated with YNP in Mammoth, Wyoming on October 21, 2014. The NPS presented an update on bison management, including a discussion of the quarantine planning process. The tribes requested more participation on bison management planning activities.

On October 29, 2014, YNP bison managers met with the Land Committee of the Tribal Council at Fort Peck to discuss bison management and the potential for quarantine operations on their lands. They also toured the quarantine facility.

During 2015, the Superintendent and managers from YNP traveled to consult with the Tribal Councils of the Shoshone-Bannock (July 24), Salish and Kootenai (July 30), Nez Perce (August 7), and Umatilla (September 4) tribes. Bison management, including quarantine, was discussed.

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References

Adams, L. G., and C. J. Schutta. 2010. Natural resistance against brucellosis: A review. Open Veterinary Science Journal 4:61-71.

Allendorf, F., and G. Luikart. 2007. Conservation and the genetics of populations. Blackwell Publishing, Malden, Massachusetts.

Associated Press. 2014. Tribes from US, Canada sign bison treaty. Washington Post, Washington, D.C.

Bailey, J. A. 2013. American plains bison. Rewilding an icon. Sweetgrass Books, Helena, Montana.

Barton, B. 2013. Letter dated July 12, 2013 from the State Veterinarian, Idaho Department of Agriculture, Division of Animal Industries, Boise, Idaho to the Texas Animal Health Commission, Austin, Texas.

Berger, J. 2004. The last mile: How to sustain long-distance migration in mammals. Conservation Biology 18:320-331.

Bidwell, D. 2010. Bison, boundaries, and brucellosis: Risk perception and political ecology at Yellowstone. Society and Natural Resources 23:14-30.

Bjornlie, D. D., D. J. Thompson, M. A. Haroldson, C. C. Schwartz, K. A. Gunther, S. L. Cain, D. B. Tyers, K. L. Frey, and B. C. Aber. 2014. Methods to estimate distribution and range extent of grizzly bears in the Greater Yellowstone Ecosystem. Wildlife Society Bulletin 38:182-187.

Blanton, D. W., P. J. White, R. L. Wallen, K. L. Auttelet, A. J. Stewart, and A. M. Bramblett. 2015. The population—attributes, behavior, distribution, resource use, and trends. Pages 1-17 in P. J. White, R. L. Wallen, D. E. Hallac, and J. A. Jerrett, editors. 2015. Yellowstone bison—Conserving an American icon in modern society. Yellowstone Association, Yellowstone National Park, Mammoth, Wyoming.

Boyd, D. P. 2003. Conservation of North American bison: Status and recommendations. Thesis, University of Calgary, Alberta, Canada.

Brown, M. 2014. FWP boss announces scaled-back Montana bison plan. Associated Press, April 24, 2014, Billings Gazette, Billings, Montana.

Cahalane, V. H. 1944. Restoration of wild bison. Transactions of the North American Wildlife Conference 9:135-143.

Centers for Disease Control. 2005. Brucellosis. Division of Bacterial and Mycotic Diseases. <http://www.cdc.gov/ncidod/dbmd/diseaseinfo/brucellosis_t.htm>. Accessed September 15, 2008.

Chang, T., and A. J. Hansen. 2013. Climate change brief. Greater Yellowstone Ecosystem. Landscape climate change vulnerability project. Montana State University, Bozeman, Montana.

Cheville, N. F., D. R. McCullough, and L. R. Paulson. 1998. Brucellosis in the Greater Yellowstone Area. National Academy Press, Washington, D.C.

Clarke, P. R., R. K. Frey, J. C. Rhyan, M. P. McCollum, P. Nol, and K. Aune. 2014. Feasibility of quarantine procedures for bison (*Bison bison*) calves from Yellowstone National Park for conservation of brucellosis-free bison. Journal of the American Veterinary Medical Association 244:588-591.

Coder, G. D. 1975. The national movement to preserve the American buffalo in the United States and Canada between 1880 and 1920. Dissertation, Ohio State University, Columbus, Ohio.

Cole, D.N., and L. Yung, editors. 2010. Beyond naturalness: Rethinking park and wilderness stewardship in an era of rapid change. Island Press, Washington, D.C.

Council on Environmental Quality. 2014. Effective use of programmatic NEPA reviews. Memorandum for heads of federal departments and agencies. Washington, D.C.

Cross, P. C., E. K. Cole, A. P. Dobson, W.H. Edwards, K. L. Hamlin, G. Luikart, A. D. Middletown, B. M. Scurlock, and P. J. White. 2010. Probable causes of increasing brucellosis in free-ranging elk of the Greater Yellowstone Ecosystem. Ecological Applications 20:278-288.

Cross, P. C., E. J. Maichak, A. Brennan, B. M. Scurlock, J. Henningsen, and G. Luikart. 2013. An ecological perspective on *Brucella abortus* in the western United States. Revue Scientifique et Technique Office International des Epizooties 32:79-87.

Cullinane Thomas, C., C. Huber, and L. Koontz. 2015. 2014 national park visitor spending effects. Economic contributions to local communities, states, and the nation. Natural Resource Report NPS/NRSS/EQD/NRR—2015/947. National Park Service, Fort Collins, Colorado.

Derr, J. N., and L. K. Dobson. 2012. Yellowstone quarantine herd comparison to National Bison Range herd. DNA Technologies Laboratory, Texas A & M University, College Station, Texas.

Dratch, P., and P. Gogan. 2010. Bison conservation initiative: Bison conservation genetics workshop: Report and recommendations. Natural Resources Report NPS/NRPC/BRMD/NRR-2010/257. National Park Service, Fort Collins, Colorado.

Duffield, J., D. Patterson, and C. Neher. 2000a. Summer 1999 visitor survey, Yellowstone National Park: Analysis and results. Draft report prepared for the National Park Service, Denver, Colorado.

Duffield, J., D. Patterson, and C. Neher. 2000b. National telephone survey for attitudes toward management of Yellowstone National Park. Final project report. Bioeconomics, Missoula, Montana.

Ebinger, M. R., P. Cross, R. Wallen, P. J. White, and J. Treanor. 2011. Simulating sterilization, vaccination, and test-and-remove as brucellosis control measures in bison. Ecological Applications 21:2944-2959.

Environmental Protection Agency. 1999. Consideration of cumulative impacts in EPA review of NEPA documents. EPA 315-R-99-002/May 1999, Office of Federal Activities (2252A), Washington, D.C.

Evermann, B. W. 1892. Report on the establishment of fish-cultural stations in the Rocky Mountain Region and Gulf States. Bulletin of the U.S. Fish Commission for 1891. Government Publishing Office, Washington, D.C.

Forgacs, D., R. L. Wallen, and J. N. Derr. 2015. Mitochondrial haplotype diversity in Yellowstone National Park bison. Poster presented at the 22nd Annual Conference of The Wildlife Society in Winnipeg, Manitoba, Canada.

Fort Peck Assiniboine and Sioux Tribes. No date. Turtle Mound bison ranch management and business plan, 2014 through 2019. Tribal Executive Board, Poplar, Montana.

Fort Peck Assiniboine and Sioux Tribes Turtle Mound Buffalo Ranch. 2014. Montana Fish, Wildlife, & Parks request for proposals for disposition of quarantine facility bison. Resolution #27-578-2014-04, Tribal Executive Board, Poplar, Montana.

Frank, D. A., R. L. Wallen, and P. J. White. 2013. Assessing the effects of climate change and wolf restoration on grassland processes. Pages 195-205 in P. J. White, R. A. Garrott, and G. E. Plumb, editors. Yellowstone's wildlife in transition. Harvard University Press, Cambridge, Massachusetts.

Franke, M. A. 1997. A grand experiment. The tide turns in the 1950s: Part II. Yellowstone Science 5:8-13.

Franke, M. A. 2005. To save the wild bison: Life on the edge in Yellowstone. University of Oklahoma Press, Norman, Oklahoma.

Freese, C. H., K. E. Aune, D. P. Boyd, J. N. Derr, S. C. Forrest, C. C. Gates, P. J. P. Gogan, S. M. Grassel, N. D. Halbert, K. Kunkel, and K. H. Redford. 2007. Second chance for the plains bison. Biological Conservation 136:175-184.

Freimund, W., M. Patterson, K. Bosak, and S. Saxen. 2009. Winter experiences of Old Faithful visitors in Yellowstone National Park. Final Report. University of Montana, Missoula, Montana.

Gates, C. C., and L. Broberg. 2011. Yellowstone bison: The science and management of a migratory wildlife population. University of Montana Press, Missoula, Montana.

Gates, C. C., C. H. Freese, P. J. P. Gogan, and M. Kotzman, editors. 2010. American bison: Status survey and conservation guidelines 2010. International Union for the Conservation of Nature and Natural Resources, Gland, Switzerland.

Geremia, C., R. Wallen, and P. J. White. 2015a. Population dynamics and adaptive management of Yellowstone bison. National Park Service, Yellowstone National Park, Mammoth, Wyoming. Available at http://ibmp.info/.

Geremia, C. J., P. J. White, R. L. Wallen, and D. W. Blanton. 2015b. Reproduction and survival. Pages 83-95 in P. J. White, R. L. Wallen, D. E. Hallac, and J. A. Jerrett, editors. 2015. Yellowstone bison—Conserving an American icon in modern society. Yellowstone Association, Yellowstone National Park, Mammoth, Wyoming.

Geremia, C. J., P. J. White, R. L. Wallen, and D. W. Blanton. 2015c. Seasonal distributions and movements. Pages 67-80 in P. J. White, R. L. Wallen, D. E. Hallac, and J. A. Jerrett, editors. 2015. Yellowstone bison—Conserving an American icon in modern society. Yellowstone Association, Yellowstone National Park, Mammoth, Wyoming.

Geremia, C., P. J. White, R. L. Wallen, F. G. R. Watson, J. J. Treanor, J. Borkowski, C. S. Potter, and R. L. Crabtree. 2011. Predicting bison migration out of Yellowstone National Park

using Bayesian models. PLoS ONE 6:e16848.
Gogan, P. J. P., R. E. Russell, E. M. Olexa, and K. M. Podruzny. 2013. Pregnancy rates in central Yellowstone bison. Journal of Wildlife Management 77:1271-1279.
Gude, P. H., A. J. Hansen, and D. A. Jones. 2007. Biodiversity consequences of alternative future land use scenarios in greater Yellowstone. Ecological Applications 17:1004-1018.
Gude, P. H., A. J. Hansen, R. Rasker, and B. Maxwell. 2006. Rates and drivers of rural residential development in the Greater Yellowstone. Landscape and Urban Planning 77:131-151.
Gunther, K. A., R. R. Shoemaker, K. L. Frey, M. A. Haroldson, S. L. Cain, F. T. van Manen, and J. K. Fortin. 2014. Dietary breadth of grizzly bears in the Greater Yellowstone Ecosystem. Ursus 25:60-72.
Gunther, K. A., K. R. Wilmot, S. L. Cain, T. Wyman, E. G. Reinertson, and A. M. Bramblett. 2015. Habituated grizzly bears: A natural response to increasing visitation in Yellowstone & Grand Teton national parks. Yellowstone Science 23:33-40.
Halbert, N. D., and J. N. Derr. 2007. A comprehensive evaluation of cattle introgression into US federal bison herds. Journal of Heredity 98:1-12.
Halbert, N., and J. Derr. 2008. Patterns of genetic variation in US federal bison herds. Molecular Ecology 17:4963-4977.
Halbert, N. D., P. J. P. Gogan, P. W. Hedrick, J. M. Wahl, and J. N. Derr. 2012. Genetic population substructure in bison at Yellowstone National Park. Journal of Heredity 103:360-370.
Hansen, A. J. 2009. Species and habitats most at risk in greater Yellowstone. Yellowstone Science 17:27-36.
Hansen, A. J., and R. DeFries. 2007. Ecological mechanisms linking protected areas to surrounding lands. Ecological Applications 17:974-988.
Haroldson, M. A., F. T. van Manen, and D. D. Bjornlie. 2015. Estimating number of females with cubs. Pages 11-20 in F. T. van Manen, M. A. Haroldson, and S. C. Soileau, editors. Yellowstone grizzly bear investigations: Annual report of the Interagency Grizzly Bear Study Team, 2014. U.S. Geological Survey, Bozeman, Montana.
Hatfield, H., T. Ecoffey, and J. Stone. 2013. A guide to managing tribal buffalo herds. InterTribal Buffalo Council, Rapid City, South Dakota.
Hedrick, P. W. 2009. Conservation genetics and North American bison (*Bison bison*). Journal of Heredity 100:411-420.
Herman, J. A. 2013. Genetic natural resistance to brucellosis in Yellowstone National Park bison (*Bison bison*): A preliminary assessment. Thesis, Colorado State University, Fort Collins, Colorado.
Herman, J., A. Piaggio, N. Halbert, J. Rhyan, and M. Salman. 2014. Genetic analysis of a *Bison bison* herd derived from the Yellowstone National Park population. Wildlife Biology 20:335-343.
Hobbs, N. T., C. Geremia, J. Treanor, R. Wallen, P. J. White, M. B. Hooten, and J. C. Rhyan. 2015. State-space modeling to support management of brucellosis in the Yellowstone bison population. Ecological Monographs, http://dx.doi.org/10.1890/14-1413.1.
Interagency Bison Management Plan [IBMP] Agencies. 2014. 2014 IBMP adaptive management plan. Available at http://ibmp.info/.
IBMP Members. 2014. Operating procedures for the Interagency Bison Management Plan. Available at http://ibmp.info/.

Isenberg, A. 2000. The destruction of the bison. Cambridge University Press, Cambridge, UK.
Jones, J. D., J. J. Treanor, R. L. Wallen, and P. J. White. 2010. Timing of parturition events in Yellowstone bison—implications for bison conservation and brucellosis transmission risk to cattle. Wildlife Biology 16:333-339.
Keiter, R. B., and M. S. Boyce. 1991. The Greater Yellowstone Ecosystem: Redefining America's wilderness heritage. Yale University Press, New Haven, Connecticut.
Keiter, R. B., and P. H. Froelicher. 1993. Bison, brucellosis, and law in the Greater Yellowstone Ecosystem. Land and Water Law Review 28:1-75.
Kilpatrick, A. M., C. M. Gillin, and P. Daszak. 2009. Wildlife-livestock conflict: The risk of pathogen transmission from bison to cattle outside Yellowstone National Park. Journal of Applied Ecology 46:476-485.
Knapp, A. K., J. M. Blair, J. M. Briggs, S. L. Collins, D. C. Hartnett, L. C. Johnson, and E. G. Towne. 1999. The keystone role of bison in North American tallgrass prairie—Bison increase habitat heterogeneity and alter a broad array of plant, community, and ecosystem processes. Bioscience 49:39-50.
Knight, R. R., and L. L. Eberhardt. 1985. Population dynamics of Yellowstone grizzly bears. Ecology 66:323-334.
Koel, T. M., J. L. Arnold, P. E. Bigelow, C. R. Detjens, P. D. Doepke, B. D. Ertel, and M. E. Ruhl. 2015. Native Fish Conservation Program, Yellowstone Fisheries & Aquatic Sciences 2012-2014. Report YCR-2015-01, National Park Service, Yellowstone National Park, Mammoth, Wyoming.
Kubinak, J. L., D. H. Cornwall, K. J. Hasenkrug, F. R. Adler, and W. K. Potts. 2015. Serial infection of diverse host (*Mus*) genotypes rapidly impedes pathogen fitness and virulence. Proceedings of the Royal Society B 282:20141568.
Little Thunder, R., and D. Geist. 2014. An open letter to tribal leaders & the American people. Buffalo Field Campaign press release 4/29/14. West Yellowstone, Montana.
Logan, J., and L. Correll. 2013. Letter dated July 15, 2013 from the State Veterinarian and Director, Wyoming Livestock Board, Cheyenne to the Texas Animal Health Commission, Austin.
Lonner, T. N., T. Manning, and J. Campanella. 2009. Back from the brink: Montana's wildlife legacy. Produced by T. Lonner, Media Works Studio, Bozeman, Montana.
Lott, D. F. 2002. American bison. University of California Press, Berkeley, California.
Luce, R., J. Snow, D. Gross, T. Murphy, J. Grandpre, W. R. Daley, J. M. Brudvig, M. D. Ari, L. Harris, and T. A. Clark. 2012. Brucellosis seroprevalence among workers in at-risk professions: Northwestern Wyoming, 2005 to 2006. Journal of Occupational & Environmental Medicine 54:1557-1560.
Lutey, T. 2014. Weather, cattle prices color the 2014 agriculture economy. Billings Gazette, Montana, December 24, 2014. <http://ravallirepublic.com/mobile/article_e0b04261-1900-5da4-9c75-c44a2c1f046d.html>. Accessed February 10, 2015.
MacDonald, D. 2009. Final inventory and evaluation report, Yellowstone National Park 2008 boundary lands archeological survey, Gardiner, Montana. University of Montana, Missoula, Montana.
Manni, M. F., M. Littlejohn, J. Evans, J. Gramann, and S. J. Hollenhorst. 2007. Yellowstone National Park visitor study, summer 2006. Park Studies Unit, Visitor Services Project, Report 178. U.S. Department of the Interior, National Park Service, Washington, D.C.

Mattson, D. J. 1997. Use of ungulates by Yellowstone grizzly bears *Ursus arctos*. Biological Conservation 81:161-177.
McDonald, J. L. 2001. Essay: Bison restoration in the Great Plains and the challenge of their management. Great Plains Research 11:103-121.
McDonald, K. 2014. Correspondence submitted during public scoping regarding plans to develop a quarantine program for Yellowstone bison. PEPC project ID 53793; Document ID 60626; Correspondence 255. Submitted September 12, 2014 from the Wildlife Division Administrator on behalf of Montana Fish, Wildlife & Parks, Helena, Montana.
McKelvey, K. S., K. B. Aubry, and Y. K. Ortega. 2000. History and distribution of lynx in the contiguous United States. Pages 207-264 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires. Ecology and conservation of lynx in the United States. University Press of Colorado, Boulder, Colorado.
McWethy, D. B., S. T. Gray, P. E. Higuera, J. S. Littell, G. T. Pederson, A. Ray, and C. Whitlock. 2010. Climate and terrestrial ecosystem change in the U.S. Rocky Mountains and upper Columbia basin: Historic and future perspectives for natural resource management. Natural Resource Report NPS/GRYN/NRR-2010/260. National Park Service, Fort Collins, Colorado.
Meagher, M. M. 1973. The bison of Yellowstone National Park. Scientific Monograph Series, National Park Service, Washington, D.C.
Meagher, M. 1989. Range expansion by bison of Yellowstone National Park. Journal of Mammalogy 70:670-675.
Meagher, M., and M. E. Meyer. 1994. On the origin of brucellosis in bison of Yellowstone National Park: A review. Conservation Biology 8:645-653.
Meagher, M., M. L. Taper, and C. L. Jerde. 2002. Recent changes in population distribution: The Pelican bison and the domino effect. Pages 135-147 in R. J. Anderson and D. Harmon, editors. Yellowstone Lake: Hotbed of chaos or reservoir of resilience? Proceedings of the sixth biennial scientific conference on the Greater Yellowstone Ecosystem. Yellowstone Center for Resources, Yellowstone National Park, Wyoming and The George Wright Society, Hancock, Michigan.
Miller, C. R., and L. P. Waits. 2003. The history of effective population size and genetic diversity in the Yellowstone grizzly (*Ursus arctos*): Implications for conservation. National Academy of Sciences 100:4334-4339.
Montana Department of Livestock [MDOL]. 2013. Designated surveillance area economic impact statement. Helena, Montana.
MDOL. 2014. Second brucellosis-infected cow found in Montana. Press release dated December 15, 2014. Helena, Montana. Accessed on February 3, 2015 at <http://liv.mt.gov/news/2014/2014_1215-carboncountybrucellosis.mcpx>.
Montana Fish, Wildlife & Parks [MFWP]. 2011. Decision notice interim translocation of bison. Helena, Montana.
MFWP. 2014. Draft environmental assessment. Disposition of quarantine facility study bison. Helena, Montana.
MFWP. 2015. Draft environmental impact statement: Bison conservation and management in Montana. Helena, Montana.
MFWP and MDOL. 2012. Joint decision notice. Adaptive management adjustments to the interagency bison management plan, February 2012. Helena, Montana.

MFWP and MDOL. 2013. Draft joint environmental assessment. Year-round habitat for Yellowstone bison. Helena, Montana.
MFWP and U.S. Department of Agriculture, Animal and Plant Health Inspection Service [USDA, APHIS]. 2006. Decision notice and finding of no significant impact: Bison quarantine feasibility study phase II/III. Region 3 Headquarters Office, Bozeman, Montana.
Murphy, K., T. Potter, J. Halfpenny, K. Gunther, T. Jones, and P. Lundberg. 2004. Final report: The presence and distribution of Canada lynx (*Lynx canadensis*) in Yellowstone National Park, WY. Yellowstone Center for Resources, Yellowstone National Park, Wyoming.
Murphy, K. M., T. M. Potter, J. C. Halfpenny, K. A. Gunther, M. T. Jones, P. A. Lundberg, and N. D. Berg. 2006. Distribution of Canada lynx in Yellowstone National Park. Northwest Science 80:199-206.
Nabokov, P., and L. Loendorf. 2004. Restoring a presence: American Indians and Yellowstone National Park. University of Oklahoma Press, Norman, Oklahoma.
National Park Service [NPS]. 1998. NPS-28: Cultural resource management guideline. U.S. Department of the Interior, Washington, D.C.
NPS. 2006a. Management policies 2006. U.S. Department of the Interior, Washington, D.C.
NPS. 2006b. Cultural landscapes inventory, historic game ranch. Yellowstone National Park. Mammoth, Wyoming.
NPS. 2010. Climate change response strategy. U.S. Department of the Interior, Washington, D.C
NPS. 2011. Director's Order #12: Conservation planning, environmental impact analysis, and decision-making. U.S. Department of the Interior, Washington, D.C.
NPS. 2015. National Park Service NEPA handbook. U.S. Department of the Interior, Washington, D.C.
NPS, Yellowstone National Park and the Bureau of Indian Affairs. 2012. October 17, 2012 summary of comments received from members of Native American Tribes associated with Yellowstone National Park regarding bison during consultation phone calls on October 15 and 16, 2012. National Park Service, Yellowstone National Park, Mammoth, Wyoming.
Partner Agencies, Interagency Bison Management Plan [IBMP]. 2008. Adaptive adjustments to the Interagency Bison Management Plan. National Park Service, Yellowstone National Park, Mammoth, Wyoming. Available at http://ibmp.info/.
Pérez-Figueroa, A., R. L. Wallen, T. Antao, J. A. Coombs, M. K. Schwartz, P. J. White, and G. Luikart. 2012. Conserving genomic variability in large mammals: Effect of population fluctuations and variance in male reproductive success on variability in Yellowstone bison. Biological Conservation 150:159-166.
Plumb, G. E., and R. Sucec. 2006. A bison conservation history in the U.S. National Parks. Journal of the West 45:22-28.
Plumb, G. E., P. J. White, M. B. Coughenour, and R. L. Wallen. 2009. Carrying capacity, migration, and dispersal in Yellowstone bison. Biological Conservation 142:2377-2387.
Rather, D. 2014. Dan Rather presents: Range war. Episode 102.
Rhyan, J. C., K. Aune, T. Roffe, D. Ewalt, S. Hennager, T. Gidlewski, S. Olsen, and R. Clarke. 2009. Pathogenesis and epidemiology of brucellosis in Yellowstone bison: Serologic and culture results from adult females and their progeny. Journal of Wildlife Diseases 45:729-739.

Rhyan, J. C., P. Nol, C. Quance, A. Gertonson, J. Belfrage, L. Harris, K. Straka, and S. Robbe-Austerman. 2013. Transmission of brucellosis from elk to cattle and bison, Greater Yellowstone Area, USA, 2002-2012. Emerging Infectious Diseases 19:1992-1995.

Rodman, A., S. Haas, K. Bergum, C. Hendrix, J. Jerrett, N. Bowersock, M. Gore, E. Oberg, and L. Smith, editors. 2015. Ecological implications of climate change on the Greater Yellowstone Ecosystem. Yellowstone Science 23:1-87.

Ruediger, B., J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, B. Naney, G. Patton, T. Rinaldi, J. Trick, A. Vandehey, F. Wahl, N. Warren, D. Enger, and A. Williamson. 2000. Canada lynx conservation assessment and strategy. U.S. Department of Agriculture, U.S. Forest Service, U.S. Department of the Interior [USDI], U.S. Fish & Wildlife Service, USDI, Bureau of Land Management, and USDI National Park Service, Missoula, Montana.

Salazar, K. 2012. Directive on the placement of Yellowstone bison. May 11, 2012. Washington, D.C.

Sanderson, E. W., K. H. Redford, B. Weber, K. Aune, D. Baldes, J. Berger, D. Carter, C. Curtin, J. Derr, S. Dobrott, E. Fearn, C. Fleener, S. Forrest, C. Gerlach, C. C. Gates, J. E. Gross, P. Gogan, S. Grassel, J. A. Hilty, M. Jensen, K. Kunkel, D. Lammers, R. List, K. Minkowski, T. Olson, C. Pague, P. B. Robertson, and B. Stephenson. 2008. The ecological future of the North American bison: Conceiving long-term, large-scale conservation of wildlife. Conservation Biology 22:252-266.

Schullery, P., and L. H. Whittlesey. 2006. Greater Yellowstone bison distribution and abundance in the early historical period. Pages 135-140 in A. W. Biel, editor. Greater Yellowstone public lands: Proceedings of the eighth biennial scientific conference on the Greater Yellowstone Ecosystem. Yellowstone National Park, Mammoth, Wyoming.

Schumaker, B. 2013. Risks of *Brucella abortus* spillover in the Greater Yellowstone Area. Revue Scientifique et Technique Office International des Epizooties 32:71-77.

Schumaker, B. A., D. E. Peck, and M. E. Kauffman. 2012. Brucellosis in the Greater Yellowstone Area: Disease management at the wildlife-livestock interface. Human-wildlife Interactions 6:48-63.

Schweitzer, B. 2011. Executive order prohibiting the transport of live fish and wildlife in Montana to or from any USDI-managed lands or facilities. Executive order number 16-2011 signed December 13 in Helena, Montana.

Seabury, C. M., N. D. Halbert, P. J. P. Gogan, J. W. Templeton, and J. N. Derr. 2005. Bison PRNP genotyping and potential association with *Brucella* spp. seroprevalence. Animal Genetics 36:104-110.

Secretary of War. 1871. Senate letter communicating the report of Lieutenant Gustavus C. Doane upon the so-called Yellowstone Expedition of 1870. Executive document number 51 dated March 3 at the 41st Congress, 3rd session, Committee on Territories. Washington, D.C.

Shaw, J. H. 1995. How many bison originally populated western rangelands? Rangelands 17:148-150.

Smith, D. W., R. O. Peterson, and D. B. Houston. 2003. Yellowstone after wolves. BioScience 53:330-340.

Smith, D. W., D. Stahler, E. Stahler, M. Metz, K. Quimby, R. McIntyre, C. Ruhl, and M. McDevitt. 2014. Yellowstone National Park wolf project annual report 2013. National Park Service, Yellowstone National Park, Mammoth, Wyoming.

Stone, J. 2013. Buffalo and the use of contraception for population control. Buffalo Tracks, Fall 2013, InterTribal Buffalo Council, Rapid City, South Dakota. <www.itbcbuffalo.com>. Accessed December 13, 2013.

Stynes, D. J. 2008. Impacts of visitor spending on the local economy: Yellowstone National Park, 2006. Michigan State University, East Lansing, Michigan.

Talbott, S. 2014. Guidelines for implementing quarantine with Yellowstone bison. Letter WER 13429 dated July 3, 2014 from the Director, Wyoming Game and Fish Department, Cheyenne, Wyoming to P. J. White, Yellowstone National Park, Mammoth Wyoming.

Teets, B., and D. Mahony. 2013. Reese creek flow and water use monitoring. National Park Service, Yellowstone National Park, Mammoth, Wyoming.

Tercek, M., A. Rodman, and D. Thoma. 2015. Trends in Yellowstone's snowpack. Yellowstone Science 23:20-27.

Treanor, J. J. 2013. Integrating ecology with management to control wildlife brucellosis. Revue Scientifique et Technique Office International des Epizooties 32:239-244.

Treanor, J. J., C. Geremia, P. H. Crowley, J. J. Cox, P. J. White, R. L. Wallen, and D. W. Blanton. 2011. Estimating probabilities of active brucellosis infection in Yellowstone bison through quantitative serology and tissue culture. Journal of Applied Ecology 48:1324-1332.

Tulchin Research. 2015. Poll finds strong support for protecting bison in Montana. Memorandum dated January 7, 2015 on behalf of Defenders of Wildlife. Tulchin Research Polling and Strategic Consulting, San Francisco, California.

Udevitz, M. S., and P. J. P. Gogan. 2012. Estimating survival rates with time series of standing age-structure data. Ecology 93:726-732.

U.S. Animal Health Association. 2012. Brucellosis in the Greater Yellowstone Area. Approved resolution number 17, Committee on Brucellosis, Greensboro, North Carolina. <http://www.usaha.org> Accessed September 19, 2013.

U.S. Department of Agriculture, Animal and Plant Health Inspection Service [USDA, APHIS]. 2003. Brucellosis eradication: Uniform methods and rules, effective October 1, 2003. Animal and Plant Health Inspection Service 91-45-013, Washington, D.C.

USDA, APHIS. 2010. Brucellosis class free states and certified brucellosis-free herds; revisions to testing and certification requirements. Federal Register 75:81090-81096.

USDA, APHIS. 2012. Evaluation of GonaCon^{TM}, an immunocontraceptive vaccine, as a means of decreasing transmission of *Brucella abortus* in bison in the Greater Yellowstone Area. Environmental assessment, May 2012. Veterinary Services, Fort Collins, Colorado.

USDA, APHIS. 2014. Brucellosis class free states and certified brucellosis-free herds; revisions to testing and certification requirements. Federal Register 79:66591-66597.

U.S. Department of the Interior [USDI]. 2012. Department of the Interior policy on consultation with Indian tribes. Washington, D.C.

USDI. 2014. DOI bison report: Looking forward. Natural Resource Report NPS/NRSS/BRMD/NRR—2014/821. Fort Collins, Colorado.

USDI, Bureau of Indian Affairs. 2015. Programmatic environmental assessment for Fort Peck agricultural leasing. Decision record and finding of no significant impact. Fort Peck Tribes, Fort Peck Indian Reservation, Poplar, Montana.

USDI, National Park Service [USDI, NPS]. 2006. Stephens Creek Administrative Area Environmental assessment/assessment of effect. Yellowstone National Park, Mammoth, Wyoming.

USDI, NPS. 2010a. Bison brucellosis remote vaccination. Draft environmental impact statement. Yellowstone National Park, Mammoth, Wyoming.
USDI, NPS. 2010. Native fish conservation plan environmental assessment. Yellowstone National Park, Mammoth, Wyoming.
USDI, NPS. 2011. A call to action: Preparing for a second century of stewardship and engagement. Washington, D.C.
USDI, NPS. 2013. Yellowstone National Park winter use plan / Supplemental environmental impact statement. Mammoth, Wyoming.
USDI, NPS. 2014a. Remote vaccination program to reduce the prevalence of brucellosis in Yellowstone bison. Final environmental impact statement. Yellowstone National Park, Mammoth, Wyoming.
USDI, NPS. 2014b. Foundation document; Yellowstone National Park; Wyoming, Montana, Idaho. YELL 101/122938. Mammoth, Wyoming.
USDI, NPS. 2015a. Environmental impact statement for a management plan for Yellowstone-area bison. Federal Register 80:13603-13604.
USDI, NPS. 2015b. Assessment of actions having an effect on historic properties. Stephens Creek Administrative Area improvements. PEPC project number 59715. September 3, 2015, Yellowstone National Park, Mammoth, Wyoming.
USDI, NPS, and Montana Fish, Wildlife & Parks. 2013. Brucellosis science panel review workshop panelist's report. Yellowstone National Park, Mammoth, Wyoming.
USDI, NPS and U.S. Department of Agriculture, U.S. Forest Service and Animal and Plant Health Inspection Service [USDA, USFS and APHIS]. 2000a. Bison management for the state of Montana and Yellowstone National Park. Final environmental impact statement. Washington, D.C. Available at http://ibmp.info/.
USDI, NPS and USDA, USFS and APHIS. 2000b. Record of decision for the final environmental impact statement and bison management plan for the state of Montana and Yellowstone National Park. Washington, D.C. Available at http://ibmp.info/.
USDI, NPS, Yellowstone National Park, the U.S. Forest Service, Gallatin National Forest, and the Center for Invasive Plant Management. 2005. Results of the Gardiner basin restoration workshop, April 19-21, 2005. Gardiner, Montana.
U.S. Department of the Interior, U.S. Fish & Wildlife Service [USDI, USFWS]. 1978. Reclassification of the gray wolf in the United States and Mexico, with determination of critical habitat in Michigan and Minnesota. Federal Register 43:9607-9615.
USDI, USFWS. 1994. Establishment of a nonessential experimental population of gray wolves in central Idaho and southwestern Montana. Federal Register 59:60266-60281.
USDI, USFWS. 2000. Determination of threatened status for the contiguous U. S. distinct population segment of the Canada lynx. Federal Register 65:16052-16086.
USDI, USFWS. 2005. Designating the Greater Yellowstone Ecosystem population of grizzly bears as a distinct population segment; removing the Yellowstone distinct population segment of grizzly bears from the federal list of endangered and threatened wildlife; proposed rule. Federal Register 70:69854-69884.
USDI, USFWS. 2007. Final rule designating the Greater Yellowstone Area population of grizzly bears as a distinct population segment; removing the Yellowstone distinct population segment of grizzly bears from the federal list of endangered and threatened wildlife; 90-day finding on a petition to list as endangered the Yellowstone distinct population segment of grizzly bears. Federal Register 72:14866-14938.

USDI, USFWS. 2009a. Revised designation of critical habitat for the contiguous United States distinct population segment of the Canada lynx. Federal Register 74:8616-8702.
USDI, USFWS. 2009b. Final rule to identify the northern Rocky Mountain population of gray wolf as a distinct population segment and to revise the list of endangered and threatened wildlife. Federal Register 74:15023-188.
USDI, USFWS. 2012. Removal of the gray wolf in Wyoming from the federal list of endangered and threatened wildlife and removal of the Wyoming wolf population's status as an experimental population. Federal Register 77:5530-55604.
USDI, USFWS. 2015. Fort Peck Indian Reservation agricultural leasing, permitting, and associated improvements. File M.02 BLM (1); 06E11000-2015-I-0129. Memorandum dated February 11, 2015. U.S. Fish & Wildlife Service, Ecological Services, Helena, Montana.
USFWS, Nez Perce Tribe, National Park Service, and U.S. Department of Agriculture, Wildlife Services. 2003. Rocky Mountain wolf recovery 2002 annual report. T. Meier, editor. U.S. Fish & Wildlife Service, Ecological Services, Helena, Montana.
van Manen, F. T., M. A. Haroldson, D. D. Bjornlie, M. R. Ebinger, D. J. Thompson, C. M. Costello, and G. C. White. 2015. Density dependence, whitebark pine, and vital rates of grizzly bears. Journal of Wildlife Management DOI: 10.1002/jwmg.1005.
van Manen, F. T., M. A. Haroldson, K. West, and S. C. Soileau, editors. 2014. Yellowstone grizzly bear investigations: Annual report of the Interagency Grizzly Bear Study Team, 2013. U.S. Geological Survey, Bozeman, Montana.
Varley, J. D., and P. Schullery. 1998. Yellowstone fishes: Ecology, history, and angling in the park. Stackpole Books, Mechanicsburg, Pennsylvania.
Wallen, R. L., and P. J. White. 2015. Adaptive capabilities and genetics. Pages 119-129 in P. J. White, R. L. Wallen, D. E. Hallac, and J. A. Jerrett, editors. 2015. Yellowstone bison—Conserving an American icon in modern society. Yellowstone Association, Yellowstone National Park, Mammoth, Wyoming.
Wallen, R. L., P. J. White, and C. J. Geremia. 2015a. Ecological role—bison relations with other animals and effects on grassland processes. Pages 107-117 in P. J. White, R. L. Wallen, D. E. Hallac, and J. A. Jerrett, editors. 2015. Yellowstone bison—Conserving an American icon in modern society. Yellowstone Association, Yellowstone National Park, Mammoth, Wyoming.
Wallen, R. L., P. J. White, and T. W. Roop. 2015b. Cultural importance. Pages 131-139 in P. J. White, R. L. Wallen, D. E. Hallac, and J. A. Jerrett, editors. 2015. Yellowstone bison—Conserving an American icon in modern society. Yellowstone Association, Yellowstone National Park, Mammoth, Wyoming.
Watson, F. G. R., T. N. Anderson, W. B. Newman, S. S. Cornish, and T. R. Thein. 2009. Modeling spatial snow pack dynamics. Pages 85-112 in R. A., Garrott, P. J. White, and F. G. R. Watson, editors. The ecology of large mammals in central Yellowstone: Sixteen years of integrated field studies. Elsevier, San Diego, California.
Wenk, D. N. 2012. Revised biological evaluation. Effects of hazing Yellowstone bison on threatened grizzly bears. Yellowstone National Park, Mammoth, Wyoming.
Wenk, D. N. 2015. Section 106 review, Stephens Creek Administrative Area improvements, Park County, Montana; NPS PEPC project #59715. Letter H3015(YELL), XC58 dated August 17, 2015 to M. Baumler, Montana State Historic Preservation Office, Helena, Montana.

White, P. J. 2015. Wildlife in Yellowstone: What are we trying to preserve? Unpublished essay on file at the Yellowstone Center for Resources, Yellowstone National Park, Mammoth, Wyoming.
White, P. J., D. E. Hallac, R. L. Wallen, and J. R. White. 2015a. Brucellosis: A nonnative disease hindering the restoration of Yellowstone bison. Pages 19-43 in P. J. White, R. L. Wallen, D. E. Hallac, and J. A. Jerrett, editors. 2015. Yellowstone bison—Conserving an American icon in modern society. Yellowstone Association, Yellowstone National Park, Mammoth, Wyoming.
White, P. J., R. A. Garrott, and G. E. Plumb. 2013a. The future of ecological process management. Pages 255-266 in P. J. White, R. A. Garrott, and G. E. Plumb, editors. Yellowstone's wildlife in transition. Harvard University Press, Cambridge, Massachusetts.
White, P. J., G. E. Plumb, R. L. Wallen, and L. M. Baril. 2013b. Migration and dispersal: Key processes for conserving national parks. Pages 164-178 in P. J. White, R. A. Garrott, and G. E. Plumb, editors. Yellowstone's wildlife in transition. Harvard University Press, Cambridge, Massachusetts.
White, P. J., K. M. Proffitt, L. D. Mech, S. B. Evans, J. A. Cunningham, and K. L. Hamlin. 2010. Migration of northern Yellowstone elk – Implications of spatial structuring. Journal of Mammalogy 91:827-837.
White, P. J., J. J. Treanor, C. Geremia , R. L. Wallen, D. W. Blanton, and D. E. Hallac. 2013b. Bovine brucellosis in wildlife—Using adaptive management to improve understanding, technology, and suppression. Revue Scientifique et Technique Office International des Epizooties 32:263-270.
White, P. J., and R. L. Wallen. 2012. Yellowstone bison—Should we preserve artificial population substructure or rely on ecological processes? Journal of Heredity 98:1-12.
White, P. J., R. L. Wallen, C. Geremia, J. J. Treanor, and D. W. Blanton. 2011. Management of Yellowstone bison and brucellosis transmission risk – Implications for conservation and restoration. Biological Conservation 144:1322-1334.
White, P. J., R. L. Wallen, and D. E. Hallac. 2015b. Introduction. Pages *xiii-xv* in P. J. White, R. L. Wallen, D. E. Hallac, and J. A. Jerrett, editors. 2015. Yellowstone bison—Conserving an American icon in modern society. Yellowstone Association, Yellowstone National Park, Mammoth, Wyoming.
White, P. J., R. L. Wallen, D. E. Hallac, C. J. Geremia, J. J. Treanor, D. W. Blanton, and T. C. Reid. 2015c. Current management—Attempting to balance conservation with disease concerns. Pages 141-157 in P. J. White, R. L. Wallen, D. E. Hallac, and J. A. Jerrett, editors. 2015. Yellowstone bison—Conserving an American icon in modern society. Yellowstone Association, Yellowstone National Park, Mammoth, Wyoming.
White, P. J., R. Wallen, C. J. Geremia, J. Treanor, and D. E. Hallac. 2015d. The future—Recommendations for bison conservation. Pages 159-176 in P. J. White, R. L. Wallen, D. E. Hallac, and J. A. Jerrett, editors. 2015. Yellowstone bison—Conserving an American icon in modern society. Yellowstone Association, Yellowstone National Park, Mammoth, Wyoming.
Whitman, S. C. 2012. Nez Perce tribal coordination of management concerns surrounding the Yellowstone bison. Letter dated August 27, 2012 from the Nez Perce Tribal Executive Committee, Lapwai, Idaho to M. Black, Director, Bureau of Indian Affairs, Washington, D.C.

Whittlesey, L. H. 1995. "They're going to build a railroad!": Cinnabar, Stephens Creek, and the Game Ranch addition to Yellowstone National Park. Draft manuscript dated March 9th. Yellowstone National Park, Heritage Research Center, Gardiner, Montana.

Whittlesey, L. H., S. Bone, A. Klein, P. J. White, A. W. Rodman, and D. E. Hallac. 2015. Using historical accounts (1796-1881) to inform contemporary wildlife management in the Yellowstone area. Unpublished manuscript on file at the Yellowstone Center for Resources, Yellowstone National Park, Mammoth, Wyoming.

Wilmers, C. C., K. Ram, F. G. R. Watson, P. J. White, D. W. Smith, and T. Levi. 2013. Climate and vegetation phenology. Predicting the effects of warming temperatures. Pages 147-163 in P. J. White, R. A. Garrott, and G. E. Plumb, editors. Yellowstone's wildlife in transition. Harvard University Press, Cambridge, Massachusetts.

Wilson, R. M. 2012. Revised biological evaluation, IBMP. File M.25. USFWS, Ecological Services, Montana Field Office, Helena, Montana.

Youpee, C. 2014. Cultural resources inventory. Pedestrian survey report, September 26, 2014. Letter dated October 2, 2014 from the Cultural Resources Department of the Fort Peck Assiniboine and Sioux Tribes to J. Plumage, Bureau of Indian Affairs, Billings, Montana and R. Magnum, Fish & Game Department, Fort Peck Tribes, Poplar, Montana.

Zaluski, M. 2013. Letter dated July 11, 2013 from the State Veterinarian, MDOL, Helena to the Texas Animal Health Commission, Austin.

Appendix A: Environmental and Other Issues Identified by the Public

Description of Environmental and Other Issues	Sections Where Issue/Impact is Discussed
Site-specific Impacts to Quarantined Bison	
Quarantine feasibility study: Consider lessons learned and incorporate them in current analyses and future operations.	Background (Quarantine Feasibility Study); Alternatives (Programmatic Actions Common to All Action Alternatives)
Domestication: Evaluate the impacts of keeping wild bison in captivity.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Disease: Concern about spread among quarantined bison.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Humane treatment: Care and well-being of bison during capture, testing, transport, and confinement.	Alternatives (Alternative 2); Affected Environment and Environmental Consequences (Yellowstone Bison)
Captures/shipments of bison: Quarantine would only divert these activities to other places and times.	Purpose and Need; Affected Environment and Environmental Consequences (Yellowstone Bison)
Facilities: There are quarantine facilities available for use without additional cost to taxpayers.	Alternatives (Alternatives 2 and 3)
Fencing: Require double fencing similar to the quarantine feasibility study pastures.	Alternatives (Programmatic Actions Common to All Action Alternatives)
Translocation: What is the process/procedure?	Purpose and Need; Alternatives (Programmatic Actions Common to All Action Alternatives)
Escapes and Property/Safety: Bison would be difficult to contain and cause private property damage or be a threat to human safety if they escape from quarantine facilities or pastures.	Alternatives (Programmatic Actions Common to All Action Alternatives); Affected Environment and Environmental Consequences (Yellowstone Bison; Human Health and Safety)
Guidelines: Provide information on quarantine facility requirements, length of quarantine for various ages and sexes, and priorities for the distribution of bison to and from quarantine.	Alternatives (Programmatic Actions Common to All Action Alternatives)
Disposition: The destination and recipients of bison completing quarantine should be known before initiating quarantine. Place bison within their historic distribution.	Purpose and Need; Alternatives (Programmatic Actions Common to All Action Alternatives)
Carrying capacity: Disclose the maximum number of bison that would be placed into quarantine and restored at sites.	Purpose and Need; Alternatives (Alternative 2)
Costs: How much would it cost? Who would pay? Need to secure funding for managing bison and quarantine facilities. Efficient/wise use of taxpayer money.	Purpose and Need; Alternatives (Programmatic Actions Common to All Action Alternatives)
Vegetation/Water: Impacts of bison confined in quarantine on native vegetation and water/aquatic resources.	Affected Environment and Environmental Consequences (Vegetation; Water/Aquatic Resources)
Social structure: New herds created from quarantine bison should have a social structure similar to other bison (e.g., family groups).	Affected Environment and Environmental Consequences (Yellowstone Bison)

Regulations: The federal and state regulatory requirements for transferring Yellowstone bison would be complicated.	Alternatives (Programmatic Actions Common to All Action Alternatives); Consultation and Coordination (Agency Coordination)
Commercial use: Bison completing quarantine should be available to commercial bison operations and private individuals.	Purpose and Need; Alternatives (Programmatic Actions Common to All Action Alternatives); Affected Environment and Environmental Consequences (Yellowstone Bison)
Commercial exploitation: Quarantine would lead to the conversion of wild bison to private livestock raised for profit.	Purpose and Need; Affected Environment and Environmental Consequences (Yellowstone Bison)
Genetics: Concern about losing genetic diversity due to the founder effect and genetic drift.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Demand: There could be diminishing interest in obtaining bison from quarantine over time due to saturation and proliferation of herds.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Location of quarantine: Facilities should/should not be located in YNP; on private lands; on tribal lands.	Alternatives (Alternatives 1-3)
Designated surveillance area for brucellosis: Quarantine facilities should be located within this area. Yellowstone bison should not be moved outside this area.	Background (Designated Surveillance Area); Alternatives (Alternatives 2)
Human consumption: Concerns about potential brucellosis infection.	Affected Environment and Environmental Consequences (Human Health and Safety)
Precedent: Concerns about setting a precedent for removing other native species from Yellowstone and other national parks.	Purpose and Need; Affected Environment and Environmental Consequences (Yellowstone Bison)
Programmatic Impacts to the Yellowstone Bison Population	
Population dynamics: Impacts of capturing and removing bison from the population. Maintain current abundance or allow it to increase if there is greater tolerance in Montana.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Disease: Brucellosis is/is not a disease threat to livestock.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Disease: The removal of bison testing negative for brucellosis exposure for quarantine should not increase the overall prevalence of brucellosis in Yellowstone bison.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Vaccination: Bison should be tested for, and vaccinated against, brucellosis.	Alternatives (Alternative 1)
Genetics: Impacts of removing bison with innate resistance to brucellosis from the population. Protect the diversity and integrity of the Yellowstone bison genome.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Adaptive capabilities: Evolutionary potential and genetic integrity need to be preserved.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Shipments to slaughter: Quarantine facilities and terminal pastures should be used to reduce the number of bison shipped to meat processing facilities. Estimate numbers.	Alternatives (Programmatic Actions Common to All Action Alternatives; Alternative 2); Affected Environment and Environmental Consequences (Yellowstone Bison)

Tolerance in GYE: Quarantine operations should not impinge on efforts to increase the conservation and hunting areas for bison near YNP and elsewhere.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Migration: Choose migration corridors over quarantine.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Operations: Quarantine would become a permanent tool in the management of Yellowstone bison.	Purpose and Need; Affected Environment and Environmental Consequences (Yellowstone Bison)
Ecological role: Preserve the role Yellowstone bison play in ecological processes in the GYE.	Affected Environment and Environmental Consequences (Mitigation Measures); Affected Environment and Environmental Consequences (Yellowstone Bison)
Native: Bison are not native to YNP; they were introduced.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Programmatic Impacts to Plains Bison	
Conservation/Culture: The value of establishing new populations with brucellosis-free Yellowstone bison.	Purpose and Need; Affected Environment and Environmental Consequences (Yellowstone Bison; Ethnographic Resources)
Conservation/Culture: There are better ways than quarantine to achieve the purpose of the project.	Purpose and Need; Affected Environment and Environmental Consequences (Yellowstone Bison)
Conservation/Culture: Other bison populations could be used for augmenting or establishing new herds.	Purpose and Need; Affected Environment and Environmental Consequences (Yellowstone Bison)
Genetics: Yellowstone bison would be viewed as seedstock for conservation, cultural, and commercial herds of bison.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Genetics: There is a need for new herds of Yellowstone bison to keep the genetics dispersed in several populations.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Restoration: Quarantine would not restore the species.	Purpose and Need; Affected Environment and Environmental Consequences (Yellowstone Bison)
Livestock and Other Wildlife Species	
Other wildlife: Impacts of establishing a quarantine facility in YNP on other wildlife species.	Affected Environment and Environmental Consequences (Other Wildlife; Special Status Species)
Other wildlife: Impacts of removing Yellowstone bison on predators and scavengers.	Affected Environment and Environmental Consequences (Other Wildlife; Special Status Species)
Precedent: Quarantine would make it easier to contain and/or harvest other wildlife species in the park.	Affected Environment and Environmental Consequences (Other Wildlife)
Barrier to movements: Fencing required to keep bison enclosed during quarantine could impede movements by other wildlife.	Affected Environment and Environmental Consequences (Other Wildlife; Special Status Species)
Brucellosis transmission: Bison in quarantine could transmit brucellosis to livestock and/or wide-ranging elk, with adverse economic impacts to the cattle industry.	Alternatives (Programmatic Actions Common to All Action Alternatives); Affected Environment and Environmental Consequences (Yellowstone Bison)

Vaccination: Ranchers should vaccinate cattle.	Background (Designated Surveillance Area for Brucellosis)
Humans	
Recreation: Bison quarantine facilities and operations would restrict existing recreation opportunities on public lands.	Affected Environment and Environmental Consequences (Visitor Use and Experience)
Tribes: Native Americans have not been involved in the planning and development of bison relocation proposals.	Alternatives (Programmatic Actions Common to All Action Alternatives; Alternative 3); Consultation and Coordination (Tribal Consultation)
Treaty harvests: Impacts of removals on the number of bison available for treaty harvests outside YNP.	Purpose and Need; Affected Environment and Environmental Consequences (Yellowstone Bison); Consultation and Coordination (Tribal Consultation)
Safety: The health and safety of personnel involved with bison capture, handling, and quarantine.	Affected Environment and Environmental Consequences (Human Health and Safety)
Visitors: The impacts of quarantine facilities and operations on visitor use and experience.	Affected Environment and Environmental Consequences (Visitor Use and Experience)
Park operations: The impacts of quarantine facilities on operations in YNP and elsewhere.	Alternatives (Alternative 2); Affected Environment and Environmental Consequences (Yellowstone Bison)
Economic risk: Risk to state livestock industries from Yellowstone bison and quarantine.	Purpose and Need; Background (Brucellosis); Affected Environment and Environmental Consequences (Yellowstone Bison)
Land use: Possible conflicts of bison quarantine operations and pastures with existing land uses.	Impact Topics Dismissed from Further Analysis
Local opposition: Lack of support from some local and state officials and livestock producers for bison populations or quarantine facilities in their jurisdictions.	Affected Environment and Environmental Consequences (Yellowstone Bison); Consultation and Coordination (Agency Coordination)
Trust resources: Should bison be managed as trust resources for the benefit of one or more Tribes?	Impact Topics Dismissed from Further Analysis
Hunting: Quarantine bison should be used to establish or augment public or tribal herds available for hunting.	Purpose and Need; Alternatives (Alternatives 2 and 3); Affected Environment and Environmental Consequences (Yellowstone Bison; Ethnographic Resources); Consultation and Coordination (Tribal Consultation)
Procedural	
NEPA: Develop an Environmental Impact Statement instead of an Environmental Assessment to evaluate the impacts of this proposal.	Purpose and Need
Authority: Yellowstone National Park is misusing Congressional authority to get rid of surplus bison. Congress never intended wild bison to be declared surplus.	Purpose and Need; Authorities, Policies, and Regulations
Authority: The NPS should be in charge with no interference from other agencies.	Purpose and Need; Consultation and Coordination

Quarantine is ongoing: There are already bison in quarantine.	Background (Quarantine Feasibility Study); Alternatives (Alternative 3)
Purpose: The NPS is misleading the public with purported conservation and cultural values of quarantine. The program would be costly, reduce Yellowstone bison to a commodity, and result in little conservation.	Purpose and Need; Alternatives (Alternatives 2 and 3; Environment and Environmental Consequences (Yellowstone Bison)
Alternatives: Quarantine does not address the problem (i.e., brucellosis) because bison and elk are treated differently (e.g., no elk quarantine) even though the disease is endemic in both species.	Alternatives Considered and Dismissed from Detailed Analysis; Affected Environment and Environmental Consequences (Yellowstone Bison)
Goals: Each alternative should address each goal separately (i.e., augment or establish new bison populations; support culture/nutrition of Tribes; reduce bison shipments to meat processing facilities).	Alternatives (Alternative Summaries); Affected Environment and Environmental Consequences (Yellowstone Bison)
Coordination: Need meaningful discussions between the USDI, USDA, and state of Montana regarding brucellosis in wildlife, consequences of suppression actions, and quarantine.	Alternatives; Consultation and Coordination
Interagency Bison Management Plan: Continue current practices. Implement risk management.	Background (Interagency Bison Management Plan); Alternatives (Alternative 1; Mitigation Measures)
Nomenclature: Should be called a translocation program rather than a quarantine program.	Purpose and Need
Conservation assurance: How would the NPS ensure quarantined bison will be used for conservation purposes.	Alternatives (Programmatic Actions Common to All Action Alternatives; Alteratives 2 and 3)
Joint management: Quarantine should be jointly managed by private organizations, public agencies, and/or tribal governments	Alternatives (Programmatic Actions Common to All Action Alternatives; Alteratives 2 and 3)
Scientific information: Decisions should be based on peer-reviewed scientific information.	Affected Environment and Environmental Consequences (Yellowstone Bison)
Public information: Make more information available for people who cannot attend meetings.	This document provides information relevant to the proposed decision. Also see <ibmp.info> website.
Tribal hunting: Allow tribal hunting in YNP.	Hunting in YNP is not authorized by Congress and longstanding policy prohibits hunting in units of the NPS system unless specifically authorized.
PEPC Website: The website for submitting public comments is poorly designed and should be changed.	The Superintendent responded via email with instructions on how to submit comments. No other issues were conveyed.

Appendix B: Estimated Number of Bison in a Quarantine Facility Each Year

The number of bison consigned to quarantine determines the size of the facility needed to adequately care for these individuals. We developed a simple model to estimate the number of bison in a quarantine facility at any point in time given varying numbers of bison (50 to 250) placed in the facility annually. We modeled a quarantine group with an equal sex ratio and an age distribution for each gender of 14% adults, 16% yearlings, and 20% calves. In the model, bison were placed in quarantine each year during February to April. Estimates of brucellosis seroconversion (i.e., test-negative to test-positive) rates were based on findings from the quarantine feasibility study and a subsequent fertility control study (Clarke et al. 2014; USDA, APHIS 2012). A number of assumptions were derived from these estimates:

- 80% of calves remain test-negative for *Brucella* bacteria after entering quarantine;
- 80% of yearlings remain test-negative after entering quarantine;
- 50% of adult males remain test-negative after entering quarantine;
- 70% of adult females remain test-negative after entering quarantine;
- 90% of test-negative adult females entering quarantine are pregnant; and
- 100% of females bred in quarantine get pregnant and have a calf.

The process of tracking bison through quarantine is complicated because there are seven different demographic classes with varying characteristics affecting their time in quarantine (Table B1). An example using a group of 50 bison consigned to quarantine each year is provided in Table B2. Seven adult males (14% of 50 animals), eight yearling males (16%), 10 male calves (20%), and an equal number of females in each age class are placed into quarantine during February to April. In May, the seven adult females give birth to six calves (three males, three females). Brucellosis testing of the bison during June and again in December results in a remaining test-negative group of (1) eight adult males comprised of the survivors from the seven adult and eight yearling males that entered quarantine, (2) eight yearling males that survived from the 10 male calves that entered quarantine, and (3) two male calves born to the pregnant adult females that entered quarantine. The facility would likely reach a maximum number of 127 bison in the quarantine facility during the fourth year of operations.

Figure B1 provides estimates of the number of bison in a quarantine facility at any point in time during the process based on varying numbers of bison (i.e., 50 to 250) placed in the facility annually. The results indicate a quarantine facility would reach maximum capacity in any given year immediately following the calving period, with numbers slowly decreasing thereafter as some animals test positive for brucellosis exposure during June through December. Following the December test period, some bison would complete the quarantine process and be moved to new locations. The number of bison in a facility is expected to increase most during the first two years of operations, less during years three and four, and stabilize after the fourth year.

Placing 250 bison per year into quarantine would require a large area (315+ acres or 128+ hectares) for pastures due to the rapid increase to about 630 bison in the facility within three years due to the relatively lengthy testing requirements for females (Figure B2). Even accepting 150 bison per year into quarantine would necessitate a facility large enough to hold almost 400 bison within four years. Adding 100 or 50 bison to a quarantine facility each year would require a facility large enough to contain about 250 and 125 bison, respectively.

Table B1. Demographic classes of bison and the rates at which they move through the quarantine process.

Demographic Classification	Date Completing Quarantine	Length of Time in Quarantine
Males captured and consigned to quarantine	December of the second year in the quarantine facility	21 to 23 months
Males born in captivity to pregnant females that were captured and consigned to quarantine	June of the second year	14 to 16 months
Females born in captivity to pregnant females that were captured and consigned to quarantine	December of the fourth year	45 to 47 months
All calves born to females that got pregnant in quarantine and are completing quarantine	December of the first year	6 months
Females calves born the May prior to capture and consignment to quarantine	December of the third year	33 to 35 months
Yearling females born nearly two years prior to capture and consignment to quarantine	December of the second year	21 to 23 months
Adult females that are captured and consigned to quarantine	December of the second year	21 to 23 months

Table B2. Example of the number of bison in a quarantine facility at different times of year when 50 animals are consigned to quarantine each year.

Year	Month	Adult Males	Yearling Males	Calf Males	Adult Females	Yearling Females	Calf Females	Total
1	**January**							0
	February to April Bison entering quarantine	7	8	10	7	8	10	50
	May Demographic adjustment and new calves born	15	10	3	15	10	3	56
	December Number of bison that remain test-negative	8	8	2	11	8	2	38
	December Number of bison that convert to test-positive	8	2	1	5	2	1	18
2	**January**	8	8	2	11	8	2	38
	February to April New annual cohort enters quarantine	7	8	10	7	8	10	50
	May Demographic adjustment and new calves born	31	12	8	34	12	8	105
	December Number of bison that remain test-negative	24	10	7	30	10	7	88

	December Number of bison that convert to test-positive	8	2	1	5	2	1	18
	December Number of bison that complete quarantine	16	2	5	11	0	5	39
3	**January**	8	8	2	19	10	2	49
	February to April New annual cohort enters quarantine	7	8	10	7	8	10	50
	May Demographic adjustment and new calves born	31	12	12	44	12	12	123
	December Number of bison that remain test-negative	24	10	11	40	10	11	106
	December Number of bison that convert to test-positive	8	2	1	5	2	1	18
	December Number of bison that complete quarantine	16	2	9	19	0	9	55
4	**January**	8	8	2	21	10	2	51
	February to April New annual cohort enters quarantine	7	8	10	7	8	10	50
	May Demographic adjustment and new calves born	31	12	13	46	12	13	127
	December Number of bison that remain test-negative	24	10	12	42	10	12	110
	December Number of bison that convert to test-positive	8	2	1	5	2	1	18
	December Number of bison that complete quarantine	16	2	10	21	0	10	59

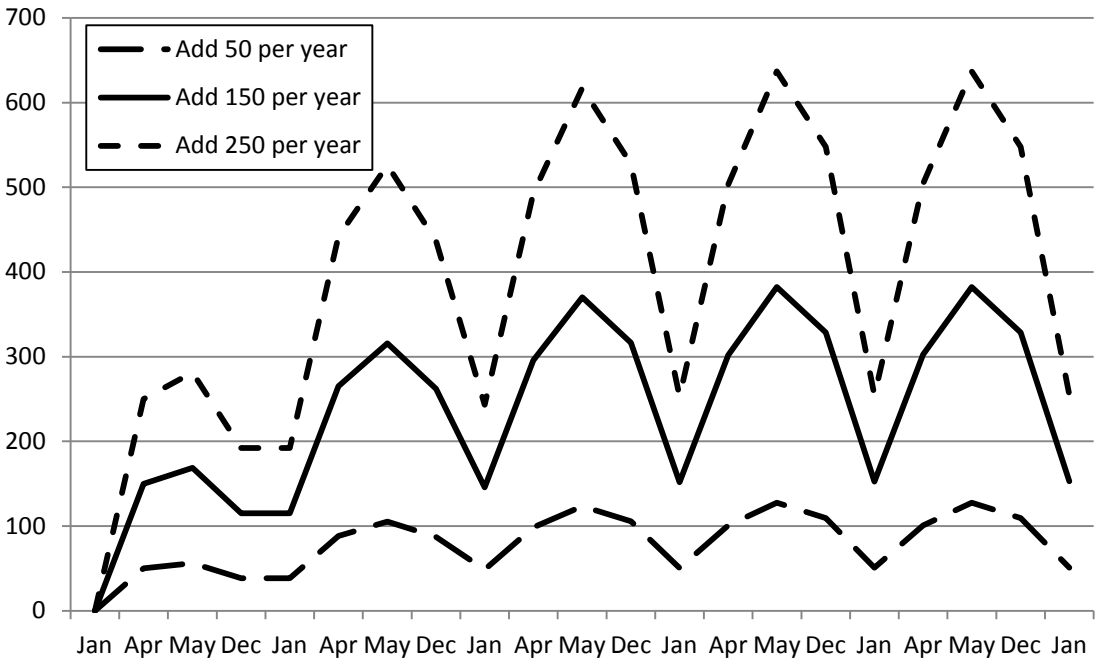

Figure B1. Estimated number of bison in quarantine by time of year and year of operation when 50, 150, and 250 bison are consigned to quarantine each year.

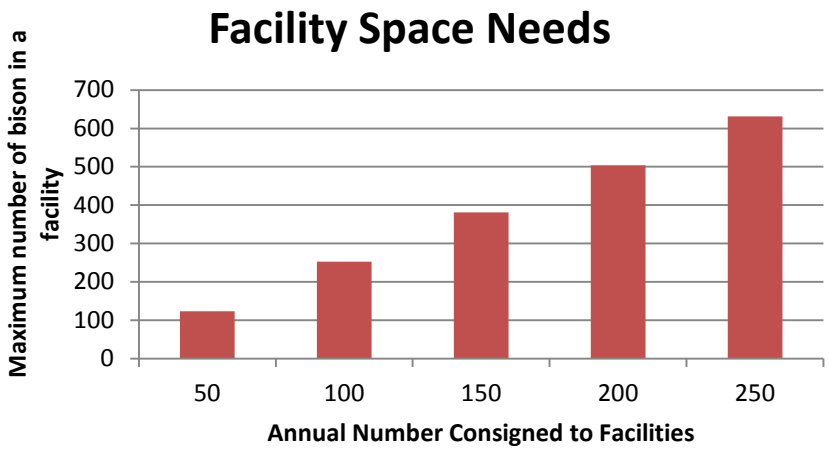

Figure B2. Estimated maximum number of bison a facility needs to accommodate at peak occupancy based on variations in annual input into the facility.

Appendix C: Migration of Bison into the Gardiner Basin during Winter

The number of bison available for placement in quarantine would depend, in part, on the number of bison migrating to the north boundary of YNP each year when the population size is above the agreed-upon guideline. Bison responses to the timing and extent of snow accumulation are a key driver of migration, and as a result, fluctuations in weather result in high variation in migration behavior (Geremia et al. 2011, 2015c). We estimated the numbers of bison in various areas of YNP and nearby areas of Montana during each winter from 2000 through 2014 using data from 93 aerial surveys. One or two Piper Super Cub airplanes were used to survey designated count units in the central and northern regions of YNP. Also, a validated snow pack model (Watson et al. 2009) was used to estimate snow conditions based on predictions of snow water equivalents within each count unit.

These estimates were used to develop a model predicting bison migrations across a range of population and snow conditions. Using a simplified approach of Geremia et al. (2011), we assumed the number of bison counted in the Gardiner basin[16] during late winter, summed with removals occurring prior to the count plus bison held in capture facilities at the time of counting (which were not counted during aerial surveys), were related to bison herd sizes and snow conditions in YNP. We used a beta-binomial model to relate these counts to different snow measures and the total number of bison counted the previous summer (Table C1). The best relationship between counts and snow conditions included central and northern herd sizes entering winter and snow conditions during late winter in the upper-elevation regions of northern Yellowstone used by bison. Based on this analysis, we predicted numbers of bison migrating to the Gardiner basin during winter under a variety of herd sizes and snow conditions (Table C2).

These analyses and computer simulations suggested 50 to 1,800 bison could migrate to the northern boundary of YNP during winters when the population contains more than 3,000 bison and 2,000 or more of these bison live in northern Yellowstone (Table C2). There is substantial variability in the predicted migration from winter-to-winter due to the numbers of bison in the central and northern regions of YNP and the severity of snow conditions (Geremia et al. 2011). When abundance increases above 4,500 bison, about 675 to 1,400 bison are likely to migrate to the north boundary under average snow conditions (Table C2). Therefore, hundreds of bison should be available for hunting in Montana, and possibly quarantine operations, during some winters when there are more than 3,000 bison in the population—similar to migrations during winters in 2013 and 2014 (Geremia et al. 2015a).

[16] The Gardiner basin includes areas inside the northern portion of YNP from Mammoth to Reese Creek and out-of-park areas along the Yellowstone River from the Eagle Creek Special Management Area to Yankee Jim Canyon.

Table C1. Annual maximum numbers of bison counted in the Gardiner basin during aerial surveys and removed through culling or hunting before the date of the count. Snow conditions are the percentage above (+) or below (-) normal for upper-elevation areas. The predicted migrations, with standard deviations in parentheses, are provided.

Year	Count Date	Gardiner Basin Count	Snow Conditions	Predicted Migration	Previous Summer Count		
					Central	Northern	Total
2000	January 30, 2000	0	-40%	22 (56)	1,904	540	2,444
2001	March 1, 2001	24	-110%	9 (32)	1,924	508	2,432
2002	April 3, 2002	22	0%	116 (128)	2,564	719	3,283
2003	March 20, 2003	270	+15%	251 (196)	2,902	813	3,715
2004	April 4, 2004	497	-86%	105 (138)	2,923	888	3,811
2005	January 26, 2005	22 (87)[1]	-125%	123 (164)	3,339	876	4,215
2006	February 12, 2006	999 (1,332)[2]	-8%	1,129 (486)	3,531	1,484	5,015
2007	March 24, 2007	243	-78%	142 (154)	2,512	1,377	3,889
2008	April 11, 2008	1,978	140%	1,880 (530)	2,624	2,070	4,694
2009	April 18, 2009	80 (121)[3]	38%	113 (117)	1,469	1,500	2,969
2010	April 9, 2010	52	-78%	74 (103)	1,539	1,644	3,183
2011	April 23, 2011	1,212	218%	1,181 (426)	1,653	2,245	3,898
2012	April 22, 2012	100	-16%	234 (193)	1,406	2,314	3,720
2013	March 19, 2013	599 (671)[4]	-16%	496 (318)	1,561	2,669	4,230
2014	March 22, 2014	1,770	148%	1,863 (612)	1,504	3,420	4,924
2015	February 12, 2015	920	NA	NA	1,444	3,421	4,865

[1] Aerial surveys occurred before peak migration and ground surveyers reported an additional 65 (87 total for year) bison in the Gardiner basin during March.

[2] Aerial surveys occurred before peak migration and ground surveyers reported an additional 333 (1,332 total for year) bison in the Gardiner basin, including 310 animals temporarily held within the Stephen's Creek facility during March.

[3] One hundred and twenty-one bison were hazed in the Gardiner basin on April 17, 2009.

[4] Ground surveyers reported 671 bison in the Gardiner basin on March 11, 2013.

Table C2. Predicted averages (with standard deviations in parentheses) of Yellowstone bison migrating into the Gardiner basin under different herd sizes and winter conditions.

Population Size			Snow Conditions (Percent of normal during 2000-2014)		
Central	Northern	Total	-100%	normal	+100%
1,000	2,000	3,000	45 (81)	94 (116)	196 (168)
1,500		3,500	89(120)	184 (170)	375 (234)
2,000		4,000	178 (182)	359 (244)	710 (330)
2,500		4,500	342 (269)	674 (353)	1,256 (443)
3,000		5,000	651 (420)	1,209 (513)	2,052 (599)
1,000	2,500	3,500	116 (148)	201 (186)	355 (237)
1,500		4,000	229 (224)	384 (264)	659 (323)
2,000		4,500	432 (342)	714 (383)	1,173 (424)
2,500		5,000	795 (510)	1,272 (552)	1,953 (573)
1,000	3,000	4,000	298 (297)	420 (306)	626 (338)
1,500		4,500	557 (454)	770 (443)	1,110 (449)
2,000		5,000	980 (676)	1,335 (620)	1,850 (571)
1,000	3,500	4,500	710 (616)	835 (509)	1,056 (486)
1,500		5,000	1,203 (869)	1,410 (704)	1,773 (614)

Appendix D: Human Activities Potentially Contributing to Cumulative Impacts

Planning or development activities currently being implemented or likely to be implemented in the reasonably foreseeable future that have some relation to a quarantine program for Yellowstone bison and could contribute to cumulative effects include the following:

Parkwide Road Improvement Plan (1992) – This plan provides direction to preserve and extend the service life of principal roads, enhance human safety, and continue access to YNP.

Interagency Bison Management Plan (2000) – This plan established guidelines with the state of Montana for cooperatively managing the risk of brucellosis transmission from bison to cattle, while allowing some bison to occupy winter ranges on public lands in Montana.

Wireless Communications Services Plan (2008) – This plan provides a framework for establishing wireless communication services throughout YNP.

Native Fish Management Plan (2010) – This plan conserves native fish from threats of nonnative species, disease, and other factors using an adaptive framework for managing fisheries and aquatic resources.

Tower-Roosevelt Comprehensive Plan (2010) – This plan alters or improves visitor services, facilities (buildings, roads, and paved parking areas), and utilities while preserving the rustic western camp character and resources in the Tower-Roosevelt area.

Lake Comprehensive Plan (2012) – This plan alters or improves visitor services, facilities, buildings, roads, paved parking areas, and utilities in the Lake developed area, while managing growth and development.

Invasive Vegetation Management Plan (2013) – This plan provides guidance to prevent, eradicate, and control the spread of nonnative plants through the use of manual and herbicide methods.

Wildland Fire Management Plan (2013) – Many developed areas in Yellowstone have been evaluated and treated for hazard fuel reduction projects, and all of the developed areas are monitored. Tree canopy density needs to be modified to stop crown fires, which may initially take several years to accomplish through treatment. A quality fuel reduction project would make allowances for wind-throw, and over the course of a few years of conservative treatment, the final canopy spacing would be achieved. Accumulated dead and down fuels would be removed using chainsaws, chippers and possibly some small, minimal footprint types of machinery. Fuel not chipped and removed may be piled and burned when it is safe and appropriate to do so.

Over-snow Vehicle Recreation on Groomed Roads in YNP (2013) – The NPS developed a Supplemental Environmental Impact Statement, Record of Decision, and long-term regulations that would continue the grooming of roads in the interior of YNP for over-snow vehicles.

Electric Transmission/Distribution System Communication and Automation Plan (2014) –

YNP in conjunction with Northwestern Energy, one of the electricity providers for YNP, would improve the reliability, safety, and overall service quality of electrical power distribution to the NPS, concessioners, and visitors. The project also includes a communication system for use by Northwestern Energy.

Commercial Stock Outfitter Concession Contracts (2014) – Actions proposed in this Environmental Assessment would provide opportunities for visitors to experience the backcountry of YNP using guided saddle and pack tours, while protecting the natural and cultural resources of YNP.

Fort Peck Agricultural Leasing (2015) – Actions proposed in this Environmental Assessment include continued and expanded agricultural leasing and permitting, including associated improvements, and an expansion of the wild bison herds by the Assiniboine and Sioux Tribes on the Fort Peck Reservation.

Stephens Creek Administrative Area Improvements (2015) – This project added holding pastures (~36 acres) to the existing bison capture facility, northwest of the current sorting pen and squeeze chute, and new gates in existing fence lines. Existing fences were repaired.

Long Range Interpretive Plan (ongoing) – The Long Range Interpretive Plan would provide visitor experience goals, primary interpretive themes, and program recommendations.

Trail Maintenance Projects (ongoing) – YNP rehabilitates or relocates 10 to 15 sections of trail per year. This action results in short-term adverse impacts to soils, vegetation, visitor use, and wildlife, while resulting in long-term benefits to soils, vegetation, and visitor use.

Gardiner Basin and Cutler Meadows Restoration (ongoing) – The USFS and NPS are attempting to restore native plants to these areas where bison move in winter months.

Agricultural Landscapes (ongoing) – Cattle grazing and supplemental irrigation of valley bottom private lands in Idaho, Montana, and Wyoming would continue.

Motorized Visitor Use on National Forest System and Private Lands (ongoing) – Visitors are increasingly using these areas for recreation and other amenities.

Increasing Outfitter/Guide Activity (ongoing) – Visitors are increasingly using outfitters and guides, especially for skilled or knowledge-based activities like wildlife viewing, hunting, and photography.

Population Growth in the GYE (ongoing) – This area has been experiencing rapid population growth for the last 40 years. Such growth can lead to more recreation in wildlife habitat and more development in current areas of open habitat.

NEON Environmental Assessment (in progress) – The National Ecological Observatory Network (NEON) is a continental-scale monitoring platform for discovering and understanding impacts of climate change, land use change, and invasive species. NEON is proposing to gather

long-term data on ecological responses of the biosphere to changes in land use and climate, and on feedbacks with the geosphere, hydrosphere, and atmosphere. It would consist of distributed sensor networks and experiments, linked by advanced cyber infrastructure to record and archive ecological data for at least 30 years. Northern Yellowstone is being considered by NEON, Inc. and the NPS as one of 20 Core Wildland Sites throughout the country. Core NEON sites would require permanent scientific monitoring equipment. A full proposal would detail what types and where such infrastructure is needed. Any infrastructure proposals would follow the guidelines determined through this plan and additional compliance might be required.