2015 ANNUAL REPORT OF THE INTERAGENCY BISON MANAGEMENT PLAN

November 1, 2014 through October 31, 2015

This report was produced by representatives of the Animal and Plant Health Inspection Service; Confederated Salish and Kootenai tribes; Custer Gallatin National Forest; InterTribal Buffalo Council; Montana Fish, Wildlife & Parks; Montana Department of Livestock; Nez Perce tribe; and Yellowstone National Park.

The report summarizes progress under the Interagency Bison Management Plan during November 1, 2014 to October 31, 2015. It provides the results of education, management, monitoring, outreach, and research activities conducted as part of adaptive management (see <http://ibmp.info/adaptivemgmt.php> website).

In addition, the report documents the effects and effectiveness of management actions taken to progress towards objectives and adjust management actions for the following year, as appropriate, to better meet those objectives. The annual report is *not* intended to provide a comprehensive description of all actions taken by the agencies during the preceding year. Additional information is available at the <http://ibmp.info/index.php> website, including meeting notes, key science reports, and information on other relevant activities.

2015 Annual Report of the Interagency Bison Management Plan

Table of Contents

Background

In 2000, the federal government and the state of Montana agreed to an Interagency Bison Management Plan (IBMP) to cooperatively manage the risk of brucellosis transmission from Yellowstone bison to cattle, while conserving a wild bison population and allowing some bison to occupy winter habitat on public lands in Montana. The Animal and Plant Health Inspection Service, Forest Service (Custer Gallatin National Forest), Montana Department of Livestock, Montana Fish, Wildlife & Parks, and the National Park Service (Yellowstone National Park) were initially responsible for implementing the plan. In 2009, the Confederated Salish and Kootenai tribes 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.[1]

The conservation of Yellowstone bison has been successful under the IBMP, with a viable, wide-ranging population of 3,000 to 5,000 migratory animals. The transmission of brucellosis from bison to cattle has not occurred due, in part, to successful efforts by federal and state agencies to maintain separation. As a result, there is some local and national support for allowing these wild bison to migrate and disperse to additional suitable areas outside Yellowstone National Park. However, managing these massive, unfenced animals near humans can be challenging and requires substantial investments of time, effort, and money. Also, there are lingering concerns about human safety, property damage, competition for grass with livestock, and brucellosis transmission to livestock. Thus, there is an ongoing need to evaluate the effectiveness of management actions and make adjustments to progress further towards desired conditions.

Objectives

The purpose of the IBMP is to maintain a wild population of Yellowstone bison and address the risk of brucellosis transmission from bison to protect the economic interest and viability of the livestock industry in the state of Montana. The agencies agreed to address these objectives:

- Regulate the population size and distribution of bison;
- Define boundaries beyond which bison will not be tolerated;
- Mitigate the risk to public safety and private property from bison;
- Commit to the eventual elimination of brucellosis in bison and other wildlife;
- Protect livestock from the risk of brucellosis transmission from bison;
- Protect the state of Montana from losing its class-free brucellosis status;[2]
- Maintain a viable population of wild bison, based on biology, genetics, and ecology;
- Consider factual information in decision-making, such as new science or conditions; and
- Protect other cultural and natural resources affected by bison management activities.

[1] The Shoshone-Bannock tribes and the Confederated Umatilla tribes have recognized treaty rights to harvest bison in southwestern Montana, but do not regularly participate in IBMP discussions and management operations.

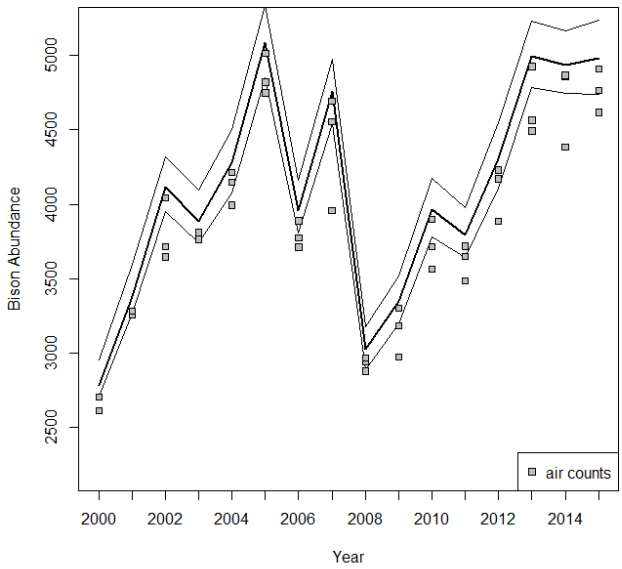
[2] A "brucellosis-free" classification allows producers outside the Designated Surveillance Area for brucellosis to export livestock to other states or nations without testing for brucellosis exposure.

Under the IBMP, the number of bison in the Yellowstone population is supposed to be maintained around 3,000. The plan is not intended to eradicate brucellosis, but rather to prevent transmission from bison to cattle and reduce the prevalence of brucellosis in bison. In addition, biologists at Yellowstone National Park have recommended the following desired conditions for Yellowstone bison:

- Average at least 3,000 to 3,500 bison over decades to preserve genetic diversity;
- Minimize the effects of selective culling on bison and allow numbers in the central and northern regions of the park to vary depending on dispersal rates and natural selection;
- Maintain similar proportions of males and females and an age structure of about 70 percent adults and 30 percent juveniles to facilitate competition for mates;
- Sustain ecological processes such as predation, migration, dispersal, and competition in the park and other agreed-upon conservation areas; and
- Restore the contributions of bison to herbivore-grassland dynamics, the predator-prey-scavenger association, and many other relationships in the ecosystem.

Pre-winter Status and Trends

About 4,865 bison were counted during July 2014, including 3,421 in northern Yellowstone and 1,444 in central Yellowstone (Figure 1). The composition of the population was about 20% calves, 15% yearlings, 45% adult females, and 20% adult males. Population size remained well above the IBMP target of 3,000 bison, but the age structure trended towards the desired condition of about 70% adults and 30% juveniles. Since 2005, there has been a continuing decrease in bison abundance in central Yellowstone due to dispersal movements to northern Yellowstone and some removals of bison that migrate to this area during winter.



Estimated abundance of Yellowstone bison based on aerial counts conducted during the Interagency Bison Management Plan. Bold lines depict average abundance, while thin lines depict 95% credible intervals.

Operations Plan

The extent and timing of bison migration to the northern management area (Mammoth to Yankee Jim Canyon) depends primarily on the amount of snow that precludes access to forage and the total population size since bison from both the central and northern regions of the park migrate to this area during winter. Biologists from the National Park Service predicted up to 2,000 bison moving in and out of the northern management area under average snow conditions, with numbers increasing substantially during February and March. Smaller migrations of fewer than 1,000 bison were predicted if snow conditions were well below normal. The extent and timing of bison migration to the western management area (Madison Junction to the Hebgen basin) depends primarily on the green-up of new vegetation each spring. Biologists forecast that about 100 bison would migrate to this area during autumn and early winter, with numbers increasing to about 350 bison during April and May.

Biologists from the National Park Service recommended removing at least 900 bison during the winter of 2015 (November 2014 - May 2015), including 180 calves, 70 yearling females, 410 adult females, 60 yearling males, and 180 adult males. Biologists stressed it was important to meet the removal objectives for females and calves to reduce bison abundance and productivity. Removals were anticipated through public and treaty hunting in Montana and shipment to meat processing or research facilities from the Stephens Creek capture facility in northern Yellowstone. Biologists recommended harvests be restricted to adult males in the western management area.[3] They also recommended that capture-and-consignment be limited to the northern management area because central herd animals move to both the northern and western management areas and the central herd was estimated at approximately 1,444 animals.

To minimize impacts to hunting, biologists recommended that capture-and-consignment operations be implemented throughout the winter with relatively small numbers (e.g., 25-150) of bison removed weekly during January through March. This stepwise approach would also limit the number of bison held within the capture facility at Stephens Creek, reduce logistical constraints of transporting large numbers of bison to meat processing facilities over brief periods, limit transporting females late in pregnancy to processing facilities (which could occur if gather-and-consignment occurred after the close of hunting seasons), and lower the chances of out-of-park abundance surpassing levels which exacerbate conflict.

The operations plan for the winter of 2015 can be viewed at <http://ibmp.info/Library/OpsPlans/2015_IBMP_Winter_Operations_Plan_FINAL.pdf>. The operations plan was informed by data provided in a National Park Service recommendation to the agencies (see http://www.ibmp.info/Library/20140730/Bison%20Population%20and%20Disease%20Model%20v6%20(final%20for%202014).pdf).

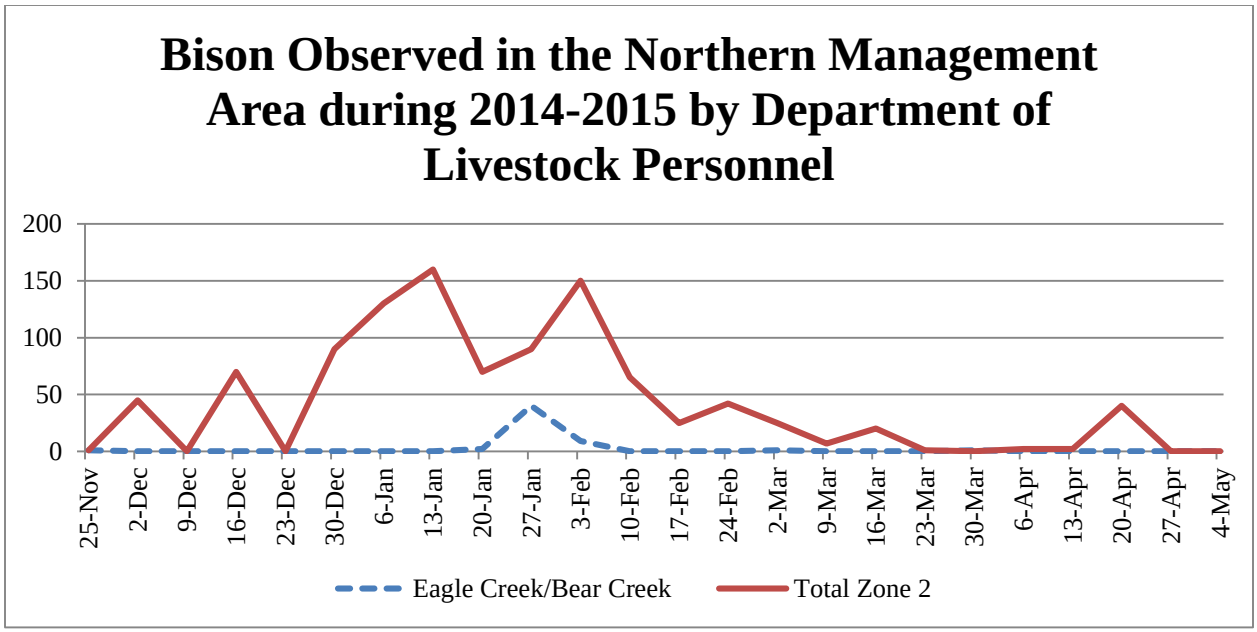
[3] Maps of the northern and western management areas for the Interagency Bison Management Plan are provided in Appendix C.

Migration and Distribution

Bison began migrating into the northern management area during December 2014, but few bison moved north of the park boundary until mid-January (Table 1). The maximum number of bison in the northern management area was about 540 during mid-January. There were few bison north of the park boundary after February 8 due to unseasonably mild weather that suspended migration to lower elevations in and outside the park.

Table 1. Numbers of Yellowstone bison observed by National Park Service personnel in the northern management area (Mammoth to Yankee Jim Canyon) for the Interagency Bison Management Plan during winter 2015.

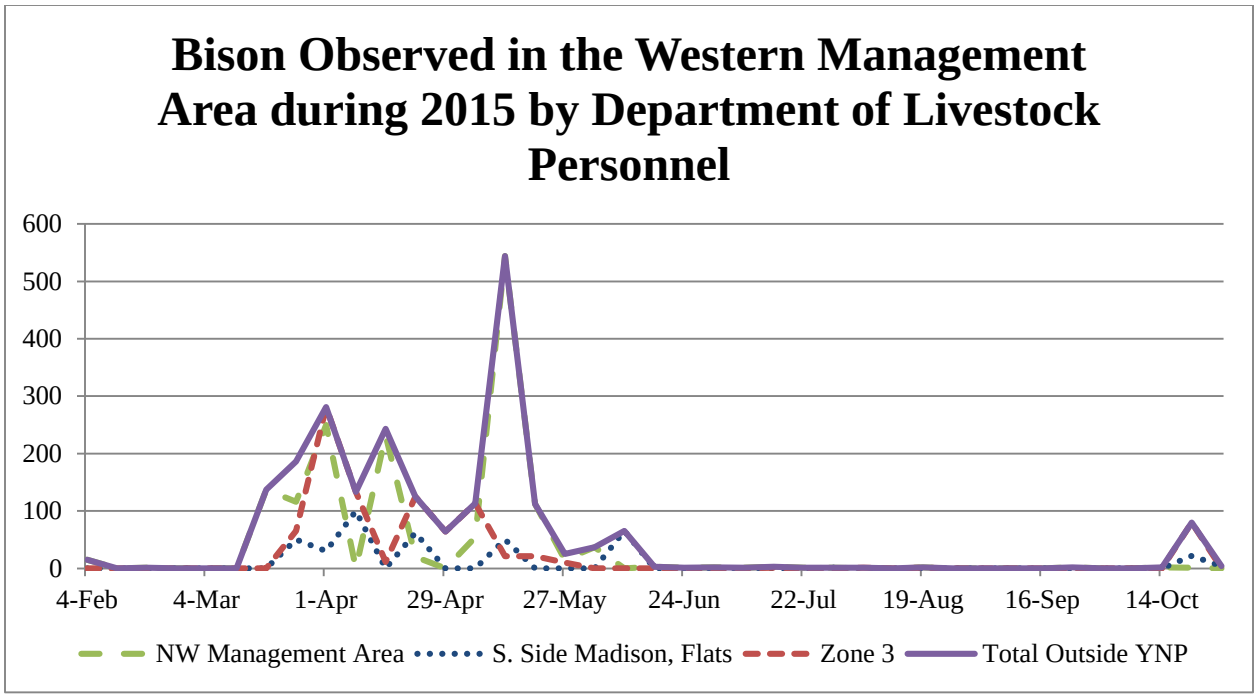
Date	Mammoth to Gardiner	North Entrance Station to Stephens Creek Facility	Stephens Creek Facility to Park Boundary	North of Park Boundary	Eagle Creek Area	**Total**
12/4/2014	24	0	0	0	4	**28**
12/11/2014	58	0	0	0	0	**58**
12/15/2013	0	0	0	0	0	**0**
12/31/2014	86	280	0	0	0	**366**
1/5/2015	61	125	0	11	0	**197**
1/9/2015	90	117	0	39	0	**246**
1/12/2015	56	196	78	113	7	**450**
1/14/2015	150	349	17	24	0	**540**
1/20/2015	86	265	105	0	21	**477**
1/23/2015	66	407	53	2	0	**528**
1/27/2015	97	351	25	0	11	**484**
1/28/2015	35	341	50	1	11	**438**
1/30/2015	58	343	20	0	10	**431**
2/2/2015	60	216	37	2	0	**315**
2/4/2015	119	208	25	77	0	**429**
2/9/2015	86	58	0	1	0	**145**
2/11/2015	54	20	0	1	3	**78**
2/18/2015	30	0	0	0	0	**30**
2/23/2015	4	64	1	0	0	**69**
3/3/2015	4	53	0	1	0	**58**
3/9/2015	23	3	0	1	0	**27**
3/20/2015	21	2	2	1	0	**26**
4/16/2015	101	0	2	1	0	**104**

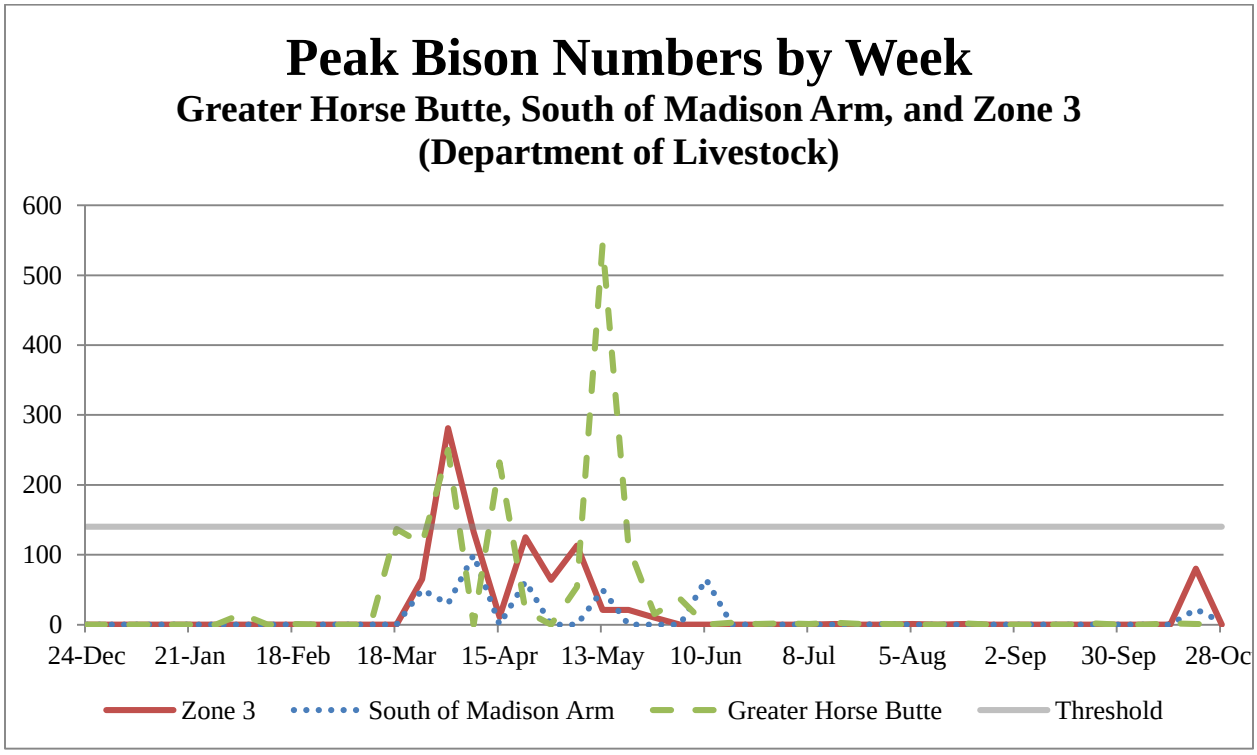


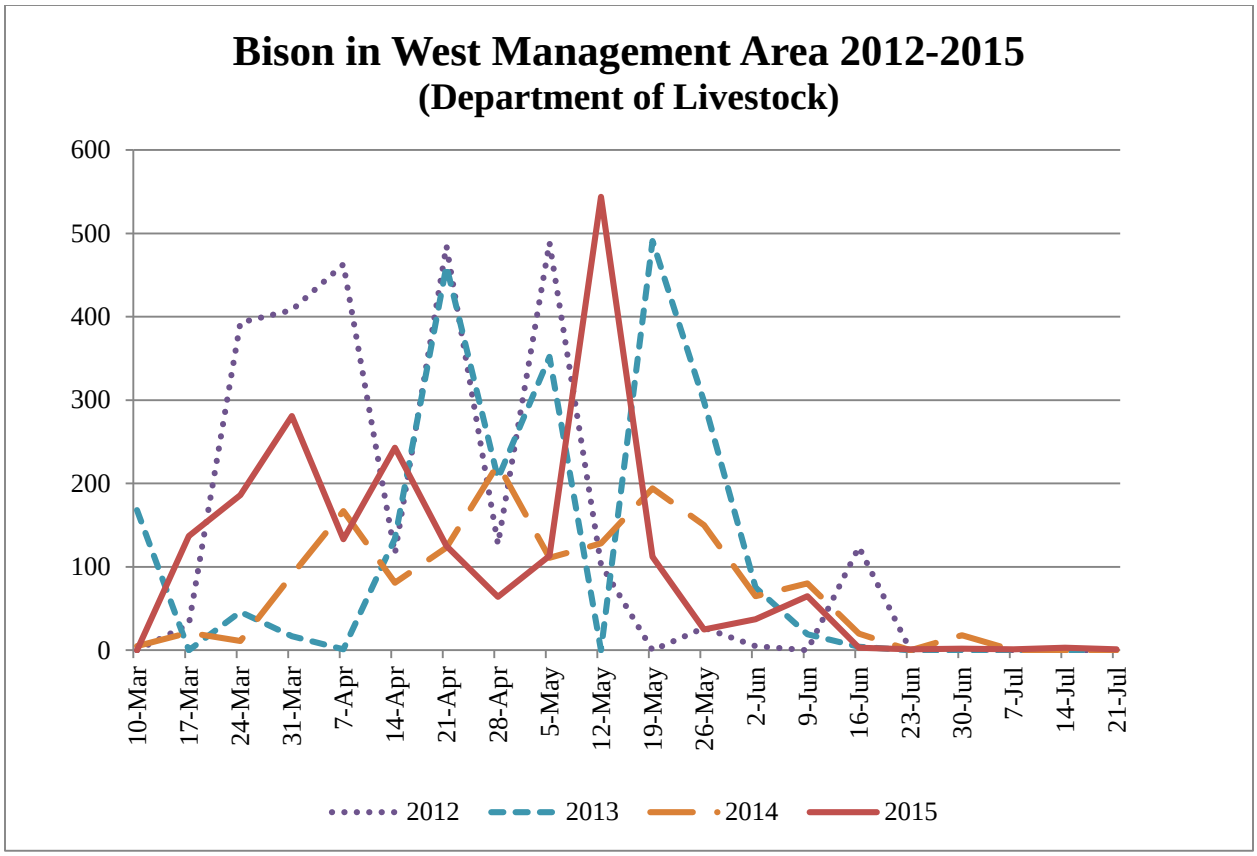
A combination of aerial monitoring and ground observations of bison distribution indicated that bison moved to the western boundary and outside the park for a brief period in November and then returned beginning in February. Abundance increased through early May and decreased thereafter (Table 2).

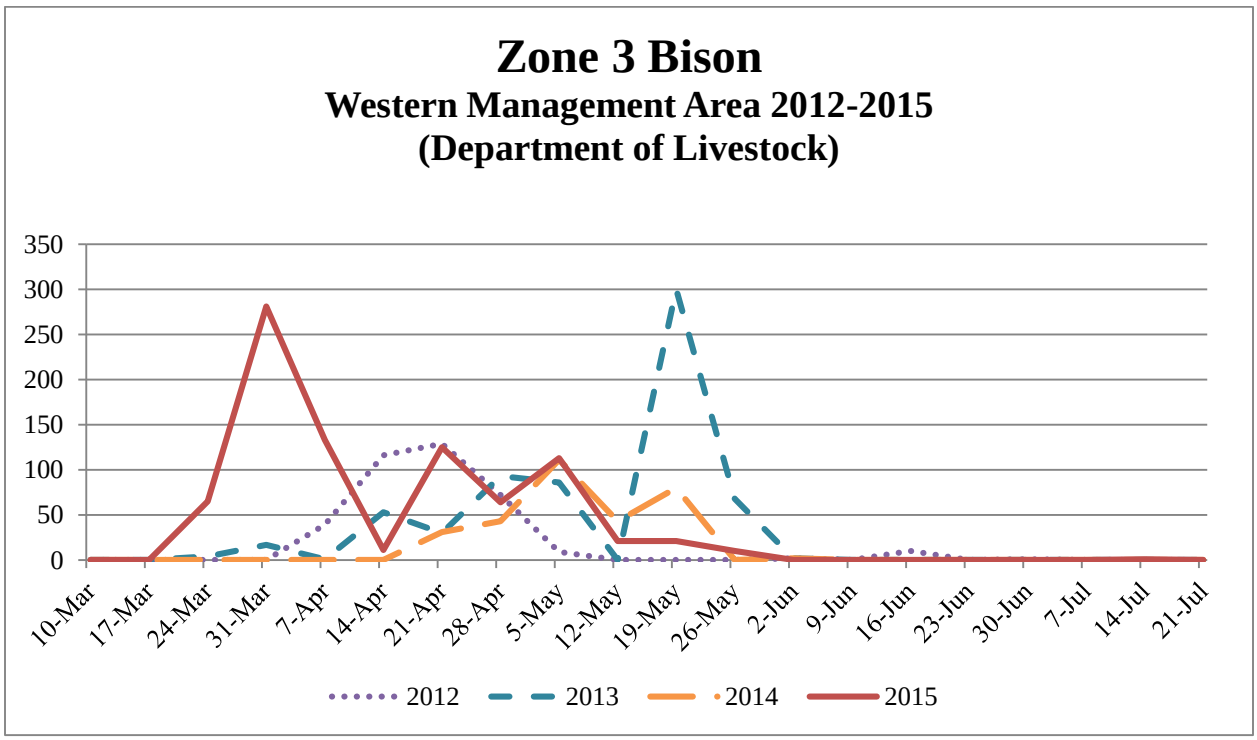
Table 2. Numbers of Yellowstone bison observed by National Park Service personnel in the western management area (Hebgen basin) for the Interagency Bison Management Plan during winter 2015.

Western Management Area	January 2	February 12	April 20	June 13
Outside Yellowstone National Park	0	45	235	72
NPS boundary to 7 Mile Bridge	9	0	355	3
West of Madison Junction to 7-mile bridge	26	139	81	2
Total	**35**	**184**	**671**	**77**


Bison Observed in the Western Management Area during 2015 by Department of Livestock Personnel
600
500
400
300
200
100
0
4-Feb
4-Mar
1-Apr
29-Apr
27-May
24-Jun
22-Jul
19-Aug
16-Sep
14-Oct
NW Management Area
S. Side Madison, Flats
Zone 3
Total Outside YNP


Peak Bison Numbers by Week
Greater Horse Butte, South of Madison Arm, and Zone 3
(Department of Livestock)
600
500
400
300
200
100
0
24-Dec
21-Jan
18-Feb
18-Mar
15-Apr
13-May
10-Jun
8-Jul
5-Aug
2-Sep
30-Sep
28-Oc
Zone 3
South of Madison Arm
Greater Horse Butte
Threshold


Bison in West Management Area 2012-2015
(Department of Livestock)
600
500
400
300
200
100
0
10-Mar
17-Mar
24-Mar
31-Mar
7-Apr
14-Apr
21-Apr
28-Apr
5-May
12-May
19-May
26-May
2-Jun
9-Jun
16-Jun
23-Jun
30-Jun
7-Jul
14-Jul
21-Jul
2012
2013
2014
2015


Zone 3 Bison
Western Management Area 2012-2015
(Department of Livestock)
350
300
250
200
150
100
50
0
10-Mar
17-Mar
24-Mar
31-Mar
7-Apr
14-Apr
21-Apr
28-Apr
5-May
12-May
19-May
26-May
2-Jun
9-Jun
16-Jun
23-Jun
30-Jun
7-Jul
14-Jul
21-Jul
2012
2013
2014
2015

We are not aware of any incidents of bison commingling with cattle in the northern or western management areas. The Montana Department of Livestock responded to three reports of bison adjacent to cattle in the western management area, each of which resulted in the lethal removal of a single bull bison.

Hunting

Each year, Montana Fish, Wildlife & Parks allocates permits for bison hunting from November 15 through February 15 in the northern and western management areas. Also, the Nez Perce, Salish-Kootenai, Shoshone-Bannock, and Confederated Umatilla tribes have rights, reserved through treaties with the federal government, to hunt bison on open and unclaimed lands in southwestern Montana. These parties coordinate each summer regarding bison removal objectives, permits, and harvests. Also, they enforce regulations and permit requirements for their respective hunters by sending game wardens to oversee hunts.

Approximately 223 bison were harvested by public and tribal hunters during winter 2015. Public hunters harvested 47 bison, including 29 in the Gardiner basin north of Yellowstone National Park (Hunting District 385) and 18 in the Hebgen basin west of the park (Hunting District 395). Tribal hunters harvested 176 bison in the Gardiner basin, including 142 by the Salish-Kootenai, 25 by the Nez Perce, 5 by the Shoshone-Bannock, and 4 by Confederated Umatilla tribes. The overall harvest removed 160 adult or yearling males, 35 adult or yearling females, 8 male calves, 13 female calves, and 7 bison of unreported age and sex.

Culling

Approximately 519 bison were captured at the Stephens Creek facility in the northern management area of Yellowstone National Park during January 14 through February 5, 2015. Specific capture dates were January 14-17, 23, and 30-31; and February 2-5. Many bison had either moved beyond the capture facility or were already outside the park on days when captures occurred (Table 3). Also, many of the bison north of Stephens Creek had already returned to the park after being engaged by hunters close to the boundary. Seventy bison were harvested in the northern management area by January 22 and 145 bison were harvested by February 5.

A total of 507 bison were shipped to processing facilities, including 347 by the Salish-Kootenai tribes, 138 by the InterTribal Buffalo Council, and 22 by the Eastern Shoshone tribe. Specific shipping dates were January 20-23, 26-28, and 30-31; and February 2-5, 11, and 18-20. All bison consigned to processing were shipped within two days after testing for brucellosis exposure. Seven bison were transferred to the Animal and Plant Health Inspection Service for fertility control research. Four bison died during confinement (starvation; unknown cause) or processing (broken leg; capture myopathy), and one bison was released from the facility.

Table 3. Numbers of bison observed north of the Stephens Creek capture facility or outside Yellowstone National Park in the northern management area of Montana during winter of 2014-2015 by personnel from the National Park Service. Capture operations occurred over three weeks between January 14 and February 5, 2015 (indicated by bold font).

Date	Stephens Creek to Park Boundary	North of Park Boundary	Eagle Creek Management Area	Total
December 4	0	0	4	4
December 11	0	0	0	0
December 15	0	0	0	0
December 31	0	0	0	0
January 5	0	11	0	11
January 9	78	39	0	117
January 12	17	113	7	137
January 14	**105**	**24**	**0**	**129**
January 20	**53**	**2**	**21**	**76**
January 23	**25**	**0**	**0**	**25**
January 27	**50**	**1**	**11**	**62**
January 28	**20**	**0**	**11**	**31**
January 30	**37**	**2**	**10**	**49**
February 2	**25**	**77**	**0**	**102**
February 4	**0**	**1**	**0**	**1**
February 9	0	1	0	1
February 11	0	0	3	3
February 18	1	0	0	1
March 3	0	1	0	1
March 9	0	1	0	1
March 20	2	1	0	3
April 16	2	1	0	3

Hazing

In the northern management area, one hazing operation occurred on January 23, 2015 to remove 70 mixed bison from a private hayfield.[4] There were four additional hazing operations to remove one to two bulls from private property in the Corwin Springs area. In the western management area, operations began on March 27, 2015 due to bison moving into Zone 3, with 31 separate operations occurring over the following 80 days. Also, a hazing event occurred on October 26, 2015 due to bison moving into Zone 3.

A spring haze-back operation to bring bison from the Gardiner basin back into the park was not necessary due to the mild winter weather and return of most bison on their own prior to May 1. The spring haze-back of bison from the Hebgen basin into Yellowstone National Park began on May 12. Bison groups were hazed into Baker's Hole from Montana on 12-14, 19, 21, 26, and 28 May. A cumulative total of about 402 bison were moved on those dates.

[4] Information regarding hazing events of bison in the Gardiner and Hebgen basins is provided in Appendix D. The number of bison counted by Montana Department of Livestock personnel outside Yellowstone National Park when hazing events occurred is provided in Appendix E.

Once bison were herded into Baker's Hole near the park boundary, the bison seemed to move relatively easily with minimal hazing pressure (none in some cases). Given a high count of nearly 750 bison observed at the park boundary or beyond in early May, only about 400 bison were hazed back into the park, with little evidence of bison being hazed multiple times to get them to move on eastward toward the interior park ranges.

On June 3, about 50 to 70 bison moved back into the park without being hazed and few bison remained outside the park after that time. This group was observed moving in and out of the park along the Madison River between the Hebgen Lake Delta and the Baker's Hole area for about two weeks. It was last reported in the boundary area on June 13.

Brucellosis Testing and Vaccination

Serum from 481 bison captured at the Stephens Creek facility was tested for brucellosis exposure (i.e., antibodies) using the fluorescent polarization assay and the card test. Positive test results were obtained for 22 of 33 (67%) adult males, 23 of 80 (29%) yearling males, 4 of 58 (7%) male calves, 112 of 192 (58%) adult females, 25 of 67 (37%) yearling females, and 2 of 51 (4%) female calves. No bison were vaccinated for brucellosis using strain RB51 vaccine during winter 2015.

Per Administrative Rule of Montana 32.3.436, all sexually female intact cattle and domestic bison within the entirety of the counties in which the Designated Surveillance Area is located are required to be official brucellosis vaccinates.

Livestock locations in the Gardiner and Hebgen basins

Ownership and Turn-out Dates for the Northern Management Area

Owner	Zone	No. Cattle	Maximum	Class	On-date	Off-date
JT	2	23		Pairs	Year-round	Not applicable
Grizzly Creek	3	100	250	Pairs	May 21	December 31
Yellowstone Cattle Co	3	100	600	Pairs	May 21	October 14
B-Bar	3	150	600	Yearlings	June 15	November 15
Anderson Ranch	3	100	160	Pairs	January 1	December 31
West Creek Ranch	3	100	100	Pairs	June 1	November 1
Bridger Cunningham	3	74/6	80	Pairs/Bulls	July 5	October 6

Ownership and Turn-out Dates for the Western Management Area

Property Owner	Livestock Owner	Zone	Date in	No. Cattle	Class	Date out
SR—Red Creek Ranch	BM—Reed Point, MT	2	Jun 20	200/4	Pairs/Bulls	October 17
PP—Deep Well Ranch	LM—Twin Bridges, MT	3	Jun 15	320/10	Pairs/Bulls	November 3
LD—Quarter Circle JK	CC/BF—Cameron, MT	3	Jul 1	22/1	Pairs/Bulls	
USFS—South Fork Allotment	CC/BF—Cameron, MT	3	Jul 1	11/1	Pairs/Bulls	
USFS—Watkins Cr. Allotment	CC/BF—Cameron, MT	3	Jul 1	55/4	Pairs/Bulls	

On October 23, 2014, a three year-old cow was tested as part of 349 animals moving from the Park County Designated Surveillance Area to Carbon County. The cow was classified as a reactor on a serological test and later cultured *Brucella* positive. The reactor cow tested negative in 2013 prior to returning to Carbon County from the Park County Designated Surveillance Area. This cow was not pregnant; therefore, posed very little risk to herds adjacent in Carbon County. Four adjacent herds (approximately 500 head) were identified in Park County and required to test for brucellosis. An additional four adjacent herds (approximately 500 head) were required to test in Carbon County. The reactor herd completed their entire herd test in late November of 2014 with no additional suspects or reactors.

Post-winter Status and Trends

Culls and harvests during the winter of 2015 (November 2014 through May 2015) totaled 737 bison, including 18 harvested from the western management area, 201 harvested from the northern management area, 507 consigned to meat processing facilities, 7 consigned to research facilities, and 4 that died within the containment facilities at Stephens Creek in Yellowstone National Park. Removals included 276 males, 297 females, 161 calves, and 3 animals of unknown age and sex. The total sum of removals was below the recommended guideline of 900 animals. Importantly, only 223 adult (at least two years old) females were removed, which was significantly below the recommended guideline of 410 adult females.

The net result was a slightly larger bison population after calving in the spring of 2015. About 4,910 bison were counted during June and July, including 3,626 in northern Yellowstone and 1,284 in central Yellowstone. The composition of the population was about 17% calves, 5% yearling females, 6% yearling males, 39% adult females, and 20% adult males. Juveniles (calves and yearlings) comprised about 28% of the population (25-32%), while the sex ratio was 46% males (41-51%) and 54% females (49-59%). The population size remained well above the IBMP objective of 3,000 bison, but age and sex composition was near the objectives of 70% adults and 30% juveniles, with neither sex exceeding 60% of the population.

Human Safety and Property Damage

There were five people injured by bison in Yellowstone National Park during summer 2015 due to people approaching too close, primarily for photographs. Thirteen bison were killed in the park by vehicle strikes during November 1, 2014 through October 31, 2015.

The National Park Service recommended the speed limit on Highway 89 in the northern management area be reduced to 55 miles per hour when the bison guard is in place during winter to reduce vehicle collisions with bison and other wildlife. The state agencies or Park County Commissioners should coordinate this speed reduction with the Montana Department of Transportation.

Habitat Assessments and Enhancement

The Custer Gallatin National Forest and Montana State University initiated a habitat assessment project to develop a well-defined plant and soil community description for historical habitat conditions in the Gardiner basin. Such a description would facilitate tracking changes in ecological conditions over time. During 2014-2015, scientists worked to identify existing data sets that might serve as baseline for historic habitat conditions and collect new field data to help reconstruct reference conditions. Field sampling was stratified at representative sites throughout the Gardiner basin and included soil layers and characteristics, vegetation layers and canopy cover, shrub canopy cover and density, and site occupancy by ungulates. The eventual goal is to be able to detect a 20% change in soil or vegetation parameters at a site with 80% accuracy.

Biologists from the National Park Service and Syracuse University continued a collaboration to quantify forage production and consumption at several study sites on grasslands in Yellowstone National Park. Consumption of above-ground biomass in and near the Lamar Valley exceeded 70% in 2012 and 2013, yet gross annual production was higher compared to areas where grazing was excluded. Bison repeatedly grazed the same areas and above-ground biomass at the end of summer was approximately 10% of that available in areas where grazing was excluded. While high rates of consumption may result in the appearance of reduced biomass production in some areas, grazing stimulates large amounts of soil nitrogen for plants leading to higher nitrogen availability in the food available for bison. Bison are selecting areas with high quality food value (grasses with higher nitrogen content) and both re-grazing of sites and deposition of urine and fecal material are enhancing grass quality. The area that is being grazed at very high consumption rates is quite small compared to total available grassland habitat within the park. Bison appear to be engineering their own habitat and enhancing the nutritional value by repeated grazing of sites throughout the growing season. However, shifting patterns of use are likely to be an ongoing process with Yellowstone bison.

Research and Surveillance

Scientists from Colorado State University and the Animal and Plant Health Inspection Service evaluated the genetic diversity of Yellowstone bison using a sample from the quarantine feasibility study and found no evidence of cattle DNA introgression using nuclear markers and

mitochondrial DNA analyses (*Herman et al. 2014, Genetic analysis of a Bison bison herd derived from the Yellowstone National Park population, Wildlife Biology 20:335-343*). Genetic diversity levels were high and most of the adults were breeding and contributing offspring. As a result, the bison from the quarantine feasibility study will provide a strong foundation for restoring populations and preserving plains bison.

Scientists from the Department of Agriculture evaluated the immune responses of captive bison after vaccination and booster vaccination with strain RB51 via syringe (*Olsen et al. 2015, Efficacy and immune responses of bison after booster vaccination with Brucella abortus strain RB51, Clinical and Vaccine Immunology* 22:440-447**).** As expected, antibody responses of bison were greater after initial vaccination and booster vaccination as compared to non-vaccinates. Vaccinated bison challenged with *Brucella abortus* strain 2308 had fewer abortions and less infection than non-vaccinated bison. Booster vaccinates had less infection in fetal and maternal tissues than non-vaccinates. Thus, booster vaccination could enhance herd immunity in bison against brucellosis. However, these results also highlighted the need for a better vaccine for wild bison since about 70% of the females remained infected after giving birth and 40% of their offspring were infected. In addition, about 20% of booster-vaccinated females had mammary and uterine infections, which have potential for vertical and horizontal transmission.

Biologists from the National Park Service and Colorado State University integrated short-term research on processes with long-term monitoring data to construct a Bayesian state-space model that evaluated the effects of brucellosis and alternate management strategies on the population dynamics of Yellowstone bison (*Hobbs et al. 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*). Brucellosis transmission was more dependent on the portion of the population that was infectious (frequency dependent) than the number of infectious individuals in the population (density dependent). About 60% of adult females tested positive for previous exposure to brucellosis, but only 8-12% were infectious. Estimates of population growth rate (λ) for the infected population averaged 1.07 compared to 1.11 for the population without the disease. The annual removal of 200 bison previously exposed to brucellosis increased the probability of reducing transmission below 50% by 110 times relative to taking no action. Likewise, vaccinating 200 unexposed bison each year increased the probability of achieving a 50% reduction in brucellosis transmission by 30 times compared to no action. However, high levels of uncertainty in implementing these management actions due to random variations in the number of bison accessible for capture or vaccination from year-to-year substantially reduced the probability of achieving goals compared to no action. Managers should use an adaptive approach to implement management actions over relatively short time frames (3-5 years) and frequently reevaluate the effects and effectiveness of these actions in response to new data and model forecasts.

Biologists from the National Park Service collaborated with geneticist Dr. James Derr at Texas A&M University to estimate the overall diversity of mitochondrial DNA haplotypes in DNA samples from 25 bison randomly sampled in central and northern Yellowstone. Ten different mitochondrial DNA haplotypes were identified and haplotype diversity was 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, Mitochondrial haplotype diversity in Yellowstone National Park bison, Texas A & M University, Poster at the 22nd Annual Conference of The Wildlife Society in Winnipeg, Manitoba, Canada*).

A comprehensive report on surveillance regarding bison and brucellosis can be viewed at <http://ibmp.info/Library/OpsPlans/Surveillance_YellowstoneBison_NPS_Apr2015.pdf>.

Landowner Engagement

Nothing reported by the IBMP members.

Education and Outreach

Three education brochures were created by the Citizens Group on Bison Education with support from the IBMP agencies. The topics of these brochures are: 1) *Bison Basics: Biology, Behavior, and a Brief History*; 2) *Staying Safe in Bison Country*; and 3) *Bison and Tribal Peoples*. The brochures can be downloaded at <http://ibmp.info/bisoneducation.php> or obtained at the Montana Fish, Wildlife & Parks' office on 1400 South 19th Street in Bozeman.

Biologists from Yellowstone National Park published a book entitled *Yellowstone Bison—Conserving an American Icon in Modern Society* with chapters about the status and ecology of bison, as well as their management history and current challenges. The book can be downloaded at the <http://www.nps.gov/features/yell/bison/Yellowstone_Bison_Final_ForWeb.pdf> website.

Stakeholder and Public Engagement

Representatives of the Custer Gallatin National Forest and the Nez Perce tribe co-hosted a half-day field trip in the Gardner Basin on November 19, 2014 for IBMP agency staff and the public. The focus of the field trip was to consider and discuss bison management opportunities within the IBMP framework in the Gardiner Basin. Topics included area history; past, present and potential future forage; bison migration patterns; and current issues and possible solutions (e.g., concentrated hunting in Beattie Gulch).

A public meeting of the IBMP partners was held on November 20, 2014 in Pray, Montana at Chico Hot Springs. The main topics of discussion were the status of state of Montana programs; the National Academy of Sciences review of brucellosis in the Yellowstone area; preparation for operations during the 2015 winter; bison and the Nez Perce tribe; bison and the American Prairie Reserve; status of brucellosis-free bison from quarantine; the North Hebgen habitat restoration project; and a project to assess rangeland health in the Gardiner basin. Meeting notes are available at <http://ibmp.info/meetings.php>.

On February 18, 2015, the National Park Service held a media tour with about two dozen reporters of the Stephens Creek bison capture facility in the northern management area.

Representatives from Montana Fish, Wildlife & Parks and Yellowstone National Park met with the Gallatin and Park County Commissioners on April 6, 2015 to discuss bison planning efforts, bison habitat use, and concerns related to brucellosis, human safety, and property damage. The parties agreed to meet several times each year to facilitate communication and information exchange.

The Hebgen Lake Ranger District, Custer Gallatin National Forest, hosted a public meeting on April 21 in West Yellowstone, Montana to discuss the North Hebgen Landscape Project. The proposal included various treatments to address forest health issues on about 980 acres, benefit wildlife habitat on about 2,020 acres, and reduce fuels and fire risk on about 3,000 acres near West Yellowstone. Documents related to the North Hebgen project are available online at <www.fs.usda.gov/custergallatin> or at the Hebgen Lake Ranger District.

A public meeting of the IBMP partners was held on April 23, 2015 in West Yellowstone, Montana. The main topics of discussion were a review of winter 2015 operations; update on the North Hebgen Landscape Project; genetic findings regarding Yellowstone bison and brucellosis transmission dynamics in the Yellowstone area; bison grazing and habitat assessments; and an update on the National Academy of Sciences review of brucellosis in the Yellowstone area. Meeting notes are available at <http://ibmp.info/meetings.php>.

A state of Montana and tribal treaty bison hunt meeting was held in Missoula, Montana on May 27, 2015 to affirm hunt goals, discuss issues and perspectives, discuss population management goals, and plan for future harvests. Representatives from the Forest Service and National Park Service also attended the meeting. Issues that were discussed included male-biased harvests, a firing line effect at Beattie Gulch, gut piles and activities near roads, human safety, the perception of unethical hunting practices, and the effects of bison captures at Stephens Creek on hunting opportunities outside the park. Recommendations suggested to alleviate these issues included issue female-calf only permits to some hunters/hunting parties, hunt Thursday-Sunday with no hunting during Monday-Wednesday, a hunt closure area adjacent to roads, having hunters empty rumens and move guts out of sight, a hunt closure area near houses, and no hazing of bison toward the road to shoot. Representatives of the IBMP agencies and treaty tribes agreed to initiate weekly coordination phone calls during future hunts.

A public meeting of the IBMP partners was held on August 6, 2015 in Lapwai, Idaho. The main topics of discussion were Nez Perce oral traditions and relationships with bison; considering new paradigms for Yellowstone bison and habitat management; methods for forecasting the timing and extent of bison migration; bison removal recommendations for winter 2015-2016; bison hunt meeting summary; and an update on hunt issues related to the Beattie Gulch area. Meeting notes are available at <http://ibmp.info/meetings.php>.

Representatives from Montana Fish, Wildlife & Parks and Yellowstone National Park met with the Gallatin and Park County Commissioners on October 7, 2015 to discuss bison planning efforts for the forthcoming winter.

Adaptive Management Adjustments

The IBMP agencies approved an administrative change to reformat the annual report to improve readability and lessen redundancy. Information on previous adaptive management adjustments can be obtained at http://ibmp.info/adaptivemgmt.php.

Environmental Compliance, Legislation, and Litigation

In autumn 2014, the Animal and Plant Health Inspection Service provided the National Academy of Sciences with funding for an 18-month evaluation to update a 1998 report on brucellosis in the Greater Yellowstone Area. During 2015, a committee appointed by the National Research Council began reviewing and evaluating the available scientific literature and other information on the prevalence and spread of *Brucella abortus* in the Greater Yellowstone Area in wild and domestic animals. The committee will also assess the feasibility, time-frame, and cost effectiveness of options to contain or suppress brucellosis across the region. Updated information on this review entitled *Revisiting Brucellosis in the Greater Yellowstone Area* can be obtained at the <http://dels.nas.edu/Study-In-Progress/Revisiting-Brucellosis-Greater-Yellowstone/DELS-BANR-14-03?bname=banr> website.

In September 2014, the Friends of Animals and the Buffalo Field Campaign filed an *Emergency Rulemaking Petition to Protect the Genetic Diversity and Viability of the Bison of Yellowstone National Park and Gallatin National Forest* with the federal District Court in the District of Columbia. The Forest Service and the National Park Service each responded to the petition and the District Court dismissed the case with stipulations in March 2015.

In July 2011, the Alliance for the Wild Rockies sued several IBMP agencies for failing to address environmental impacts and alleged harm to the threatened grizzly bear resulting from low-altitude helicopter hazing operations of bison during spring and summer. The Alliance argued grizzly bears were harassed by the helicopter hazing bison, displaced from feeding activities, and as a result, these activities violated the Endangered Species Act and the National Environmental Policy Act. The district court ruled in favor of the IBMP agencies during March 2013 (Alliance for the Wild Rockies v. U.S. Dept. of Agric., 938 F.Supp.2d 1034, 1040–41 [D. Mont. 2013]). The court found that the Alliance lacked standing to bring its claims against the federal defendants because they do not conduct, authorize, or currently fund helicopter hazing, and thus, do not cause its alleged harm. The court also held that the Alliance's Endangered Species Act claim was moot because the National Park Service had already completed a biological assessment finding grizzly bears were not adversely affected and the Fish and Wildlife Service concurred with the analysis and determination. The court further found that the record did not demonstrate the "take" of grizzly bears pursuant to the Act because there was no evidence showing the flights caused significant disruption of their behavioral patterns. The district court found there was no new information that warranted supplementation of the IBMP's original environmental impact statement and that the Forest Service did not violate the Gallatin National Forest Plan or the National Forest Management Act. The Alliance appealed this decision to the 9th circuit court, which in November 2014, affirmed the district court's grant of summary judgment to the defendants (Alliance for the Wild Rockies v. Dep't of Agric., 772 F.3d 592 [9th Cir. 2014]).

In February 2015, the American Civil Liberties Union of Wyoming and the Buffalo Field Campaign filed a complaint requesting immediate, continuing, and future access to the Stephens Creek capture facility. The National Park Service responded to the complaint and held a media tour of facility on February 18, 2015.

In November 2014, the Western Watersheds Project and the Buffalo Field Campaign submitted a petition to the Fish and Wildlife Service requested that the Fish and Wildlife Service designate the Yellowstone bison a distinct population segment of plains bison and protect them as an endangered species. Another petition with a similar request was submitted to the Fish and Wildlife Service by a private individual during March 2015. Both petitions are currently under review. In June 2015, the National Park Service submitted comments on these petitions to the Fish and Wildlife Service which recommend Yellowstone bison meet the criteria for a distinct population segment, but that their conservation status is not threatened or endangered. The more pertinent question is whether additional wild, wide-ranging populations subject to the forces of natural selection need to be augmented or established elsewhere to preserve the species.

In March 2015, the NPS and the state of Montana announced the initiation of an Environmental Impact Statement for a new plan to manage the wild and migratory population of Yellowstone-area bison, while minimizing the risk of brucellosis transmission between bison and livestock to the extent practicable. The new plan is needed because conditions have changed since implementation of the IBMP began in 2001, including agency experience in managing bison and new science. Cooperating agencies include the Forest Service, InterTribal Buffalo Council, Nez Perce tribe, Salish-Kootenai tribes, Shoshone-Bannock tribes, and the Umatilla tribes. A range of six preliminary draft alternative concepts was developed and disseminated for a 90-day public comment period that ended on June 15. The alternative concepts differed in terms of bison abundance, bison tolerance outside of the park, and the tools that would be used to manage the bison population within the park and on lands adjacent to the park. The agencies expect to have a draft Environmental Impact Statement available for public review during 2016.

During summer 2015, staff at Yellowstone National Park developed an Environmental Assessment to evaluate establishing a quarantine program for bison at one or more facilities within the park, on tribal lands, or elsewhere. The need for quarantine is to identify brucellosis-free bison from the chronically infected Yellowstone population for relocation to augment or establish populations of plains bison elsewhere for conservation, cultural, and/or commercial purposes. These bison, which are removed from the population to limit population growth pursuant to the IBMP, would otherwise be sent to meat processing or research facilities.

APPENDIX A

MANAGEMENT OBJECTIVES AND ACTIONS (2014 ADAPTIVE MANAGEMENT PLAN)

Objective 1.1: Within timing and geographical considerations, allow bison within Zone 2 of the Hebgen and Gardiner basins to manage the risk of brucellosis transmission from bison to livestock and enhance wild bison conservation and hunting.

- Management action 1.1.a—Consistent with the management responses outlined below, allow untested female bison (or mixed groups of males and females) to migrate onto and occupy the Horse Butte peninsula (between the Madison Arm of Hebgen Lake and Grayling Creek) and the Flats (the area east of South Fork Madison River, south of the Madison Arm, and west of Highway 191) each winter and spring in Zone 2.
    - See *Migration and Distribution* section of report
- Management action 1.1.b—Consistent with the management responses outlined below, allow bison on habitat on U.S. Forest Service and other lands north of the park boundary and south of Yankee Jim Canyon (see attached map at the end of this Adaptive Management Plan). Bison would not be allowed north of the hydrological divide (i.e., mountain ridge-tops) between Dome Mountain/Paradise Valley and the Gardiner basin on the east side of the Yellowstone River and Tom Miner basin and the Gardiner basin on the west side of the Yellowstone River.
    - See *Migration and Distribution* section of report
- Management Action 1.1.c—Use research findings to inform adaptive management.
    - See *Research and Surveillance* section of report

Objective 1.2: Manage bull bison to reflect their lower risk of transmission of brucellosis to cattle.

- Management Action 1.2.a—Allow bachelor groups of bull bison to occupy suitable habitat areas outside the west boundary of YNP in the portion of Zone 2 south of Duck Creek each year within the parameters of conflict management.
    - See *Migration and Distribution* section of report
- Management Action 1.2.b—Allow bachelor groups of bull bison to occupy suitable habitat areas in Zone 2 outside the north boundary of YNP within the following parameters of conflict management.
    - See *Migration and Distribution* section of report

Objective 1.3: Reduce conflict between landowners, livestock operators, and bison outside YNP via permit management, improved relations, education, and incentives.

- Management Action 1.3.a—Work with private land owners and livestock producers and operators to provide conflict-free habitat in the Hebgen and Gardiner basins.
    - See *Human Safety and Property Damage* and *Landowner Engagement* sections of report
- Management Action 1.3.b—Work with landowners who have human safety and property damage concerns, as well as those who favor increased tolerance for bison, to provide conflict-free habitat in the Hebgen and Gardiner basins.
    - See *Human Safety and Property Damage* and *Landowner Engagement* sections of report
- Management Action 1.3.c—Annually, the Gallatin National Forest will ensure conflict-free habitat is available for bison and livestock grazing on public lands, as per management objectives of the Interagency Bison Management Plan (IBMP).
    - See *Migration and Distribution* and *Habitat Assessment and Enhancement* sections of report
- Management Action 1.3.d—Consider a voluntary compensation program to allow for adjusting the dates livestock are released on private land beyond May 15.
    - See *Landowner Engagement* section of report

Objective 1.4: Recognize tribal treaty rights for hunting bison.

- Management Action 1.4a—Allow bison to occupy National Forest System lands and other areas determined suitable within the designated tolerance area (Zone 2), and maximize timing and geographical extents to increase tribal hunt opportunities.
    - See *Migration and Distribution* and *Hunting* sections of report

- Management Action 1.4b—Coordinate management activities that could potentially impact opportunities for tribal members to exercise their treaty rights.
    - See *Migration and Distribution*, *Hunting*, and *Hazing* sections of report

Objective 2.1: Manage the Yellowstone bison population to ensure the ecological function and role of bison in the Yellowstone area and to maintain genetic diversity for future adaptation.

- Management action 2.1.a—Increase the understanding of bison population dynamics to inform adaptive management and reduce sharp increases and decreases in bison abundance.
    - See *Pre-winter Status and Trends*, *Post-winter Status and Trends*, and *Research and Surveillance* sections of report
- Management action 2.1.b—Increase the understanding of genetics of Yellowstone bison to inform adaptive management.
    - See *Research and Surveillance* section of report
- Management action 2.1.c—Increase understanding of the ecological role of bison to inform adaptive management by commissioning a comprehensive review and assessment.
    - See *Research and Surveillance* section of report

Objective 2.2: Minimize bison slaughter by employing alternative management techniques.

- Management action 2.2.a—Use slaughter only when necessary (e.g., disease suppression by selectively removing likely infectious bison); attempt to use other risk management tools first.
    - See *Operations Plan* section of report
- Management action 2.2.b—In Zone 2 lands adjacent to YNP, emphasize management of bison as wildlife and increase the use of state and treaty hunts to manage bison numbers and demographic rates, limit the risk of brucellosis transmission to cattle, and protect human safety and property.
    - See *Hunting* section of report
- Management action 2.2c—Complete the quarantine feasibility study and consider an operational quarantine facility to provide a source of live, disease-free bison for tribal governments and other requesting organizations.
    - See *Research and Surveillance* section of report

Objective 3.1: Reduce the risk of disease transmission through vaccination.

- Management Action 3.1.a—Continue bison vaccination under prevailing authority.
    - See *Brucellosis Testing and Vaccination* section of report
- Management Action 3.1.b—Complete EIS processes (MEPA/NEPA) for remote delivery vaccination of bison and use the outcomes to inform adaptive management.
    - This action has been completed (Federal Register 79:35567-35568).
- Management Action 3.1.c—Test and vaccinate cattle.
    - See *Brucellosis Testing and Vaccination* section of report

Objective 3.2: Prevent cattle/bison interactions, with an emphasis on the likely bison birthing and abortion period each year.

- Management action 3.2.a—Use spatial and temporal separation and hazing to prevent cattle/bison interactions.
    - See *Migration and Distribution* and *Hazing* sections of report
- Management action 3.2.b—Evaluate the use of limited, strategically placed fencing when and where it could effectively create separation between domestic livestock and bison, and not create a major movement barrier to other wildlife.
    - See *Landowner Engagement* section of report
- Management Action 3.2.c—Haze bison from the Hebgen basin into YNP with a target date of May 15.
    - See and *Hazing* section of report
- Management Action 3.2.d—Haze bison from the Gardiner basin into YNP with a target date of May 1.
    - See and *Hazing* section of report
- Management Action 3.2.e—Haze bison away from tolerance boundaries when conditions are conducive to breach. The goal is to reduce the opportunity for bison to breach the tolerance zone boundaries by

employing management actions at the most efficient trigger points in consideration of overall conditions and risks.

- See and *Hazing* section of report

APPENDIX B

CITIZENS WORKING GROUP RECOMMENDATIONS (2011)

Risk Reduction

- Reduce risk of transmission of brucellosis from wildlife to livestock by improving implementation of currently known livestock vaccine protocols, and through further research and refinement of livestock vaccination.
    - See *Brucellosis Testing and Vaccination* and *Research and Surveillance* sections of report
- Work with livestock industry to work toward adoption of mandatory statewide Official Calfhood Vaccination (OCV).
    - See *Brucellosis Testing and Vaccination* and *Research and Surveillance* sections of report
- Lobby to modify Select Agent List (Homeland Security) to enable improved livestock or other vaccine research on *Brucella abortus.*
    - See *Brucellosis Testing and Vaccination* section of report
- Strongly encourage continued funding and research to develop a practical test on live animals to distinguish between infected and resistant animals.
    - See *Research and Surveillance* section of report
- Provide a clearinghouse and other opportunities to gather and report on research related to *Brucella abortus* and management tools from various research institutions to present to the public annually.
    - See *Research and Surveillance* section of report
- Reduce livestock/wildlife interactions at key seasons.
    - See *Hazing*, *Habitat Assessments and Enhancement*, and *Landowner Engagement* sections of report
- Reduce artificial concentrations of animals (elk or bison) that may be exacerbating transmission.
    - See *Hazing*, *Habitat Assessments and Enhancement*, and *Landowner Engagement* sections of report
- Remote vaccination of wild bison using the current vaccine and delivery method as a means of reducing a risk of transmission should not be a priority at this time.
    - This recommendation was implemented (Federal Register 79:35567-35568).
- Education – to be addressed by the education group.
    - See *Education and Outreach* section of report
- Advocate for completion of a Statewide Bison Management Plan.
    - See *Environmental Compliance, Legislation, and Litigation* section of report

Population Management

- Modify the Interagency Bison Management Plan Zones 1, 2, and 3 with an eye to finding better habitat solutions particularly in light of changes that have occurred since zones were designated in 2000. Identify habitat that can alleviate population pressure, including available public and private lands, and potential habitat acquisition as well as potential funding sources.
    - See *Habitat Assessments and Enhancement*, *Landowner Engagement*, and *Adaptive Management Adjustments* sections of report
- Strive to manage bison as wildlife, and complete, implement, and support a Montana Fish, Wildlife and Parks management plan that includes setting bison population objectives and hunting strategies as a priority population management tool.
    - See *Objectives*, *Operations Plan*, and *Environmental Compliance, Legislation, and Litigation* sections of report
- Make hunting a bigger component of bison management and consider different seasons or other opportunities to increase the impact of hunting.
    - See *Operations Plan* and *Hunting* sections of report
- Montana Fish, Wildlife and Parks and the tribes hunting Yellowstone bison should work more closely together to set collective hunt targets and to document the hunting success numbers.
    - See *Operations Plan* and *Hunting* sections of report

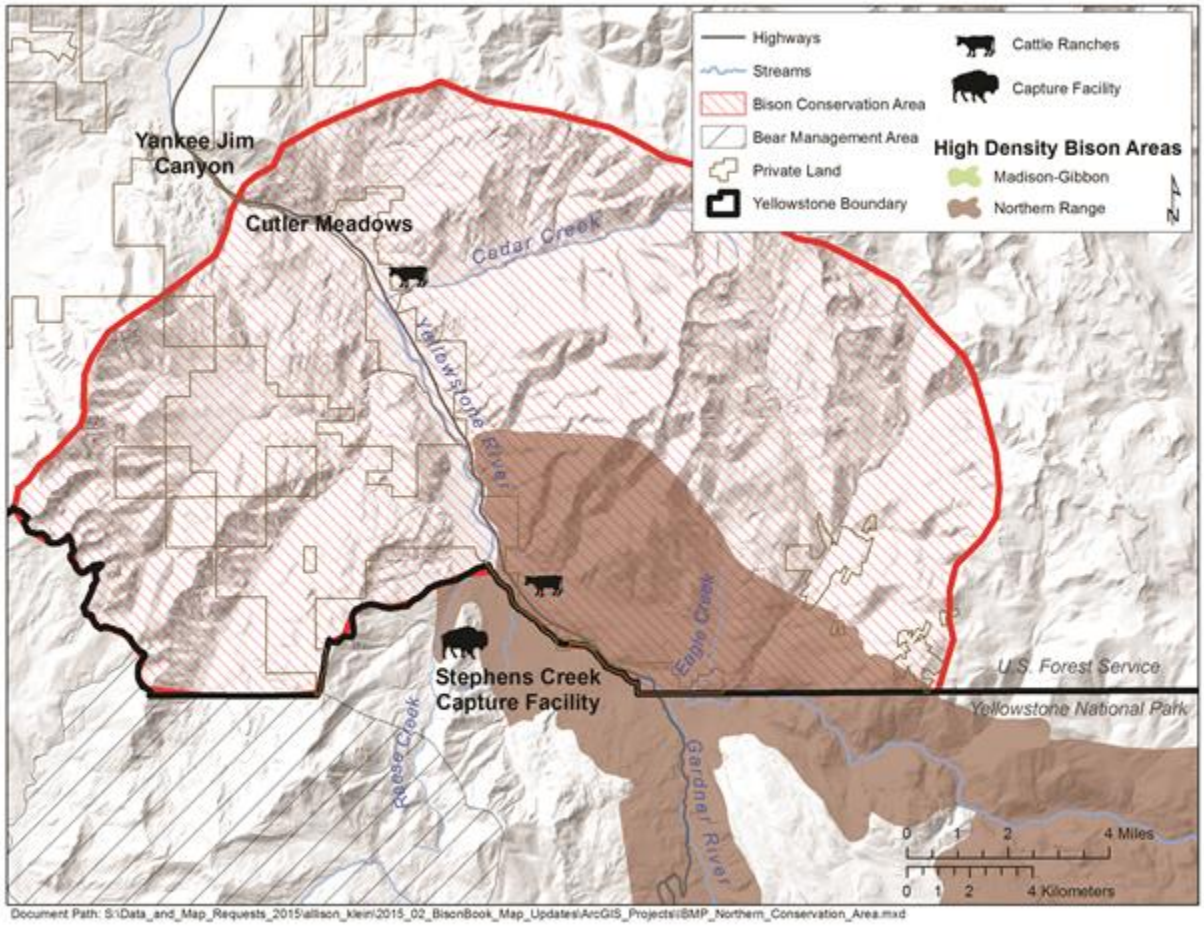
- Agree on and establish a target population range that is biologically and ecologically acceptable and accounts for a variety of public interests. As Interagency Bison Management Partners, agree on criteria for evaluating and determining a population range and appropriate management tools, such as: a) winter range outside the park; b) risk factors; c) individual agency management mandates, constraints and responsibilities; d) genetic diversity, population structure and demographics, reproduction, and distribution; e) realistic opportunity for addressing private land owners' concerns; and f) hunting and wildlife viewing opportunities.
    - See *Objectives*, *Operations Plan*, *Adaptive Management Adjustments*, and *Environmental Compliance, Legislation, and Litigation* sections of report
- When bison have to be removed because of high migration numbers, management constraints, safety, etc., the priorities should be: a) hunting outside the park; b) moving them to nearby appropriate available lands; c) translocation from the Yellowstone area; and d) lethal removal by managing agencies.
    - See *Operations Plan*, *Adaptive Management Adjustments*, and *Environmental Compliance, Legislation, and Litigation* sections of report
- Quarantine should be economically justified in comparison with other means of producing *Brucella*-free Yellowstone bison for conservation purposes.
    - See *Environmental Compliance, Legislation, and Litigation* section of report
- In order to locate bison to lands elsewhere, Montana should develop and implement a translocation process for bison leaving quarantine. The quarantine process should minimize infrastructure requirements for places receiving bison.
    - See *Environmental Compliance, Legislation, and Litigation* section of report
- Determining where bison completing quarantine will go and *how* they will be restored and conserved on the landscape, with the highest priority on managing them as public and tribal wildlife, must precede capturing bison and implementing quarantine. Recipients of quarantined bison must be identified and an acceptable, appropriate translocation process must be in place prior to quarantining Yellowstone bison. This determination of where bison will go should be integrated with all Fish, Wildlife and Parks or other assessments of relocation possibilities for wild bison in Montana.
    - See *Environmental Compliance, Legislation, and Litigation* section of report
- Bison translocation and bison movement should not include moving seropositive animals outside the current DSA, and may preclude relocating seropositive animals to new areas within the DSA with the intent of establishing new herd ranges. The intent is to avoid establishing new sources of disease and new disease risks to cattle.
    - See *Operations Plan* and *Environmental Compliance, Legislation, and Litigation* sections of report
- Hazing of bulls should be minimized, unless there are issues with property damage or safety, because they are not a factor in the issue of brucellosis transmission. Hazing of newborn calves should be minimized for humane reasons.
    - See *Hazing* section of report
- Discuss expected adverse weather events (similar to fire management) and work with involved entities (public and private) to develop and agree on contingency plans.
    - See *Operations Plan* and *Stakeholder and Public Engagement* sections of report
- Develop and work with the livestock industry to implement an effective cattle vaccine and protocol to reduce the risk of transmission and make bison presence/translocation more acceptable. Support/secure funding for ongoing vaccine research.
    - See *Brucellosis Testing and Vaccination* and *Research and Surveillance* sections of report
- Lobby for removing the significant barriers that exist for *Brucella abortus* research because of the select agent listing.
    - See *Brucellosis Testing and Vaccination* section of report
- Develop and implement a strong, factual education component so an informed public is involved in the discussions.
    - See *Education and Outreach* section of report
- Outside the Park, hazing and removals should be minimized in selected, suitable areas to establish year-round populations of Montana bison.
    - See *Culling*, *Hazing*, and *Environmental Compliance, Legislation, and Litigation* sections of report

Habitat Effectiveness / Habitat Expansion

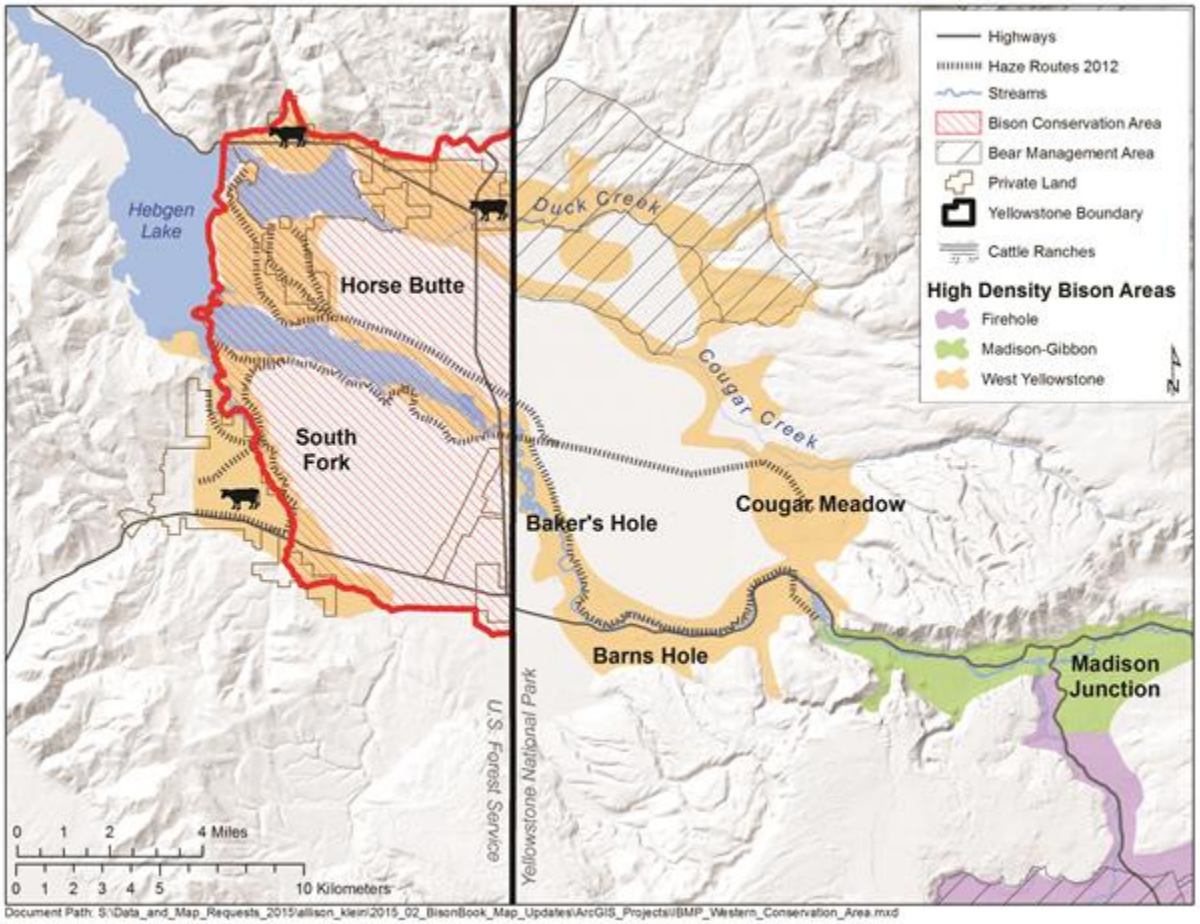
- Identify public lands that could/should be open to bison year-round in accordance with state and federal law.
    - See *Habitat Assessments and Enhancement* sections of report
- Systematically identify suitable, available habitat outside Yellowstone National Park in the Greater Yellowstone Area (i.e., Federal, State and Private lands).
    - See *Habitat Assessments and Enhancement* and *Landowner Engagement* sections of report
- Develop and implement strategies (e.g., year-round bison habitat; interview landowners to identify where bison are welcome; implement adequate fencing or acceptable alternatives) that manage bison as wildlife on those lands, specifically: a) Hebgen basin; b) Gardiner basin c) beyond the Gardiner basin (Dome Mountain Ranch, Dome Mountain Wildlife Management Area); d) and in the Upper Gallatin, Taylor Fork, Cabin Creek, Porcupine, and Buffalo Horn Creek areas. Also, complete the statewide bison management plan to restore wild bison to additional biologically suitable, socially acceptable areas.
    - See *Habitat Assessments and Enhancement*, *Landowner Engagement*, and *Environmental Compliance, Legislation, and Litigation* sections of report

APPENDIX C

NORTHERN AND WESTERN MANAGEMENT AREA MAPS



Northern management area for the Interagency Bison Management Plan as adjusted during 2012.



Western management area for the Interagency Bison Management Plan.

APPENDIX D

HAZING EVENTS IN THE GARDINER AND HEBGEN BASINS

Hazing Events in the Gardner Basin

Date	Number of Bison	Start Location	Stop Location
1/23/2015	70	Zone 2 Private Property	Zone 2
2/11/2015	1	E of Corwin Springs	Devil's Slide
2/13/2015	2	Zone 2 Private Property	Zone 2
3/26/2015	1	Corwin Springs	Devil's Slide
4/22/2015	2	N of Corwin Springs	YNP

Hazing Events in the Hebgen Basin

Date	Number of Bison	Start Location	Stop Location
3/27/2015	65	South Fork Zone 3	Whiskey Bay
3/30/2015	49	South Fork Zone 3	2.5 mm, Madison Arm Rd
4/1/2015	158	South Fork Zone 3	Horse Butte
4/3/2015	100	South Fork Zone 3	3 mm Madison Arm Rd
4/4/2015	46	South Fork Zone 3	South Fork
4/6/2015	281	South Fork Zone 3	Whiskey Bay
4/7/2015	44	Road 6697-Horse Butte	Horse Butte
4/9/2015	86	South Fork Zone 3	Horse Butte
4/13/2015	133	South Fork Zone 3	Horse Butte
4/14/2015	107	South Fork Zone 3	Horse Butte
4/17/2015	8	South Fork Zone 3	4 mm Madison Arm Rd
4/27/2015	3	Red Canyon	Fire Station 2
4/27/2015	53	South Fork Zone 3	1 mm Madison Arm Rd
4/28/2015	125	South Fork Zone 3	3 mm Madison Arm Rd
4/29/2015	64	South Fork Zone 3	Horse Butte
5/1/2015	22	South Fork Zone 3	4 mm Madison Arm Rd
5/2/2015	21	South Fork Zone 3	4 mm Madison Arm Rd
5/4/2015	43	South Fork Zone 3	3 mm Madison Arm Rd
5/8/2015	64	South Fork Zone 3	3 mm Madison Arm Rd
5/11/2015	24	Red Canyon	Grayling Creek
5/12/2015	113	South Fork Zone 3	Baker's Hole*
5/13/2015	118	Horse Butte Narrows	Baker's Hole

5/13/2015	177	Barn's Hole	7-mile Meadows
5/14/2015	18	Horse Butte	Duck Creek
5/14/2015	21	South Fork Zone 3	Baker's Hole
5/19/2015	18	Horse Butte	Maple Creek*
5/20/2015	21	South Fork Zone 3	3 mm Madison Arm Rd
5/21/2015	21	South Fork Zone 3	Barn's Hole*
5/26/2015	112	Horse Butte	Baker's Hole
5/27/2015	120	Baker's Hole	7-mile Meadows
5/27/2015	10	South Fork Zone 3	Baker's Hole*
6/15/2015	65	South Fork Zone 3	Barn's Hole
7/15/2015	1	South Fork Zone 3	Removal**
7/17/2015	3	Horse Butte	Horse Butte
8/5/2015	1	South Fork Zone 3	Removal**
8/22/2015	1	South Fork Zone 3	Removal**
10/26/2015	80	South Fork Zone 3	Horse Butte

**Hazing operations were halted at the orders of NPS officials.*
***Removal of bison adjacent to cattle*

APPENDIX E

BISON ABUNDANCE DURING HAZING EVENTS IN THE GARDINER AND HEBGEN BASINS

Bison Abundance, Gardiner Basin 2014-2015

Date	Head	Type	Hazing Operation	Location
11/29/2014	1	Bull	No	Eagle Creek
12/15/2014	7	Mixed	No	Gardiner Basin Zone 2
12/19/2014	70	Mixed	No	Gardiner Basin Zone 2
12/29/2014	90	Mixed	No	Gardiner Basin Zone 2
12/30/2014	45	Mixed	No	Gardiner Basin Zone 2
1/3/2015	4	Mixed	No	Gardiner Basin Zone 2
1/5/2015	53	Mixed	No	Gardiner Basin Zone 2
1/5/2015	23	Mixed	No	Steven's Creek to Boundary
1/6/2015	37	Mixed	No	Steven's Creek to Boundary
1/7/2015	131	Mixed	No	Steven's Creek to Boundary
1/8/2015	31	Mixed	No	Gardiner Basin Zone 2
1/12/2015	100	Mixed	No	Gardiner Basin Zone 2
1/12/2015	30	Mixed	No	Steven's Creek to Boundary
1/12/2015	2	Bulls	No	Zone 2 Private Property
1/13/2015	35	Bulls	No	Gardiner Basin Zone 2
1/13/2015	35	Mixed	No	Zone 2 Private Property
1/14/2015	20	Bulls	No	Gardiner Basin Zone 2
1/14/2015	15	Mixed	No	Zone 2 Private Property
1/16/2015	64	Mixed	No	Gardiner Basin Zone 2
1/20/2015	2	Bulls	No	Eagle Creek
1/22/2015	13	Mixed	No	Gardiner Basin Zone 2
1/23/2015	**70**	**Mixed**	**Yes**	**Zone 2 Private Property**
1/26/2015	13	Mixed	No	Eagle Creek
1/26/2015	40	Mixed	No	Gardiner Basin Zone 2
1/26/2015	20	Mixed	No	Steven's Creek to Boundary
1/28/2015	6	Mixed	No	Eagle Creek
1/28/2015	40	Mixed	No	Gardiner Basin Zone 2
1/28/2015	1	Cow	No	Zone 2 Private Property
1/29/2015	9	Bulls	No	Eagle Creek
1/30/2015	40	Mixed	No	Eagle Creek
1/30/2015	60	Mixed	No	Gardiner Basin Zone 2
1/30/2015	90	Mixed	No	Mammoth to Gardiner

1/30/2015	85	Mixed	No	Steven's Creek to Boundary
2/2/2015	9	Bulls	No	Eagle Creek
2/2/2015	66	Mixed	No	Steven's Creek to Boundary
2/2/2015	1	Bull	No	Zone 2 Private Property
2/3/2015	9	Bulls	No	Eagle Creek
2/3/2015	39	Mixed	No	N of Trail Creek/E of River
2/3/2015	75	Mixed	No	Steven's Creek to Boundary
2/4/2015	0		No	Gardiner Basin Zone 2
2/5/2015	11	Mixed	No	Gardiner Basin Zone 2
2/5/2015	150	Mixed	No	Steven's Creek to Boundary
2/9/2015	1	Cow	No	N of Trail Creek/E of River
2/11/2015	**1**	**Bull**	**Yes**	**Zone 2 Private Property**
2/12/2015	65	Mixed	No	Gardiner Basin Zone 2
2/13/2015	**2**	**Bulls**	**Yes**	**Zone 2 Private Property**
2/17/2015	2	Bulls	No	Gardiner Basin Zone 2
2/17/2015	1	Cow	No	N of Trail Creek/E of River
2/17/2015	25	Mixed	No	Steven's Creek to Boundary
2/23/2015	18	Mixed	No	Steven's Creek to Boundary
2/24/2015	1	Cow	No	N of Trail Creek/E of River
2/25/2015	13	Mixed	No	Steven's Creek to Boundary
2/26/2015	1	Cow	No	N of Trail Creek/E of River
2/27/2015	42	Mixed	No	Steven's Creek to Boundary
3/2/2015	1	cow	No	N of Trail Creek/E of River
3/2/2015	25	Mixed	No	Steven's Creek to Boundary
3/3/2015	12	Mixed	No	Steven's Creek to Boundary
3/11/2015	7	Mixed	No	Mammoth to Gardiner
3/12/2015	1	Bull	No	N of Trail Creek/E of River
3/19/2015	32	Mixed	No	Gardiner Basin Zone 2
3/19/2015	1	Bull	No	Zone 2 Private Property
3/20/2015	29	Mixed	No	Gardiner Basin Zone 2
3/23/2015	1	Bull	No	Gardiner Basin Zone 2
3/23/2015	1	Cow	No	N of Trail Creek/E of River
3/26/2015	**1**	**Bull**	**Yes**	**Zone 2 Private Property**
3/31/2015	1	Bull	No	Eagle Creek
3/31/2015	1	Cow	No	N of Trail Creek/E of River
4/8/2015	2	Bulls	No	Gardiner Basin Zone 2
4/16/2015	2	Bulls	No	Gardiner Basin Zone 2
4/16/2015	1	Cow	No	N of Trail Creek/E of River
4/20/2015	2	Bulls	No	Gardiner Basin Zone 2
4/20/2015	1	Cow	No	N of Trail Creek/E of River
4/21/2015	28	Bulls	No	Gardiner Basin Zone 2

4/21/2015	1	Cow	No	N of Trail Creek/E of River
4/21/2015	40	Mixed	No	Steven's Creek to Boundary
4/22/2015	**2**	**Bulls**	**Yes**	**Zone 2 Private Property**
4/24/2015	1	Cow	No	N of Trail Creek/E of River
4/30/2015	5	Bulls	No	Eagle Creek
4/30/2015	1	Cow	No	N of Trail Creek/E of River

Bison Abundance, Hebgen Basin 2015

Date	Head	Type	Hazing Operation	Location
2/7/2015	15	Mixed	No	Greater Horse Butte
2/8/2015	15	Mixed	No	Greater Horse Butte
2/19/2015	1	Bull	No	Greater Horse Butte
3/23/2015	137	Mixed	No	Greater Horse Butte
3/26/2015	20	Mixed	No	South Fork Zone 3
3/26/2015	50	Mixed	No	South of Madison Arm
3/26/2015	116	Mixed	No	Greater Horse Butte
3/27/2015	**65**	**Mixed**	**Yes**	**South Fork Zone 3**
3/30/2015	**49**	**Mixed**	**Yes**	**South Fork Zone 3**
3/31/2015	50	Mixed	No	South Fork Zone 3
4/1/2015	**158**	**Mixed**	**Yes**	**South Fork Zone 3**
4/2/2015	30	Mixed	No	South of Madison Arm
4/2/2015	250	Mixed	No	Greater Horse Butte
4/3/2015	**100**	**Mixed**	**Yes**	**South Fork Zone 3**
4/4/2015	**46**	**Mixed**	**Yes**	**South Fork Zone 3**
4/6/2015	**281**	**Mixed**	**Yes**	**South Fork Zone 3**
4/7/2015	**44**	**Mixed**	**Yes**	**Greater Horse Butte**
4/8/2015	100	Mixed	No	South of Madison Arm
4/9/2015	**86**	**Mixed**	**Yes**	**South Fork Zone 3**
4/12/2015	100	Mixed	No	South Fork Zone 3
4/13/2015	**133**	**Mixed**	**Yes**	**South Fork Zone 3**
4/14/2015	**107**	**Mixed**	**Yes**	**South Fork Zone 3**
4/15/2015	222	Mixed	No	Greater Horse Butte
4/17/2015	**8**	**Mixed**	**Yes**	**South Fork Zone 3**
4/20/2015	11	Mixed	No	South Fork Zone 3
4/20/2015	232	Mixed	No	Greater Horse Butte
4/23/2015	10	Mixed	No	Greater Horse Butte
4/23/2015	10	Mixed	No	Greater Horse Butte
4/25/2015	3	Mixed	No	Greater Horse Butte
4/25/2015	45	Mixed	No	South Fork Zone 3

4/26/2015	3	Cows	No	Greater Horse Butte
4/26/2015	15	Mixed	No	South Fork Zone 3
4/26/2015	62	Mixed	No	South of Madison Arm
4/27/2015	**3**	**Mixed**	**Yes**	**Greater Horse Butte**
4/27/2015	**53**	**Mixed**	**Yes**	**South Fork Zone 3**
4/28/2015	**125**	**Mixed**	**Yes**	**South Fork Zone 3**
4/29/2015	**64**	**Mixed**	**Yes**	**South Fork Zone 3**
5/1/2015	**22**	**Mixed**	**Yes**	**South Fork Zone 3**
5/2/2015	**21**	**Mixed**	**Yes**	**South Fork Zone 3**
5/4/2015	**43**	**Mixed**	**Yes**	**South Fork Zone 3**
5/8/2015	**64**	**Mixed**	**Yes**	**South Fork Zone 3**
5/11/2015	**24**	**Mixed**	**Yes**	**Greater Horse Butte**
5/11/2015	30	Mixed	No	Greater Horse Butte
5/12/2015	**113**	**Mixed**	**Yes**	**South Fork Zone 3**
5/13/2015	**118**	**Mixed**	**Yes**	**Greater Horse Butte**
5/14/2015	**18**	**Mixed**	**Yes**	**Greater Horse Butte**
5/14/2015	**21**	**Mixed**	**Yes**	**South Fork Zone 3**
5/17/2015	10	Mixed	No	South Fork Zone 3
5/17/2015	50	Mixed	No	South of Madison Arm
5/17/2015	140	Mixed	No	Greater Horse Butte
5/19/2015	**18**	**Mixed**	**Yes**	**Greater Horse Butte**
5/19/2015	526	Mixed	No	Greater Horse Butte
5/20/2015	**21**	**Mixed**	**Yes**	**South Fork Zone 3**
5/21/2015	**21**	**Mixed**	**Yes**	**South Fork Zone 3**
5/26/2015	**112**	**Mixed**	**Yes**	**Greater Horse Butte**
5/27/2015	**10**	**Mixed**	**Yes**	**South Fork Zone 3**
5/27/2015	15	Mixed	No	Greater Horse Butte
6/3/2015	37	Mixed	No	Greater Horse Butte
6/15/2015	**65**	**Mixed**	**Yes**	**South of Madison Arm**
6/18/2015	3	Mixed	No	Greater Horse Butte
6/22/2015	2	Mixed	No	Greater Horse Butte
6/23/2015	1	Bull	No	Greater Horse Butte
6/23/2015	2	Mixed	No	Greater Horse Butte
6/29/2015	1	Bull	No	Greater Horse Butte
6/30/2015	1	Bull	No	Greater Horse Butte
7/1/2015	2	Bull	No	Greater Horse Butte
7/10/2015	1	Bull	No	Greater Horse Butte
7/15/2015	**1**	**Bull**	**Removal**	**South Fork Zone 3**
7/17/2015	**3**	**Bull**	**Yes**	**Greater Horse Butte**
7/20/2015	1	Bull	No	**Greater Horse Butte**
7/27/2015	1	Bull	No	**Greater Horse Butte**

7/30/2015	1	Bull	No	**Greater Horse Butte**
8/4/2015	1	Bull	No	South of Madison Arm
8/5/2015	**1**	**Bull**	**Removal**	**South Fork Zone 3**
8/21/2015	1	Bull	No	Greater Horse Butte
8/21/2015	1	Bull	No	South Fork Zone 3
8/22/2015	**1**	**Bull**	**Removal**	**South Fork Zone 3**
8/24/2015	1	Bull	No	Greater Horse Butte
8/25/2015	2	Bull	No	Greater Horse Butte
9/24/2015	2	Bull	No	Greater Horse Butte
10/19/2015	1	Bull	No	Greater Horse Butte
10/20/2015	2	Bull	No	Greater Horse Butte
10/22/2015	22	Mixed	No	South of Madison Arm
10/23/2015	1	Bull	No	Greater Horse Butte
10/26/2015	**80**	**Mixed**	**Yes**	**South Fork Zone 3**
10/27/2015	20	Mixed	No	South of Madison Arm
10/28/2015	4	Mixed	No	South of Madison Arm
10/29/2015	1	Mixed	No	South of Madison Arm