

ANNUAL REPORT, INTERAGENCY BISON MANAGEMENT PLAN
1 AUGUST 2010 - 31 OCTOBER 2011

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REPORT OVERVIEW

This report, which covers 1 August 2010 to 31 Oct 2011, begins by describing events leading up to the creation of the Interagency Bison Management Plan (IBMP), then presents highlights for the past year. The report next summarizes progress under the Adaptive Management Plan of the IBMP. Monitoring data and/or narrative summaries are provided for each management action taken under the current adaptive management plan, using the framework of that plan. Agencies involved with the IBMP include the Animal and Plant Health Inspection Service (APHIS), Confederated Salish and Kootenai Tribes (CSKT), InterTribal Buffalo Council (ITBC), Montana Department of Fish, Wildlife and Parks (MFWP), Montana Department of Livestock (MDOL), National Park Service (NPS), Nez Perce Tribe (NP), and U.S. Forest Service (USFS).

Annual reports are used by the IBMP agencies to a) judge the effects and effectiveness of management actions taken to meet IBMP goals, and b) adjust management actions for the following year, as appropriate, to better meet those goals. This report also summarizes progress on Yellowstone National Park's (YELL) surveillance plan for bison (White et al. 2011). The annual report is *not* intended to provide a summary of *all* actions of the IBMP agencies for the preceding year. Instead, the website www.ibmp.info is the agencies' repository for meeting notes, key science reports, and other relevant activities.

BACKGROUND

Since the mid-1980s, increasing numbers of bison have moved to low-elevation winter ranges outside the northern and western parts of YELL in response to accumulating snow pack (Gates et al. 2005) and increased population. These movements led to an enduring series of societal conflicts among various publics and management entities regarding bison abundance and the potential transmission of brucellosis to domestic cattle with widespread economic repercussions (Cheville et al. 1998). Thus, the federal government and State of Montana agreed to an Interagency Bison Management Plan that established guidelines for managing the risk of brucellosis transmission from bison to cattle by implementing hazing, test-and-slaughter, hunting, and other actions near the park boundary (USDI and USDA 2000a). This plan identified the need to conserve bison and established conservation zones encompassing approximately 250,000 acres of the northern two-thirds of YELL and a small portion of the adjacent Gallatin National Forest.

Since the Record of Decision was signed for the IBMP in 2000 (USDI and USDA 2000b), the signatories have collected substantial new information regarding bison, brucellosis, and the management of disease risk and suppression. However, progress has been slow in completing the plan's three successive management steps. As a result, the federal government and State of Montana were criticized for: 1) not clearly defining measurable objectives to express desired outcomes; and 2) not systematically applying adaptive management principles, including defining specific scientific and management questions to be answered, conducting specific activities to answer them, and incorporating findings into the IBMP (U.S. Government Accountability Office 2008). Thus, there was a need to develop specific management objectives, conduct surveillance to evaluate the effects and effectiveness of management actions, and develop methods for informing stakeholders and adjusting the IBMP based on these assessments.

In addition, the NPS is considering the implementation of a remote delivery vaccination program for brucellosis in free-ranging bison at YELL, an action previously directed by the IBMP (USDI and USDA 2000a,b). The overall goal of this action is to meet the NPS's mission to preserve native species as a component of a naturally operating ecosystem and protect them from exotic diseases. Simulation modeling suggests an effective strategy for reducing brucellosis seroprevalence in bison would be to combine boundary management (i.e., removal of likely infectious bison and vaccination of other female bison) with the remote delivery vaccination of all female bison distributed throughout YELL (Treanor et al. 2010). This approach is expected to lead to the greatest decrease in brucellosis infection over time, though there is a need to reduce uncertainty in parameter estimates regarding bison demography and brucellosis transmission.

Information obtained from monitoring and research activities will improve parameter estimation and model predictions, and enable an evaluation of the effects and effectiveness of a bison management and vaccination program.

To address these needs, the IBMP agencies met several times in public venues during August-December 2008 to deliberate on recommendations by the U.S. Government Accountability Office, assess the effectiveness and outcomes of IBMP management activities and, considering prevailing conditions, develop and incorporate short- and long-term adaptive management adjustments to the IBMP for winter 2008-2009 and beyond (USDI et al. 2008). These adjustments were based on the adaptive management framework and principles outlined in the USDI Technical Guide on Adaptive Management (Williams et al. 2007). Also, NPS staff developed a surveillance plan to implement a long-term monitoring and research program for bison to obtain relevant information for decision making regarding the conservation of bison, adaptive management of the IBMP, and evaluation of the effectiveness of remote delivery vaccination.

2010 / 2011 HIGHLIGHTS

- **Meetings.**—The IBMP agencies met four times in Montana between 1 August 2010 to 31 Oct 2011: August 11, 2010 in Bozeman; Dec 7/8, 2010 at Chico Hot Springs; May 17/18, 2011 in Bozeman; August 4/5, 2011 in Pablo. Full reports summarizing each meeting can be found at www.ibmp.info. In addition, numerous teleconferences and subcommittee meetings were held.
- **Field trips.**—Staff from the IBMP agencies and the public met with landowners on the and North and West Management Areas to better assess and understand bison/cattle issues “on-the-ground,” as well as to listen for potential adaptive management opportunities. The west-side trip around the Hebgen Basin occurred August 10, 2010; the north-side trip around the Gardner Basin took place December 7, 2010. Additionally, staff from the agencies and the public visited CSKT safe-wildlife passages and the National Bison Range on August 4, 2011 in an effort to learn about wildlife management in the Flathead region.
- **Adaptive management opportunities.**—The IBMP agencies developed a list of 33 possible adaptive management recommendations during the fall of 2010. The Technical Committee found consensus on roughly half of these, then the managers further modified the list. NPS legal counsel provided a review of the agencies’ National/Montana Environmental Policy Act (NEPA/MEPA) sufficiency documentation of the resulting proposed adaptive changes. Upon completion of this effort, the proposed changes were added to the adaptive management plan, are expected to be signed at the November 30, 2011 IBMP meeting, and will then be part of bison management for the upcoming 2011/2012 season.
- **Increased tolerance area for bison north of the Park.**—The IBMP Partners negotiated an area of increased tolerance for bison in mid-March and completed an adaptive adjustment endorsed by all partners in late April. The enlarged conservation area encompasses the north end of the Gardner Basin on both sides of the Yellowstone River, but does not extend any farther north than Yankee Jim Canyon (the original northern extent of the conservation area disclosed in the 2000 Federal Environmental Impact Statement [FEIS]). Two lawsuits were filed against the state of Montana in objection to the increased area for tolerance on—one lawsuit from Park County, one from the Park County Stockgrowers—and are ongoing.
- **Subcommittee deliberations.**—The IBMP Partners created four subcommittees to discuss issues of greatest conflict and develop resolutions to consider for adaptive management adjustments. The issues being discussed are 1) available habitat outside Yellowstone National Park, 2) restoration of bison beyond the current conservation area for Yellowstone bison, 3) transfer of surplus bison to other administrative units for the conservation of Plains bison, and 4) appropriate methods for reduction of brucellosis infection. The committees met outside the regularly scheduled IBMP Partner meetings, presented preliminary findings to the decision makers in August of 2010, and continue to work toward resolutions.
- **Transfer of quarantined bison.**—The agencies discussed possible processes, methods, and challenges for transferring bison to American Indian tribes, federal and state lands, and private entities.
- **Bison hunt.**—The agencies continued discussions of hunting as a management tool for bison, including location, dates, and quotas. MFWP and MDOL met with the CSKT and Nez Perce, as well as the Umatilla and Shoshone-Bannock Tribes, to discuss harvest strategies to preserve demographic ratios and subpopulation distribution. They also discussed logistics to provide a safe hunting program to include the possible addition of a winter/spring hunt on the west side of the Yellowstone River in the newly expanded conservation area.
- **Partner decision making procedures.**—The IBMP Partners recognize and are acting on the need to set up more consistent business practices with respect to such items as document signing, decision making, and other processes needed for conducting efficient interagency meetings.

- **IBMP interactions with County Commissioners.**—The IBMP agencies offered, via letter, to attend or in some way interact with County Commissioners in Gallatin, Madison, and Park counties of Montana.
- **On-going Partner, staff, and public education.**—IBMP meetings included numerous educational presentations in science and public policy realms including (1) the use of risk management in APHIS decision-making, and (2) NPS report on genetic diversity in Yellowstone bison.
- **Communication with the public.**—The IBMP information portal, www.ibmp.info, continues to serve as a data repository for IBMP-related materials such as historical reports (e.g., environmental impact statements), meeting agendas, and summary reports on IBMP meetings, with links to agency web sites that have additional data and reports about Yellowstone bison conservation.
- **Citizens' Working Group (CWG).**—An open forum, citizens' working group was formed under citizen initiative with encouragement and facilitator funding by the IBMP agencies. The group met monthly from January-October 2011. Upon request, the IBMP agencies provided endorsement to, and some thoughts on, initial goals for the CWG, but sought not to prejudice or direct specific CWG deliberations. A final report on CWG recommendations is expected at the November 30, 2011 IBMP meeting.

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MANAGEMENT ACTIONS FOR THE IBMP

ACTION 1.1A: ALLOW UNTESTED FEMALE/MIXED GROUPS OF BISON TO MIGRATE ONTO AND OCCUPY THE HORSE BUTTE PENINSULA AND THE FLATS EACH WINTER AND SPRING IN ZONE 2.

Monitoring Metric 1: Weekly surveys of the number and distribution of bison on Horse Butte, the Flats, crossing the Narrows, and going beyond the Madison Resort (Lead = MDOL).

Data for bison in the West Management area are shown in Figure 1. A comparison of 2009, 2010, and 2011 is presented in Figure 2.

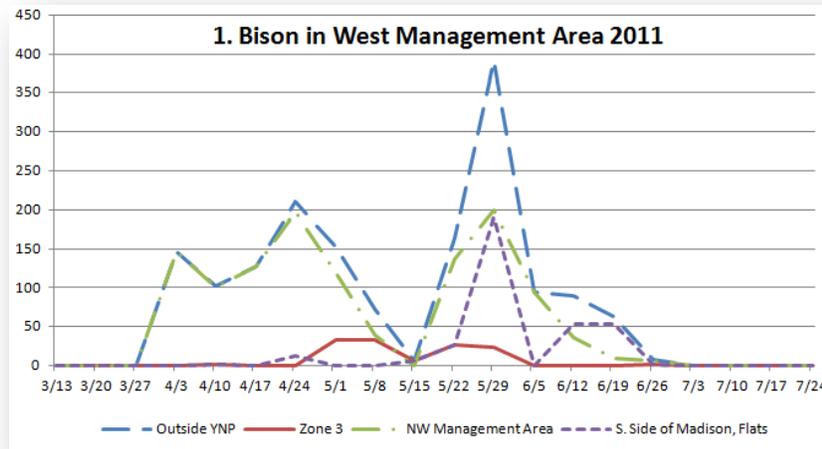


Figure 1.—Chart 1. Bison abundance in various portions of the West Management Area during the 2011 management season. Note: due to staffing constraints, no survey was taken during the week of May 15

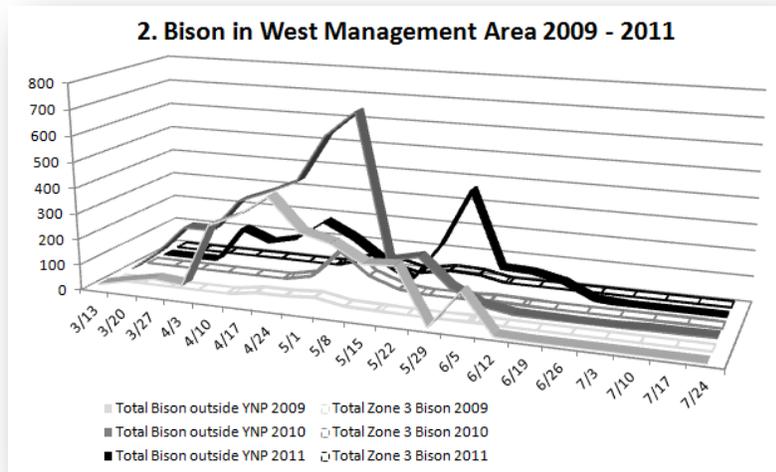


Figure 2.—Chart 2. Comparison of bison abundance in the West Management Area during the 2009, 2010 and 2011 management seasons. Note: due to staffing constraints, no survey was taken during the week of May 15, 2011.

Monitoring Metric 2: Annually document the number of bison using Zone 2 and the number and type of management activities needed to manage bison distribution (Lead = MDOL).

The numbers of bison using Zone 2 of the west management area ranged from zero until the week of April 3 to 368 during the week of May 29, 2011 (Figure 3). A maximum of about 391 bison simultaneously occupied Zones 2 and 3 during 2011. Twenty-five hazing operations were conducted to manage bison distribution. Field operations were conducted almost every week on one to three days per week from mid April to July 1st. All twenty-five hazing operations were directly related to bison occupying Zone 3 ($n = 10$) or breaching other trigger points ($n = 15$) established in the adaptive management plan (e.g., bison entering non-tolerance areas or exceeding numerical tolerance levels; Appendix A). A helicopter was used for hazing bison during 3 operations.

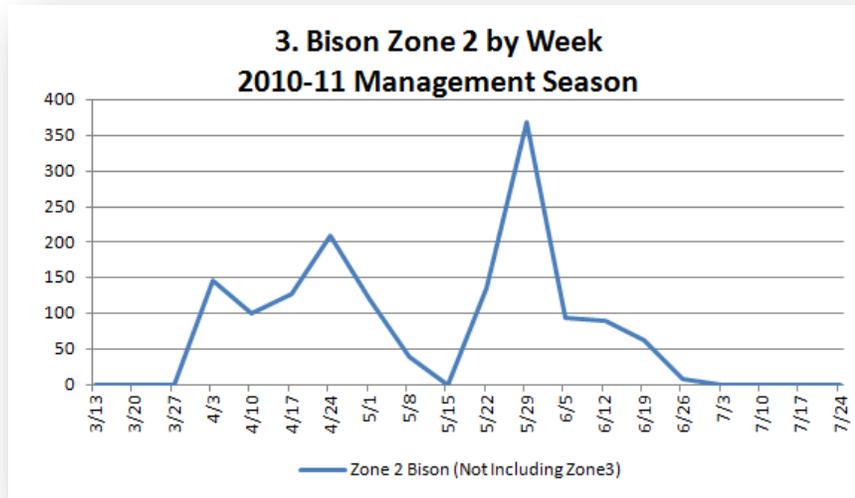


Figure 3.—Weekly abundance of bison in West Management Area. Note: due to staffing constraints, no survey was taken during the week of May 15.

Monitoring Metric 3: Create a density curve of the threshold number of bison on Horse Butte that results in movements of bison to the South Fork Madison area (Lead = MDOL).

Due to staffing changes, surveys of bison numbers were taken only on Horse Butte except in the instances when hazing operations occurred in other areas of the West Management Area. The total number of bison outside YELL on the west side was much lower than in previous years, other than a temporary spike in numbers at the end of May when a total of 391 bison were recorded outside the park. Throughout April and the first half of May, numbers on Horse Butte did not exceed 200. Bison numbers on the south side of the Madison Arm (Flats) did not exceed tolerance levels until the end of April, and hazing operations occurred on four separate days from the end of April through June when numerical tolerance levels were exceeded. The maximum number of bison on the south side of the Madison Arm reached 168 during this time period. For the 2011 management season, a direct correlation between the threshold number of bison on Horse Butte resulting in movement to the South Fork of the Madison is difficult to make due in part to a limited amount of data collected or the threshold not being reached.

Monitoring Metric 4: Determine natural routes and timeframes (without hazing) for bison migration back into the park (Lead = NPS). Use this information to evaluate the effectiveness of management responses for bison tolerance in Zone 2 (Lead = MDOL).

Bison occupied the western risk management zone outside Yellowstone National Park for most of the autumn, winter, and spring months (Table 1). Radio-marked bison have used two primary migration routes to reach the western boundary of YELL and move into the Hebgen basin of Montana. Bison move west along the Yellowstone River to the area near 7-mile bridge, after which some bison travel north through Cougar Meadows and some bison travel west through Baker’s Hole (Figure 4). These routes intersect further west along the Madison River, after which nearly all bison move along the north bank of the Madison River to Hebgen Lake. Initially, bison use the bench above the north

bank of the Madison River and the Madison Arm of Hebgen Lake, but bison eventually access both sides of the lake when conditions are suitable. Some bison use the lake’s delta as a way to cross from the Horse Butte peninsula to the south side of the Madison Arm (Figure 5).

Table 1.—Number of bison observed during aerial counts conducted over the West Management Area during November 2010 to May 2011.

| Location | Number of Bison Observed | | | | | |
|---|--------------------------|-----------------|--------|--------|--------|--------|
| | Nov 1 | Jan 26 | Feb 14 | Mar 23 | Apr 23 | May 22 |
| IBMP Zone 1 | 8 | 215 | 15 | 62 | 109 | 116 |
| IBMP Zone 2 | 1 | 36 ¹ | 44 | 63 | 114 | 319 |
| West of Madison Junction to 7-mile bridge | 28 | 41 | 26 | 30 | 14 | 33 |
| Total | 37 | 292 | 85 | 155 | 237 | 468 |

¹ Approximately 50 bison were harvested by state and tribal hunters (November to January).

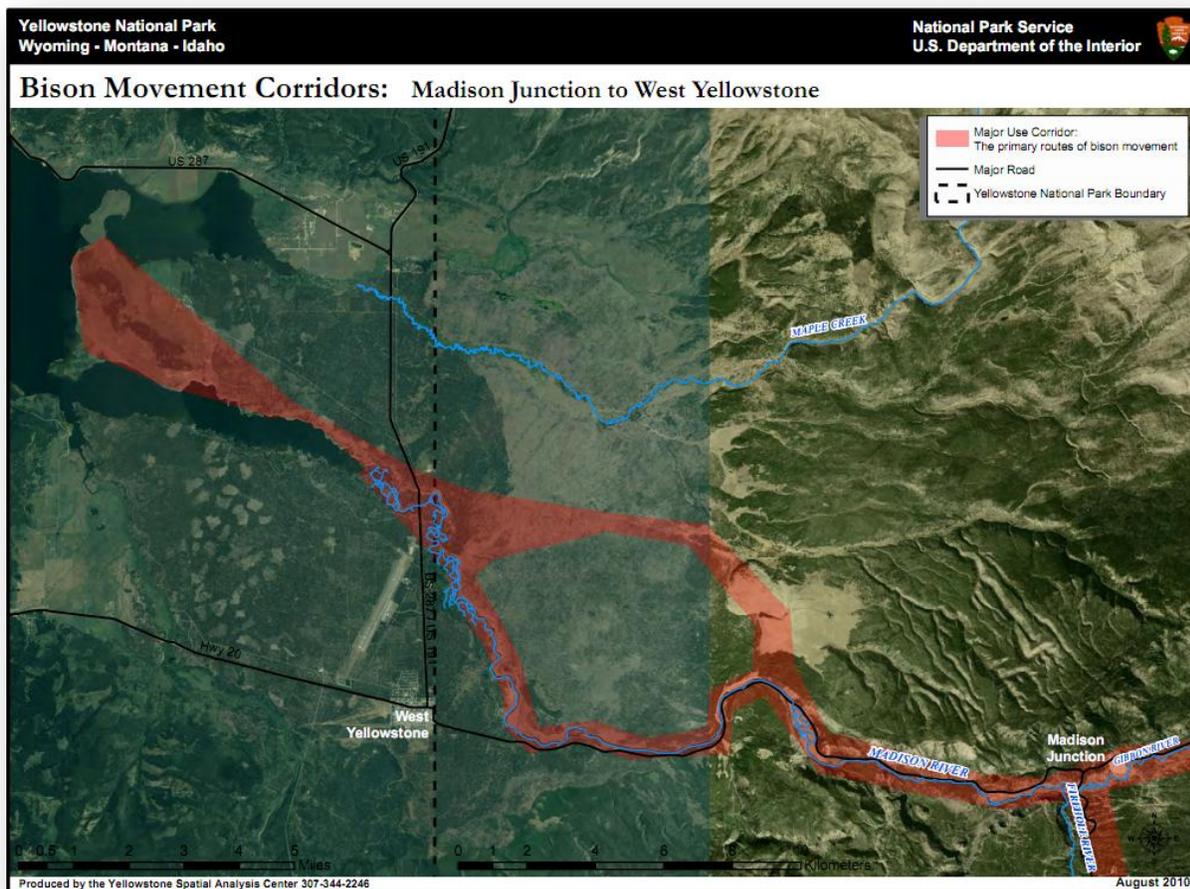


Figure 4. Major migration routes of bison to the west boundary of the park and into Montana.

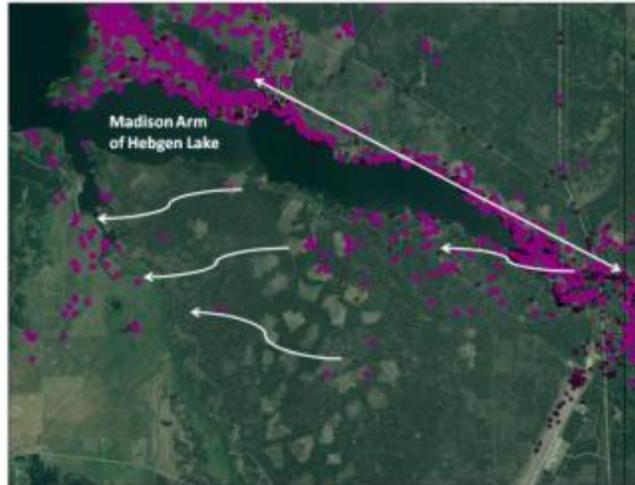


Figure 5. Relocation points and movement routes of bison using the South Fork area along the Madison River, and the Flats area south of the Madison Arm of Hebgen Lake.

ACTION 1.1B: USE ADAPTIVE MANAGEMENT TO GAIN MANAGEMENT EXPERIENCE REGARDING HOW BISON USE ZONE 2 IN THE GARDINER BASIN, AND PROVIDE SPACE/HABITAT FOR BISON IN CATTLE-FREE AREAS.

Monitoring Metric 1: Weekly survey of the number and distribution of bison in the Eagle Creek/Bear Creek area and the Gardiner basin (Lead inside YELL = NPS; Lead outside YELL = MDOL with MFWP).

Inside YELL

NPS staff conducted periodic aerial surveys through winter 2010-11 to estimate the number of bison occupying northern IBMP management monitoring areas, including the Eagle Creek/Bear Creek and Gardiner basin areas (Table 2).

Table 2.—Summary of bison abundance in the North Management Area based on aerial surveys between November 2010 and May 2011. The bison held in the Stephens Creek and the Corwin Springs holding facilities were not included in the aerial survey counts because of the difficulty in counting groups sizes when bison are so tightly confined. Other methods were used to account for these figures.

| Location** | Nov 1 | Dec 21 | Jan 26 | Feb 14 | Mar 23 | Apr 23 | May15 |
|---------------------------------------|-------|---------|--------|--------|--------|--------|-------|
| Zone 1 (Gardiner basin within YELL) | 0 | 27 | 114 | 7 | 235 | 318 | 236 |
| Zone 2 | 0 | 0 | 4 | 26 | 34 | 30 | 0 |
| Eagle Creek, Gallatin National Forest | 0 | 11 | 57 | 13 | 10 | 53 | 15 |
| Hellroaring Creek, YELL | 24 | 330 | 67 | 20 | 6 | 230 | 41 |
| Blacktail Plateau, YELL Deer | 172 | 1,253 | 1,230 | 1,125 | 830 | 300 | 536 |
| Swan Lake, YELL | 11 | no data | 53 | 29 | 40 | 4 | 5 |

Table 2.—Summary of bison abundance in the North Management Area based on aerial surveys between November 2010 and May 2011. The bison held in the Stephens Creek and the Corwin Springs holding facilities were not included in the aerial survey counts because of the difficulty in counting groups sizes when bison are so tightly confined. Other methods were used to account for these figures.

| Location** | Nov 1 | Dec 21 | Jan 26 | Feb 14 | Mar 23 | Apr 23 | May15 |
|--|-------|--------|--------|--------|--------|--------|-------|
| Total | 207 | 1,621 | 1,525 | 1,220 | 1,155 | 935 | 833 |
| Number held in Stephens Creek facilities | 0 | 0 | 62 | 524 | 632 | 664 | 386 |
| No. in Gardiner basin | 0 | 38 | 237 | 570 | 911 | 1,065 | 637 |

** Monitoring areas are described in the Interagency Field Operating Procedures (2009). Zone 2 and the Eagle Creek area are located outside the National Park. All other areas are within Yellowstone National Park. Appendix B shows the location of the monitoring sites relative to the park boundary.

Outside YELL

Figure 6 shows the maximum number of bison outside the boundary of YELL at one time in the North Management area.

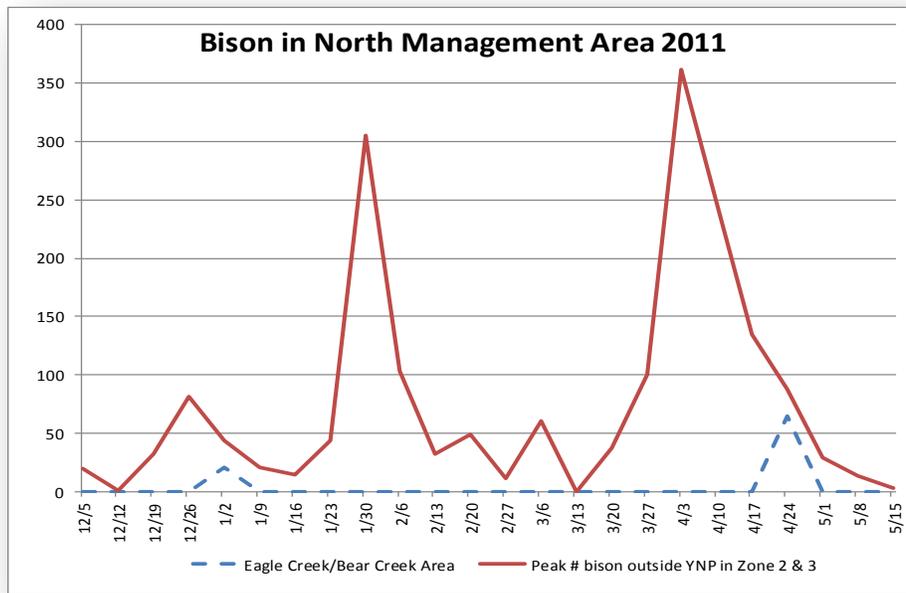


Figure 6.—Bison abundance in various portions of the North Management Area during the 2010-2011 management season. Note that no MDOL hazing operations or surveys occurred during the week of March 13, 2011, therefore the number of bison outside YELL is recorded as zero.

Monitoring Metric 2: Annually document the numbers and dates that bison attempt to exit Zone 2 by passing through Yankee Jim Canyon, west up Mol Heron Creek Canyon, or to the east side of the Yellowstone River and north of Little Trail Creek (Lead = MDOL/MFWP).

Bison attempted to exit Zone 2 by passing through Yankee Jim Canyon a total of seven times during the 2010-2011 management season. There were 64 instances of bison entering Zone 3 east of the Yellowstone River and north of

Little Trail Creek. There were no recorded instances of bison attempting to exit Zone 2 west up Mol Heron Creek Canyon. For exact dates and numbers, please see Appendix C.

Monitoring Metric 3: Annually document the number of bison using Zone 2 and the number of management activities needed to manage bison distribution (Lead = MDOL/MFWP).

Bison began occupying the Zone 2 area of the Gardiner Basin in early December, 2010, and consistently used the area until the end of May (Table 2). The maximum number of bison outside the park at one time was 362 in early April. A total of 174 hazing operations were conducted in the Gardner Basin between Dec 5, 2010, and May 24, 2011. For exact dates and numbers for each hazing operation, please see Appendix C. At least one hazing operation occurred on each date listed in the table.

Monitoring Metric 4: Annually collect data to update the relationships between bison management at the Stephens Creek facility and the interaction between bison density and snow pack in the central and northern herds (Lead = NPS).

NPS staff published a scientific article (Geremia et al. 2011b) summarizing analyses of the relationships between bison population size, winter severity, and the number of bison removed near the boundary of YELL. Accumulating snow pack interacts with bison herd sizes to increase the numbers of bison migrating to lower elevation ranges near the boundary of YELL. There is a high probability that fewer than 10 percent of the population will exit the park with moderate herd sizes (1,000-2,000), snow pack less than 60% of average, and average forage production on the summer ranges in YELL. At higher values, however, the number of bison migrating to boundary ranges during winter and spring rapidly increases. Under severe snow pack conditions, there is a significant chance that the majority of bison could migrate to the lower elevation ranges where snow pack is lower and new vegetation growth begins earlier in spring than on the higher elevation summer ranges in the park (Thein et al. 2009). The model predicted about 1,300 bison would migrate into the Gardiner basin during winter 2011 and by the end of winter about 1,400 bison actually made the migration.

Monitoring Metric 5: Annually collect data to determine natural migration routes and timeframes (in the absence of hazing) for bison migration out of and back into the park (Lead inside YELL = NPS; Lead outside YELL = MDOL/MFWP).

By mid-December 2010, a majority of the northern breeding herd had migrated to lower elevations due to early deep snows, with 1,250 bison on the Blacktail Deer Plateau and another 700 bison on mid-elevation ranges near Tower Junction. By February 2011, only one of 36 radio-marked bison from the northern herd was still east of the Blacktail Deer Plateau, while 10 (28%) were already in the Gardiner basin. By April, all but one (97%) of these 36 radio-marked bison had spent some time in the Gardiner basin and three (8%) had already begun the migration back to the east end of the northern range using small patches of south-facing slopes that were providing new growth in the Tower Junction area.

By February 2011, 6 (33%) radio-marked bison from the central breeding herd had migrated to the northern winter range (4 in Gardiner basin and 2 on the Blacktail Deer Plateau). One additional radio-marked bison from central herd moved north to the Gardiner basin in March. These movements suggest mixing of bison from the northern and central breeding herds occurred early and often through the winter.

Migration routes out of the park included two primary routes into the Gardiner basin: 1) across the Blacktail Deer Plateau and down the Lava Creek drainage along the creek or the road corridor; and 2) down the Yellowstone River trail to Eagle Creek or Shooting Range Flats. The primary exit routes out of the park were across Reese Creek west of the Yellowstone River, along the Highway 89 corridor, or through Eagle Creek to Little Trail Creek.

ACTION 1.1C: USE RESEARCH FINDINGS ON BISON BIRTH SYNCHRONY AND FETAL AND SHED *BRUCELLA ABORTUS* FIELD VIABILITY AND PERSISTENCE TO INFORM ADAPTIVE MANAGEMENT.

Monitoring Metric 1: Complete research reports and attempt to publish findings in a peer-reviewed, scientific journal (Lead = MFWP and NPS).

NPS staff monitored adult, female bison from April through mid-June during 2004-2007 to estimate the timing and location of parturition events (e.g., abortions and live births) that may shed tissues infected by *Brucella abortus*. They observed 115 bison parturition events including 54 live births (49 direct observations and 5 placenta retentions with a calf present), 29 reproductive failures (13 stillborn calves, 11 placenta retentions with no calves present, and 5 deaths of females during parturition), and 32 radio-collared females with newborn calves. Parturition events were primarily

concentrated inside YELL, but 12 events occurred outside the western boundary on the Horse Butte peninsula in Montana. Reproductive failures, which may include *Brucella*-induced abortions, occurred primarily from January through April, with 76% of observations occurring by the end of April and the latest reproductive failure observed on May 19. Yellowstone bison exhibited a high degree of birth synchrony in which peak calving (80% of births) occurred between April 25 and May 26 and was finished by June 5. Bison mothers typically cleaned birth sites (i.e., consumed shed tissues) and typically left the site within two hours.

Results of this study suggest that allowing bison to occupy public lands outside YELL where cattle are never present (e.g., Horse Butte peninsula) until most bison calving is completed (late May or early June) is not expected to significantly increase the risk of brucellosis transmission from bison to cattle because (1) bison parturition is essentially completed weeks before cattle occupy nearby ranges, (2) female bison typically consume birthing tissues, (3) ultraviolet light and heat degrade *Brucella* on tissues, vegetation, and soil, (4) scavengers remove fetuses and remaining birth tissues, and (5) management maintains separation between bison and cattle on nearby ranges. Allowing bison to occupy public lands outside YELL through their calving season will help conserve bison migratory behavior and reduce stress on pregnant females and their newborn calves, while still minimizing the risk of brucellosis transmission to cattle (Jones et al. 2010).

ACTION 1.2A: ALLOW BACHELOR GROUPS OF BULL BISON TO OCCUPY SUITABLE HABITAT AREAS OUTSIDE THE WEST BOUNDARY OF YELL IN THE PORTION OF ZONE 2 SOUTH OF DUCK CREEK EACH YEAR WITHIN THE PARAMETERS OF CONFLICT MANAGEMENT.

Monitoring Metric 1: Weekly counts and locations of bull bison in Zone 2 (Lead = MDOL).

Due to staffing changes, a limited amount of data was collected and not all locations of bull bison in Zone 2 were recorded throughout the entire management season. Locations of bull bison that were associated with hazing operations are shown in Table 3. Bulls were tolerated in the West Management Area, and the timing and numbers were not recorded unless associated with a hazing operation.

Table 3.—Weekly counts of bull bison on the West Side.

| DATE | TRIGGER POINT(S) BREACHED | # OF BULLS | LOCATION of BISON | OPERATIONS |
|------|--|------------|---|------------|
| 4/28 | Madison Resort by 4/15 | 8 | South Fork of Madison River | YES |
| 5/2 | Zone 3 | 6 | Hwy 287 west of MA | YES |
| 5/4 | Zone 3 | 4 | Hwy 287 west of MA | YES |
| 5/5 | Zone 3 | 12 | 4 at Hwy 287 west of MA, additional 8 picked up in Lower Bear Trap area during haze | YES |
| 5/16 | Zone 3 | 1 | West of South Fork | YES |
| 6/2 | After May 15 Deadline Limit 0 Bison in Flats or North of Duck Creek | 5 | Lower Bear Trap area | YES |
| 6/17 | After May 15 Deadline Bulls only North of Madison River and South of Duck Creek | 1 | South side of Duck Creek (with a cow & calf) | YES |
| 6/23 | After May 15 Deadline Limit 0 Bison in Flats or North of Duck Creek | 2 | Lower Bear Trap area | YES |
| 6/29 | After May 15 Deadline Limit 0 Bison in Flats or North of Duck Creek | 7 | North of Duck Creek | YES |
| 7/1 | Zone 3 | 1 | West of South Fork (lethal removal after attempted haze) | YES |

Bull bison were present as late as June 29, up to 3 days after cattle turnout in the Zone 2/Duck Creek area.

Monitoring Metric 2: Document threats to human safety and property damage (Lead = MFWP).

During the course of the fall, winter and spring of 2010 and 2011 Montana Fish, Wildlife and Parks staff—along with MDOL and YNP staff— responded to public safety and property damage concerns throughout West Yellowstone and Gardiner areas. Montana Fish, Wildlife and Parks Wardens also assisted in hazing operations on both the North and West side during this time. These responses began on October 4, 2010 and ended on July 17, 2011. A total of thirteen Montana Fish, Wildlife and Parks Game Wardens spent 429 working days responding to calls concerning all public hazing, safety and property damage situations. Example Warden Sergeant Joe Knarr made 346 hazing contacts and 275 property damage contacts during this time period. These responses were either immediate or generally within twenty four hours depending on staffing and travel time to the complaint.

Data for MFWP activities for 2010/2011 can be found in Appendices D and E.

ACTION 1.2B: ALLOW BACHELOR GROUPS OF BULL BISON TO OCCUPY SUITABLE HABITAT AREAS IN ZONE 2 OUTSIDE THE NORTH BOUNDARY OF YELL WITHIN THE FOLLOWING PARAMETERS OF CONFLICT MANAGEMENT.

Monitoring Metric 1: Weekly counts and locations of bull bison in Zone 2 (Lead = MDOL/MFWP).

Table 4 shows weekly counts and locations of bull bison in Zone 2.

Table 4.—Bison counts in Zone 2, on the North Side.

| Week of: | # Bulls | Location | Operations |
|----------|---------|--------------------------------------|------------|
| 12/5 | 3 | Pearl's pasture | Yes |
| 12/12 | 1 | RTR HQ | Yes |
| 12/19 | 3 | RTR HQ | Yes |
| | 3 | RTR HQ | Yes |
| 12/26 | 9 | RTR | Yes |
| | 3 | RTR/Spring Creek | Yes |
| | 4 | Beattie Gulch | Yes |
| | 2 | RTR | Yes |
| 1/2 | 0 | | |
| 1/9 | 0 | | |
| 1/16 | 4 | Corwin Springs Bridge | Yes |
| | 5 | RTR | Yes |
| 1/23 | 5 | Beattie Gulch | Yes |
| 1/30 | 15 | Beattie Gulch | Yes |
| | 1 | Beattie Gulch | Yes |
| 2/6 | 1 | RTR | Yes |
| | 3 | RTR | Yes |
| | 3 | Cinnabar Rd/Old Yellowstone Trail Rd | Yes |
| 2/13 | 2 | Beattie Gulch | Yes |
| | 4 | RTR | Yes |
| 2/20 | 0 | | |
| 2/27 | 0 | | |
| 3/6 | 0 | | |
| 3/13 | 0 | | |
| 3/20 | 0 | | |
| 3/27 | 1 | RTR HQ | Yes |
| 4/3 | 0 | | |
| 4/10 | 67 | Devil's Slide | Yes |
| 4/17 | 7 | Cutler lake | Yes |
| | 2 | Cutler Meadows | Yes |
| 4/24 | 11 | Devil's Slide | Yes |

Table 4.—Bison counts in Zone 2, on the North Side.

| Week of: | # Bulls | Location | Operations |
|----------|---------|--------------------|------------|
| | 7 | Devil's Slide | Yes |
| 5/1 | 10 | Beattie Gulch | Yes |
| | 1 | Devil's Slide | Yes |
| | 6 | West side of river | Yes |
| 5/8 | 5 | RTR | Yes |
| | 13 | Devil's Slide | Yes |
| | 6 | Devil's Slide | Yes |
| | 1 | Beattie Gulch | Yes |
| 5/15 | 1 | Beattie Gulch | Yes |
| | 3 | Devil's Slide | Yes |

Monitoring Metric 2: Document threats to human safety and property damage (Lead = MFWP/MDOL).

See Action 1.2A, Monitoring Metric 2.

Data for MFWP activities for 2010/2011 can be found in Appendices D and E.

Monitoring Metric 3: Annually document the numbers and dates that bull bison attempt to exit Zone 2 by passing through Yankee Jim Canyon, west up Mol Heron Creek Canyon, or to the east side of the Yellowstone River and north of Little Trail Creek (Lead = MDOL/MFWP).

Table 5 shows the number of bull bison attempting to exit Zone 2 via Yankee Jim Canyon, west up Mol Heron Creek Canyon, or to the east side of the Yellowstone River and north of Little Trail Creek.

Table 5.—Bull bison attempts to exit the North Side, per Monitoring Metric 3. (Producer A: BH; Landowner B: FR)

| Date | # Bulls | Location |
|-----------|---------|---|
| 12/5/2010 | 7 | Corwin Springs Quarantine Pen area |
| 1/18/2011 | 4 | Producer A property |
| 1/20/2011 | 3 | Producer A Property |
| 1/27/2011 | 4 | Private property north of Little Trail Creek |
| 2/3/2011 | 5 | Corwin Springs |
| 2/7/2011 | 9 | US 89/Little Trail Creek |
| 2/8/2011 | 2 | US 89/Little Trail Creek |
| 2/12/2011 | 1 | Producer A property |
| 2/14/2011 | 2 | US 89/Little Trail Creek |
| 2/15/2011 | 2 | US 89/Little Trail Creek |
| 2/16/2011 | 1 | Unsuccessful haze from Corwin Springs; bull went up mountain to Bassett Creek |
| 2/24/2011 | 6 | Producer A property |
| 3/6/2011 | 5 | Yankee Jim Canyon |
| 3/10/2011 | 4 | CUT property east of river |
| 3/11/2011 | 4 | CUT property east of river (Corwin Springs) |
| 3/21/2011 | 6 | Yankee Jim Canyon/Sphinx Creek |
| 3/22/2011 | 6 | Entrance of Yankee Jim Canyon |
| 3/30/2011 | 1 | Producer A property |
| 4/2/2011 | 5 | Producer A property |
| 4/9/2011 | 1 | Unsuccessful haze from east side of river into YNP; bull went into Gardiner |
| 4/11/2011 | 5 | Private property complaint east of river |
| 4/15/2011 | 7 | Landowner B property |
| 4/16/2011 | 11 | Landowner B property |
| 4/16/2011 | 11 | Producer A property |

Table 5.—Bull bison attempts to exit the North Side, per Monitoring Metric 3. (Producer A: BH; Landowner B: FR)

| Date | # Bulls | Location |
|-----------|---------|--|
| 4/18/2011 | 19 | Yankee Jim Canyon |
| 4/18/2011 | 10 | Yankee Jim Canyon |
| 4/18/2011 | 6 | Landowner B property |
| 4/18/2011 | 15 | Unsuccessful haze from Cedar Creek |
| 4/19/2011 | 3 | Producer A property |
| 4/20/2011 | 4 | Landowner B property |
| 4/20/2011 | 5 | Corwin Springs east of river |
| 4/21/2011 | 3 | LaDuke Springs east of river |
| 4/21/2011 | 8 | Private property north of Little Trail Creek |
| 4/21/2011 | 11 | Up Little Trail Creek |
| 4/22/2011 | 2 | Landowner B property |
| 4/22/2011 | 3 | Corwin Springs east of river |
| 4/22/2011 | 6 | Producer A property |
| 4/23/2011 | 2 | Corwin Springs east of river |
| 4/23/2011 | 11 | Corwin Springs east of river |
| 4/24/2011 | 2 | Papesh Ln area |
| 4/24/2011 | 59 | Corwin Springs east of river |
| 4/25/2011 | 2 | Producer A property |
| 4/26/2011 | 20 | Up Little Trail Creek |
| 4/26/2011 | 12 | Mile post 5 on east side of river |
| 4/27/2011 | 17 | LaDuke Springs east of river |
| 4/27/2011 | 3 | Producer A property |
| 4/27/2011 | 6 | Brogan's landing |
| 4/27/2011 | 1 | Corwin Springs east of river |
| 4/28/2011 | 6 | Brogan's landing |
| 4/28/2011 | 1 | Corwin Springs east of river |
| 4/28/2011 | 3 | Producer A property |
| 4/28/2011 | 1 | Producer A property |
| 4/29/2011 | 2 | Brogan's landing |
| 4/29/2011 | 2 | Producer A property |
| 4/30/2011 | 9 | US 89/Little Trail Creek |
| 5/2/2011 | 12 | Corwin Springs east of river |
| 5/2/2011 | 11 | Mile post 10 east of river |
| 5/3/2011 | 6 | Mile post 5 east of river |
| 5/3/2011 | 6 | Papesh subdivision |
| 5/3/2011 | 12 | Cedar Creek Trailhead |
| 5/3/2011 | 3 | Rigler Bluff subdivision |
| 5/4/2011 | 1 | North of Corwin Springs (old injury, lethal removal) |
| 5/5/2011 | 5 | Producer A property |
| 5/5/2011 | 8 | McConnell subdivision ** |
| 5/5/2011 | 1 | Producer A property |
| 5/6/2011 | 2 | East side of river |
| 5/7/2011 | 5 | Producer A property |
| 5/7/2011 | 20 | Little Trail Creek |
| 5/8/2011 | 1 | McConnell fishing access ** |
| 5/12/2011 | 3 | LaDuke Springs east of river |

** McConnell river access is in the Eagle Creek area and technically an area bison can access year around.

ACTION 1.3A: WORK WITH PRIVATE LAND OWNERS AND LIVESTOCK PRODUCERS AND OPERATORS TO PROVIDE CONFLICT-FREE HABITAT IN THE HEBGEN AND GARDINER BASINS.

Monitoring Metric 1: Create an annual record of the: a) number of acres made available to bison from conservation easements (Lead = MFWP); b) locations, numbers, types, and turn-out/off dates for cattle grazed on private land in the Hebgen and Gardiner basins (Lead = MDOL); and c) extent of fencing erected to separate bison from livestock (Lead = MDOL).

No known acreage was made available to bison from new conservation easements during the 2010/11 season.

North Management Area

Table 6.—Locations, numbers, types and turnout and off dates for cattle grazed on private land (A) in the Gardiner Basin, and (B) near the Gardiner Basin.

| | | | | | | | |
|-----|-----------------------|------|------------|---------|------------|------------|-------------|
| (A) | Owner | Zone | No. Cattle | Maximum | Class | On-date | Off-date |
| | BH | 3/GB | 20/1 | | pairs/bull | year-round | |
| | JT | 3/GB | 23 | | pairs | June 1 | October 15 |
| (B) | Owner | Zone | No. Cattle | Maximum | Class | On-date | Off-date |
| | VS | 3 | 100 | 250 | pairs | May 21 | December 31 |
| | Grizzly Creek | 3 | 100 | 250 | pairs | May 21 | December 31 |
| | Yellowstone Cattle Co | 3 | 100 | 600 | pairs | May 21 | December 1 |
| | B-Bar | 3 | 150 | 600 | pairs | June 15 | November 15 |
| | Anderson Ranch | 3 | 100 | 160 | pairs | June 15 | November 15 |
| | West Creek Ranch | 3 | 100 | 100 | pairs | June 1 | November 1 |

West Management Area

Table 7.—Locations, number, types, and turn-out/off dates for cattle grazed on private land in the Hebgen basin.

| Property Owner | Livestock Owner | Zone | Date in | No. Cows | No. Calves | No. Bulls | No. Yearling Heifers | No. Yearling Steers |
|-------------------------|----------------------|------|------------------|----------|------------|-----------|----------------------|---------------------|
| SR Red Creek Ranch | BM Reed Point, MT | 2 | 6/26 | 185 | 185 | 5 | | |
| RS Duck Creek | BM Reed Point, MT | 2 | 7/7 | 26 | 26 | 1 | | |
| PP Deep Well Ranch | LM Sheridan, MT | 3 | 6/1 ¹ | 293 | 293 | 7 | | |
| LD Quarter Circle JK | CC/BF Cameron, MT | 3 | 6/30 | 15 | 15 | | 10 | |
| RP Diamond P Ranch | BM Billings, MT | 3 | 6/1 ² | -- | 10 | 22 | 6 | 4 |

¹ Discrepancy exists between agencies regarding whether cattle turn on date was 6/1 or instead several weeks later.

² Discrepancy exists between agencies regarding whether cattle turn on date was 6/1 or instead several weeks later.

North Management Area Fencing

- The bison quarantine feasibility study is also located in the north management area near Corwin Springs, Montana, with approximately 50 bison in double-fenced pastures throughout the year.
- A cattle guard was put in across Highway 89 and an adjoining fence was constructed at the entrance of Yankee Jim Canyon at the boundary of Zone 3 during the 2011 management season.
- The property where Producer A (see Action item 1.2B, Monitoring Metric #3) grazes his cattle during the spring is being fenced on three sides (except the river side) with high tensile, six strand fence, with every other wire on the fence electrified and with a visual deterrent on one strand. This should reduce the opportunity for bison to commingle with cattle on these premises. Fencing effectiveness is diminished because of a) lack of fencing along the Yellowstone River, and b) limited fence height.
- Although Producer C's (HR) has not had significant problems with bison co-mingling, the property is being fenced on the western boundary (road side) with a jackleg fence to minimize the likelihood of bison entering the property.

ACTION 1.3B: 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.

Monitoring Metric 1: Annually document the numbers, timing, and types of reported incidents for human safety and property damage related to bison (Lead = MFWP with support from MDOL).

See Action 1.2A, Monitoring Metric 2.

Data for MFWP activities for 2010/2011 can be found in Appendices D and E.

Monitoring Metric 2: Annually document the numbers and types of actions taken to provide conflict-free habitat for bison (Lead = MFWP with support from MDOL).

Data for MFWP activities for 2010/2011 can be found in Appendices D and E.

Numerous proposed adaptive management adjustments were agreed to in principle by the partners at the May 2011 IBMP meeting.

ACTION 1.3C: 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 IBMP.

Monitoring Metric 1: Annually track the status (e.g. number of acres, location, etc.) of active and inactive cattle grazing allotments on public lands (Lead = USFS).

Forest Service grazing allotments within and near the adaptive management areas are summarized in Appendix F, and changes to their management are briefly summarized below. However, it is important to note that allotment "status" (Active, Vacant, Closed—Appendix F) do not correspond with compatibility for bison presence on those allotments. The Gallatin National Forest can modify the conditions of grazing permits and use other means to alleviate potential bison/livestock conflicts when necessary as part of proposed adaptive management changes.

North Side

Slip and Slide Allotment: One of two permits waived; 47 cow/calf pairs on one permit remaining in this allotment (previously 213 pairs). The Section 22 and Mill Creek Allotments with 36 pairs were waived back to the government leaving these vacant. One of two permits for the Green Lake Allotment was waived, leaving 46 pairs (from 69).

West Side

Wapiti Allotment is vacant; the second permittee waived his permit in 2010. South Fork and Watkins Allotments are under NEPA analysis. One alternative under consideration directly addresses the opportunity to modify the type of livestock on the allotment, should the management zone boundaries change for bison, to alleviate concerns for brucellosis transmission.

ACTION 2.1A: INCREASE THE UNDERSTANDING OF BISON POPULATION DYNAMICS TO INFORM ADAPTIVE MANAGEMENT AND REDUCE SHARP INCREASES AND DECREASES IN BISON ABUNDANCE.

Monitoring Metric 1: Conduct aerial and ground surveys to estimate the annual abundance of bison each summer (Lead = NPS).

NPS staff completed three aerial surveys of the bison population during June and July 2010 and estimated a minimum population size of 3,837 bison with a 95% confidence interval around this estimate as 2,606 to 5,067 bison (Figure 7).

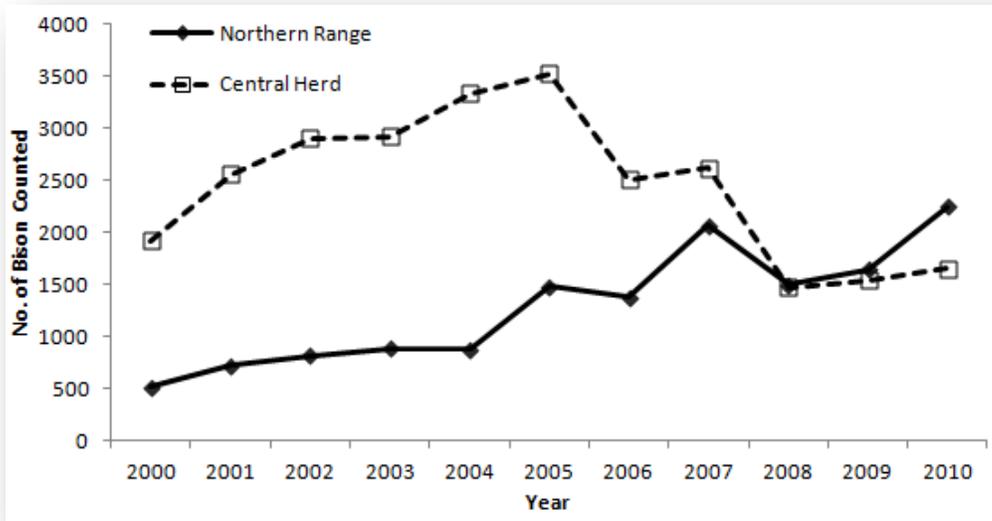


Figure 7.—Bison count of the two breeding herds of Yellowstone bison from 2000 to present.

Monitoring Metric 2: Document and evaluate relationships between bison migration to the boundary of YELL and bison abundance, population (or subpopulation) growth rates, and snow pack in the central and northern herds (Lead = NPS).

NPS staff collaborated with scientists from Montana State University, California State University Monterey Bay, National Aeronautical and Space Administration, and Yellowstone Ecological Research Center to further analyze the relationships between bison population size, winter severity, and the number of bison removed near the boundary of YELL (Geremia et al. 2011b). Migration differed at the scale of herds (central, northern), but a single unifying exponential model was useful for predicting migrations by both herds. Annual maxima of bison migrating beyond the northern boundary occurred during the senescent vegetation period (February-March), while peak migration to the western boundary occurred during May when high quality forage was becoming readily available (Thein et al. 2009). Migration beyond the northern park boundary was affected by herd size, accumulated snow pack, and forage biomass. Migration beyond the western park boundary was less influenced by these predictors and model predictions since 2006 suggest that additional drivers of migration (e.g., learned behavior, onset of vegetation green-up) were not included in the model. Simulations of migrations over the next decade suggest that a strategy of sliding tolerance, where more bison are allowed beyond park boundaries during severe climate conditions, may increase hunting opportunities that could, in turn, decrease episodic, large-scale reductions to the Yellowstone bison population in the foreseeable future.

Monitoring Metric 3: Continue to obtain estimates of population abundance through the remainder of the year based on surveys, knowledge of management removals, and survival probabilities (Lead = NPS).

NPS staff completed an aerial survey of bison distribution on February 14, 2011, during which they observed 2,234 bison (805 on the central interior ranges and 1,429 on the northern range). At this point in winter, 524 bison were

being held at the Stephens Creek capture facility in northern YELL and about 150 bison had been harvested by public and treaty hunters.

Monitoring Metric 4: Conduct an assessment of population range for bison in YELL that successfully addresses the goals of the IBMP by retaining genetic diversity and the ecological function and role of bison, while lessening the likelihood of large-scale migrations to the park boundary and remaining below the estimated carrying capacity of the park's forage base (Lead = NPS).

NPS staff synthesized available information and interpreted results of a spatially-explicit model of the Yellowstone system (Coughenour 2005) in a peer-reviewed article published in the journal *Biological Conservation* (Plumb et al. 2009). Findings suggest that bison abundance has not exceeded the theoretical food-limited carrying capacity of approximately 6,200 in YELL, but more bison migrate earlier to lower-elevation winter ranges as numbers increase and climatic factors interact with density to limit nutritional intake and foraging efficiency. NPS staff believe that a bison population that varies on a decadal scale between 2,500 and 4,500 animals should satisfy the collective long-term interests of stakeholders, as a balance between the park's forage base, conservation of the genetic integrity of the bison population, protection of their migratory tendencies, brucellosis risk management, and other societal constraints related to management of massive free-ranging wildlife.

Gross et al. (2006) showed that maintaining a herd size of 1000 bison would likely retain 90% of existing allelic diversity for 200 years. However, while the initial model of Gross et al. (2006) was informative, it did not consider the effects of variance in male reproductive success or annual variation in population size due to culling, both of which are relevant factors for maintaining genetic diversity. Pérez-Figueroa et al. (2010) considered both these factors when assessing the potential loss of genetic heterozygosity and allelic diversity from the Yellowstone bison population. Genetic heterozygosity was maintained at more than 95% over 200 years (~28 bison generations) for simulation scenarios with a population size greater than 500 bison. Conservation of 95% of the current level of allelic diversity was likely during the first 100 years under most scenarios considered in the model, including moderate-to-high variations in male reproductive success, population sizes greater than 2,000 bison, and approximately five alleles per locus, regardless of whether culling strategies resulted in high or low fluctuations in abundance. Maintenance of 95% of allelic diversity was likely with a fluctuating population size that increased to greater than 3,500 bison and averaged around 3,000 bison (Pérez-Figueroa et al. 2010). In addition, the findings of Pérez-Figueroa et al. (2010) suggest that culling will seldom accelerate loss of genetic variation when population size remains larger than 2,000 to 3,000 individuals.

ACTION 2.1B: INCREASE THE UNDERSTANDING OF GENETICS OF BISON IN YELL TO INFORM ADAPTIVE MANAGEMENT.

Monitoring Metric 1: Complete an assessment of the existing genetic diversity in bison and how the genetic integrity of bison may be affected by management removals (all sources combined) by October 2010 to estimate existing genetic diversity and substructure in the population (Lead = NPS).

Through collaboration with colleagues at University of Montana, DNA extractions were successfully conducted with fecal samples collected from Yellowstone bison in the northern and central breeding herds during 2006 and 2008. Genetic differentiation between the two herds based on mitochondrial DNA extraction of the 2006 samples was described by Gardipee (2007) and resulted in rather large differences ($F_{ST} = 0.402$). However, estimates of differentiation between the breeding ranges based on microsatellite analyses showed a much smaller difference ($F_{ST} = 0.02$ in 2006; $F_{ST} = 0.01$ in 2008). F_{ST} is the portion of total genetic variance contained in a subpopulation compared to the total genetic variance. Values can range from 0 to 1 and high F_{ST} implies considerable differentiation among subpopulations. In bison, mitochondria are normally inherited exclusively from the mother, while microsatellites, which are repeating sequences of 1-6 base pairs of DNA, result from a mixing of DNA from both parents. Thus, while the mitochondrial DNA results suggest female Yellowstone bison exhibit moderate to high fidelity to their breeding ranges, the microsatellite results suggest that males commonly disperse and contribute to gene flow between the two breeding herds.

Monitoring Metric 2: Conduct an assessment of the genetic diversity necessary to maintain a robust, wild, free-ranging population that is able to adapt to future conditions (Lead = NPS).

NPS staff collaborated with colleagues at the University of Montana to complete an assessment of how management actions may affect the conservation of genetic diversity in Yellowstone bison. The team developed a mathematical model to quantify the influences of population size, removals, and male reproductive success on the maintenance of heterozygosity and allelic diversity for 100 and 200 years (Pérez-Figueroa et al. 2010). Input values to the model were derived from age structure, genetic, and demographic data on Yellowstone bison. Heterozygosity was

maintained at more than 95% over 200 years (28 bison generations) for simulation scenarios with a population size of more than 500 bison. The conservation of allelic diversity was dependent on average population size in fluctuating populations. Simulations suggested that 95% of allelic diversity would be maintained over 100 years if the total population size remained above 2,000-3,000 bison. Culling scenarios had little effect on allelic diversity or the effective population size.

ACTION 2.1C: INCREASE UNDERSTANDING OF THE ECOLOGICAL ROLE OF BISON TO INFORM ADAPTIVE MANAGEMENT BY COMMISSIONING A COMPREHENSIVE REVIEW AND ASSESSMENT.

Monitoring Metric: Develop and implement by October 2011 a joint research strategy agreed to by the interagency partners that focuses on understanding the role and function of bison for providing nutrient redistribution, prey and carrion, and microhabitats for other species (Lead = NPS).

During summer 2011, YELL collaborated with Dr. Doug Frank at Syracuse University to identify six study sites across the summer range for bison in northern Yellowstone. Five or six grazing exclosures were deployed at each site. Production and percent consumption estimates were gathered in late autumn 2011. During the 1980s and 1990s, migratory ungulates on the northern grassland of YELL had tight biogeochemical linkages with plants and soil microbes that doubled the rate of net nitrogen mineralization, stimulated aboveground production by as much as 43 percent, and stimulated belowground productivity by 35 percent (Frank and McNaughton 1993). These biogeochemical linkages were largely driven by high densities of elk that deposited large quantities of nitrogen, phosphorus, and other nutrients via dung and urine. However, rates of ungulate grazing intensity and grassland nitrogen mineralization were reduced by 25-53 percent by 1999-2001, partially as a result of 60% fewer elk. Since 2002, bison numbers on the northern range have more than doubled from 813 to 2,400 this year. Larger groups of grazing bison could potentially have quite different effects than elk on nutrient redistribution and cycling on northern Yellowstone grasslands. The work initiated this summer is planned to elucidate the influence of recent changes in elk and bison numbers and distributions on ecosystem processes such as the spatial pattern and intensity of ungulate grazing and grassland energy and nutrient dynamics. The project will replicate previous work describing plant production on grazed and ungrazed sites sampled 10 and 20 years ago (Frank and McNaughton 1993, Frank 2008) to compare the effects of grazing across multiple decades and evaluate the effects of changes in grazer densities (e.g., bison, elk) on nutrient cycling and plant productivity.

ACTION 2.2A: USE SLAUGHTER ONLY WHEN NECESSARY; ATTEMPT TO USE OTHER RISK MANAGEMENT TOOLS FIRST.

Monitoring Metric 1: Annually document the number, age, sex, and sero-status of bison sent to slaughter (Lead = APHIS with the MDOL).

No bison were sent to slaughter this management season.

ACTION 2.2B: IN ZONE 2 LANDS ADJACENT TO YELL, 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.

Monitoring Metric 1: Weekly and annual summaries of bison harvested by state and treaty hunters (Lead = MFWP / Nez Perce / Confederated Salish and Kootenai Tribes).

Montana Fish, Wildlife and Parks along with the Confederated Salish & Kootenai Tribes, Nez Perce Tribe, Shoshone Bannock Tribes, and Confederated Tribes of the Umatilla were the lead agencies/governments regulating bison harvest through hunting. MFWP Wardens monitored the hunting activities, worked collaboratively with Tribal Enforcement Officer to ensure a safe, ethical and rewarding hunt experience. Montana FWP Wardens also acted as a liaison between the Gardiner community and the tribes.

Currently each Tribe sets its own season and reporting requirements; none presently require mandatory reporting to MFWP. The breakout of available harvest information follows:

- Hunting season is set by MFWP for state hunters. State hunters harvested 22 bison out of 44 permits issued during the 2010/2011 hunt.

- Salish-Kootenai hunters, hunting from September through January, harvested 81 animals, composed of mostly males on the North Side and females on the West Side of YELL. The CSKT tribal council approved a later hunt for bull bison, but then decided not to exercise this option so as not to conflict with IBMP adaptive management efforts.
- The Nez Perce Tribe hunted December–March. Like the CSKT, the NP hunters attend a mandatory orientation before the hunt commences. The Nez Perce Tribe reported harvesting 80 bison and issuing 125 permits
- The Umatilla Tribe reported harvesting 11 bison.
- The Shoshone and Bannock tribes reported harvesting no bison because they did not travel to the area to hunt for bison.

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.

Monitoring Metric 1: Annual summary of bison sent to quarantine and bison transported from quarantine to suitable restoration sites (Lead = MFWP/APHIS).

No bison were transported to bison quarantine and to date no bison have been transported from quarantine to suitable restoration sites. In February of 2010 the 87 bison from the first cohort eligible for translocation were transported to the Green Ranch (Turner Enterprises). February 2010 marked the beginning of a 4-5 year ‘soft release’ and monitoring period for these bison.

Monitoring Metric 2: Annual summaries from bison populations restored using quarantined bison from YELL, including numbers, demographic rates, and implemented risk management actions (Lead = MFWP/APHIS).

To date, no bison populations have been restored using quarantined bison from the study.

Monitoring Metric 3: Evaluate regulatory requirements and constraints for moving live bison, including adults, to suitable restoration sites (Lead = APHIS/MDOL).

On December 27, 2010 APHIS published an interim rule for brucellosis that relieved some constraints on movement of bison from an infected herd. APHIS currently expects little or no change to the final rule from the interim rule. The final rule will be put out for comment late in 2012. In the meantime, operations will continue under the interim rule. An evaluation of the quarantine study and further work on a permanent brucellosis rule are in progress and once completed they will serve as aids in selecting suitable restoration sites for bison.

Monitoring Metric 4: Conduct an assessment of the quarantine feasibility study and offer recommendations regarding whether the quarantine of bison should become operational (Lead = MFWP/APHIS).

APHIS and MFWP initiated a 5-year research program in 2005 and 2006 with bison calves from YELL to determine the latent expression of brucellosis and test the sensitivity of quarantine procedures for detecting the bacteria in multiple generations. This quarantine feasibility study has demonstrated that it is possible to consider these bison as free from brucellosis. Recommendations for quarantine are forthcoming and a full report of the results of bison quarantine will be available in 2012.

Monitoring Metric 5: Identify suitable release sites for brucellosis-free bison in quarantine, and solicit proposals from groups interested in restoring bison, through the Interagency/Tribal Bison Restoration Panel (Lead = MFWP/APHIS).

No proposals have been solicited from groups interested in restoring bison in 2010/2011. MFWP is working on an environmental assessment to translocate bison into the state of Montana.

ACTION 3.1A: CONTINUE BISON VACCINATION UNDER PREVAILING AUTHORITY.

Monitoring Metric 1: Document the number of eligible bison captured and vaccinated outside of the park (Lead = MDOL/APHIS).

No bison were captured and vaccinated outside of the park during winter 2010-2011.

Monitoring Metric 2: Implement the Bison and Brucellosis Monitoring and Surveillance Plan (Lead = NPS).

The NPS is implementing a bison monitoring and surveillance plan, as described later in this document (see page 30). NPS staff conducted brucellosis tests (FPA) on 692 bison captured at the Stephens Creek facility during January to May of 2011 (Table 8). Males tended to have higher seropositive rates than females, and young bison had significantly lower seropositive rates than older individuals (Figure 8). Seropositive rates in older age classes tended to asymptote (level off) and not change significantly with increasing age (Treanor et al. 2011).

Table 8.—Brucellosis test results (FPA) from bison captured at the Stephens Creek facility in Yellowstone National Park during January to May 2011.

| | Females | Males |
|---------------------------|-----------------|----------------|
| Total tested = 692 | 479 | 213 |
| Seropositive rates | | |
| Calves | 12 of 105 = 11% | 10 of 71 = 14% |
| Yearlings | 44 of 115 = 38% | 28 of 69 = 40% |
| 2 year-olds | 28 of 57 = 49% | 28 of 38 = 73% |
| 3 year-olds | 10 of 27 = 37% | 12 of 20 = 60% |
| 4 year-olds | 5 of 9 = 56% | 2 of 5 = 40% |
| 5+ year-olds | 89 of 165 = 54% | 5 of 7 = 71% |
| Vaccinates = 153 | 138 | 15 |

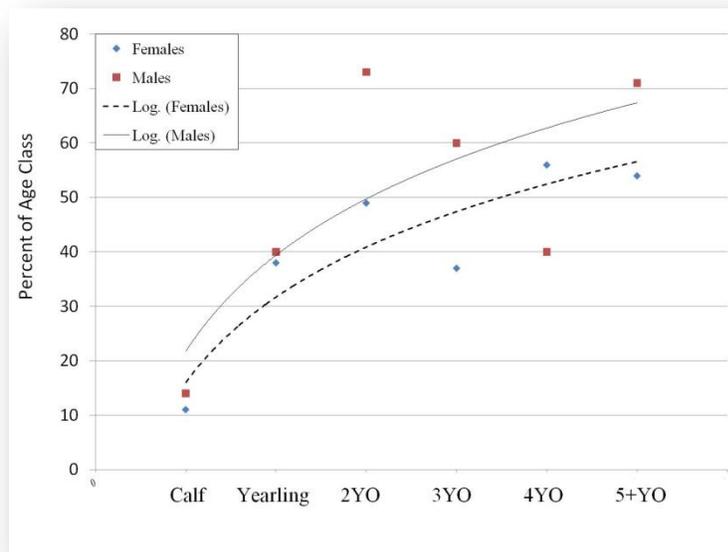


Figure 8.—Age-specific seropositive rates for male and female bison based on serology results from blood tests (FPA) collected at the Stephens Creek facility in Yellowstone National Park during January to May 2011.

The NPS vaccinated a total of 153 bison in 2011, including 76 calf and 61 yearling females, one seronegative non-pregnant 2-year-old female, and 15 calf and yearling males.

ACTION 3.1B: COMPLETE EIS PROCESSES (MEPA/NEPA) FOR REMOTE DELIVERY VACCINATION OF BISON AND USE THE OUTCOMES TO INFORM ADAPTIVE MANAGEMENT.

Monitoring Metric 1: Complete the NEPA process and reach a decision on whether remote delivery vaccination of bison can/will be employed inside YELL (Lead = NPS).

The decision for the NPS is whether or not to proceed with implementation of remote delivery vaccination of bison inside YELL. The purpose for the action is to address NPS responsibilities directed by a 2000 record of decision for the IBMP regarding the release of bison outside the park that are untested for exposure to brucellosis. The need for remote delivery vaccination is to protect Yellowstone bison by reducing brucellosis infection, preserving threatened cross-boundary migration processes, increasing tolerance for bison on essential winter ranges in Montana, and reducing the need for capture and large-scale shipments of bison to slaughter. The public comment period for the draft environmental impact statement (USDI 2010) closed on September 25, 2010 and the NPS completed the analysis of public comments with a contractor in August 2011. The NPS has drafted a final environmental impact statement and internal NPS review should begin in January 2012.

Monitoring Metric 2: Based on the MEPA process, determine if remote delivery vaccination of bison can/will be employed outside of YELL (Lead = MDOL).

MDOL will review the NPS final EIS prior to final evaluation of remote vaccination outside the park.

ACTION 3.1C: TEST AND VACCINATE CATTLE.

Monitoring Metric 1: By June 15th, determine and document the vaccination status of all “at-risk” cattle in or coming into the Hebgen and Gardiner basins. (Lead = MDOL/APHIS).

About 70% of the eligible cattle in Montana are vaccinated as calves for brucellosis. The percentage of cattle vaccinated is >70% in the southwest portion of the state where the risk of transmission of brucellosis from wildlife is greater. All vaccination eligible cattle in or coming into the Hebgen and Gardiner basins have had an Official Calfhood Vaccination for brucellosis. All those producers for which the Adult Vaccination for brucellosis is appropriate have been offered this type of vaccination at no cost. All resident cattle in the Gardiner Basin have been both calfhood and adult vaccinated as of spring 2011. One producer in the Hebgen Basin vaccinates their adult cattle on a regular basis. One additional producer in the Hebgen Basin has indicated they will begin adult vaccination of their adult cattle in the Fall 2011.

ACTION 3.2A: USE SPATIAL AND TEMPORAL SEPARATION AND HAZING TO PREVENT CATTLE/BISON INTERACTIONS.

Monitoring Metric 1: Document the minimum temporal separation and space between bison and cattle during February through June (Lead = MDOL).

In the North Management Area, numerous cattle and bison comingling events occurred between February and June. Please see Action Item 3.2B, Monitoring Metric 2, for a complete list.

In the West Management Area, mixed bison were present on private property in the South Fork area of Zone 3 as late as June 1, within 16 days of cattle turnout³. A single bull was present in Zone 3 west of the South Fork as late as July 1, 30 days after cattle turnout in the area.

Monitoring Metric 2: Document the number of times bison are successfully or unsuccessfully moved to create separation in time and space from cattle (Lead = MDOL).

Prior to May 15, 2010, bison moved into non-tolerance areas in the west management area 7 times. Bison moved west of the Madison Arm Resort once after April 15 and occupied Zone 3 west of the South Fork on five separate days, including four times after May 15. There were also five Zone 3 breaches up Highway 287 northwest of the management area, all of which occurred in the first two weeks of May. Bison remained in Montana after the May 15 haze-back date (up to 47 days) and resulted in hazing operations as referenced in Appendix A. In the North Management Area, numerous bison and cattle comingling events occurred as documented in Action Item 3.2B, Monitoring Metric 2.

³ Discrepancy exists between agencies regarding whether cattle turn on date was 6/1 or instead several weeks later.

During the third trimester of pregnancy, when abortion events due to brucellosis infection are most common (February to mid-April), there were up to 128 bison west of the park boundary. While there were no cattle in the Hebgen basin at this time, the *Brucella* organism has been shown to have an environmental persistence of up to 81, 63 and 44 days in materials deposited in February, March and April, respectively (Aune 2007). During the parturition season (April 15 to May 31), there remains the potential for a live birth event during which *Brucella* bacteria may be shed. There were approximately 200 bison in the Hebgen basin at this time, which coincides with the late part of the parturition period. While there were no cattle in the Hebgen basin, the *Brucella* organism has been shown to have an environmental persistence of up to 44 and 25 days in materials deposited in April and May, respectively. One observation of a group of 23 mixed bison occurred in the Zone 3 area west of the South Fork of the Madison River on June 1, and a single bull was removed from the area on July 1. On June 23, a group of 6 mixed bison was observed just north of Duck Creek near Hwy 191. This event occurred approximately 3 days prior to cattle occupying the area. Based on the intensive management operations conducted by the interagency partners, the risk of brucellosis transmission from bison to livestock in the Hebgen basin was minimized. Gestation status of the bison was not assessed.

ACTION 3.2B: 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.

Monitoring Metric 1: Document the number of additional acres of habitat made available for bison as a result of strategic fencing (Lead = MFWP/USFS/MDOL).

West Side

No fencing has been constructed on the West Side. During a meeting in early March, 2010, the agencies discussed the possibility of using strategic fencing from the northern end of the West Yellowstone airport fence approximately 1.8 miles to the Madison Arm. The fence was contemplated as a means of guiding bison onto Horse Butte to reduce the utilization of the south side of the Madison and therefore prevent Zone 3 breaches. The partners have not reached any conclusion on whether this action should be considered further.

North Side

Permit provided to MFWP to construct about 900 feet of jackleg fence on the Gallatin National Forest on the North Side to help keep bison south of Yankee Jim Canyon. MFWP has constructed the fence. A cattle guard and adjoining fence was put in across Highway 89 at the entrance to Yankee Jim Canyon to prevent Zone 3 breaches.

Monitoring Metric 2: Document fence damage or the number of times fencing fails to inhibit bison trespass on private property occupied by cattle (Lead = MDOL).

North Management Area

Table 9 lists the dates and numbers of bison involved in comingling events in the North Management Area. Bison and cattle comingling reports that were called in after dark were dates that MDOL did not conduct hazing operations. Any private property complaints in the West Management Area were referred to MFWP.

Table 9.—Documentations of fence damage or failure on the North Side

| Date | # of Bison | MDOL Hazing Operation |
|------|------------|-----------------------|
| 1/20 | 3 bulls | Yes |
| 1/29 | 16 mixed | Yes |
| 2/2 | 18 mixed | Yes |
| 2/14 | 16 mixed | Yes |
| 2/18 | 6 mixed | Yes |
| 2/24 | 6 bulls | Yes |
| 3/1 | 4 mixed | Yes |
| 3/2 | 4 mixed | Yes |
| 3/6 | 21 mixed | Yes |

Table 9.—Documentations of fence damage or failure on the North Side

| Date | # of Bison | MDOL Hazing Operation |
|------|------------|-----------------------|
| 4/4 | 18 mixed | No |
| 4/5 | 4 bulls | No |
| 4/16 | 33 mixed | No |
| 4/17 | 33 mixed | Yes |
| 4/19 | 2 bulls | Yes |
| 4/20 | Unknown | No |
| 4/25 | 2 bulls | Yes |
| 4/27 | 3 bulls | Yes |
| 4/28 | 3 bulls | Yes |
| 5/12 | 3 bulls | Yes |

ACTION 3.2C: HAZE BISON FROM THE HEBGEN BASIN INTO YELL WITH A TARGET DATE OF MAY 15.

Monitoring Metric 1: Consistent with management action 1.1a, assess the prevailing environmental conditions and reach consensus by May 13 on a step-wise, integrated plan for the end-of-winter return of bison into YELL from Zone 2 (Lead = MDOL/NPS).

The IBMP agencies began discussing potential haze-back dates on April 25, 2011. The above-average snow fall that occurred over the winter resulted in a slower than average melt period in which there was still 33 inches of snow on the ground near West Yellowstone on May 2 (for comparison, there was no snow on May 2, 2010). Thus, the agencies agreed to postpone the initiation of haze-back operations until snow conditions had receded and the spring green-up of vegetation had begun. The West Yellowstone SNOTEL site recorded no snow on May 16 and the IBMP agencies agreed to begin the end-of-winter return of bison into YELL on June 1 (Figure 9).

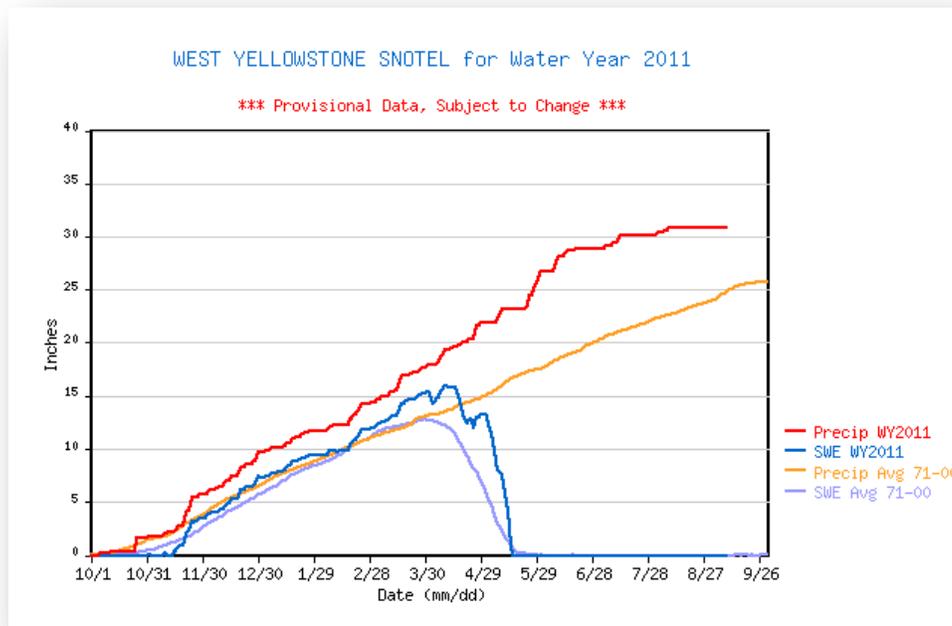


Figure 9.—Precipitation in inches of accumulated water in snow water equivalents compared to an average year. Data and graphic from Natural Resources Conservation Services SNOTEL site at West Yellowstone, Montana.

Monitoring Metric 2: Annually document the timing of the end-of-winter return of bison into YELL, the number of bison returned, prevailing environmental conditions, and success or lack thereof of hazing bison and getting them to remain in the park (Lead = MDOL/NPS).

The end-of-winter return of bison was facilitated by hazing operations conducted in June (Table 10, Figure 10). A late-May observation flight noted about 470 bison in the monitoring area west of Madison Junction (320 outside the park and 150 inside the park). The initial hazing operation conducted during the first week in June reduced the number of bison outside the park from 375 to less than 100. Over the next couple of weeks, 70 to 100 bison occupied the areas along the west boundary and hazing was needed one or two days per week to return these groups back to the park. A final operation was conducted on June 29 to return 7 males east into the park.

Mixed bison groups with adult females and calves were easier to haze on June 1 than during spring 2010. Hazing large groups of bison was more successful with assistance from the MDOL contract helicopter. Operations to move bison back into the park during June were successful because approximately 75% of the bison using Zone 2 at the beginning of the operations remained in the park following the first three days of operations (Table 11). Cattle arrived in the Hebgen basin on or about June 17⁴. Bison did not comingle with cattle in the Hebgen basin during winter or spring.

Table 10.—Number of bison hazed from the Hebgen Basin, Montana back into Yellowstone National Park along the west boundary during June 2011.

| Date | 1 | 2 | 3 | 8 | 9 | 14 | 22 | 23 | 29 |
|------------------------|-----|----|----|----|----|----|----|----|----|
| South Fork | 160 | | | | | | 71 | | |
| Horse Butte | 93 | | 45 | 74 | | 98 | | | |
| North of Grayling Arm | | 79 | | | 18 | | | 6 | 7 |
| Number hazed each week | 377 | | | 92 | | 98 | 77 | | 7 |

On three occasions bison were hazed from Cougar Meadows to the meadows near 7-mile bridge. Traffic was stopped on the west entrance road during these events for 45 minutes while the bison swam the Madison River and passed near 7-mile bridge to the eastern end of meadows. There were no extended 2-hour delays as in previous years while bison were hazed along the west entrance road to Madison Junction.

The prevailing environmental conditions this year resulted from a long, cold winter with above-average snow fall (Figure 9). The West Yellowstone SNOTEL site had measurable snow until May 16. Consistent overnight temperatures above freezing did not occur until after May 8 and growing-degree-days (an index for plant growth rate) were limited in late May due to cold wet weather (Figure 11). Flooding in the Madison Valley resulted from the deeper than average snow pack this spring. The low-lying meadows at 7-mile bridge and Madison Junction tend to flood when the stream discharge at the park boundary is greater than 1,000 cubic feet per second. This year the stream discharge hit flood stage on May 23 and stayed at that level through the end of June (Table 11).

⁴ Discrepancy exists between agencies regarding whether cattle turn on date was 6/1 or instead several weeks later.

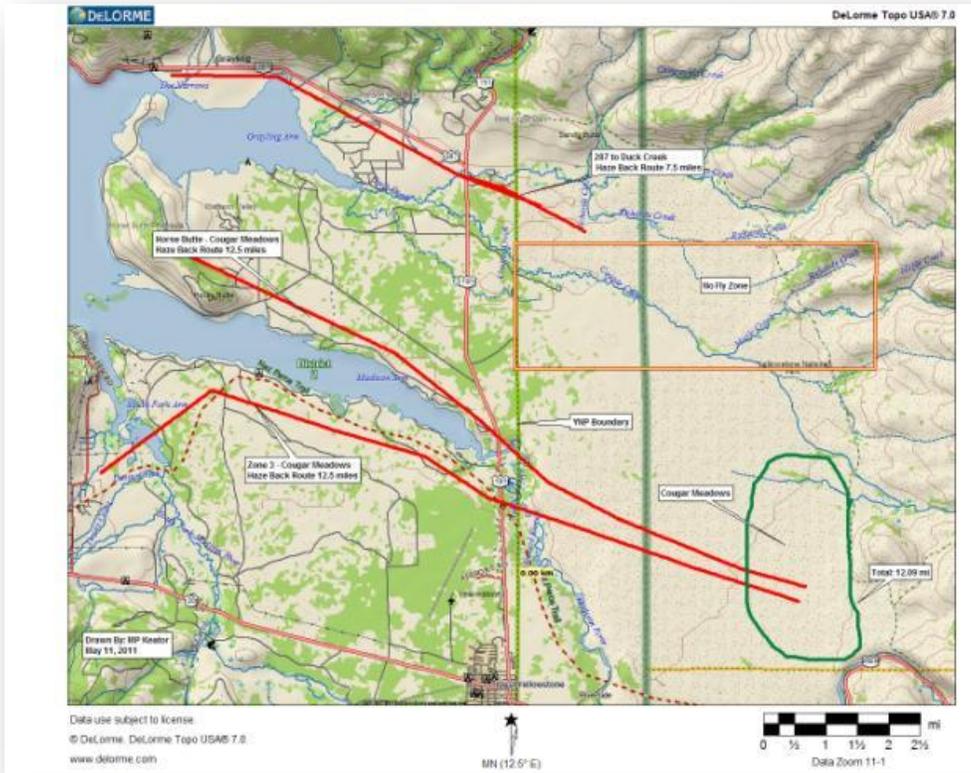


Figure 10.—Routes used to haze bison back to the National Park during the end-of-winter return to YELL in June 2011.

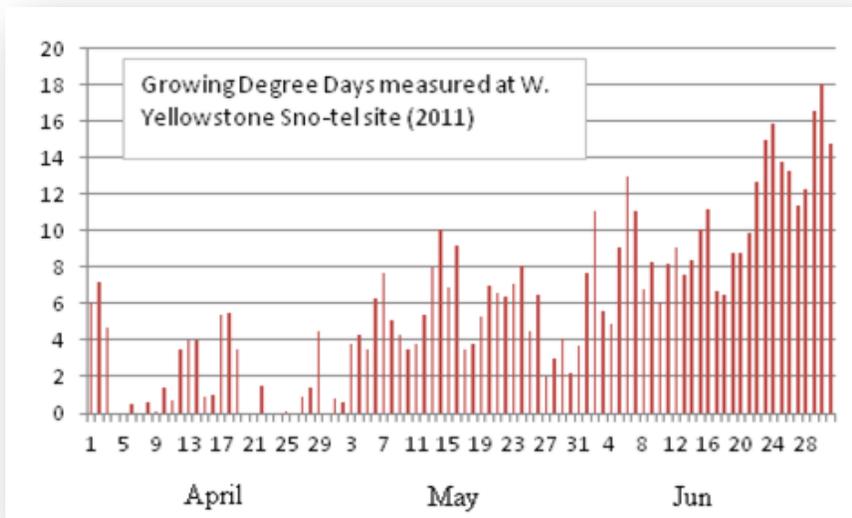


Figure 11.—Growing-degree-days measured from temperature data collected at the West Yellowstone SNOTEL site. Growing-degree-days is a calculation of maximum temperature minus minimum temperature divided by two and adjusted by a base value for species of interest. The base value used for this calculation was freezing point (zero degrees centigrade).

Table 11.—Environmental data for the Madison Valley during May and June of 2011.

| Date | Snow Water Equivalent (Year-to-date accumulation in inches) | Snow Depth (inches) | Precipitation Year-to-date (inches) | Air Temperature Degrees C | | Growing Degree Days (Temperature units) | Madison River Discharge (cfs) |
|-------|---|---------------------|-------------------------------------|---------------------------|------|---|-------------------------------|
| | | | | Max | Min | | |
| 05-01 | 13.2 | 34.0 | 21.9 | 8.9 | -7.8 | 0.8 | 385 |
| 05-02 | 13.0 | 33.0 | 21.9 | 8.8 | -7.5 | 0.6 | 381 |
| 05-03 | 12.2 | 29.0 | 21.9 | 12 | -9.7 | 3.8 | 413 |
| 05-04 | 11.4 | 27.0 | 21.9 | 10 | -0.6 | 4.3 | 430 |
| 05-05 | 10.6 | 26.0 | 21.9 | 9.6 | -2 | 3.5 | 437 |
| 05-06 | 9.8 | 22.0 | 21.9 | 14.2 | -3.6 | 6.3 | 509 |
| 05-07 | 8.7 | 20.0 | 21.9 | 13.6 | 1.7 | 7.7 | 591 |
| 05-08 | 8.0 | 19.0 | 22.4 | 11.9 | 2 | 5.1 | 763 |
| 05-09 | 7.7 | 18.0 | 22.7 | 8.3 | 1.5 | 4.3 | 728 |
| 05-10 | 7.4 | 17.0 | 23.2 | 7.4 | 1.7 | 3.5 | 708 |
| 05-11 | 6.6 | 15.0 | 23.2 | 8.1 | -1.5 | 3.8 | 605 |
| 05-12 | 5.7 | 13.0 | 23.2 | 15.2 | -2.9 | 5.4 | 706 |
| 05-13 | 4.1 | 9.0 | 23.2 | 17.9 | -4.7 | 8 | 802 |
| 05-14 | 2.6 | 6.0 | 23.2 | 21.1 | -1.2 | 10.1 | 902 |
| 05-15 | 0.8 | 3.0 | 23.2 | 13.3 | -1.3 | 6.9 | 933 |
| 05-16 | 0.0 | 0.0 | 23.2 | 17.5 | 0.5 | 9.2 | 1050 |
| 05-17 | 0.0 | 0.0 | 23.2 | 10 | -0.7 | 3.5 | 913 |
| 05-18 | 0.0 | 0.0 | 23.2 | 10.9 | -2.8 | 3.8 | 895 |
| 05-19 | 0.0 | 0.0 | 23.2 | 13.5 | -5.5 | 5.3 | 902 |
| 05-20 | 0.0 | 0.0 | 23.2 | 12.7 | 3.1 | 7 | 929 |
| 05-21 | 0.0 | 0.0 | 23.2 | 10.9 | 2.1 | 6.6 | 909 |
| 05-22 | 0.0 | 0.0 | 23.2 | 13.7 | -1.3 | 6.4 | 928 |
| 05-23 | 0.0 | 0.0 | 23.3 | 15.9 | -1.6 | 7.1 | 1080 |
| 05-24 | 0.0 | 0.0 | 23.5 | 17.1 | 2.7 | 8.1 | 1280 |
| 05-25 | 0.0 | 0.0 | 24.4 | 6.7 | 2.8 | 4.5 | 1340 |
| 05-26 | 0.0 | 0.0 | 24.4 | 14.8 | 0.3 | 6.5 | 1190 |
| 05-27 | 0.0 | 0.0 | 25.1 | 6.4 | -1.5 | 2 | 1050 |
| 05-28 | 0.0 | 0.0 | 25.5 | 10 | -2.2 | 3 | 1050 |
| 05-29 | 0.0 | 0.0 | 25.6 | 10.5 | 0.3 | 4.1 | 978 |
| 05-30 | 0.0 | 0.0 | 26.4 | 4.3 | 0.3 | 2.2 | 967 |
| 05-31 | 0.0 | 0.0 | 26.7 | 11.2 | 0.6 | 3.7 | 908 |
| 06-01 | 0.0 | 0.0 | 26.7 | 16.2 | 1.5 | 7.7 | 883 |
| 06-02 | 0.0 | 0.0 | 26.7 | 21.3 | -0.7 | 11.1 | 1010 |
| 06-03 | 0.0 | 0.0 | 26.7 | 10.2 | 1.1 | 5.6 | 1000 |
| 06-04 | 0.0 | 0.0 | 26.7 | 12.5 | -2.3 | 4.9 | 940 |
| 06-05 | 0.0 | 0.0 | 26.7 | 20.8 | -4.6 | 9.1 | 1050 |
| 06-06 | 0.0 | 0.0 | 26.7 | 25.4 | -0.6 | 13 | 1310 |
| 06-07 | 0.0 | 0.0 | 26.7 | 24.5 | -0.4 | 11.1 | 1640 |
| 06-08 | 0.0 | 0.0 | 27.6 | 12.1 | 3.8 | 6.8 | 2270 |

Table 11.—Environmental data for the Madison Valley during May and June of 2011.

| Date | Snow Water Equivalent (Year-to-date accumulation in inches) | Snow Depth (inches) | Precipitation Year-to-date (inches) | Air Temperature Degrees C | | Growing Degree Days (Temperature units) | Madison River Discharge (cfs) |
|-------|---|---------------------|-------------------------------------|---------------------------|------|---|-------------------------------|
| | | | | Max | Min | | |
| 06-09 | 0.0 | 0.0 | 28.0 | 14.2 | 3.8 | 8.3 | 2060 |
| 06-10 | 0.0 | 0.0 | 28.1 | 11.9 | 0.5 | 6.1 | 1560 |
| 06-11 | 0.0 | 0.0 | 28.1 | 15.9 | 0.7 | 8.2 | 1490 |
| 06-12 | 0.0 | 0.0 | 28.1 | 16.8 | 1 | 9.1 | 1500 |
| 06-13 | 0.0 | 0.0 | 28.4 | 13.6 | 3.7 | 7.6 | 1500 |
| 06-14 | 0.0 | 0.0 | 28.6 | 16.4 | 3.6 | 8.4 | 1700 |
| 06-15 | 0.0 | 0.0 | 28.7 | 18.1 | 0.2 | 10.1 | 1670 |
| 06-16 | 0.0 | 0.0 | 28.7 | 19.5 | 0.8 | 11.2 | 1610 |
| 06-17 | 0.0 | 0.0 | 28.7 | 13.7 | 1.1 | 6.7 | 1370 |
| 06-18 | 0.0 | 0.0 | 28.7 | 11.8 | 1.9 | 6.5 | 1170 |
| 06-19 | 0.0 | 0.0 | 28.9 | 16.3 | 1.6 | 8.8 | 1230 |
| 06-20 | 0.0 | 0.0 | 28.9 | 15.8 | 2.7 | 8.8 | 1210 |
| 06-21 | 0.0 | 0.0 | 28.9 | 17.4 | 3 | 9.9 | 1120 |
| 06-22 | 0.0 | 0.0 | 28.9 | 21.9 | 1 | 12.7 | 1170 |
| 06-23 | 0.0 | 0.0 | 28.9 | 24.8 | 1.9 | 15 | 1210 |
| 06-24 | 0.0 | 0.0 | 28.9 | 25.4 | 6.5 | 15.9 | 1260 |
| 06-25 | 0.0 | 0.0 | 28.9 | 22.1 | 3 | 13.8 | 1200 |
| 06-26 | 0.0 | 0.0 | 28.9 | 21.9 | 3 | 13.3 | 1140 |
| 06-27 | 0.0 | 0.0 | 28.9 | 19.2 | 0.8 | 11.4 | 1050 |
| 06-28 | 0.0 | 0.0 | 28.9 | 23.1 | -1.8 | 12.3 | 1030 |
| 06-29 | 0.0 | 0.0 | 28.9 | 28.8 | 1.9 | 16.6 | 1040 |
| 06-30 | 0.0 | 0.0 | 28.9 | 26.9 | 7 | 18 | 1050 |

- Shaded boxes in date column represents days hazing operations conducted
- Shaded box in snow depth column shows the date the snowpack disappeared
- Shaded boxes in the minimum temperature column shows the nights that temp dropped below freezing
- Shaded boxes in the Discharge column represent time periods of extensive flooding in Madison River Valley
- Growing Degree Days is a temperature equation that represents relative rate of growth in plant community

Please see Appendix A for numbers of bison outside YELL with related hazing operations in the West Management Area during the 2010-2011 management season. Operations began in mid-April and occurred on an average of one to three days per week until July 1, 2011. One lethal removal occurred west of the South Fork in Zone 3 when a single bull was not able to be hazed.

Monitoring Metric 3: Annually review and apply *B. abortus* persistence information, private land cattle turn-on dates, and applicable research results to determine the effects of haze-to-habitat actions on bison and their effectiveness at preventing the commingling of bison and cattle (Lead = MDOL).

Cattle turn-on dates were previously described for action 1.3a. The *Brucella* organism has been shown to have an environmental persistence of up to 81, 63, 44, and 25 days in materials deposited in February, March, April, and May, respectively (Aune 2007). Bison were present in Zone 3 of the West Management Area as late as June 1, which is within the window of *Brucella* persistence in the environment.

ACTION 3.2D: HAZE BISON FROM THE GARDINER BASIN INTO YELL WITH A TARGET DATE OF MAY 1.

Monitoring Metric 1: Consistent with management action 1.1b, assess the prevailing environmental conditions and reach consensus by April 15 on a step-wise, integrated plan for the end-of-winter return of bison into YELL from Zone 2 (Lead = MDOL/NPS).

Consensus was reached between the IBMP agencies by April 15 on a step-wise, integrated plan for the end-of-winter return of bison into YELL from Zone 2.

Monitoring Metric 2: Annually document the timing of the end-of-winter return of bison into YELL, the number of bison returned, prevailing environmental conditions, and success or lack thereof of hazing bison and getting them to remain in the park (Lead = MDOL/NPS).

See Appendix C for exact numbers of bison returned to YELL throughout the entire 2010-2011 management season. Bison continually left the park beginning in December, 2010, and were frequently hazed back into YELL until the end of May, 2011.

More than 300 bison were north of the park boundary in the Gardiner basin during April 7-19, with another 450 bison south of Reese Creek. Hazing operations were conducted 4-6 days per week from April 8 through the end of the month to move bison south to the park boundary, while simultaneously moving bison near the Reese Creek boundary south back into the park towards Mammoth.

During April 19-20, a large number of bison near Yankee Jim Canyon were hazed to the south end of the Gardiner basin. Thus, on April 21 only 28 bison were observed north of Reese Creek. However, some bison moved back to the north following the hazing operations and, on April 27 and 29, about 100 bison were hazed south into the park and towards Mammoth. Ground counts of bison in the Gardiner basin during the first week of May indicated bison abundance was less than 50 on May 6. Thus, management operations transitioned from hazing to releasing bison from the Stephens Creek and Corwin Springs facilities during May 7 to 25.

Three lethal removals occurred:

- On January 24, 2011, one cow refused several hazing attempts in the northern area of Zone 3 east of the Yellowstone River.
- On February 10, 2011, a severely crippled yearling bull was lethally removed from outside the quarantine pen near the entrance to Yankee Jim Canyon on the east side of the river.
- On May 4, 2011, a bull with an old leg injury became aggressive when hazing was attempted and was lethally removed from private property on the east side of the river north of Corwin Springs.

Monitoring Metric 3: Annually review and apply *B. abortus* persistence information, private land cattle turn-on dates, and applicable research results to determine the effects of haze-to-habitat actions on bison and their effectiveness at preventing the commingling of bison and cattle (Lead = MDOL).

Cattle turn-on dates were previously described for action 1.3a. The *Brucella* organism has been shown to have an environmental persistence of up to 81, 63, 44, and 25 days in materials deposited in February, March, April, and May, respectively (Aune 2007). There were numerous commingling events in the North Management Area involving cattle that are present year-round with mixed groups of bison as late as mid-April, and groups of bulls as late as mid-May. There was no detected transmission to livestock in the Hebgen or Gardiner basins based on testing results conducted in 2011.

YELLOWSTONE NATIONAL PARK BISON MONITORING AND SURVEILLANCE PLAN

OBJECTIVE 1. ESTIMATE THE ABUNDANCE, DEMOGRAPHY, AND LIMITING FACTORS FOR THE OVERALL BISON POPULATION AND TWO PRIMARY SUBPOPULATIONS (I.E., CENTRAL AND NORTHERN BREEDING HERDS).

NPS staff developed a population model using data collected from Yellowstone bison during 1970-2011 and estimated the abundance, composition, and trends of each breeding herd to evaluate the relative impacts of harvests and other types of management removals (Geremia et al. 2011a). Demographic estimates were integrated with a model of bison migration (Geremia et al. 2011b) to predict the numbers of bison moving to the park boundary each winter. These tools combined long-term monitoring data with information gained from radio-collared bison to draw conclusions about future conditions of Yellowstone bison. A decision-making process was developed to advise the management of population abundance and trans-boundary movements of bison. During June and early July, NPS staff conducted population counts and age and gender classifications of each breeding herd. They then used long-term weather forecasts and the models described above to predict herd abundances and compositions at the end of the upcoming winter, and the magnitude of numbers of bison migrating to park boundaries. NPS staff established annual removal objectives for bison based on abundance, disease, distribution, and demographic (age, herd, sex) goals to reduce bison numbers towards an end-of-winter target of 3,000, while progressing towards equal abundance in each herd and sex ratios of 50% adult males and 50% adult females in each herd. A variety of management tools were considered for reducing bison numbers including (1) public and treaty harvests in Montana, (2) selective culling (shipment to slaughter) at boundary capture facilities to reduce the proportion of infectious bison, (3) selective culling (shooting, shipment to slaughter) in Montana to prevent brucellosis transmission to nearby livestock or due to human safety or property damage concerns, (4) transfer of bison to American Indian tribes or other organizations for quarantine and eventual release, and (5) transfer bison to research facilities.

OBJECTIVE 2. DESCRIBE MIGRATORY AND DISPERSAL MOVEMENTS BY BISON AT A VARIETY OF TEMPORAL AND SPATIAL SCALES IN AND OUTSIDE THE PARK.

NPS staff collaborated with staff from Colorado State University to analyze the relationships between bison population size, winter severity, and the number of bison removed near the boundary of Yellowstone during 1990-2010 (Geremia et al. 2011b). Migration differed at the scale of herds, but a single unifying exponential model was useful for predicting migrations by both herds. Migration beyond the northern park boundary was affected by herd size, accumulated snow water equivalent, and aboveground dry biomass. Migration beyond the western park boundary was less influenced by these predictors, and model predictions since 2006 suggest additional drivers (e.g., learning) of migration were not in the model. Simulations of migrations over the next decade suggest that a strategy of sliding tolerance where more bison are allowed beyond park boundaries during severe climate conditions may be the only means of avoiding episodic, large-scale reductions to the Yellowstone bison population in the foreseeable future.

OBJECTIVE 3. ESTIMATE THE EXISTING HETEROZYGOSITY, ALLELIC DIVERSITY, AND LONG-TERM PROBABILITIES OF GENETIC CONSERVATION FOR THE OVERALL BISON POPULATION AND IDENTIFIED SUBPOPULATIONS.

The NPS reviewed a study by Pringle (2011) that concluded that some Yellowstone bison have deleterious genetic mutations and, as a result, "are predicted significantly impaired in aerobic capacity, disrupting highly evolved cold tolerance, winter feeding behaviors, escape from predators and competition for breeding." Bison with haplotype 6 in their mitochondrial genome carry a double mutation that affects two genes: cytochrome b and ATP6. These bison are primarily found in the central breeding herd based on recent genetic sampling. This inherited mutation could affect their production of energy (i.e., ATP produced by mitochondrial oxidative phosphorylation). Bison with haplotype 8 in their mitochondrial genome do not carry the double mutation and are primarily found in the northern breeding herd. Even if the genetic sequences and analyses reported by Pringle (2011) are correct, genetic mutation does not automatically equal genetic disease. There are multiple compensating mechanisms in biological systems that combine to overcome theoretical metabolic deficiencies. Also, there is direct evidence that even if Yellowstone bison have some sort of genetic deficiency, it has not been manifested through any biologically significant effect on their ability to survive. Estimated annual survival rates and birth rates for adult female bison were quite high during 1995-2006; especially given the severe, prolonged, high-elevation winter conditions and predator-rich environment in and near Yellowstone National Park. The NPS is taking steps to follow-up on Dr. Pringle's work and recommendations.

OBJECTIVE 4. ESTIMATE THE PROBABILITIES (I.E., RISKS) OF BRUCELLOSIS TRANSMISSION AMONG BISON, CATTLE, AND ELK, AND THE ELK FEED GROUNDS IN WYOMING AND NORTHERN YELLOWSTONE.

NPS and APHIS staff collaborated with colleagues at the University of California-Davis on a spatially-explicit assessment of brucellosis transmission risk among bison, elk, and cattle in the northern portion of the greater Yellowstone area (Schumaker et al. 2010). Population size and winter severity were major determinants influencing bison movements to lower elevation winter grazing areas, overlapping with federally-regulated domestic cattle grazing allotments. Increasing population size resulted in higher herd densities and increased bacterial shedding. Median total risk to cattle from elk and bison was 3.6 cattle-exposure event-days (95% P.I. 0.1-36.6). The estimated percentage of cattle exposure risk from the Yellowstone bison herd was small (0.0-0.3% of total risk) compared with elk which contributed 99.7-100% of the total risk. Natural herd migration and boundary management operations were important in minimizing the contribution of bison to cattle exposure risk, which supports continued boundary management operations for separation between bison and cattle. Transmission risks to elk from elk in other populations or from bison were very small. Minimal opportunity exists for *B. abortus* transmission from bison to elk under current natural conditions in the northern greater Yellowstone area. Management alternatives that reduce bison seroprevalence are unlikely to substantially reduce transmission risk from elk to cattle. Strategies that decrease elk herd densities and group sizes and reduce elk-to-elk transmission could reduce the overall risk to cattle grazing in the northern portion of the greater Yellowstone area. Efforts should be taken to reduce the comingling of cattle and elk, especially during the late gestation period for elk, when spontaneous elk abortions pose a risk for interspecies disease transmission. Bison vaccination did not meaningfully reduce *B. abortus* transmission risk to cattle. Effective strategies included delaying the turn-on date to cattle grazing allotments, reducing elk seroprevalence, reducing the number of cattle at-risk, or prohibiting the comingling of elk and cattle on individual premises.

OBJECTIVE 5. ESTIMATE AGE-SPECIFIC RATES OF BISON TESTING SEROPOSITIVE AND SERONEGATIVE FOR BRUCELLOSIS THAT ARE ALSO CULTURE POSITIVE AND THE PORTION OF SEROPOSITIVE BISON THAT REACT POSITIVELY ON SEROLOGIC TESTS DUE TO EXPOSURE TO CROSS-REACTIVE AGENTS OTHER THAN *B. ABORTUS* (E.G., *YERSINIA*).

NPS and APHIS staff sampled more than 400 bison that were consigned to slaughter during winter 2007-08 and collected blood and tissues to estimate the proportion of seropositive and seronegative bison that were actively infected with *B. abortus* (i.e., culture positive; Treanor et al. 2011). Removing brucellosis-infected bison is expected to reduce the level of population infection, but test and slaughter practices may instead be removing mainly recovered bison. Recovered animals could provide protection to the overall population through the effect of herd immunity, thereby reducing the spread of disease. Identifying recovered bison is difficult because serologic tests (i.e., blood tests) detect the presence of antibodies, indicating exposure, but cannot distinguish active from inactive infection. Age-specific serology and *B. abortus* culture results from slaughtered bison were integrated to estimate probabilities of active brucellosis infection using a Bayesian framework. Infection probabilities were associated with age in young bison (0-5 years old) and with elevated antibody levels in older bison (>5 years old). Results indicate that Yellowstone bison acquire *B. abortus* infection early in life but typically they recover as they grow older. A tool was developed to allow bison management to better reflect the probability that particular animals are infective, with the aim of conserving Yellowstone bison while reducing the risk of brucellosis transmission to cattle. Fluorescent polarization assay (FPA) values were higher in seropositive bison that were culture positive compared to seropositive bison that were culture negative, supporting that active infection is associated with increased antibody production. The two covariates (age and FPA) have management application to identify the probability of active infection within specified credible intervals. This would allow for removing bison that most likely contribute to brucellosis maintenance in the population, while keeping bison that contribute to herd immunity which reduces brucellosis transmission. Estimation of true infection probabilities can replace culling practices (such as the slaughter of all seropositive individuals) that conflict with bison conservation. Combining selective removal of infectious bison with additional management practices, such as vaccination, has the potential to advance an effective brucellosis reduction program.

OBJECTIVE 6. ESTIMATE THE TIMING AND PORTION OF REMOVALS FROM THE CENTRAL AND NORTHERN HERDS EACH WINTER, INCLUDING THE PORTION OF REMOVALS FROM EACH AGE AND SEX CLASS AND CALF-COW PAIRS.

NPS staff retrospectively evaluated if reality met expectations by comparing assumptions and predictions for the alternative selected from the Final Environmental Impact Statement and described in the Record of Decision for the

IBMP with observed impacts and changes since implementation of the plan began in 2001 (White et al. 2011). Intensive management near conservation area boundaries maintained separation between bison and cattle, with no transmission of brucellosis. However, brucellosis prevalence in the bison population was not reduced and the management plan underestimated bison abundance, distribution, and migration, which contributed to larger risk management culls (total >3,000 bison) than anticipated. Culls differentially affected breeding herds and altered gender structure, created reduced female cohorts, and temporarily dampened productivity. This assessment was used to develop adaptive management adjustments to the IBMP in 2008 and similar future assessments will be essential for effective management to conserve the largest free-ranging population of this iconic native species, while reducing brucellosis transmission risk to cattle.

OBJECTIVE 7. DOCUMENT BISON USE OF RISK MANAGEMENT ZONES OUTSIDE THE NORTHERN AND WESTERN BOUNDARIES OF YELLOWSTONE AND COMMINGLING WITH LIVESTOCK DURING THE LIKELY BRUCELLOSIS-INDUCED ABORTION PERIOD FOR BISON EACH SPRING.

Bison migrated outside the northern and the western boundaries of Yellowstone National Park during November 2010 to May 2011. Bison use of cattle-occupied pastures was observed numerous times in the North Management Area, but not in the western area. Bison often crossed the Yellowstone River from the vicinity of Stephens Creek and entered a pasture (Stermitz property) where it was unfenced along the river. Groups ranging from 1 to 39 bison were observed in this pasture on at least 10 occasions, with some mixed-gender groups of bison mingling with cattle during the brucellosis-induced abortion period (primarily from February to mid-May; Jones et al. 2010). However, no bison parturition events were observed or reported. A few male bison were also observed in the Rate/Thomas pastures (located approximately 12 miles north of Stephens Creek) on less than five occasions. However, no comingling with cattle occurred because cattle were kept in a different pasture.

North Management Area Chronology

By late December 2010, about 35 to 50 bison had accumulated in the Gardiner basin and about half of these bison were consistently moving north into the Zone 2 area along the Yellowstone River. At this time, additional bison were moving into the Gardiner basin every few days.

Sixty-eight bison were captured at the Stephens Creek facility during January 4-8 to select a group of 25 bison testing negative for brucellosis for a study of bison habitat use north of Yellowstone National Park. During this time, hazing operations pushed other small groups of bulls gathered along the northern park boundary south towards Gardiner, Montana (within the park). When the 25 test-negative bison were released north of the park on January 19, hazing operations continued to keep untested bison from moving north to interact with the test group. By January 28, all but one of the 25 animals in the study group had returned to the park on their own or through capture and return to the park. One bison stayed north near Cutler Lake until May, when it was returned to the park during the end-of-winter hazing operations.

By January 31, about 320 bison had accumulated in the Gardiner basin and the NPS was capturing groups that routinely moved north of Stephens Creek into the risk management zone. A flight on February 14 documented less than 50 bison in the Gardiner basin outside the Stephens Creek facility. The agencies managed bison distribution by hazing groups of up to 42 animals from private lands north of Reese Creek to the Stephens Creek area within the park. Few bison were migrating into the Gardiner basin during the latter half of February.

On March 23, a group of 6 male bison were prevented from moving north through Yankee Jim Canyon and were hazed back to Cutler Meadow where they were observed daily for the remainder of the month. Groups of female bison moving north of Reese Creek became common after March 25 and hazing operations were conducted on most days. On March 29, more than 50 bison were observed north of Corwin Springs and more than 100 bison were observed north of Reese Creek. The primary goal of hazing at this time was to keep groups with adult females from mingling with cattle.

During late March and early April, about 550 additional bison migrated into Gardiner basin, resulting in more than 300 bison north of the park boundary during April 7-19. On April 11, a thorough ground count detected 300 bison north of Reese Creek and another 450 bison south of Reese Creek. Hazing operations were conducted 4-6 days per week from April 8 through the end of the month. State personnel conducted operations to move bison south to the park, while park staff conducted operations to move bison south away from the Reese Creek boundary and, on occasion, south of the town of Gardiner to make space for other bison being brought back from north of the park boundary.

A major effort was conducted on April 19-20 to move a large number of bison near Yankee Jim Canyon south and to redistribute bison more to the south end of the Gardiner basin. This effort was successful and on April 21 only 28 bison were observed north of Reese Creek. Thereafter, the number of bison north of Reese Creek was generally less than

30 as hazing operations gathered groups of bison that arrived at Reese Creek and turned them south and back into the park.

During the third week in April, the sizes of bison groups hazed in the vicinity of the park boundary decreased from over 200 to less than 50 as many bison moved south and east out of the basin to points upstream along the Yellowstone River. On April 27 and 29, about 100 bison were moved south towards Gardiner (within the park). Due to persistent snow fall throughout April, some bison would drift back to the north following hazing operations and be gathered up in subsequent events.

Hazing operations during April reduced the number of bison in the Gardiner Basin from 750 on April 11 to 470 on April 19 and 250 on April 21. During the last week of April, the majority of bison in the Gardiner basin were located at the eastern (upstream) end, setting the stage for systematic release of bison that were held in the two fenced facilities (Stephens Creek and Corwin Springs).

Ground counts of bison in the Gardiner basin during the first week of May indicated a decrease in bison abundance from 270 to less than 50 on May 6. As a result of the general southward and eastward movements of bison, management operations transitioned from hazing to releasing bison from the Stephens Creek and Corwin Springs facilities during May 7 to 25.

West Management Area Chronology

Bison occupied the western risk management zone outside Yellowstone National Park for most of the autumn, winter, and spring months. There were 34 inches of snow at the West Yellowstone SNOTEL site on May 1, compared to zero inches during other recent years. This SNOTEL site registered zero inches of snow on May 16.

Bison operations began on May 1 when MDOL located 25 bison in Zone 3/Red Canyon/Highway 287 area. From May 1 to May 11, six separate hazing operations were conducted along Highway 287. A mixed group of 25 adult female and calf bison often occupied the road corridor because the right-of-way was clear of trees and presented the first grazing opportunities of the season. Areas outside the road corridor were snow covered with limited grazing opportunities.

On May 16, eight bison were hazed from the Denny Creek Road/Zone 3 to the old burn on the Madison Arm Road/Zone 2. On May 23, more than 20 bison were observed in Zone 3/Denny Creek Road during an aerial survey by MDOL. These bison remained in Zone 3 until May 25 when a mixed group of 38 adult female and calf bison were hazed from the Denny Creek Road/Zone 3 to Barns Hole/Zone 2. On May 18, eight bull bison (1 bull from Zone 3) were hazed east along Highway 287 to an area south of the highway that had limited grazing opportunities.

There were 10 separate breaches of Zone 3 by a total of 169 bison. A total of about 99 bison reached the Highway 287/Zone 3 area on seven occasions (May 1, 2, 4, 5, 9, 11, and 18). A total of about 70 bison reached the Denny Creek Road/Zone 3 area on 3 occasions (May 16, 25, and June 1).

June 1 was established as the date to begin moving all bison back into Yellowstone National Park. During June 1 through 3, 969 bison were hazed (24 from Zone 3, 353 from Zone 2, 592 from Zone 1). Mixed bison groups with adult females and calves were easier to haze on June 1 than during spring 2010. Hazing large groups of bison was more successful with assistance from the MDOL contract helicopter.

A second operation was conducted on June 8 and 9, during which 92 bison were hazed from Zone 2. A third operation was conducted on June 14 and 128 bison were hazed (98 from Zone 2, 30 from Zone 1). A fourth operation was conducted June 22 and 23, during which 192 bison were hazed (77 from Zone 2, 115 from Zone 1). On June 29, seven bulls were hazed from north of Duck Creek to Cougar Meadows.

Interagency operations to move bison back into the park during June were successful because approximately 75% of the bison using Zone 2 at the beginning of the operations remained in the park following the first three days of operations.

Cattle arrived in the Hebgen basin on or about June 17⁵. Bison did not commingle with cattle in the Hebgen basin during winter or spring.

⁵ Discrepancy exists between agencies regarding whether cattle turn on date was 6/1 or instead several weeks later.

OBJECTIVE 8. ESTIMATE THE EFFECTS OF HAZING OR TEMPORARILY HOLDING BISON IN CAPTURE PENS AT THE BOUNDARY OF YELLOWSTONE (FOR SPRING RELEASE BACK INTO THE PARK) ON SUBSEQUENT BISON MOVEMENTS OR POSSIBLE HABITUATION TO FEEDING.

Forty bison were captured during winter 2008 at the Stephens Creek capture facility and fitted with radio transmitters prior to their release in spring. The winter movements of these bison (minus mortalities) were monitored during winters 2009 through 2011 to evaluate if the capture and feeding of bison appeared to be influencing future migration tendencies towards the park boundary (Table 12). Results during these winters with snow packs ranging from modest (2010) to severe (2011) snow pack conditions suggest few bison are habituated to hay provided at the Stephens Creek capture facility and most bison do not migrate to lower elevations to seek forage until deep snow accumulates at higher elevations.

Table 12.—Winter movements of radio-marked bison following release from the Stephens Creek capture facility in spring of 2008.

| | Winter 2009 | Winter 2010 | Winter 2011 |
|---|----------------|----------------|----------------|
| Percent of marked bison returning to the Gardiner basin | 13 of 38 = 34% | 3 of 37 = 8% | 28 of 33 = 85% |
| Percent of marked bison returning to the Blacktail Deer Plateau, but not migrating as far as the Gardiner basin | 14 of 38 = 37% | 11 of 37 = 30% | 3 of 33 = 9% |
| Percent of marked bison that remained on interior ranges of the park | 8 of 38 = 21% | 19/37 = 51% | 1 of 33 = 3% |
| Percent of marked bison that migrated to the west boundary of the park | 3 of 38 = 8% | 4/37 = 11% | 1 of 33 = 3% |

OBJECTIVE 9. DETERMINE THE STRENGTH AND DURATION OF THE IMMUNE RESPONSE IN BISON FOLLOWING PARENTERAL (E.G., SYRINGE DELIVERY) VACCINATION FOR BRUCELLOSIS.

Through the Civilian Research and Development Foundation, the NPS provided cooperative funding to key Russian vaccinologists to develop the first comprehensive review of scientific laboratory and field studies on the primary Russian brucellosis vaccine derived from *B. abortus* strain 82 (SR82), and publish this report in an English language peer-reviewed scientific journal (Olsen et al. 2010, Ivanov et al. 2011). The smooth-rough strain SR82 vaccine combines the desired weak responses on standard tests with high efficacy against brucellosis. In 1974, prior to widespread use of strain SR82 vaccine, 5,300+ cattle herds were known to be infected with *B. abortus* across the former Soviet Union. By January 2008, only 68 cattle herds in 18 regions were known to be infected, and strain SR82 continues to be the most widely and successfully used vaccine in many regions of the Russian Federation.

OBJECTIVE 10. DETERMINE THE STRENGTH AND DURATION OF IMMUNE RESPONSE IN BISON FOLLOWING REMOTE DELIVERY (E.G. BIO-BULLET) VACCINATION FOR BRUCELLOSIS.

NPS staff collaborated with the University of Utah and the Agricultural Research Service to develop a protocol for pursuing minor enhancements to the vaccine payload performance and the ballistic delivery system under quality controlled production prior to field test on bison. It will also involve (1) negotiating supply agreements with various reagent vendors, (2) developing scientific and technical protocols to facilitate technology transfer to a contractor who can procure and produce the entire vaccine component line, (3) initiation and supervision of a production program for biobullet vaccine formulations under quality systems validation, and (4) final delivery of ready-to-use biobullet vaccine formulations and protocols for field use (Grainger 2011).

OBJECTIVE 11. DOCUMENT LONG-TERM TRENDS IN THE PREVALENCE OF BRUCELLOSIS IN BISON, AND THE UNDERPINNING EFFECTS OF REMOTE AND/OR PARENTERAL VACCINATION, OTHER RISK MANAGEMENT ACTIONS (E.G., HARVEST, CULLING), AND PREVAILING ECOLOGICAL CONDITIONS (E.G. WINTER-KILL, PREDATION) ON THESE TRENDS.

NPS staff collaborated with colleagues at the U.S. Geological Survey and Montana State University to use an individually-based epidemiological model to assess the relative efficacies of three management interventions (sterilization, vaccination, and test-and-remove; Ebinger et al. 2011). Sterilization and test-and-remove were most successful at reducing seroprevalence when they were targeted at young seropositive animals, which are the most likely age and sex category to be infectious. Sterilization and test-and-remove, however, also required the most effort to implement. Vaccination was less effective, but also required less effort to implement. For the treatment efforts we explored (50-100 females per year), sterilization had little impact on the bison population growth rate when selectively applied and the population growth rate usually increased by year 25 due to the reduced number of disease-induced abortions. Initial declines in seroprevalence followed by rapid increases occurred in 3-13% of simulations with sterilization and test-and-remove, but not vaccination. We believe this is due to the interaction of super-spreading events and the loss of herd immunity in the later stages of control efforts. Vaccination reduces seroprevalence while maintaining herd-immunity and minimizing the occurrence of super-spreading events. Sterilization and test-and-remove reduce herd-immunity and super-spreading events become more common as the population becomes more susceptible. Sterilization provided a mechanism for achieving large disease reductions while simultaneously limiting population growth, which may be advantageous in some management scenarios. However, the field effort required to find the small segment of the population that is infectious rather than susceptible or recovered will likely limit the utility of this approach in many free-ranging wildlife populations.

NPS staff prepared a Draft Environmental Impact Statement to decide whether or not to proceed with implementation of remote delivery vaccination of bison in the park. Three alternatives were included in the document (USDI 2010). The no action alternative describes the current vaccination program that is intermittently implemented at the Stephens Creek capture facility in concert with capture operations. The second alternative would include a combination of the capture program at Stephens Creek and a remote delivery vaccination strategy that would focus exclusively on young, non-pregnant bison of both sexes. Remote delivery vaccination could occur from March to June and mid-September to mid-January through many areas of bison distribution in the park. A third alternative would include all components of the second alternative, as well as the remote vaccination of adult females during autumn. The vaccination program is intended to lower the percentage of bison susceptible to brucellosis infection. The Notice of Availability for the Draft Environmental Impact Statement was published in the Federal Register (75 FR 27579) on May 17, 2010. The comment period was from May 28, 2010 to September 24, 2010. Also, NPS staff conducted three public meetings to gain information from the public on the park's purpose and significance, issues, and alternatives presented in the Draft Environmental Impact Statement. These meetings were held in Bozeman, Montana on June 14, 2010, Helena, Montana on June 15, 2010, and Malta, Montana on June 16, 2010. The NPS received a total of 1,644 correspondences via letters, electronic mail (email), faxes, comments from public meetings, park forms, and web forms. These correspondences were distilled into 9,410 individual comments. From this correspondence, the NPS in collaboration with Weston Solutions, identified 6,629 substantive comments, which were divided into 26 concern statements. Most respondents associated with conservation constituencies opposed the remote vaccination program and recommended vaccination of cattle rather than bison. Conversely, most respondents associated with livestock groups supported vaccination. Nearly all respondents suggested that the projected cost of park-wide remote vaccination was too expensive to justify the benefits. A few constituency groups initiated letter writing campaigns to suggest re-directing funding to purchase grazing opportunities from private landowners outside Yellowstone National Park. Many respondents disputed the scientific information presented in the draft Environmental Impact Statement or suggested that inadequate scientific information existed to justify a decision to implement remote vaccination.

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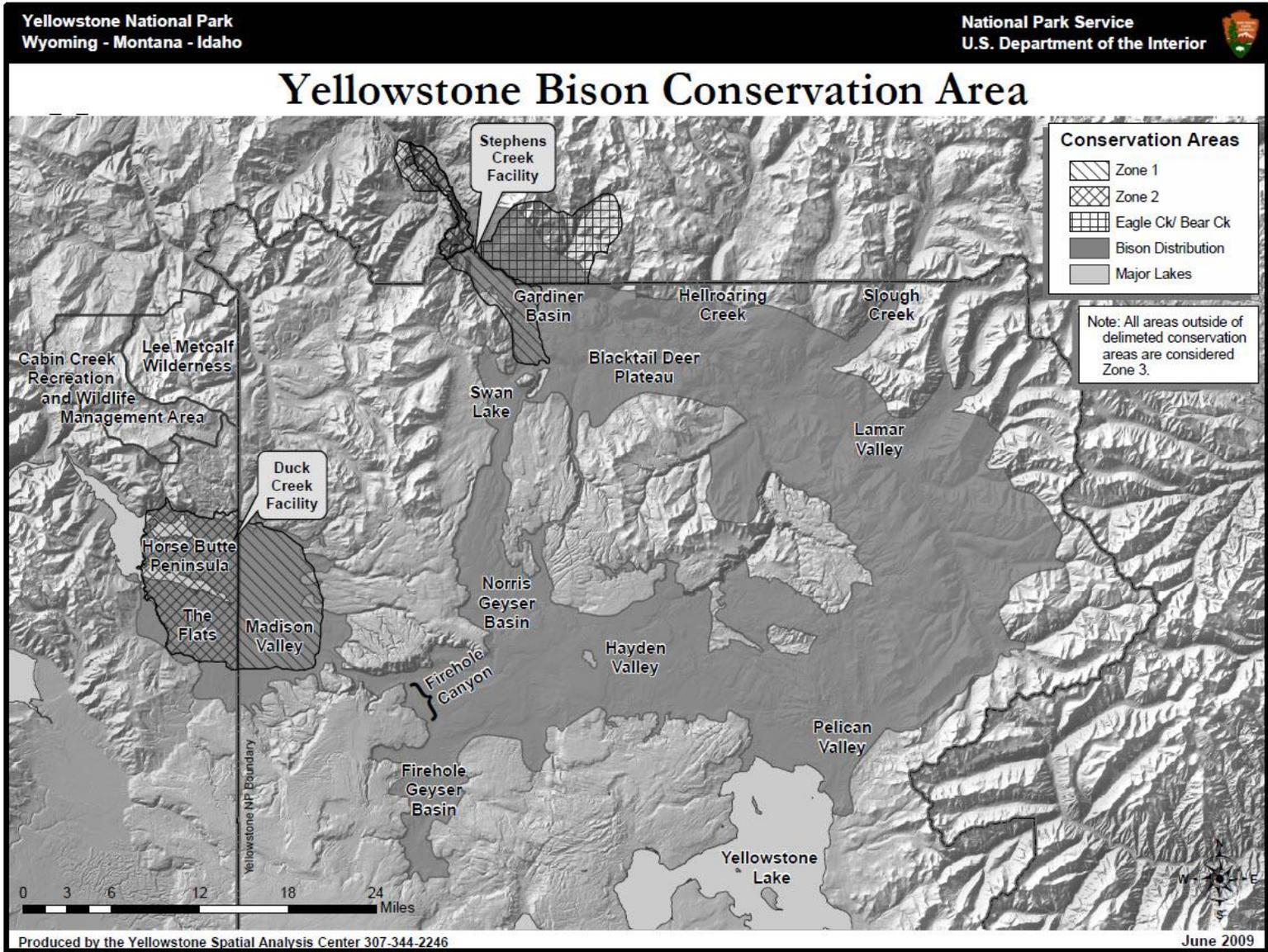
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**APPENDIX A: BISON BREACHES TO RECORD OF DECISION AND ADAPTIVE MANAGEMENT PLAN IN
WEST MANAGEMENT AREA FOR THE 2010-2011 MANAGEMENT SEASON**

Table A1.—Record of Bison Breaches on the West Side

| DATE | TRIGGER POINT(S) BREACHED | # OF BISON | LOCATION of BISON | OPERATIONS |
|------|---|------------|--|------------|
| 4/14 | Zone 3 | 1 | West of South Fork | YES |
| 4/28 | Madison Resort by 4/15 | 12 | South Fork of Madison River | YES |
| 5/2 | Zone 3 | 28 | Hwy 287 west of MA (6) Red Canyon (22) | YES |
| 5/4 | Zone 3 | 7 | Hwy 287 west of MA (4) Yellowstone Holiday Campground (3) | YES |
| 5/5 | Zone 3 | 4 | Hwy 287 mile marker 14 | YES |
| 5/9 | Zone 3 | 9 | Hwy 287/Spady Rd | YES |
| 5/11 | Zone 3 | 24 | Hwy 287 west of MA | YES |
| 5/16 | Zone 3 | 6 | West of South Fork | YES |
| 5/25 | Zone 3 | 27 | West of South Fork | YES |
| 6/1 | Zone 3 After May 15 Deadline Limit 0 Bison in Flats or North of Duck Creek Bulls only North of Madison River and South of Duck Creek | 283 | West of South Fork (23) Madison Arm Flats (168) Horse Butte (92) | YES |
| 6/2 | After May 15 Deadline Limit 0 Bison in Flats or North of Duck Creek | 62 | Upper Bear Trap area (5) Lower Bear Trap area (57) | YES |
| 6/3 | After May 15 Deadline Bulls only North of Madison River and South of Duck Creek | 46 | Mixed bison on Horse Butte | YES |
| 6/8 | After May 15 Deadline Bulls only North of Madison River and South of Duck Creek | 74 | Cougar Creek and 191 | YES |
| 6/9 | After May 15 Deadline Bulls only North of Madison River and South of Duck Creek | 20 | Private property near Duck Creek | YES |
| 6/13 | After May 15 Deadline Bulls only North of Madison river and South of Duck Creek Limit 0 Bison in Flats or North of Duck Creek | 87 | Private property on Horse Butte (33) South of Madison Arm (53) | YES |
| 6/17 | After May 15 Deadline Bulls only North of Madison River and South of Duck Creek | 3 | South of Duck Creek | YES |
| 6/22 | After May 15 Deadline Limit 0 Bison in Flats or North of Duck Creek | 57 | South of Madison Arm (53) North of Duck Creek (4) | YES |
| 6/23 | After May 15 Deadline Limit 0 Bison in Flats or North of Duck Creek | 6 | Lower Bear Trap area (2) Duck Creek and Hwy 191 (4) | YES |
| 6/29 | After May 15 Deadline Limit 0 Bison in Flats or North of Duck Creek | 7 | North of Duck Creek | YES |
| 7/1 | Zone 3 | 1 | West of South Fork | YES |

**APPENDIX B:
YELLOWSTONE BISON CONSERVATION AREA**



APPENDIX C:
BISON NUMBERS IN NORTH MANAGEMENT AREA FOR THE 2010-2011 MANAGEMENT SEASON

Table C1.—Bison numbers on the North Side

| Date | Eagle Creek/ Bear Creek Area | Yankee Jim Canyon Zone 3 | Mol Heron Creek Canyon Zone 3 | East of River/ North of Little Trail Creek Zone 3 | Gardiner Basin Zone 2 | Total Bison Outside YNP |
|-------|------------------------------------|--------------------------------|-------------------------------------|--|-----------------------------|-------------------------------|
| 12/5 | 0 | 0 | 0 | 7 | 0 | 7 |
| 12/8 | 0 | 0 | 0 | 0 | 3 | 3 |
| 12/11 | 0 | 0 | 0 | 0 | 20 | 20 |
| 12/12 | 0 | 0 | 0 | 0 | 1 | 1 |
| 12/20 | 0 | 0 | 0 | 0 | 32 | 32 |
| 12/21 | 0 | 0 | 0 | 0 | 3 | 3 |
| 12/24 | 0 | 0 | 0 | 0 | 3 | 3 |
| 12/26 | 0 | 0 | 0 | 0 | 9 | 9 |
| 12/27 | 0 | 0 | 0 | 0 | 3 | 3 |
| 12/28 | 0 | 0 | 0 | 0 | 81 | 81 |
| 12/30 | 0 | 0 | 0 | 0 | 4 | 4 |
| 12/31 | 0 | 0 | 0 | 0 | 12 | 12 |
| 1/1 | 0 | 0 | 0 | 17 | 2 | 19 |
| 1/2 | 0 | 0 | 0 | 14 | 22 | 36 |
| 1/4 | 21 | 0 | 0 | 0 | 23 | 44 |
| 1/6 | 0 | 0 | 0 | 0 | 8 | 8 |
| 1/7 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1/8 | 0 | 0 | 0 | 0 | 19 | 19 |
| 1/9 | 0 | 0 | 0 | 11 | 0 | 11 |
| 1/10 | 0 | 0 | 0 | 11 | 0 | 11 |
| 1/11 | 0 | 0 | 0 | 0 | 21 | 21 |
| 1/15 | 0 | 0 | 0 | 4 | 0 | 4 |
| 1/17 | 0 | 0 | 0 | 0 | 5 | 5 |
| 1/18 | 0 | 0 | 0 | 4 | 0 | 4 |
| 1/19 | 0 | 0 | 0 | 0 | 12 | 12 |
| 1/20 | 0 | 0 | 0 | 3 | 12 | 15 |
| 1/21 | 0 | 0 | 0 | 11 | 0 | 11 |
| 1/24 | 0 | 0 | 0 | 14 | 0 | 14 |
| 1/26 | 0 | 0 | 0 | 13 | 0 | 13 |
| 1/27 | 0 | 13 | 0 | 4 | 0 | 17 |
| 1/28 | 0 | 0 | 0 | 13 | 5 | 18 |
| 1/29 | 0 | 0 | 0 | 39 | 5 | 44 |
| 1/30 | 0 | 0 | 0 | 83 | 58 | 141 |
| 1/31 | 0 | 5 | 0 | 0 | 300 | 305 |
| 2/1 | 0 | 0 | 0 | 0 | 28 | 28 |
| 2/2 | 0 | 0 | 0 | 18 | 21 | 39 |
| 2/3 | 0 | 0 | 0 | 5 | 25 | 30 |
| 2/4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2/5 | 0 | 0 | 0 | 18 | 1 | 19 |
| 2/6 | 0 | 0 | 0 | 0 | 40 | 40 |
| 2/7 | 0 | 0 | 0 | 9 | 1 | 10 |
| 2/8 | 0 | 0 | 0 | 2 | 3 | 5 |

Table C1.—Bison numbers on the North Side

| Date | Eagle Creek/ Bear Creek Area | Yankee Jim Canyon Zone 3 | Mol Heron Creek Canyon Zone 3 | East of River/ North of Little Trail Creek Zone 3 | Gardiner Basin Zone 2 | Total Bison Outside YNP |
|------|------------------------------------|--------------------------------|-------------------------------------|--|-----------------------------|-------------------------------|
| 2/9 | 0 | 0 | 0 | 0 | 103 | 103 |
| 2/10 | 0 | 1 | 0 | 0 | 12 | 13 |
| 2/11 | 0 | 0 | 0 | 0 | 27 | 27 |
| 2/12 | 0 | 0 | 0 | 1 | 33 | 34 |
| 2/13 | 0 | 0 | 0 | 0 | 32 | 32 |
| 2/14 | 0 | 0 | 0 | 18 | 4 | 22 |
| 2/15 | 0 | 0 | 0 | 2 | 13 | 15 |
| 2/16 | 0 | 0 | 0 | 1 | 0 | 1 |
| 2/18 | 0 | 0 | 0 | 6 | 0 | 6 |
| 2/19 | 0 | 0 | 0 | 0 | 24 | 24 |
| 2/20 | 0 | 0 | 0 | 7 | 42 | 49 |
| 2/21 | 0 | 0 | 0 | 0 | 42 | 42 |
| 2/23 | 0 | 0 | 0 | 0 | 12 | 12 |
| 2/24 | 0 | 0 | 0 | 6 | 20 | 26 |
| 2/25 | 0 | 0 | 0 | 0 | 14 | 14 |
| 2/26 | 0 | 0 | 0 | 0 | 24 | 24 |
| 3/1 | 0 | 0 | 0 | 4 | 7 | 11 |
| 3/2 | 0 | 0 | 0 | 4 | 0 | 4 |
| 3/6 | 0 | 5 | 0 | 21 | 0 | 26 |
| 3/7 | 0 | 0 | 0 | 0 | 8 | 8 |
| 3/8 | 0 | 0 | 0 | 0 | 8 | 8 |
| 3/9 | 0 | 0 | 0 | 0 | 60 | 60 |
| 3/10 | 0 | 0 | 0 | 4 | 0 | 4 |
| 3/11 | 0 | 0 | 0 | 4 | 0 | 4 |
| 3/21 | 0 | 6 | 0 | 0 | 0 | 6 |
| 3/22 | 0 | 6 | 0 | 0 | 29 | 35 |
| 3/24 | 0 | 0 | 0 | 0 | 37 | 37 |
| 3/25 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3/26 | 0 | 0 | 0 | 0 | 22 | 22 |
| 3/28 | 0 | 0 | 0 | 0 | 15 | 15 |
| 3/29 | 0 | 0 | 0 | 0 | 100 | 100 |
| 3/30 | 0 | 0 | 0 | 7 | 0 | 7 |
| 3/31 | 0 | 0 | 0 | 0 | 48 | 48 |
| 4/2 | 0 | 0 | 0 | 5 | 74 | 79 |
| 4/7 | 0 | 0 | 0 | 0 | 142 | 142 |
| 4/8 | 0 | 0 | 0 | 82 | 280 | 362 |
| 4/9 | 0 | 0 | 0 | 1 | 325 | 326 |
| 4/10 | 0 | 0 | 0 | 20 | 228 | 248 |
| 4/11 | 0 | 0 | 0 | 5 | 67 | 72 |
| 4/12 | 0 | 0 | 0 | 230 | 0 | 230 |
| 4/13 | 0 | 0 | 0 | 0 | 210 | 210 |
| 4/14 | 0 | 0 | 0 | 0 | 60 | 60 |
| 4/15 | 0 | 0 | 0 | 7 | 80 | 87 |
| 4/16 | 0 | 0 | 0 | 22 | 0 | 22 |
| 4/17 | 0 | 0 | 0 | 33 | 0 | 33 |
| 4/18 | 0 | 29 | 0 | 21 | 17 | 67 |
| 4/19 | 0 | 0 | 0 | 3 | 132 | 135 |

Table C1.—Bison numbers on the North Side

| Date | Eagle Creek/ Bear Creek Area | Yankee Jim Canyon Zone 3 | Mol Heron Creek Canyon Zone 3 | East of River/ North of Little Trail Creek Zone 3 | Gardiner Basin Zone 2 | Total Bison Outside YNP |
|------|------------------------------------|--------------------------------|-------------------------------------|--|-----------------------------|-------------------------------|
| 4/20 | 0 | 0 | 0 | 9 | 7 | 16 |
| 4/21 | 0 | 0 | 0 | 22 | 0 | 22 |
| 4/22 | 0 | 0 | 0 | 11 | 42 | 53 |
| 4/23 | 0 | 0 | 0 | 2 | 11 | 13 |
| 4/24 | 0 | 0 | 0 | 2 | 59 | 61 |
| 4/25 | 0 | 0 | 0 | 2 | 11 | 13 |
| 4/26 | 11 | 0 | 0 | 57 | 20 | 88 |
| 4/27 | 0 | 0 | 0 | 62 | 0 | 62 |
| 4/28 | 20 | 0 | 0 | 11 | 0 | 31 |
| 4/29 | 34 | 0 | 0 | 4 | 0 | 38 |
| 4/30 | 0 | 0 | 0 | 23 | 0 | 23 |
| 5/2 | 0 | 0 | 0 | 27 | 2 | 29 |
| 5/3 | 0 | 0 | 0 | 27 | 0 | 27 |
| 5/4 | 0 | 0 | 0 | 1 | 10 | 11 |
| 5/5 | 0 | 0 | 0 | 14 | 5 | 19 |
| 5/6 | 0 | 0 | 0 | 2 | 6 | 8 |
| 5/7 | 0 | 0 | 0 | 25 | 0 | 25 |
| 5/8 | 0 | 0 | 0 | 1 | 5 | 6 |
| 5/9 | 0 | 0 | 0 | 0 | 13 | 13 |
| 5/12 | 0 | 0 | 0 | 3 | 6 | 9 |
| 5/13 | 0 | 0 | 0 | 0 | 1 | 1 |
| 5/16 | 0 | 0 | 0 | 0 | 1 | 1 |
| 5/20 | 0 | 0 | 0 | 0 | 3 | 3 |

APPENDIX D:
MFWP MANAGEMENT ACTIONS TAKEN IN THE NORTH MANAGEMENT AREA FOR THE
2010-2011 MANAGEMENT SEASON

Table D1.—MFWP Management Actions taken in the North Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-----------|------------|----------|---|---|-------------------------------------|
| 01-Jan-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 01-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X6 | | calls, instructions |
| 02-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X2 | | calls, instructions |
| 03-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X2 | | calls, instructions |
| 04-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X2 | | calls, instructions |
| 06-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X1 | | calls, instructions |
| 07-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X2 | | calls, instructions |
| 08-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X1 | | calls, instructions |
| 09-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X2 | | calls, instructions |
| 10-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X2 | | calls, instructions |
| 11-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X3 | | calls, instructions |
| 12-Jan-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 13-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X2 | | calls, instructions |
| 14-Jan-11 | Knarr | Gardiner | phone calls regarding hazing/property damage X1 | | calls, instructions |
| 15-Jan-11 | Knarr | Gardiner | hazing & property damage, meet Archy, Alex & Lee in Gardiner X6 | CSKT hunter cited by Archy for shoot from roadway | calls/instructions/invest w/CSKT |
| 16-Jan-11 | Knarr | Gardiner | To Gardiner, patrol tribal hunters, Gunny back to Boz. Vet X2 | Two bison taken by CSKT hunters | calls/instructions/invest w/CSKT |
| 17-Jan-11 | Knarr | Gardiner | Hazing & property damage, X2 | | calls/instructions |
| 18-Jan-11 | Knarr | Gardiner | Bison in Hoppes, X6 | | Bison hazed out of Hoppes |

Table D1.—MFWP Management Actions taken in the North Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|----------------------|-------------|------------------|---|---|---|
| Jan 18,19,20 | Dean | Gardiner | Hazing bison to the north | moved bison at a quick pace when we got them out of the pen | 18th travel day, 19th and 20th were hazing days |
| Jan 18-20, 2011 | Kline | Gardiner | Stephens Creek Project | | |
| 19-Jan-11 | Knarr | Gardiner | Bison in Hoppes, X7 | | Bison hazed out of Hoppes |
| 19-Jan-11 | Sheppard | Bozeman/Gardiner | Bison Hunt, IBMP Monitoring | | |
| 21-Jan-11 | Knarr | Gardiner | X3 | | |
| 22-Jan-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 23-Jan-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 23-Jan-11 | Knarr | Gardiner | Hazing & property damage, X1 | | Calls/instructions |
| 24-Jan-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 24-Jan-11 | Knarr | Gardiner | Hazing & property damage, X2 | | Calls/instructions |
| 25-Jan-11 | Knarr | Gardiner | Hazing & property damage, X3 | | Calls/instructions |
| 26-Jan-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 27-Jan-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 27-Jan-11 | Knarr | Gardiner | Hazing & property damage, X3 | | Calls/instructions |
| 28-Jan-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 28-Jan-11 | Knarr | Gardiner | Hazing & property damage, X4 | | Calls/instructions |
| 29-Jan-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 29-Jan-11 | Knarr | Gardiner | To Gardiner to patrol W/38, X13 | Haze bison off school yard | Calls/instructions |
| 30-Jan-11 | Knarr | Gardiner | Hazing & property damage, X10 | | Calls/instructions |
| 31-Jan-11 | Brian Lloyd | Gardiner area | Traffic control for bison hazing operation. | Hazing operation moved approximately 260 bison into trap at Stephens Creek. | Shut down roads and helped haze bison on foot. |
| 31-Jan-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 31-Jan-11 | Knarr | Gardiner/West | To W. Yellowstone, meet with "Cavin" F.S. biologist, X4 | | Calls/instructions |
| 01-Feb-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 2/1,2/2011 (no bill) | Knarr | Gardiner/West | To W. Yellowstone, meet with "Cavin" | | Calls/instructions |

Table D1.—MFWP Management Actions taken in the North Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-----------|-------------|---------------|---|---|--|
| | | | F.S. biologist, X4 | | |
| 02-Feb-11 | Brian Lloyd | Gardiner area | Traffic control for bison hazing operation. | Hazing operation moved approximately 30 bison. | Shut down roads and helped shuttle vehicles for horse and rider pick up. |
| 02-Feb-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 03-Feb-11 | Knarr | Gardiner/West | To West Yellowstone, meet with "Cavin" F.S. biologist, X3 | | Calls/instructions |
| 04-Feb-11 | Knarr | Gardiner/West | To West Yellowstone, meet with "Cavin" F.S. biologist, X6 | | Calls/instructions |
| 05-Feb-11 | Knarr | Gardiner/West | To West Yellowstone, meet with "Cavin" F.S. biologist, X3 | | Calls/instructions |
| 08-Feb-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Shut hunt down-no hunters contacted |
| 09-Feb-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | Shut Little Trail Creek Down while hazing were intact | |
| 09-Feb-11 | Knarr | Gardiner/West | To West Yellowstone, meet with "Cavin" F.S. biologist, X1 | | Calls/instructions |
| 10-Feb-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | Shut Little Trail Creek Down while hazing were intact | Bison hit on highway approx. 2200 hours, responded and euthanized animal |
| 10-Feb-11 | Knarr | Gardiner | Haze and property damage, X1 | | Calls/instructions |
| 11-Feb-11 | Knarr | Gardiner | Haze and property damage, X2 | | Calls/instructions |
| 12-Feb-11 | Knarr | Gardiner | Haze & property damage, X2 | | Calls/instructions |
| 13-Feb-11 | Knarr | Gardiner | Haze & property damage, X3 | | Calls/instructions |
| 14-Feb-11 | Knarr | Gardiner | Haze & property damage, X3 | | Calls/instructions |
| 16-Feb-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 16-Feb-11 | Knarr | Gardiner | Haze & property damage, X4 | | Calls/instructions |
| 17-Feb-11 | Knarr | Gardiner/West | Calls, haze/hunt/property damage, X4 | | Call & try to set up rescue for stuck tribal wardens |
| 18-Feb-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 18-Feb-11 | Knarr | Gardiner | Haze/hunt/property damage, X4 | | Calls/instructions |
| 19-Feb-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 19-Feb-11 | Knarr | Gardiner | Haze/hunt/property damage, X7 | | Calls/instructions |
| 20-Feb-11 | Knarr | Gardiner | Haze/hunt/property | | Calls/instructions |

Table D1.—MFWP Management Actions taken in the North Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-----------|------------|------------------|--|----------------|---|
| | | | damage, X5 | | |
| 21-Feb-11 | Knarr | Gardiner | To Gardiner meet w/Morgan, X3 | | Discuss hunt w/F.S. |
| 22-Feb-11 | Knarr | Gardiner | To Gardiner meet w/Morgan, X3 | | Discuss hunt w/F.S. |
| 23-Feb-11 | Knarr | Gardiner | Haze/hunt/property damage, X3 | | Calls/instructions |
| 24-Feb-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 26-Feb-11 | Knarr | Gardiner | To Gardiner, meet w/31, 313, F.S., (X12 incl. 25 & 26) | | Patrol tribal hunts |
| 27-Feb-11 | Knarr | Gardiner | To Gardiner, tribal hunt patrol, X9 | | Brogan F.A.S., invest. tribal hunter |
| 28-Feb-11 | Knarr | Gardiner | Haze/hunt/property damage, X3 | | Calls/instructions |
| 02-Mar-11 | Knarr | Gardiner | Haze/hunt/property damage, X3 | | Calls/instructions |
| 03-Mar-11 | Knarr | Gardiner | Haze/hunt/property damage, X5 | | Calls/instructions |
| 06-Mar-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | Buffalo in Yankee Jim Canyon(5 bulls) assisted with traffic |
| 06-Mar-11 | Knarr | Gardiner | Haze/property damage, X 5 | | Calls/instructions |
| 07-Mar-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | no buffalo out | |
| 07-Mar-11 | Knarr | Gardiner | Haze/property damage, X3 | | Calls/instructions |
| 09-Mar-11 | Drew Scott | Gardiner | hazed 5 bulls from church compund | | |
| 10-Mar-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 11-Mar-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | hazed 4 bulls off church |
| 21-Mar-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 21-Mar-11 | Knarr | Gardiner | To Gardiner/patrol/calls, X21 | | Bull bison back So. of line. Meet with/Tierny. |
| 22-Mar-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 22-Mar-11 | Knarr | Gardiner | Calls/patrol, X3 | | Calls/instructions |
| 23-Mar-11 | Knarr | Gardiner/West | Calls/patrol, X8 | | Calls/instructions |
| 26-Mar-11 | Knarr | Gardiner | Calls/haze/property damage, X1 | | Calls/instructions |
| 27-Mar-11 | Knarr | Gardiner | Calls/haze/property damage, X2 | | Calls/instructions |
| 28-Mar-11 | Knarr | Gardiner | Calls/haze/property damage, X4 | | Calls/instructions |
| 29-Mar-11 | Knarr | Gardiner | Calls/haze/property damage, X2 | | Calls/instructions |
| 30-Mar-11 | Knarr | Gardiner | Calls/haze/property damage, X2 | | Calls/instructions |
| 30-Mar-11 | Sheppard | Bozeman/Gardiner | Bison Hunt, IBMP Monitoring | | |

Table D1.—MFWP Management Actions taken in the North Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-----------|--------------------|------------------|---|--|---|
| 31-Mar-11 | Knarr | Gardiner | Calls/haze/property damage, X10 | | Calls/instructions |
| 01-Apr-11 | Knarr | Gardiner | Haze/property damage, X2 | | Calls/instructions |
| 02-Apr-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 02-Apr-11 | Knarr | Gardiner | Haze/property damager, X3 | | Calls/instructions |
| 04-Apr-11 | Knarr | Gardiner | Haze/property damage, X5 | | Calls/instructions |
| 05-Apr-11 | Knarr | Gardiner | Haze/property damage, X2 | | Work on letter, response back to Franklin |
| 08-Apr-11 | Knarr | Gardiner | Haze/property damage, X5 | | Calls/instructions |
| 09-Apr-11 | Knarr | Gardiner | To Gardiner, bison work, X15 | | Check on property damage, hazing |
| 10-Apr-11 | Knarr | Gardiner | To Gardiner, bison work, X1 | | Calls/instructions |
| 11-Apr-11 | Drew Scott | Gardiner | responded to property damage | went to four different residents and talked with the homeowners, took pictures of property damage. | Bill Oestrch, Keith Hatfield, Tina Hollan, Peter Schmidt. |
| 11-Apr-11 | Knarr | Gardiner | To Gardiner, bison work, X7 | | Calls/instructions |
| 12-Apr-11 | FG318 Jen Williams | Gardiner | Traffic control for hazing operation | | hazed 180 from west side of hwy to park line |
| 12-Apr-11 | Knarr | Gardiner | To Gardiner, bison work, X17 | | P.U. new bison, rifle |
| 13-Apr-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control/responded to property damage | went to three different residents hazed 9 bulls from one property owners place | Norman Millman, Jim Cole, Keith Hatfield and Bill Hoppe. |
| 13-Apr-11 | Knarr | Gardiner | To Gardiner, bison work, X1 | | P.U. new bison, rifle |
| 14-Apr-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 14-Apr-11 | Knarr | Gardiner | To Gardiner for bison public meeting, X9 calls | | Meeting/calls/instructions |
| 14-Apr-11 | Sheppard | Bozeman/Gardiner | IBMP Monitoring, property damage, hazing | | |
| 14-Apr-11 | SMOLCZYNSKI | GARDINER | BISON MEETING | | |
| 15-Apr-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 15-Apr-11 | Knarr | Gardiner | Calls, haze, property damage, X11 | | Calls/instructions |
| 15-Apr-11 | Sheppard | Bozeman/Gardiner | IBMP Monitoring, property damage, hazing, poaching | | |

Table D1.—MFWP Management Actions taken in the North Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-------------------|--------------------|------------------------------|---|---|--|
| | | | investigation | | |
| 16-Apr-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 16-Apr-11 | FG318 Jen Williams | Gardiner | Traffic control for hazing operation | bison at rigler's | |
| 16-Apr-11 | Sheppard | Bozeman/Gardiner | IBMP Monitoring, property damage, hazing, poaching investigation | | |
| 17-Apr-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | Responded to Pat Reemers @ 1400 hours for bison in yard-bison were gone when I arrived. | |
| 18-Apr-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | responded to Hatfields-pushed buffaloe off place. Also assisted with Bison on the Canyon. | |
| 18-Apr-11 | Knarr | Gardiner | To Gardiner, haze bison, meet with 544, 38. 8 bison off Riglers, check Joe Stefanos, move more bison from Riglers. Move bison off Hatfields. Leave dinner respond to Riglers 911 call. Bison not actually in his yard/property. X36 calls | | G/N Gardiner |
| April 18, 19, 20 | Dean | Gardiner | Hazing bison south into the park | moving mostly bulls | 18th travel day, 19th and 20th were hazing days |
| April 18-20, 2011 | Kline | Gardiner-Cutler Meadows area | Herd back to park | | |
| 19-Apr-11 | Drew Scott | Gardiner | Assisted DOL/Traffic Control | | |
| 19-Apr-11 | Knarr | Gardiner | Gardiner, cont. bison haze, necropsy bison @ bone yard in Park. No bullets recovered for case. X17 | | |
| 20-Apr-11 | Drew Scott | Gardiner | Assisted DOL/Traffic Control | | |
| 20-Apr-11 | Knarr | Gardiner | Call/haze/property damage, X2 | | Calls/instructions |
| 21-Apr-11 | Brian Lloyd | Gardiner area | Traffic control for bison hazing operation. | N/A | Shut down roads and helped shuttle vehicles for horse and rider pick up. |
| 21-Apr-11 | Drew Scott | Gardiner | no actions | | |

Table D1.—MFWP Management Actions taken in the North Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-------------------|--------------------|------------------|---|--------------|--|
| 21-Apr-11 | Knarr | Gardiner | To Pine Crk p.u. horse from Sallee take to Gardiner. Continue bison investigate w/38 in Gardiner. X25 | | |
| 21-Apr-11 | SMOLCZYNSKI | GARDINER | ASSIST IN HAZE | | |
| 22-Apr-11 | Brian Lloyd | Gardiner area | Traffic control for bison hazing operation. | N/A | Shut down roads and helped shuttle vehicles for horse and rider pick up. |
| 22-Apr-11 | Knarr | Gardiner | Calls/haze/property damage, X12 | | Calls/instructions |
| 23-Apr-11 | Knarr | Gardiner | Calls/haze, property damage, X7 calls | | To Gardiner, assist with haze, Roscoe back to Bozeman vet |
| 24-Apr-11 | Knarr | Gardiner | Calls/haze/property damage, X8 | | To Gardiner, assist with haze, check on bison in town (0), catch horses at pasture for Coy |
| April 24-26, 2011 | Kline | Gardiner area | Herd off private prop to park | | |
| 25-Apr-11 | Knarr | Gardiner | Calls/haze/property damage X2 | | Calls/instructions |
| 25-Apr-11 | SMOLCZYNSKI | GARDINER | ASSIST IN HAZE | | |
| 26-Apr-11 | Knarr | Gardiner | Calls/haze/property damage, X8 | | Lee Hart, check on horses 4 sale |
| 26-Apr-11 | Sheppard | Bozeman/Gardiner | IBMP Monitoring, property damage, hazing, outreach | | |
| 27-Apr-11 | Derek Fagone FG55 | Gardiner Basin | Bison Hazing via horseback | | hazed Bison |
| 27-Apr-11 | Knarr | Gardiner | Calls/haze/property damage, X8 | | Meet with 313, file bison case in Park Co. |
| 28-Apr-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 28-Apr-11 | Knarr | Gardiner | Calls, haze/property damage, X6 | | Check horses at Harts w/31 |
| 29-Apr-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 29-Apr-11 | Knarr | Gardiner | Calls,haze/property damage, X7 | | Calls/instructions |
| 29-Apr-11 | Sheppard | Bozeman/Gardiner | IBMP Monitoring, property damage, hazing, ourtreach | | |
| 30-Apr-11 | FG318 Jen Williams | Gardiner | Traffic control for hazing operation | | |
| 01-May-11 | FG318 Jen Williams | Gardiner | Hazing Horses | | |
| 01-May-11 | Miller | Corwin Springs | assist hazing | | |
| 01-May-11 | Miller | YNP Stephens cr | assist trapping operation | | |
| 01-May-11 | Miller | | Calls: Eric MoreyX3, 320X2, MountX2 | | |
| 02-May-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 02-May-11 | Knarr | Gardiner/West | Calls/haze/property | | Calls/instructions |

Table D1.—MFWP Management Actions taken in the North Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|----------------------------|--------------------|-------------------------------------|---|--|---|
| | | | damage, X4 | | |
| 02-May-11 | Miller | Gardiner | move hay for buff hazing | | |
| 02-May-11 | SMOLCZYNSKI | GARDINER | ASSIST IN BISON HAZE | | |
| 03-May-11 | Brian Lloyd | Gardiner area | Traffic control for bison hazing operation. | N/A | Shut down roads and helped shuttle vehicles for horse and rider pick up. |
| 03-May-11 | Knarr | Gardiner/West | Calls,haze/property damage, X4 | | Calls/instructions |
| May 3-4 2011 | Derek Fagone FG55 | Gardiner Basin | Bison Hazing via horseback | | hazed Bison |
| 04-May-11 | FG318 Jen Williams | Gardiner | Traffic control for hazing operation | | assisted DOL in putting down 4 yr old injured bull |
| 04-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X7 | | Catch Butte horses at pasture for Coy |
| 04-May-11 | Sheppard | Bozeman/Gardiner | IBMP Monitoring, property damage, hazing, outreach | | |
| May 4th, 5th and 6th, 2011 | Shane Yaskus | Gardiner area and north of Gardiner | Drove to Gardiner on the 4th worked 4 hours, hazed buffalo 8 hours on the 5th, hazed and travelled home 7 hours on the 6th. | Observed approximately 15 buffalo in residential areas and numerous other buffalo in non-residential areas outside of the park | Assisted Department of Livestock and National Park Service in Hazing buffalo out of residential areas north of Gardiner back into Yellowstone Park. |
| 05-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X3 | | To West Yellowstone, deliver ATV, rifle. Check on bison movement |
| 05-May-11 | Miller | Gardiner | assist hazing | | |
| 06-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X1 | | Calls/instructions |
| 06-May-11 | Miller | | get hay for buff hazing | | |
| 06-May-11 | Sheppard | Bozeman/Gardiner | IBMP Monitoring, property damage, hazing, outreach | | |
| 06-May-11 | SMOLCZYNSKI | GARDINER | PICK UP HORSES FOR BISON SEASON IN WEST | | |
| 07-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X3 | | Calls/instructions |
| 07-May-11 | Miller | Gardiner | assist hazing | little trail creek | |
| 07-May-11 | Miller | | calls: DOL X 3 | | |
| 08-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X1 | | Calls/instructions |
| 08-May-11 | Miller | Gardiner | assist hazing | | |
| 09-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X2 | | Calls/instructions |
| 10-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X1 | | Calls/instructions |
| 10-May-11 | Miller | Gardiner | Calls: DOL Anderson | | |
| 11-May-11 | Knarr | Gardiner/West | Calls/haze/property | | Calls/instructions |

Table D1.—MFWP Management Actions taken in the North Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-------------|------------------|---------------------------------------|--|----------------------------|--------------------------|
| | | | damage, X5 | | |
| 11-May-11 | Miller | Gardiner | assist hazing | | |
| 11-May-11 | Miller | | Calls: DOL Anderson | | |
| 12-May-11 | Drew Scott | Gardiner | Assist DOL/Traffic Control | | |
| 12-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X1 | | Calls/instructions |
| 12-May-11 | Miller | Gardiner | Move horses for buff hazing | | |
| 12-May-11 | Miller | | Calls: 38, DOL Mount | | |
| 13-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X7 | | Calls/instructions |
| 13-May-11 | Miller | | Calls: DOL Mount | | |
| 15-May-11 | Miller | | Calls: Gene Carter - fence, Rowdie Yates - Bison, MHP Buff at Kirkwood, DOL - Mount, | | |
| 16-May-11 | Miller | | Calls: Joe Sparano - Bison fence | | |
| 17-May-11 | Miller | Gardiner | Check for bison in town | | none |
| 18-May-11 | Miller | Gardiner - West Yell | take horses to West Yell for hazing | | |
| 20-May-11 | Miller | Gardiner | Calls: 31- bison fence | | |
| 20-May-11 | Sheppard | Bozeman/Gardiner | outreach, strategic fencing, property damage | | |
| 23-May-11 | Miller | Gardiner | Calls: Lorraine Miller - Buff damage, Alan Shaw, 31 - Gene Carter fence, Jim Stermitz - Buff at cinnabar | | |
| 31-May-11 | Sheppard | Bozeman/Gardiner | outreach, strategic fencing, property damage | | |
| 02-Jun-11 | Kerry Wahl/FG-36 | Flats north of town to Cougar Meadows | Horseback hazing of Bison | Constantly followed by BFC | |
| 08-Jun-11 | Miller | | Calls: DOL , 312, YNP Morey, YNP Wallen | | |
| 28-Jun-11 | Knarr | Gardiner | Plotting safety zone | | Plotting GPS safety zone |
| 21-Jul-11 | Sheppard | Bozeman/Gardiner | outreach, strategic fencing, property damage | | |
| 25-Jul-11 | Sheppard | Bozeman/Gardiner | outreach, strategic fencing, property damage | | |
| 29-Aug-11 | Sheppard | Bozeman/Gardiner | outreach, strategic fencing, property damage, hunt, tribal | | |
| 13-Jul-11 | Sheppard | Bozeman/Gardiner | RTR fencing | Status report | |
| 3/02 (2), 3 | Knarr | Gardiner | Haze/property | | Calls/instructions |

Table D1.—MFWP Management Actions taken in the North Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-------------|--------|----------|----------------------------------|---------------------|--|
| (10), 4 (3) | | | damage, X15 combined | | |
| | Dean | Gardiner | Hazing bison south into the park | moving mostly bulls | 4th travel day, 5th worked traffic, 6th hazed bison south into the park. |

**APPENDIX E:
MFWP MANAGEMENT ACTIONS TAKEN IN THE WEST MANAGEMENT AREA FOR THE
2010-2011 MANAGEMENT SEASON**

Table E1.—MFWP Management Actions taken in the West Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-----------|-------------|------------------|---|--------------|---------|
| 17-Jul-10 | SMOLCZYNSKI | WEST YELLOWSTONE | HAZE BULLS OFF SOUTHFORK | | |
| 04-Oct-10 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL FOR BISON AND HUNTERS | | |
| 07-Oct-10 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL FOR BISON AND HUNTERS | | |
| 15-Oct-10 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL FOR BISON AND HUNTERS | | |
| 19-Oct-10 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL FOR BISON AND HUNTERS | | |
| 25-Oct-10 | SMOLCZYNSKI | WEST YELLOWSTONE | YNP, LOOK FOR BISON MOVEMENT | | |
| 04-Nov-10 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS | | |
| 10-Nov-10 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS | | |
| 15-Nov-10 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS | | |
| 16-Nov-10 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS | | |
| 23-Nov-10 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS | | |
| 29-Nov-10 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS | | |
| 05-Dec-10 | SMOLCZYNSKI | WEST YELLOWSTONE | CALLS, BISON ACTIVITY AND HUNTER SUCCESS, TRIBAL | | |
| 15-Dec-10 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON PATROL, HUNTERS, TRIBAL | | |
| 17-Dec-10 | SMOLCZYNSKI | WEST YELLOWSTONE | CALLS, ABOUT BISON ON RAINBOW POINT ROAD | | |
| 20-Dec-10 | SMOLCZYNSKI | WEST YELLOWSTONE | CALLS, ABOUT HUNTERS IN YELLOWSTONE VILLAGE, BISON ACTIVITY | | |
| 21-Dec-10 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON PATROL, HUNTERS, TRIBAL | | |

Table E1.—MFWP Management Actions taken in the West Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-------------------------|-------------|------------------|---|--------------|--------------------|
| 30-Dec-10 | SMOLCZYNSKI | WEST YELLOWSTONE | CALLS, COMPLAINT ABOUT TRIBAL HUNTERS IN YELLOWSTONE VILLAGE, CSKT?? | | |
| 04-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | INVESTIGATE WITH TRIBE ON COMPLAINT OF ILLEGAL ACTIVITY IN YELLOWSTONE VILLAGE. | | |
| 05-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | CALL TO ANN STOVAL AND CINDY NEVILLE, GET REPORT | | |
| 06-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | VIST ANN STOVAL AND CINDY ABOUT INCIDENT. | | |
| 14-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | COMPLAINTS ABOUT TRIBAL HUNTERS IN VILLAGE. PATROL HUNTERS AND BISON | | |
| 15-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS,TRIBAL | | |
| 17-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS,TRIBAL | | |
| 18-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | CALLS, COMPLAINTS ABOUT BLOOD AND UNSIGHTLYNESS ON HWY FROM BISON HUNT. | | |
| 20-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS,TRIBAL | | |
| 23-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS,TRIBAL | | |
| 27-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS, SHOOT FROM ROAD CASE REPORTED BY BFC | | |
| 28-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | MEET WITH TRIBAL WARDEN AND FOLLOW UP ON SHOOT FROM ROAD CASE, PATROL BISON AND HUNTERS | | |
| 29-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS, TRIBAL | | |
| 30-Jan-11 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS, TRIBAL | | |
| 31-Jan-11 | Knarr | Gardiner/West | To W. Yellowstone, meet with "Cavin" F.S. biologist, X4 | | Calls/instructions |
| 2/1,2/2011 (no bill) | Knarr | Gardiner/West | To W. Yellowstone, meet with "Cavin" F.S. biologist, X4 | | Calls/instructions |
| 03-Feb-11 | Knarr | Gardiner/West | To West Yellowstone, meet with "Cavin" F.S. biologist, X3 | | Calls/instructions |

Table E1.—MFWP Management Actions taken in the West Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-----------|-------------|--------------------------|--|--------------|--|
| 03-Feb-11 | SMOLCZYNSKI | WEST YELLOWSTONE, POLSON | AFTER VISITING WITH TRIBAL WARDENS, TRAVEL TO ISSUE CITATIONS IN POLSON FOR SHOOT FROM ROAD CASE. NON-TRIBAL MEMBER. | | |
| 04-Feb-11 | Knarr | Gardiner/West | To West Yellowstone, meet with "Cavin" F.S. biologist, X6 | | Calls/instructions |
| 05-Feb-11 | Knarr | Gardiner/West | To West Yellowstone, meet with "Cavin" F.S. biologist, X3 | | Calls/instructions |
| 07-Feb-11 | SMOLCZYNSKI | WEST YELLOWSTONE, POLSON | PATROL BISON AND HUNTERS,TRIBAL | | |
| 09-Feb-11 | Knarr | Gardiner/West | To West Yellowstone, meet with "Cavin" F.S. biologist, X1 | | Calls/instructions |
| 10-Feb-11 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND TRIBAL HUNTERS | | |
| 11-Feb-11 | SMOLCZYNSKI | WEST YELLOWSTONE | PATROL BISON AND HUNTERS,TRIBAL | | |
| 16-Feb-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ATTEND MEETING WITH FS ABOUT BISON HUNT ISSUES | | |
| 17-Feb-11 | Knarr | Gardiner/West | Calls, haze/hunt/property damage, X4 | | Call & try to set up rescue for stuck tribal wardens |
| 18-Feb-11 | SMOLCZYNSKI | WEST YELLOWSTONE | INVESTIGATE CLAIM OF BISON BEING FEED ON HORSE BUTTE | | |
| 19-Feb-11 | SMOLCZYNSKI | WESTYELLOWSTONE | FOLLOW UP WITH DONKERSGOOD AND STOVALL ABOUT FEEDING ISSUES. INFORM TO CLEAN UP OLD HAY. | | |
| 20-Feb-11 | SMOLCZYNSKI | WEST YELLOWSTONE | VISIT WITH FS ABOUT CAMPGROUND AND HORSEBUTTE BISON ISSUES, PATROL | | |
| 24-Feb-11 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON PATROL AND HUNTERS, TRIBAL. WORK WITH FS ENFORCEMENT | | |
| 25-Feb-11 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON PATROL AND HUNTERS, TRIBAL. WORK WITH FS ENFORCEMENT | | |
| 26-Feb-11 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON PATROL AND HUNTERS, TRIBAL. WORK WITH FS ENFORCEMENT | | |
| 28-Feb-11 | SMOLCZYNSKI | WEST YELLOWSTONE | HAZE BISON FROM SOUTHFORK | | |

Table E1.—MFWP Management Actions taken in the West Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-----------|-------------|------------------|---|--|---|
| | | | W/SNOWMACHINE | | |
| 04-Mar-11 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON PATROL, TRIBAL HUNTERS | | |
| 06-Mar-11 | SMOLCZYNSKI | WEST YELLOWSTONE | CHECK BISON NUMBERS | | |
| 08-Mar-11 | SMOLCZYNSKI | WEST YELLOWSTONE | HAZE BISON FROM SOUTHFORK | | |
| 12-Mar-11 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON PATROL, TRIBAL HUNTERS | | |
| 14-Mar-11 | SMOLCZYNSKI | WEST YELLOWSTONE | FOLLOW UP ON BISON FEEDING ISSUE IN YELLOWSTONE VILLAGE, CLEANING UP OLD HAY. | | |
| 18-Mar-11 | SMOLCZYNSKI | WEST YELLOWSTONE | CHECK BISON NUMBERS | | |
| 23-Mar-11 | Knarr | Gardiner/West | Calls/patrol, X8 | | Calls/instructions |
| 05-Apr-11 | SMOLCZYNSKI | WEST YELLOWSTONE | DOL, FWP HAZE BISON FROM SOUTHFORK, SNOWMACHINE | | |
| 06-Apr-11 | Knarr | West/Gardiner | Haze/property damage, X3 | | Work on letter, response back to Franklin |
| 07-Apr-11 | Knarr | West/Gardiner | Haze, property damage, X4 | | Work on letter, response back to Franklin |
| 08-Apr-11 | SMOLCZYNSKI | WEST YELLOWSTONE | DOL,FWP HAZE BISON FROM HWY 287 | | |
| 19-Apr-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ASSIST APHIS IN BUFFALO PROJECT | | |
| 27-Apr-11 | SMOLCZYNSKI | WEST YELLOWSTONE | HAZE BISON FROM HWY287 | | |
| 29-Apr-11 | SMOLCZYNSKI | WEST YELLOWSTONE | DOL,FWP HAZE BISON FROM SNOWMACHINE | | |
| 01-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X6 | | Calls/instructions |
| 01-May-11 | Miller | YNP Stephens cr | assist trapping operation | | |
| 01-May-11 | Miller | | Calls: Eric MoreyX3, 320X2, MountX2 | | |
| 01-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | HAZE BISON FROM HWY20/DENNYCRK | | |
| 02-May-11 | Gosse | West Yellowstone | Haze on US Hwy 287 | Herd of 50 pushed past Red Mountain. One deformed calf observed. | None |
| 02-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X4 | | Calls/instructions |
| 03-May-11 | Knarr | Gardiner/West | Calls,haze/property damage, X4 | | Calls/instructions |
| 04-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X7 | | Catch Butte horses at pasture for Coy |
| 04-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON HAZE FROM 287 | | |

Table E1.—MFWP Management Actions taken in the West Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-----------|-------------|------------------|--|--|--|
| 05-May-11 | Gosse | West Yellowstone | Haze on US Hwy 287 | Herd pushed from US Hwy 287 to 191-287 junction | None |
| 05-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X3 | | To West Yellowstone, deliver ATV, rifle. Check on bison movement |
| 05-May-11 | Miller | | Calls: John Robideau, 318-horse, Phil Currie - fencing | | |
| 06-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X1 | | Calls/instructions |
| 06-May-11 | Miller | | get hay for buff hazing | | |
| 07-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X3 | | Calls/instructions |
| 07-May-11 | Miller | | calls: DOL X 3 | | |
| 07-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | RETRIEVE BISON HIT ON HWY 191 | | |
| 08-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X1 | | Calls/instructions |
| 09-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X2 | | Calls/instructions |
| 10-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X1 | | Calls/instructions |
| 10-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ASSIST ON BISON HAZE | | |
| 11-May-11 | Gosse | West Yellowstone | Haze on US Hwy 287 | Herd pushed on Hwy 287 past Red Mountain to Spring | None |
| 11-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X5 | | Calls/instructions |
| 11-May-11 | Miller | | Calls: DOL Anderson | | |
| 12-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X1 | | Calls/instructions |
| 12-May-11 | Miller | | Calls: 38, DOL Mount | | |
| 13-May-11 | Knarr | Gardiner/West | Calls/haze/property damage, X7 | | Calls/instructions |
| 13-May-11 | Miller | | Calls: DOL Mount | | |
| 13-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ASSIST ON BISON HAZE | | |
| 15-May-11 | Miller | | Calls: Gene Carter - fence, Rowdie Yates - Bison, MHP Buff at Kirkwood, DOL - Mount, | | |
| 16-May-11 | Knarr | West Yellowstone | Calls/haze, property damage, X3 | | Calls/instructions |
| 16-May-11 | Miller | | Calls: Joe Sparano - Bison fence | | |
| 16-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ASSIST ON BISON HAZE | | |
| 17-May-11 | Knarr | West Yellowstone | Calls/haze/property damage, X8 | | Purchase horse from Lee Hart |
| 17-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON ON HWY ISSUES | | |
| 18-May-11 | Knarr | West Yellowstone | Calls/haze/property | | Purchase horse |

Table E1.—MFWP Management Actions taken in the West Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|----------------------|--------------------|---------------------------------------|--|--|---|
| | | | damage, X4 | | from Lee Hart |
| 18-May-11 | Miller | Gardiner - West Yell | take horses to West Yell for hazing | | |
| 19-May-11 | Knarr | West Yellowstone | Calls/update/haze X1 | | Calls/update |
| 19-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON COUNT | | |
| 20-May-11 | Knarr | West Yellowstone | Haze, X3 | | Calls/update |
| 23-May-11 | Knarr | West Yellowstone | Hazing, X4 | | Calls/update |
| 23-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON MEETING | | |
| 24-May-11 | Knarr | West Yellowstone | Hazing, X1 | | Calls/update |
| 25-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ASSIST ON BISON HAZE | | |
| 26-May-11 | Knarr | West Yellowstone | Hazing, X1 | | Calls/update |
| 27-May-11 | Knarr | West Yellowstone | Hazing, X1 | | Calls/update |
| 27-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ASSIST ON BISON HAZE | | |
| 30-May-11 | SMOLCZYNSKI | WEST YELLOWSTONE | BISON/LANDOWER COMPLAINT, ISSUE RUBBER BULLETS | | |
| 31-May-11 | Knarr | West Yellowstone | Calls, hazing update, X5 | | Calls/update |
| May 31- June 3, 2011 | Kline | West Yellowstone | Bison Herding-Horse Butte-Cougar | | |
| 01-Jun-11 | Kerry Wahl/FG-36 | Horse Butte to Cougar Meadows | Horseback hazing of Bison | Constantly followed by BFC | |
| 01-Jun-11 | Gosse | West Yellowstone | Haze from Horse Butte to Cougar Meadows | Haze 300+ from west end of Horse Butte into Cougar Meadows | None |
| 01-Jun-11 | Knarr | West Yellowstone | Calls, hazing, to West, X9 | | Assist in West. Hazing off South Fork |
| 01-Jun-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ASSIST ON BISON HAZE | | |
| 02-Jun-11 | FG318 Jen Williams | West | Hazing Horses | | haze from cougar meadows to 7 mile in YNP |
| 02-Jun-11 | Kerry Wahl/FG-36 | Flats north of town to Cougar Meadows | Horseback hazing of Bison | Constantly followed by BFC | |
| 02-Jun-11 | Knarr | West Yellowstone | Calls, hazing Ops, X2 | | Conf. Call 10:00 |
| 02-Jun-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ASSIST ON BISON HAZE | | |
| 03-Jun-11 | Knarr | West Yellowstone | Calls, hazing, X5 | | Calls,instructions |
| 03-Jun-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ASSIST ON BISON HAZE | | |
| 05-Jun-11 | Knarr | West Yellowstone | Calls, hazing, X5 | | Calls, instructions |
| 06-Jun-11 | Knarr | West Yellowstone | Calls, hazing, X7 | | Calls, instructions |
| 08-Jun-11 | Miller | | Calls: DOL , 312, YNP Morey, YNP Wallen | | |
| 09-Jun-11 | FG318 Jen Williams | West | Hazing Horses | | haze from 191 to cougar meadows |
| 09-Jun-11 | Knarr | West Yellowstone | Calls, hazing ops, X7 | | |
| 10-Jun-11 | Knarr | West Yellowstone | Calls, hazing ops, X1 | | |
| 14-Jun-11 | Gosse | West Yellowstone | Haze from Horse Butte to Cougar Meadows | Haze 50+ from Horse Butte To Cougar | None |

Table E1.—MFWP Management Actions taken in the West Management Area for the 2010-2011 management season

| DATE | WARDEN | LOCATION | ACTIVITY | OBSERVATIONS | ACTIONS |
|-----------|-------------|------------------|------------------------|---|---------------------|
| 14-Jun-11 | Knarr | West Yellowstone | Calls, hazing ops, X5 | | |
| 14-Jun-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ASSIST ON BISON HAZE | | |
| 15-Jun-11 | Knarr | West Yellowstone | Calls, hazing ops, X2 | | |
| 16-Jun-11 | Knarr | West Yellowstone | Calls, hazing ops, X3 | | |
| 17-Jun-11 | Knarr | West Yellowstone | Calls, hazing ops, X4 | | |
| 18-Jun-11 | Knarr | West Yellowstone | Calls, hazing ops, X2 | | Calls, instructions |
| 20-Jun-11 | Knarr | West Yellowstone | Calls, hazing ops, X3 | | Calls, instructions |
| 21-Jun-11 | Knarr | West Yellowstone | Calls, hazing ops, X11 | Late night call for haze next day, called Gosse in for assistance, schedule Smolz | |
| 22-Jun-11 | Gosse | West Yellowstone | Haze Bison | Haze 80+ from Mile 3 closure Madison Arm Road into Cougar Meadows | None |
| 22-Jun-11 | Knarr | West Yellowstone | Calls, hazing ops, X2 | Smolz remembered he had made plans to teach F.S. @ last minute | |
| 28-Jun-11 | SMOLCZYNSKI | WEST YELLOWSTONE | ASSIST ON BISON HAZE | | |

**APPENDIX F:
STATUS OF GALLATIN NATIONAL FOREST GRAZING ALLOTMENTS**

Table F1.—Status of Gallatin National Forest grazing allotments

| Allotment Name | Location | Status | Class and Number of Livestock | On-Off Dates | Changes |
|------------------------|---------------------------------|--------|-----------------------------------|--------------|-------------------------------|
| West of Park | | | | | |
| Watkins Creek | West of Hebgen Lake | Active | 51 cow/calf pairs | 7/1-9/30 | |
| South Fork | South of Hebgen Lake | Active | 19 cow/calf pairs | 7/1-9/30 | |
| Basin | South of Hebgen Lake | Active | 16 cow/calf pairs | 7/21-9/19 | |
| Sulphur Springs | South of Hebgen lake and Hwy 20 | Active | 10 horses | 7/1-9/30 | Changed from cattle to horses |
| Wapiti | Taylor Fork | Vacant | 160 cow/calf pairs (2 permittees) | 7/11-10/10 | Permit waived to FS |
| Cache-Eldridge | Taylor Fork | Vacant | 154 cow/calf | 7/1- | Permit waived to |

Table F1.—Status of Gallatin National Forest grazing allotments

| Allotment Name | Location | Status | Class and Number of Livestock | On-Off Dates | Changes |
|-------------------------------------|--|------------------------------|--|--------------|--|
| | | | pairs | 10/15 | FS |
| Red Canyon | North of Horse Butte, North of Hwy 287 | Vacant | cow/calf pairs | | |
| Duck Creek | East of Hebgen Lake | Closed | cow/calf pairs | | Status changed from vacant to closed |
| Dry Gulch | Northeast of Horse Butte, North of Hwy 287 | Closed | cow/calf pairs | | Status changed from vacant to closed |
| Horse Butte | East of Hebgen Lake | Vacant | cow/calf pairs | | |
| University | Taylor Fork | Closed | sheep | | Status changed from vacant to closed |
| Sheep Mile | S. of Quake Lake | Active | 89 yearlings | 6/20-10/20 | |
| Two Top | Hebgen Lake | Closed | Used to be sheep | | Status changed from vacant to closed |
| Lionhead | Hebgen Lake | Closed | Used to be sheep | | Status changed from vacant to closed |
| North of Park | | | | | |
| Tom Miner and Ramshorn | | Active (combined allotments) | 126 cow/calf pairs 134 pvt land permit | 7/1-10/15 | |
| Horse Creek and Reeder Creek | Upper Tom Miner | Active (combined allotments) | 78 cow/calf pairs 30 horses | 7/1-9/30 | |
| Mill Creek and Section 22 | Upper Cinnebar and Upper Mulherin | Vacant | 36 cow/calf pairs | 6/16-10/15 | Permit waived to FS |
| Green Lake | | Active | 46 cow/calf pairs | 6/16-10/15 | Change from 2 permittees to 1, permittee waived permit to FS |
| Wigwam | | Active | 56 cow/calf pairs | 6/16-9/30 | |
| Slip and Slide | East side of Yellowstone River | Active | 47 cow/calf pairs, one permit vacant | 6/16-10/15 | Change from 2 permittees to 1, permittee waived permit to FS |
| Canyon | | Closed | cow/calf pairs | | Status changed from vacant to closed |
| Cottonwood | | Vacant | cow/calf | | |

Table F1.—Status of Gallatin National Forest grazing allotments

| Allotment Name | Location | Status | Class and Number of Livestock | On-Off Dates | Changes |
|----------------|----------|--------|-------------------------------|--------------|--------------------------------------|
| | | | pairs | | |
| Lion Creek | | Vacant | cow/calf pairs | | |
| Park | | Closed | cow/calf pairs | | Status changed from vacant to closed |
| Sentinel Butte | | Closed | cow/calf pairs | | Status changed from vacant to closed |