Informational Summary of Volume I, Part I
Final Environmental Impact Statement (EIS)
Bison Management Plan for the State of Montana and Yellowstone National Park

Note: The informational summary presented here is verbatim, paraphrased or collated from different sections of Volume I of the final EIS on long-term management of Yellowstone's bison herd. This summary includes only the purpose and need of action, the agencies and their respective roles, the timeline and project location, some background information, details and strategies of the modified preferred alternative including costs, objectives and some impacts to the bison population. It was prepared by Darrell Geist, Executive Director of Cold Mountain, Cold Rivers PO Box 7941 Missoula MT 59807 406-728-0867 cmcr@wildrockies.org.

Purpose of Action: To maintain a wild, free ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana.
pg. i.

Need for Action: Bison are an essential component of Yellowstone National Park because they contribute to the biological, ecological, cultural and aesthetic purposes of the Park. However, the Park is non a self-contained ecosystem and periodic bison migrations into Montana are natural events. Some bison carry brucellosis and may transmit it to cattle that occupy bison range.
pgs. vi,vii, 14

Project Agencies: The U.S. Department of Interior (National Park Service) and the U.S. Department of Agriculture (Forest Service) are the federal lead agencies. The U.S. Department of Agriculture (Animal and Plant Health Inspection Service) is a cooperating agency. The state of Montana was a lead agency in the preparation of the EIS until December, 1999, when disagreements over a final plan led the federal government to terminate a Memorandum of Understanding between the parties which was affirmed by U.S. District Court Judge Charles C. Lovell. (Note: If Montana is not a signatory to a final Record of Decision it may devise its own plan or continue implementing an Interim Plan to manage migrating bison in Montana).
pg. i, iii, 40-41, 453, 711-727

The National Park Service is the federal agency with authority for conserving and protecting Park resources by such means as will leave them unimpaired for the enjoyment of future generations.

APHIS is the federal agency with authority to protect and improve the United States' agricultural sector, and to cooperate with states to prevent the spread of livestock diseases. It also has jurisdiction over the national brucellosis eradication program. Under Title 9, CFR Part 78 APHIS have jurisdiction over the classification of a state's brucellosis status.

The Montana Department of Livestock have statutory authority to protect and promote the livestock industry, including explicit statutory authority to control migrating bison from the Park. This agency is funded by State Special Revenue paid into by all Montana livestock producers. However, the agency has received grant money from APHIS for a bison capture facility on Horse Butte (Gallatin National Forest).

The Montana Department of Fish, Wildlife and Parks is responsible for game and wildlife management including on national forest lands. However, the Montana Department of Livestock has primary authority over migrating bison as state statute classifies them as diseased or originating from a diseased herd.

The U.S. Forest Service is the federal agency with authority for managing habitat on national forests including the maintenance of viable populations of native wildlife and plant species to meet multiple use objectives. It is responsible for ecological conditions on national forests, and as such, makes jurisdictional decisions as to when livestock grazing allotments need modification to give preference to native wildlife. However, changes to national forest grazing allotments based on brucellosis (or disease) is under the jurisdiction of APHIS and the Montana Department of Livestock. These changes in allotments or livestock management for reasons of disease are made to the U.S. Forest Service and the grazing permit holders. The U.S. Forest Service can then modify grazing permits or allotment plans, as needed, to minimize the risk of disease transmission from wildlife to livestock.
pgs. 46-51, 453-454, Appendix E

Project Location: Greater Yellowstone ecosystem, the largest and most intact ecosystem in the contiguous United States. The ecosystem encompasses the 2.2 million acre Yellowstone National Park, of which 1.75 million acres is 'habitually' occupied by bison. The lands outside the Park include 568,994 acres primarily located on the Gallatin National Forest (97%). State or local government lands (1%) and private lands (2%) account for the remainder of lands affected by this project.
pg. vi.

Timeline: 15 years beginning in the winter of 2000-2001 through the winter of 2014-2015.

Background: Bison once ranged from the Appalachian Mountains to the Great Basin south into Mexico and as far north as the Yukon territory in Canada. The bison population in historic times ranged from 30 to 65 million. Bison are native to the Greater Yellowstone ecosystem and ranged in the northern Rocky Mountains of western Montana and Wyoming. By 1901, only 25 bison were counted in Yellowstone National Park. By January 2000, 2,410 bison roamed the Park. The Yellowstone bison are the descendants of the only continually wild herd to occupy their native range in the United States.
pgs 15-41

Bison retain the memory of migratory routes. Bison winter range and corridors on the Northern boundary include Gardiner Valley, Reese Creek, Eagle Creek/Bear Creek, Little Trail Creek/Maiden Basin, Hellroaring and Slough Creek.

Bison winter range and corridors on the Western boundary include Grayling Creek/Fir Ridge, Madison River, Duck Creek, Cougar Creek, Horse Butte Peninsula, and the south arm of the Madison River.
pg vii, xi, xlv, 15, 30, 35, 59,61

Approximately 2,019 cow-calf pairs graze on bison winter range within 10 miles north and west of Yellowstone National Park - less than 4% of the cattle population of Gallatin and Park counties.
pgs xxxiii, 304-308, (Maps 309-316), 456, 471

Nine objectives were identified in determining which alternatives are reasonable, and in guiding the selection of a preferred alternative:

1. Address bison population size and distribution; have specific commitments relating to the size of Yellowstone's bison herd.
2. Clearly define a boundary line beyond which bison will not be tolerated.
3. Address the risk to public safety and property damage by bison.
4. Commit to the eventual elimination of brucellosis in bison and other wildlife.
5. Protect livestock from the risk of brucellosis.
6. Protect the state of Montana's brucellosis-free status.
7. At a minimum, maintain a viable population of wild bison in Yellowstone National Park, as defined in biological, genetic and ecological terms.
8. Be based on factual information, with the recognition that the scientific database is changing.
9. Recognize the need for coordination in the management of natural and cultural resource values that are the responsibility of the signatory agencies.
pgs. xiii, 43-45

Modified Preferred Alternative: Although the government has not issued a Record of Decision, they have identified a modified preferred alternative for implementation. The federal agencies acknowledge that the state of Montana would decide the long-term management for bison located on lands outside Yellowstone National Park in Montana.
pg. 177

Elements of the Modified Preferred Alternative include:
1. An adaptive management approach that allows agencies to gain experience and knowledge of bison migrations and behavior over time, including a phased or 3-step process for plan implementation, and bison management zones. Adaptive management strategies to ensure spatial and temporal separation include hazing, capturing, testing, slaughter and quarantine of bison, and a zone management regime based on decreasing tolerance for bison that migrate near zone boundaries.
pgs. 178, 186-188

2. A 45-day spatial and temporal separation of bison or their birth products and cattle.

3. When bison are allowed to exit the Park to access winter range they are managed in zones. The intensity of management increases (lethal means) and tolerance decreases as bison migrate near zone boundaries.

4. An overall bison population of 3,000. Bison tolerance limits of 100 each on the north and west boundaries of the Park. Tolerance limits are based on the ability of the agencies to monitor, manage and limit bison movements within a specific geographic area.
pg 192.

5. Vaccination of vaccine-eligible bison, including remote vaccination inside the Park.

6. Telemetry would be used to monitor seronegative pregnant bison, i.e. captured pregnant bison that test negative would be radio-collared and implanted with a vaginal telemetry device that would be expelled/activated on birth or abortion.

7. Testing, calfhood vaccination, and possible adult vaccination of cattle grazing on bison range west and north of the Park. At the owner's request APHIS could certify as brucellosis-free, cattle herds that occupy bison range if they meet certification requirements. APHIS will also reimburse costs of cattle vaccination.
pg. 191

8. Untested bison would be allowed to occupy these public lands year-round without agency interference: Eagle Creek/ Bear Creek and the Absaroka Beartooth Wilderness (on the north); Cabin Creek Recreation and Wildlife Management Area, and the Monument Mountain Unit of the Lee Metcalf Wilderness (on the west). Bison would be hazed off Cabin Creek/Monument Mountain in the spring, if feasible.
pgs. 183-185

Detail of Modified Preferred Alternative:
Step 1 on the Northern boundary (Gardiner)
Bison migrating north of the Park near public and private lands on Reese Creek would be hazed to prevent migration outside the Park. If hazing becomes ineffective bison would be captured and tested in the Stephens Creek capture facility, or shot. Bison testing seropositive would be shipped to slaughter. Calves and yearlings would be vaccinated. Up to 125 seronegative bison would be held at the capture facility by the National Park Service until late winter or early spring and released to move back into the Park on their own. A few might be used for research purposes. Bison that could not be hazed back into the Park would be shot.
pgs. 177-180, 183, 185

Bison would be allowed to occupy the Eagle Creek/Bear Creek area up to the Little Trail Creek/Maiden Basin divide. Bison migrating beyond the divide would be hazed or shot.
pgs. 177-180

Step 1 on the Western boundary (West Yellowstone)
Bison migrating out of the Park along Duck Creek, Cougar Creek, Madison River and other corridors would be hazed whenever feasible. If hazing is ineffective, bison would be captured and tested. However, haze, capture, test and bison slaughter operations are employed at the discretion of the Montana state veterinarian.Two separate bison capture facilities could be operated throughout the winter on Duck Creek (private land) and Horse Butte (public land).
pgs. 103-109, 184

All seronegative bison including pregnant females, would be released up to a tolerance level of 100 bison. Calves and yearlings would be vaccinated. Pregnant females would be radio collared and implanted with a vaginal telemetry device that would be expelled/activated on birth or abortion. Bison would be hazed back into the Park 45 days prior to cattle occupying allotments in the area. Bison that could not be hazed, captured or are not tolerated would be shot.
pg. 178, 184

During step 1 APHIS would initiate a NEPA (National Environmental Protection Act) process to determine the design, location and operation parameters of a bison quarantine facility.
pg. 178

Step 2 begins when an existing cattle lease expires on land purchased by the Rocky Mountain Elk Foundation and the federal government, which is now under the jurisdiction of the Gallatin National Forest.
pg 178.

Step 2 on the Northern boundary (Gardiner)
Hazing of bison would be employed to prevent migration north of the Park. If hazing was ineffective, capture of bison would begin. Seropositive bison would be sent to slaughter. Captured calves and yearlings would be vaccinated. Pregnant females would be radio collared and implanted with a vaginal telemetry device that would be expelled/activated on birth or abortion. Up to 100 seronegative bison would be allowed to occupy these lands during the winter under certain conditions including: the overall bison late winter/early spring population is at 3,000, only seronegative bison are allowed out of the Park, no more than 100 bison occupy the area, and all bison not returning on their own would be hazed back into the Park in the spring.
pg 179, 183

Step 2 on the Western boundary (West Yellowstone)
Identical to step 1, except any untested calves, yearlings, or other vaccine-eligible bison that could not be captured would be remotely vaccinated if an effective

delivery system is available. Other bison that could not be hazed, captured or are not tolerated, would be shot.
pg. 179

Step 3 begins when the agencies gain experience managing bison in each boundary zone, and after a minimum of two years following the release of seronegative bison, e.g. the winter of 2003/2004 in West Yellowstone and 2004/2005 in Gardiner. Up to 100 untested bison would be allowed to freely range in designated management zones on both the western and northern boundaries of the Park. Bison would be hazed back into the Park in the spring or shot.
pg 179-180

Bison capture facilities in Gardiner (Stephens Creek) and West Yellowstone (Duck Creek and Horse Butte), and a quarantine facility would be used to maintain the bison population at 3,000, enforce tolerance levels of 100 bison, and ensure a 45-day separation period between bison and cattle. Park wide vaccination of bison calves and yearlings would begin.
pg 179-180

The unknowns involved in implementing the modified preferred alternative include: safety and efficacy of RB 51 vaccination; availability of a remote delivery system; location, design, operation, holding capacity and date of availability of a bison quarantine facility which requires a new NEPA process; and the outcome of a new NEPA process for Park wide vaccination of bison.
pgs. 179-180

Zone Management:
Special management areas or management zones would be created and could be implemented under current federal regulations. However, creation of these zones requires the approval of the state of Montana as specified by Montana law.
pg xv, 55, 454

The agencies would limit bison movement on the North boundary to Yankee Jim Canyon and would rely on topography and progressively more intense management (lethal means) as bison migrated near the boundaries of zone management areas even if cattle were not present in the area. A second capture facility may be constructed between Reese Creek and Yankee Jim Canyon to control bison migration. Bison beyond the Little Trail Creek/Maiden Basin hydrographic divide would be hazed or shot.
pgs. 183, 185, 188, 189

Zone 1 includes bison winter range on the northern boundary of Yellowstone National Park near Reese Creek. Bison would be subject to hazing in the spring to maintain a 45-day separation period. Capture and testing of bison may occur to manage for bison tolerance limits (100 bison) and herd population size (3,000). The zone is from Mammoth Hot Springs north to Gardiner and west-northwest to Reese Creek.

pg 185, 181

Zone 2 includes U.S. Forest Service bison winter range with some conservation easement lands where bison would be managed for a 45-day separation period, lethal removal for private property owners and bison tolerance limits (100). The zone borders Maiden Basin divide, north of Reese Creek, in a 1-mile wide corridor paralleling Highway 89 to Yankee Jim Canyon. pg. 186, 181

Zone 3 includes lands where bison leave Zone 2 and would be intercepted and killed. The zone roughly parallels to the east and west the 1-mile wide corridor in zone 2 to Yankee Jim Canyon.
pg. 186, 181

Bison in the West boundary area would be managed in four zones, using topography and progressively more intense management (lethal means) to ensure no contact is made between bison and cattle outside the boundary zones. Bison would always be hazed back into the Park in the spring, or captured or shot to ensure none remain on the West boundary during the 45-day period before cattle return.
pg 184

Zone 1 includes bison winter range on the western boundary of Yellowstone National Park. Bison would be subject to hazing in the spring to maintain a 45-day separation period. The zone approximately follows Highway 191-287 (on the east side) from West Yellowstone north to Duck Creek.
pgs 187, 181

Zone 2 includes U.S. Forest Service bison winter range and some private property where bison would be managed for a 45-day separation period, lethal removal for private property owners, bison tolerance limits (100) and bison population size (3,000). The zone approximately follows Highway 191-287 (on the west side) from West Yellowstone north to Duck Creek. The north boundary approximately parallels Highway 287 to Red Canyon Creek. The south boundary roughly parallels Highway 20 to the south arm of the Madison River. The western boundary is the Horse Butte Peninsula (Hebgen Lake) and the south arm of the Madison River.
pgs 187, 181

Zone 3 includes lands where bison leave Zone 2 and would be intercepted and killed. The zone is roughly a 2-mile wide corridor paralleling Highway 287 from Red Canyon Creek to Hebgen Dam. It also includes a roughly 2-mile wide corridor from the south arm of the Madison River west on Highway 20 to Targhee Pass.
pgs. 187, 181

Zone 4 is an extra buffer between the bison herd and cattle that winter beyond zone 3.
pg. 187

Note: Topographical descriptions of zone management areas are not provided in the EIS. They are only presented on a map for the Modified Preferred Alternative.

Annual Cost/Income Estimates of the Modified Preferred Alternative:
National Park Service: $1,059,700
U.S. Forest Service: $22,000
State of Montana: $371,020*
APHIS: $1,203,800-$1,533,800
Shared Costs: $29,100,000 (Acquisition/easement of 6,000 acres along Reese Creek)
Total: $2,656,520-$2,986,520
Note: These figures do not include a one-time cost of $150,000 to construct a new bison capture facility between Reese Creek and Yankee Jim Canyon, land costs for a bison quarantine facility and the acquisition/easement of 6,000 acres along Reese Creek .
* Includes income of $51,480 from the sale of bison heads, hide and meat.
pg v, 195, 531-532, 534

Impacts on Bison Population:
With an average number of bison migrating outside the Park the modified preferred alternative would remove between 159 and 165 bison in each year of the 15-year plan. Of the 159 bison, 62 would be shipped to slaughter and 97 sent to quarantine. Of the 165 bison, 49 would be shipped to slaughter and 124 sent to quarantine.

However, to maintain the population below 3,000 an additional 79 to 81 bison would be removed for a total annual average removal of 159 to 246 bison. Larger removals of bison would occur to maintain this average removal rate when severe winter conditions periodically forced additional bison outside Park boundaries.
pg 430

see also pgs 287-288 (NRAMP gene), 277-292, 429-440

Informational Summary of Volume I, Part II
Final Environmental Impact Statement (EIS)
Bison Management Plan for the State of Montana and Yellowstone National Park

Note: The informational summary presented here is verbatim, paraphrased or collated from different sections of Volume I of the final EIS on long-term management of Yellowstone's bison herd. This summary (Part II) includes information on the Yellowstone bison population such as herd dynamics, ecology, genetics, access to range and impacts of the modified preferred alternative; recent research on brucellosis, including its viability in the environment and prevalence in the herd, and the safety and efficacy of vaccinating bison. It was prepared by Darrell Geist, Executive Director of Cold Mountain, Cold Rivers PO Box 7941 Missoula MT 59807 406-728-0867 cmcr@wildrockies.org.

Yellowstone Bison Population:
Studies of the paleontology and history of the Greater Yellowstone ecosystem indicate bison have inhabited the area since prehistoric times. Yellowstone National Park is the most severe North American habitat supporting a viable population of free-ranging bison (Meagher 1971). The accumulation of snow on the Yellowstone Plateau makes it more stressful for bison and affects their behavior. Bison are well adapted to this environment, and use their massive heads, supported by powerful neck and shoulder muscles, to displace snow to access forage in areas unavailable to other ungulates. During winter, 99% of bison diet is grasses and sedges, with browse accounting for 1%.
pg. 277, 278, 279

The social bonds formed by bison cow-calf herds are strong and usually broken only be severe environmental conditions. Young bulls often separate from cow-calf herds after the rut to form small fraternal groups. Old bulls are often found as scattered individuals, and can move long distances. These bison bulls are often the least tolerant of any other animals, including humans.
pg. 277

Field classification of the Yellowstone bison herd by NPS biologists in August of 1998 and 1999 show a substantial difference in the proportion of the population comprised of yearlings.
pg. 281

Because individual bison tend to live on large quantities of forage, bison herds are constantly on the move, and have great stamina to travel long distances. In deep snow, they commonly travel in single file, with alternating leaders, to reduce energy expenditures. Bison appear to retain and pass along knowledge through generations, including pathways to better forage. Suitable bison habitat outside Yellowstone National Park includes lower elevation winter range along major drainages.
pg. 278, 279

While earlier reports suggested bison may use groomed roads or trails for travel (Meagher 1989a), results of another study indicated 17% of bison travel on roads during the grooming season and 83% of bison travel occurred on off-road, off-trail, and on established trails in the Madison-Gibbon-Firehole study area. Bison use of groomed roads seems to be an activity neither sought out or avoided (Bjornlie 2000).
pg. 279

Bison Ecology:
Bison play an important role in Yellowstone's ecosystem. There is some evidence that grazing by both bison and elk can increase the productivity and stability of grassland ecosystems, and enhance the nutrient content of grazed plants (Frank and McNaughton 1993; Singer 1995; Wallace 1996). Bison contribute to new plant growth by distributing seeds, breaking up soil surfaces with their hooves and wallows, and fertilizing by recycling nutrients through their waste products. Grazing may also maintain open grassland communities by preventing accumulation of dead grass litter that would otherwise suppress growth of grasses (T. Baumeister, pers. comm). Thus, bison help maintain open grasslands that are important to many other species.
pg. 284, 286

Historically, prairie dog distribution overlapped completely with bison distribution (J. Shaw, pers. comm.). Burrowing rodents appear to benefit from disturbances created by bison trampling and wallowing.
pg. 286

Bison rub trees and saplings, debarking and sometimes killing them (NPS, Meagher 1973). This activity may benefit insects and bird species such as woodpeckers and cavity-nesting birds. It has been suggested that tree rubbing and debarking by bison may impede or even prevent forest invasion of open grasslands. (NPS, Meagher 1973; J. Shaw, pers comm.)
pg. 284, 286

From March through May, ungulates, mostly elk and bison carrion, are the most important food source for Yellowstone grizzly bears (Mattson, Blanchard et al. 1991). A secondary peak in consumption of ungulates occurs during the fall, as bears scavenge carcasses of bison, elk, and moose that die or are preyed upon during the rut. Grizzly bears show an apparent preference for bison carcasses (Craighead et al. 1995). The largest biomass consumed per carcass is from scavenged male bison. Overall, army cutworm moths, elk, bison, cutthroat trout, and whitebark pine seeds are the highest sources of digestible energy and the most important foods available to grizzly bears in the Yellowstone ecosystem (Mealey 1975; Pritchard and Robbins 1990; Craighead et al. 1995). These food sources may exert a positive influence on grizzly bear fecundity and survival.
pg. 345, 347, 348

In the Yellowstone ecosystem, wolves feed on live and dead elk, deer, bison, and smaller mammals. Due to their size and shape, bison in deep snow are vulnerable to wolves (Telfer and Kelsall 1984). As their numbers increase, wolves may increasingly use bison as a prey source (Koth et al. 1990). Boyce and Gaillard (1992) predicted that in Yellowstone, wolf predation of bison would decrease the bison population by no more than 15%. For some wolves, Yellowstone bison may become a regular prey item, particularly during late winter and spring (Smith et al. 1999).
pg. 349, 282

Predators and scavengers in the Yellowstone ecosystem include grizzly bears, wolves, black bears, mountain lions, coyotes, foxes, wolverines, bobcats, and a variety of smaller mammals, bald eagles, golden eagles, ravens, magpies, and several smaller bird species. Specialized scavengers also include a variety of insect species. Scavengers in the Yellowstone ecosystem rely heavily on carcasses of bison and elk for both winter and early spring food.
pg. 359

Yellowstone Bison Genetics:
Genetic variability allows populations to evolve under different selection pressures. If a population is not genetically variable, it may not be able to survive changing environmental conditions, and may also suffer from inbreeding effects. According to Frankel and Soule (1981) the estimated size of a minimum viable population should not allow greater than 1% loss of the genetic variation per generation if the population is to avoid inbreeding effects over a long period of time. As a species, bison show levels of variation that are relatively low (Bonnell and Selander 1974; Roy et al. 1994). Yellowstone's bison display average levels of genetic variation compared with other bison populations (Polziehn et al. 1996; Ward et al. 1999; Stormont 1993).
pg. 286-287

What the above studies suggest is that for large-bodied polygynous mammals that have experienced fairly recent bottlenecks, a large proportion of genetic variability may already have been lost (Berger and Cunningham 1994). When bison were driven to near extinction in the late 19th century, the species experienced an extremely large bottleneck (Roe 1970). Without knowing the levels of genetic variability prior to their near extinction, it is difficult to determine what level of genetic variability in bison was lost.
pg. 287

Because Yellowstone's bison herd is an isolated population, it can be susceptible to genetic drift. Genetic drift is the change in genetic frequencies (diversity) over generations due to the random sampling (loss) of the genetic material in the population. Genetic variation will be lost faster in smaller populations (Frankham 1996). Eventually, genetic drift can result in a depression of genetic diversity.
pg. 287

Cattle mitochondrial DNA has been discovered in a number of bison populations as a result of earlier private-sector crossbreeding trials. Polziehn et al (1995) found cattle mitochondrial DNA in almost one third of the bison from Custer State Park, and Ward et al (1999) found cattle mitochondrial DNA in other private, state and federal herds. Cattle mitochondrial DNA was not found in Yellowstone's bison herd.
pg. 287

An additional genetic issue concerning Yellowstone's bison is the extent to which the gene, known as the natural resistance associated macrophage protein1 (NRAMP1) gene, is prevalent in the bison herd. This gene has been shown to have a major impact on controlling a natural resistance to brucellosis in bovines. It appears that the DNA sequence of NRAMP1 has been partially conserved in native bison. Although the extent to which this genetic trait is expressed in Yellowstone's bison is not fully understood, conserving this trait would seem to be an important consideration for long-term brucellosis management.
pg. 287-288

Management prescriptions that result in nonrandom selective removal of bison from the population through lethal and nonlethal mechanisms (e.g. selective removal of pregnant females, females that carry the NRAMP1 trait, or prime breeding-age bulls) can negatively influence the resultant genetic integrity and viability of Yellowstone's bison population.
pg. 288

From the winter of 1984-1985 through 1999-2000 approximately 3,172 Yellowstone bison were shot in the field or shipped to slaughter. During the winter of 1996-1997, 1,084 bison were killed, approximately 31.5% of Yellowstone's herd. [Note: Table 17 Historic Bison Population Counts and Removals from the Winters 1901-02 to 1999-2000 show 3,177 bison were shot in the field or shipped to slaughter].
pg. 379, 285

Brucella Abortus:
The precise relationship between serological tests (the test used to determine seropositivity or seronegativity) and the presence of Brucella abortus bacteria (brucellosis) in bison is unknown. Even the precise relationship between serological tests and the ability to culture the Brucella abortus organism from bison is not well understood at this time. A bison with no detectable antibodies in a blood serum test is seronegative. A bison with detectable antibodies in a blood serum test is seropositive.
pg. 288, 804

A positive culture indicates the presence of Brucella abortus (B. abortus), but a negative culture does not prove the absence of the organism. In addition, it is possible that a seropositive bison may not truly be infected.
pg. 289

A recent study using a rigorous experimental sampling protocol found that 46% of 26 seropositive female Yellowstone bison were culture positive (Roffe et al. 1999). Selected specimens from 144 bison that were either shot or sent to slaughter from 1997 to 1999 were cultured for B. abortus. Of the 97 seroreactors in the group of 144 bison, 13 of 52 seropositive females (25%) and 13 of 45 seropositive males (29%) were culture positive (USDA, unpub. data).
pg. 289

The primary route of animal infection from Brucella abortus arises from contact with or ingestion of aborted fetal material and fluids, and the risk of transmission in animals is largely determined by the presence and survival of Brucella abortus in the aborted fetal material and placenta (Wray 1975; Stableforth 1959; Nicoletti 1986; National Academy of Sciences 1998).
pg. 291

Samples taken in April 1996, May 1997, and May 1998 from 30 known birth or abortion sites in Yellowstone National Park resulted in B. abortus being isolated at only two of those sites and lasting a maximum of 18 days after the birth or abortion event (K. Coffin, pers. comm.). Field tests in Laramie, Wyoming by Cook (1999) found that B. abortus strain RB51 survived on samples taken from the exposed surface of bovine fetuses from 17.1 days in February to 0.3 days in June. Samples taken from the underside of the fetuses showed bacteria surviving from 60.5 days in February to 4.7 days in June.
pg. 291, 292

In a separate study, Cook (1999) placed fetuses in various habitats within the Greater Yellowstone ecosystem during February and March of 1996-1998 and found that 90% were scavenged, primarily by carnivores, and disappeared within 4 days. By consuming the products of birth and abortion, carnivores remove the bulk of infectious materials from the site and expose remaining B. abortus on the soil and vegetation to light and desiccation, to which they are vulnerable (Mitscherlich and Marth 1984). The National Academy of Sciences (1998) also concluded "predation and scavenging by carnivores likely biologically decontaminates the environment of infectious B. abortus with an efficiency unachievable in any other way."
pg. 291

The data presented by Cook (1999) show that the viability of the organism drops off rapidly during April and May and that separation of bison and cattle on public grazing allotments by as little as 4.7 days in mid-June could be sufficient to eliminate the risk of cattle being exposed to viable Brucella bacteria.
pg. 291

Bison Vaccination Safety and Efficacy:
Evaluations of RB51 indicate the vaccine is clinically safe when administered to bison calves from three to at least six months of age. To be defined as safe, a vaccine would not have any clinical effects that would increase predation or decrease survivability. However, adverse clinical effects, such as listlessness,

anorexia, depression, and arthritis, that are transient and minimal with no long-term effects on survival may be acceptable. Research is ongoing to evaluate safety and efficacy of RB51 booster vaccination of bison yearlings previously vaccinated as calves. Results of these safety evaluations will be available in 2001 and efficacy data will be available in 2004 (Steve Olsen, pers. comm). Research on whether vaccinating calves with RB51 affects later reproductive ability is ongoing using domestic bison. Results are expected by 2001.
pg. 387, 96, 94

RB51 vaccination did not cause morbidity or mortality in adult male bison and administration of RB51 to adult males is generally concluded to meet biosafety requirements (Olsen et al. 1999; Elzer et al. 1998).
pg. 387, 96

Available evidence regarding vaccination of adult female bison is ambiguous. Initial tests of RB51 administered on pregnant adult females indicated a substantial number of them had vaccine-induced abortions, fetal RB51 infections, and placentitis (Palmer et al. 1996). To be defined as efficacious in female bison, a vaccine must induce statistically greater protection against fetal loss, infected calves, or infection in pregnant vaccinates after experimental challenge when compared with nonvaccinated bison in the same experiment. At this time, vaccination of adult pregnant bison with RB51 would not meet the biosafety protocols. Furthermore, the federal agencies assume that such a vaccine for pregnant bison and female adult bison would not be available in any alternative proposed or in the near future of the Bison Management Plan.
pg. 387, 97, 96, 94

RB51 is a live vaccine, i.e. live forms of Brucella abortus bacteria are used in the manufacture of the vaccine.
pg. 93

Modeling Effects of the Modified Preferred Alternative on Yellowstone's Bison:
If implementation of the government's modified preferred alternative began in 2000, deterministic modeling of seroprevalence in the bison population showed 33% of the herd would be seropositive in 2006, due to the removal of seropositive bison and remote calfhood vaccination (at 70% efficacy). Seroprevalence in the bison herd would be 25% by 2011.
pg. 433

An enhanced stochastic model of seroprevalence in the bison population showed a decline from 36% in the herd in 2002, to 11% by 2014 the last year of the government's 15-year plan.
pg. 434

Brucellosis transmission from elk to bison is likely to prevent the long term eradication of brucellosis from bison (NAS 1998); indeed, preliminary stochastic

model runs simulating a bison test and slaughter program without vaccination illustrated this point. After brucellosis was eliminated from the model population, reinfection of bison from elk led to an increase of seroprevalence to pretest and slaughter levels in about 20 years (R. Angliss, unpub. data).
pg. 383-384

Considering that management actions may occur when tolerance limits were exceeded for bison, the enhanced stochastic model projected that between the years 2002 and 2014 an average of 10-20 bison would remain outside the northern Park boundary within special management areas during winter.
pg. 435

The enhanced stochastic model estimated that between 2-10 bison would occupy the special management areas on the western Park boundary prior to 2004. After 2004, the model projected that an average of 10-12 bison would remain outside the western Park boundary during winter.
pg. 435

For the northern boundary, the modified preferred alternative calls for no bison being allowed north of the Park at Reese Creek for two years while livestock grazing continues. Bison would be hazed to prevent migration outside the Park, and if hazing is unsuccessful, bison would be captured and tested with seropositives sent to slaughter. In 1999, the Departments of the Interior and Agriculture and the Rocky Mountain Elk Foundation government acquired approximately 4,800 acres of land north of Reese Creek for wildlife winter range, including bison, and an additional 1,200 acres is under conservation easement. Bison would be prevented from occupying public and conservation easement lands north of the Park boundary at Reese Creek from mid-April through October 31. However, these lands require the establishment of a special management area which is subject to the approval by the state of Montana.
pg. 429, 432, 438, 269-270

Approximately 125 seronegative bison would be temporarily held in the Stephens Creek capture facility until early spring. Approximately 13 acres of winter range habitat inside Yellowstone National Park in the Stephens Creek area would be unavailable to bison because of management actions to capture bison at the Stephens Creek facility. Beginning in 2003, approximately 65-82 seronegative bison would be allowed to winter in this area.
pg. 429-430, 432, 438

[Note: The bison capture facility at Stephens Creek is located in the core of Yellowstone pronghorn antelope winter range. Observations made during bison capture and hazing activities in the winter of 1996-97 indicated that pronghorn were displaced at least 1/2 mile from the bison capture facility (Caslick and Caslick 1997). The Yellowstone pronghorn population contains unique genetic elements, and has been shown to have greater genetic variability than many other pronghorn populations (Lee, Bickham, and Scott 1994). This population has experienced a

major decline in recent years, and Goodman (1996) has indicated that the Yellowstone pronghorn is at a high risk of extinction within the next 100 years. The cumulative effects of bison capture operations combined with predation, restricted winter range, increasing human development and other activity could result in eventual irreversible loss of Yellowstone's pronghorn antelope].
pg. 590-591, 609, 355

For the western boundary, the modified preferred alternative would initially allow up to 100 seronegative bison, with 22-60 bison expected to winter there. Bison would be prevented from occupying public lands in the western boundary area from mid-May through October 31. Beginning in 2003, as many as 56 untested bison could winter in the west boundary; however these bison might be captured and tested, with seropositive bison sent to slaughter and seronegative bison sent to quarantine, if available, to limit the population to 3,000. These actions would result in few (if any) bison remaining in the western boundary of the Park in spring and during the life of the 15-year plan.
pg. 432, 433, 439

The deterministic model predicted that management removals would average about 1.5% of the total Yellowstone bison population from 1997 to 2002. Beginning in 2003, additional removals would be required to manage the population near 3,000 bison, and these removals would average about 7.6% of the early winter population.
pg. 436

The enhanced stochastic model indicated that after tolerance of untested bison is reached outside the Park in 2002, additional removals totaling 19% of the early winter population would be required to manage the early spring population to 3,000 bison.
pg. 436

Using the enhanced stochastic model, total bison removals under the modified preferred alternative would be 11% greater than alternative 1 (the current Interim Plan) over the life of the 15-year plan, which is considered a moderate adverse impact.
pg. 438

By summing the mean number of bison removals, the stochastic model predicted a total of 4,664 bison would be removed under alternative 1 (the current Interim Plan) over the lifetime of the 15-year plan.
pg. 393

For the modified preferred alternative, the stochastic model projects 1,382 bison would be killed and 3,792 bison would be removed to quarantine, if available, over the life of the 15-year plan.
pg. 394

With an average number of bison migrating outside the Park the modified preferred alternative would remove between 159 and 165 bison in each year of the 15-year plan. Of the 159 bison, 62 would be shipped to slaughter and 97 sent to quarantine, if available. Of the 165 bison, 49 would be shipped to slaughter and 124 sent to quarantine, if available. [Note: 49 + 124 = 173 bison].
pg. 430

However, to maintain the Yellowstone population below 3,000 an additional 79 to 81 bison would be removed for a total annual average removal of 159 to 246 bison. Larger removals of bison would occur to maintain this average removal rate when severe winter conditions periodically forced additional bison outside Park boundaries.
pg. 430