Management

Bison/Livestock Interactions

Free-ranging bison and cattle have coexisted within the same regions of the Henry Mountains in Utah since the 1940s. The cattle are managed within a traditional fencing system and the bison are able to move across the landscape. Observations of interactions between the two species have shown that they will sometimes graze within close proximity of one another, with neither species altering its behavior in response to the other until about 13 feet apart (Van Vuren, 2001). When bison and cattle did come within 13 feet of each other, the cattle either altered their direction away from the bison, or moved aside as the bison approached (Van Vuren, 1980; 2001). During a few observations bison were openly aggressive toward cattle. This mainly occurred with yearling bison. Cattle were always submissive and were driven an average of 13 feet away during these interactions (Van Vuren, 1980). Studies have found that dominance hierarchies between different species are complicated by the observation that the social rank of individual animals within their own species influences how they behave toward other species. For example, if an individual is timid and low ranking within its own herd, it will tend to behave this way toward an individual of another species (Mosley, 1999).

Bison and domestic cattle coexist in Henry Mountains. PHOTO CREDIT: A. DOOD

The experience that ranchers have had with bison and cattle interactions have been similar in Saskatchewan with the free-ranging Sturgeon River Plains Bison Herd. Regional ranchers have reported that they occasionally see bison in the presence of cattle, but they have not had incidents of bison harassing the cattle, and note that the two species seem pretty tolerant of each other (G. Vaadeland, personal communication). There have been no observed occurrences of male bison attempting to breed with cattle within the Sturgeon River Plains Bison Herd (G. Vaadeland, personal communication).

Grazing

Montana has a long-standing tradition of allowing private citizens to graze domestic livestock on public lands. This practice is important for the economic viability of individual ranchers and communities within the state. Prior to the ratification of the Taylor Grazing

Act in 1934, ranchers in Montana assumed a "right" to graze livestock on public lands. The language within the Taylor Grazing Act defined the grazing of private livestock on public lands as a privilege and not a vested right.

Though recognized as a privilege and not an inherent right, the continuation of the practice of private grazing on public lands is essential to ensure the survival of domestic livestock ranching in Montana. With the passage of the Taylor Grazing Act and the Multiple-Use Sustained Yield Act, a focus was placed on balancing the need to graze domestic livestock on public land with concerns for range health, watershed protection, and the resource needs of wildlife.

Currently within Montana private grazing occurs on a variety of public lands that are managed by independent agencies. The largest landowners that allow public grazing are the U.S. Forest Service, Bureau of Land Management, and Department of Natural Resources and Conservation.

There are nine national forests under management of the U.S. Forest Service (USFS) in the state. Within its grazing program the USFS permits an overall number of animal unit months (AUMs) that may be issued. Based on evaluations of range health and seasonal condition, the USFS determines how many AUMs will actually be authorized each year and then awards grazing allotments to private citizens. The number of permits allowed and then authorized can differ among the national forests. A combined total of approximately 491,970 AUMs were authorized on the national forests in Montana based on AUMs authorized in 2010 for Flathead, Gallatin, Kootenai, Lewis and Clark, Lolo; 2009 for Bitterroot, Custer, and Helena; and 2008 for Beaverhead-Deer Lodge. The allotments are used primarily for cattle grazing, but there is some limited grazing of horses and sheep.

The Bureau of Land Management (BLM) manages around 7,500,000 acres throughout Montana and maintains an active grazing program. The BLM had approximately 1,270,000 currently active AUMs for 2010. The allotments are primarily for cattle, but there are a limited number of horse, domestic bison, sheep, goats, and burro grazing allotments.

Another type of public land that has an active grazing program within Montana is the state trust lands, which are managed by the Montana Department of Natural Resources and Conservation (DNRC). There were approximately 996,195 active AUMs on DNRC-managed lands in 2010.

Fencing

When examining the effectiveness of fencing, it is important to recognize that the purpose of the fence has a large impact on evaluations of its effectiveness. Most of the information pertaining to the effectiveness of fencing related to bison comes from those who are attempting to contain domestic bison and deter their natural instinct to move to better habitat. Fencing is viewed differently when it is recognized as a way to keep

domestic livestock contained while allowing wildlife to move across the landscape. For example, if a fence is meant to contain a captive bison herd and the animals are able to jump the fence, then it is ineffective; however, if the purpose is to contain other domestic livestock and allow free-ranging bison to move across the landscape by jumping the fence, then it is considered effective.

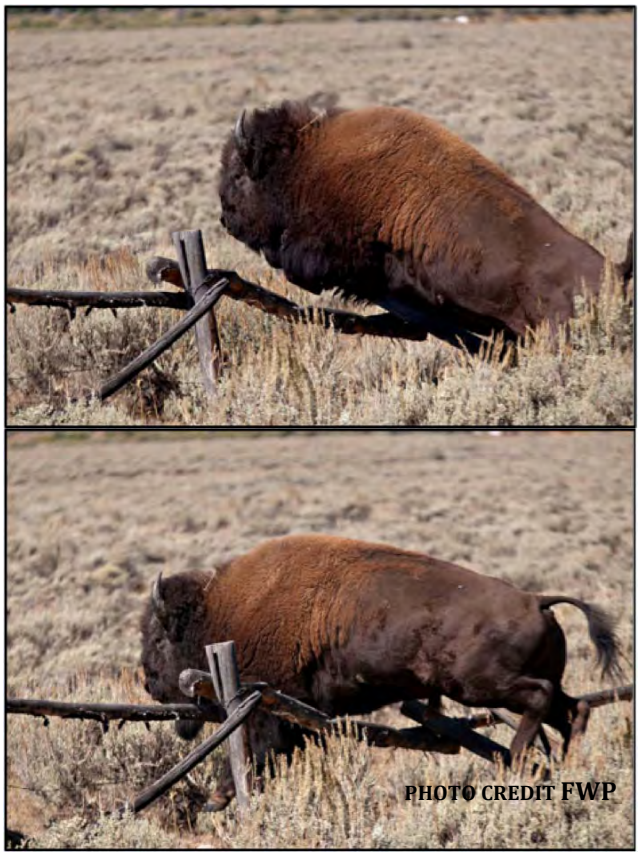
PHOTO CREDIT: FWP

When evaluating a fence's ability to contain captive bison, it is important to consider the following factors, as they may enhance or hinder the effectiveness of fencing. Whether or not a fence is constructed and maintained properly will have a large impact on its ability to contain bison. The ability of the herd to access the proper quality and quantity of food and water is essential to maintaining them within fencing, as bison's motivation to breach the fence will increase if attractive food or other objects are on the other side of the fence (Gates et al., 2010). If bison are to be maintained in captivity on larger sections of public land, fencing needs to be used to rotate bison through established seasonal ranges. The density of bison can impact the effectiveness of fencing, with effectiveness decreasing as density increases (Gates et al., 2010). The age and sex structure of the herd can impact the effectiveness of a fence. For example, to ensure genetic variation it has been recommended that sex ratios be close to 50/50. However, this ratio will increase the competition between bulls, and could lead to containment difficulties as less-dominant males try to roam. Snowpack and drift can also have an impact on the ability of a fence to contain bison (Gates et al, 2010; C. Knowles, Wildlife Biologist and Bison Rancher, personal communication). Another important factor in evaluating the effectiveness of fencing is determining the impact it may have on all other wildlife species in the area.

Properly constructed and maintained electrified high-tensile fencing appears to be highly effective in containing captive bison herds (Lee, 1990; Butterfield Sr., 1990; Karhu, 2004; Quitmeyer et al., 2004; Dixon, Manager Snowcrest Ranch, personal communication). Maintenance of high-tensile electric fencing is minimal, with most of the maintenance issues occurring due to improper construction (Lee, 1990; Quitmeyer et al., 2004). Familiarity with electric fencing deters domestic bison from contact. Typically domestic bison do not rub on high-tensile electric fencing (Lee, 1990). It has been observed that bison are easier to train to respect electric fences than cattle (Dixon, personal communication). While electric fencing does appear to be more effective than other types of fencing in containing bison, bison handlers have reported that when electric fences short out, bison quickly test the fences and move through them (C. Knowles, personal communication).

There is support that properly maintained three-wire, four-wire, and five-wire high-tensile electric fences are all effective for containing domestic bison (Lee, 1990; Butterfield Sr., 1990; Karhu, 2004; Quitmeyer et al., 2004; Paige, 2008; Dixon, personal communication). If three-wire fencing is properly constructed and maintained, it should contain bison and cattle yet be traversable by both adult and juvenile deer, elk, moose, and pronghorn antelope (Karhu, 2004; Quitmeyer et al., 2004; Paige, 2008). Four-wire fencing has not been proven to offer better control of bison or cattle, but it can be difficult for elk and moose to traverse (Karhu, 2004). Dixon recommends a five-wire high-tensile electric fence, which is 48 inches in height with an 18-inch bottom wire (personal communication). However, FWP's *A Landowner's Guide to Wildlife Friendly Fences: How to Build Fence with Wildlife in Mind* (Paige, 2008) strongly cautions against fencing over 42 inches. L. Feight, High County Ag Marketing Inc., notes that three-wire high-tensile electric fencing is effective for 2 to 3 miles from the energizer; however, if a fence has to run farther from the energizer it is better to increase the number of strands. This is because the farther the electricity has to travel, the more strands will be needed to deliver an effective shock (personal communication).

A study of the effectiveness of three-wire high-tensile electric fencing to contain bison by Quitmeyer et al. (2004) examined the following tests. First, two yearling separation tests, which separated cows from their calves in the fall in a corral or in a pasture setting, were conducted, and in each case there was 100 percent containment of the bison. Second, two bull-cow separation tests, which separated bulls from cows that were coming into estrus, were conducted. In the first test there was 100 percent containment. During the second test there was 95 percent containment, as three of the bulls escaped without any damage to the fencing and two cows were pushed through the fence when the herd was crowded into a corner. The Quitmeyer et al. (2004) study also conducted one test to determine the fence's effectiveness in excluding bison from a winter wheat field, which was 100 percent effective.



Maynard Barrows noted in a letter from 1937 that "in the buffalo show pasture at YNP, several small hills were being overgrazed. An electric fence of three strands of (electric) barbed wire, spaced about 18 inches apart, was set up around one of these hills. So long as supplied with current it kept the buffalos out" (McAtee, 1939).

A wild animal that is unfamiliar with fencing often will investigate the fence with its nose, leading to a severe shock, which deters crossings (Mckillop and Sibly, 1988). Attaching objects such as plastic strips or plastic bottles will increase the likelihood that wildlife will stop and investigate an electric fence and subsequently be shocked (Paige, 2008). Averse conditioning, as well as the increased awareness of fencing, will decrease the likelihood that wildlife will cross the fence (Mckillop and Sibly, 1988), yet reports from private landowners who share their region with free-ranging herds suggest that if bison are being pursued by humans, "there isn't a fence in the world that will stop them" (G. Vaadeland, personal communication).

One of the main concerns with high-tensile wire is that it tends to stretch, and therefore does not readily break when an animal becomes entangled. It is recommended that electric fencing be equipped with energizers, which increase the amperage and voltage, and thus the power of the electric shock, on the fence line for brief periods of time. The periods of increased electric shock deters crossing, but the periods of decreased strength allow humans and animals to free themselves from a fence should they become entangled (Lee, 1990).

Barbed wire fencing has also been used to contain domestic bison herds. Some landowners recommend five wires with a height of about 5 feet 6 inches, though others note that a properly maintained three- or four-wire fence will deter free-ranging bison and/or contain domestic bison (Butterfield Sr., 1990; G. Vaadeland, personal communication). Barbed wire fencing can be highly problematic for wildlife species, however, especially if wires are loose or are spaced too closely (Paige, 2008). Many wildlife species, including native ungulates and birds, become tangled in barbed wire fencing and perish (Paige, 2008).

Woven wire fencing that is 48 inches high with two or three barbed wire strands at the top has also proven successful in containing captive bison (Butterfield Sr., 1990). However, woven wire creates a complete barrier to fawns and calves, which are then separated from the herd and perish. It also creates a barrier for other wildlife species, such as bears or bobcats, that are not able to jump or slip through (Paige, 2008). Woven wire becomes a complete barrier when it is topped with barbed wire, especially for fawns, calves, pronghorn, and other animals that are unable to jump such a fence (Paige, 2008). A study that examined 600 miles of different fence types for two seasons found that woven wire fence topped with a single strand of barbed wire was the most lethal type of fence. This was due to the increased chance that an animal's leg would become tangled between the barbed wire and the rigid woven wire (Paige, 2008).

When containing a captive bison, it is recommended that fence lines be higher than the bison's line of sight (Butterfield Sr., 1990). Knowles notes that he has found that 48 inches is the minimum height needed to deter bison from attempting to cross (personal communication). Regardless of fence type, the impact to wildlife must be considered when deciding upon fence height.

If bison need to be managed in a quarantine program, a significantly taller and stronger fence is required. It is recommended that quarantine fencing be at least 7 feet high to prevent bison from jumping out (Dixon, personal communication). If a quarantined bison were to escape and mix with non-quarantined animals, then all of the non-quarantined animals would have to be placed in quarantine (M. Frisina and S. Knapp, Montana Fish, Wildlife & Parks, personal communication). The purpose of a quarantine fence is to keep non-quarantined bison, livestock, and wildlife from coming into nose-to-nose contact with the quarantined bison. Therefore it is recommended that the fence be constructed of high-tensile woven wire with a strand of high-tensile wire as a top strand (Dixon, personal communication).

Raymond Ranch elk jump that bison learned to jump, but neighboring domestic cattle did not.
PHOTO CREDIT: A. DOOD

The interactions of free-ranging bison with fencing have been studied within the northern boundary of Yellowstone National Park. Observations by Scott (1992) of wildlife crossings of an approximately 6-foot buck and pole fence during the winter showed that bison did not cross the fence if it was intact. A small number of bison crossed the obstacle by breaking rails, or by using the 3-foot 3-inch irrigation ditches that ran under the fence. The majority of bison that came into contact with the fence would walk along the fence downhill until they were able to circumvent it or until they reached an open gate. Meagher (1989) observed that bison went around an 8-foot-2-inch-high fence constructed of cable, woven wire, and wooden snow fence.

Due to the limited number of free-ranging bison herds, there is a general lack of information on the impact that free-ranging bison have on fences. Further observation of the few existing free-ranging herds and their impact on fencing is needed to develop creative management solutions.

Hunting

FWP utilizes hunting as a wildlife management tool and as a means to generate public interest in the conservation of a species. In 2005 FWP began issuing permits for "fair chase" bison hunting within limited regions adjacent to Yellowstone National Park. The Montana bison hunt has been used to cull bison that exit the park, and increase the interest of the sportsman community in the species and its management. The number of bison that exit the park varies from year to year, and therefore hunter success has varied, from 46 bison taken in 2005–06, 57 in 2006–07, 167 in 2007–08, and only one bison in

2008–09. The bison season for 2010–11 was set from November 15, 2010 to February 15, 2011. During the 2010 bison season, it is estimated that 26 were harvested by state hunters and 185 were harvested by tribal treaty hunters.

Year	Applications	Successful Drawing Applicants
2004	8,373	10*
2005	6,178	24
2006	6,210	74
2007	4,402	38
2008	3,079	36
2009	10,363	36
2010	7,754	34

*The hunting season did not begin until 2005. The successful 2004 applicants were given a 2005 license; therefore there were 34 licenses issued in 2005.

Table 2: Number of Applications and Successful Applicants for Bison Hunting Tags in Montana. Data provided by N. Whitney, FWP

Hunters from the Confederated Salish and Kootenai, the Shoshoni-Bannock, the Nez Perce, and the Umatilla tribes are able to hunt bison in regions of Montana surrounding Yellowstone National Park based on the off-reservation hunting rights within their respective treaties. The four tribes exercise these hunting rights to harvest bison during the 2010–11 season. In addition to the four tribes listed above who are exercising their off-reservation hunting rights, a legislative statute preserves the limited rights to hunt bison of the Assiniboine and Sioux, Blackfeet, Chippewa Cree, Crow, Gros Ventre and Assiniboine, Northern Cheyenne, and Little Shell Band of Chippewa (MCA 87-2-731).

One common misperception is that bison are less wary of humans than other wildlife. This is because most people are exposed to bison that are in domestic herds or in protection, such as in a national park. Yet regions that maintain free-ranging populations of hunted bison report that bison become very wary of humans, resulting in an experience similar to that with other big game species. Game managers in Utah report that hunting has caused bison to become very wary of human presence with a strong tendency to flee at the sound of a stopping vehicle or the smell of approaching hikers (K. R. Hersey, Utah Division of Wildlife Resources, personal communication). Bob Hayes, a biologist for the Kluane region of the Yukon, notes, "hunting pressure is changing the behaviour of these animals. They're moving away from places where people commonly saw bison the last few years in late winter and they're clearly avoiding people, going to places that are difficult to go to" (CBC News, 2001).

Hunting is used as a bison management tool in Alaska, Alberta, Arizona, British Columbia, South Dakota, Utah, and Wyoming. The cost of a 2010–11 bison license in the state of Montana was $125 for residents and $750 for nonresidents. Table 3 outlines the cost of a bison license for the 2010–11 season for other states and provinces.

Region	Type of License	Resident	Nonresident
Alaska	General Bison License	General hunting license fee	$450.00 nonresident
			$650.00 alien nonresident
Arizona	Bull	$1,095.00	$5,452.25
	Cow	$659.50	$3,262.75
	Cow or Yearling	$659.50	$3,262.75
	Yearling	$362.75	$1,754.75
Alberta	General Bison License	$50.00	Not offered
British Columbia	General Bison License	$70.00	$700.00
South Dakota	Trophy Bull	$5,000.00	$5,000.00
	Non-Trophy Bull	$1,500.00	$1,500.00
	Cow	$1,000.00	$1,000.00
Utah—Henry Mountains	General Bison License	$408.00	$1,513.00
Utah—Antelope Island	General Bison License	$1,105.00	$2,610.00
Wyoming	General Bison License	$402.00	$2,502.00

Table 3: Prices of Bison Licenses in Other Regions. The prices listed above are for hunting tags only and additional hunting licenses and application fees may apply. (Alaska Department of Fish and Game, Arizona Game and Fish Department, Government of Alberta Sustainable Resource Development, British Columbia Ministry of Environment, South Dakota Game, Fish and Parks, Utah Division of Wildlife Resources, Wyoming Game and Fish Department; personal communications).

The number and types of licenses/permits that are issued, as well as the format of hunts within each region, changes based on the current bison population and management objectives. In Custer State Park, hunters are guided by state agency staff and have three consecutive days to harvest their bison. Ten trophy bull, 25 non-trophy bull, and 10 cow permits were issued for the 2011 season (South Dakota Game, Fish and Parks, personal communication). The Delta bison hunt in Alaska generates 15,000 applications annually for approximately 100 permits. Nonresidents must be accompanied by a guide (Alaska Department of Fish and Game, 2010). In Utah six permits are issued annually for the herd on Antelope Island. The number of permits issued for the Henry Mountains has been approximately 170 in past years. This number was reduced to 39 for 2010 since a number of bison have been transferred to the Book Cliffs (Utah Division of Wildlife Resources, personal communication). In 2010 Wyoming issued 80 “any bison” tags and 200 cow tags (Wyoming Game and Fish Department, personal communication).

Because of their wariness of humans and the resulting difficulty to hunt on both the House Rock Wildlife Management Area and the Raymond Ranch Wildlife Management Area (WMA), the Arizona Game and Fish Department employs three different types of hunts. First is a general season hunt, which occurs in the spring and fall on both wildlife management areas. For 2010, 14 spring hunt permits were issued for the House Rock WMA, but there were no fall hunting permits issued in an attempt to entice bison to move back onto the wildlife management area from neighboring Grand Canyon National Park (B. Wakeling, Arizona Game and Fish Department, personal communication). Four permits were issued for both the spring and the fall hunt for the captive Raymond Ranch bison. A wildlife manager accompanies hunters on the Raymond Ranch, and specific bison are preselected for harvest (B. Wakeling, personal communication). The bison population in Arizona is also managed through a population management hunt. The Arizona Game and Fish Commission sets a maximum number of Population Management Hunt Permits, then the director quickly issues these permits throughout the year if population objectives are not being met through the regular hunt or if bison escape from the Raymond Ranch (B. Wakeling, personal communication). Finally, companion tags are used in Arizona as an additional bison population management tool. Hunters of other big game species on the House Rock WMA have the opportunity to purchase companion bison tags. The companion tags allow for the additional annual harvest of bison should they move back onto the wildlife management area (B. Wakeling, personal communication).

Harvested bison. PHOTO CREDIT: FWP

Native American Off-Reservation Hunting Rights

Many of the tribes who were native to Montana and surrounding regions entered into treaties with the U.S. government that preserved their right to continue to hunt bison outside of their respective reservations. Due to subsequent treaties and treaty disputes, many of these rights are still being contested. The following is an attempt to summarize some of these preserved off-reservation hunting rights. Note that if a Native American tribe is not included in the list below, it does not mean that they do not have off-reservation hunting rights.

Blackfeet Nation

Members of the Blackfeet Nation, which is made up of descendents of the Blackfeet, Kainah or Bloods, and Piegans, preserved their right to hunt outside of their reservation on what is known as the Badger Two Medicine Area, or the "ceded strip" (Juneau, 2009). Following the original designation of the Blackfeet Nation's reservation, an agreement was signed in 1895 and ratified in 1896, which ceded part of the existing reservation to the United States (Kappler, 1904). The ceded region consisted of "a strip of land, along the west side of the Blackfeet Reservation, from the crest of the Continental Divide east to the foothills, using the center high points of Chief Mountain and Heart Butte as key references for the north and south ends" (USFS, 2005). The right of the Blackfeet Nation to hunt on this land was preserved under Article I, which stated "that the said Indians hereby reserve and retain the right to hunt upon said lands and to fish in the streams thereof so long as the same shall remain public lands of the United States under and in accordance with the provisions of the game and fish laws of the State of Montana" (Kappler, 1904, pp. 605).

Confederated Salish and Kootenai Tribes

The Confederated Salish and Kootenai Tribes (CSKT), composed of the Bitterroot Salish, the Pend d'Oreille, and the Kootenai, maintain hunting rights outside of the Flathead Reservation through their respective signatures of the Treaty of Hellgate. The Treaty of Hellgate, which was signed in 1855 between the United States and the confederated tribes of the Flathead, Kootenai, and Upper Pend d'Oreille preserved the rights of these respective tribes to continue to hunt outside of their reservation's land. Under Article III the tribes retain the "privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land" (Kappler, 1904, pp. 723). "The CSKT consider all state and federal land that is "open and unclaimed" (e.g., not some of the designated parks) "within the Tribes' aboriginal territory to be places that tribal members can exercise off-reservation treaty hunting rights, consistent with CSKT member hunting regulations" (J. Harrison, Confederated Salish and Kootenai Tribes, personal communication).

Crow Tribe

The Crow tribe's right to hunt for game including bison off their reservation land was preserved through the ratification of the 1868 Fort Laramie Treaty. Under Article IV of this treaty it is stated that the Crow "shall have the right to hunt on the unoccupied lands of the United States so long as game may be found thereon, and as long as peace subsists among the whites and Indians on the borders of the hunting districts" (Kappler, 1904, pp. 1009).

Shoshone and Shoshone-Bannock Tribes

The 1868 Fort Bridger Treaty preserved the rights of the Eastern Shoshone tribe of

the Wind River Reservation in Wyoming and the Shoshone-Bannock tribes of the Fort Hall Reservation in Idaho to hunt on lands outside of their respective reservations (Kappler, 1904). Article IV of the treaty states that the tribes "shall have the right to hunt on the unoccupied lands of the United States so long as game may be found thereon, and so long as peace subsists among the whites and Indians on the borders of the hunting districts" (Kappler, 1904, pp. 1021).

Nez Perce Tribe

The Nez Perce Treaty of 1855 preserves the right of the Nez Perce to hunt on land outside of their reservation, which is located in Idaho. This preservation of hunting rights is articulated under Article III of the 1855 Treaty. Article III states that the Nez Perce retain "the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land" (Kappler, 1904, pp. 703).

Confederated Tribes of the Umatilla Reservation

In accordance with the Treaty of 1855 between the United States and the Walla Walla, Cayuse, and Umatilla tribes, members of the Confederated Tribes of the Umatilla Reservation were reserved the right to hunt on land outside of their reservation. Under Article I of the 1855 Treaty Between the Cayuse, Umatilla and Walla Walla Tribes, in Confederation, and the United States, it states "the privilege of hunting, gathering roots and berries and pasturing their stock on unclaimed lands in common with citizens, is also secured to them" (Kappler, 1904, pp. 695). According to the 2010 Treaty Hunting Seasons and Regulations, the 1855 Treaty preserves the right of enrolled tribal members to hunt on state and federal lands where hunting is a permitted use, including all national forest lands, state forest lands, Bureau of Land Management lands, and national wildlife refuges where hunting is permitted (Confederated Tribes of the Umatilla Indian Reservation Department of Natural Resources, 2010).

Public Safety

"As with other species of large herbivores (e.g., moose and elk), bison pose small, but manageable, risks of personal injury" (Gates et al., 2010, pp. 111). The two free-ranging bison programs in Utah have not had any reported incidents of bison threatening or injuring humans, even though the region of the Henry Mountains occupied by bison has seen a large increase in public recreational use (K.R. Hersey, personal communication). Uses include backcountry travel, mountain biking, horseback riding, ATV use, camping, hiking, and hunting. An outdoor educational school also utilizes the region, taking large groups of young men and women into the backcountry to learn survival and leadership skills (Utah Division of Wildlife Resources, 2007b). As a result of hunting, the Henry Mountains bison have become very wary of humans, with most tending to flee at the sound

of a stopping vehicle or the smell of approaching hikers (K.R. Hersey, personal communication).

Those involved in the management of the free-ranging Sturgeon River Plains Bison Herd, which moves between Prince Albert National Park and the surrounding region of Saskatchewan, have not had any reported incidents involving human injury as a result of contact with bison (G. Vaadeland, personal communication). There was one instance of a man being charged by a bull bison that he startled on a trail. The bison pushed him into a bush, but he escaped without reported injury (G. Vaadeland, personal communication). A similar incident occurred on Antelope Island in Utah, and the hiker sustained broken ribs, though the details of the incident were unclear (S. Bates, Utah Division of Wildlife Resources, personal communication). Landowners in Saskatchewan have reported that bison tend to move off when humans enter an area, noting that it is possible to approach them more closely on horseback, but "if you can get as close as 50 yards, you are lucky" (G. Vaadeland, personal communication).

Bison moving through a Yellowstone National Park campground.
PHOTO CREDIT: J. PEACO; COURTESY NPS

Bison that are habituated to humans often exhibit a mild-mannered domestic cow–like appearance. This is particularly true in national parks like Yellowstone, which hosts around three million visitors a year. Yellowstone National Park annually reports bison encounters and related human injuries, which typically result from individuals attempting to approach, feed, pet, or be photographed with bison (Conrad and Balison, 1994; Olliff and Caslick, 2003). This type of interaction has occurred on Antelope Island in Utah, where a person was head-butted after attempting to pet a bison in a campground (S. Bates, personal communication). Yellowstone National Park has taken extensive measures to educate visitors on the importance of maintaining the proper distance from bison. These efforts have led to a reduction in human/bison conflicts from a high in 1983 of 13 conflicts, followed by ten in 1984 and ten in 1985, to just two conflicts in 1997, followed by five in 1998 and only one in 1999 (Olliff and Caslick, 2003). Wind Cave National Park in South Dakota, which reports around 600,000 annual visitors and has a herd of approximately 400 bison, has not reported any bison-related human injuries as of August 2010 (R. Mossman, Wind Cave National Park, personal communication).

A study of the behavioral response of the free-ranging Sturgeon River Plains Bison Herd to human activity found that following the detection of human presence, bison reacted by fleeing the area (51 percent of 384 observations), looking in the direction of the human while remaining in place (46 percent of 384 observations), or approaching the human (3 percent of 384 observations) (Fortin and Andruskiw, 2003). Observations of

free-ranging bison in the Henry Mountains found that bison would often flee from an area after coming into contact with humans (Nelson, 1965).

A study was completed during the summers of 2000 and 2001 that examined the reaction of bison, mule deer, and pronghorn antelope to hikers and mountain bikers who were on designated trails on Antelope Island in Utah. The study took place prior to the implementation of a bison-hunting program on the island. It attempted to determine at what distance from a lone silent hiker or mountain biker an animal would become alert to the presence of humans and begin to flee, and for what distance. The hiker or biker did not approach the wildlife, but continued to steadily move down the trail and past the animal or groups of animals. Of the 98 trial encounters with bison, the study found that 75 of the groups, or 77 percent, fled from the person, compared to 56 percent of pronghorn and 60 percent of mule deer (Taylor and Knight, 2003). There was not a significant difference between the reaction of bison to hikers or mountain bikers. The study found that on average bison became alert to the presence of the human when the person was 531 feet away, began to flee when the individual was 308 feet away, and tended to flee 82 feet from their original position (Taylor and Knight, 2003). For comparison, mule deer became alert to the presence of the human at 620 feet, began to flee when the individual was 449 feet away, and tended to flee 616 feet from their original position (Taylor and Knight, 2003). The study found that a larger group size tended to increase the flight response, as did the presence of calves (Taylor and Knight, 2003).

Bison/Vehicle Collisions

Most experienced drivers in Montana are aware of the potential for wildlife collisions due to the large variety of wildlife and occasionally domestic livestock that may be present on roadways. Most experienced drivers in Montana recognize the need to be very aware of their surroundings as they drive, and the state tries to mark regions of increased potential for wildlife collisions with warning signs. Data on the potential for bison/vehicle collisions and frequency of bison encountered on roadways is limited due to the lack of free-ranging herds in the United States. Many mitigating techniques, such as wildlife underpasses, fencing, and signs are already being implemented through the cooperative work of agencies, nongovernmental organizations, and citizens to reduce conflicts of wildlife on roadways around the state. If free-ranging bison were to return to the state, it will be important for the different government agencies, citizens, and private organizations to work together to develop creative solutions for reducing the potential of bison/vehicle collisions. As with all wildlife there is the potential that bison may on occasion enter roadways.

The British Columbia Conservation Foundation's Wildlife Collision Prevention Program (WCPP) examines bison/vehicle collisions with wood bison. The WCPP identifies some of the reasons why wood bison utilize roadways in northwestern Canada. A few of the reasons the animals are attracted to the roadways that were noted include: (1) plowed roads can provide easier travel routes than forested locations, especially during deep snow; (2) highways and right of ways are often windy, which relieves some irritation from biting

insects; (3) vegetation along the side of the road is accessible throughout the year; and (4) the disturbed sites on roads provide good establishment of palatable vegetation (British Columbia Conservation Foundation, 2010). The WCPP indicates that traffic factors influencing the number of bison/vehicle collisions include increased traffic volume, an increased number of industrial vehicles, and long straight stretches that allow drivers to travel at speeds well over the posted limits (British Columbia Conservation Foundation, 2010).

The wildlife factors that contribute to collisions include the fact that bison are a herd animal; that the lowered position in which bison typically hold their head reduces the reflectivity of their eyes, thereby decreasing visibility at night; that bison may have different reactions based on their perception of a threat; and that seasonal factors such as the rut or the presence of calves may alter the potential of bison/vehicle collisions (British Columbia Conservation Foundation, 2010). The WCPP has found that low and changing light at dawn, dusk, and night can increase the risk of bison/vehicle collisions for a number of reasons including the fact that bison may be more active during periods of low light; that bison have dark coats; and that during periods of snowfall the snow can accumulate on the backs of bison, reducing the contrast between the bison and the ground (British Columbia Conservation Foundation, 2010).

Another important factor in the probability of bison/vehicle collisions is based on whether the roadway transects highly used habitats, as it does outside of West Yellowstone. A report compiled by the Western Transportation Institute noted that "one of the winter grazing grounds used by Yellowstone bison is the West Yellowstone basin. US 191 directly cuts through the bison migratory paths, which creates a high level of bison cross-traffic on the 10-mile stretch of US 191 just north of the town of West Yellowstone" (Dupree and DiMambro, 2010).

Bison Vehicle Collisions in Montana and Yellowstone National Park

The region of Montana where free-roaming bison are found and where there have been reports of bison/vehicle collisions is the area surrounding US 191, which runs north from West Yellowstone to just past the junction of US 287. The report by Western Transportation Institute utilized information from the Montana Department of Transportation (MDOT) crash (1999–2008) and carcass removal data (1999–2009). The report recognizes that the data are not complete, but does give a general overview of the number of collisions that occur as well as the number of bison killed. The number of bison killed is larger than the number of crashes that occur, due to the fact that 31 percent of recorded bison/vehicle collisions on US 191 involve more than one bison (Dupree and DiMambro, 2010).

Based on MDOT's data on crashes involving bison, the average number of bison collisions on US 191 between 1999 and 2009 was approximately 1.7 per year. There were no reported crashes involving bison in 2002 and 2004; there was one reported collision in 2000, 2001, 2003, and 2007; there were two reported collisions in 2006 and 2008; and

there were seven reported collisions in 2005 (data provided by P. A. Jomini, Montana Department of Transportation). In 2009, 15 bison were killed between April 11 and 13 when a single car killed seven bison, and in a separate incident a truck killed seven bison and an SUV following the truck killed an additional bison. None of the drivers were seriously injured in the collisions (Mayrer, 2009). The majority of these crashes occurred in the evening or early morning hours (data provided by P. A. Jomini, Montana Department of Transportation).

With more than three million annual visitors to Yellowstone National Park, most arriving during the concentrated summer vacation season and using limited roadways, there is a large potential for collisions with wildlife. The park compiles data on the number of bison killed on roadways based on reported carcasses. The number of bison killed between 2000 and 2009 from vehicle collisions varied yearly from a high of 28 bison killed in 2002 to 9 bison in both 2000 and 2008 (data provided by K. Gunther, National Park Service). The average number of bison killed yearly from 2000 to 2009 was approximately 16. Between 2000 and 2009 approximately 146 bison were killed in Yellowstone as a result of collisions with vehicles (data provided by K. Gunther). Of the 146 killed approximately 75 were bulls, 45 were females, and the gender of 27 was not recorded (data provided by K. Gunther). The ages of the bison killed varied, with approximately 112 adults and subadults, 10 yearlings, 10 calves under a year old, and no age recorded for 14 (data provided by K. Gunther).

Bison on the roadway in Yellowstone. PHOTO CREDIT: J. PEACO; COURTESY NPS

Personnel within the park feel that excessive vehicle speed is what increases the risk of collisions with bison, as does the time of day (K. Gunther, personal communication). The WCPP program recommends the enforced reduction of speed limits, especially during the evening, as an effective way to reduce bison/vehicle collisions (British Columbia Conservation Foundation, 2010). The YNP Division of Law Enforcement notes that there have been no reported human fatalities from accidents involving bison within the park, based on accident reports from 2008, 2009, and 2010 (Division of Law Enforcement, personal communication).

Bison Vehicle Collision Mitigation

The Buffalo Field Campaign (BFC), a conservation organization in West Yellowstone, has made the reduction of bison/vehicle collisions a priority. Several BFC members were trained by the State of Montana as highway flaggers to help facilitate the safe passage of bison across US 191 and to alert motorists to their presence when they are aware that

bison are near the road (Dupree and DiMambro, 2010; D. Brister, Buffalo Field Campaign, personal communication). The BFC has also worked to have the speed limit reduced from 70 mph to 55 mph on US 191 during the bison migration. The organization notes that although the state has reduced the speed limit and the Montana Highway Patrol provides an officer to enforce the reduced speed, very few motorists abide by the reduced speed limit (D. Brister, personal communication).

BFC volunteers warn motorists of bison on the highway. COURTESY BFC

The WCPP has undertaken various projects to decrease the probability of bison/vehicle collisions, with mixed success. One of the mitigation techniques that has shown success is to leave un-mowed stretches of vegetation parallel to the tree line while continuing to mow the region immediately adjacent to the roadway. The un-mowed sections are then plowed during the winter to provide trails that are parallel to the tree line and contain more forage (British Columbia Conservation Foundation, 2010). There has also been some success with plowing "escape routes" off the highway for bison use (British Columbia Conservation Foundation, 2010). The WCPP notes that the use of wildlife warning signs may also decrease the number of bison/vehicle collisions. To increase the effectiveness of signs, the WCPP recommends using signs that emphasize seasonal risks and that should either be removed during periods of lower risk or enhanced during periods of higher risk; signs that are larger and more variable; signs that are portable so they can be moved as needed; signs that are personalized for each species; signs that emphasize the danger the animal poses to the driver; and signs enhanced with flashing lights or flags (British Columbia Conservation Foundation, 2010).

Seasonal reduction in speed limit on US 191. COURTESY BFC

The WCPP recommends a number of ways that drivers can reduce the risk of bison/vehicle collisions. These practices include paying attention to road signs indicating the potential presence of bison, maintaining the posted speed, reducing speed at night, remaining more vigilant, and practicing defensive driving while traveling through regions where bison have been observed.