Government of Northwest Territories
Gouvernement des Territoires du Nord-Ouest

# Mackenzie Bison Management Plan

Mackenzie Bison Working Group

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## THE MACKENZIE BISON WORKING GROUP: A SHARED VISION FOR BISON MANAGEMENT

This draft management plan was developed by the Mackenzie Bison Working Group (MBWG) and is the shared vision of the members. The MBWG comprised members from communities that harvest Mackenzie bison, agencies that have management authority for the population, and those whose land-use areas include part of its range. Members were tasked with bringing their organizations' perspectives to the group and communicating the group's progress and decisions back to their organizations. The MBWG operated by consensus to create this draft plan. The group consisted of:

- Community Government of Behchokǫ - Moise Rabesca
- Deh Gáh Got'îê First Nation - Victor Constant and Eric Nadli
- Fort Providence Métis Council - John McLeod and Richard Lafferty
- Fort Providence Resource Management Board - Priscilla Canadien
- Hamlet of Fort Providence - Evelyn Krutko
- North Slave Métis Alliance - Wayne Langenhan and Matt Hoover
- Northwest Territories Wildlife Federation - Ken Hall
- NWT Métis Nation - Trevor Beck
- Tłı̨cho Government - Joe Mackenzie
- Wek'èezhìi Renewable Resources Board - Boyan Tracz and Karin Clark
- Yellowknives Dene First Nation
- Department of Environment and Natural Resources
    - Terry Armstrong, Wildlife Division, Headquarters
    - Dean Cluff, Regional Biologist, North Slave Region
    - Troy Ellsworth, Superintendent, South Slave Region

The MBWG met nine times between November 2011 and March 2014 both by teleconference and in person in Yellowknife, Behchokǫ, Fort Providence and Hay River to develop this plan.

We thank Greg Wilson, James Hodson, Nic Larter, Suzanne Carrière, Mike Gravel, Iga Stasiak, Brett Elkin, Karen McMaster, Lynda Yonge, Nicole McCutchen and Allicia Kelly for their helpful comments on a previous draft; Karl Cox and Bonnie Fournier for producing maps; and Wayne Norris (Department of Municipal and Community Affairs) and Brett Elkin (Department of Environment and Natural Resources) for their contributions as invited participants to address specific issues for the MBWG. We also thank Mark Cleveland for his expert facilitation skills and support to the MBWG.

# EXECUTIVE SUMMARY

The *Mackenzie Bison Management Plan* was drafted by Mackenzie Bison Working Group (MBWG) and is the shared vision of its members. The purpose of this plan is to provide direction for managing the Mackenzie wood bison population to help meet the goals of the *Wood Bison Management Strategy for the Northwest Territories* (hereafter, the *Strategy*). This plan's goal is to manage the Mackenzie bison population to sustain its long-term viability while providing for social, economic and cultural connections to people. The MBWG identified five objectives that will need to be achieved in order to reach that goal and support the *Strategy's* goals. They are:

1. Manage bison harvests at sustainable levels for the benefit of all residents of the Northwest Territories (NWT).
2. Reduce bison–human conflicts in communities and on highways.
3. Maintain the bison population free of bovine tuberculosis and brucellosis, as well as other significant livestock diseases that may be transmitted from domestic animals.
4. Maintain and enhance the bison population's genetic diversity while preventing hybridization with plains bison or cattle.
5. Prevent conflicts with bison from arising with agriculture and other land uses.

The MBWG also identified key management actions for each goal.

The first sections of the plan review the history of bison in the NWT and especially the Mackenzie population, and its current status. Each management objective is discussed in detail along with factors that affect each, along with key actions identified to address them. Recommendations for harvest levels in a matrix of population size and trend are presented as a working guideline until more information is collected on the factors that affect the ability of this population to sustain harvest. Information is vital to sound management and this plan identifies knowledge gaps and key actions to address them.

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# INTRODUCTION

In 2010, the Government of the Northwest Territories (GNWT) released the *Wood Bison Management Strategy for the Northwest Territories* (hereafter, the *Strategy*), which provides the long-term vision for the management of wood bison in the Northwest Territories (NWT).

The *Strategy* established two goals to guide the management of wood bison in the NWT:

1. Recover free-ranging, genetically diverse, healthy[1] wood bison throughout their historic range in the NWT, which can sustain on-going harvests for the benefit of all NWT residents.
2. Contribute to the recovery of free-ranging, healthy wood bison throughout their historic range in Canada.

One of the components identified to achieve the goals of the *Strategy* is to work with communities, Indigenous governments, organizations and other stakeholders to develop and implement management plans for the Mackenzie, Nahanni and Slave River Lowland bison populations.

The purpose of this plan is to fill that need for the Mackenzie wood bison population. It has been built on the principles underlying the *Strategy*: all responsible jurisdictions will contribute and take a long-term recovery approach to managing wood bison at the landscape level, using adaptive management, all sources of knowledge, and employing the precautionary principle.

[1]Healthy means that bison are free of bovine tuberculosis (TB), brucellosis and other significant infectious diseases that may be introduced from domestic animals.

A management plan for the Mackenzie bison population was developed in 1987, but it has not been revised or updated. A number of things have happened since 1987 that point to the need for a new management plan: expansion of the range used by these bison, large anthrax outbreaks in 1993 and 2012, an increased number of bison–vehicle collisions on NWT Highway 3, conflicts arising when bison enter Fort Providence resulting in deterrence measures and a growing interest in bison hunting.

A management plan helps managers identify a vision and set goals for a wildlife population, coordinate management actions, measure progress toward achieving goals, determine when goals are met and define how management actions may change as a result. It can also promote reassessment of actions if goals are not met. A management plan is an aid to accountability and helps wildlife managers be proactive. The purpose of this plan is to provide a coordinated, proactive approach to managing the Mackenzie wood bison population.

The *Strategy* confirmed the importance of cooperation and support from Aboriginal organizations, the Tłı̨cho Government and NWT communities in the development of management plans and the role of communities in identifying specific management objectives for bison on their traditional lands. In keeping with that approach, this plan was developed by the Mackenzie Bison Working Group (MBWG) and is the shared vision of the members.

## MANAGEMENT GOAL AND OBJECTIVES

The shared vision of the MBWG was that the Mackenzie wood bison population will be managed to sustain its long-term viability while providing for social, economic and cultural connections to people. Managing the population so it is both large and widely distributed will increase the likelihood of its long-term viability, enhance the potential for social, economic and cultural connections to people, increase its contribution to the recovery of wood bison in the NWT and nationally, and decrease the rate of loss of genetic diversity.

The MBWG did not include a specific population size target as a goal of this management plan because it was unable to determine how many bison the habitat could support and how that number is likely to change as habitat conditions change. The plan does contain a detailed range of management and monitoring actions under different population sizes and trend.

The MBWG identified objectives to be achieved and key management actions within each objective.

Management Objectives:

1. Manage harvests at sustainable levels for the benefit of all residents of the NWT.
2. Reduce bison–human conflicts in communities and on highways.
3. Maintain the population free of bovine TB and brucellosis, as well as other significant livestock diseases that may be transmitted from domestic animals.
4. Maintain and enhance the population's genetic diversity while preventing hybridization with plains bison or cattle.
5. Prevent conflicts from arising with agriculture and other land uses.

The next section briefly summarizes the history and status of wood bison to provide context for the challenges bison management faces in order to meet the plan's goal. Subsequent sections address each objective in turn and list management actions to meet them.

## HISTORY OF WOOD BISON IN THE NWT

There is a very long history of bison in what is now the NWT. The steppe bison (*Bison priscus*) lived in the region between the last ice ages, and went extinct about 11,000 years ago. In this region, it was replaced by the modern wood bison (*Bison bison athabascae*) which first appeared about 35,000 years ago.

Stephenson et al. (2001) described the history of wood bison in northern Canada and Alaska (AK) over the past few thousand years. Wood bison were widely distributed from northwestern Saskatchewan (SK) to AK in the past 5,000 years (Figure 1) but disappeared from a large part of their original range in AK and north-western Canada by the early 1800s.

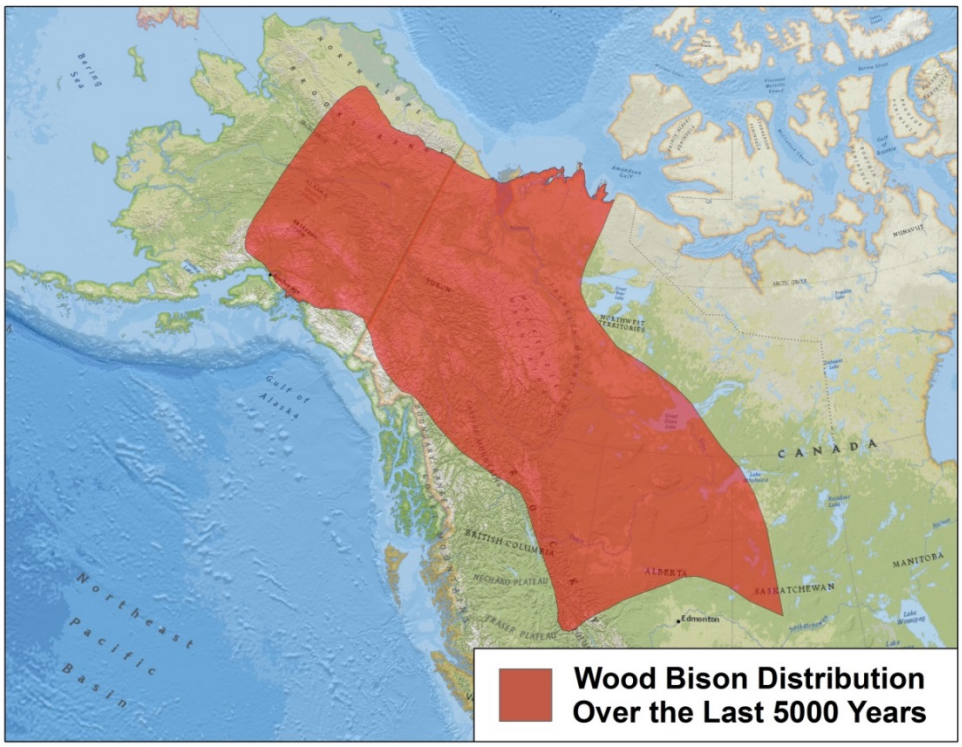


**Figure 1.** Distribution of wood bison over the past 5,000 years (after Stephenson et al. 2001).

Most of the range contraction took place prior to the arrival of firearms or Euro-Canadians, but some wood bison persisted in AK, Yukon (YT) and western NWT into the early 1900s. There are oral records of when bison were last shot in some areas, including the Trout Lake area of the NWT where the last bison was killed in the 1890s (Larter and Allaire 2007).

Causes of the disappearance of wood bison are not clear, but a combination of environmental factors that resulted in habitat changes may have been involved (Stephenson et al. 2001). It has been suggested that the progressive loss of suitable habitat may have resulted in populations becoming fragmented and isolated in local areas. In isolated populations, even modest amounts of predation, disease, or hunting could have had substantial effects on population survival. Where a local population was eliminated, barriers to movements – such as large areas of unsuitable habitat – would have reduced the chances that the area would be recolonized by other bison. This pattern would have been repeated throughout AK, YT and the NWT (Stephenson et al. 2001).

It is not known when bison disappeared from the area that is now the range of the Mackenzie population, but it probably occurred within the last 200 years. Records of wood bison in the Mackenzie region were summarized by Soper (1941), including those of Mackenzie (1801), Richardson (1829) and Preble (1908). Mackenzie (1801) wrote that in 1789 people told him "buffaloes abounded" in the area now known as Mills Lake and bordering the Horn River. Mackenzie later saw bison there and one was killed in that area during his return trip. Richardson (1829) wrote that informants had reported that in "earlier times" Great Slave Lake was the northern boundary of bison range, but "of late years, they have taken possession of the flat limestone district of Slave Point, on the north side of the lake, and have wandered to the vicinity of Great Marten Lake, in latitude 63$^{o}$ or 64$^{o}$." In 1911, Radford collected a wood bison skull "that he found to the north of Great Slave Lake on the Indian winter trail between Forts Providence and Rae" (Soper 1941). Preble (1908) reported that the Hudson's Bay Company journals in Fort Simpson "mention two buffalo bulls killed April 29, 1831 near mouth of the Martin River, approximately eight

miles west, below Fort Simpson." There appear to be no definite records of bison in the Liard River valley after 1897 (Soper 1941). That bison previously occupied the range long ago is also known from traditional knowledge of the region (Ted Landry, Samuel Gargan and Victor Constant, 2015 personal communication).

Wood bison, like plains bison, were driven to near extinction in the late 1800s. By then the remnant population was restricted to the Slave River Lowlands – Wood Buffalo National Park (WBNP) area. The Government of Canada responded by enacting legal protection in 1894 but it was neither well known nor enforced until 1897 when North West Mounted Police patrols were initiated. By 1922, when WBNP was created to protect both wood bison and their habitat, the population had increased to 1,500–2,000 animals (Seibert 1925).

Efforts to conserve wood bison have consisted in large part of regulating hunting and re-establishing free-ranging populations within their original range in Canada, but in 2015 wood bison were released in AK to establish a free-ranging population there. The original range extended from SK to AK but the core range is the southern NWT, northern Alberta (AB) and northeastern British Columbia (BC) (Figure 2). In the 1960s, recovery efforts resulted in the re-establishment of the Mackenzie wood bison population and the formation of a captive herd at Elk Island National Park, east of Edmonton, AB.

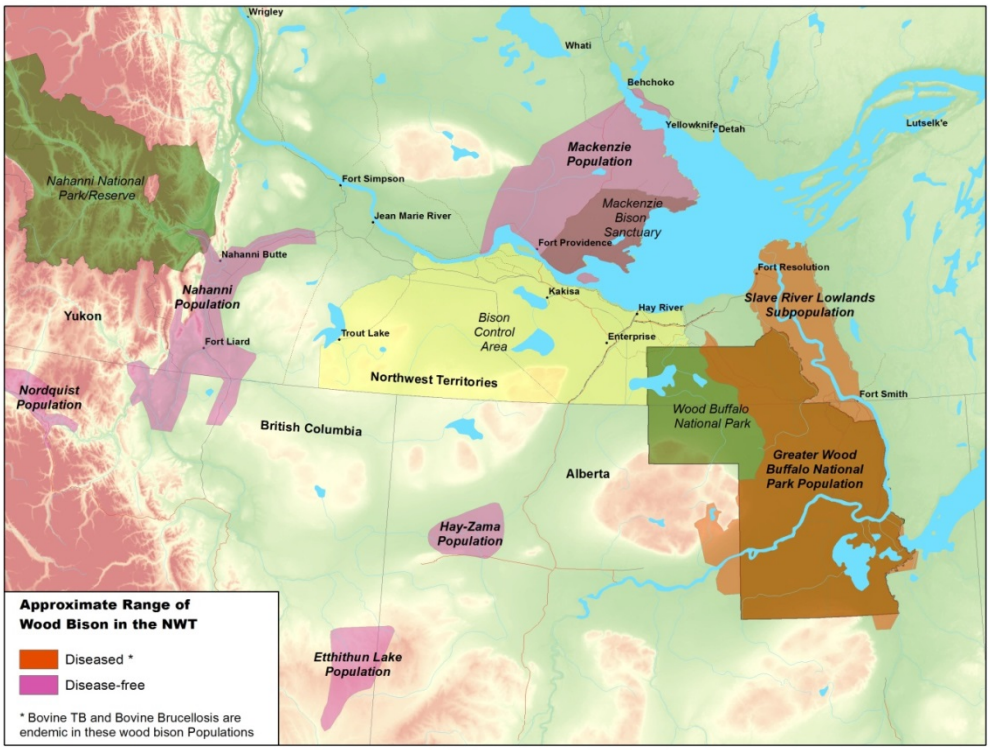


**Figure 2.** Distribution of wood bison in the NWT. Bovine TB and brucellosis occur in bison in the Slave River Lowlands – WBNP area.

Bison may have been absent from the area now occupied by the Mackenzie wood bison population for 100 years or more when, in 1963, 18 bison originally captured near Needle Lake in the northwestern part of WBNP were transported from a holding facility near Fort Smith and released northeast of Fort Providence (Novakowski 1963). The population grew rapidly to an estimated peak of 2,400 animals in 1989, and then appears to have fluctuated between 1,800 and 2,000 animals for ten years. Following this period of apparent stability, numbers subsequently declined (Figure 3). In addition to mortality factors such as predation, weather and the occasional drowning, these bison were subject to harvest, bison–vehicle collisions, and changes to habitat caused by rising water levels in the shallow lake basins that were important grazing areas. This population has also suffered periodic catastrophic events: 177 drowned in Falaise Lake in May 1989 from an estimated total population of 2,400 (Gates et al. 1991); in 1993, 172 died of anthrax (Gates et al. 1995); and

in the summer of 2012, anthrax killed over 450 bison, the largest outbreak recorded in northern Canada.

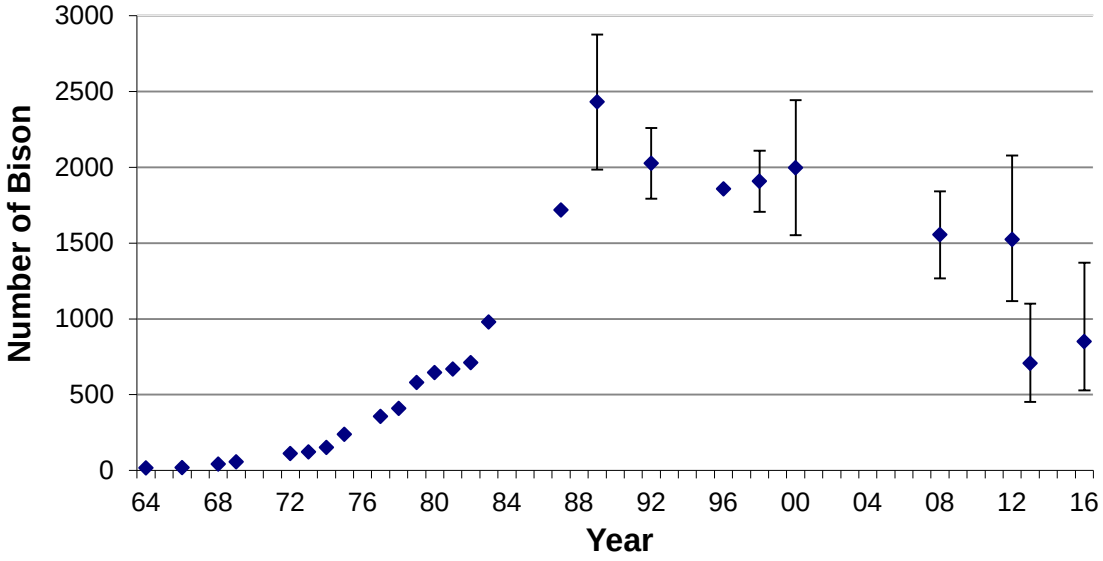


**Figure 3.** Mackenzie wood bison population size estimates 1964–2016. All estimates were made using aerial surveys, initially conducted by total counts, then a combination of total count and strip transects, and using distance sampling methods since 2012. Error bars are 95% confidence limits. Sources were Larter et al. (2000) and unpublished Department of Environment and Natural Resources (ENR) data.

In the early years following the 1963 release, bison occupied range within the Mackenzie Bison Sanctuary (Figure 2), where they grazed on meadows in shallow lake basins, particularly Falaise, Calais, and Boulogne Lakes. They slowly expanded their range, initially within the sanctuary, but by 1987 bison were found in the Mills Lake and Mink Lake areas (Figure 4). In 2008, bison were found at Whitebeach Point, had crossed Frank Channel, and were observed between Behchokǫ and Yellowknife, mostly along Highway 3 or the shore of the North Arm of Great Slave Lake. Individuals have been found near the Yellowknife city limits, but observations within 40 km of Yellowknife are not common.

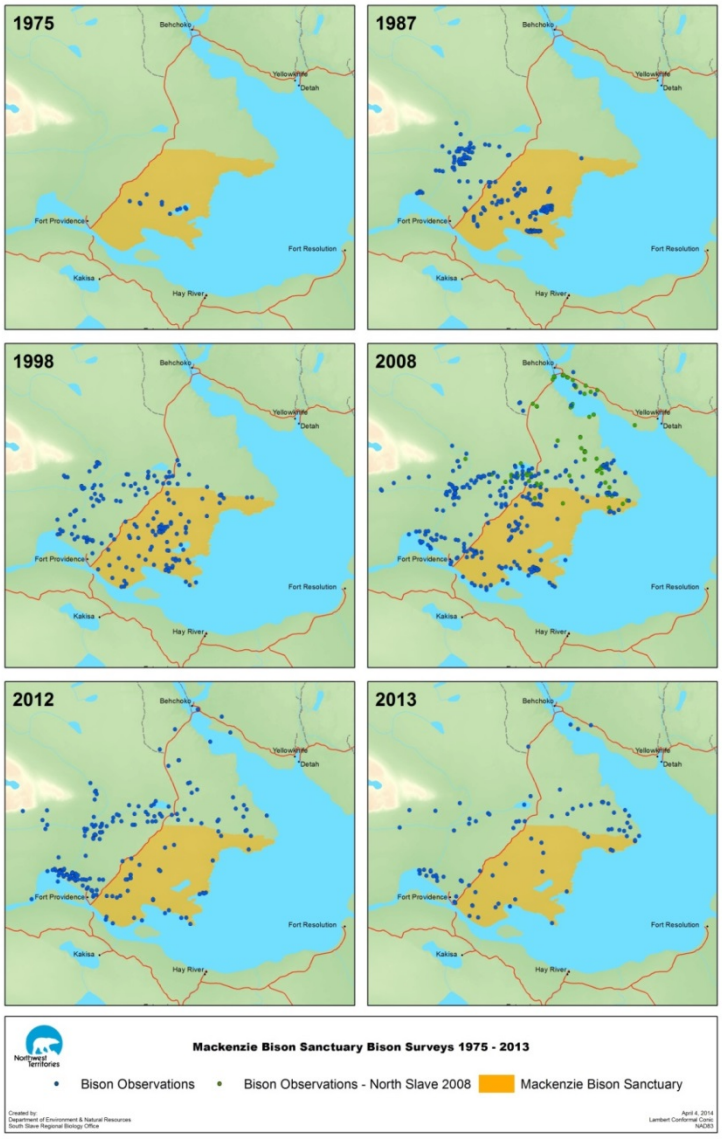


**Figure 4.** Mackenzie wood bison population distribution as observed during late winter surveys, 1975–2013.

Since 1980, six more free-ranging wood bison populations have been re-established in Canada with releases of bison originating from Elk Island National Park. In addition to populations shown in Figure 2, wood bison are also found in the Aishihik herd in YT and at Chitek Lake herd in Manitoba (MB). Efforts to conserve and recover wood bison continue, and the NWT is a partner in this work.

## BISON OR BUFFALO?

The frequent use of the term 'buffalo' when referring to North American bison has been addressed by other authors (Shaw and Meagher 2000, Reynolds et al. 2003, Gates et al. 2010, Plumb et al. 2014). Gates et al. (2010) called the term 'buffalo' an historical misnomer when referring to bison rather than African buffalo (or cape buffalo, *Syncerus caffer*) or Asian water buffalo (*Bubalus* spp.). However, in North America bison and buffalo are freely interchanged as the common name without apparent conflict in meaning or loss of understanding (Plumb et al. 2014). Buffalo is commonly used by many users, from government authors to the media, but rarely in scientific or technical work.

## CURRENT STATUS OF THE MACKENZIE WOOD BISON POPULATION

The Mackenzie population was estimated at 851 bison (95% Confidence Interval: 528-1,371) in March 2016, up from the 2013 estimate of 706 (453–1,100) but still well below the March 2012 estimate of 1,525 (1,118–2,079) animals. The 2013 result was the lowest estimate of this population in 30 years (Figure 3). The decrease between 2012 and 2013 was due in large part to an anthrax outbreak in the summer of 2012 that killed at least 451 bison.

Since the 1990s, there have been significant habitat changes in this population's range. Rising water levels in many lakes have flooded formerly important grazing areas, e.g. Falaise, Boulogne, Calais and Caen Lakes and in the area east of Mink Lake (ENR unpublished data). These changes in habitat may have contributed to the population decline observed between the early 1990s and 2012. Habitat changes may also have resulted in changes in bison distribution over the same period (Figure 4). For example, fewer bison were observed at Falaise and Boulogne Lakes after 2000 than on surveys prior to 1998, and in recent years, Tłı̨chǫ community members have observed bison both along the highway and in forested areas between Behchokǫ̀ and Whatì.

The Mackenzie population is isolated from bison in the Slave River Lowlands and WBNP and is considered to be free of bovine TB and brucellosis. Mackenzie bison have been monitored for the presence of diseases using samples obtained from hunter-killed animals and animals collected for disease surveillance. No evidence of either disease has been found (B. Elkin personal communication, Tessaro et al. 1993). Preventing the spread of bovine TB and brucellosis to populations not currently infected is important for the conservation and recovery of wild bison and to help ensure they continue to be a healthy source of country food. To reduce the risk of disease transmission, the GNWT established the Bison Control Area (BCA), now a cooperative program with WBNP (see Objective 3,

below). AB has implemented a bison management area between its Hay-Zama wood bison population and WBNP for the same reason.

The negotiation of land claim and self-government agreements, and implementation of co-management boards have changed how wildlife management is practiced in the NWT. The Mackenzie bison population's range includes land that falls under the jurisdiction of the Tłı̨cho Government and the Wek'èezhìi Renewable Resources Board as well as under the *Dehcho Land Use Plan*. Further changes to the overall management regime for the Mackenzie wood bison population are expected when land claims in the Dehcho region are settled.

## LEGAL STATUS OF WOOD BISON

The legal and conservation status of bison varies by jurisdiction and listing body. In the NWT, bison are categorized as wildlife and big game under the NWT *Wildlife Act* (2014). Wood bison were assessed as Threatened in the NWT by the NWT Species at Risk Committee in 2016 and added to the NWT List of Species at Risk in 2017.

The federal *Species at Risk Act* lists wood bison on Schedule 1 as Threatened. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is a national organization that assesses species status across the country, and in 1987 it assessed wood bison as Endangered. In 1988, wood bison were re-assessed as Threatened, confirmed as Threatened in 2000, and down listed to Special Concern in November 2013. A response to COSEWIC's assessment was expected from the Government of Canada in 2016.

Internationally, wood bison were listed as Endangered in Canada in 1970 under the *United States Endangered Species Act*, and in 2012 were re-classified as Threatened throughout their range. On the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species, the American bison, *Bison bison,* including both plains and wood subspecies, are listed as Near Threatened (Gates and Aune 2008). Within the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), wood bison are listed on Appendix II, indicating the species is not currently threatened with extinction but may become so unless trade in the species is closely controlled. Wood bison were originally listed in Appendix I in 1977 and down listed to Appendix II in 1997 (Gates et al. 2001). A CITES permit is required to export wood bison, whether whole animals or animal parts. Some countries also require a CITES permit to import listed species.

## BISON AND PEOPLE

> "The wood bison represents a valuable heritage for the people of Canada and other northern regions. The bison is of cultural and spiritual significance for many Aboriginal peoples in North America and wood bison are highly valued as part of the cultural inheritance of many communities within the original range of the subspecies" (Gates et al. 2001, p. 28).

Bison continue in the oral history among some Aboriginal communities even where the species has not been present for decades or longer (Stephenson et al. 2001, N. Larter personal communication). Stephenson et al. (2001) learned a great deal about the history of bison in AK from the oral history there but the species appears to have almost disappeared from the oral history in the Dehcho region of the NWT (e.g. Fanni 2014). In the NWT, apart from the Slave River Lowlands and WBNP, there may have been little or no cultural connection between Aboriginal people and bison, or it has been lost. In communities where wood bison have been re-introduced, the connection to bison is slowly being re-established or created anew if it did not exist in the past. There is a stronger connection between people and bison in Fort Providence (V. Constant, personal communication) than in Nahanni Butte and Fort Liard, where connections are just beginning to emerge.

Non-Indigneous people also have a history with bison in the NWT. In the 1960s and 1970s, resident hunters harvested bison in the Slave River Lowlands, and the NWT Anglers and Hunters Association held annual bison barbeques for the public for several years during that time (K. Hall, personal communication).

Even in areas where there is little or no current cultural connection to bison, their historic presence is often reflected in place names such as Buffalo Lake, Buffalo Narrows, Buffalo Head Hills and Buffalo Shirt Mountain among many others.

Hunting remains an important social, cultural and economic activity in Indigenous and non-Indigenous cultures alike. In addition to the economic value of the food obtained, hunting is an important means by which cultural connections are made to wildlife in general, not just bison.

Within NWT communities there are divergent opinions about the place of bison on the land. Some people feel bison are a nuisance and do not belong; they destroy the land, scare away other animals and, as a result, should be removed. Some are indifferent to bison. Others believe there is a strong spiritual connection between people and bison; that bison are an important part of a community's culture and heritage, and therefore should be managed so herds can support sustainable harvests and varied economic opportunities. Finally, many people feel a connection to bison, whether simply because they exist and are part of the nation's history and natural heritage, because the animals inspire people through art, literature or science, or due to a general appreciation of the natural world.

Bison were of great economic importance to some North American Aboriginal peoples, especially those living on the Great Plains. Food may have been the most important economic aspect of bison but traditional societies would also have obtained clothing, sleeping skins, tools and glue, among other things from the animals. In addition to, or perhaps because of their importance as a source of food and materials, bison were also part of peoples' social, cultural and spiritual lives. Today, in addition to the value of bison hunted, economic value is also realised through tourism and marketing, including guided hunts. Guiding and outfitting can provide significant economic benefit, and outfitters often supply meat to local communities. Using rules of thumb for meat yield from beef carcasses and $25/kg as the replacement cost of beef in Dehcho communities (Larter and Allaire 2014), each 550 kg bison (1,200 lbs.) would provide meat worth over $6,400.

Bison are the NWT's most easily viewed and photographed large wildlife species, and for some people the opportunity to encounter wild wood bison is part of the reason to visit the NWT. As long as there are free-ranging wood bison, and especially if they can be accessed easily by road, there may be opportunities for bison-related ecotourism.

While bison are generally considered unwelcome visitors within communities, their presence results in employment in the form of programs to deter the animals from remaining there. Bison are often used on government and business promotional materials (e.g. parks and hotels) so their presence in the wild helps promote the NWT to the world.

# MANAGEMENT OBJECTIVES

There is a range of issues that affect bison management. This section describes the major issues facing management of the Mackenzie wood bison population, identifies objectives for management, and actions for each objective.

## Objective 1: Manage harvests at sustainable levels for the benefit of all residents of the NWT.

A goal of the *Strategy* is to maintain healthy bison populations that can sustain on-going harvests. Harvesting can have significant effects on wildlife populations and harvest management is often one of the few things that wildlife managers can do to affect or protect wildlife. In some cases it may be the most important factor in wildlife population dynamics. Sound management can use harvesting to help regulate a population's size and alter its distribution. Reducing harvests when populations are low or declining may help slow the decline or allow the population to grow. Increasing harvest may slow the growth of rapidly expanding populations. Hunting is used as a management technique to restrict the distribution of bison in the NWT by preventing them from expanding their range into the BCA and establishing herds there. Hunting of Mackenzie and Nahanni wood bison has always been managed by a quota set under the *Big Game Hunting Regulations*.

The effects of harvesting vary with the proportion of animals taken combined with other sources of mortality along with current reproductive rate. In many species, the age and sex of animals taken may also affect the impacts of harvesting. In species like bison, taking females usually affects future population size and growth more than removing males. Generally, harvesting females is less detrimental to populations that are growing rapidly or are very large. However, when populations are small or declining, harvesting females can increase the rate of decline and further reduce numbers. The science of managing harvests depends on knowing population size, trend (whether increasing, decreasing or stable), and

how quickly the population is changing. Sex ratio and how the population is distributed on the land can also inform management. The art of harvest management is to balance the benefits of harvesting with the risks of taking too many or too few animals.

For the Mackenzie population, there is likely to be an ongoing need to manage the number of bison harvested. In addition to the normal demand for bison hunting, when other species such as moose or caribou decline, hunters may switch their hunting effort to bison. However, the MBWG agreed that hunters should not be encouraged to hunt bison as a replacement for other species that have declined.

For many years, the demand for hunting opportunities has exceeded the Mackenzie population's capacity to sustain it. There were typically 220-250 applicants for the 15 tags allotted in the limited entry draw, which was open to all hunters in the NWT until it was closed following a bison die-off due to anthrax in 2012. Within the community of Fort Providence, the desire to hunt bison has varied but has generally increased over time. There is also a strong desire on the part of Aboriginal harvesters in other communities in the South Slave Region for a quota to hunt Mackenzie bison, but demand for bison tags by Aboriginal harvesters in the North Slave Region is unknown. In the past, there was also active outfitting of non-resident hunts for Mackenzie bison.

Wildlife harvesting can be regulated in a number of ways to achieve management objectives. Harvest quotas can change for the entire population, or be set locally to direct harvest in some areas and not others, or to concentrate harvest on animals of a particular age or sex. Changing the length and timing of the hunting season are other management options. For example, hunters with a tag obtained in the limited entry draw for Mackenzie bison were allowed to take only a male bison from management area D/WB/03 (Figure 5) and were allowed a five-day period during the open season in which to hunt.

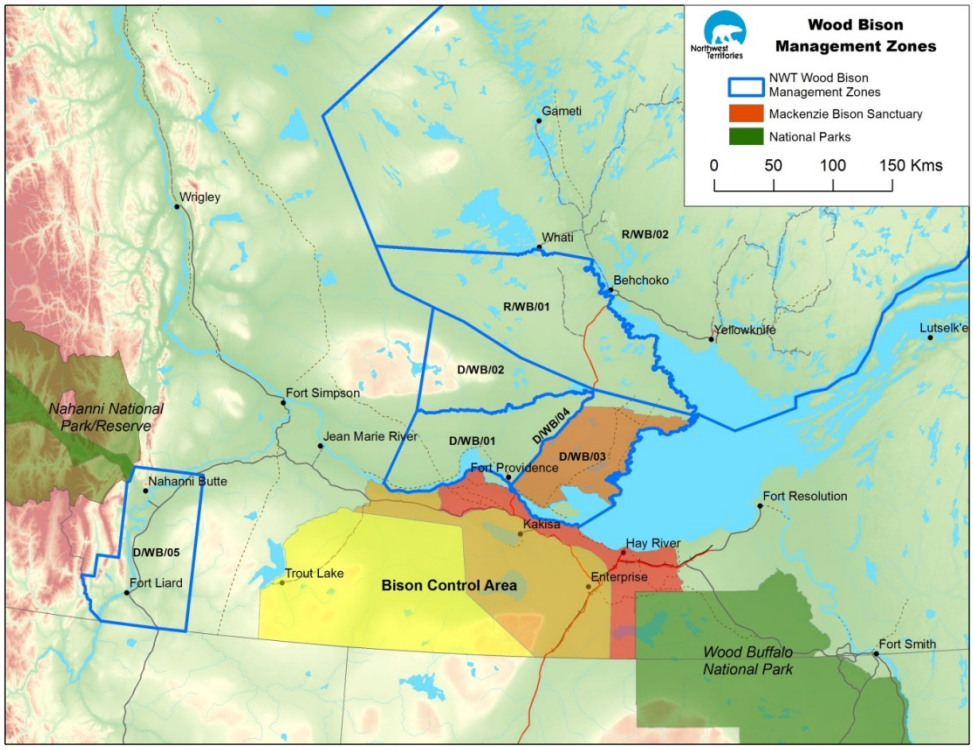


**Figure 5.** Wood bison management areas in the NWT.

Until 2010, all harvest of Mackenzie bison was regulated by a quota system that provided 47 tags. In 2010, the quota was increased to 118 and bison management area R/WB/02 (Figure 5) was created where Aboriginal hunters were allowed to hunt bison without a tag or quota but were required to report their harvests within 72 hours. However, reporting is known to be incomplete and the number of animals taken was undetermined. In 2012, all hunting of the Mackenzie population was halted following the loss of over 450 bison to anthrax.

Since harvest management is especially important for small populations, the MBWG agreed that anyone hunting wood bison must be required to report their harvest.

The MBWG did not set an explicit size target for the Mackenzie bison population, but did reach a consensus that 1,000 animals would be the lower limit below which bison would

not be harvested, except for a small number of males for safety or cultural purposes. The threshold of 1,000 animals was chosen as a minimum size for this population for two reasons. First, results of modeling found that approximately 1,000 animals were required to retain existing genetic diversity and second, a minimum population of 1,000 bison is likely to survive a catastrophic event such as another massive anthrax outbreak or a large drowning event.

The MBWG recognized that the larger the population size, the more opportunities there will be for hunting and other social and cultural connections, improved conservation of genetic diversity and resilience in the face of catastrophes. They refrained from setting a high population size target because of a lack of knowledge of how many bison the range will support (carrying capacity) and how it may change over time.

The MBWG recognized that management of hunting is likely to be the most important and effective way that the goals of the *Strategy* and conservation of the Mackenzie bison population can be achieved. Human-caused wildlife mortality, whether by hunting or other causes, is one of the few factors that can be managed effectively to achieve wildlife population goals. With information on the number of animals that are killed each year, managers can set quotas that balance the need to conserve wildlife populations for the long term with the objective of providing harvest opportunities for people. Understanding hunting effort and hunter success rates also increases the ability to meet management objectives. Information to be reported includes whether the tag holder hunted bison, and if a bison was taken, what was the animal's sex, age class and general condition as well as the management unit where it was taken. Changes to regulations may be needed to implement this.

The MBWG agreed that most management actions, particularly harvest management, and monitoring should be based on population size and trend (Appendix 1). However, some

actions need to be consistent, regardless of population size or trend (see Appendix 2). The intent is to manage the harvest to balance the demand for hunting opportunities while minimizing the risk of causing the population to decline.

The model for harvesting Mackenzie bison is based on the population's size, trend (whether increasing, decreasing or stable) and the sex of animals that hunters may take. Harvest regulations and quotas based on population size and trends, and a suitable allocation of the harvest are recommended to achieve this objective (Table 1, Appendix 1). The MBWG's first priority when recommending harvest quotas was sustainability and calculated the proposed quota as a percentage of total population size. In addition, only males may be taken when the population is below 1,500 animals and if commercial, i.e., outfitted, hunts are permitted, only males may be taken by those hunters regardless of population size. Also, the number of bison killed in collisions and removed from the community must be considered when determining the percentage of the population available for harvest.

Even though the model (Table 1) allows no harvesting if the population is below 1,000 animals, taking a small number of bison would still be acceptable. On occasion, it is necessary to destroy some bison if they become a problem in Fort Providence and the situation cannot be resolved by other means. In this circumstance, it is strongly recommended that cows not be taken. Similarly, harvesting two or three male bison for cultural events in Fort Providence would also be acceptable. However, the total combined harvest should be <1% of the total population size.

**Table 1.** Harvest plan for the Mackenzie bison population. This table is to be used in conjunction with Appendix 1 to establish quotas of total take on both population size and trend.

| Population Size | Total Take as a Percentage of Herd Size[1] | Sexes to be Harvested by Hunting Cohort | | |
|---|---|---|---|---|
| | | Aboriginal Hunters | Resident Hunters | Commercial Outfitted |
| **Over 2,000** | 3-5% | Either sex | Either sex | Bulls only |
| **1,500–2,000** | 2-3% | Either sex | Either sex | Bulls only |
| **1,000–1,500** | 1-3% | Bulls only | Bulls only | None |
| **Under 1,000** | No harvesting[2] or 0-<1% | Bulls only for cultural events[2] | None | None |

[1] See Appendix 1. If the population has been in decline, total take shall be at the lower end of the range, and if the trend has been increasing, total take may be near the upper end of the range.

[2] It may be acceptable to harvest some male bison under an applicable permit in Fort Providence for cultural events or because they have become a problem in the community. This take is to be <1% of the total population size. When the population is >1,000 animals, quota and tag allocations will are be used for to manage the harvest.

The MBWG set four population levels where harvest management and population monitoring actions would change (Appendix 1). Historically, the Mackenzie population has rarely numbered over 2,000 animals (Figure 3) so the MBWG classed the population size as high when the estimate is over 2,000 bison and the allowable harvest would be greatest at high population size (Table 1). From 1,500-2,000 animals, moderate levels of harvest would be allowed, and from 1,000-1,500, the population would be considered low and only a small harvest would be permitted. At <1,000, the population was considered to be at a critical level, requiring enhanced management actions and in general, no harvesting would be allowed, except as noted above.

The total allowable take (including harvests, collisions and nuisance kills) as a percentage of the total population size was proposed as a range, so that harvest could be adjusted for the population's trend (Table 1, Appendix 1). If the population is declining, total take is to be set at the lower level, and if increasing, at the upper level. If the population changes from increasing or decreasing to stable, there would be no change in the quota.

**Key Actions:**

The MBWG identified a number of key actions related to managing harvests and the resulting impacts on population size, as well as monitoring to provide information needed to manage bison:

- Base most management actions; particularly harvest management, and monitoring on population size and trend (Appendix 1). However, some actions need to be consistent, regardless of population size or trend (Appendix 2).
- Manage bison harvests using a quota and tag system.
- Require anyone who hunts wood bison to submit a report on their hunting effort, any harvest and details of the animal taken.
- Manage the harvest to balance the demand for hunting opportunities while minimizing the risk of causing the population to decline. Harvest regulations and quotas based on population size and trends, and a suitable allocation of the harvest are recommended to achieve this objective (Table 1, Appendix 1).
- Refine total allowable take guidelines based on population modeling.
- Collect data on bison survival, reproductive rate and all causes of mortality to provide sound input to population models. See Knowledge Gaps: Information Required for Management Decisions below.
- Anticipate and allow for problem bison shot in communities and killed in collisions when setting harvest quotas.
- Allow a limited take of male bison from Fort Providence to remove bison in conflict with the community that cannot be resolved by other means, or to harvest animals

for a cultural event. This take is to total <1% of the total population size if the Mackenzie bison number under 1,000 animals. If the population is >1,000, this take would form part of the Aboriginal harvest quota as per Table 1.

### Objective 2: Reduce bison–human conflicts in communities and on highways.

People and bison tend to live in the same habitats because locations that are good for roads and communities also tend to be good habitat for bison. The creation of lawns and gardens in communities, and the removal of woody plants from roadsides, power lines and pipeline corridors tend to create habitats that attract bison. Bison may be attracted to roadsides and communities, and linear features like roads and seismic lines that create easy travel routes through otherwise thick forests or wetlands. Bison will travel on roads in winter, especially in years of deep snow.

Two communities, Fort Providence and Behchokǫ, are within the range of the Mackenzie bison population. Bison rarely enter Behchokǫ but have often been found in Fort Providence where the ENR maintains an active program to herd the animals out of the community in order to reduce the potential for damage or injury. Bison that behave aggressively or persist in returning to the community are destroyed by ENR staff and the meat is distributed to community members.

It is important to note that bison have never injured a person in a community, but the potential exists and most community members would rather not have large, wild animals in town. Bison can damage property but they mainly forage in gardens and on lawns that are not fenced and their droppings can be a nuisance. At the same time, it should be noted that governments and businesses use photos of bison, including bison within communities on promotional materials. Some residents enjoy observing bison within their community and are very tolerant of the animals.

ENR recorded 270 bison-vehicle collisions on NWT Highway 3 from 1989 to the end 2015. Some collisions are reported to either ENR or the Royal Canadian Mounted Police (RCMP), but others are detected by the presence of dead or injured bison found along the highway. The number of collisions varies year-to-year for unknown reasons, but there appears to have been a general increase over time (Figure 6). Even though the Mackenzie population is much smaller than it was previously, more collisions were recorded in 2012 and 2013 than in any previous year, but there appears to have been fewer collisions in 2014 and 2015 (Figure 6). Collisions are more frequent from August through November with a peak in October (Figure 7). Since 2005, data reported to ENR show that motor-vehicle collisions have killed an average of 22 bison per year on Highway 3 (Figure 8). This represents just over 1% of the total population each year prior to 2012. Since the major decline in population size in 2012, the number of animals known to have been killed on the highway was over 5% of the population in 2012 and 2013, and between 1–2% in 2014 and 2015. Highway 3 runs through the centre of the Mackenzie population's recent distribution (Figure 4) so bison will often encounter it as they move about their range. They also use the highway as a travel route and graze on roadside vegetation so reducing the frequency and number of bison found near the highway may not be a simple task.

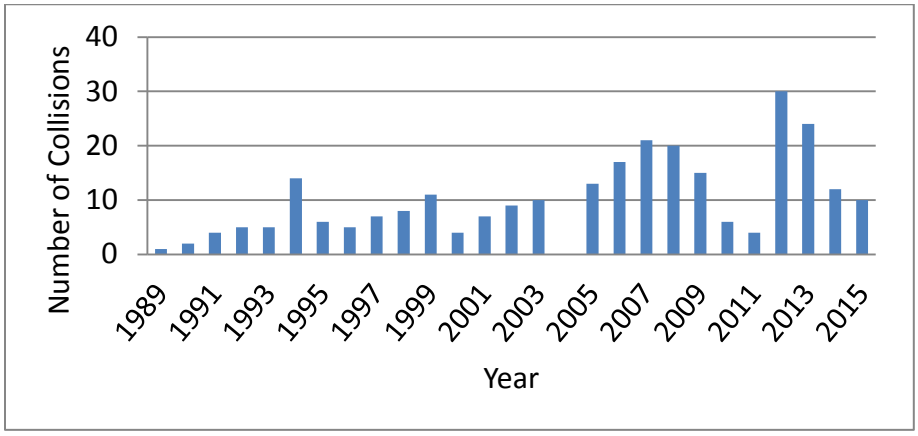


**Figure 6.** Number of bison–vehicle collisions each year on NWT Highway 3, 1989–2015, as reported to ENR.

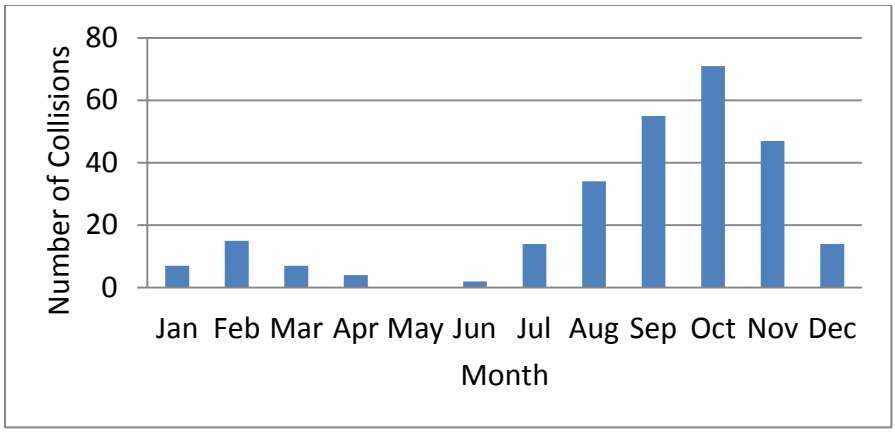


**Figure 7.** Most bison–vehicle collisions in the NWT occur in the fall. Total number of bison–vehicle collisions by month on NWT Highway 3, 1989–2015, as reported to ENR.

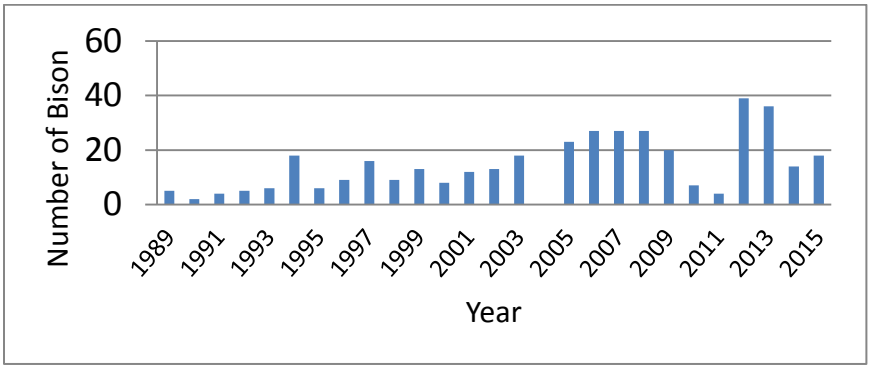


**Figure 8.** Number of bison killed in motor-vehicle collisions on NWT Highway 3, 1989–2015, as reported to ENR.

While there has been no loss of human life due to a collision with a bison in the NWT, people have been injured and there is potential for fatalities. These incidents have resulted in the deaths of hundreds of bison, and an undetermined cost in injuries and damage to vehicles.

The GNWT has made efforts to reduce the number of bison-vehicle collisions by using both static and electronic signs to caution drivers that bison may be on or near the highway, including bison as a hazard to be aware of in the *Drive Alive* program, posting warning notices on the Department of Transportation's (DOT) website, operating highway check-

stops where staff stopped all vehicles and spoke to drivers, producing posters and pamphlets to educate drivers, and advertising on the radio.

In some winters, bison appear reluctant to leave the road, perhaps to avoid walking through deep snow. Ploughing travel lanes for bison away from the road has been successful in reducing the number of animals on roads. In most cases, however, we have a poor understanding of why bison use roads or enter communities, how much time bison spend in places that result in conflicts, or how to prevent those incursions.

Developing actions to reduce bison–vehicle collisions and conflicts while conserving bison is currently hindered by a lack of information on why the animals are attracted to these areas, when and where they occur most frequently, and how long they remain in the area. We also need to understand if the problems are caused by regular presence of a small number of animals, or the infrequent occurrence of many different animals in order to devise effective management actions. A key step is to gather complete and reliable data on both conflicts and collisions. It may help to increase awareness and reduce the number of bison–vehicle collisions if we are able inform drivers of the cost of damage to vehicles, the number of people injured and the number of bison injured or killed in collisions.

**Key Actions:**

- Improve consistency of reporting of bison hit or killed in collisions and incursions into communities.
- Collaborate with DOT to merge collision databases.
- Reduce the number and frequency of bison incursions into Fort Providence:
    - Engage the Department of Municipal and Community Affairs (MACA), community governments, First Nations and others to find ways to reduce bison incursions into communities.

- Improve public awareness and knowledge of what to do when bison are in a community or person's "backyard".
- Engage DOT, community governments and others to address and reduce bison-vehicle collisions. Potential actions include:
    - Undertake relevant research and testing to prevent collisions, in cooperation with DOT.
    - Use more electronic signs to warn drivers of bison along highways.
    - Implement special reduced-speed zones.
    - Implement night-time speed limit reduction.
    - Enforce speed limits, use photo-radar.
    - Plough "bison lanes" in the snow along the treeline to reduce the number of bison on the highway in winters of deep snow. Bison use roads to travel and avoid deep snow. Deep, hard snow ploughed into ditches forms a barrier that bison have difficulty crossing to get away from the road when vehicles approach.
    - Use alternatives to salt that do not attract bison.
    - Estimate and publicize the cost of injuries and damage to vehicles due to collisions with bison.
    - When hunting is re-opened, allow hunting near highway areas in an adaptive management approach to assess its effectiveness at reducing collisions.
    - Target drivers with information on the presence of bison on highways, when most collisions occur, how to avoid hitting bison, the importance of reporting all collisions with bison to ENR and what information to report.
- Study bison movements to learn:
    - How and why bison enter Fort Providence, and how much time they spend near the community.
    - Why bison use Highway 3 and determine if a few animals are frequently on or near the highway or if many bison use it but less frequently.

### Objective 3: Maintain the population free of bovine TB and brucellosis, as well as other significant livestock diseases that may be transmitted by domestic animals.

All species can become infected with a range of potential diseases and parasites, and wood bison are no exception. At this time there are three diseases of significant management concern due to their presence in the NWT and their potential to harm both bison and people: anthrax (*Bacillus anthracis*), bovine TB (*Mycobacterium bovis*) and brucellosis (*Brucella abortus*). All three can be transmitted between domestic livestock, wildlife and humans but only anthrax is known to occur in the Mackenzie bison population.

#### Anthrax

Anthrax is a seasonal and sporadic disease in northern bison populations. All detected outbreaks have occurred in the summer months, but we are unable to predict in which years an anthrax outbreak will occur or how many animals will die. In the Mackenzie population, anthrax outbreaks have only been detected in 1993, 2010 and 2012, though cases have likely occurred in other years as well. Some outbreaks are minor with only a few animals dying, while others can be catastrophic, such as the 2012 outbreak in this population. Based on oral history and recent scientific research, it is believed that anthrax is not a new disease in the north but has likely been here for thousands of years.

Anthrax is caused by a spore-forming bacterium that can persist in the environment for many years. It is believed that under certain environmental conditions, spores become concentrated in locations where bison can inhale or eat them. Inside the bison, the spores germinate and cause a blood-born infection that can be fatal. Anthrax infections generally cause rapid death in bison, and dead animals decompose quickly. When an infected animal dies, bacteria are released back into the environment through discharges from the body or when the carcass is opened by scavengers. This local environmental contamination may become a new source of anthrax infection. Active anthrax surveillance and control measures are in place to try to limit the impacts of this disease on bison.

## Bovine TB

Bovine TB is a chronic, infectious disease. Active cases in bison can cause lesions in lymph nodes and organs, most commonly the liver and lungs, but can be found anywhere in the body. In advanced cases TB can cause death of an animal. TB can also affect an animal's immune function and energy balance, which may reduce reproduction and survival rates. These effects on bison health and reproduction may result in lowered population growth rate and population size.

An animal can be infected with the TB bacteria for a long period of time before the disease actively develops and appears sick. These chronic infections are common and are very difficult to detect because the bacteria are found within the host's cells where they can evade the body's immune system. There are currently no good live animal TB tests for individual wildlife or domestic animals, and no effective treatment for animals already infected with the disease. As a result, the current approach in livestock is to remove all animals in a TB infected herd and replace them with healthy animals. Research is ongoing to identify better tools and approaches to diagnose and manage TB in wildlife, including bison.

## Bovine brucellosis

Bovine brucellosis is a chronic infection mainly found in the reproductive organs and joints. This disease lowers the reproductive rate in populations by causing most cows to abort their calf in the first pregnancy after developing an active infection. Typically, abortions no longer occur after the first pregnancy; however, bacteria continue to be shed in milk and reproductive tract discharge. In males, brucellosis causes infection of the testes leading to infertility. Brucellosis in the joints causes arthritis and lameness which may increase susceptibility to predation. Transmission is by eating contaminated material, or by oral or nose contact with aborted foetuses, contaminated placentas or discharges from the uterus.

Current testing methods can reliably detect brucellosis infections in bison but, as for TB, effective treatment of infected animals is not possible. In domestic livestock, management of the disease is done by removing an entire infected herd and repopulating from a healthy source population. Some potential new disease management tools including vaccines and reproductive technologies are being investigated in bison and other wildlife, but more work is still needed to assess their potential.

Bovine TB and brucellosis originated from domestic livestock. They were introduced to wood bison following the transfer of infected plains bison from central AB to WBNP in the 1920s. Both diseases are now present in bison in WBNP and the Slave River Lowlands, but all other wild bison populations are free of those two diseases. The continued presence of bovine TB and brucellosis in the WBNP and Slave River Lowlands area poses an ongoing risk that they will be transmitted to other wild bison populations. The Mackenzie and AB's Hay-Zama population are the two bison populations closest to the area where the disease is present and most at risk of being infected. The most likely route of transmission is the movement of bison from the Slave River Lowlands or WBNP into disease-free areas. If transmission occurs, not only would the health of the Mackenzie population be affected, but the public's attitude toward these bison could also be negatively affected.

Barren-ground caribou (*Rangifer tarandus groenlandicus*) are known to be infected with *Brucella suis* which can also infect other mammals. There has been little or no overlap of barren-ground caribou with Mackenzie bison. If bison continue to expand their range north and if barren-ground caribou return to wintering areas close to or within the current bison range there may be a risk of disease transmission from caribou to bison; how great that risk may be is unknown. In the past, barren-ground caribou have crossed the North Arm of Great Slave Lake and wintered in the northern part of the Mackenzie population's range.

There is also a perception that bovine brucellosis and TB affect the quality of meat from bison. Hunters in the Slave River Lowlands report leaving infected animals that they have harvested. How much meat is not used and how many animals are abandoned due to the presence of these diseases is unknown.

Given the significant impacts of bovine TB and brucellosis on bison populations and challenges in trying to manage the diseases, it is important to prevent the movement of those diseases to areas where they currently do not occur.

### BCA

The BCA is a program designed to reduce the risk of bovine brucellosis or TB being transmitted from the bison in WBNP and the Slave River Lowlands to other bison populations. The program was implemented by the GNWT in 1989 to create a barrier to the movement of free-ranging bison between diseased and disease-free populations and reduce the likelihood the Mackenzie and other currently uninfected populations would become infected. Now a cooperative program with WBNP, the BCA remains an important aspect of bovine brucellosis and TB management.

### New or Emerging Diseases

It is important to be vigilant for any new or emerging diseases that may infect bison and cause management problems. It is very difficult to predict which disease will emerge next and, once present in a wildlife population, new diseases can be very difficult or impossible to eradicate or control. Prevention is likely to be the most effective approach to managing new diseases.

Likely sources of new diseases include the movement or import of domestic animals, farmed wildlife or contaminated materials into areas used by bison, or the movement of

indigenous or introduced wildlife. The distribution of diseases may also change following landscape disturbances (e.g. new cut lines or roads), climatic or other changes.

**Key Actions:**

- Monitor and respond to anthrax outbreaks as described in ENR's Anthrax Emergency Response Plan.
- Continue the BCA program.
    - Review the BCA program to assess its effectiveness and determine if it can be improved.
- Develop a plan for responding in the event bovine TB, brucellosis or other significant disease is discovered in the Mackenzie bison population.
    - Assess the risks, costs and benefits of potential management responses to the arrival of new diseases.
- Establish regulations and protocols to address importing and movement of domestic animals or translocating wildlife within the NWT that will prevent the introduction or transmission of diseases or parasites.
    - Establish a permitting process for the import, holding and health testing of domestic animals.
- Conduct surveillance for bovine TB, brucellosis and other diseases.
    - Train ENR officers and staff to collect, label and preserve appropriate samples.
    - Obtain samples from harvested and road-killed bison.
    - Regularly monitor the population with respect to identified diseases.
    - Maintain a long-term sample archive to support future research and management needs.

### Objective 4. Maintain and enhance the population's genetic diversity while preventing hybridization with plains bison or cattle.

Genetic diversity impacts a population's ability to adapt to changing environmental conditions. Loss of genetic diversity can negatively affect a population's long-term survival by reducing its ability to adapt to new or changing selection pressures, which include every aspect of a population's environment that can affect an individual's survival or reproductive success. Selection pressures can change with changes to habitat conditions, weather, the community of parasites and diseases, predators, and the quality and quantity of available food.

Low genetic diversity often caused by a genetic bottleneck and inbreeding, can also lead to a decrease in population vigour. This has been shown in some mammals, including bison in the Texas State herd (Halbert et al. 2004) and wolves (Vilà et al. 2002, Mlot 2016). These effects are known as inbreeding depression, which can reduce a population's ability to reproduce effectively and if unchecked, may result in the population's extinction.

During the great bison population contraction in the late 1800s, wood bison numbers were drastically reduced from many thousands to around 250 animals in what is now WBNP. The effect of that reduction on the genetic diversity of wood bison is unknown. Only 18 animals were released when bison were re-introduced north of Fort Providence in 1963. It is unlikely that a population originating from a small number of animals will contain the genetic variation of the source population, and this is indeed true for the Mackenzie population. All other wood bison recovery populations were also founded by a small number of source animals and all have less genetic variation than the original source population, WBNP–Slave River Lowlands.

It is important to monitor genetic diversity of these populations to assess how it changes over time. Populations tend to lose genetic diversity over time and small, isolated

populations lose it more quickly than large populations. Regular monitoring will indicate if management action is needed to address that loss. All wood bison recovery populations, including the Mackenzie, are isolated from each other and there has been no gene flow among them to slow the loss of genetic diversity.

For bison, recent research has suggested that populations should have an effective size of 1,000 or more to have a high probability of retaining most of the existing genetic diversity for a reasonably long time[2]. Loss of genetic diversity is greatest in small, isolated populations, but gene flow between populations can help to maintain genetic diversity. Allowing or enabling animals to move between populations fosters gene flow and formerly isolated, small populations begin to function more like a larger population. Creating connections or travel corridors between isolated populations can help to facilitate movement between populations. The nearest bovine TB- and brucellosis-free wood bison are in the Nahanni population, but the western portion of the BCA, the Mackenzie River and an extensive area of habitat poorly suited to bison separate them from the Mackenzie. However, bison do cross the Mackenzie River on occasion and have been reported in the western part of the BCA, so it may be physically possible for bison to move between the Mackenzie and Nahanni populations, especially as fires alter the habitat. It remains for management to create a way for bison to move around the western side of the BCA. If necessary, animals may be introduced into a population to increase genetic diversity but great care must be taken to avoid introducing new diseases at the same time. New technologies in animal reproduction also offer potential means to create gene flow and enhance genetic diversity in isolated bison populations.

[2] Gross and Wang (2005) modeled loss of genetic diversity in bison populations and concluded that populations of 1,000 animals would have a 90% probability of retaining 90% of existing alleles for 200 years, or about 25 generations. Hedrick (2009) advised that bison populations would need 2,000–3,000 animals to have an effective population size of 1,000. The difference between estimated number of bison and the effective population size is due to their mating system where a relatively small proportion of bison males breed most of the cows. The mating system effect and other factors such as genetic drift become more important as populations become very small.

Bison conservation efforts in the late 1800s and early 1900s were motivated in part by the desire to improve the hardiness of cattle by cross-breeding them with bison. Bison and cattle do not normally interbreed even when sharing the same range, but interbreeding can be forced. Over time, these efforts resulted in the incursion of cattle genes into bison, plains bison in particular, and this is a major conservation issue for some bison herds. Cross-breeding experiments were also done at Buffalo National Park, near Wainwright, AB, prior to plains bison from that park being translocated to WBNP in the 1920s; however, it is not known if the animals shipped from Wainwright to WBNP carried cattle genes. If cattle genes are present in Mackenzie wood bison, they probably occur at very low frequency. While hybridization between Mackenzie bison and cattle is not a current threat, managers need to be aware of the potential to introduce it if animals are moved in from elsewhere.

A second source of foreign genes in wild wood bison is hybridization with plains bison or domestic bison. Following the transfer of plains bison from Buffalo National Park to WBNP in the 1920s, interbreeding between the two subspecies occurred. Studies have shown that wood and plains bison are still genetically different, and it is strongly recommended that they be managed separately. Domestic bison generally have mixed or unknown genetic histories and in all cases, their management as livestock puts different selection pressures on them than exist for wild bison. It is also recommended that hybridization with domestic bison be prevented in order to conserve wild bison.

Genetic diversity of the Mackenzie wood bison population was assessed in the 1990s, and another study to reassess the diversity is currently under way.

**Key Actions:**

- Monitor genetic diversity.
    - At ten year intervals or after a major reduction in population size (e.g. 50% or more).
    - Collect DNA samples from as many road-killed bison as possible and every bison destroyed as a problem or nuisance animal to create a DNA bank for ongoing genetic diversity monitoring.
    - Train ENR officers and staff to collect, label and preserve appropriate samples.
- Prevent any further hybridization with plains bison, domestic bison, cattle or other species.
    - Enact regulations to prevent the import or holding of plains bison or domestic bison in the NWT. This will address the hybridization challenge identified in the *Strategy*.
- Increase genetic diversity of Mackenzie wood bison if possible without introducing new diseases to the population or non-wood bison genetic material.
    - Examine ways to facilitate bison movements between the Mackenzie and Nahanni populations.
    - Support research into genetic salvage and storage of genetic material with a goal of increasing genetic diversity in wood bison populations.
    - Support research on reproductive technologies that may lead to breakthroughs that will permit the safe introduction of genetic material to disease-free populations without risk of introducing disease.
- Maintain a long-term DNA storage bank.

## Objective 5: Prevent conflicts from arising with forestry, agriculture and other land uses.

### Timber Harvesting

Plans are being developed for a timber harvesting industry in the Fort Providence area including part of the Mackenzie population's current range, and adjacent areas within the BCA south of the Mackenzie River. Currently, the plan calls for a harvest of approximately 1,000 ha (10 $km^2$) per year. Harvesting would most likely begin south of the Mackenzie River to take advantage of existing access and proximity to a proposed wood pellet mill in Enterprise. At this point it is difficult to assess when timber harvesting might begin within bison range or the significance of this development to bison, if any. The nature of harvesting operations is unknown, as is the potential increase in associated traffic within bison range. It is most likely that new roads to access timber and increased traffic will have the greatest effect on bison, with more traffic resulting in more bison–vehicle collisions. Bison readily follow linear features such as roads and may use them to expand their range, and new roads may also make it easier for hunters to access bison. Increased water runoff from harvested sites may result in a secondary effect if this alters local water levels in sedge meadow habitats used by foraging bison. New roads within the BCA south of the Mackenzie River may facilitate movements by bison if they enter the BCA in that area.

### Agriculture

Agriculture has been the largest cause of bison habitat loss in North America. Effectively all former bison habitat on the grasslands of North America from Mexico to central AB has been lost, mostly due to conversion to agricultural use. Agriculture continues to be a threat to bison and other wildlife due to loss of habitat and risk of disease transmission between species. Also, where wild bison occur near agricultural operations in North America, there are conflicts when they move onto farms or ranches, for example outside Prince Albert National Park in SK and around Yellowstone National Park, especially in Montana. These conflicts invariably complicate bison management and increase costs.

In the NWT, agriculture currently is not a source of conflict or a threat to bison or bison habitat. However, there has been agricultural activity in the past and there is potential for more in the future. There have been farm operations at Horn River near Mills Lake and in the Mackenzie Bison Sanctuary at Bluefish Creek, about 12 km from Fort Providence, but they are no longer operating. Livestock were kept in both areas and feral horses were present at Mills Lake near the Horn River for years after the farm ceased operations, and there has been a report of goats being kept in Fort Providence in recent years. The Department of Industry, Tourism and Investment (ITI) and the federal Department of Agriculture have launched the *Growing Forward 2* program to increase employment and business opportunities in agriculture in the NWT. Creation of agricultural operations within bison range has the potential to intensify conflicts with bison, e.g. bison damaging crops, and, if livestock are involved, there is potential for the introduction and transmission of new diseases. If any livestock are imported to Yellowknife they would mostly likely arrive there via Highway 3, which bisects the Mackenzie bison range. It will be important for departments to work together and be proactive to prevent conflicts from arising. The Dehcho Land Use Planning Committee assessed the potential for large-scale agriculture in the Dehcho, including much of the range of Mackenzie bison. Most of the range was assessed as having low to moderate agricultural potential.

### Economic Opportunities and Tourism

Bison provide economic benefits to communities and the NWT as a whole. Due to the habitats they use and their tendency to tolerate vehicles and humans, bison are the most watchable large wildlife in the territory. Tourists will make side trips to observe and photograph bison when visiting the NWT and it is common for people to drive from Yellowknife to Fort Providence in the hope of seeing bison along the highway.

There are opportunities to realise economic benefits from wild bison. There currently is no quota available for outfitted hunts for wood bison, but in other jurisdictions guided hunts command significant fees and provide business opportunities for outfitters and

employment for local guides. In addition, much of the meat often goes to a nearby community. There is potential to use either resident or non-resident hunters to help reduce the occurrence of problem bison within communities. Even though resident hunters rarely employ outfitters or guides, they spend significant amounts of money to go hunting which creates economic activity for various types of businesses. There may also be opportunities for non-consumptive forms of wildlife viewing tourism. If wild bison are present in sufficient numbers, there will be opportunities for entrepreneurs to develop tourism or other business activities related to them, but there is no need for bison management actions. There are no specific management objectives related to economic opportunities at this time.

**Key Actions:**

- Prevent loss of bison habitat caused by conversion of land to other purposes.
    - Establish regulations to manage land-use changes and the impact on wildlife habitat.
- Prevent conflicts between agriculture and habitat use by bison.
    - Coordinate and consult with the Department of Lands to discuss zoning and apportionment of lands for wildlife habitat.
    - Consult with the ITI regarding the location of any new farm operations to avoid future conflicts.

### National Wood Bison Recovery Strategy

Wood bison are listed as Threatened under the federal *Species at Risk Act* and therefore the Government of Canada must produce a recovery strategy for the species that includes population size and distribution objectives to achieve recovery. The goal of recovery planning is to reverse the decline of a species or reduce or remove threats to its long-term survival in the wild. Environment and Climate Change Canada (ECCC) is the lead agency drafting the recovery strategy for wood bison and has posted the proposed strategy on Canada's Species at Risk Public Registry. The recovery planning process is required of the

federal government because it is based on federal legislation, but the provinces, territories and Parks Canada Agency have the management authority to implement actions. When the national *Recovery Strategy for the Wood Bison* is finalized this plan may be revised, if necessary, to set specific objectives to support the recovery strategy's objectives.

# KNOWLEDGE GAPS: INFORMATION REQUIRED TO IMPROVE MANAGEMENT DECISIONS

## Sustainable Harvest Levels and Population Modeling

Harvest quotas recommended in Table 1 are based on the MBWG's consensus of what levels may be sustainable, but members recognized that these recommendations were made in the absence of information about factors that are critical to a population's ability to sustain harvesting. Factors that are especially important are survival and reproductive rates.

With knowledge of the factors that cause populations to increase or decline, managers may be able to use a wider array of management options when setting harvest quotas and taking other management actions. Population models enable managers to assess different management options and their potential effects on wildlife.

**Key Actions:**

- Mark bison with global positioning system (GPS) collars and use them to:
    - Estimate survival rates of collared bison.
    - Estimate reproductive rate of female bison by monitoring marked individuals.
        - Compare estimates of reproduction from marked bison to estimates from herd composition surveys to determine the most effective way to estimate reproductive rate.
    - Determine predation rate and relative importance of different mortality factors from collared bison.
    - The need for data from collar-marked bison with respect to habitat and range use, disease surveillance, improving aerial surveys and mitigating the effects of roads on bison have been addressed in earlier sections.

- Coordinate collar-related data gathering and population modeling with other ENR programs including boreal woodland caribou, moose and wildlife health as those programs develop and progress.
- Create models to predict changes in population size and serve as a check on survey results.

### Population Size and Trend

Population size and trend are the most basic pieces of information needed to manage wildlife to achieve management goals. Knowledge of size and trend is often achieved by conducting regular surveys to estimate the population's size, and trend can then be determined from a series of sequential estimates. While information on a population's trend is useful, it is important to recognize that the previous trend may not continue in the future.

The size and trend of bison populations are difficult to estimate with precision because bison are social animals that are not evenly or randomly distributed on the landscape. These two features make it common to record survey lines with no bison and others with large numbers, and in the NWT, bison group sizes range from lone individuals to several dozen or over 100. Both issues reduce the precision of estimates and confidence in population trends. NWT bison also use a complex of habitats including forested areas where they are very difficult to see on aerial surveys and most bison in treed habitats are probably missed, which biases the results.

Accuracy and precision of bison population estimates can be improved significantly by estimating aerial survey detection rates independently of the survey design. Common methods of estimating animal detection use either a double-observer method or detection of radio collar marked bison. Detection may be improved by using aircraft with better

windows and that have a smaller blind spot directly in front of and under the aircraft, and by using advanced technology that help observers detect animals.

Corroborating population trends from survey data with output of population models based on survival and reproduction data (see below) is a good practice because it provides more information based on different sources of data, and reduces reliance on a single source of information.

**Key Actions:**

- Estimate detectability of bison on aerial surveys from data that are independent of the current distance sampling methods by using sightings of GPS collar-marked bison during aerial surveys.
    - GPS collared bison will also enable us to estimate detectability in different habitat types, especially in forested habitats, further improving the ability to estimate bison numbers with increased precision.
    - Lack of suitable aircraft currently limits the use of the double-observer method.
- Improve survey methods, especially the precision of population estimates, to increase the ability to detect changes in population size.
- Evaluate current surveys and methods, and model bison populations to determine the most appropriate intervals between population surveys and which type of information is needed most to monitor and manage bison.

### Interactions with Other Species

Some people believe that bison displace moose and boreal caribou, and that moose and caribou numbers have declined following the re-establishment of the Mackenzie bison population. There is very little data on the interactions between these species, but the differences in habitat selection and diet suggest that bison are not very likely to be direct

competitors of moose or boreal caribou. When flying aerial surveys, it is not unusual to observe moose near bison, which suggests moose do not leave areas occupied by bison.

Indirect interactions between species may be more likely than direct competition, avoidance or aggression. The increase of one prey species may result in higher predator numbers, which may in turn increase mortality of a second species and give the appearance of competition between the two prey species.

**Key Actions:**

- Collaborate with ongoing ENR programs studying boreal caribou, moose and wolves to increase our understanding of the relationships between bison and other key species (boreal caribou and moose) and quantify the impacts of the various species upon each other if possible.
- Study the relationships between bison and predators (e.g. wolves, bears and cougars).
    - Assess the impacts of predators on bison population size.

### Habitat and Habitat Management

The distribution and abundance of all species is affected by how well populations can meet their needs for food, water and shelter. For a species to occupy an area, suitable habitat must fall within the species' tolerance limits for climatic and geological conditions. Distribution and abundance may also be affected by other species including parasites and diseases, competitors and predators.

Availability of suitable habitat depends largely on geography and climate, and is mostly outside of the control of management actions. For example, between Great Slave Lake, the Mackenzie River and the Horn Plateau there has been a history of fluctuating water levels,

which has affected the amount and location of grazing habitat. Since the late 1980s, water levels in this area have been higher than in previous decades, resulting in the loss of grazing in some locales, which may have contributed to the decline in bison numbers since 1990. Local knowledge holders from Fort Providence have suggested that beaver activity has contributed to the flooding and that it would be valuable to determine the impact that beavers have on bison habitat. Beavers may flood low-lying areas and reduce grazing habitats used by bison, while at the same time killing shrubs and trees. However, when beaver dams break and the ponds dry, the area may become grazing habitat for bison.

Fire also affects bison habitats. Bison are known to move to recently burned forest areas, and burning grass and sedge habitats removes old, dead plant material and stimulates new growth including grasses and sedges, which bison find attractive. In 2014, fires of varying intensities burned nearly 9,000 of the approximately 20,000 $km^2$ of the Mackenzie population's range, which may influence bison habitat use, movements and population growth for years to come.

Currently, there are few threats to the Mackenzie bison habitat, but the cumulative effects of natural and human-caused changes in the landscape can have a large impact on the population. It will be important to co-ordinate information gathering so that it both supports and is supported by cumulative effects monitoring initiatives in the region.

The number of feasible management actions that can be taken to alter habitat to affect bison distribution and abundance is limited. There have been prescribed burning programs to enhance bison habitat in the Mackenzie and Slave River Lowlands but it is difficult to determine if these actions changed bison numbers or the way in which bison used the habitat. Further, when resource development takes place, it may become important to manage it in a way that limits impacts on bison, for example by avoiding the destruction of grazing habitats.

The Dehcho Land Use Planning Committee assessed much of the recent range of the Mackenzie wood bison population as having high conservation value for both wildlife and cultural resources. The plan rated development potential for timber, oil and gas, minerals, and agriculture. Ratings for these forms of development were classified from moderate to high, but most of the areas used heavily by bison in recent years were assessed as having moderate development potential.

**Key Actions:**

- Develop resource selection functions for Mackenzie bison from the habitat and range use data.
    - Use GPS telemetry collars on bison to collect data on bison habitat use and movement patterns.
    - Analyse movements by male and female bison to assess how they use the range and determine if they move widely within the range or if they tend to remain in discrete areas, and if habitat use varies seasonally.
- Support research on how bison use recently burned habitats.
- Estimate carrying capacity of the population's range under different water level and habitat conditions.
- Define critical habitat for Mackenzie bison if required by federal legislation, based on habitat and range use patterns.
- Use historic satellite imagery to measure changes to important bison habitats due to flooding.
- Determine the effects of beaver activities on bison habitat.
    - Monitor beaver numbers, active lodges and dams to assess how beavers affect water levels and flooding.
- Assess the impact bison may have on habitats also used by moose.
    - Measure overlap in habitat use by moose and bison.
    - Assess how bison use of habitats may alter their suitability for moose.

- Coordinate data collection so that information on habitats and the interactions between bison and their habitats will support and be supported by cumulative effects monitoring in the region.

## INFORMING PEOPLE ABOUT THIS MANAGEMENT PLAN

Communicating information to all parties is important to the success of wildlife management programs. Changing circumstances will dictate what information is most important and how intensive communications efforts should be. In addition to the public in general, communications need to be directed to residents of communities linked to or benefitting from the bison population. It is also important to communicate with hunters, community and Indigenous governments and organizations, GNWT departments, and businesses that may be interested in or affected by bison and their management.

**Key Actions:**

- Consult with Indigenous governments and organizations about this plan.
- Inform the public and co-management partners of this plan and make it available on ENR's website.
- Engage ENR's communications group to increase communications and public education about the Mackenzie bison population, its status, factors affecting it and management actions.
- Maintain public information campaigns to inform the public of the value and importance of wood bison as well as the risks associated with human–bison interactions, including collisions.

# REVISING AND UPDATING THIS PLAN

Changing circumstances and availability of new information make it important to review management plans periodically. It is recommended that this plan be reviewed and updated in five years, or earlier if warranted by significant events. It is also recommended that the MBWG, or a similar group, meet annually to review updates on matters that affect bison management and receive annual updates on bison management and research activity, to provide continuity in management planning and information exchange, and to serve as a management group that can be engaged as needed for operational planning.

**Key Actions:**

- Review the management plan in five years.
- The MBWG to meet annually.

# CONCLUSION

Sound management of the Mackenzie wood bison population is important to the people of the NWT and will contribute to recovery of the species nationally. This plan outlines a collaborative effort among communities and departments to address current management issues, has recommended actions that can be taken and has identified information gaps that limit our ability to manage the Mackenzie population.

## PERSONAL COMMUNICATION

Dr. Brett Elkin, Director, Wildlife, Environment and Natural Resources, Yellowknife, NT

Ken Hall, Resident hunter, Yellowknife, NT

Dr. Nic Larter, Manager, Wildlife Research and Monitoring, Environment and Natural Resources, Fort Simpson, NT

Samuel Gargan, Councillor, Deh Gáh Got'îê First Nation, Fort Providence, NT

Ted Landry, Elder, Fort Providence, NT

Victor Constant, Councillor, Deh Gáh Got'îê First Nation, Fort Providence, NT

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# APPENDIX 1. POPULATION MONITORING AND HARVEST MANAGEMENT ACTIONS

Recommended management actions and monitoring differ based on the size of the population and its trend and on potential options available to affect change in population size or distribution. Allowable harvest quotas are presented in Table 1 of the management plan. Management may change if the population's trend is increasing or decreasing. The MBWG set four population size categories for the purposes of this management plan:

- High: estimated population size greater than 2,000 bison
- Moderate: 1,500-2,000
- Low: 1,0001,500
- Critical: <1,000

| Critical Population Level (<1,000 animals) | | |
|---|---|---|
| | **Trend Population Increasing** | **Trend Population Decreasing** |
| Monitoring | | |
| | Survey to estimate population size at least every two to three years | |
| Management Actions | | |
| | Restrict harvest level to zero | |
| | Expand efforts to reduce losses to collisions, destruction of bison in communities | |
| | Determine key factors resulting in population level and related trends | |
| | Expand public information to support population recovery actions | |
| | Evaluate the potential impact of predators and consider introduction of predator control | |

| Low Population Level (1,000-1,500 animals) | | |
|---|---|---|
| | **Trend<br>Population Increasing** | **Trend<br>Population Decreasing** |
| Monitoring | | |
| | Survey to estimate population size every three to four years | |
| Management Actions | | |
| | Permit harvest at low levels | Reduce harvest to low level |
| | Identify research and experimentation initiatives that could benefit herd management | Identify research needed to determine causes of population decline |
| | Evaluate the potential for habitat manipulation | |
| | Expand public information activities to support population recovery actions | |
| | Expand public information in an effort to reduce losses to collisions, destruction of bison in communities | |

| Moderate Population Level (1,500–2,000 animals) | | |
|---|---|---|
| | **Trend<br>Population Increasing** | **Trend<br>Population Decreasing** |
| Monitoring | | |
| | Survey to estimate population size every four to five years | |
| Management Actions | | |
| | Increase harvesting levels | Reduce harvesting levels |
| | Conduct planned experimentation such as:<br>- Habitat manipulation<br>- Alternative approaches to harvesting (e.g. use of sex- or age-specific or geographic specific harvesting) | |

| High Population Level (2,000 or more animals) | | |
|---|---|---|
| | **Trend<br>Population Increasing** | **Trend<br>Population Decreasing** |
| Monitoring | | |
| | Survey to estimate population size every four to five years | |
| Management Actions | | |
| | Increased harvesting levels | Maintain harvesting levels |
| | Conduct planned experimentation such as:<br>- Habitat manipulation<br>- Alternative approaches to harvesting (e.g. use of sex- or age-specific or geographic specific harvesting) | |
| | Enhance public awareness of potential for highway collisions | |
| | Enhance public awareness regarding human interactions | |

# APPENDIX 2: SUMMARY OF MANAGEMENT ACTIONS AND MONITORING AT ALL POPULATION SIZES

| **Monitoring** |
|---|
| Monitor conditions for anthrax and conduct surveillance to detect outbreaks annually |
| Monitor for presence of bovine TB and brucellosis |
| Monitor and record information related to bison-human interactions (e.g., collisions, bison entering communities) |
| Collect information on all bison harvested as well as those destroyed by accident or to preserve public safety |
| Monitor genetic diversity at ten year intervals or following a major population decline |
| Assess predator impacts on population size |
| Survey to estimate herd composition annually |
| **Management Actions** |
| Maintain the capability to detect and respond to all anthrax outbreaks within the bison population |
| Continue the BCA program |
| Enact regulations regarding the import, holding, movement and disease testing of livestock or translocation of wildlife in the NWT that could affect the genetics or health of wild bison. |
| Assess the impact of any development (including agricultural development) within the herd range with the goal of preventing or mitigating all impacts |