RECOVERY STRATEGY FOR WOOD BISON (*Bison bison athabascae*)

In the Northwest Territories

SPECIES AT RISK (NWT) ACT

Management Plan and Recovery Strategy Series 2019

For copies of the recovery strategy or for additional information on NWT species at risk, please visit the NWT Species at Risk website (www.nwtspeciesatrisk.ca).

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Cover photo: Danny Allaire, Dehcho Wildlife Technician II with Environment and Natural Resources, who assisted with collar deployment, population surveys, and participated in 17 consecutive annual sex and age classification surveys of the Nahanni wood bison population. Danny passed away on January 12, 2019 and his contributions to wildlife management in the NWT will not be forgotten.

What is the *Species at Risk (NWT) Act*?
The *Species at Risk (NWT) Act* (the Act) provides a process to identify, protect, and recover species at risk in the Northwest Territories (NWT). The Act applies to any wild animal, plant, or other species for which the Government of the Northwest Territories has management authority. It applies everywhere in the NWT, on both public and private lands, including private lands owned under a land claims agreement, in accordance with the land claims agreements.

What is the Conference of Management Authorities?
The Conference of Management Authorities (the Conference) was established under the Act and is made up of the wildlife co-management boards and governments in the NWT that share responsibility for the conservation and recovery of species at risk in the NWT (referred to as 'Management Authorities'). The purpose of the Conference is to build consensus among Management Authorities on the conservation of species at risk and to provide direction, coordination, and leadership with respect to the assessment, listing, conservation, and recovery of species at risk while respecting the roles and responsibilities of Management Authorities under land claim and self-government agreements. The Conference develops consensus agreements on listing species at risk, conservation measures, management plans, and recovery strategies. Only Management Authorities that have jurisdiction for that species are involved in making the decisions. In this case, Management Authorities for wood bison in the NWT are the Wek'èezhìı Renewable Resources Board, the Tłı̨chǫ Government, and the Government of the Northwest Territories.

What is a Threatened species?
Under the Act, a Threatened species is a species that is likely to become Endangered in the Northwest Territories if nothing is done to reverse the factors leading to its extirpation or extinction.

What is a recovery strategy?

Under the Act, a recovery strategy is a document that recommends objectives for the conservation and recovery of a Threatened species. It also recommends approaches to achieve those objectives. It includes a description of threats and positive influences on the species and its habitat. Under the Act, a recovery strategy must be done for Threatened species within two years after the species is added to the NWT List of Species at Risk.

PREFACE

Three free-ranging populations of wood bison can be found in the NWT: the Greater Wood Buffalo metapopulation, and the Mackenzie and Nahanni populations. The Greater Wood Buffalo metapopulation is made up of several intermixing subpopulations, including Hook Lake and Grand Detour (together known as the Slave River Lowlands population), Nyarling River (in Wood Buffalo National Park), as well as three subpopulations in the Alberta portion of Wood Buffalo National Park.

Wood bison are currently listed as Threatened in the NWT under the *Species at Risk (NWT) Act*, owing to their small population size and recent population decline. Following a listing as Threatened, the Conference of Management Authorities is required to develop a recovery strategy within two years of listing. This document fulfills the requirement to develop a recovery strategy for wood bison and constitutes advice to other jurisdictions and organizations that may be involved in conserving wood bison.

The management of wood bison on federal Crown land (i.e. national parks, migratory bird sanctuaries, or national wildlife areas) is guided by the national *Recovery Strategy for the Wood Bison (*Bison bison athabascae*) in Canada*[1]. This *Recovery Strategy for Wood Bison in the NWT* (recovery strategy) will guide overall conservation and recovery of wood bison in areas of the NWT outside of federal Crown lands. More specific recovery actions for each wood bison population in the NWT will be captured in population-specific management plans. In the case of the Greater Wood Buffalo metapopulation, which occurs on both federal land (Wood Buffalo National Park) and on lands under the administration and control of the Government of the Northwest Territories (GNWT), this recovery strategy will focus on the Slave River Lowlands (Hook Lake and Grand Detour subpopulations). Recognizing the transboundary nature of some wood bison populations (both across federal land/on lands under the administration and control of the GNWT within the NWT, and across provincial/territorial borders), collaboration on management and information sharing among management agencies and jurisdictions will be important to the success of conservation and recovery actions for this species.

This recovery strategy will be followed by a consensus agreement by the Conference of Management Authorities, which will lay out the actions Management Authorities agree to undertake to implement it.

This recovery strategy does not commit any party to actions or resource expenditures; implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating Management Authorities.

At least every five years, the Conference of Management Authorities will review this recovery strategy and report on the actions undertaken to implement it and on the progress made towards meeting its objectives.

[1] Environment and Climate Change Canada. 2018. Recovery Strategy for the Wood Bison (*Bison bison athabascae*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada. Ottawa. Viii + 59 pp. Website: http://www.sararegistry.gc.ca/document/default_e.cfm?documentID=2914

Background information on wood bison, threats, and positive influences is mainly summarized from the 2016 *Species Status Report for Wood Bison (*Bison bison athabascae*) in the Northwest Territories*[2] as well as the *Wood Bison Management Strategy for the NWT: 2010-2020*[3]. To avoid repetitive citations, it can be assumed that the information was taken from these reports unless another reference is given.

[2] Species at Risk Committee. 2016. Species Status Report for Wood Bison (*Bison bison athabascae*) in the Northwest Territories. Species at Risk Committee, Yellowknife, NT. Website: http://www.nwtspeciesatrisk.ca/sites/default/files/wood_bison_status_report_final_w_assessment_-_may1716_-_w_nyarling_correction.pdf

[3] Government of the Northwest Territories. 2010. Wood Bison Management Strategy for the Northwest Territories: 2010-2020. Environment and Natural Resources, Yellowknife, NT. Website: http://www.bisonandroads.com/docs/wood_bison_management_strategynwt2010.pdf

ACCEPTANCE STATEMENT

The Wek'èezhìı Renewable Resources Board, Tłı̨chǫ Government, and the Government of the Northwest Territories accepted this recovery strategy on April 29, 2019 through a Conference of Management Authorities consensus agreement under the *Species at Risk (NWT) Act*.

ACKNOWLEDGEMENTS

Preparation of this strategy was funded by Environment and Natural Resources (ENR). This strategy is an update of the *Wood Bison Management Strategy for the NWT: 2010-2020*. We would like to thank ENR, and particularly Dr. Terry Armstrong (Wildlife Biologist – Bison), for their work on that original document, as well as all the partners and reviewers who provided input.

The principal compilers of this update were Michele Grabke (Species at Risk Implementation Specialist), Lisa Worthington (Species at Risk Recovery Planning Coordinator (former)), and Claire Singer (Species at Risk Implementation Supervisor).

In addition to the *Wood Bison Management Strategy for the NWT: 2010-2020*, background information in this document is also drawn from the 2016 *Species Status Report for Wood Bison (*Bison bison athabascae*) in the Northwest Territories*. We would like to thank the NWT Species at Risk Committee for their work on this document.

We thank the many individuals who reviewed drafts and provided input that significantly improved the recovery strategy. We also thank the following organizations for providing helpful comments:

- Government of the Northwest Territories
- Wildlife Management Advisory Council (NWT)
- Gwich'in Renewable Resources Board
- Sahtú Renewable Resources Board
- Wek'èezhìı Renewable Resources Board
- Tłı̨chǫ Government
- EcoBorealis Consulting
- Government of Canada, Parks Canada, Wood Buffalo National Park
- Acho Dene Koe First Nation
- Alaska Department of Fish and Game

EXECUTIVE SUMMARY

Wood bison have played an essential role in the lives of many Indigenous communities in the Northwest Territories (NWT), from an economic, cultural, and spiritual perspective. Today, some Indigenous communities still maintain a strong connection to wood bison, while other communities no longer see bison as part of their heritage, particularly if the species has not been present around their communities for several generations. Recovering bison populations will provide opportunities for cultural and spiritual reconnection, for harvesting, and for viewing. Recovering bison populations will also help re-establish the ecological role bison play on the landscape.

Wood bison are currently listed as Threatened in the NWT under the *Species at Risk (NWT) Act*, owing to their small population size and recent population declines. This listing triggered a requirement to develop an NWT recovery strategy for the species within two years of listing. This document fulfills that requirement.

It is essential to have a recovery strategy in place for the NWT to help ensure the survival of wood bison for future generations. This strategy describes recovery and conservation goals and objectives for wood bison, and recommended approaches to achieve these objectives. It was developed collaboratively by co-management partners and recognizes the shared responsibilities for conservation and recovery under land claim agreements and species at risk legislation. Traditional and community knowledge (TK/CK) and scientific knowledge were considered in the preparation of this document.

More specific recovery actions for each wood bison population in the NWT will be captured in herd-specific management plans. Herd-specific management plans have been published (Mackenzie Bison Management Plan[4]) or are nearing completion (Nahanni and Slave River Lowlands populations) for each of the three populations of wood bison in the NWT.

Background

Wood bison are the largest land mammals in North America, with adult males weighing more than 800 kilograms (kg) and females more than 500 kg. They graze mainly on grasses and sedges found in meadows, wetlands, and recently disturbed areas.

Over the last 5,000 years, wood bison have ranged over most of what is now the western NWT, nearly all of northern Alberta, northeastern British Columbia, a small part of northwestern Saskatchewan, and most of the Yukon and Alaska.

Wood bison disappeared from much of this range by the end of the 19th century and remained only in the area between Great Slave Lake and the Peace-Athabasca Delta. It is estimated that their population declined from possibly 150,000 in 1800 to only 250 by 1891. As of 2016/2017, there are about 8,000 wood bison in the world and 2,700 in the NWT.

[4] Government of the Northwest Territories. 2018. Mackenzie Bison Management Plan. Environment and Natural Resources. Yellowknife, NT. Website: http://www.enr.gov.nt.ca/sites/enr/files/resources/151_file.pdf

There are eight free-ranging populations of wood bison in Canada. Of these, three are found in the NWT: the Greater Wood Buffalo metapopulation (GWBM), Mackenzie, and Nahanni populations. The Greater Wood Buffalo metapopulation is made up of several intermixing subpopulations. Of these, the Hook Lake and Grand Detour subpopulations (managed together as a single unit and known as the Slave River Lowlands population) are the only ones that occur outside of Wood Buffalo National Park. The Mackenzie population is the only population that ranges solely within the NWT on lands under the administration and control of the Government of the Northwest Territories (GNWT). The Nahanni population extends into Yukon and British Columbia.

Threats, Management, and Positive Influences

One of the main threats to wood bison is disease, including bovine tuberculosis, bovine brucellosis, and anthrax. These diseases can be transmitted to wildlife, livestock, and humans.

Tuberculosis and brucellosis are introduced diseases that came from domestic animals. These are chronic infections that reduce reproduction and survival in bison. Tuberculosis and brucellosis currently affect only the GWBM; the Nahanni and Mackenzie populations are considered disease-free. The GNWT established a Bison Control Area (BCA) in 1987 to reduce the risk of tuberculosis and brucellosis spreading to the Mackenzie and Nahanni populations from the GWBM; the area was expanded in 1990. The BCA is managed and operated by the GNWT and has been jointly funded by Parks Canada Agency and the GNWT since 1993.

Anthrax is a naturally occurring acute bacterial infection caused by exposure to anthrax spores during wallowing and feeding. Once ingested or inhaled, the anthrax bacterium produces toxins that quickly kill the animal.

Although there is currently enough habitat in the NWT to support wood bison populations, habitat loss, degradation, and/or fragmentation (e.g. changes in water levels, flooding, and fire regime; increased shrub encroachment; agriculture; linear features such as access roads; active logging; industrial development) could adversely impact the amount and quality of available habitat. Other factors, including overharvesting, bison-human conflicts, social and cultural attitudes towards wood bison, low genetic diversity, hybridization with cattle or plains bison, and a growing agricultural industry could also have adverse effects on the recovery of wood bison in the NWT.

Land use planning initiatives, if approved, could have a positive influence on wood bison as they would complement wood bison management in their respective regions. Herd-specific management plans are nearing completion for the Nahanni and Slave River Lowlands populations. The Mackenzie Bison Management Plan was completed in early 2018.

Forest fires of moderate intensity could increase bison habitat by encouraging the growth of forage.

Conservation and Recovery Goals and Objectives

Recognizing the ecological role of wood bison and their importance to people – the cultural and spiritual values of bison combined with their consumptive and non-consumptive uses – the goals of this recovery strategy are to:

1. Recover free-ranging, genetically diverse, and healthy[5] wood bison populations broadly distributed within the Northwest Territories, to levels which can sustain ongoing harvest for the benefit of all people in the Northwest Territories.
2. Contribute to the recovery of free-ranging, healthy wood bison populations in Canada.

In order to attain these goals, this strategy recommends five objectives combined with 15 recommended approaches. Progress toward achieving these objectives will be evaluated at least every five years. The objectives and approaches are:

Objective 1: Work with communities and Indigenous governments and organizations to complete and implement separate management plans for the Mackenzie, Nahanni, and Slave River Lowlands populations.

Approach 1.1: Develop management plans for each of the Nahanni and Slave River Lowlands populations[6].

Approach 1.2: Implement management plans for the Mackenzie, Nahanni, and Slave River Lowlands populations.

Objective 2: Promote opportunities to increase acceptance as well as social, cultural, and economic benefits of wood bison.

Approach 2.1: Manage wood bison harvest to be sustainable for the benefit of all people in the NWT.

Approach 2.2: Promote non-consumptive economic benefits, including tourism based on wood bison viewing.

Approach 2.3: Work with communities and other agencies to reduce bison-human conflicts.

Objective 3: Maintain healthy, genetically diverse, and productive wood bison populations.

Approach 3.1: Monitor health in all populations.

Approach 3.2: Continue to manage the risk of disease transmission.

Approach 3.3: Collaborate with and engage partners, agencies, and organizations to manage diseases and investigate new or emerging methods to manage diseases.

[5] Healthy means that bison are free of bovine tuberculosis, brucellosis, and other significant diseases from domestic animals.

[6] The Mackenzie Bison Management Plan is complete and was published in early 2018.

Approach 3.4: Eliminate bovine tuberculosis and brucellosis from wood bison over the long term in the NWT.

Approach 3.5: Explore options to increase genetic diversity of Mackenzie and Nahanni wood bison, and avoid loss of genetic diversity from bison in the Slave River Lowlands.

Approach 3.6 Develop studies to learn what factors regulate population size of bison in the NWT.

Objective 4: Monitor and conserve important wood bison habitat.

Approach 4.1: Monitor and assess the cumulative effects of changes to wood bison habitat.

Approach 4.2: Manage bison habitat to prevent habitat loss and degradation and maintain adequate, productive habitat.

Objective 5: Support recovery of healthy wood bison populations broadly distributed within the NWT.

Approach 5.1: Consult with communities, wildlife management boards, and Indigenous governments and organizations to support and expand wood bison recovery efforts in the NWT.

Approach 5.2: Collaborate on recovery and management of wild bison in Canada.

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RECOVERY STRATEGY

1. GOALS

The goals for wood bison management recognize that bison, like other wildlife, have ecological, cultural, and spiritual values along with consumptive and non-consumptive uses. The goals are to:

1. Recover free-ranging, genetically diverse, and healthy[7] wood bison populations broadly distributed within the Northwest Territories, to levels which can sustain ongoing harvest for the benefit of all people in the Northwest Territories.
2. Contribute to the recovery of free-ranging, healthy wood bison populations in Canada.

Outcomes of achieving these goals include:

- Recovery and re-occupation of wood bison broadly distributed within the NWT.
- Benefits to the people of the NWT once bison populations return to levels that can sustain annual harvests with limited regulation.
- Restored relationships between the people of the NWT and free-ranging wood bison.
- Continued active surveillance for tuberculosis and brucellosis in wood bison populations and containment of these diseases, as long as there are infected populations and a desire to protect non-infected animals from infection.
- Continuation of the Bison Control Area program until bison in and around Wood Buffalo National Park are no longer infected with tuberculosis or brucellosis.
- Prevention of further loss of genetic diversity within, and among, wood bison populations and enhancement of genetic diversity in wood bison in the NWT and Canada. Continued survival of populations will be more likely with broader genetic diversity within, and among, populations.

2. PRINCIPLES

The purpose of this recovery strategy is to provide an action-oriented planning tool that identifies how conservation and recovery of wood bison can be accomplished in the NWT. It will help Management Authorities decide what actions to take, how to prioritize their work, and how to allocate their resources in order to conserve and recover wood bison.

The Management Authorities for wood bison recognize that:

[7] Healthy means that bison are free of bovine tuberculosis, brucellosis, and other significant diseases from domestic animals.

- Recovery and restoration of wood bison in the NWT cannot be achieved without the cooperation and support of Indigenous governments and organizations and NWT communities.
- Indigenous communities will take the lead in identifying specific management objectives for bison on their traditional lands.

This recovery strategy also adopts the following principles:

- Collaborative or cooperative management (i.e. co-management) will be integral to shared decision-making among Management Authorities, Indigenous governments and organizations, and communities and will emphasize shared learning and responsibility.
- All available sources of knowledge, including traditional and community knowledge (TK/CK) and scientific knowledge, will be considered in the recovery of wood bison in the NWT.
- The Precautionary Principle[8] will be considered at all levels of management.
- Management will be focused at the landscape level and on an ecosystem basis, which recognizes the connections among wildlife, the environment, and people.
- Management will be adaptive[9]; monitoring programs will be used to continually improve management responses over time.
- Recovery approaches will be long-term and forward-thinking in nature.
- Recognizing the transboundary nature of wood bison populations in northern Canada, NWT wood bison Management Authorities will work with neighbouring jurisdictions and governments to harmonize management across borders.

3. BACKGROUND

Wood bison (*Bison bison athabascae*) are the largest land mammals in North America. Adult males weigh more than 800 kilograms (kg) and females more than 500 kg. They graze mainly on grasses and sedges found in meadows, wetlands, and recently disturbed areas.

Over the last 5,000 years, wood bison ranged over most of what is now the western NWT, nearly all of northern Alberta, northeastern British Columbia, a small part of northwestern Saskatchewan, and most of Yukon and Alaska (Fig. 1).

Wood bison disappeared from much of this range by the end of the 19th century and remained only in the area between Great Slave Lake and the Peace–Athabasca Delta. The decline of wood bison paralleled the demise of plains bison in the south between

[8] The Precautionary Principle states that a lack of scientific certainty will not be used as a reason to delay measures to alleviate a threat to a species at risk.

[9] Adaptive management is a systematic approach for continually learning from the outcomes of management actions and improving management policies or practices by deliberately monitoring the outcomes of management actions.

1840 and 1900. There may have been more than 150,000 wood bison across their global range in 1800, but it is estimated that only 250 remained by 1891. This has increased since the mid-20th century and there are now approximately 8,000 wood bison across their global range. Of this total, about 2,700 wood bison reside in the NWT.

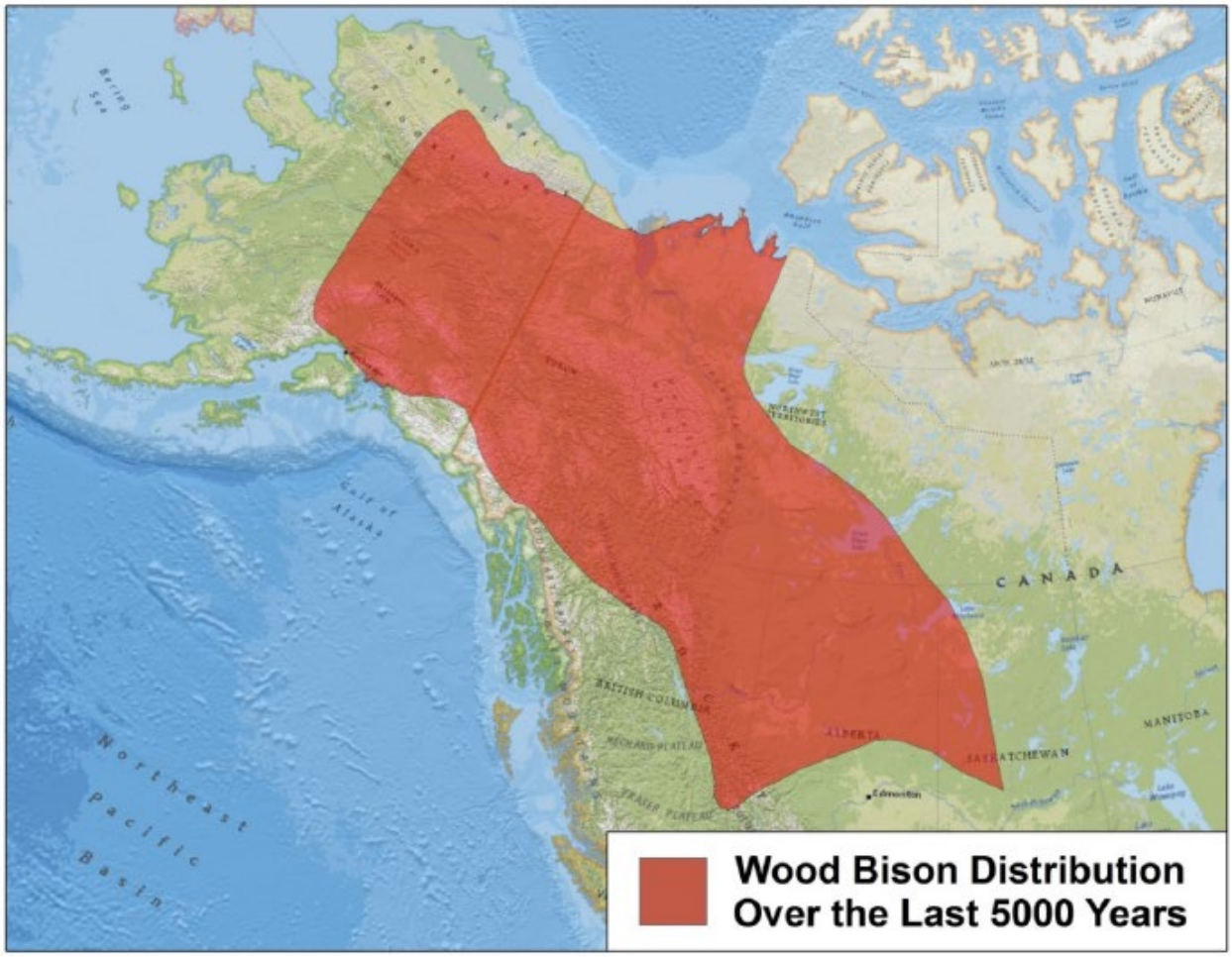

Figure 1. Distribution of wood bison over the past 5,000 years (based on Stephenson et al. 2001[10]).

Bison are important to people for many reasons. Both plains and wood bison were a critical resource to Indigenous peoples. People today still harvest bison where they can. Many Indigenous peoples have a strong cultural and spiritual connection to bison. However, some people no longer see bison as part of their heritage, particularly where the species has been missing from the local landscape for a number of generations.

Recovering bison populations will provide opportunities for social and cultural reconnection, as well as for viewing, harvesting, and other aesthetic and economic benefits. Recovering bison populations will also re-establish the ecological role bison play on the landscape.

[10] Stephenson, R.O., S.C. Gerlach, R.D. Guthrie, C.R. Harington, R.O. Mills, and G. Hare. 2001. Wood bison in late Holocene Alaska and adjacent Canada: paleontological, archaeological and historical records. Pp. 124-158 in S.C. Gerlach and M.S. Murray (eds.). People and Wildlife in Northern North America: Essays in Honor of R. Dale Guthrie, BAR International Series 944. British Archaeological Reports, Oxford.

Wood bison were initially assessed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1978. Population increases over the following decade resulted in COSEWIC reassessing wood bison as Threatened in 1988. This status was confirmed in the 2000 reassessment. In 2003, wood bison were listed as Threatened on Schedule I of the federal *Species at Risk Act*. In 2013, following further population increases, COSEWIC reassessed wood bison as Special Concern. As of 2019, a federal decision on the recommended down-listing of wood bison to Special Concern is still pending.

The national *Recovery Strategy for the Wood Bison (*Bison bison athabascae*) in Canada*[11] was prepared as per section 37 of the federal *Species at Risk Act* (SARA) with cooperation from the Government of Alberta, Government of British Columbia, Government of Manitoba, Government of the Northwest Territories (GNWT), Tłı̨chǫ Government, Wek'èezhìı Renewable Resource Board, Government of Yukon, Yukon Fish and Wildlife Management Board, and many others as per subsection 39(1) of SARA.

In the NWT, the Species at Risk Committee assessed wood bison as Threatened in 2016 because of its small population size and recent population declines. In 2017, wood bison were legally listed as Threatened under the *Species at Risk (NWT) Act*. This recovery strategy meets the recovery requirements in the Act for a Threatened species.

4. POPULATIONS IN THE NORTHWEST TERRITORIES

There are eight free-ranging populations of wood bison in Canada. Three populations are found in the NWT: the Greater Wood Buffalo metapopulation (GWBM), Mackenzie, and Nahanni populations (Fig. 2). Of these, only the Mackenzie population ranges entirely within the NWT; the GWBM and Nahanni population extend into other provinces and territories.

The GWBM is made up of several intermixing subpopulations, including Hook Lake, Grand Detour, and Nyarling River subpopulations in the NWT, and the Hay Camp, Garden River, and Delta subpopulations in Alberta. Of the three NWT subpopulations, only Hook Lake and Grand Detour occur on lands under the administration and control of the GNWT. For the purposes of this recovery strategy, the Hook Lake and Grand Detour subpopulations are considered as one management unit, referred to as the Slave River Lowlands population. The other four subpopulations (Nyarling River, Hay Camp, Garden River, and Delta) all occur within Wood Buffalo National Park and are managed by the Parks Canada Agency. The focus of this recovery strategy is the Slave River Lowlands, Mackenzie, and Nahanni populations (see *Preface*).

[11] Environment and Climate Change Canada. 2018. Recovery Strategy for the Wood Bison (*Bison bison athabascae*) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada. Ottawa. viii + 59 pp. Website: https://www.sararegistry.gc.ca/document/default_e.cfm?documentID=2914

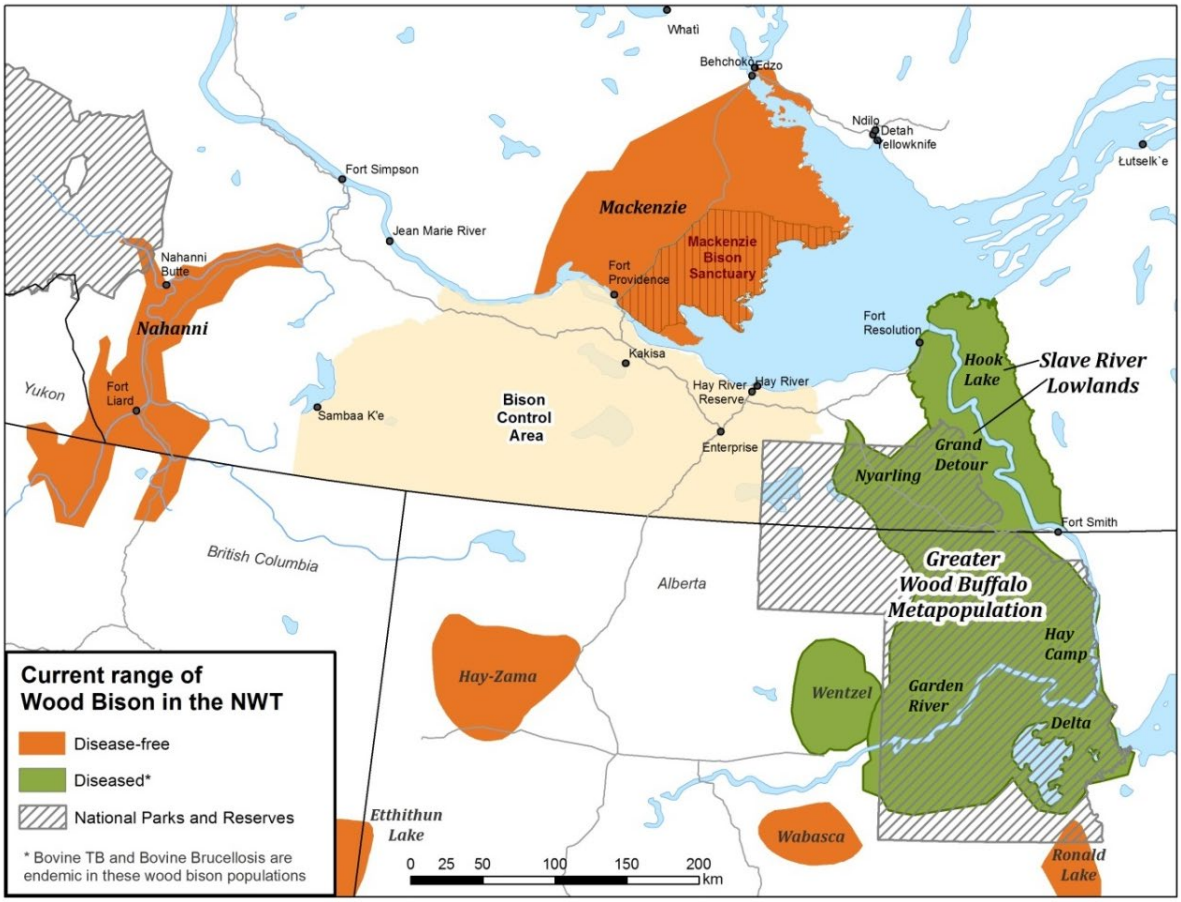

Figure 2. NWT wood bison distribution (map by B. Fournier, ENR, 2018).

As of 2016/2017, the total wood bison population occurring in the NWT was approximately 2,700. The NWT Species at Risk Committee estimated an overall population decline of at least 10% from 1993 to 2014, with only the Nahanni population increasing from 2008 to 2014. Conversely, the distribution of wood bison in the NWT has increased in the last half-century, most notably with the expansion of the Mackenzie population outward from the Mackenzie Bison Sanctuary.

Management needs to consider the ecological conditions the population is subject to, the distribution of populations, and potential periodic catastrophic events (i.e. mass drownings and disease outbreaks).

4.1. Greater Wood Buffalo Metapopulation

As noted earlier, the GWBM is managed in two distinct units. The Slave River Lowlands includes the Grand Detour and Hook Lake subpopulations, while Wood Buffalo National Park includes the Nyarling River, Hay Camp, Garden River, and Delta subpopulations. These six subpopulations are interconnected, with some amount of immigration and emigration occurring among them.

The GWBM is distinct from the Mackenzie and Nahanni populations, in that it is infected with tuberculosis and brucellosis.

Slave River Lowlands

The Grand Detour and Hook Lake subpopulations are located just outside of Wood Buffalo National Park in the Slave River Lowlands. The most recent population estimate for the Slave River Lowlands population was completed in 2016. The survey estimated approximately 662 wood bison in the Slave River Lowlands, including 399 individuals in the Hook Lake subpopulation and 263 in the Grand Detour subpopulation (Figs. 3a and b).[12,13] In 2014, the Slave River Lowlands wood bison population was estimated at 1,083, down from the 2009 estimate of 1,790.

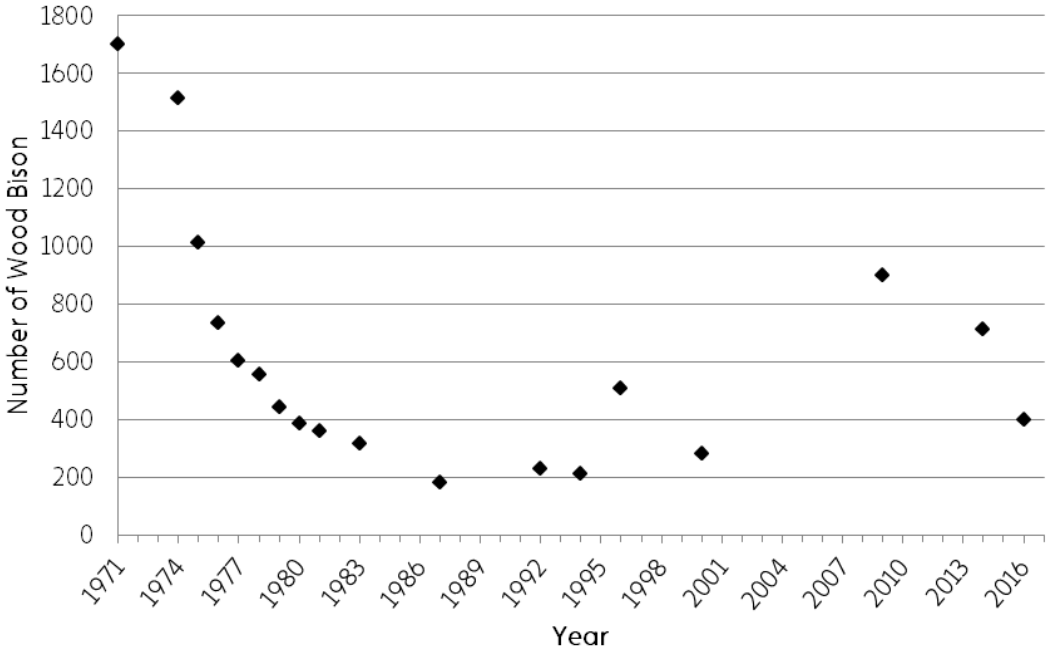

Figure 3a. Hook Lake subpopulation abundance since 1971.The difference in the 2014 and 2016 estimates is not considered statistically significant, owing to the lack of precision around the 2014 estimate (the result of differences in data collection and analysis methodologies used between surveys).

[12] Armstrong, T. and J. Boulanger. 2016. Slave River Lowlands 2016 Wood Bison Population Estimate. Unpublished report. Environment and Natural Resources, Fort Smith, NT. 6pp.

[13] Data for Figures 3a through 6 were obtained from a number of sources. Complete citations and references for 1971-2014 estimates can be found in the *Species Status Report for Wood Bison* (Bison bison athabascae) *in the Northwest Territories*. Estimates from 2016 and 2017 are from Armstrong and Boulanger (2016), Kindopp (pers. comm. 2016), and Larter (2017). Original references should also be used for accessing confidence intervals associated with these estimates. A count of an entire population of animals would be very costly if not impossible to do. A well-designed survey that samples the area where the population occurs can provide a good estimate of the population size. A confidence interval typically accompanies a survey estimate, to represent the variation that exists with this method. It means that if the survey were to be done repeatedly under the same conditions, the estimates would fall within that range. So with a 95% confidence interval, if the survey was repeated many times, 95% of the time the estimates would fall within that range.

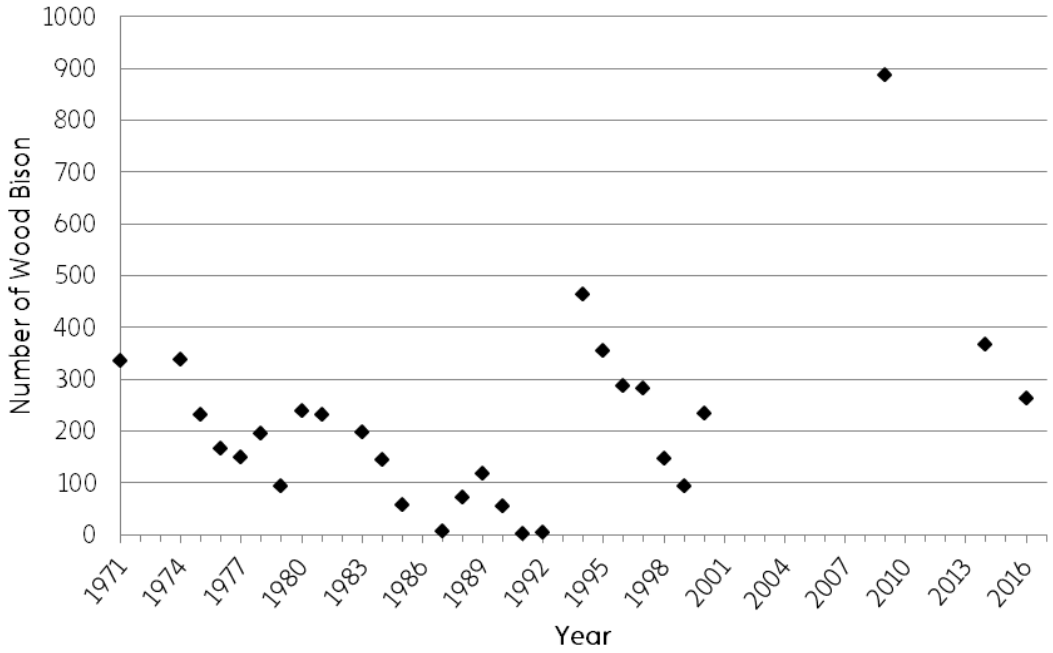

Figure 3b. Grand Detour subpopulation abundance since 1971. The difference in the 2014 and 2016 estimates is not considered statistically significant, owing to the lack of precision around the 2014 estimate (the result of differences in data collection and analysis methodologies used between surveys). Fluctuations in numbers for this subpopulation may be related to movement of animals between the NWT and another jurisdiction.

Wood Buffalo National Park

Wood Buffalo National Park includes the Nyarling River, Hay Camp, Garden River, and Delta subpopulations. Most of the Nyarling River subpopulation is found in the NWT, although its southern extremities extend into Alberta. Except for a minor extension into the NWT, the Hay Camp subpopulation occurs mostly within Alberta. The Garden River and Delta subpopulations occur entirely within Alberta.

The most recent population estimates from within the Park (including both the NWT and Alberta subpopulations) are from 2016. This survey estimated a total of 2,882 animals within the Park. For the Nyarling River subpopulation, which is the only Wood Buffalo National Park subpopulation that occurs within the NWT, the 2016 estimate was 185 individuals (Fig. 4)[14]. This represents a population decline from previous survey years.

[14] Kindopp, R. pers. comm. 2016. Email correspondence to L. Worthington. A/Manager of Resource Conservation, Wood Buffalo National Park, Parks Canada, Government of Canada, Fort Smith, NT.

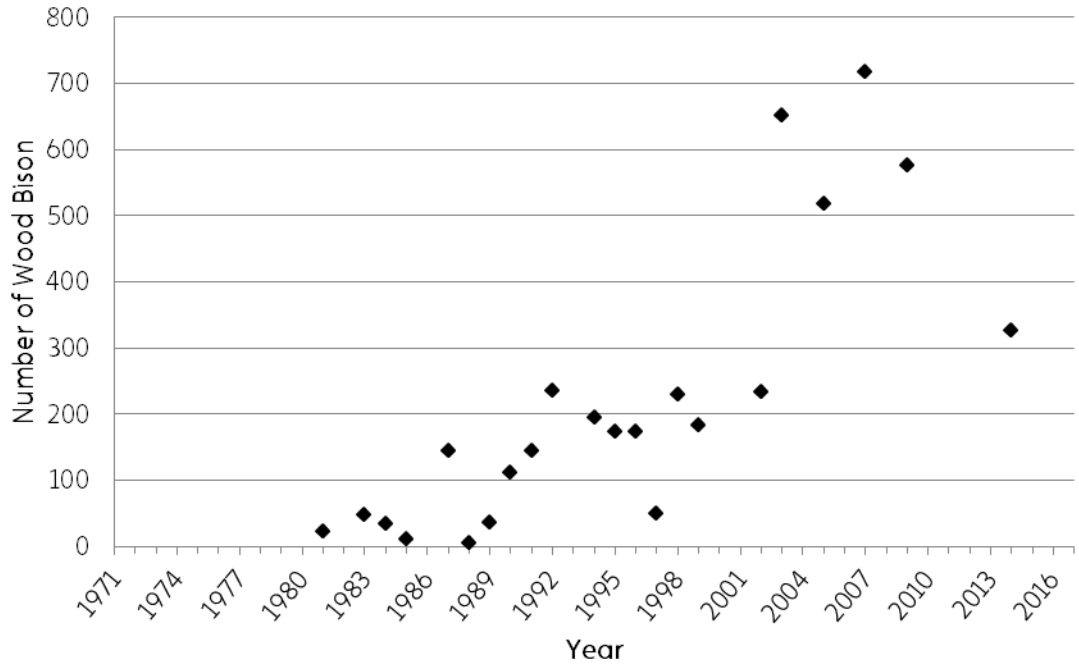

Figure 4. Nyarling River subpopulation abundance since 1971.

4.2. Mackenzie

The Mackenzie bison population was established in 1963 from 16 bison captured in the Needle Lake area of Wood Buffalo National Park, transported, and released in an area of historic wood bison range west of Great Slave Lake. By 1989, the population had increased to 2,400 animals. The population declined to about 1,600 bison by March 2008, and by 2013, following a severe 2012 anthrax outbreak in the herd, was estimated at 706 animals. The 2016 survey showed a slight population increase to 851 bison[15]. Although the Mackenzie population decline can, in large part, be attributed to the 2012 anthrax outbreak, it is important to note that the population was declining slowly for approximately 12 years prior to this outbreak (Fig. 5).

The Mackenzie population is considered free from infection of bovine tuberculosis and brucellosis.

[15] Armstrong, T. and J. Boulanger. 2016. Mackenzie wood bison population estimate. Unpublished report. Environment and Natural Resources, Fort Smith, NT. 4 pp.

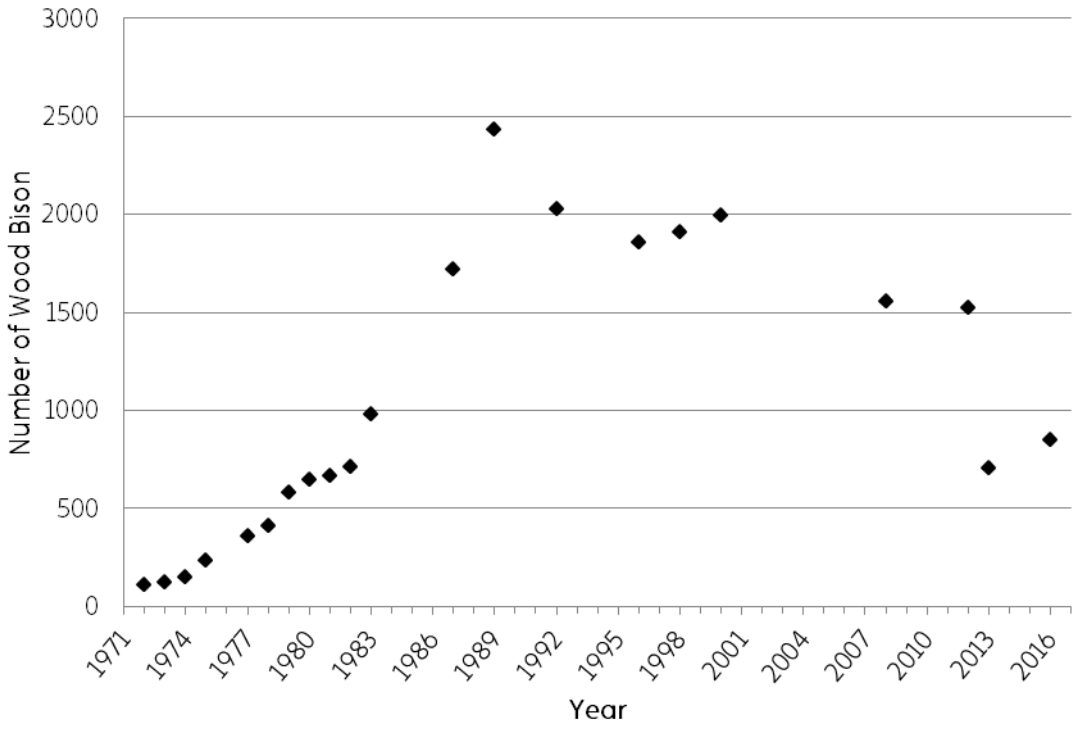

Figure 5. Mackenzie population abundance since 1971.

4.3. Nahanni

The Nahanni population was established in 1980 from 28 wood bison transported from Elk Island National Park (EINP) and released near Nahanni Butte. By 1989, numbers had increased to about 40. Twelve wood bison from Moose Jaw Wild Animal Park, which also had their origins in EINP, were released near Nahanni Butte in 1989. In 1998, the population was further increased through the release of 59 more wood bison from EINP. The Nahanni population was estimated at 511 animals in 2004 and 408 animals in 2011. The most recent estimate, from March 2017, was 962 animals (Fig. 6).[16]

The Nahanni population has increased in size in recent years, is considered free from infection of bovine tuberculosis and brucellosis, and has never had a documented anthrax outbreak[17].

[16]Larter, N., pers. comm. 2017. Email correspondence to L. Worthington. Manager, Wildlife Research and Monitoring, Environment and Natural Resources, Fort Simpson, NT.
[17] Allaire, D., pers. comm. 2018. Email correspondence with M. Grabke. Wildlife Technician II, Environment and Natural Resources, Fort Simpson, NT.

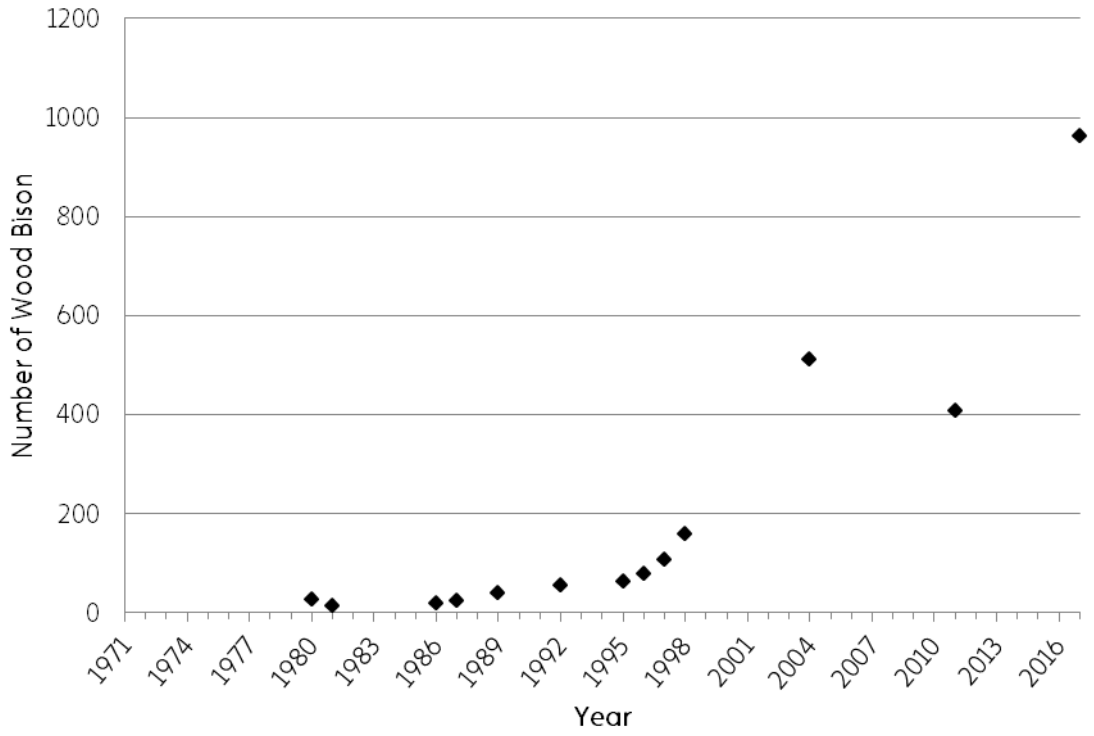

Figure 6. Nahanni population abundance since 1971.

5. THREATS, MANAGEMENT, AND POSITIVE INFLUENCES

This section provides information on threats and positive influences impacting wood bison. Information on current management specific to the outlined threats is also included. However, it is important to note that herd-specific management planning processes are underway for each of the Nahanni, Mackenzie, and Slave River Lowlands populations.

5.1. Disease

Three diseases currently challenge wood bison management in Canada. They are bovine tuberculosis (*Mycobacterium bovis)*, bovine brucellosis (*Brucella abortis*), and anthrax (*Bacillus anthracis*).

5.1.1. Bovine Tuberculosis and Bovine Brucellosis

Bovine tuberculosis and bovine brucellosis are common in the GWBM, including in the Slave River Lowlands. The Mackenzie and Nahanni populations are believed to be free of these diseases. Bison in the GWBM were infected with tuberculosis when more than 6,600 plains bison were moved from Wainwright, Alberta, to Wood Buffalo National Park in the 1920s. The origin of the bovine brucellosis infection in the GWBM is not clear but the most likely source was the animals from Wainwright. It is believed that tuberculosis and brucellosis in the Wainwright bison originally came from infected

cattle. Both tuberculosis and brucellosis can be spread among wildlife populations and back to domestic livestock and to humans.

Tuberculosis and brucellosis are chronic infections that reduce reproductive rates (fecundity and production) and survival (i.e. winter survival) in bison. Brucellosis mainly impacts female bison reproduction by causing abortions of the foetus by the third trimester of pregnancy. Both sexes are susceptible to inflammation of the reproductive tract, and sterility in advanced cases. Infection occurs primarily via the respiratory and digestive systems and the disease can occasionally pass from mother to offspring. Pregnancy effects for tuberculosis have been detected in the Nyarling River subpopulation. Either disease may cause death of individuals.

A survey for prevalence in the GWBM (1997-1999 survey of Nyarling River [females only], Hay Camp, and Delta subpopulations) found about 50 percent of the animals tested positive for tuberculosis and 30 percent tested positive for brucellosis. Testing positive means that the animals have been exposed to the bacteria, however, actual infection rates are likely lower than this.

Although the GWBM continues to persist in the presence of tuberculosis and brucellosis, the Mackenzie and Nahanni populations, being relatively unexposed to these diseases and with less genetic diversity, may be more vulnerable to the lethal effects of the two diseases should they contract either of them.

The Bison Control Area (BCA, Fig. 7) was established in 1987 by the GNWT to reduce the risk of disease spreading to the Mackenzie and Nahanni populations. It was expanded in 1990 to extend to the Alberta border and later became a jointly funded program of the GNWT and Parks Canada. The BCA is surveyed by air each winter to detect and remove any bison in the area. Any NWT resident can shoot bison in the BCA but animals removed from the BCA must be reported to ENR as soon as possible. To prevent contact between infected bison near Wood Buffalo National Park and the growing Hay-Zama bison population (Fig. 2), the Alberta government has implemented approaches for managing the risk of disease spread, including a controlled harvest of Hay-Zama bison to reduce numbers and limit range expansion east towards Wood Buffalo National Park, aerial surveillance, public reporting and removal of bison outside of prescribed zones, and determining disease status of wood bison through sampling efforts[18].

[18] Government of Alberta. 2011. Fact Sheet: Managing Disease Risk in Alberta's Wood Bison. Website: http://aep.alberta.ca/fish-wildlife/wildlife-diseases/documents/ManagingDiseaseRisk-WoodBison-Feb2011.pdf

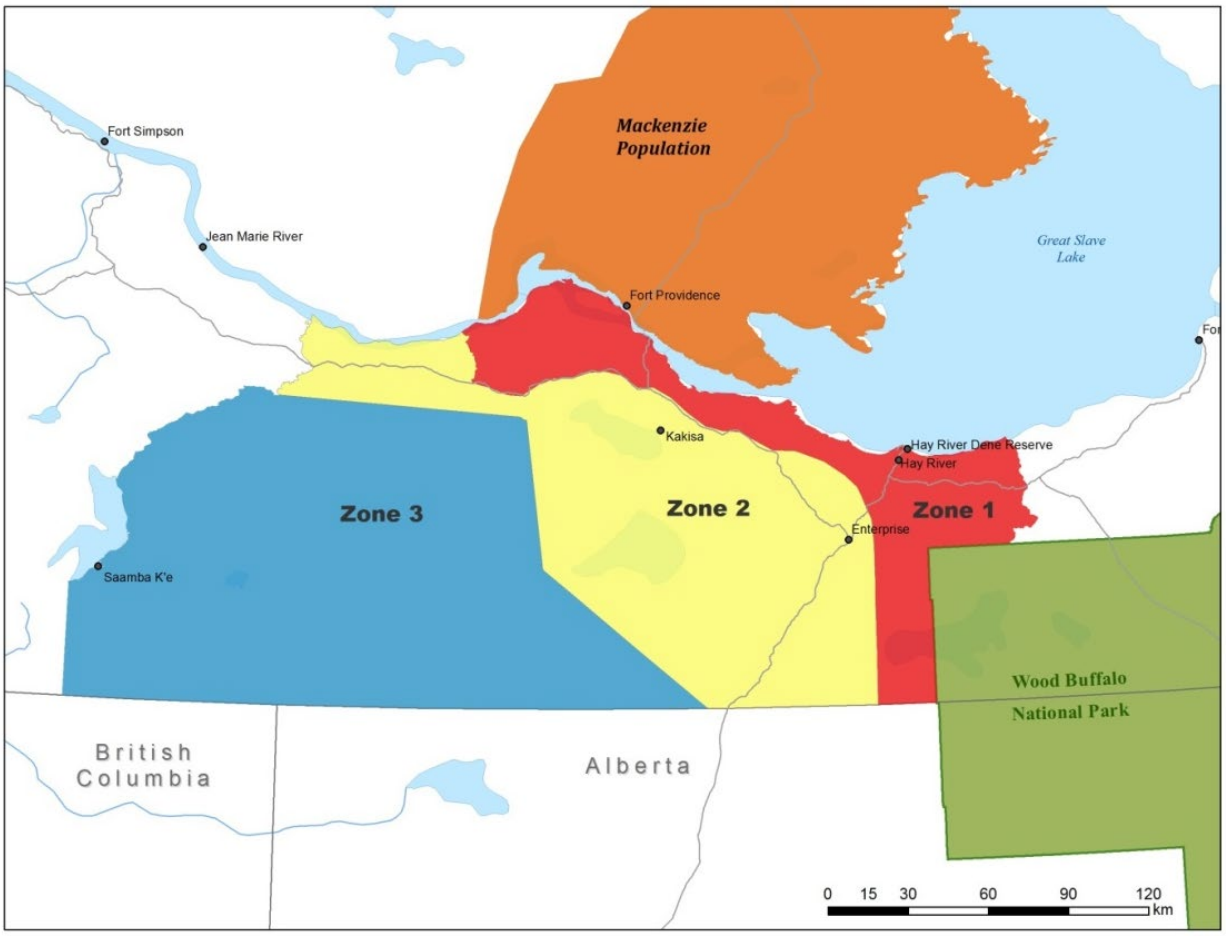

Figure 7. The Bison Control Area is divided into three zones. Zone 1 is considered to be the area in which bison are most likely to be seen. Aerial surveillance is most frequent in zone 1. Zone 2 is surveyed less frequently. Zone 3 relies on reports from people in or near the area. The BCA originally extended south of the Mackenzie River and north of the Mackenzie Highway, between Mills Lake and Hay River (map by B. Fournier, ENR, 2018).

Although the BCA prevents wood bison from using part of their historic range, reducing gene flow and the possibility of rescue among the populations, exclusion zones like the BCA are currently the only protection available against infection of disease-free herds. From 1987 to 2017, 16 bison were removed from the BCA[19]. The BCA will need to remain in place until tuberculosis and brucellosis are eradicated from the GWBM.

Eradicating tuberculosis and brucellosis from wild bison will require concerted effort by all partners and is a major challenge as there are limitations to what can practically be achieved.

[19] Environment and Natural Resources (ENR), unpubl. data. 2018. Bison Removed from Bison Control Area. Unpublished data provided by T. Armstrong. Government of the Northwest Territories, Fort Smith, NT.

5.1.2. Anthrax

Anthrax is a naturally occurring acute bacterial infection caused by exposure to anthrax spores. Anthrax spores can persist in the soil where wood bison encounter them while wallowing or feeding. Infections occur when large numbers of spores are inhaled or ingested. The anthrax bacterium multiplies rapidly in the blood, producing toxins that quickly kill the animal. Spores are released back into the environment when fluids are released from infected carcasses, and when scavengers spread infected tissues or pass spores in their feces.

Severe anthrax outbreaks can kill many animals in a short time. Anthrax outbreaks have occurred in GWBM bison in Wood Buffalo National Park and the Slave River Lowlands, as well as in the Mackenzie population. No outbreaks have been reported in the Nahanni population. Anthrax can have devastating effects on cattle, bison, deer, sheep, goats, horses, and humans. In the NWT, outbreaks of anthrax have occurred only in bison, although on rare occasions, moose and black bears have died from the disease. The most recent outbreaks of anthrax in bison in the NWT occurred in Wood Buffalo National Park in 2007, the Slave River Lowlands in 2010, the Mackenzie population in 2012, and in the Alberta portion of Wood Buffalo National Park in 2015[20].

5.1.3. New or Emerging Diseases

Preventing the spread of diseases carried by domestic animals to wood bison is an important concern in parts of Canada where ranching and farming take place extensively within bison range. In the NWT, disease transmission from domestic to wild animals is an emerging issue that is gaining importance as agriculture expands north.

Sheep are of concern because they are carriers of the ovine herpes virus-2 infection (OHV-2) and show no signs or ill effects. The OHV-2 infection can spread to bison through direct or indirect contact with sheep. In bison, OHV-2 causes malignant catarrhal fever (MCF). MCF is an infectious, viral disease to which bison tend to be very susceptible and which can result in exceptionally high mortality rates. Although this infection is a concern, the OHV-2 infection has not been detected in wood bison in the NWT.

Mycobacterium avium subspecies *paratuberculosis* (MAP) is the causative agent of Johne's disease. Johne's disease has not been documented in any free-ranging wood bison, however, the causative agent is present in all NWT wood bison populations. It is mainly a chronic disease of domestic ruminants, but disease has been reported in select free-ranging ungulate populations[21,22]. It is unlikely that Johne's disease causes

[20] Parks Canada, unpubl. report. 2015. Wood Buffalo National Park Anthrax Surveillance Report. Unpublished report provided by K. White. Parks Canada, Fort Smith, NT.
[21] Murray, H.L. 2012. Potential Contamination of Endangered Florida Key Deer Habitat with *Mycobacterium Avium* subspecies *Paratuberculosis*. Master's Thesis, University of Georgia, Athens, GA, US.
[22] Sleeman, J.M., E.J.B. Manning, J.H. Rohm, J.P. Sims, S. Sanchez, R.W. Gerhold, and M.K. Keel. 2009. Johne's disease in a free-ranging white-tailed deer from Virginia and subsequent surveillance for *Mycobacterium avium* subspecies *paratuberculosis*. *Journal of Wildlife Diseases* 45(1). Website: https://doi.org/10.7589/0090-3558-45.1.201

mortality in wild wood bison, but such chronic diseases can have a debilitating impact on a population.

Overall, diseases in domestic livestock that have the potential to infect wildlife are a concern for wildlife managers. NWT wildlife managers are addressing these concerns proactively through import, possession, and export regulations. Risk mitigation also includes regulating the transport of domestic animals (including containment systems), fencing, and disease testing.

For tuberculosis and brucellosis, the challenge is to minimize the risk of disease-causing pathogens spreading from the GWBM and infecting healthy wood bison populations in the NWT and northern Alberta. For anthrax, the challenge is to monitor outbreaks, find infected carcasses, reduce the number and severity of future outbreaks, and prevent transmission to humans. The primary challenge associated with the other diseases is preventing their spread into the NWT. Approaches and actions to manage diseases must also conserve genetic diversity where possible.

5.2. Habitat Loss, Degradation, and Fragmentation

Currently, there is sufficient habitat in the NWT to support expanding bison populations and there are few significant threats to bison habitat (e.g. changes in water levels, flooding, and fire regime; increased shrub encroachment; agriculture; linear features such as access roads; active logging; industrial development). However, the cumulative effects of natural and human-caused changes in the landscape can have a large impact on available habitat. The additive and combined effects of different changes to the land may lead to larger than expected impacts on bison and other wildlife populations. It will be important to coordinate information gathering so that it both supports and is supported by cumulative effects monitoring initiatives.

Potential causes of bison habitat loss or degradation in the NWT include various factors that may contribute to a loss of or change to meadow habitat. The main landscape features providing forage biomass for wood bison are marl lake basins, fens, floodplains, and salt plains. Frequent floods/drawdowns revitalize and maintain necessary seral (intermediate) stages of vegetation succession. However, since the early 1970s, the flood/drawdown cycle has diminished in the range of the GWBM, and in the Mackenzie population range there is currently less marl lake meadow habitat because of high water levels.

Linear features tend to attract wood bison and may create forage, however, they may also increase access for hunting. Bison use linear features for traveling through the range and to explore and expand their range. Active logging may cause wood bison to leave an area, and bison tend to stay in areas with less logging. Bison using development sites increase instances of bison-human conflicts, including damaging equipment or pipelines, collisions with vehicles on roads, and conflicts with industrial/forestry/agricultural operations. Some of these impacts are already being seen in the NWT. In Alberta and British Columbia, development has already caused major losses of historic bison habitat.

Land-use planning initiatives, if passed, could have a positive influence on wood bison. For example, future land use plans have the potential to complement wood bison management in the Dehcho region if approved (i.e. Interim Dehcho Land Use Plan and a land use plan by the Acho Dene Koe First Nation).

Recent forest fire activity in the NWT will encourage the growth of forage such as grasses and sedges. Bison are known to feed in recently burnt forest and meadow areas, likely attracted by the fresh plant growth.

The challenges will be to monitor, assess, and manage the cumulative effects of habitat changes to maintain adequate habitat for wood bison and maintain habitat productivity.

5.3. Overharvesting

The devastating declines in wood and plains bison populations, resulting in their near extinction in the late 1800s, were primarily caused by hunting. Today, regulated hunting is part of recovery management for wood bison. In the NWT, harvesting is used to provide benefits to people of the NWT and increase acceptance of bison. It is also used to manage risk of disease transmission between bison populations and to reduce bison-human conflicts, particularly in communities. However, there is concern that hunting pressure on bison has increased due to reductions in populations of other harvested species like barren-ground caribou.

Currently, *The Wood Buffalo National Park Game Regulations* prohibit all people from hunting wood bison inside Wood Buffalo National Park[23].

Under the NWT's *Big Game Hunting Regulations*[24], both Indigenous harvesters in their traditional use area and General Hunting Licence holders may hunt bison in Wildlife Management Zone U – which includes the Slave River Lowlands – without any season restrictions, limits, or any other condition. In 2014, a limited resident harvest of one tag per hunter per year was reinstated for the Slave River Lowlands population.

Because wood bison in the NWT were designated as a species in danger of becoming extinct under regulation (*Game Declared in Danger of Becoming Extinct*, C.R.C., c. 1236), the reintroduced Nahanni and Mackenzie populations were granted special protection from unrestricted hunting. Protection measures were carried over in the regulations when the new NWT *Wildlife Act* (SNWT 2014, c 31) came into force in November 2014. Harvest levels of these animals are managed through quotas.

Under this system, the harvest quota for the Nahanni population as of 2018 is seven animals per year. However, since 2003/2004, legal harvest of the Nahanni population has never exceeded 3 animals per year (usually 1 animal annually). Following the 2012 anthrax outbreak in the Mackenzie population, all hunting of the Mackenzie population

[23] *Canada National Parks Act*. 2018. Wood Buffalo National Park Game Regulations SOR/78-830. Website: https://laws-lois.justice.gc.ca/PDF/SOR-78-830.pdf
[24] *Wildlife Act*. 2010. Big Game Hunting Regulations R-019-92. Website: https://www.justice.gov.nt.ca/en/files/legislation/wildlife/wildlife.r1.pdf.

was halted until the population shows recovery (with the exception of 4-5 males harvested annually by the Deh Gáh Got'ı̨ę First Nation under a Wildlife Permit).

Any NWT resident may hunt bison without a licence within the BCA at any time, but bison removed from the BCA must be reported to ENR as soon as possible.

Harvest is also used as a recovery management tool in the Yukon and Alberta. Management concerns in these jurisdictions include bison exceeding target population sizes and traffic safety.

5.4. Social and Cultural Factors

Because bison disappeared from much of their range in the NWT by the late 1800s and have been absent from much of the landscape for a number of generations, there is a perception in some communities that wood bison are a novel wildlife species. In some communities, there may be limited or no connection between Indigenous people and wood bison. In these communities less value is placed on wood bison. There is mixed sentiment about bison presence and some members of Dehcho and Tłı̨chǫ communities consider bison as a nuisance and do not want them in the region. They believe that bison displace moose and caribou by competing with them. Other complaints are that bison make it difficult to set small mammal snares, they trample or eat plants and berries that are harvested by individuals, and they have lost their fear of humans. These beliefs present challenges to recovery since continued existence of wildlife depends on social and cultural acceptance by local people and Indigenous communities.

In contrast, in areas where bison populations have persisted (i.e. in the Slave River Lowlands), communities and Indigenous people consider bison presence as a positive and a connection to the species has been maintained. Bison in this area are considered to be an important food source, an important part of the communities' heritage, and many people in the region have maintained a social, cultural, spiritual, and economic connection to the bison.

While some individuals hold negative attitudes towards wood bison, a positive shift in attitude is occurring in areas where bison have been re-established. Community members are engaging in harvest and consumption of wood bison, youth are developing open outlooks toward wood bison, and community members are becoming interested in learning to harvest bison.

The challenge is to promote/foster the social and cultural acceptance of bison within the NWT.

5.5. Bison-Human Conflicts

Bison, like other wildlife, can come into conflict with humans. In the NWT, conflicts generally occur when bison enter communities or occupy highway corridors. Roads and other linear features can also provide access for bison into new and novel areas. In other jurisdictions, bison have caused conflicts with agricultural activities; this has not occurred in the NWT to date.

5.5.1. Community Conflicts

Bison frequently come into the communities of Nahanni Butte, Fort Liard, and Fort Providence, and infrequently come into Behchokǫ̀. Once in communities, bison can damage property, injure pets, be a hazard to human safety, and leave copious amounts of fecal patties. There are programs in Fort Providence and Fort Liard to herd bison out of the communities, however, herding tends to be a short-term solution and may not deter bison from returning. In this respect, more work is needed to develop effective measures to keep bison out of communities.

5.5.2. Vehicle Collisions

Collisions between bison and vehicles occur on all NWT highways within wood bison range. From 1989 to 2017, an average of about 11 vehicle-bison collisions were reported annually (Fig. 8). Vehicle-bison collisions in the NWT are most frequent between August and December and about 84% of all collisions involve the Mackenzie population.

The proposed construction of a Tłı̨chǫ all-season road from Highway 3 to Whatì, which would extend through the range of the Mackenzie population, would create an additional corridor for possible vehicle-bison collisions.

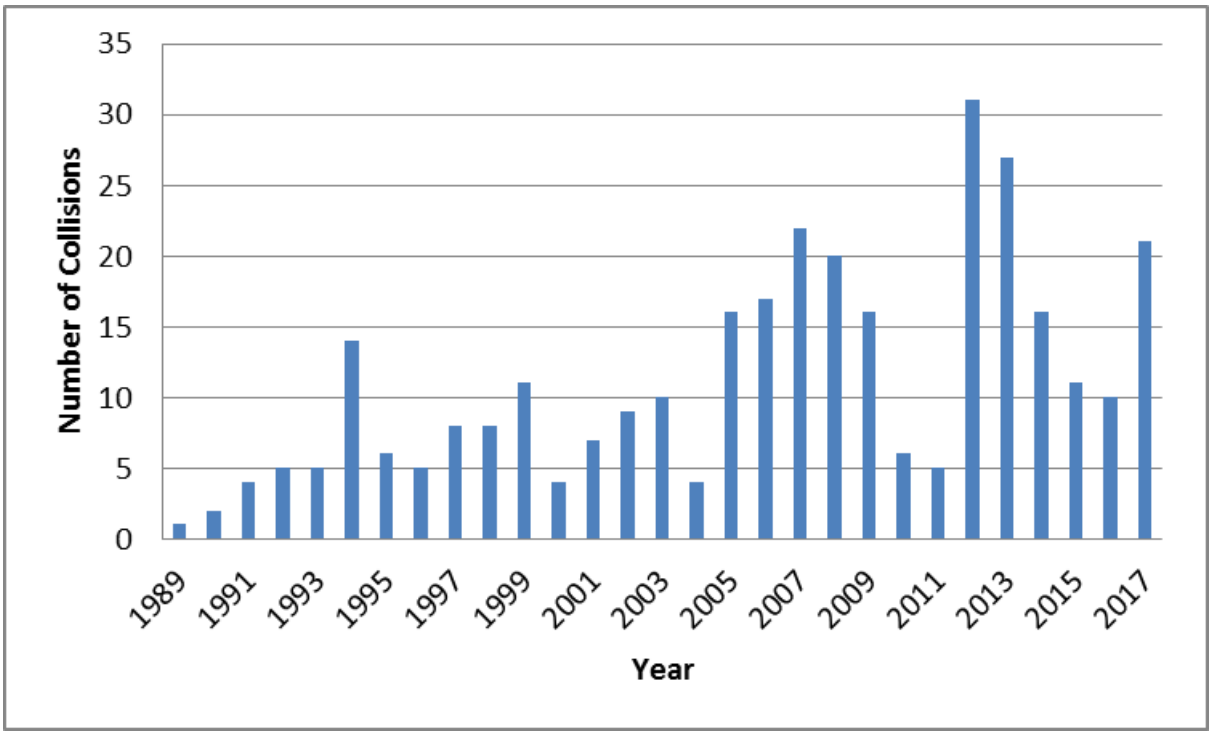

Figure 8. Vehicle-bison collisions reported to ENR for all NWT highways from 1989-2017.[25]

The GNWT's Department of Infrastructure (INF) manages an annual campaign from late August to October focused on public safety. The campaign is communicated through radio advertisements and encourages drivers to practice "bison-safe driving" by

[25] Environment and Natural Resources (ENR), unpubl. data. 2018. Vehicle-bison collisions. Unpublished data provided by T. Armstrong. 2018. Environment and Natural Resources, Fort Smith, NT.

wearing seatbelts and driving at an appropriate speed for road conditions. The advertisements also caution drivers to avoid both distractions and overdriving their headlights. Portable highway signs are also used to remind drivers of bison on the road. When a collision does occur, collaboration among motorists, ENR, and INF is valuable in determining if any meat is salvageable for community use and for the collection of samples for disease surveillance.

INF has collaborated with Parks Canada and ENR to raise public awareness and install warning signs in an effort to reduce collisions along Highway 5 to Fort Smith, Highway 7 to Fort Liard, and the access roads to Fort Liard and Nahanni Butte.

The challenge is for all people living and working within the range of wood bison to work together to reduce bison-human conflicts within communities and along highways.

5.6. Impacts of Bison on Ecosystems

Wood bison are the largest land mammals in North America and have a noticeable impact on local ecosystems. Wood bison influence habitats directly by grazing, trampling, defecating, urinating, making trails, wallowing, horning, and rubbing against trees and other objects. Ecological restoration of bison increases energy flow, ecosystem productivity, habitat complexity, and biodiversity[26,27,28]. For example, their wallows create openings for early successional stage plant species. Wood bison consume resources not used by other wildlife and are an important resource for other species, including humans, predators, scavengers, and birds.

Given their use of transportation corridors, in areas where re-vegetation has occurred as a result of human activity, wood bison have the potential to disperse invasive alien plant species.

There is potential for food competition between wood bison and moose or caribou, but research shows their dietary overlap is low to moderate[29]. However, there is concern that predator densities may increase as predators follow bison.

In some NWT communities, concern has been expressed regarding interactions between wood bison and other important species (e.g. caribou). This includes concerns related to competition and predation, but also the possibility of disease (e.g. brucellosis and tuberculosis) transmission between these species within the GWBM. However, despite

[26] Gates, C.C., C.H. Freese, P.J.P. Gogan, and M. Kotzman .(eds. and comps.). 2010. *American Bison: Status Survey and Conservation Guidelines 2010*. International Union for the Conservation of Nature, Gland, Switzerland.

[27] Sanderson, E.W., K.H. Redford, B. Weber, K. Aune, *et al*. 2008. The ecological future of the North American bison: conceiving long-term, large-scale conservation of wildlife. Conservation Biology 22:252-266.

[28] Knapp, A.K., J.M. Blair, J.M. Briggs, S.L. Collins, *et al*. 1999. The keystone role of bison in North American tallgrass prairie: bison increase habitat heterogeneity and alter a broad array of plant, community, and ecosystem processes. BioScience 49:39-50.

[29] Jung, T.S., S.A. Stotyn, and S.M. Czetwertynski. 2015. Dietary overlap and potential competition in a dynamic ungulate community in northwestern Canada. Journal of Wildlife Management, 79(8): 1277-1285.

over 80 years of co-occurrence, there has been no known case of bovine brucellosis or tuberculosis transmission to caribou or moose in the GWBM.

The challenge for bison management is to understand the interactions among bison populations, ecosystems, and other species, particularly boreal caribou and moose, and to balance the needs of species.

5.7. Genetic Diversity

The GWBM is the most genetically diverse wood bison population in the NWT. The Mackenzie and Nahanni populations have lower levels of genetic diversity as a result of being established by a small number of animals. Limited genetic diversity in bison populations is also an issue outside of the NWT (e.g. the captive population within Elk Island National Park in Alberta).

Low levels of genetic diversity in a population can result in a higher vulnerability to disease and lower reproductive success and/or survival. It can also result in a reduced ability to adapt to changes in the environment, such as those resulting from climate change.

In populations of wild species, depopulation has sometimes been used as an effective tool to eliminate diseases. However, this approach has negative impacts on the genetic diversity of populations. Evaluating options for alternative means of managing diseases in wood bison (e.g. genetic salvage, new vaccination approaches, detection methods, etc.) would help conserve genetic diversity.

The challenge is to maintain genetic diversity in the Greater Wood Buffalo metapopulation and increase the genetic diversity (without introducing diseases) of the Mackenzie and Nahanni populations.

5.8. Hybridization

There are three types of hybridization that challenge wood bison conservation across the species' range. These are hybridization with domestic bison, hybridization with cattle, and hybridization with wild plains bison.

Domestic bison are selected for traits that are likely to be maladaptive in wild populations, particularly tractability and meat production (e.g. "less hump, more rump"). This makes it important to prevent hybridization between wild and domestic bison. Currently, this is a low risk because there are no domestic bison in the NWT.

Efforts have been made to cross-breed plains bison with cattle in attempts to introduce desirable traits from bison into cattle. Some of the resulting hybrids were backcrossed to bison. After generations of these backcrosses, hybrids became indistinguishable from pure bison to the point where some were incorporated into bison herds. The legacy of hybridization with cattle implies that a significant number of plains bison herds have some cattle ancestry. To conserve wild bison, it is important to prevent the spread of cattle DNA into bison populations where it does not already exist. Cattle DNA is most

likely to spread via bison with cattle ancestry. To date, there have been no published reports of cattle DNA in NWT wood bison populations.

Bison in the GWBM, and all populations established from Wood Buffalo National Park founders, are wood bison genetically. They remain a subspecies distinct from plains bison despite the introduction of plains bison to Wood Buffalo National Park in the 1920s, where they subsequently hybridized with wood bison. Cross-breeding between wood bison and plains bison is considered a threat to the genetic integrity, fitness, and evolutionary pathway of wood bison. Since wood and plains bison are genetically distinct, they should be managed separately to prevent further hybridization.

The threat of further hybridization is currently low in the NWT. However, there is a free-ranging, feral plains bison population within the original wood bison range at Pink Mountain, British Columbia. To help prevent contact, management zones have been established by British Columbia for the Pink Mountain plains bison herd and bison ranching activities. Cooperative work with other jurisdictions is required to prevent contact between these plains bison and the Nahanni and other wood bison populations.

The challenge is to prevent domestic bison and plains bison from entering wood bison range in the NWT.

5.9. Agriculture

Agricultural activities have historically been fairly limited in the NWT. However, in an effort to improve food security, the NWT has seen a rise in agricultural activities over the last decade. In 2015, the GNWT produced the first NWT Agriculture Strategy - *The Business of Food: A Food Production Plan, 2017-2022*. Some goals of the strategy include building a viable agriculture industry, increasing availability of local food for northern residents, and contributing to the sustainability of NWT communities. The agriculture strategy was created after extensive discussions about land use and the development of a regulatory framework. It was produced with the aim of supporting the safe, sustainable development of food production systems. However, agriculture presents a number of challenges to wood bison recovery. Changing natural ecosystems into farmland reduces wildlife habitat. If diseases are undetected in livestock, domestic animals have the potential to spread diseases such as tuberculosis and brucellosis to wood bison. Crop or property damage caused by bison reduces local acceptance of wildlife and problem animals may be at risk of being killed by land owners.

The challenge will be to manage agriculture and bison recovery actions together so they do not have negative impacts on each other.

6. CONSERVATION AND RECOVERY GOALS AND OBJECTIVES

Recognizing the ecological, cultural, and spiritual importance of wood bison, combined with their consumptive and non-consumptive uses, the goals of this recovery strategy are to:

1. Recover free-ranging, genetically diverse, and healthy[30] wood bison populations broadly distributed within the Northwest Territories, to levels which can sustain ongoing harvest for the benefit of all people in the Northwest Territories.
2. Contribute to the recovery of free-ranging, healthy wood bison populations in Canada.

In order to attain these goals, five objectives have been established, combined with 15 recommended approaches. Progress toward achieving these objectives will be evaluated every five years.

6.1. Objectives and Approaches

The *Recovery Strategy for Wood Bison in the NWT* recommends the following five objectives to achieve its goals and address threats:

Table 1. Conservation and recovery objectives.

NO.	CONSERVATION AND RECOVERY OBJECTIVES
1	Work with communities and Indigenous governments and organizations to complete and implement separate management plans for the Mackenzie, Nahanni, and Slave River Lowlands populations.
2	Promote opportunities to increase acceptance as well as social, cultural, and economic benefits of wood bison.
3	Maintain healthy, genetically diverse, and productive wood bison populations.
4	Monitor and conserve important wood bison habitat.
5	Support recovery of healthy wood bison populations broadly distributed within the NWT.

[30] Healthy means that bison are free of bovine tuberculosis, brucellosis, and other significant diseases from domestic animals.

6.2. Approaches to Achieve Objectives

This recovery strategy recommends approaches to achieve the conservation and recovery objectives for all wood bison in the NWT. These objectives and approaches will guide the overall recovery of wood bison in the NWT. However, recognizing that each population is unique in terms of population dynamics and the threats it faces, the development and implementation of herd-specific management plans forms an important pillar of this recovery strategy.

The recommended approaches are described on the following pages and summarized in Table 2.

Objective 1: Work with communities and Indigenous governments and organizations to complete and implement separate management plans for the Mackenzie, Nahanni, and Slave River Lowlands populations.

The challenges to recovery are different for each wood bison population in the NWT. Through a collaborative process with local communities, Management Authorities will take the lead to ensure community perspectives and knowledge are incorporated at the outset of any management process and that steps within the process are appropriate and acceptable to community members. This can be achieved by continuing to work with communities and Indigenous governments and organizations on the completion and implementation of individual population management plans. Collecting the information needed to manage wood bison populations will continue throughout this process. At the time of publishing this recovery strategy, the management plan for the Mackenzie population was completed and management plans for the Nahanni and Slave River Lowlands populations were nearing completion.

Approach 1.1: Develop management plans for each of the Nahanni and Slave River Lowlands populations.

Approach 1.2: Implement management plans for the Mackenzie, Nahanni, and Slave River Lowlands populations.

Objective 2: Promote opportunities to increase acceptance as well as social, cultural, and economic benefits of wood bison.

For long term success, recovery and conservation projects must be supported by local community residents. The likelihood of community support is greater if species conservation results in social, economic, or cultural benefits for communities. Wood bison currently provide a number of community benefits, including a subsistence food resource and economic diversification. However, further promoting the potential benefits wood bison can provide for communities will help to enhance their perceived value.

Wood bison harvest provides community members with a valuable protein source acquired through traditional means; this helps to relieve dependence on store bought food, encourages a healthy diet, and promotes a subsistence lifestyle. A sustainable wood bison harvest also has the potential to diversify subsistence game target species.

The management and regulation of wood bison harvest is important to ensure that it is sustainable.

Bison can also contribute to economic diversification. Wood bison are an important tourist attraction and many people consider the NWT as a destination to view them. Wood bison are frequently found near roads, making them easily accessible for tourists. They are a popular and easy to photograph species; photos of wood bison are often used in tourism brochures.

In addition to promoting potential benefits, communities and other agencies also need to work on reducing bison-human conflicts. Management approaches that help to address issues relating to vehicle-bison collisions and keeping bison out of communities will encourage community residents to support further recovery actions.

Approach 2.1: Manage wood bison harvest to be sustainable for the benefit of all people in the NWT.

Approach 2.2: Promote non-consumptive economic benefits, including tourism based on wood bison viewing.

Approach 2.3: Work with communities and other agencies to reduce bison-human conflicts.

Objective 3: Maintain healthy, genetically diverse, and productive wood bison populations.

Understanding the health status of the Mackenzie, Nahanni, and Slave River Lowlands populations will help guide the recovery and management of these herds.

Anthrax, tuberculosis, and brucellosis directly affect the survival and productivity of wood bison populations and reduce population growth potential. These diseases also present potentially serious health risks to humans, other wildlife, and livestock. Risk to humans can be reduced through increased public awareness of proper techniques in butchering and preparing meat to prevent infection.

Reducing the frequency and severity of anthrax outbreaks is a goal of the NWT Anthrax Emergency Response Plan (AERP). The AERP encompasses collaboration with a number of outside agencies and organizations including (but not limited to) the Canadian Food Inspection Agency and Parks Canada-Wood Buffalo National Park. It will continue to be applied in the NWT as part of conservation and recovery efforts.

This recovery strategy includes the long-term goal of recovering healthy wood bison populations. To achieve this goal, the long-term aim is to eliminate bovine tuberculosis and brucellosis in the NWT, and the short-term focus is to manage disease transmission of bovine tuberculosis and brucellosis from infected populations to disease-free populations. If these diseases were eliminated, disease monitoring costs would be greatly reduced, the Bison Control Area program would no longer be necessary, and all bison in the Slave River Lowlands would be healthy for people to harvest. Eliminating these diseases would require commitments from Management Authorities, communities, and other governments (i.e. Canada, Alberta, and British Columbia, and their respective

agencies). However, elimination as a disease control measure is neither practical nor possible with the current resources or technology available. There are currently no vaccines that have demonstrated efficacy in delivery and prevention of infection for anthrax, tuberculosis, brucellosis, and Johne's disease in wild bison. Nonetheless, if disease eradication/elimination does become achievable, and is realized, then recovery efforts could shift from disease eradication to focusing more on increasing genetic diversity and productivity of wood bison populations. As long as tuberculosis and brucellosis remain, management actions to reduce risk of transmission will be needed (such as continuing the BCA).

Genetic diversity impacts a population's ability to adapt to changing environmental conditions. Increasing genetic diversity can positively affect a population's prospects for long term survival. Exploring ways to increase genetic diversity without introducing diseases or non-wood bison genetic material is important for the future of wood bison populations in the NWT.

Approach 3.1: Monitor health in all populations.

Approach 3.2: Continue to manage the risk of disease transmission.

Approach 3.3: Collaborate with and engage partners, agencies, and organizations to manage diseases and investigate new or emerging methods to manage diseases.

Approach 3.4: Eliminate bovine tuberculosis and brucellosis from wood bison over the long term in the NWT.

Approach 3.5: Explore options to increase genetic diversity of Mackenzie and Nahanni wood bison, and avoid loss of genetic diversity from bison in the Slave River Lowlands.

Approach 3.6 Develop studies to learn what factors regulate population size of bison in the NWT.

Objective 4: Monitor and conserve important wood bison habitat.

Monitoring habitat changes and determining current and estimated future levels of natural and human disturbances will help to identify acceptable levels of habitat loss and degradation. Identifying important habitat and preventing habitat loss or degradation are key factors in the recovery of wood bison populations.

Approach 4.1: Monitor and assess the cumulative effects of changes to wood bison habitat.

Approach 4.2: Manage bison habitat to prevent habitat loss and degradation and maintain adequate, productive habitat.

Objective 5: Support recovery of healthy wood bison populations broadly distributed within the NWT.

Over the last 5,000 years, wood bison in the NWT inhabited significantly more area than they currently do. Supporting wood bison range re-occupation in some of this

previously used habitat, where appropriate and consistent with local priorities, may contribute to the eventual removal of the species from federal and territorial lists of species at risk.

Wood bison populations in the NWT extend across regional and jurisdictional boundaries. Therefore, cooperation among Indigenous governments and organizations, territorial and provincial governments, and management agencies is necessary to facilitate recovery of the species in the NWT. Differing federal, territorial, provincial, and regional priorities add complexity to this management scenario. The Nahanni population extends across multiple jurisdictions and is managed in collaboration with the governments of Canada, Yukon, and British Columbia. The Slave River Lowlands subpopulations are part of the GWBM metapopulation, which is in part managed by Parks Canada Agency-Wood Buffalo National Park. The Mackenzie population, while occurring entirely within the NWT, crosses regional boundaries and management is therefore coordinated among a number of groups. Therefore, efforts are being made, and will continue to be made, to manage subpopulations cooperatively. Success will require interagency support and the cooperation of co-management partners, governments, organizations, and NWT communities.

Approach 5.1: Consult with communities, wildlife management boards, and Indigenous governments and organizations to support and expand wood bison recovery efforts in the NWT.

Approach 5.2: Collaborate on recovery and management of wild bison in Canada.

6.3. Measuring Progress

The Conference of Management Authorities will report to the public at least every five years on the actions undertaken to implement the recovery strategy and on the progress made towards meeting its objectives. The first such report will be due by April 2025. This recovery strategy may also be updated at that time.

Overall success can be measured using the following long-term indicators:

- increasing, or at least stable, population trends, within the natural range of variation;
- increasing, or at least stable population distributions, without evidence of range recession;
- species status has improved or at least not become further at risk; and
- community engagement in current management processes and continued support for management objectives.

Table 2 provides a summary of the objectives and approaches for the conservation and recovery of wood bison. Each approach has a corresponding performance measure that provides an indicator of success.

Management will be considered successful if the conservation and recovery goals are achieved. In other words, management will be a success if recovery of free-ranging,

genetically diverse, healthy wood bison broadly distributed in the NWT is achieved, with a population that is abundant enough to sustain ongoing harvests for the benefit of all people in the NWT and contribute to the recovery of wood bison in Canada.

Table 2. Approaches to conservation and recovery of wood bison in the NWT.

This recovery strategy recommends the approaches discussed below to achieve the conservation and recovery objectives. It provides additional information for each approach, including the relative priority, time frame, threats and/or knowledge gaps addressed, and performance measures. More specific recommended actions will form part of the herd-specific management plans.

Objective	Management approaches	Threats and/or knowledge gaps addressed	Relative priority[31]/ time frame[32]	Outcomes and/or performance measures[33]
Objective #1: **Work with communities and Indigenous governments and organizations to complete and implement separate management plans for the Mackenzie, Nahanni, and Slave River Lowlands populations.**	1.1 Develop management plans for each of the Nahanni and Slave River Lowlands populations.	• Potential to address all threats and challenges.	Critical / Short-term	• Management plans to address specific objectives and challenges for each population are developed. • Communities and Indigenous governments and organizations provide direction on management actions on traditional lands. • The general public and stakeholders are aware of their role in conserving wood bison.

[31] **Relative priority** can be *critical, necessary* or *beneficial*. Critical approaches are the highest priority for the conservation of bison and should be implemented sooner rather than later. Necessary approaches are important to implement for the conservation of bison but with less urgency than critical. Beneficial approaches help to achieve management goals but are less important to the conservation of the species compared to critical or necessary.

[32] **Relative timeframe** can be short-term, long-term, or ongoing. Short-term approaches should be completed within five years (2019-2024) and long-term approaches require more than five years to complete. Ongoing approaches are long-term actions carried out repeatedly on a systematic basis.

[33] Outcomes and/or **performance measures:** This represents guidance from all partners as to appropriate outcomes and/or measures of performance.

Objective	Management approaches	Threats and/or knowledge gaps addressed	Relative priority[31]/ time frame[32]	Outcomes and/or performance measures[33]
	1.2 Implement management plans for the Mackenzie, Nahanni, and Slave River Lowlands populations.	• Potential to address all threats.	Critical / Long-term or ongoing	• Actions specified in the herd-specific management plans are taken to help the recovery of wood bison and to address specific challenges to recovery.
Objective #2: **Promote opportunities to increase acceptance as well as social, cultural, and economic benefits of wood bison.**	2.1 Manage wood bison harvest to be sustainable for the benefit of all people in the NWT.	• Over-harvesting • Social and cultural factors (i.e. helps re-establish acceptance as well as social, cultural, and economic benefits for all people in the NWT).	Critical / Ongoing	• Sustainable wood bison harvest management actions (i.e. quotas and tags) are implemented based on population size and trends. • Information on population size and trends is gathered through population surveys. • Reports on hunting effort, harvest and details of the animal taken is collected. • Communities and community members are engaged in the sustainable harvest and consumption of bison (including hunter education), thereby indicating an improvement in social and cultural acceptance of wood bison.
	2.2 Promote non-consumptive economic benefits, including tourism based on wood bison viewing.	• Social and cultural factors (i.e. helps re-establish acceptance as well as social, cultural, and economic benefits for all	Beneficial / Short-term	• Local economies are diversified with economic activity attributable to non-consumptive use of bison. • Visitor volume and spending is increased in areas with the potential for non-consumptive

Objective	Management approaches	Threats and/or knowledge gaps addressed	Relative priority[31]/ time frame[32]	Outcomes and/or performance measures[33]
		people in the NWT).		economic benefits (i.e. wood bison viewing).
	2.3 Work with communities and other agencies to reduce bison-human conflicts.	• Social and cultural factors (i.e. helps re-establish acceptance as well as social, cultural, and economic benefits for all people in the NWT). • Bison-human conflicts.	Critical / Ongoing	• Increased public awareness and knowledge with regard to dealing with bison in communities or on personal property. • Reporting and recording of vehicle-bison collisions is improved in frequency and consistency. • Actions are developed within herd-specific management plans to address and reduce bison-vehicle collisions and/or bison entries into communities. • Reduction in the number of vehicle-bison collisions. • Reduction in the number of bison-human conflicts in communities and the cost to address them.
Objective #3: **Maintain healthy, genetically diverse, and productive wood bison populations.**	3.1 Monitor health in all populations.	• Disease • Provides information on the status of population health to support recovery decisions.	Beneficial / Ongoing	• Information on wood bison health is available and shared. • Where possible, surveillance is conducted and populations are monitored for diseases.
	3.2 Continue to manage the risk of disease transmission.	• Disease	Critical / Ongoing	• Anthrax outbreaks are monitored and responses adhere to the ENR Anthrax Emergency Response Plan. • The Bison Control Area program is

Objective	Management approaches	Threats and/or knowledge gaps addressed	Relative priority[31]/ time frame[32]	Outcomes and/or performance measures[33]
				continued. • The tuberculosis and brucellosis-free status of the Mackenzie and Nahanni populations are maintained. • Action plans and planned responses are developed in the event that tuberculosis, brucellosis or other significant diseases are detected in the Mackenzie and Nahanni populations. • Public is informed on how to minimize health risks.
	3.3 Collaborate with and engage partners, agencies, and organizations to manage diseases and investigate new or emerging methods to manage diseases.	• Disease	Beneficial / Ongoing	• A collaborative approach is developed to manage the risk of disease transmission and eventual elimination of bovine tuberculosis and brucellosis. • Regulations and protocols are developed to address importing and moving domestic animals within the NWT. • Management Authorities consider disease management of wildlife in land use application processes.
	3.4 Eliminate bovine tuberculosis and brucellosis from wood bison over the long-term in the NWT.	• Disease	Necessary / Long-term	• Eventual elimination of bovine tuberculosis and brucellosis.

Objective	Management approaches	Threats and/or knowledge gaps addressed	Relative priority[31]/ time frame[32]	Outcomes and/or performance measures[33]
	3.5 Explore options to increase genetic diversity of Mackenzie and Nahanni wood bison, and avoid loss of genetic diversity from bison in the Slave River Lowlands.	• Genetic diversity	Necessary / Long-term or ongoing	• Potential options for increasing/maintaining genetic diversity of wood bison populations in the NWT are assessed and a path forward is identified. • Genetic diversity of Nahanni and Mackenzie bison is increased until there is no measurable difference in diversity between them and the GWBM.
	3.6 Develop studies to learn what factors regulate population size of bison in the NWT.	• Fill knowledge gaps on factors that influence productivity, and limit or regulate population size.	Necessary / Long-term or ongoing	• Understanding of factors affecting ability of populations to recover from periodic losses. • Knowledge of factors that limit or regulate population size. • Publications documenting results.
Objective #4: **Monitor and conserve important wood bison habitat.**	4.1 Monitor and assess the cumulative effects of changes to wood bison habitat.	• Habitat loss, degradation, and fragmentation. • Impacts of bison on the ecosystem.	Necessary / Long-term or ongoing	• Cumulative effects of habitat changes and availability are monitored and assessed. • Research initiatives that study the impact that natural and human-caused changes in the landscape have on wood bison are supported. • Research initiatives that study the impact bison populations have on the ecosystem and on other species, particularly boreal caribou

Objective	Management approaches	Threats and/or knowledge gaps addressed	Relative priority[31]/ time frame[32]	Outcomes and/or performance measures[33]
				and moose, and balance the needs of species are supported.
	4.2 Manage bison habitat to prevent habitat loss and degradation and maintain adequate, productive habitat.	• Habitat loss, degradation, and fragmentation.	Necessary / Long-term or ongoing	• Abundant and productive habitat for wood bison is identified and maintained. • Habitat loss and degradation are assessed during review of new land use application processes (i.e. agriculture, oil and gas, road developments). • Minimize or mitigate loss or degradation of bison habitat caused by conversion of land to other uses.
Objective #5: **Support recovery of healthy wood bison populations broadly distributed within the NWT.**	5.1 Consult with communities, wildlife management boards, and Indigenous governments and organizations to support and expand wood bison ranges in the NWT.	• Potential to address all threats.	Necessary / Long-term or ongoing	• Support for wood bison range re-occupation/re-introduction, where appropriate and consistent with local priorities. • Population sizes and/or ranges are increased.
	5.2 Collaborate on recovery and management of wild bison in Canada.	• Potential to address all threats.	Critical / Ongoing	• National population and distribution objectives for wood bison are met.

7. NEXT STEPS

Management partners will use this strategy to help in assigning priorities and allocating resources in order to conserve and recover wood bison in the NWT. It will be reviewed every five years and may be updated.

This recovery strategy will be followed by a consensus agreement by the Conference of Management Authorities that will lay out the actions the participating Management Authorities intend to undertake to implement it.

Herd-specific management plans are published (Mackenzie Bison Management Plan) or are nearing completion (Nahanni and Slave River Lowlands populations) for each of the three populations of wood bison in the NWT. The herd-specific plans will determine more specific management actions for each herd and implementation will follow.