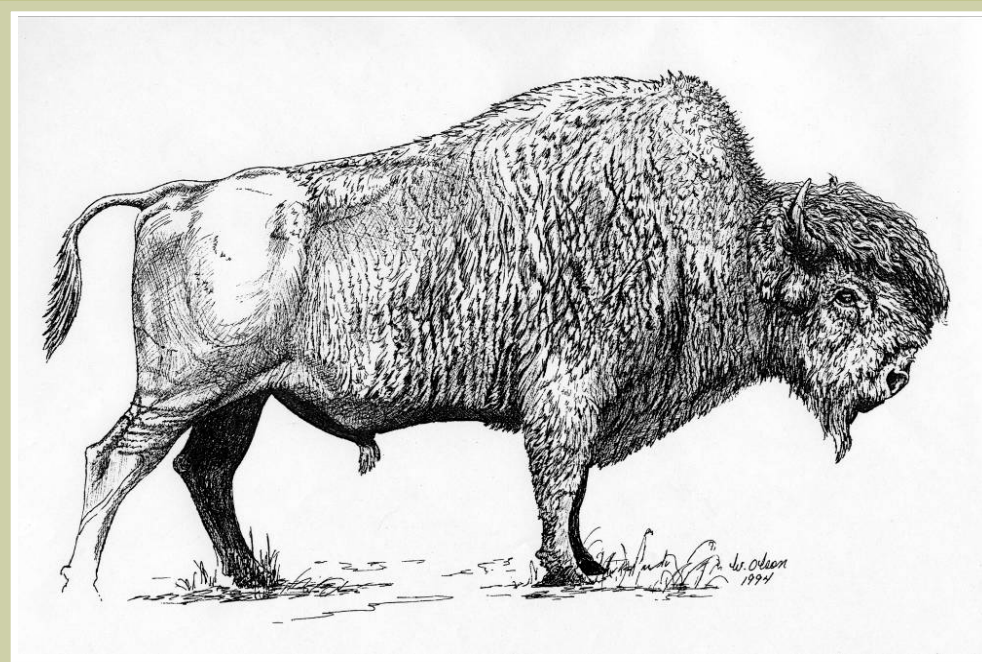


# Recovery Strategy for the Wood Bison (*Bison bison athabascae*) in Canada

## Wood Bison



2016



**Recommended citation:**

Environment and Climate Change Canada. 2016. Recovery Strategy for the Wood Bison (*Bison bison athabasca*) in Canada [Proposed]. *Species at Risk Act Recovery Strategy Series*. Environment and Climate Change Canada. Ottawa. viii + 52 pp.

For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the [Species at Risk \(SAR\) Public Registry](http://www.registrelep-sararegistry.gc.ca)<sup>1</sup>.

**Cover illustration:** graciously provided by Wes Olson.

Également disponible en français sous le titre  
« Programme de rétablissement du bison des bois (*Bison bison athabasca*) au Canada  
[Proposition] »

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ISBN

Catalogue no.

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<sup>1</sup> <http://www.registrelep-sararegistry.gc.ca>

## Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)<sup>2</sup> agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Wood Bison and has prepared this recovery strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Government of Alberta, the Government of British Columbia, the Government of Manitoba, the Government of the Northwest Territories, the Tłı̄cho Government, the Wek'èezhì Renewable Resource Board, the Government of Yukon, and the Yukon Fish and Wildlife Management Board, and any others as per section 39(1) of SARA.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment and Climate Change Canada and the Parks Canada Agency or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of Wood Bison and Canadian society as a whole.

This recovery strategy will be followed by one or more Action Plans that will provide information on recovery measures to be taken by Environment and Climate Change Canada and the Parks Canada Agency and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When the recovery strategy identifies critical habitat, there may be future regulatory implications, depending on where the critical habitat is identified. SARA requires that critical habitat identified within a national park named and described in Schedule 1 to the *Canada National Parks Act*, the Rouge National Urban Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* be described in the *Canada Gazette*, after which prohibitions against its destruction will apply. For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make

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<sup>2</sup> <http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2>

an order so that the prohibition against destruction of critical habitat applies. For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

## Acknowledgements

This recovery strategy was drafted by Greg Wilson, Hal Reynolds, Tara Fulton, Lea Craig-Moore, and Renee Franken (Environment and Climate Change Canada (ECCC)). It was prepared based on information updated from the 2001 Wood Bison Recovery Plan, and in consultation with members of the national Wood Bison Recovery Team (WBRT) whose members included Terry Armstrong (Northwest Territories (NT) Department of Environment and Natural Resources), Matt Besko (Alberta (AB) Environment and Parks, Fish and Wildlife Division), Norm Cool (Parks Canada Agency (PCA)), Cormack Gates (University of Calgary), Thomas Jung (Yukon (YT) Department of Environment), Stuart Macmillan (PCA), John Nishi (ex-officio member), Hal Reynolds (ECCC), Helen Schwantje (British Columbia (BC) Ministry of Environment), Todd Shury (PCA), Bob Stephenson (Alaska Department of Fish and Game), Bill Watkins (Manitoba (MB) Conservation), and Greg Wilson (ECCC). Alternate members consisted of Brett Elkin (NT Department of Environment and Natural Resources), Craig Gardner (Alaska Department of Fish and Game), George Hamilton (AB Environment and Parks, Fish and Wildlife Division), Archie Handel (PCA), Brian Joynt (MB Conservation), Rhona Kindopp (PCA), and Michelle Oakley (YT Department of Environment). All members of the WBRT are thanked for input and for reviewing and contributing to this recovery strategy. Dawn Andrews (PCA) Nic Larter, Rob Gau, and David Dewar (NT Department of Environment and Natural Resources), Brian Hagglund (MB Conservation), and Conrad Thiessen and Mike Rowe (BC Ministry of Environment) are thanked for providing information for the recovery strategy. Special thanks go to Wes Olson for the use of the cover illustration and the Wood Bison photograph. Thank you to Gillian Turney and Jeff Harder (ECCC) for preparing maps. Dave Duncan, Medea Curteanu, Emily Jenkins, and Amy Ganton (ECCC), Sue Cotterill, Joann Skilnick, and Natalka Melnycky (AB Environment and Parks), Conrad Thiessen and Gerald Kuzyk (BC Ministry of Environment), Brian Joynt (MB Conservation), the Yukon Wood Bison Technical Team (YT Department of the Environment), Terry Armstrong, Joanna Wilson, Scott Taylor and Brett Elkin (Government of NT), Bev New (Métis Nation of Alberta, Region 5), Kate Ballegooyen (Kluane First Nation), Fort McKay Sustainability Department, Lana Cortese, Stuart Macmillan, Shelley Pruss, Laurie Wein, and Marie-Josée Laberge (PCA) and numerous anonymous reviewers are thanked for their reviews and comments.

Environment and Climate Change Canada thanks the indigenous communities surrounding the range of Wood Bison who participated in the development of this document through their feedback and the time and knowledge that they shared with Environment and Climate Change Canada to inform this document. Specifically, Environment and Climate Change Canada thanks (in no particular order) Fort McMurray Métis Local 1935, Fort Chipewyan First Nation, Fort Chipewyan Métis Local 125, Mikisew Cree First Nation, Fort McKay First Nation, Beaver First Nation, Little Red River Cree Nation, Deninu K'ue First Nation, West Point First Nation, Acho Dene Koe First Nation, Dene Tha' First Nation, Tallcree First Nation, Métis Nation of Alberta Region 6, Selkirk First Nation, Champagne and Aishihik First Nations, Métis Nation of BC, Fort Nelson First Nation, Tłı̄cho Government, Deh G'ah Got'ie First Nation, Salt River First Nation, Smith's Landing First Nation, Katl'odeeche First Nation, Doig River First Nation, Kaska Dena Council, Selkirk First Nation, and the community members of Behchoko and Fort Providence. The Aboriginal traditional and community knowledge that was shared may also be used to support the development of action plans and future identification

of critical habitat, where consent for such use is granted. Environment and Climate Change Canada appreciates that so many Aboriginal peoples were willing to share their knowledge and experiences to help with the recovery of this species.

## Executive Summary

Historically, Wood Bison (*Bison bison athabascae*) range extended throughout the boreal forest of Alberta, British Columbia, Saskatchewan, and much of the Northwest Territories, Yukon, and Alaska. During the early 1800s, Wood Bison numbers were estimated at 168,000 animals, but by the late 1800s only a few hundred animals remained. In 1978, Wood Bison were designated as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Because of an active recovery program and increased numbers, COSEWIC downlisted Wood Bison to Threatened in 1988. Wood Bison were listed as Threatened under the *Species at Risk Act* (SARA) in 2003. Wood Bison were re-examined by COSEWIC and assessed as Special Concern in November 2013, as numbers increased to nearly 10,000 animals. As of 2016, the Minister of Environment and Climate Change has not formed a recommendation regarding the downlisting of Wood Bison to Special Concern under SARA. Estimates made in 2010-2015 show ~9,189 free-ranging Wood Bison in Canada, although approximately half of these animals (N=4,645) reside in populations affected by the introduced cattle diseases, bovine tuberculosis and brucellosis. There are also ~4,244 Wood Bison in nine free-ranging, disease-free local populations plus 300 individuals in one public, captive, disease-free local population managed for conservation.

A lack of public acceptance for some reintroduced herds and drowning have been identified as limiting factors for Wood Bison. The greatest threat to Wood Bison recovery is the presence of the exotic bovine diseases brucellosis and tuberculosis on the landscape, and the resultant management actions taken. Other threats include: agriculture; energy production and mining; transportation and service corridors; hunting and collecting; logging and wood harvesting; human intrusions and disturbance; fires and fire suppression; dams and water management; invasive thistle species; severe anthrax outbreaks; increased predation; hybridization with Plains Bison, domestic bison, or cattle; pollution; climate change and severe weather; and loss of genetic diversity.

The short-term population and distribution objective is to maintain the disease-free status (free of bovine tuberculosis and brucellosis), population size and range of all disease-free Wood Bison local populations within the original range of Wood Bison in Canada. If future work shows that some of these local populations are not self-sustaining, population size and/or range size should be increased so that self-sustaining status can be attained. The maintenance of genetic diversity in diseased and disease-free local populations is also a critical component of Wood Bison recovery. This is especially true for the Wood Buffalo National Park local population, which is the most genetically diverse Wood Bison population.

The long-term population and distribution objective is to ensure the existence of at least five disease-free, genetically diverse, connected, self-sustaining, free-ranging local populations distributed throughout their original Canadian range, with a minimum size for each local population of 1,000 animals. The long-term population and distribution objective is meant to build on the short-term population and distribution objective, not replace it. Population and distribution objectives are not achieved until local population levels can sustain traditional Aboriginal harvesting activities, consistent with existing Aboriginal and Treaty rights of Aboriginal peoples in Canada.

Broad strategies to be taken to address the threats to the survival and recovery of the species are presented in the section on Strategic Direction for Recovery (Section 6.2). Insufficient information was available to Environment and Climate Change Canada to identify Wood Bison critical habitat at the time this recovery strategy was prepared. A schedule of studies to identify critical habitat is outlined in Section 7.2.

One or more action plans for Wood Bison will be completed by 2021.



## Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, recovery of Wood Bison has been deemed feasible.

### **1. Are individuals capable of reproduction available now or in the foreseeable future to sustain the population or improve its abundance?**

*Yes.* While the current number of mature Wood Bison is unknown, most of the ~9,189 free-ranging Wood Bison are capable of successful reproduction to increase population growth rate or abundance. Most Wood Bison local populations are stable.

### **2. Is sufficient habitat available to support the species or could it be made available through habitat management or restoration?**

*Yes.* There is sufficient suitable habitat available to support Wood Bison recovery. Additional habitat could be made available to Wood Bison by habitat modification and management. However, there are presently large areas within the original range of Wood Bison where reintroduction or expansion of Wood Bison is not desirable due to the risk of the transmission of bovine brucellosis and tuberculosis to disease-free Wood Bison herds.

### **3. Can the primary threats to the species or its habitat be avoided or mitigated through recovery actions?**

*Yes.* Although a number of factors continue to threaten Wood Bison, there are several strategies to avoid or mitigate these threats through recovery actions. Various actions are available or are being developed to eliminate the threat of the transmission of bovine tuberculosis and brucellosis to disease-free local populations.

### **4. Do the necessary recovery techniques to achieve the population and distribution objectives exist, or can they be developed in a reasonable timeframe?**

*Yes.* Previous reintroductions to a number of areas show that recovery techniques for Wood Bison can be successful. Achieving the long-term population and distribution objective of disease-free Wood Bison local populations throughout their original Canadian range will require that techniques to eliminate the threat of the transmission of bovine brucellosis and tuberculosis to disease-free local populations be developed, as the long-term success of current disease management efforts is unlikely.

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## 1 COSEWIC\* Status Assessment Information

**Date of Assessment:** November 2013

**Common name:** Wood Bison

**Scientific name:** *Bison bison athabascae*

**COSEWIC Status:** Special Concern

**Reason for designation:** This bison only occurs in the wild in Canada. There are currently 5,136 to 7,172 mature individuals in nine isolated wild subpopulations. The population has increased since 1987, mostly due to the establishment of new wild subpopulations within the original range. About 60% of the overall population is included in Wood Buffalo National Park and surrounding areas, and is affected by two cattle diseases, bovine brucellosis and tuberculosis. Two wild subpopulations have recently experienced significant mortality events demonstrating the inherent vulnerability of small isolated populations. The Mackenzie herd decreased by 53% due to an outbreak of anthrax and the Hay-Zama decreased by 20% due to starvation during a severe winter. Further increases to the population size or the addition of new wild subpopulations is not likely, as recovery is constrained by fragmented or unsuitable habitat, road mortality, disease management associated with livestock and commercial bison operations, and disease outbreaks.

**Canadian Occurrence:** BC, AB, YT, NT, MB.

**COSEWIC Status History:** Designated Endangered in April 1978. Status re-examined and designated Threatened in April 1988 and May 2000. Status re-examined and designated Special Concern in November 2013.

\* COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

Environment and Climate Change Canada has prepared this Recovery Strategy for Wood Bison, as they are currently listed as Threatened on Schedule 1 of the *Species at Risk Act* (SARA). Environment and Climate Change Canada is presently undertaking an extended public consultation to determine whether to recommend to the Governor in Council whether to accept, reject, or return for further review, the recommendation made by COSEWIC to downlist the species to Special Concern. If the SARA status is changed to Special Concern, a Management Plan will be produced.

## 2 Species Status Information

In Canada, the Wood Bison (*Bison bison athabascae*) is listed as Threatened on Schedule 1 in SARA. In British Columbia, Wood Bison are on the “Red List” of indigenous species or subspecies that are Extirpated, Endangered, or Threatened in British Columbia (B.C. Conservation Data Centre 2012). In 2004, Alberta’s Endangered Species Conservation Committee recommended to the Minister of Sustainable Resource Development to list all free-ranging bison as “endangered” in Alberta (Fish and Wildlife Division 2008). Currently, the

only listed bison occur within the Bison Protection Area in northwestern Alberta, where they are considered “endangered” under Alberta’s *Wildlife Act*. In the Northwest Territories, the species has not yet been assessed under the *Species at Risk (NWT) Act*. Wood Bison are not listed as “specially protected” under the Yukon *Wildlife Act*, but are recognized as being listed as Threatened by COSEWIC (Government of Yukon 2012a).

The NatureServe (2015) subnational ranks are listed in Table 1. NatureServe (2015) has ranked Wood Bison with a Canadian national status of N2N3 (imperiled to vulnerable) and a global status of T2 (imperiled).

**Table 1. NatureServe (2015) provincial and territorial ranks**

Province	NatureServe Subnational Rank
British Columbia (BC)	S2 – Imperiled
Alberta (AB)	S1 – Critically Imperiled
Saskatchewan (SK)	SX – Presumed Extinct
Manitoba (MB)	SNA – Not Applicable
Northwest Territories (NT)	S2 – Imperiled
Yukon (YT)	S2S3 – Imperiled to Vulnerable

All of the species’ global distribution occurs in Canada except for one free-ranging population in Alaska, U.S., that was released into the wild in 2015. Wood Bison were downlisted in the U.S. under the U.S. *Endangered Species Act* from Endangered to Threatened in 2012. The U.S. listing was based on the number and status of Wood Bison in Canada. In 2008, the International Union for the Conservation of Nature (IUCN) uplisted Wood Bison as a species globally from “Lower Risk – conservation dependent” to “Near Threatened” (Gates and Aune 2008). In 1997, the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) downlisted Wood Bison from Appendix I to Appendix II (CITES 2006).

### 3 Species Information

#### 3.1 Species Description

Wood Bison are the largest native terrestrial mammal in North America. They have a large triangular head, large shoulders with a high hump, and long dark brown and black hair around their head and neck (Figure 1; van Zyll de Jong et al. 1995). Males possess short, thick, black horns that end in an upward curve, while females possess thinner, more curved horns (Fuller 1962).



**Figure 1-** Male Wood Bison © Wes Olson.

Most experts recognise Wood Bison as a subspecies<sup>3</sup> of the North American bison (*Bison bison*; Cook and Muir 1984, van Zyll de Jong 1986). It is distinguished from the Plains Bison (*Bison*

<sup>3</sup> Subspecies refers to a group of natural populations capable of interbreeding but differing with respect to gene pool characteristics. They are often isolated geographically from other such groups within a biological species.

*bison bison*) subspecies by the Wood Bison's following characteristics: larger size and darker colour; absence of chap hair on the front legs; less distinct, but darker cape of the shoulders, hump, and neck region; longer and more heavily haired tail; and shorter and less dense hair on the top of the head, around the horns, and beard (see Reynolds et al. 2003 for a review).

Wood Bison are culturally important to many Aboriginal peoples (Appendix 1), and are known by many names in different Aboriginal cultures (Table 2 lists some examples). Gathering for the annual bison hunt (of Plains or Wood Bison) was a significant event for the Métis people of western Canada and is implicated in the formation of the Métis government (Appendix 1). Wood Bison are also known by many Aboriginal and non-Aboriginal peoples as buffalo.

**Table 2. Examples of names for Wood Bison**

<b>Name for Wood Bison</b>	<b>Cultural Source</b>
Dech̄t̄ah goegié	South Slavey
Dechen yághē ejere, thachin ya n'jere	Dené s̄l̄iné
Dachan tat gwi'aak'ii	Teetl'it Gwich'in
Aak'ii	Gwichya Gwich'in
Lek'aye, luk'aye, kedā-cho', ejedi	Kaska Dene
Ejuda	Slavey
Tl'oo tat aak'ii, dachan tat aak'ii, akki chashuur, nin shuurchoh, nin daa ha-an	Van Tat Gwich'in
Sakâw mostos	Mikisew Cree
Sagow mustoos	Fort McKay First Nation (Cree)
Edur-ay-cho-k	Fort McKay First Nation (Dene)
Keemoiwu hak ui	Beaver First Nation

## 3.2 Population and Distribution

### *Historical distribution and abundance*

The original distribution of Wood Bison occurred throughout the boreal forest of northwestern North America, including parts of the northern regions of Alberta, British Columbia, Saskatchewan, and much of the Northwest Territories, Yukon, and Alaska (Figure 2; van Zyll de Jong 1986, Stephenson et al. 2001). The historic Plains Bison range was to the south of that of Wood Bison. However, Plains and Wood Bison may have intermingled where their distributions overlapped during winter in the aspen parkland of what is now central Alberta and British Columbia.

Wood Bison were never as numerous as Plains Bison. Soper (1941) estimated there were once 168,000 Wood Bison. Like the Plains Bison, Wood Bison were nearly eliminated during the late 1800s. Over-hunting, changes in the distribution of habitat, and severe winters may have played a role in the decline (Soper 1941, Fuller 1962, Stephenson et al. 2001). By 1896, Wood Bison had declined to fewer than 250 animals (Soper 1941). By the 1920s, numbers had slowly increased to ~1,500 animals (Carbyn et al. 1993) and in 1922, Wood Buffalo National Park was created to protect habitat and prevent extinction of the Wood Bison (Soper 1941).



**Figure 2– Original distribution of Wood Bison during the last 5,000 years (stippled).** Based on available zooarcheological and paleontological evidence and oral and written accounts (adapted from Stephenson et al. 2001).

From 1925 to 1928, 6,673 Plains Bison were transferred from Buffalo National Park<sup>4</sup>, Wainwright, Alberta, to Wood Buffalo National Park, an event that was contested at the time (Harper 1925, Howell 1925, Saunders 1925). This translocation is believed responsible for the introduction of two cattle diseases, bovine tuberculosis (*Mycobacterium bovis*) and bovine brucellosis (*Brucella abortus*) to Wood Buffalo National Park (see Appendix 2 for a summary of disease management in Wood Buffalo National Park). By 1934, there were approximately 12,000 bison in Wood Buffalo National Park (Soper 1941), in part due to the introduction of Plains Bison that mixed and interbred with the resident Wood Bison.

In 1959, isolated Wood Bison were found in northwestern Wood Buffalo National Park. Following disease testing, 16 of these animals were transferred in 1963 to the newly established Mackenzie Bison Sanctuary, Northwest Territories (referred to as the Mackenzie population throughout this document), while 23 animals were transferred to Elk Island National Park, Alberta. Genetic and morphological evidence indicated that low levels of hybridization had occurred between Wood and Plains Bison in Wood Buffalo National Park prior to the founding

<sup>4</sup> Buffalo National Park was created in 1909 to protect bison. It was closed in 1940 and transferred to the Department of National Defence.

of the Mackenzie and Elk Island National Park local populations (van Zyll de Jong 1986, Wilson and Strobeck 1999). The founding individuals of Elk Island National Park were later discovered to carry tuberculosis that was originally undetected. The transmission of this disease requires close animal contact, illustrating that these 'pure' Wood Bison individuals had already been in contact with the disease-carrying Plains Bison before they were moved to Elk Island National Park. These adults were then culled to eliminate disease from the herd and 11 disease-free calves were salvaged and hand-reared. The Elk Island National Park local population<sup>5</sup> and all herds derived from it are descended from these calves (Appendix 3). However, Wood Bison continue to be genetically distinct from Plains Bison and should be managed separately as a distinct subspecies (Wilson and Strobeck 1999).

### ***Current distribution and abundance***

Based on estimates made between 2010 and 2015, there are approximately 9,189 free-ranging Wood Bison in Canada: ~4,244 Wood Bison in nine free-ranging, disease-free<sup>6</sup> local populations, ~4,645 in three free-ranging local populations with diseases (bovine tuberculosis and brucellosis), and 300 in one captive local population maintained for conservation purposes at Elk Island National Park (Table 3, Figure 3). More detailed information about the history of these local populations can be found in Wood Bison Recovery Team (1987) status report, Gates et al. (2001a), and COSEWIC (2013). There are also an estimated 45-60 commercial herds of Wood Bison in Canada containing approximately 500-700 animals (Gates et al. 2001). Privately-owned commercial production herds are not considered within the scope of this recovery strategy, nor are they part of recovery programs. There are also approximately 50 Wood Bison in zoos and wildlife parks in Canada, which are also not considered within the scope of this recovery strategy.

Because of the possibility for animal movement and gene flow between Wentzel Lake, Wabasca, Ronald Lake, the Slave River Lowlands, and Wood Buffalo National Park due to their proximity to one another (Figure 3), these local populations are sometimes collectively referred to as the greater Wood Buffalo National Park population throughout this document. However, while the Wentzel Lake local population is genetically indistinguishable from the Wood Buffalo National Park local population and is likely part of this local population, neither the Wabasca nor the Ronald Lake local populations appear to exchange individuals with other populations and are genetically differentiated (Ball et al. under revision). Both Wabasca and Ronald Lake are also considered to be disease-free, further suggesting that movement is limited between these local populations and the Wood Buffalo National Park population. The free-ranging local populations with diseases are important sources of genetic diversity, especially Wood Buffalo National Park, which is not only the largest free-ranging Wood Bison local population but is also the most genetically diverse (Wilson and Strobeck 1999, Wilson et al. 2005). This local population represents the only location where Wood Bison have continually persisted, and all extant populations derive from Wood Buffalo National Park, either directly or through Elk Island National Park (Appendix 3).

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<sup>5</sup> In this recovery strategy, a local population is defined as a group of Wood Bison subject to similar factors affecting their demography and occurring in the same discrete geographic area.

<sup>6</sup> Disease-free refers to local populations that are not infected with bovine tuberculosis or brucellosis. Anthrax is not included because bison are not the primary reservoir.

**Table 3. Sizes of Wood Bison local populations**

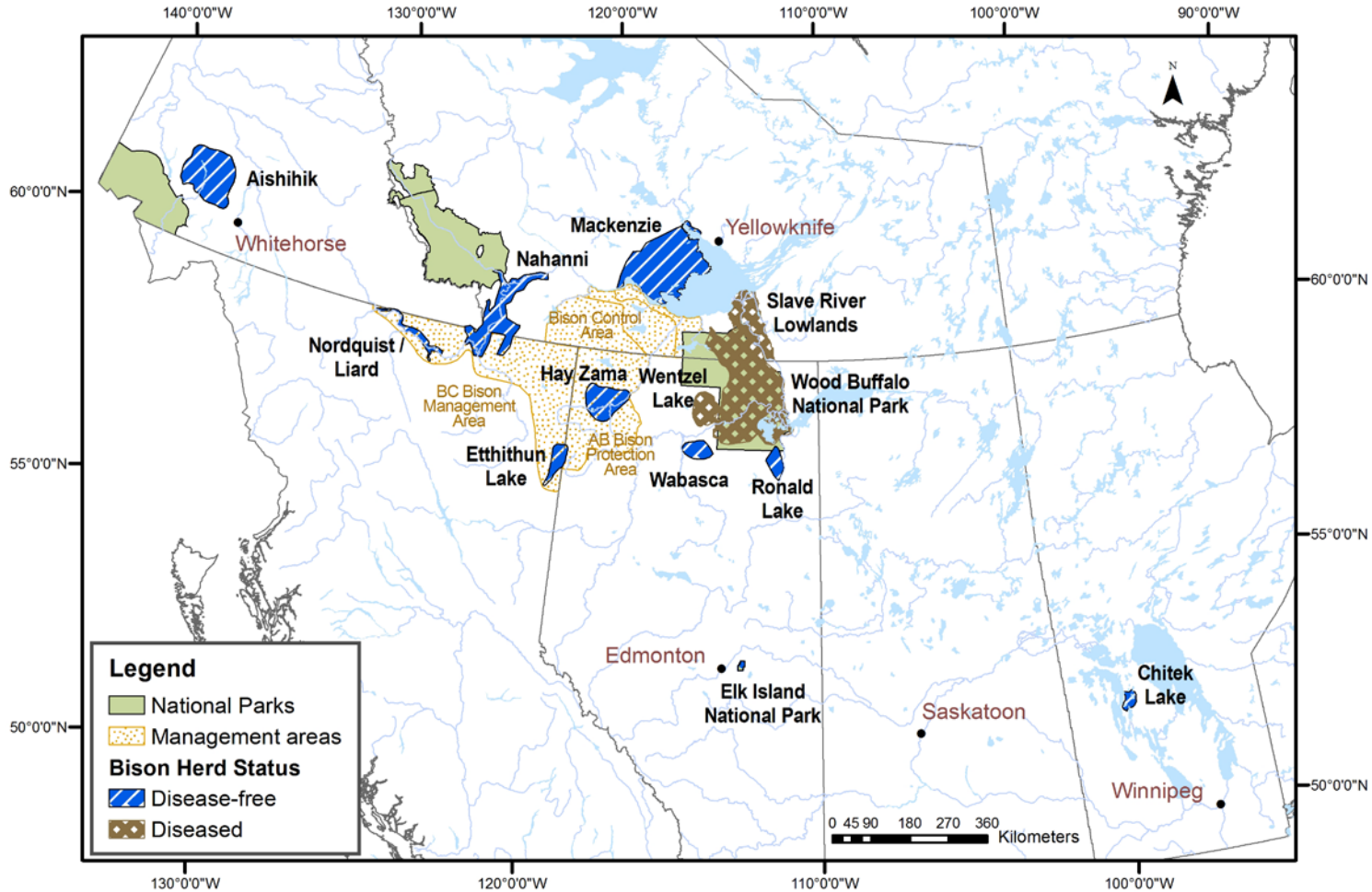
<b>Local Population Category and Name</b>	<b>Province or Territory</b>	<b>Year of Latest Estimate</b>	<b>Estimated Population Size</b>
<b>Free-Ranging, Disease-free Local Populations</b>			
Aishihik	YT	2014	1,470 [1,306-1,684] <sup>2</sup>
Chitek Lake	MB	2011	250-300 <sup>3</sup>
Etthithun Lake	BC	2011	200-300 <sup>4</sup>
Hay Zama	AB	2015	644 <sup>5</sup>
Mackenzie	NT	2013	714 <sup>6</sup>
Nahanni	NT, YT, BC	2011	431 <sup>7</sup>
Nordquist/Liard	BC, YT	2010	200-250 <sup>4</sup>
Ronald Lake <sup>1</sup>	AB	2013	~200 <sup>8</sup>
Wabasca (or Wabasca/Mikkwa) <sup>1</sup>	AB	2010	30-40 <sup>9</sup>
<i>Subtotal</i>			4,244
<b>Captive, Disease-free Conservation Local Populations – Public</b>			
Elk Island National Park	AB	2014	300 <sup>10</sup>
<b>Subtotal Disease-free Local Populations</b>			<b>~4,544<sup>13</sup></b>
<b>Free-Ranging Local Populations with Diseases</b>			
Slave River Lowlands	NT	2014	1,083±414 <sup>11</sup>
Wentzel Lake	AB	2015	199 <sup>55</sup>
Wood Buffalo National Park	NT, AB	2014	3,363±893 <sup>12</sup>
<b>Subtotal Local Populations With Diseases</b>			<b>~4,645<sup>13</sup></b>
<b>TOTAL =</b>			<b>~9,189</b>

<sup>1</sup> Between 2011 and 2014, 24 animals from Wabasca and 73 from Ronald Lake were disease-tested and no disease-positive results were obtained. The province of Alberta currently manages these herds as disease-free, as there is a 95% probability that disease prevalence is below 5%, if it is present at all (Government of Alberta 2015). In comparison, the Wood Buffalo National Park local population has a disease prevalence of 30-40%.

<sup>2</sup> Jung and Egli 2014; <sup>3</sup> Brian Joynt, pers. comm., June 2012; <sup>4</sup> Daniel Lirette, pers. comm., August 2015; <sup>5</sup> Government of Alberta 2015; <sup>6</sup> Terry Armstrong, pers. comm., August 2015; <sup>7</sup> Nic Larter, pers. comm., September 2015; <sup>8</sup> Government of Alberta 2013; <sup>9</sup> Dave Walty, pers. comm., May 2012 <sup>10</sup> Herd managed to this target size by Parks Canada; <sup>11</sup> Armstrong 2014; <sup>12</sup> Cortese and McKinnon 2015.

<sup>13</sup> Where only a range of estimates is provided, the mean was used to calculate subtotals.





**Figure 3 - Location of free-ranging Wood Bison local populations in Canada.** Disease status (disease-free, or diseased) is indicated per the inset colour key legend to indicate the presence or absence of bovine brucellosis and tuberculosis. Wood Bison control and management areas in NT, BC, and AB are indicated by the light brown stippled areas. Bison are not protected from unregulated hunting on non-federal lands outside the AB bison protection area and removal is encouraged within the NT bison control area to reduce the risk of disease transmission from the Wood Buffalo National Park area to disease-free herds. Green areas indicate National Parks.

### 3.3 Needs of the Wood Bison

#### ***Habitat requirements***

Wood Bison are primarily grazers, relying on a variety of grasses and sedges found in meadows occurring on alkaline soils and early succession habitats (Reynolds et al. 1978, Reynolds and Hawley 1987). Wood Bison show strong seasonal changes in diet, selecting plants that yield the greatest protein (Larter and Gates 1991). Wood Bison generally tend to use wet meadows with predominantly native graminoid vegetation, such as sedges (*Carex* spp.) and grasses (*Calamagrostis* spp., *Scolochloa festucacea*) as winter grazing habitat; meadows that contain slough sedge (*Carex atherodes*), northern reed-grass (*Calamagrostis canadensis*), and/or willow (*Salix* spp.) as summer grazing habitat; and deciduous and pine (e.g. Jack Pine, *Pinus banksiana*) forests associated with these meadows for resting, ruminating, avoiding biting flies, protection from deep snow and wind, and foraging at various time throughout the year (Reynolds et al. 1978, Larter and Gates 1991, Jung 2015, Jung et al. 2015b). Bison do not appear to have specific habitat requirements for rutting, mating, or gestation; however, matriarch groups tend to select larger meadows during the calving season (Calef and Van Camp 1987). Grassland/sedge habitat represents 5–20% of the land area in most Wood Bison ranges, usually interspersed among tracts of coniferous and aspen (*Populus* spp.) forest, bogs, fens, and shrublands.

#### ***Limiting factors***

##### *Lack of Public Acceptance*

In the greater Wood Buffalo National Park area where Wood Bison have persisted through time, the Aboriginal peoples of the area generally maintain a very strong, positive, connection with the Wood Bison and are advocates for their conservation (Appendix 1). However, Wood Bison local populations have also been reintroduced to parts of their range (Appendix 3), including Etthithun Lake, Hay Zama, Aishihik, Nahanni, Nordquist/Liard and Mackenzie, to varying degrees of acceptance by local residents across time and communities. Many Aboriginal communities near reintroduced herds have raised concerns about their interactions with the reintroduced animals, including trampling of plants and traplines, destruction of property, negative impacts on other desired species, and human-bison conflicts (Appendix 1). However, many Aboriginal communities also noted their support of the species, and the importance of its conservation to them. For example, Clark et al. (2015) reviewed these concerns and considerations as they pertain to local perceptions toward the Aishihik population in Yukon. Greater acceptance toward reintroduced populations is often associated with greater initial consultation efforts, and the ability of local Aboriginal and non-Aboriginal peoples to harvest the reintroduced Wood Bison once populations are stable. Local farmers and cattle/bison ranchers are also often opposed to wild bison on the landscape, as bison can consume and trample crops and pose a threat for disease transfer to commercial animals (Section 4, IUCN threat 8.1). Without public acceptance, it can be difficult to maintain conservation efforts to ensure that Wood Bison local populations continue to occur on the landscape, limiting Wood Bison recovery. Public acceptance is also a primary consideration when determining potential locations to reintroduce Wood Bison populations and, as such, has a major impact on the range of the species. Thus, a lack of public acceptance for reintroduced populations is considered a limiting factor.

### *Drowning*

Wood Bison use habitats that include wetlands, rivers, and open water bodies during all seasons. Some Wood Bison drown each spring because of flooding or falling through thin ice (Reynolds et al. 2003, Appendix 1). Because the Liard River bisects the Nahanni local population range and animals consistently cross the river, animal drowning may be a more regular and consistent mortality factor in this local population than elsewhere (Larter et al. 2003). While drowning is likely not a main limiting factor to Wood Bison in Canada, it does have implications for the survival and growth of small populations, since as a stochastic event it could reduce population size and viability.

Habitat availability is currently not considered a key limiting factor to Wood Bison recovery, except that the presence of diseased bison on parts of the landscape requires a disease management strategy that constrains the ability to allow for population expansion.

## **4 Threats**

### **4.1 Threat Assessment**

Threats are listed in Table 4, following the IUCN – CMP Unified Classification of Direct Threats version 3.2 descriptions and threat calculator, similar to that employed in the COSEWIC (2013) assessment. While the threats are listed individually, many Aboriginal communities raised concerns that the cumulative impact of these multiple threats over time remains unknown (Appendix 1).

**Table 4. Threat Assessment Table**

Threat		Impact <sup>a</sup>	Scope <sup>b</sup>	Severity <sup>c</sup>	Timing <sup>d</sup>	Detailed Threats/Comments
<b>2</b>	<b>Agriculture &amp; aquaculture</b>	<b>Low</b>	<b>Restricted</b>	<b>Slight</b>	<b>High</b>	
2.1	Annual & perennial non-timber crops	Low	Restricted	Slight	High	Herd expansion limited by agriculture.
2.3	Livestock farming & ranching	Low	Restricted	Slight	Moderate	Herd expansion limited by ranching; potential for bi-directional disease transfer (Threat 8.1).
<b>3</b>	<b>Energy production &amp; mining</b>	<b>Low</b>	<b>Large</b>	<b>Slight</b>	<b>High</b>	
3.1	Oil & gas drilling	Low	Large	Slight	High	Direct mortality; disturbance at or near well sites. Other impacts (road construction, worker presence, pollution) are considered elsewhere.
3.2	Mining & quarrying	Low	Small	Extreme	Moderate	The Ronald Lake herd may be significantly impacted by the mine(s) proposed within their range. Mining also occurs in YT.
<b>4</b>	<b>Transportation &amp; service corridors</b>	<b>Low</b>	<b>Large</b>	<b>Moderate-Slight</b>	<b>High</b>	
4.1	Roads & railroads	Medium-Low	Large	Moderate - Slight	High	Many herds live along roads and road mortality is common. Roads also facilitate hunting, though hunting mortality is accounted for in Threat 5.1.
4.3	Shipping lanes	Low	Small	Slight	High	Barge traffic sometimes leads to mortality for the Nahanni herd.
<b>5</b>	<b>Biological resource use</b>	<b>Medium</b>	<b>Pervasive</b>	<b>Moderate</b>	<b>High</b>	
5.1	Hunting & collecting terrestrial animals	Medium	Pervasive	Moderate	High	5.1.1 Intentional Use. Aboriginal Traditional use and non-Aboriginal hunting. Hunting occurs both legally and illegally; unregulated hunting is a risk. 5.1.3 Persecution/Control. Although required in the short-term to prevent disease transmission, the largest threat to bison expansion across the landscape are the strong control measures taken to prevent the spread of disease from the Wood Buffalo National Park region to disease-free herds and domestic ranched animals.
5.3	Logging & wood harvesting	Unknown	Restricted	Unknown	High	Clear-cutting may create new meadows and regenerate summer habitat, but these areas do not represent good winter habitat. Logging may increase forage quantity, but not quality.
<b>6</b>	<b>Human intrusions &amp; disturbance</b>	<b>Low</b>	<b>Restricted</b>	<b>Slight</b>	<b>High</b>	
6.3	Work & other activities	Low	Restricted	Slight	High	Industrial activities are disruptive to animals and they generally avoid both helicopters and areas where ongoing work is occurring.

Threat		Impact <sup>a</sup>	Scope <sup>b</sup>	Severity <sup>c</sup>	Timing <sup>d</sup>	Detailed Threats/Comments
<b>7</b>	<b>Natural system modifications</b>	<b>Low</b>	<b>Large</b>	<b>Slight</b>	<b>High</b>	
7.1	Fire & fire suppression	Low	Large	Slight	High - Moderate	Fire suppression may limit grazing and meadows for calving. Fires that burn too hot and too strong (often due to fire suppression over a long period or climate change) can cause direct mortality or starvation due to exclusion from a region until regrowth begins.
7.2	Dams & water management/use	Low	Large	Slight	High	The W.A.C. Bennett Dam on the Peace River is often implicated in hydrological changes in the Peace river system. Additional proposed dams may worsen these effects or impact other regions.
<b>8</b>	<b>Invasive &amp; other problematic species &amp; genes</b>	<b>High-Medium</b>	<b>Large</b>	<b>Serious - Moderate</b>	<b>High</b>	
8.1	Invasive non-native/alien species	Medium-Low	Large	Moderate - Slight	High	Invasive thistle species in Wood Buffalo National Park exclude bison from previously high quality range, as they cannot forage in these areas and avoid walking through them. (scope=Large; Severity=Slight) Brucellosis and bovine tuberculosis are cattle-derived diseases in the Wood Buffalo National Park (WBNP) regional populations (~50% of the species). Presence of both of these diseases appears to increase depredation by wolves. Significant population control measures are implemented outside WBNP to stop the spread of these diseases (Threat 5.1.3). (scope=Large; Severity=Slight)
8.2	Problematic native species	High-Low	Pervasive	Serious - Slight	Moderate	Anthrax bacteria affects bison as lethal infection outbreaks. Bison are not the main reservoir of the disease and outbreak timing and extent are unpredictable. (scope=Pervasive; Severity=Serious) Threat of predation by wolves appears to be rising. (scope=Pervasive; Severity=Slight)
8.3	Introduced genetic material	Low	Large - Restricted	Slight	Moderate - Low	Hybridization can produce less fit animals that are less likely to successfully breed and/or survive in their environments. Hybridization with cattle, domestic, or Plains Bison will likely lead to human-mediated culls at a large scale to prevent further spread of genes or disease (Threat 5.1.3).
<b>9</b>	<b>Pollution</b>	<b>Unknown</b>	<b>Large</b>	<b>Unknown</b>	<b>High</b>	
9.2	Industrial & military effluents	Unknown	Large	Unknown	High	Water systems surrounding and downstream from oil exploration sites contain higher levels of pollutants than normal. Direct mortality and/or cumulative negative health effects are possible. Oil and other spills can exclude bison from a region. Bison have been observed licking or rolling in industrial effluents.

Threat		Impact <sup>a</sup>	Scope <sup>b</sup>	Severity <sup>c</sup>	Timing <sup>d</sup>	Detailed Threats/Comments
9.5	Air-borne pollutants	Unknown	Restricted	Unknown	High	Air pollution has been reported from oil and gas development, particularly in the Fort McMurray, AB, region. Road construction, land-clearing, and mining increase airbourne particulates, and the oil and gas extraction process produces air-borne chemicals. Direct impacts remain unknown, although cumulative health effects are probable.
9.6	Excess energy	Unknown	Restricted	Unknown	High	Winter drilling noise and/or lights have altered behaviour patterns.
<b>11</b>	<b>Climate change &amp; severe weather</b>	<b>High-Low</b>	<b>Pervasive</b>	<b>Serious-Slight</b>	<b>High-Moderate</b>	
11.1	Habitat shifting & alteration	Not calculated	Pervasive	Serious - Slight	Unknown	Climate change-induced habitat shifts will likely lead to drying events, more severe climate fluctuations, increased fire, and shifting forage availability.
11.2	Droughts	Low	Large	Slight	High	Wood Buffalo National Park Peace-Athabasca delta region has been in a lasting drought for decades. As a result, vegetation is shifting, including increased spread of invasive thistle. The drought conditions reduce forage, leading to some mortality due to starvation.
11.3	Temperature extremes	Medium-Low	Pervasive	Moderate - Slight	Moderate - Low	Harsh winter conditions that reduce foraging ability (i.e., heavy snow/ice) have been linked to large reductions in population size.
11.4	Storms & flooding	Medium	Large	Moderate	Moderate	Flooding events have impacted >25% of Mackenzie animals in the past. Major floods can lead to up to 50% herd mortality.
<b>12</b>	<b>Other threats</b>		<b>Pervasive</b>	<b>Slight</b>	<b>Low</b>	
12.1	Loss of genetic diversity	Not calculated	Pervasive	Slight	Low	The entire species was reduced to ~200 animals, and all reintroduced herds have experienced further founder effects. Thus, the species is at a higher risk of inbreeding effects than normal.

<sup>a</sup> **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

<sup>b</sup> **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

<sup>c</sup> **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

<sup>d</sup> **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

## 4.2 Description of Threats

### **IUCN Threat 2. Agriculture & aquaculture**

#### **2.1 Annual & perennial non-timber crops**

#### **2.3 Livestock farming & ranching**

Part of the original range of Wood Bison is no longer available for recovery because of agricultural and rural development. Continued expansion of the commercial bison ranching industry into the Wood Bison's range is further limiting the amount of land available for free-ranging bison, as is expansion of conventional agriculture with cereal crop and cattle production. These agricultural developments exclude Wood Bison from approximately 34% of their historic range because of conflicting land uses (COSEWIC 2000). The Etthithun Lake local population in British Columbia and some local populations in the greater Wood Buffalo National Park area are in close proximity to agricultural lands, which limits the ability of these local populations to expand. Opposition from some commercial bison/cattle ranchers toward wild bison on the landscape is also linked to the limiting factor 'lack of public acceptance', as well as the concern of disease transfer both to and from domestic animals (Threat 8.1).

### **IUCN Threat 3. Energy production & mining (3.1 Oil & gas drilling, 3.2 Mining & quarrying)**

#### **IUCN Threat 5 Biological resource use (5.3 Logging & wood harvesting)**

#### **IUCN Threat 6. Human intrusions & disturbance (6.3 Work & other activities)**

#### **IUCN Threat 9. Pollution (9.2 Industrial & military effluents, 9.5 Air-borne pollutants, 9.6 Excess energy)**

Industrial forestry, oil and gas development, mining and mineral exploration are increasing across the original range of Wood Bison. However, not all resource extraction is detrimental for this species. In some instances, development may increase meadow and grassland habitat, which can be preferred habitat for Wood Bison (Mitchell and Gates 2002, Appendix 1, Mikisew Cree First Nation 2015). Opportunities may exist to maintain or "improve" available habitat through forestry and resource extraction because of the preference of bison for open areas (e.g., seismic lines). For example, habitat in the Etthithun Lake area was considered improved for Wood Bison as a result of forestry and petroleum activities (Rowe and Backmeyer 2006). In the boreal-mixed-wood forest in north-central Alberta, clear cutting (Threat 5.3) increased forage availability, but not quality, for Wood Bison; carrying capacity typically decreased when stands were greater than 8 years old (Redburn et al. 2008). In this region, clear cuts provide adequate summer forage for Wood Bison but are not suitable as winter habitat (Redburn et al. 2008). It is important to consider that these potential benefits refer only to comparatively small-scale sites, since open-pit mining projects such as the ones proposed for the Alberta oil sands area would displace bison from most (if not all) of the mine footprint (Threat 3.2). Concern for the long-term viability of the Ronald Lake local population that occurs on the northern periphery of oil sands development has been raised by many Aboriginal groups in this region (Appendix 1). Mining is also increasing in the territories.

Although forestry and resource extraction developments may initially be positive for Wood Bison by increasing available habitat, these activities also bring with them additional developments such as access roads (Threat 4.1), disturbance (Threat 6.3), pollution (Threat 9), and potentially increased predation (Threat 8.2) which can be negative to overall Wood Bison recovery. Bison have been shown to utilize oil and gas developments during summer months when fresh forage is

available, but may avoid these areas when workers are present during the winter (Appendix 1, Tan et al. 2015). Noise, lights, (Threat 9.6) and disturbance caused by winter drilling has likely altered behaviour patterns, particularly of females and younger individuals, who will avoid areas where winter drilling is ongoing (Appendix 1). Similarly, Ronald Lake herd individuals will sometimes avoid regions with noise disturbance produced during forestry activities (Mikisew Cree First Nation 2015). Developments can lead to increased human-bison conflicts, road mortality (Threat 4.1), and/or the attraction or maintenance of bison in areas where they may exhibit aggressive behaviour towards humans or damage human structures such as pipelines or vehicles, resulting in their removal. Mortality can occur due to infrastructure itself, as animals become entrapped in the structure, though the impact of this is generally low (Threat 3.1).

A common concern raised by First Nations and Métis communities in areas near oil and gas developments was the potential for negative health impacts to bison through water and air pollution (Threats 9.2, 9.5, Appendix 1). Bison have been observed rubbing on pipelines and near oil and gas infrastructure (Beaver First Nation 2015) and in cases where spills have occurred, it is highly probable that the animals come into contact with industrial effluents. Corrosion from abandoned well sites may also lead to pollution (Appendix 1). In the Alberta oil sands region, limestone is sometimes used for road base construction, creating long lasting dust that impacts air quality (Appendix 1). Air pollution produced by regional oil sands development includes significant sulfate (Howell et al. 2014), increasing levels of nitrogen oxides in Fort McMurray and Fort McKay (Bari and Kindzierski 2015), and ‘omnipresent fugitive dust’ from land-clearing, mining, and hauling emissions (Lynam et al. 2015). Airbourne industrial emissions are detected at least 30 km away from their source (Lynam et al. 2015), and waterbourne pollutants are detected up to 200 km downstream (Kelly et al. 2009, 2010). Hydrogen sulfide gas release from oil and gas drilling has the potential to be a significant threat, as noted in the Hay Zama area (Appendix 1, LeNeveu 2012). The long-term health effects and cumulative impacts of pollution, disturbance, and habitat modifications by industrial developments are currently unknown.

#### **IUCN Threat 4. Transportation & service corridors**

##### **4.1 Roads & railroads**

Collisions with vehicles are an important mortality factor for most Wood Bison local populations (Appendix 1, Beaver First Nation 2015, Nishi 2004, Rowe 2006). Wood Bison often use linear corridors such as road rights-of-way for grazing and spend considerable time on roads. During winters with high snow pack, bison tend to use roads for travel, resulting in an increase in highway mortality (Rowe 2007). Animals will sometimes bed down on the warm asphalt in winter, and then become covered by snowfall and represent a road hazard in low visibility conditions (Appendix 1). Bison on roadways are particularly problematic at night under any weather condition (Appendix 1, Beaver First Nation 2015). Road mortality also occurs during the rutting season when there is an increase in movement of bison along and across roads. For the Nordquist/Liard herd, the furthest dispersal along the highway occurs post-rut (Leverkus 2012). Road mortality tends to be more common in the fall in the Mackenzie local population (T. Armstrong, pers. comm.). Thirty or more vehicle-bison collisions can be reported annually in the range of the Mackenzie local population (T. Armstrong, pers. comm., Appendix 1); presumably more are unreported. In the Hay Zama local population in northwestern Alberta, vehicle collisions are considered the largest source of uncontrolled known mortality (Mitchell and Gates 2002).



Bison can also be associated with roads developed and maintained for industrial use (see industry-related Threats 3,5,6,9 above). Bison tend to follow linear features in an exploratory fashion and have done so in northeastern British Columbia, where they have come into conflict with agricultural operations, including commercial bison farms (C. Thiessen, pers. comm.). Linear developments that result in conflicting land use problems with Wood Bison are generally detrimental to recovery.

The preference of Wood Bison to follow linear disturbances may be exploited to encourage animals to move away from undesirable locations, such as highways, by clearing paths toward more suitable, safe, habitat. Prescribed burns may be a very effective way to encourage such movement (Fort Nelson First Nation and Shifting Mosaics Consulting 2015).

### **4.3 Shipping lanes**

Some Wood Bison local populations make extensive use of rivers in their ranges. As a result, summer and winter river crossings can be common. While Wood Bison tend to be good swimmers, increased water vehicular traffic for recreation, transportation, or seismic exploration can result in bison mortality through direct vehicle collisions or the creation of waves or choppy water that can swamp bison swimming across rivers (Larter et al. 2003). This is especially a threat for the Nahanni local population that often crosses the Liard River (Larter et al. 2003).

## **IUCN Threat 5. Biological resource use** **5.1 Hunting & collecting terrestrial animals**

### *5.1.1. Intentional Use*

Bison are hunted for Aboriginal traditional use and are of cultural importance to many Aboriginal peoples. The Ronald Lake local population has high importance for the First Nations and Métis peoples in the area, since it is the only local population in the region that is disease-free and can be legally hunted (Appendix 1). The Aboriginal and historic harvest of this population is locally considered to be sustainable, but with access into the area increasing with rising industrial activity, the herd was thought to be facing considerably higher sport and trophy hunting pressure, potentially representing a significant threat (Appendix 1). On March 31, 2016, the province of Alberta listed this herd under the provincial Wildlife Act as a Subject Animal, restricting the non-Aboriginal hunt. Prior to this, the hunt on this herd was provincially unregulated. In other parts of the range, where hunting is regulated, hunting may not be a threat to Wood Bison recovery. Hunting tags for the Aishihik and Hay Zama herds are issued yearly to control population numbers and limit the geographic spread of the herds (Threat 5.1.3). Increased access to hunting bison has been shown to increase public acceptance, as the perceived value of these animals on the landscape is increased. Thus, while unregulated hunting is a significant threat, as is the control of Wood Bison movement across the landscape (Threat 5.1.3), permitting hunting of populations where it can be done sustainably may help to improve public acceptance and have a positive impact on Wood Bison recovery overall.

### *5.1.3 Control/Persecution*

In addition to the negative impact that bovine tuberculosis and brucellosis have on the productivity of infected populations (Threat 8.1), the presence of diseased bison on the landscape constrains the ability to allow for the future expansion and re-establishment of disease-free bison

local populations in large areas of their original range (FEARP 1990, COSEWIC 2000). For example, to prevent disease transmission to the Mackenzie local population from animals in the greater Wood Buffalo National Park area, the Government of the Northwest Territories has created a Bison Control Area, a 39,400 km<sup>2</sup> bison-free buffer zone between the Mackenzie and Wood Buffalo National Park local populations (Figure 3). Within this area, aerial surveillance is conducted annually, bison are removed and disease-tested, and hunting (Threat 5.1.1) is unregulated (Gates et al. 2001, Nishi 2002). Similarly, the Government of Alberta established a 36,000 km<sup>2</sup> Bison Protection Area surrounding the Hay Zama local population (Figure 3), within which bison hunting is regulated to limit population growth to minimize the risk of disease transmission from the greater Wood Buffalo National Park area, and to assess its disease status (Government of Alberta 2015). Hunting of Wood Bison is otherwise unregulated in Alberta, except in national parks, to create a buffer zone between diseased Wood Buffalo National Park area bison and the disease-free Hay Zama local population (Gates et al. 2001). However, less lethal alternatives to discourage Wood Bison from entering these buffer zones could be applied, such as encouraging animals to use more 'desired' locations through creation of linear features, prescribed fire and connectivity between herds, strategic salt and mineral block distribution, or cattleguards (Appendix 1).

The hybridization of free-ranging Wood Bison with free-ranging Plains Bison, domestic bison, and cattle is also a threat (Threat 8.3) and management/control actions have been enacted to mitigate this threat. In British Columbia, a free-ranging Plains Bison population (Pink Mountain) was established within the original range of Wood Bison in 1971, precluding recovery of Wood Bison at this site. In 2003, this population was estimated to have a size of 876 animals (COSEWIC 2004). As a result, a Wood Bison Protection Area was designated as an active control zone (Figure 3) to prevent the hybridization of the Nordquist/Liard, Nahanni, and Hay Zama Wood Bison local populations with the Pink Mountain Plains Bison (Harper et al. 2000).

While presently important in mitigating the threats posed by hybridization and disease, management zones inhibit natural dispersal and gene flow between Wood Bison local populations and the potential re-establishment of Wood Bison populations in these areas (COSEWIC 2000), further limiting Wood Bison recovery through the loss of genetic diversity.

## **IUCN Threat 7. Natural system modifications**

### ***7.1 Fire & fire suppression***

Fire naturally acts to maintain meadow habitat preferred by Wood Bison. Wood Bison habitat may be lost or degraded through fire suppression, which can result in the transition of meadow habitats to shrubs and trees in the absence of other perturbations such as flooding (Quinlan et al. 2003). As such, fire suppression is considered a threat to Wood Bison recovery. Prescribed burning can be an effective management tool to improve foraging habitat for Wood Bison (Fort Nelson First Nation and Shifting Mosaics Consulting 2015). In the Northwest Territories, up to 270 km<sup>2</sup> were managed with fire in some years (Chowns 1998) and smaller areas near Nordquist Flats in British Columbia have benefited from fire to improve habitat for Wood Bison. Modifying policies to reduce fire suppression in large expanses of unoccupied crown land could serve to enhance or create meadow habitat for Wood Bison. Fort Nelson First Nation in British Columbia has a long tradition of using fire to regenerate the landscape in their territory and has documented the benefits for Wood Bison (Fort Nelson First Nation and Shifting Mosaics Consulting 2015). As such, fire management that emulates natural

fire regimes is not considered a threat to bison. However, fires can lead to direct mortality and bison do avoid recently burned areas, returning once the regrowth of the area has begun (Appendix 1). If fires are particularly hot or large, this can exclude bison from a large region for a longer period of time, reducing forage capacity and suitable habitat and increasing the potential for starvation (Appendix 1). Unnaturally hot fires can result from a buildup of fuel in the system due to prolonged fire suppression. Climate change and drought (Threat 11), may lead to shifting fire regimes.

## ***7.2 Dams & water management/use***

The construction of dams on rivers such as the Peace River has induced changes in the hydrological regime of areas such as the Peace-Athabasca Delta. These hydrological changes have, in turn, modified meadow succession (Carbyn et al. 1993, Gates et al. 2001). Natural variation and climate change in addition to dam construction may have contributed to these changes, but the relative contribution of each is unknown. Similar to the Peace-Athabasca Delta, the meadows downstream on the Slave River Basin do not receive the same amount of flooding they once did, although natural variation and climate change in addition to dam construction may have contributed to this change (Timoney 2006). Reduced flooding of these areas has affected the vegetation community, causing a shift from sedges (important winter forage for bison) to grass, forbs, and shrubs, thereby reducing habitat availability (Prowse and Conly 2002, Townsend 1975). Increased spread of invasive thistle (Threat 8.2) may also be associated with the lack of seasonal flooding resulting from the construction of the W.A.C. Bennett Dam or other hydrological changes (Appendix 1, Candler et al. 2015, Mikisew Cree First Nation 2015, Timoney 2013). Local residents of the Peace-Athabasca Delta region noted that bison movement patterns were historically predictable, where animals would move to higher ground at the time of spring flooding (Appendix 1). Without the annual flood, movement patterns are no longer reliable.

## ***IUCN Threat 8. Invasive & other problematic species & genes***

### ***8.1 Invasive non-native/alien species***

Two introduced, cattle-derived diseases, bovine tuberculosis and bovine brucellosis, occur in some wild bison populations in the Wood Buffalo National Park area. Both diseases were introduced into wildlife from infected cattle and can be transmitted among wildlife (including species at risk), livestock, and to humans, especially hunters (Nishi et al. 2006). Joly and Messier (2004b) found infection rates for bovine tuberculosis and brucellosis of 49% and 31%, respectively, in Wood Buffalo National Park.

Bovine tuberculosis and brucellosis can potentially limit populations because they are chronic diseases that negatively affect fecundity and production (Fuller 1962, Joly and Messier 2004a, Joly and Messier 2005). Advanced tuberculosis causes an estimated annual mortality of 4-6% of bison in Wood Buffalo National Park (Fuller 1962, Tessaro 1987). Bison that tested positive for both bovine tuberculosis and brucellosis in Wood Buffalo National Park had reduced winter survival and reproductive rates (Joly and Messier 2005), influenced in part by the interactions among disease presence, habitat quality, and wolf predation. However, the relationships between these variables in Wood Buffalo National Park are complex and poorly understood, with conflicting interpretations of how the system functions (Carbyn et al. 1993, Joly and Messier 2004a, Bradley and Wilshurst 2005).

There is currently no vaccine that has demonstrated efficacy for tuberculosis in bison. There is an effective vaccine for the control of brucellosis in bison but vaccinating wild populations is challenging.

Because management actions have to be undertaken to decrease the risk of disease transmission from diseased Wood Bison, efforts to reach the short-term population and distribution objectives may impede or delay achievement of the long-term population and distribution objectives. The potential transmission of bovine tuberculosis and brucellosis to disease-free Wood Bison carries ecological and human health implications for sustainable harvesting by local communities (Gates et al. 2001, Nishi et al. 2006). Contraction of bovine brucellosis and/or tuberculosis by disease-free populations can lead to drastic management actions. In 2006, the entire captive Hook Lake Wood Bison Recovery Project local population was destroyed after bovine tuberculosis was detected in the local population (Lutze-Wallace et al. 2006). As such, these diseases are indirectly limiting populations because management interventions have to be taken to control diseases by reducing population growth, size, and distribution (Threat 5.1.3).

Control measures can be sporadic and have no guarantee of success, and thus are not an effective long-term solution to controlling the spread of these diseases. Furthermore, there are no control areas separating diseased local populations from the disease-free Ronald Lake and Wabasca local populations, which are both in close geographic proximity to diseased local populations. It also remains important to recognize the potential for future transmission of these and other zoonotic diseases between domestic and wild animals, in both directions. Encroachment by domestic species, such as bison, cattle, sheep, and goats, into the current wild bison range represents a potential risk to be monitored.

Additionally, *Mycobacterium avium* subspecies *paratuberculosis* (MAP), the causative agent of Johne's disease, has been detected in all free-ranging and captive Wood Bison local populations tested (Forde et al. 2013). It is not known what, if any, impacts these bacteria have on Wood Bison at an individual or population level, as only one clinical case has been identified to date in Wood Bison (Forde et al. 2013). The presence of MAP may have significance for Wood Bison translocation given the potential for regulatory and import disease-testing requirements, and it is recommended that animals be translocated between herds of similar health status.

Canada thistle (*Cirsium arvense*) is an aggressive invasive weed that has been increasingly spreading in the Wood Buffalo National Park region for the last several decades. Although the cause of its introduction is unknown, it appears to be spreading from the center of the park outward, leading to speculation that it was brought in with hay for livestock in the mid-1900s. Increased drying (Threats 7.2, 11.1, 11.2) and fire (Threat 7.1) appear to promote the survival and spread of this species (Appendix 1). Mine developments (Threat 3.2) outside of Wood Buffalo National Park may also contribute to the spread of invasive thistles. Seasonal flooding was thought to reduce weed abundance, and invasive thistle is frequently observed in dried out regions. Flooding events are less frequent in the Peace-Athabasca Delta since the construction of the W.A.C. Bennett Dam (Threat 7.2, Appendix 1, Candler et al. 2015, Mikisew Cree First Nation 2015, Timoney 2013), which may be aiding the spread of invasive thistle. It is also a rapid recolonizer after a fire (Appendix 1), outcompeting native plants. Bison avoid regions where thistle is prominent as they will not walk through the area and do not eat thistle (Candler et al. 2015, Appendix 1). With increased drying conditions predicted with climate change (Threat 11),

this noxious weed will likely continue to expand, further decreasing available forage and suitable habitat for bison.

## **8.2 Problematic native species**

### *Extreme anthrax outbreaks*

Anthrax (*Bacillus anthracis*) bacterial infections are a concern for Wood Bison populations, because anthrax spores are highly resistant and long-lived, persisting in soils of meadows preferred by Wood Bison. Bison do not carry the bacteria, and are only affected during outbreaks (Bison Disease Task Force (BDTF) 1988). During outbreaks, infected animals suddenly become ill and die. It is not possible to estimate an infection rate for anthrax due to the disease ecology. Anthrax spores disperse into the local environment by the release of body fluids from infected and dead animals through body orifices or via scavenging, which then become a potential source for disease outbreaks in the future (BDTF 1988). Certain environmental and climatic conditions appear to be required to expose animals to concentrations of spores, which is followed by explosive outbreaks of the disease (Dragon and Rennie 1995, Gates et al. 1995). Timely and effective carcass cleanup reduces localized environmental contamination of anthrax spores (Nishi et al. 2003, McNab 2015).

Anthrax outbreaks have occurred within the range of Wood Bison in the Slave River Lowlands, Wood Buffalo National Park, and Mackenzie Wood Bison local populations (Gates et al. 1995, Nishi et al. 2002b, Nishi et al. 2007). The majority of previous anthrax outbreaks did not appear to significantly affect bison population dynamics (BDTF 1988, FEARP 1990). However, outbreaks can sometimes be quite extreme, affecting animals in all age classes and reducing population numbers up to 50%. For example, between 1962 and 1964, 948 bison deaths in the Hook Lake/Grande Detour region (Slave River Lowlands) were attributed to anthrax (McNab 2015). From 1962 to 2012, there have been at least 22 documented outbreaks killing at least 2200 bison in the three areas. In 2012, a record outbreak in the Mackenzie herd resulted in a mortality rate of approximately 50% (~440 deaths), including cows and young bison (McNab 2015). Continued outbreaks of this magnitude could impact population dynamics, social structure, and genetic diversity in the area. Currently, there are effective vaccines for the control of anthrax, but vaccine delivery is challenging in free-ranging populations.

### *Increased predation*

The wolf-bison predator-prey relationship has co-evolved over many years and their unbroken relationship in Wood Buffalo National Park is one of the Outstanding Universal Values (OUV) of the park as a UNESCO World Heritage Site (<http://whc.unesco.org/en/list/256>). Wolf and bear predation are naturally occurring factors for Wood Bison survival where they co-occur (Van Camp 1987, Carbyn et al. 1993, Varley and Gunther 2002), but may regulate diseased herds occurring at low densities via the “diseases-predation hypothesis”. This hypothesis, proposed by Messier (1989) and Gates (1993), suggests that bovine tuberculosis and brucellosis reduce productivity and increase the vulnerability of infected individuals to predation, with the interaction resulting in a decline in bison abundance. However, Bradley and Wilmshurst (2005) postulated that the population decline of Wood Bison in Wood Buffalo National Park during the 1970s and 1980s could be explained by low juvenile survival due to predation, without invoking

the effects of diseases. Thus, increased predation and its interplay with disease represent a threat to bison recovery.

Communities across the present range of Wood Bison report dramatically increasing numbers of wolves and in many cases, noticeable increases in wolf predation on bison (Appendix 1, Mikisew Cree First Nation 2015). In deforested regions (Threat 5.3), the decreased tree cover is suspected of raising bison susceptibility to predation (Mikisew Cree First Nation 2015). The mortality rate attributed to increased wolf presence is currently unknown, but was highlighted across the range of the species. For recently introduced herds, wolf predation appears to be increasing, presumably as wolf packs adapt to bison on the landscape and learn to hunt them.

### ***8.3 Introduced genetic material***

The hybridization of free-ranging Wood Bison with free-ranging Plains Bison, domestic bison, and cattle is a potential threat because it can compromise Wood Bison genetic integrity and introduce detrimental traits. In 2006, there were approximately 196,000 Plains Bison on about 1,900 Canadian farms (Canadian Bison Association 2009). The majority of animals used in commercial bison ranching in Canada are Plains Bison or bison of unknown genetic makeup. The proliferation of bison ranches and their encroachment into the original range of Wood Bison (Threat 2.3) increases the risk of escape or release of domestic animals, which could threaten the genetic integrity of free-ranging Wood Bison local populations.

There has been widespread cattle gene introgression in Plains Bison populations across North America (Polziehn et al. 1995, Ward et al. 1999). Cattle introgression has been shown to reduce male height and weight in some populations of Plains Bison (Derr et al. 2012), which could have a negative impact on fitness. No evidence of cattle introgression has been described in Wood Bison to date; however, statistical confidence is low due to small sample sizes (Halbert and Derr 2007). The encroachment of cattle ranching into original Wood Bison range increases the risk that hybridization between these species will occur.

### **IUCN Threat 11. Climate change & severe weather**

#### ***11.1 Habitat shifting & alteration, 11.2 Droughts, 11.3 Temperature extremes, 11.4 Storms & flooding***

Climate change is anticipated to have a negative net impact on Wood Bison habitat, including a reduction or removal of ecological barriers that limit range occupancy by bison, changes in pathogen host distribution, transmission and effects of pathogens, and habitat composition (Threat 11.1). Wood Bison are distributed within three climatic regions where the highest rates of warming in Canada (60 year warming trend of 2.2°C to 2.4°C in annual temperature, Threat 11.3) are predicted (Environment Canada 2007). Climate change has influenced, and will continue to influence, the extent of water and flooding (Threat 11.2) of the Peace-Athabasca Delta in Wood Buffalo National Park, and has the potential to be a significant threat to Wood Bison recovery. Climate change and drought (Threat 11.2) may shift the fire regime, leading to habitat alteration, the detriments or benefits of which to bison are unknown and depend on fire severity (Threat 11.1). The reduction in flooding in the Hay Zama area has reduced the availability of open grassy meadows that bison use (Beaver First Nation 2015). Extreme flooding (Threat 11.4) can have significant population impacts via mass drowning, as occurred in 1974 in the Peace-Athabasca Delta in Wood Buffalo National Park when 3,000 bison died in a severe flood

(Appendix 1, Environment Canada 1989). Extensive flooding has also reduced availability of meadow habitats and shifted the distribution of the Mackenzie local population (Northwest Territories Environment and Natural Resources 2010). Though some drowning events are a naturally limiting factor, unusually large flooding events pose a threat due to the severity of their impact on the population. Harsh winters with heavy snowfall or thick ice formation (Threats 11.3, 11.4) can lead to bison starvation (Beaver First Nation 2015). High mortality (~20%) was observed in the Hay Zama local population in 2012, which was attributed to starvation due to harsh winter conditions (COSEWIC 2013).

### **IUCN Threat 12. Other Threats**

#### **12.1 Loss of genetic diversity**

All disease-free Wood Bison local populations have either been established from relatively few founders (Elk Island National Park, Mackenzie), or have been founded from Elk Island National Park (Appendix 3), and therefore, have lower genetic diversity than the original source population in Wood Buffalo National Park (Wilson and Strobeck 1999, Wilson et al. 2005). Furthermore, several local populations are maintained at an artificially small size to prevent range expansion and contact between diseased and disease-free local populations, to manage the risk to people and property in communities, and to provide hunting opportunities (Threat 5.1). In general, smaller populations have lower genetic diversity and are subject to higher genetic drift over time. Genetic diversity within populations can be increased by allowing migration between populations; however, few movement corridors are available among Wood Bison local populations, and there is active control of movement between most diseased and disease-free local populations. Low levels of genetic diversity can have serious implications for population survival through inbreeding depression, which may reduce population fitness and increase the probability of population extirpation. Inbreeding depression has been linked to low levels of calf recruitment and high levels of calf mortality in a Plains Bison population (Halbert et al. 2004, 2005), while low levels of genetic diversity have been associated with higher disease prevalence in European Bison (*Bison bonasus*; Luenser et al. 2005). In the long-term, low levels of genetic diversity can reduce the ability of a population to adapt to changing environmental conditions, such as those resulting from climate change, and its ability to respond to natural selection pressures (summarized in McFarlane et al. 2006). Consequently, the small founding size of most Wood Bison local populations, combined with the current small size of some local populations and the lack of animal movement among local populations, raises concerns about levels of genetic diversity in Wood Bison local populations.

## **5 Population and Distribution Objectives**

Population and distribution objectives for the Wood Bison are set at two time-scales: short-term and long-term. This two-staged approach is necessary because of the complexity of the disease issue and the ongoing uncertainty as to how to eliminate the threat of exotic bovine diseases in the species over the long-term. Due to this complexity, population and distribution objectives will not be proposed for existing diseased Wood Bison local populations at this time. Instead, the competent Minister will propose population and distribution objectives for diseased local populations, informed by the work of a collaborative process to be established to explore management options for these local populations and their impact on Wood Bison recovery.

The short-term population and distribution objective is to maintain the disease-free status, population size and range of all disease-free Wood Bison local populations within the original range of Wood Bison in Canada. If future work shows that some of these local populations are not self-sustaining, population size and/or range size should be increased so that self-sustaining status can be attained. For local populations that currently exceed 1,000 animals, population reductions may sometimes be necessary to improve public acceptance, so long as the minimum population size of 1,000 animals as set by the long-term population objective remains met.

For those local populations for which the disease status is currently uncertain, the local populations and the ranges in which they occur should be maintained until such time as their disease status is ascertained. Local populations that are shown to be disease-free, or from which bovine tuberculosis and brucellosis have been eliminated, would be included under the population and distribution objective above.

Extralimital<sup>7</sup> and captive local populations managed for conservation should also be maintained. Both of these can act as important reservoirs to protect Wood Bison and their genetic diversity from catastrophes that may occur within current populations, helping to secure the subspecies in local ecosystems.

The maintenance of genetic diversity in diseased and disease-free local populations is also a critical component of Wood Bison recovery. This is especially true for the Wood Buffalo National Park local population, which is the most genetically diverse Wood Bison population (Wilson et al. 2001). Additionally, these bison are valuable for socio-cultural connections to Aboriginal groups as well as their fundamentally important ecological role in the surrounding ecosystem.

The long-term population and distribution objective is to ensure the existence of at least five disease-free, genetically diverse, connected, self-sustaining, free-ranging local populations distributed throughout their original Canadian range, with a minimum size for each local population of 1,000 animals. The long-term population and distribution objective is meant to build on the short-term population and distribution objective, not replace it.

The target population size of 1,000 animals was chosen based on modeling studies performed to estimate the loss of genetic diversity in Wood Bison populations over time. Gross and Wang (2005) found that 1,000 bison are required to achieve a 90% probability of retaining 90% of allelic diversity. The number of local populations is based on professional judgement and expertise of members within the now-dissolved Wood Bison Recovery Team as to how many local populations might ensure species recovery throughout the original range in Canada. Smaller local populations maintained in a natural state throughout and external to the original range of Wood Bison play an important role in the Wood Bison metapopulation, helping to secure the subspecies in local ecosystems.

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<sup>7</sup> Extralimital refers to those herds outside the original range of Wood Bison in Canada as shown in Figure 2.



The population and distribution objectives are not achieved until local population levels are sufficient to sustain traditional Aboriginal harvesting activities, consistent with existing Aboriginal and Treaty rights of Aboriginal peoples of Canada. Aboriginal harvest may be supported for local populations of any size, so long as the Wood Bison local population remains self-sustaining. Maintaining a self-sustaining population is traditionally part of Aboriginal herd management (Appendix 1).

## 6 Broad Strategies and General Approaches to Meet Objectives

### 6.1 Actions Already Completed or Currently Underway

Since the first national Wood Bison Recovery Plan was published (Gates et al. 2001), a number of scientific studies relating to recovery of Wood Bison in Canada have been completed or are ongoing. A partial list of pertinent publications can be found below.

#### *Research*

- Numerous reports on disease management and genetic salvage have been published (e.g., Nishi et al. 2002a, b, Joly and Messier 2004 a, b, Bradley and Wilmshurst 2005, Joly and Messier 2005, McFarlane et al. 2006, Nishi et al. 2006, Woodbury et al. 2006, Nishi et al. 2007, Thundathil et al. 2007).
- A Bison Disease Technical Workshop was held in 2005 to examine the technical feasibility of eliminating bovine diseases from the Wood Buffalo National Park ecosystem (Shury et al. 2006).
- Several studies on the genetic diversity of Wood Bison and techniques for maintaining this diversity have been carried out and published (e.g., Wilson et al. 2003, Wilson and Zittlau 2004, Wilson et al. 2005, McFarlane et al. 2006, Ball et al. under revision).
- Studies assessing the role of predation in Wood Bison local populations and their historical declines have been completed (Joly and Messier 2004a, Bradley and Wilmshurst 2005).
- Studies assessing competition between Wood Bison and other species have been performed (Fischer and Gates 2005, Kuzyk and Hudson 2007, Jung et al. 2015a, Jung et al. 2015b).
- Studies have been completed on vaccines for *Brucella abortus* in both bison and cattle (Clapp et al. 2011, Treanor et al. 2010, Denisov et al. 2010, Hu et al. 2009, 2010), and studies are being planned to look at effectiveness of vaccine for tuberculosis in bison.
- Parks Canada and Government of the Northwest Territories have initiated a joint review of their Bison Control Area program to review its efficacy and success to date in meeting its objectives, and determine where improvements can be made.
- The presence of *Mycobacterium avium* subspecies *paratuberculosis* (MAP) has been detected and characterized in all nine Canadian herds tested (Forde et al. 2013).
- Research on the socio-economic impacts of bison reintroduction to First Nation and local people has been completed in Yukon (Beach and Clark 2015, Clark et al. 2015).
- A technical team has been established with membership from Environment and Climate Change Canada, the Province of Alberta and Aboriginal and industrial partners to identify

and obtain the knowledge necessary to inform management of the Ronald Lake bison herd.

### *Management*

- Reports describing the implementation of bison control areas have been published (e.g., Government of Alberta 2015, Northwest Territories Environment and Natural Resources 2012).
- Several reintroduced free-ranging local populations (Aishihik, Hay Zama, Mackenzie) currently have highly managed hunts, where quotas are determined by the province/territory for both the Aboriginal and non-Aboriginal hunts. Quotas are based on herd population dynamics and socioeconomic factors to manage herd expansion and increase public acceptance.
- Management plans for several local populations have been completed or are in development (e.g., Cool 2006, Rowe 2006, Northwest Territories Environment and Natural Resources 2010, Harper et al. 2000, Government of Yukon 2012b).
- Recommendations for use of fire in the management of Wood Bison have been proposed (Fort Nelson First Nation and Shifting Mosaics Consulting 2015).
- Programs are in place in Fort Providence and Fort Liard (NT) to move bison out of communities (Northwest Territories Environment and Natural Resources 2010).
- Public messaging and campaigns are in place in NT to reduce bison-related traffic accidents (Northwest Territories Environment and Natural Resources 2010) and bright, reflective collars have been tested on bison in BC to increase visibility on roadways (Leverkus 2012)

### *Habitat*

- Several studies on forage availability and habitat use by Wood Bison have been published (e.g., Quinlan et al. 2003, Redburn et al. 2008, Strong and Gates 2009, Jung 2015).
- Work to identify seasonal range patterns has been carried out using radiocollar telemetry data for the disease-free Ronald Lake (Tan et al. 2015) and Ettithun (Leverkus 2012) local populations.
- Seasonal behavioural and general habitat use patterns for some herds have been documented, incorporating local community and indigenous knowledge (e.g. Leverkus 2012, Candler et al. 2015, Schram *unpublished*).

## 6.2 Strategic Direction for Recovery

**Table 5. Recovery planning table for Wood Bison**

Threat or Limitation	Priority <sup>a</sup>	General Description of Research and Management Approaches
<b>Broad strategy: Contain and prevent the spread of bovine tuberculosis and brucellosis from Wood Bison local populations with diseases to disease-free local populations, and evaluate current disease management options.</b>		
Invasive non-native species (Threat 8.1); Persecution/Control (Threat 5.1.3)	High	Examine the feasibility of various alternatives for elimination of the threat of bovine diseases from wild bison in local recovery populations, over the long-term, while conserving genetic diversity. While depopulation and repopulation is one approach, there is also long-term potential for the development of improved tests to detect tuberculosis and brucellosis, effective vaccines, and other disease management tools
		Develop a contingency plan for disease and genetic management in the event a disease-free local population becomes infected with bovine tuberculosis and/or brucellosis
		Conduct periodic disease testing of all local populations to confirm status and assess changes in prevalence over time
		Establish a collaborative multi-stakeholder bison disease management planning group to examine options and coordinate activities aimed at eliminating the risk of bovine brucellosis and tuberculosis transmission
		Develop a contingency plan for disease and genetic management in the event of a conflict with the livestock industry
		Evaluate the effectiveness of bison control areas in reducing the risk of the spread of bovine brucellosis and tuberculosis to non-diseased local populations
<b>Broad strategy: Maintain at least 90% of the genetic diversity, as measured by allelic diversity, within the Wood Bison subspecies and local recovery populations for the next 200 years.</b>		
Loss of genetic diversity (Threat 12.1)	High	Determine specific methods to obtain reproductive material from genetically diverse local populations with diseases
		Evaluate methods for enhancing genetic diversity of disease-free local populations
		Identify areas of suitable habitat for Wood Bison throughout their range where reintroduction might be possible to ensure that genetically diverse, connected local populations occur throughout their original Canadian range

Threat or Limitation	Priority <sup>a</sup>	General Description of Research and Management Approaches
		Jurisdictional collaboration for the successful reintroduction of Wood Bison to parts of their range where they are absent to ensure that disease-free, genetically diverse, connected Wood Bison local populations occur throughout their original Canadian range
<b>Broad strategy: Increase potential for connectivity among isolated local free-ranging, disease-free populations, and for population expansion.</b>		
All threats	High	Develop and implement plans to facilitate population growth and/or range expansion for local populations that do not currently meet the long-term objective of connected populations of at least 1,000 animals, where appropriate
All threats	Medium	Assess habitat within and surrounding Wood Bison local populations that seem to have stabilized at a small size. If habitat does not appear to be limiting the size of these local populations, assess other potential limiting factors
Fire & fire suppression (Threat 7.1)	Medium	Determine the potential for using prescribed burning to create, improve, and maintain bison habitat across the range
Agriculture (Threat 2); Energy production & mining (Threat 3); Logging & wood harvesting (Threat 5.3); Human intrusions & disturbance (Threat 6)	Medium	Evaluate methods for integration of bison habitat management with forestry, oil and gas development, mining, exploration for natural resources, and reclamation of industrial sites
<b>Broad strategy: Address and reduce other key threats to Wood Bison and their habitat.</b>		
All Threats	High	Determine and implement best management practices to achieve conservation of suitable habitat, and reduction or elimination of threats
Transportation and service corridors (Threat 4)	High	Identify, evaluate, and implement measures to reduce collisions with vehicles on land and water
Introduced genetic material (Threat 8.3)	Low	Manage genetic integrity by preventing free-ranging Plains Bison, domestic bison, and cattle from hybridizing with Wood Bison through controlling, eliminating and/or preventing incursion of these animals into areas with Wood Bison

Threat or Limitation	Priority <sup>a</sup>	General Description of Research and Management Approaches
		<p>Develop guidelines and regulations for bison producers in areas near free-ranging herds of Wood Bison to ensure the risk of mixing and hybridization of domestic bison with Wood Bison is minimized</p> <p>Identify and evaluate the extent of potential conflicts between the domestic bison and cattle industries and habitat availability for free-ranging Wood Bison</p>
Dams & water management/use (Threat 7.2); Climate change & severe weather (Threat 11)	Medium	Evaluate changes to hydrology and implications for bison habitat, particularly in the Lower Peace River, the Peace-Athabasca Delta, and the Slave River Lowlands
Invasive & native problematic species (Threat 8)	Low	Better understand the interactions among Wood Bison, other herbivore species, vegetation (including invasive thistle), and predator populations
<b>Broad strategy: Increase public awareness and acceptance for Wood Bison, including acknowledging and augmenting social, cultural, ecological, and economic relationships among Wood Bison and Aboriginal peoples and local communities.</b>		
Lack of public acceptance (Limiting Factor)	Medium	<p>Assess the risk of infection with bovine tuberculosis and brucellosis to people who handle or eat infected bison and develop guidelines to reduce risk of transmission</p> <p>Improve communication to local hunters about the safety level of meat, where lacking. Where population size allows it, support regulated Aboriginal and non-Aboriginal hunting to increase acceptance of bison on the landscape (Appendix 1)</p> <p>Increase public awareness and involvement in Wood Bison recovery and habitat management to maintain or improve the public's acceptance of Wood Bison</p> <p>Educate land users (ranchers, farmers, hunters, etc.) to reduce negative interactions with Wood Bison and habitat loss caused by their activities</p> <p>Identify and address bison-human conflicts, particularly near residences and communities</p> <p>Collaborate with Aboriginal groups, land owners, land managers, government agencies and other relevant parties to promote, coordinate and implement habitat management and conservation efforts</p>

<sup>a</sup> "Priority" reflects the degree to which the broad strategy contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species.

### 6.3 Narrative to Support the Recovery Planning Table

#### **Contain and prevent the spread of bovine tuberculosis and brucellosis from Wood Bison local populations with diseases to disease-free local populations and evaluate current disease management options.**

The existence of bovine tuberculosis and brucellosis in Wood Bison indirectly limits local population growth of the species and will always pose a threat to surrounding disease-free local populations, domestic bison, cattle, and people, unless the threat of disease transmission is eliminated from infected local populations. There is currently a vaccine available for the control of brucellosis in bison (RB51), but no vaccine has demonstrated efficacy for tuberculosis in bison. Also, it should be noted that brucellosis is unlikely to be eradicated through an RB51 vaccination program alone (Olsen et al. 2003), and research on the development and efficacy of tuberculosis vaccines for cattle and badgers in Great Britain has proven to be challenging, time-consuming, and resource-intensive (see Chambers et al. 2014).

Containment strategies cannot guarantee 100% effectiveness in perpetuity, although they are extremely important in the short-term to mitigate the risk of spread of bovine tuberculosis and brucellosis. Preventing the spread of these diseases from diseased local populations in the greater Wood Buffalo National Park area will require the development and implementation of interim management measures that, at a minimum, will contain the spread of these diseases. Presently, control activities to decrease the risk of disease transmission to healthy local populations consist primarily of the removal of bison within control/buffer zones. Other interim actions, such as population reduction and disease testing, are underway in Alberta. In addition, a contingency plan must be developed to address the scenario of potential disease transmission to currently uninfected Wood Bison recovery local populations. The National Wildlife Disease Strategy (2004) provides an opportunity and the context under which implementation of a shared management solution would be possible.

While interim measures are important, ultimately elimination of the threat of transmission of bovine tuberculosis and brucellosis over the long-term is necessary. While reduction and elimination of these bovine diseases in the Greater Wood Buffalo Region through depopulation and repopulation has been deemed technically feasible (Shury et al. 2006) at a substantial cost over many years, there is little support amongst local communities for the depopulation of the Greater Wood Buffalo Region as a method for managing disease (Will 2015). Aboriginal and non-Aboriginal community members generally support the presence of Wood Bison in Wood Buffalo National Park, but would prefer that these animals were disease-free (Will 2015). Because Wood Buffalo National Park, where bovine brucellosis and tuberculosis are present, is the most genetically diverse Wood Bison local population, elimination of disease must conserve this genetic diversity. At present, the only effective tool for the elimination of the threat of bovine brucellosis and tuberculosis from Wood Buffalo National Park is the depopulation of the Wood Bison in the area. However, this may not be a desired action for a number of reasons, including: public acceptance; the cultural connection between Aboriginal groups in the area and these bison; the potential negative impacts on the Wood Buffalo National Park ecosystem; and the value of the Wood Buffalo National Park Wood Bison to species recovery as the most genetically variable Wood Bison population and the only bison population in the world that has existed in a location where they have always experienced wolf predation (although wolves were

managed in Wood Buffalo National Park through poisoning and trapping from 1935 to the 1970s (Carbyn et al. 1993). As such, a new assessment of the practicality of alternatives to eliminate the threat of disease transmission, including recent advances in genetic salvage and long-term potential for the development of effective vaccines and improved diagnostic tests for bovine diseases, is required.

A multi-stakeholder collaborative planning committee is being established to evaluate options to eliminate the risk of transmission of bovine brucellosis and tuberculosis from wild bison.

**Maintain at least 90% of the genetic diversity, as measured by allelic diversity, within the Wood Bison subspecies and local recovery populations for the next 200 years.**

McFarlane et al. (2006) reported that population size is the primary factor affecting loss of genetic diversity and populations need to be maintained above a minimum population size (*i.e.*  $\geq 400 - 500$  individuals) to minimize the reduction of heterozygosity<sup>8</sup>, which is a measure of genetic diversity. Modeling work suggests that a population size of 1,000 bison is required to achieve a 90% probability of retaining 90% of allelic diversity for 200 years (Gross and Wang 2005). Like most species, the effective population size in bison is much smaller than the actual size, due to past bottlenecks and inequality in number of breeding males and females (Hedrick 2009). Because the Wood Buffalo National Park local population is the most genetically diverse Wood Bison local population (McFarlane et al. 2006), it represents an important genetic heritage and resource for Wood Bison conservation and recovery.

Options to address the threat of loss of genetic diversity include movement of disease-free animals of known genetic background among local populations (Gross and Wang 2005), implementing selective breeding in recovery local populations (Wilson et al. 2005), establishing preservation and artificial breeding programs, and carefully managing local population reductions. Genetic diversity in reintroduced Wood Bison local populations could be improved by augmenting them with disease-free genetic material from the most genetically diverse stock in Wood Buffalo National Park or the Slave River Lowlands. A method for application of advanced reproductive techniques to Wood Bison is being developed.

There is value in maintaining publicly managed local conservation populations that may be outside of the traditional Wood Bison Range, such as the Elk Island National Park local population, to assist in achieving the short- and long-term objectives of the Wood Bison Recovery Strategy. Recommendations have been outlined in Wilson and Zittlau (2004) that will assist land managers in maintaining genetic diversity within these local conservation populations.

**Increase potential for connectivity among isolated local free-ranging, disease-free populations, and for population expansions.**

A number of Wood Bison local populations have stabilized at a smaller size than required to meet the long-term population and distribution objectives, and are in relatively close proximity to other Wood Bison local populations. Determining the factors explaining why local populations are not

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<sup>8</sup> Heterozygosity is the expected probability that the maternal and paternal copies of genetic material are different for a given region of the genome.

increasing in size or expanding their range will allow the development of plans to facilitate population growth and/or range expansion for local populations that do not currently meet the long-term objective of connected populations of at least 1,000 animals, in areas where this is deemed suitable and acceptable.

Currently, the total amount of suitable habitat available for Wood Bison recovery is unknown. Identification of potential areas for reintroductions will be an important step for future recovery of Wood Bison to ensure that disease-free, genetically diverse, connected, self-sustaining, free-ranging local populations can be distributed throughout their original Canadian range. The habitat limits for all local populations should also be examined, as this will help direct management decisions for maintaining local population sizes in line with the population and distribution objectives. Modification of habitat is a valuable management tool to improve habitat conditions and may be accomplished through such activities as fire management or industrial/agricultural practices.

A large area of the Wood Bison's original range is occupied by infected or disease-exposed bison, which limits the amount of habitat available to establish or expand disease-free recovery local populations. The containment of these diseases in the short-term and elimination in the long-term is an important step to increase the area available for additional healthy local populations and support the population and distribution objectives.

The continued inventory and monitoring of demographics and disease status of all Wood Bison local populations is a necessary component of the recovery program, as it will assist with evaluating and determining when population and distribution objectives have been attained. Population and genetic modelling through population viability analyses will help determine persistence levels of local populations under current conditions, assess limiting factors, and evaluate the importance of different management scenarios.

### **Address and reduce other key threats to Wood Bison and their habitat.**

Other threats that will need to be removed or reduced to meet the population and distribution objectives include accidental mortality via land and water traffic (Threat 4), hybridization (Threat 8.3), habitat loss and degradation (Threats 7.2, 11, 8.1), and predation (Threat 8.2).

A number of management options exist that may reduce road mortality including: high visibility collars on bison, enforcement of lower speed limits, improved signage, modifications to road salting policies, aversive conditioning (where unpleasant stimuli are applied to unwanted behaviour, such as using loud noises to scare bison away from roads), modification of the habitat adjacent to the highway to deter bison or create more suitable habitat away from the highway with prescribed burning, and intercept baiting with salt or high quality feed (Yukon Renewable Resources 1998, Rowe 2006, 2007, B.C. Bison and Roads Workshop 2007, Fort Nelson First Nation 2015). Development of new roadways for industrial access into Wood Bison ranges should consider the potential impacts of these roadways on bison movement.

Policies, regulations, and guidelines need to be developed and implemented to maintain genetic integrity and prevent hybridization between Plains and Wood Bison in the wild, and the mixing of domestic bison and cattle with free-ranging recovery local populations of Wood Bison. The British Columbia Bison Management Area (Figure 3) has been established to limit the



distribution of Plains Bison and to exclude domestic bison. However, existing policies, regulations, and enforcement in this area are inadequate to prevent mixing of domestic bison and free-ranging Wood Bison (Harper et al. 2000).

Spread of invasive thistle in the Wood Buffalo National Park region could be limited by implementing early detection and rapid response methods (Mikisew Cree First Nation 2015). Canada Thistle is classified as a noxious weed in Alberta and an integrated management plan with a variety of control options will likely be most effective as a long-term elimination strategy, given that killing the extensive root system is the only effective control method (Alberta Invasive Species Council 2014). Maintaining healthy native plant cover and rapidly reseeding disturbed areas can help to prevent establishment (Alberta Invasive Species Council 2014).

In harsh winters with heavy snowfall, local community members could be contracted to provide supplemental food to reduce starvation-related deaths, as have occurred in the Hay Zama herd (Beaver First Nation 2015). Ascertaining contaminant levels in Wood Bison residing near industrial areas would allow assessment of present levels and a basis upon which to monitor for changes to determine any potential for risk to the animals and those who consume them (Beaver First Nation 2015).

**Increase public awareness and acceptance for Wood Bison, including acknowledging and augmenting social, cultural, ecological, and economic relationships among Wood Bison and Aboriginal peoples and local communities.**

To successfully re-establish and recover Wood Bison in parts of their original range, it is necessary to address and increase awareness of social, cultural, ecological, and economic issues of Aboriginal peoples and local communities. Long-term sustainability of Wood Bison conservation efforts will largely be dependent on the cultural, social, and economic value these conservation populations bring to local communities and Aboriginal peoples (see for e.g. Clark et al. 2015). In many areas throughout the range of Wood Bison, experience has shown that the perspectives, support, and engagement of local and Aboriginal communities will have a significant influence on the outcome of long-term management objectives. Developing educational material to inform the public about the benefits of having bison on the landscape should increase public acceptance of Wood Bison recovery. Note that many activities to address this limiting factor are already underway (Section 6.1).

## **7 Critical Habitat**

### **7.1 Identification of the Species' Critical Habitat**

Critical habitat is defined in the *Species at Risk Act* (SARA) section 2(1) as “the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species”. Section 41 (1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction.

Critical habitat for the Wood Bison cannot be identified at this time due to insufficient information regarding range and habitat usage. Although each local population has similar general needs (Section 3.3), the specific habitat and land use patterns differ between local populations, often dramatically, due to regional differences in landscape characteristics and climate. Given the unique land use patterns of each local population, information will need to be acquired for each one. The general annual range of most herds is known (Figure 3); however, the specific regions within these ranges that are critical to survival and recovery are presently unknown. Furthermore, the minimum amount of habitat that is critical to support the targeted number of individuals is also unknown for each local population as most local populations are presently not habitat-limited, excluding limitations of their range by control measures or agricultural/industrial activity.

One approach to identify Wood Bison critical habitat is to use resource selection function (RSF) models to determine important habitat variables and delineate suitable habitats (Jensen 2005a, b); thereafter the amount of habitat required to support population and distribution objectives can be identified. Critical habitat can also be identified through other means, such as identifying important areas within local population ranges based on use by Wood Bison. The identification of critical habitat can consider graminoid prevalence, winter foraging habitat (with forage biomass being an important component), connectivity (including mean inter-patch distance and patch size), habitat use based on occurrence data, standing crop biomass, and species composition. The appropriate method for the identification of critical habitat for each local population will be determined through completion of the Schedule of Studies.

A schedule of studies is presented in section 7.2 for identification of critical habitat (Table 6).

## **7.2 Schedule of Studies to Identify Critical Habitat**

Critical habitat will be fully identified for all free-ranging disease-free local populations within the original Canadian range of Wood Bison (Figure 2) following completion of the schedule of studies (Table 6). The Chitek Lake local population is not included herein because it lies outside the original range of Wood Bison. Disease status is as listed in Table 3. Traditional Ecological Knowledge and contributions from Aboriginal and other local persons that help to identify critical habitat will be included where possible/available. Many Aboriginal communities contributed extensive knowledge during community consultations in 2015 or prior (Appendix 1) that will inform the critical habitat identification for bison herd(s) in their traditional territory. Critical habitat will be identified for diseased local populations once population and distribution objectives are developed as presented in section 5.

**Table 6. Schedule of Studies to Identify Critical Habitat**

<b>Description of Activity</b>	<b>Rationale</b>	<b>Timeline</b>
Collect and analyse existing occurrence data (e.g., telemetry, aerial surveys, local observations) for Wood Bison. Where necessary, conduct additional western science and indigenous knowledge studies to refine knowledge on existing distribution and occupancy.	Areas used by Wood Bison in all free-ranging disease-free local populations are determined.	2016-2019
Obtain data and knowledge on habitat use and suitability, including traditional ecological knowledge.	Resources and predictors of use are identified.	2016-2019
Identification and assembly of comprehensive habitat layers as required for the development of a predictive habitat model	Comprehensive habitat layers are identified and assembled	2016-2017
Develop and apply a predictive habitat model for species recovery for all disease-free local populations, where appropriate.	Predictive habitat model applied in all disease-free local populations, where appropriate.	2017-2021
Evaluate range composition and carrying capacity. Determine the amount and spatial distribution of habitat types required within the range, where appropriate.	Type, quality, amount, and spatial distribution of habitat components are specified and critical habitat is identified.	2016-2021

## 8 Measuring Progress

The performance indicators presented below provide a way to define and measure progress towards achieving the population and distribution objectives.

- Disease-free status, local population size, and range of all disease-free local populations within the original range will be maintained in cases where local populations are self-sustaining.
- Local population size and/or range are increased to allow for self-sustaining status to be achieved for disease-free local populations that are not currently self-sustaining.
- Extralimital and captive local populations managed for conservation are maintained.
- Genetic diversity is maintained or increased in all local populations.
- At least five disease-free, genetically diverse, self-sustaining, free-ranging Wood Bison populations exist, distributed across their original Canadian range, with a minimum size for each population of 1,000 animals.
- Bovine brucellosis and tuberculosis within Wood Buffalo National Park will be contained over the short term, and the threats from these diseases will be eliminated in the long-term.
- Connectivity and gene flow among Wood Bison populations similar to original levels occur after threats resulting from the presence of bovine diseases have been eliminated.

## **9 Statement on Action Plans**

One or more action plans will be completed for Wood Bison by 2021.

Action plans may be developed for Wood Bison local populations and not necessarily by jurisdiction. The Minister of Environment and Climate Change may adopt or incorporate parts of an existing provincial or territorial plan, or other relevant planning documents that meet the requirements of SARA as an action plan. Local community involvement and engagement in the development of each of these local population-based documents will be critical for the successful recovery of Wood Bison.

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## Appendix 1: Métis and First Nations Contribution Summary

In 2015, Environment and Climate Change Canada engaged with First Nations and Métis communities within the present range of Wood Bison in Canada. Following is a list of contributors whose knowledge and input was invaluable in shaping this recovery strategy.

The unpublished meeting summaries and correspondence comprise the following meetings/documents:

- Beaver First Nation. (April 16, 2015). *Summary of Community Meeting with Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. Child's Lake, AB.
- Beaver First Nation. (May 2015). *Report on Environment Canada's National Recovery Strategy for Wood Bison*. Beaver First Nation unpublished report. High Level, AB.
- Champagne and Aishihik First Nations. (March 13, 2015). Letter to Environment Canada re: *Comments on Wood Bison Recovery Strategy*. Haines Junction, YT.
- Dene Tha' First Nation. (July 6, 2015). *Summary of Community Meeting with Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. Busche River, AB.
- Deh G'ah Got'ie First Nation. (June 18, 2015). *Summary of Community Meeting with Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. Fort Providence, NT.
- Fort Chipewyan Métis Local 125. (March 3, 2015). *Summary of Community Meeting with Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. Fort Chipewyan, AB.
- Fort McKay First Nation. (April 23, 2015). *Summary of Community Meeting with Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. Fort McKay, AB.
- Fort McMurray Métis Local 1935. (October 21, 2014). *Summary of Community Meeting with Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. Fort McMurray, AB.
- Fort Nelson First Nation. (June 23, 2015). Letter to Environment Canada regarding the Draft Recovery Strategy for Wood Bison in Canada. Fort Nelson, BC.
- Fort Providence Community and Deh G'ah Got'ie First Nation. (June 18, 2015). *Summary of Community Meeting with Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. Fort Providence, NT.
- Kaska Dena Council. (April 20, 2015). Letter to Environment Canada re: *Inviting Kaska Dena Council cooperation to develop the draft Recovery Strategy for Wood Bison (Bison bison athabasca) in Canada*. Lower Post, BC.
- Kátl'odeeche First Nation. (July 9, 2015). *Summary of Community Meeting with Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. NT.
- Little Red River Cree Nation. (February 27, 2015). Letter to Environment Canada: LRRCN Input to the draft National Wood Bison Recovery Strategy Report. AB.

- Métis Nation of British Columbia. (March 17, 2015). Letter to Environment Canada re: *Recovery Strategy for the Wood Bison (Bison bison athabascae) in Canada*. Abbotsford, BC.
- Mikisew Cree First Nation. (February 25, 2015). *Summary of Community Meeting with Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. Fort Chipewyan, AB.
- Tallcree First Nation. (May 28, 2015). *Summary of Community Meeting with Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. North Tallcree, AB.
- Tlicho Government and Region. (May 20, 2015). *Summary of Community Meeting with Environment Canada and Government of NWT for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. Behchoko, NT.
- Salt River First Nation. (June 15, 2015). *Summary of Community Meeting with Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. Fort Smith, NT.
- Selkirk First Nation. (March 3, 2015). *Summary of Community Meeting between the Selkirk Renewable Resource Board and Environment Canada for Wood Bison Recovery Strategy Development*. Canadian Wildlife Service unpublished report. Pelly Crossing, YT.
- Smith's Landing First Nation. (May 20, 2015). *Questionnaire Response to Environment Canada for Wood Bison Recovery Strategy Development*. NT.

## Appendix 2: Summary of the History of Disease Management in Wood Buffalo National Park

Year	Event
1922	Wood Buffalo National Park (WBNP) established.
1926	Introduction of Plains Bison to WBNP. The Plains Bison are believed to have brought bovine tuberculosis and brucellosis to the park.
1954-62	Bison Management Program was implemented with the goal of reducing prevalence of disease, mainly tuberculosis. The program ceased in 1962 due to public criticism and lack of acceptance.
1968	Management proposal for WBNP. Proposed using enclosures to contain animals and slaughter animals that tested positive for bovine tuberculosis or brucellosis. This test and slaughter proposal was rejected due to cost and perceived criticism of slaughter.
1972 - 1977	WBNP Management Programs initiated and included construction of corrals to increase vaccination rate for anthrax. Round-ups terminated in 1977 due to high cost, difficulty in capturing animals, short-term nature of vaccine, harassment and stress to bison, and public criticism.
1986	An interjurisdictional steering committee to review and evaluate management options created a Disease Task Force.
1988	The Disease Task Force Report was completed. It evaluated bovine tuberculosis and brucellosis in bison in Northern Canada and options for dealing with the issue. The bison disease issue was referred to a federal Environmental Assessment Panel (EAP) to recommend a solution and assess its impact on environment, resource conservation, people, and the local economy.
1990	EAP Report recommended depopulation and repopulation with disease-free Wood Bison (Federal Environmental Assessment and Review Process 1990). There was strong opposition to this recommendation from the public including First Nations.
1991	The Northern Buffalo Management Board (NBMB) was established (including representatives from native communities and Department of Indian Affairs and Northern Development to develop a management plan for eradication of bovine tuberculosis and brucellosis in and around WBNP.
1992	The Northern Buffalo Management Report was submitted to the federal government identifying significant knowledge gaps that needed to be addressed and a request for significant additional funding.
1995	A 5-year Bison Research Containment Program (BRCP) was established in response to EAP and NBMB. The objective was to contain diseases and to establish a basis for management decision-making grounded in science, traditional knowledge, and consensus. Development of Research Advisory Committee (RAC). A research program on bison ecology and the effects of predators, disease, and habitat change on the population dynamics of Wood Bison in WBNP was initiated.
2001	BRCP Final Report recommended a 4-year extension because of the complex issue and requested significant additional funding. The request was denied and the RAC was terminated.
2003	Interim Measures Working Group was established, consisting of agencies from Canada, Alberta and NT. Purpose was to examine establishing control zones in northern Alberta on the west side of WBNP to contain and manage diseases. This initiative was deferred in favour of recommending that a long-term strategy for disease risk management be developed.
2005	The Disease Task Group of the Canadian Wildlife Directors' Committee (CWDC) was established to take the lead and develop a strategic path forward for conservation and recovery of Canada's threatened Wood Bison local populations, based on the concern that the likelihood of successful recovery is reduced until the disease issue is adequately addressed. The group consists of Parks Canada Agency, Alberta, NT, and the Canadian Wildlife Service.
2005	A Bison Disease Technical Workshop was held to assess the technical feasibility of eliminating bovine tuberculosis and brucellosis from free-roaming local populations of bison in the WBNP area through depopulation and subsequent repopulation (Shury et al. 2006). The conclusion was that it is technically feasible, but at a very high cost over 10-20 years.

### Appendix 3: Genetic History of Current Wood Bison Local Populations in Canada

For a full review of the translocation history, please see Gates et al. (2001).

Wood Bison local population	Province/Territory	Year of founding(s)	Number of founders	Source of founders
Mackenzie	NT	1963	16	WBNP
Elk Island National Park (EINP)	AB	1970	11 <sup>1</sup>	WBNP
Nahanni <sup>2</sup>	BC,NT,YT	1980, 1989, 1998	99	EINP, Moose Jaw Wild Animal Park <sup>3</sup>
Aishihik	YT	1988-1992	142	EINP, Toronto Zoo, Moose Jaw Wild Animal Park <sup>3</sup>
Hay Zama	AB	1984	29	EINP, Banff National Park <sup>3</sup>
Nordquist/Liard	BC,YT	1995	49	EINP
Etthithun	BC	1999	19	EINP
Chitek Lake	MB	1991, 1996	22	EINP
Slave River Lowlands <sup>*</sup>	NT	—	200 <sup>4</sup>	—
Wood Buffalo National Park <sup>*</sup> (WBNP)	AB, NT	—	250 <sup>5</sup>	—
Wentzel Lake*, Wabasca, Ronald Lake	AB	—	n/a <sup>6</sup>	—

<sup>1</sup> Parent founder herd of 23 animals, released in 1965 and 1967, destroyed because of disease. 11 calves salvaged at birth and hand-reared (Gates et al. 2001).

<sup>2</sup> A total of 99 individuals were introduced into the Nahanni herd over three founding events to the same location in northern BC. The population subsequently expanded into NT and YT.

<sup>3</sup> The Moose Jaw Wild Animal Park, Toronto Zoo, and Banff National Park populations were all established from EINP animals. The Moose Jaw Wild Animals Park and Banff National Park populations no longer exist.

<sup>4</sup> For this local population, “founders” refers to the lowest number of animals estimated, which was 200 in 1949 (Fuller 1950).

<sup>5</sup> For this local population, “founders” refers to the lowest number of animals in region estimated around 1900s (Soper 1941).

<sup>6</sup> These populations are thought to be associated with Wood Buffalo National Park. They were not established through human actions.

\* Populations are affected by bovine tuberculosis and brucellosis.

## Appendix 4: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#)<sup>9</sup>. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the [Federal Sustainable Development Strategy](#)'s<sup>10</sup> (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general; however, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

It is anticipated that the activities identified in this recovery strategy will benefit several species and the environment. In particular, the conservation and reintroduction of Wood Bison could have a positive impact on large carnivores through the addition of another prey species in the ecosystem. If Wood Bison populations are removed or lost, then co-evolved predators, such as wolves, will be negatively affected. Local populations of two predatory species classified as Special Concern by COSEWIC, the Grizzly Bear (*Ursus arctos*) and Wolverine (*Gulo gulo*), may benefit from Wood Bison recovery. Other species that prefer sedge habitats such as the Yellow Rail (*Coturnicops noveboracensis*, listed as a species of Special Concern under SARA) may benefit from habitat protection or enhancement for Wood Bison. However, the Baikal Sedge (*Carex sabulosa*, listed as Threatened under SARA) may be negatively affected by trampling if bison herds expand into the Alsek Dunes in Kluane National Park and Reserve, one of the locations where the species grows. Management strategies should strive to benefit all target species and minimize negative effects on other native species. Efforts should be coordinated across species to help ensure the most efficient use of resources, and to prevent duplication of effort and management conflicts.

It has been suggested that the reintroduction of Wood Bison to areas where they have been absent for many decades may have implications to existing wildlife, specifically populations of Moose (*Alces alces*) and Woodland Caribou (*Rangifer tarandus*), species with which local people have long-established cultural relationships (Appendix 1). However, Wood Bison that have been present in habitats for long periods, such as in Wood Buffalo National Park and Elk Island National Park, appear to coexist with Moose without detriment to either species. The Wood Bison in the introduced Aishihik herd in Yukon Territory do not appear to displace moose or caribou in winter (Jung et al. 2015a, Jung et al. 2015b). Bison diets are primarily comprised of grasses and sedges, while moose forage primarily on woody browse; thus competition for forage between these two species is likely low (Waggoner and Hinkes 1986, Reynolds et al. 2003). Wood Bison and

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<sup>9</sup> <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

<sup>10</sup> <http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1>

Woodland Caribou select different habitats with little overlap in diet composition (Fischer and Gates 2005). In the Mackenzie population, Larter and Gates (1991) found a high percentage of lichens in the fall diet of Wood Bison, suggesting there may be forage competition with Woodland Caribou, although this was found to occur only during the fall season. However, Wood Bison may also have an indirect negative impact on caribou and other ungulates by acting as an alternate prey species that results in an increase in wolf numbers (Larter et al. 1994, Jung 2011, Species at Risk Committee 2012). Habitat alterations undertaken to improve Wood Bison population connectivity such as controlled burns or linear features should consider impacts to Woodland Caribou habitat. Additional studies are needed for information on the effects of newly reintroduced Wood Bison on other species in a variety of habitats and across seasons.