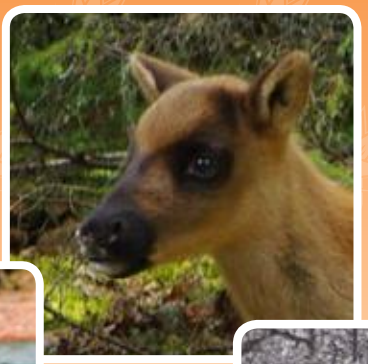

CONSERVING THE ICON OF THE BOREAL

MANITOBA'S BOREAL WOODLAND CARIBOU RECOVERY STRATEGY

Part of:
TOMORROW NOW
Manitoba's GREEN Plan

Manitoba

TOMORROW NOW

Manitoba's GREEN Plan

This document is part of "TomorrowNow - Manitoba's Green Plan"; an eight-year strategic action plan for mobilizing Manitobans to work together to protect the environment while ensuring a prosperous and environmentally-conscious economy. In addition to the actions outlined in this plan, the province has other initiatives underway to ensure we protect the environment and sustainably manage our natural resources now, for tomorrow.

Manitoba's goal is to be one of the most sustainable places to live on earth.

Copies of this publication may be downloaded at: **www.manitoba.ca/conservation/wildlife**

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MESSAGE TO THE PUBLIC

This draft of Manitoba's Boreal Woodland Caribou Recovery Strategy will be available for public comment on Manitoba Conservation and Water Stewardship's website for 60 days after its release.
All public comments will be considered during preparation of the final strategy for future release.

Email: wildlife@gov.mb.ca

Mail to:
Attention: Boreal Caribou Recovery Strategy
Manitoba Conservation and Water Stewardship
Wildlife Branch
Box 24, 200 Saulteaux Crescent
Winnipeg, Manitoba, R3J 3W3

PREFACE

Manitoba species at risk recovery strategies are prepared under the direction of the Wildlife Branch, Manitoba Conservation and Water Stewardship. Manitoba's Boreal Woodland Caribou Recovery Strategy was written by recovery team members of the Manitoba Boreal Woodland Caribou Management Committee, in consultation with stakeholders.

Manitoba's Boreal Woodland Caribou Recovery Strategy, hereafter referred to as the recovery strategy, was prepared to meet Manitoba's commitments under the *Accord for the Protection of Species at Risk in Canada*, the *National Framework for the Conservation of Species at Risk*, the federal *Species at Risk Act* (SARA) and TomorrowNow - Manitoba's Green Plan.

It is intended for adoption under Manitoba's *The Endangered Species and Ecosystems Act*, which requires the minister to prepare recovery strategies for all species listed as threatened, endangered or extirpated.

This strategy outlines measures required to ensure the continued persistence and recovery of boreal woodland caribou populations within Manitoba's boreal forest. The actions identified in this strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised goals and objectives. Implementation of this recovery strategy will be subject to the availability of resources, and priorities from within and outside government. Manitoba Conservation and Water Stewardship invites interested government and non-government groups, and all Manitobans, to collaborate and support the implementation of this recovery strategy for the benefit of boreal woodland caribou in Manitoba.

ACKNOWLEDGEMENTS

Throughout the development of this strategy, the Manitoba Boreal Woodland Caribou Recovery Team was assisted by many individuals and groups. We would like to acknowledge non-government and academic biologists and managers for increasing our knowledge and their dedication to caribou conservation. Many Aboriginal people and communities have contributed traditional knowledge that aided our understanding of caribou, which supports recovery of the species. The Eastern Manitoba Woodland Caribou Advisory Committee, Northeast Woodland Caribou Advisory Committee, and Northwest Region Woodland Caribou Research and Management Committee helped with program development, provided input on management strategies and collected data on boreal caribou throughout the province. We also acknowledge the financial support of the Province of Manitoba, through the Endangered Species Biodiversity Fund, the Government of Canada, through the Habitat Stewardship Program, and all of the industrial, community resource management boards, and academic partners. Without their assistance, we would not have such an expansive data set on boreal caribou across Manitoba. Lastly, we acknowledge the many valuable comments received through the internal and public review processes that have been helpful in improving the strategy.

GLOSSARY

Aboriginal: Canada's *Constitution Act, 1982* refers to all Indian, Inuit and Metis people in Canada as Aboriginal people.

Anthropogenic: Caused or produced by humans.

Boreal Caribou: The boreal ecotype of woodland caribou occurs within the boreal forest of Canada. These non-migratory caribou form small aggregations throughout the year and disperse for solitary calving.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC): A committee made up of experts from academic, government and non-government organizations that assess species at risk across Canada.

Core Use Area: An area of concentrated use determined by kernel density analysis of location data.

Critical Habitat: The area within the boundary of boreal caribou ranges that:

- provides an overall ecological condition that allows for an ongoing recruitment and retirement cycle of habitat
- maintains a perpetual state of a minimum of 65 per cent of the area as undisturbed habitat
- provides for the habitat characteristics that are required by caribou to carry out life processes (Environment Canada 2012)

Cumulative Disturbance Effects: The combined effects of anthropogenic (forestry, mining, hydro electric development, etc.) and natural (fire, wind, disease, etc.) disturbance on a caribou range, which serve to reduce functional use of habitat by caribou or increase mortality.

Designatable Unit: A robust classification system for caribou that represents discrete and significant units that are irreplaceable components of Canada's caribou biodiversity (COSEWIC 2011).

Ecotype: A classification term within a species or sub-species that identifies a distinct group that is adapted to specific landscapes or environments as expressed primarily by calving behaviour, movements and feeding behaviour (modified from Thomas and Gray 2001).

Endangered: A species facing imminent extinction or extirpation (COSEWIC 2011).

Kernel Density Analysis: A statistical method used to calculate home range or core use areas using location data (ex: GPS collar data). Densities of locations indicate the approximate percentage of locations that occur in a given area. For example, a 70 per cent kernal represents 70 per cent of the locations occur within the boundary that has been calculated.

Lambda: Population growth rate over time.

Local Populations: A group of caribou occupying a similar location during the same time period; the most basic unit of conservation and management (Thomas and Gray 2001).

Management Unit: A geographical land base within which one or more caribou ranges will be managed in combination for population sustainability, connectivity and habitat goals.

Management Unit Action Plan: A document that will provide direction and information on recovery and management measures within individual management units. It provides details on implementation of the action plan with the goal of achieving or maintaining self-sustaining populations.

Minimum Convex Polygon: A method for defining a geographical range that completely encloses all location data by connecting the outer most locations create the smallest area where an animal has been recorded.

Range: The current geographic area of contiguous suitable habitat occupied over the last 10 years by a local population.

Recovery: In the context of species at risk conservation, recovery is the process by which the decline of an endangered, threatened or extirpated species is stopped or reversed, and threats are removed or reduced to improve the likelihood the species will persist in the wild. A species will be considered recovered when its long-term persistence in the wild has been secured (National Recovery Working Group, 2005).

Recovery Habitat: A geographic area that contains important life requisite habitat components (ex: calving/nursery areas, wintering areas, rutting areas) that are required to maintain self-sustaining populations. It may include currently unoccupied areas that may be required to provide future habitat and ensure that populations can be maintained as self-sustaining into the future.

Recruitment: Occurs when juveniles survive to be added to the adult population.

Self-Sustaining Population: A population with stable or positive population growth over 20 years (short-term), large enough to persist over 50 years (long-term) and withstand random environmental effects, all without ongoing active management (Environment Canada 2011).

Subspecies: The biological classification that ranks immediately below a species.

Threatened: A species likely to become endangered if limiting factors are not reversed (COSEWIC 2011).

Traditional Knowledge: Traditional knowledge is the understanding by Aboriginal people of their relationship to the earth and the universe, and the knowledge inherent within that relationship.

Vulnerable: Now referred to as special concern, a species that is of special concern because of characteristics that make it particularly sensitive to human activities or natural events (COSEWIC 2011). A species likely to become threatened if limiting factors are not reversed.

EXECUTIVE SUMMARY

The boreal population of woodland caribou herein referred to as boreal caribou, was assessed as threatened in 2002 by the Committee on the Status of Endangered Wildlife in Canada and listed as threatened under the federal *Species At Risk Act* in 2003. Manitoba listed boreal caribou as threatened in 2006 under *The Endangered Species Act*.

This recovery strategy is an update to Manitoba's Conservation and Recovery Strategy for Boreal Woodland Caribou 2006. Since the release of the 2006 strategy, GPS collaring and genetic monitoring programs have been used on the majority of boreal caribou ranges in Manitoba. As a result, an extensive database has been created allowing for an increased number and greater precision of caribou range boundaries being delineated, a greater understanding of the how caribou are using the landscape and how individual populations are genetically related.

Caribou populations can be negatively affected by the cumulative effects of various factors including:

- habitat destruction or alteration caused by, but not limited to, forest fires, forest harvesting and mineral exploration
- habitat fragmentation caused by linear development of roads, trails and transmission lines
- increased access for predators
- caribou harvesting
- disease

All of these factors can occur at various geographical scales, including scales that are larger than a single boreal caribou range. For this reason, this recovery strategy identifies the need for conservation and management strategies to be developed for individual populations at multiple spatial scales across the landscape to allow for Manitoba's caribou ranges to remain self-sustaining.

Nine management units were defined within the provincial extent of boreal caribou and 15 individual caribou ranges have been identified within them. Conservation status assessments were completed on all management units. Five management units rank as high, two as medium and two as low conservation status. Implementing the recovery strategy will include increasing habitat protection for boreal caribou as well as enhancing efforts for monitoring caribou to improve our understanding of caribou range occupancy and abundance for better decision-making.

The strategy outlines management initiatives in six key areas:

1) management unit planning
2) habitat planning
3) population monitoring
4) management of other species
5) stewardship and outreach
6) legislation and policy

This recovery strategy provides a new framework for development and implementation of boreal caribou action plans along with greater transparency in caribou recovery planning. Action plans will be developed for all management units within the next four years, with plans being developed by 2016 for management units assessed as high conservation status. Manitoba will work with committees that will support the development of action plans.

TABLE OF CONTENTS

SPECIES STATUS

Common Name:
Boreal woodland caribou

Scientific Name:
Rangifer tarandus caribou

Provincial Assessment (MESAC):
Endangered - September 1994

Provincial Listing (MESA):
Threatened - April 2006

Federal Assessment (COSEWIC):
Threatened - 2002

Federal Listing (SARA):
Threatened - 2003

1. INTRODUCTION

The purpose of this recovery strategy is to provide a framework for the development and implementation of boreal caribou action plans. The recovery strategy will be progressively refined and updated as our knowledge of boreal caribou increases.

The Western Canadian population of boreal woodland caribou (*Rangifer tarandus caribou*) was declared a vulnerable species in April 1984 by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Kelsall, 1984). In May 2002, the status of woodland caribou in Canada, excluding all forest-tundra populations, was reassessed as threatened by COSEWIC. In 2003, boreal woodland caribou was listed as threatened under Canada's *Species at Risk Act* (SARA). In September 1994, the Manitoba Endangered Species Advisory Committee assessed the status of the boreal woodland caribou in Manitoba as endangered. In 2006, the population was listed under *The Endangered Species Act* of Manitoba as threatened. The forest-tundra ecotype of woodland caribou, including the Pen Island and Cape Churchill ranges, were excluded from this listing.

National and provincial assessments concluded that major threats to boreal woodland caribou, here referred to as boreal caribou, were habitat loss, degradation and fragmentation. Further, as boreal caribou depend upon mature and old-growth forest habitats (Darby *et al.*, 1989), they are considered an indicator species that reflects the quality and health of the ecosystems they inhabit (Thomas and Gray, 2002).

Caribou management efforts and monitoring projects have occurred within Manitoba for over 40 years and have been instrumental in survival of the species. The intent of these efforts has been to enhance the knowledge base for the species, to generate baseline data for furthering our ability to mitigate development impact and to ensure the species remains as an integral component of Manitoba's wildlife mosaic. Significant input on management issues and core funding has been provided by partners on the Eastern Manitoba Woodland Caribou Advisory Committee, the Northeast Woodland Caribou Advisory Committee and the Northwest Region Woodland Caribou Research and Management Committee.

The challenges of implementing a recovery strategy, particularly on such a wide-ranging species, will be great. Challenges could be related to:

- forest management practices and adapting wood supply
- access control
- mining
- tourism and recreation
- routing of linear features (roads, transmission lines, rail lines)
- alternative management regimes for moose and white-tailed deer populations
- protection and management of large intact caribou habitats
- harvesting by Aboriginal people
- securing commitments for resources needed to monitor populations and evaluate and measure the success of management unit action plans

"TomorrowNow - Manitoba's Green Plan" is an eight-year provincial government action plan for environmental protection while ensuring a prosperous and environmentally conscious economy. It includes a commitment to develop a Boreal Plan to ensure the sustainability of northern forests and species that depend on it such as the boreal caribou. An important part of the Boreal Plan is this caribou recovery strategy which addresses four fundamental themes:

1) to develop action plans for all boreal caribou ranges
2) to engage Aboriginal people, environmental groups, industry and stakeholders in boreal caribou conservation
3) to increase habitat protection for boreal caribou
4) to enhance monitoring efforts for boreal caribou

This strategy provides a framework for the conservation of boreal caribou and its habitat in Manitoba. It replaces Manitoba's Conservation and Recovery Strategy for Boreal Woodland Caribou 2006.

2. SPECIES ECOLOGY

2.1 Designatable Unit Classification Under COSEWIC

Boreal caribou in Manitoba belong to the boreal population designatable unit (DU) 6 (COSEWIC 2011) (Figure 1). DU6 (boreal population) extends from Labrador to British Columbia, into the northeast corner of the Yukon, and south to Lake Superior with some isolated populations in central Quebec. DU6 is considered distinct based on unique antler formation, behavior and pelage (COSEWIC 2011).

Boreal caribou are genetically different from other DUs in Canada because annual range overlap only occurs during winter when there is no chance of genetic exchange. Boreal caribou are the only caribou ecotype found exclusively in the boreal ecoregion on a year-round basis and populations have developed dispersal, aggregation and migration strategies that increase survival of not only adults but also calves (COSEWIC 2011).

During the calving and summer periods, females are generally solitary, and space away from one another to reduce predation risk. For the remaining periods of the year, boreal caribou form mixed-sex groups of around 20 caribou. Calving activities of individual female boreal caribou are more independent than migratory tundra caribou (DU3 and DU4), and are co-ordinated with respect to timing, but not in space (COSEWIC 2011). Boreal caribou make their longest movements during spring and early winter, and are most dispersed and the least mobile during the calving season and late winter. The year-to-year location of their winter ranges can be variable, however females have fidelity to general calving areas, if not specific sites (COSEWIC 2011).

Although they do share a common ancestor with DU4 (eastern migratory) caribou, the different behaviours demonstrated by these two groups reflects a separation into two ecotypes (forest-dwelling and forest-tundra) following re-colonization of regions uncovered by retreating glacial ice. It is the adaptation of a dispersed calving strategy that separates boreal caribou from caribou of DU3 (barren-ground caribou) and DU4, with which they have some annual range overlap (COSEWIC 2011).

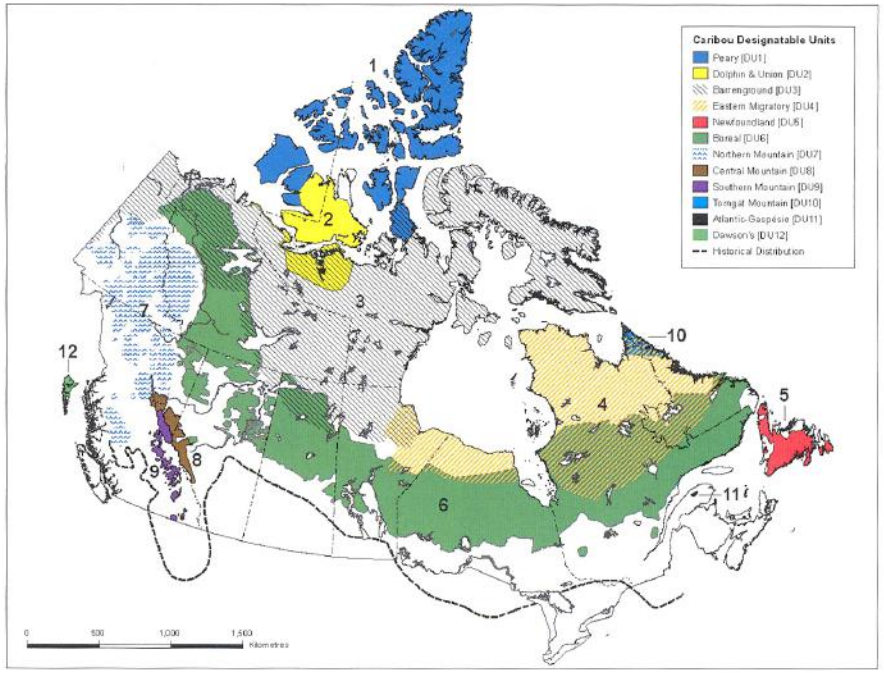

Figure 1. Designatable Units of Caribou in Canada (COSEWIC 2011).

2.2 Physical Description

Boreal caribou are a medium-sized (100-250 kg) subspecies of caribou belonging to the deer family (Cervidae) (Thomas and Gray, 2002). Their coat is brown with a white neck, mane and rump. Caribou are the only cervid in which both males and females have antlers. Their large crescent-shaped hooves provide support for walking on snow or moist peat. Hooves are also used to dig through the snow for lichens and other ground forage (Kelsall, 1984). This subspecies of caribou inhabit the boreal forest and are usually larger and darker than other subspecies and ecotypes (Thomas and Gray, 2002).

2.3 Manitoba Distribution and Population Size

The historical distribution of boreal caribou in Manitoba was from the Manitoba/Minnesota border in southeastern Manitoba to approximately 57 degrees north latitude (Seton, 1909; Banfield, 1961). Caribou no longer occur south of the Winnipeg River in southeastern Manitoba. Recent aerial surveys southeast of the Porcupine Mountains in western Manitoba (Swan-Pelican) indicate caribou no longer occur in this area (Figure 2). Local knowledge in addition to substantial GPS collar data and updated survey information has resulted in modifications to the northern boundary. This boundary represents the currently understood transition between barren-ground and boreal caribou in the northwest and forest-tundra and boreal caribou in the northeast.

Surveying boreal caribou populations is difficult due to their clumped distributions and natural low densities across the landscape (Bradshaw and Hebert, 1996; Thomas, 1998). Most literature on boreal caribou in Manitoba refers to individual caribou herds or ranges. For example, Johnson (1993) suggested there were 27 distinct herds province-wide with an estimated population of 2,000 animals (Crichton, 1992). Subsequent investigations have shown that this estimate is likely low due to the difficulty in using aerial surveys to census caribou. In 2006, Manitoba's boreal caribou population estimate was between 1,500 and 3,100 animals (Manitoba Conservation, 2006). The estimate represented a best approximation based on combining minimum counts or estimations of local populations within Manitoba. This estimate is not the product of systematic surveys, therefore is likely an underestimate of the actual population size.

Because surveying caribou populations is complicated, increased efforts will be made to develop and use methodologies that will provide minimum population estimates and measures of population health for all caribou populations in Manitoba.

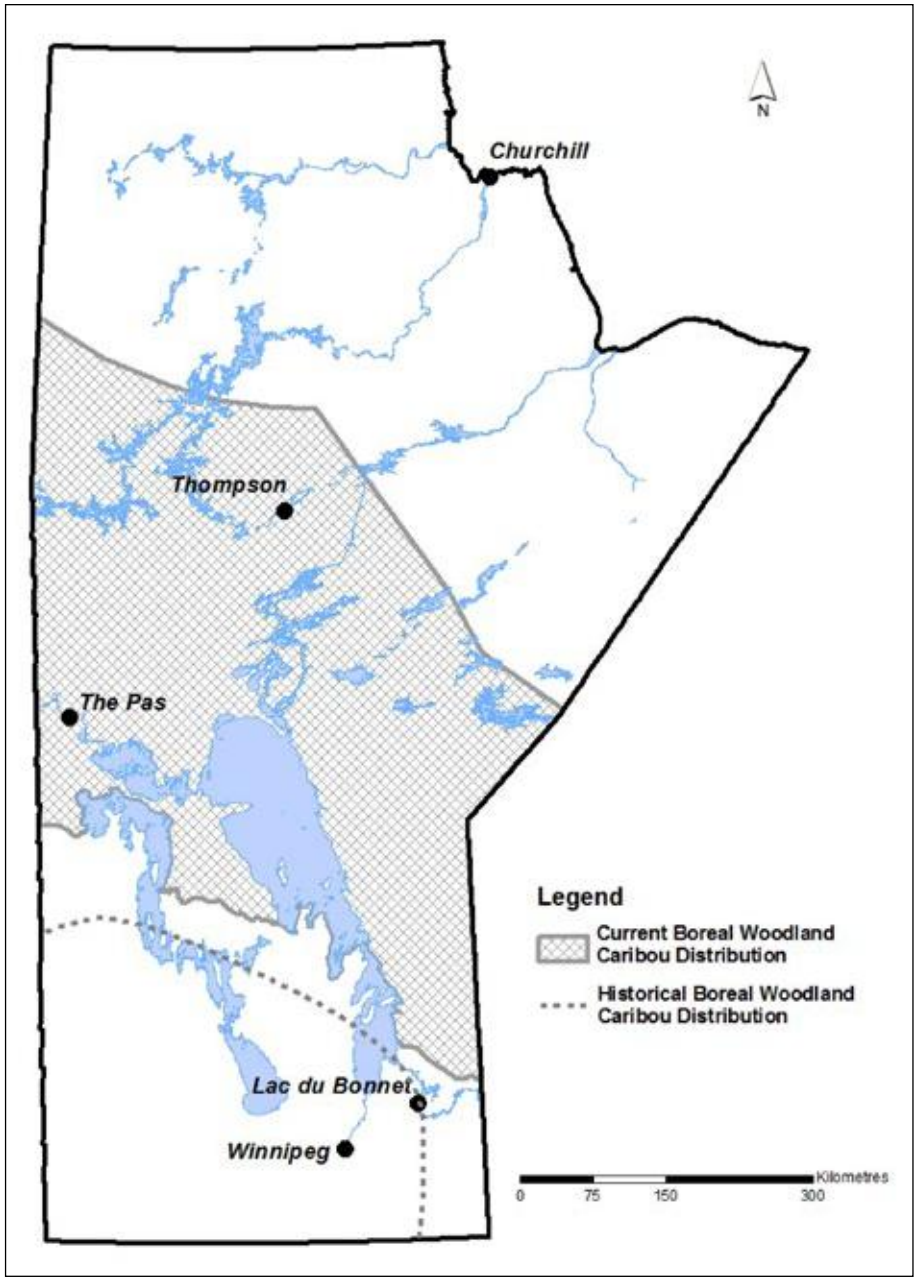

Figure 2. Historical[1] and Current Boreal Caribou Distribution in Manitoba.

[1]Historical distribution based on Johnson, 1993.

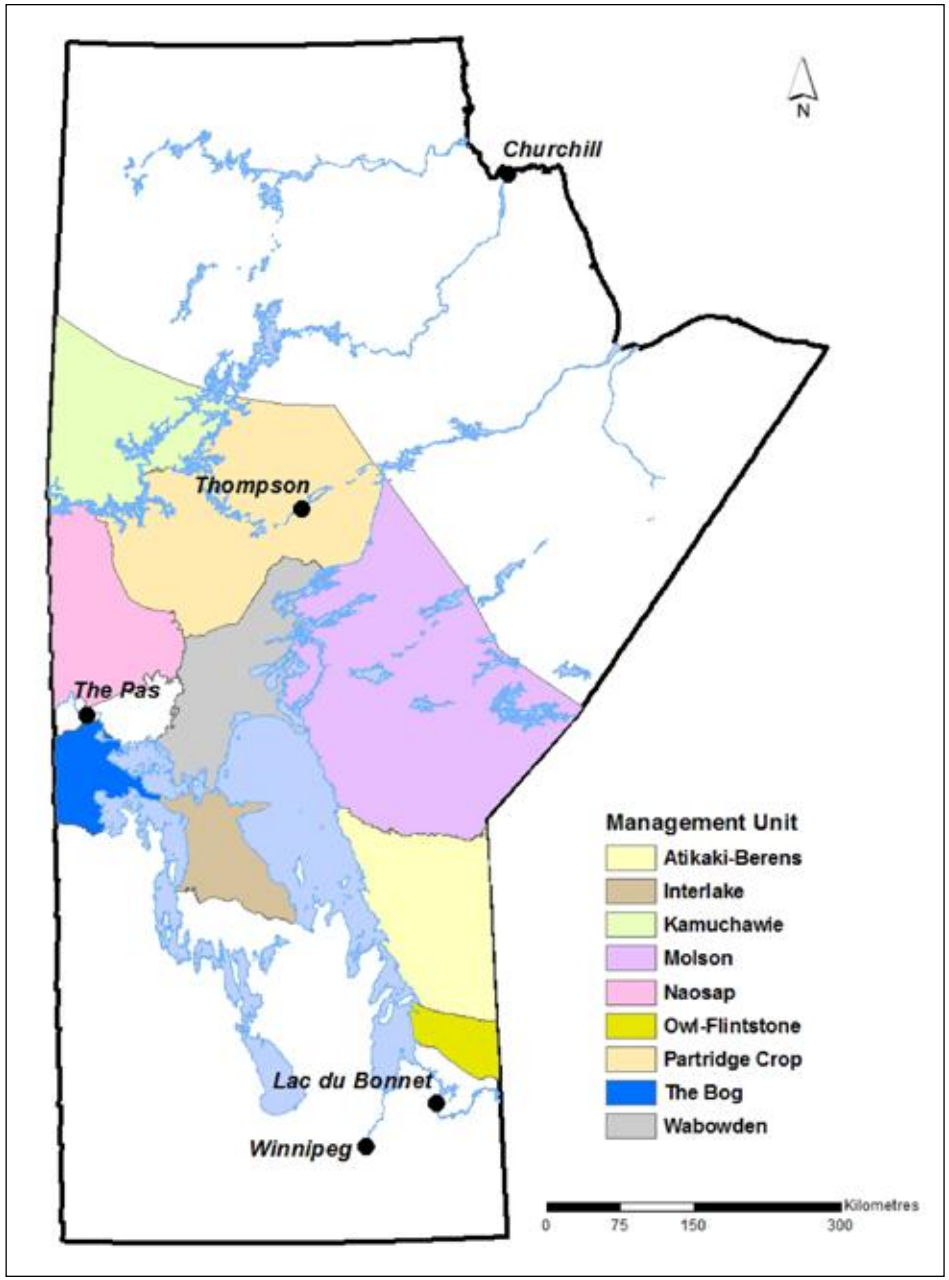

Figure 3. Management Units[1] for Boreal Caribou in Manitoba.

[1]Justification for delineating management units can be found in Appendix B.

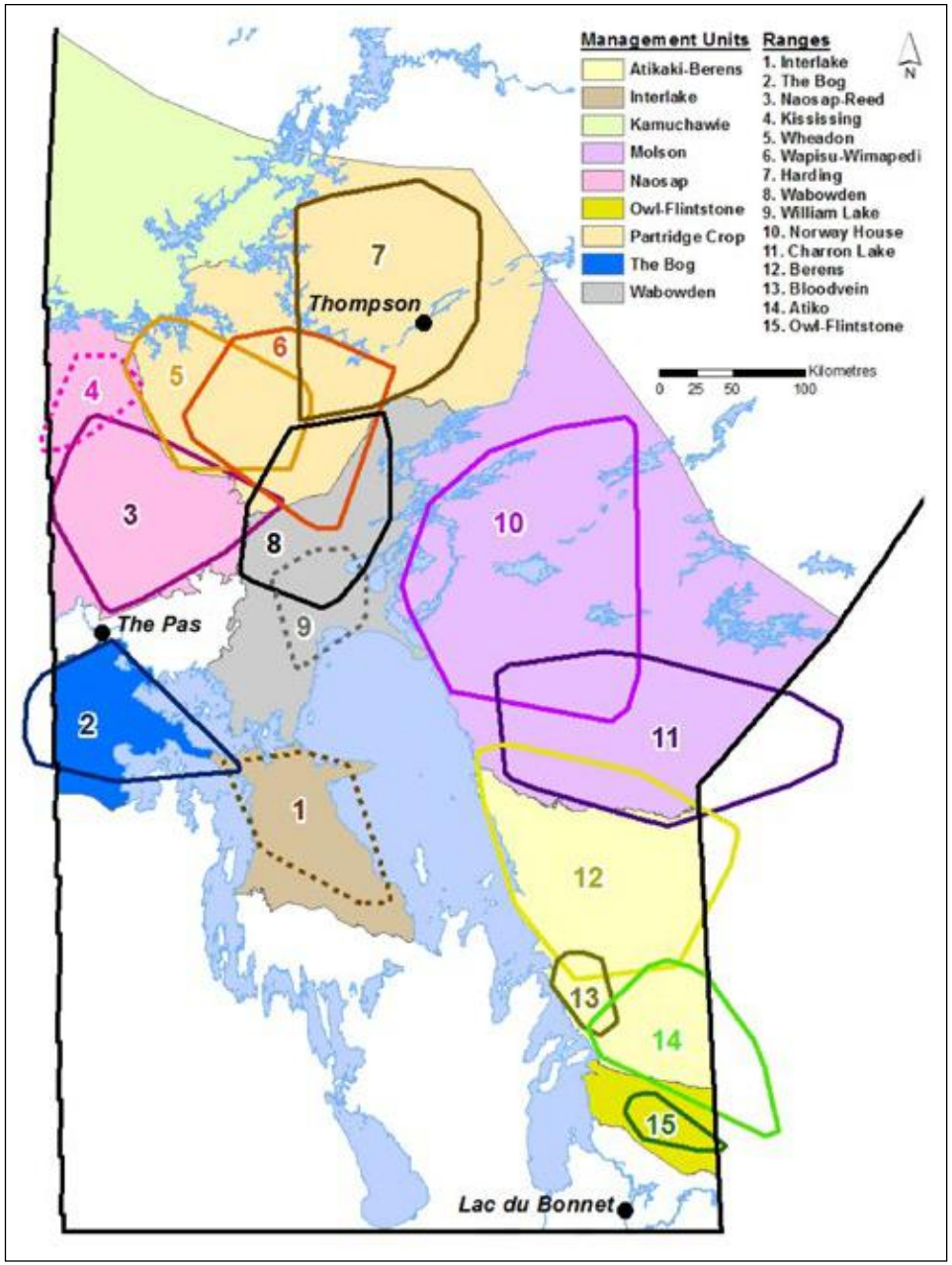

Figure 4. Delineated Boreal Caribou Ranges[1] within Management Units in Manitoba.

[1]*Justification for delineating range boundaries can be found in Appendix B.*

2.4 Habitat Requirements

Boreal caribou have distinct habitat requirements at different scales (Rettie and Messier, 2000). The selection of habitat by boreal caribou at multiple scales reflects strategies used to offset low populations numbers and reproductive rates by maintaining low levels of predation. At the coarse scale, habitat selection enables predator avoidance with boreal caribou selecting for peat land complexes intermixed with mature (60 to 80 year old) pine, black spruce and tamarack-dominated upland (Bergerud, 1974; Carbyn, 1968; Darby, 1978, 1979; Rettie and Messier, 1998; Shoesmith and Storey, 1977; Stardom, 1977). At the fine scale, habitat is selected to meet forage requirements (Stuart-Smith *et al.*, 1997), with caribou selecting habitat having abundant arboreal and terrestrial lichens in winter, and making use of habitats containing more varied food sources such as leaves of deciduous trees, sedges, pitcher plants and mushrooms, during summer. Because of these preferences, they generally inhabit lichen-rich areas of the boreal forest (Hristienko, 1985).

At the coarse scale, large tracts of undisturbed habitat are required (Rettie and Messier, 2000; Brown *et al.*, 2003). Such habitat reduces predation risk in several ways. First, boreal caribou require sufficient space to spread out within the landscape, thereby maintaining themselves at low densities, which reduces the hunting efficiency of predators (Bergerud, 1980; Bergerud *et al.*, 1984). Second, large expanses enable caribou to select habitats with low densities of moose and white-tailed deer, which normally form the primary prey species for wolves, and thereby are associated with lower wolf densities and less likelihood of wolf encounters (Bergerud and Page, 1987; Seip, 1992). Finally, relatively undisturbed habitats enable avoidance of linear developments like roads and power lines that increase the hunting efficiency of predators and people (James and Stuart-Smith, 2000).

The suitability of the landscape is not only determined by the amount of habitat available but also by the spatial configuration of areas of preferred habitat, particularly in fragmented landscapes (O'Brien *et al.*, 2006). The spatial heterogeneity of Manitoba's boreal forest, driven primarily by fire, generally precludes the existence of large contiguous areas of mature forests within caribou ranges. This necessitates the need for focusing on seasonal use areas (ex: smaller scales) of suitable habitat and ensuring that connectivity is maintained between these areas (ex: habitat fragmentation is minimized). Seasonal use habitats essential to securing the persistence of boreal caribou in Manitoba's wildlife mosaic include winter and summer foraging, calving and calf-rearing, rutting and migration corridors capable of providing thermal cover and escape from predation.

2.5 Limiting Factors and Threats

Threats and limiting factors of boreal caribou in Manitoba are interrelated; however, predation is generally accepted as the proximate limiting factor (Bergerud, 1988). To decrease predation risk, boreal caribou occur at low densities on the landscape (Cumming and Beange, 1993; Bergerud and Page, 1987) and avoid areas where other ungulate densities are high (Bergerud and Page, 1987). As such, caribou require large tracts of intact suitable forest to persist on the landscape. Elevation in predation rates above naturally occurring levels poses a direct threat to boreal caribou populations.

Boreal caribou are threatened by anthropogenic and natural disturbances that cause habitat loss, degradation or fragmentation, which in turn can increase predation rates. Anthropogenic disturbances affecting boreal caribou include industrial developments such as logging, mining and construction of linear features (Thomas and Gray, 2002). Various studies have demonstrated that boreal caribou avoid the vicinity of industrial and other human developments, even when forest habitat conditions adjacent to these developments are otherwise suitable (Ontario Woodland Caribou Recovery Team, 2008, Mahoney and Schaefer 2002, Dyer *et al.*, 2002) resulting in functional habitat loss. Natural disturbances such as wildfires, windstorms and forest disease are part of the natural cycle, but pose threats where habitat is already limiting or human activities have altered or affected natural cycles. Additional threats in the future may include those caused by global climate change, such as range expansion of forest insects, increase in ungulate parasites, and increased frequency and numbers of wildfires. Fires are a natural component of the boreal forest ecosystem. They play an essential role in the evolution of natural habitats at natural frequencies over protracted time scales (Dunford, 2003), but destroy lichens and other vegetation in the short term. Boreal caribou selection for mature forests means burned areas are avoided for 50 years or more following a fire (Thomas and Gray, 2002). Boreal caribou have evolved to coexist with fire if suitable habitat is available in adjacent areas (Schaefer and Pruitt, 1991).

These threats are interrelated in complex ways and have cumulative direct and indirect impacts on caribou and their habitat. For example, habitat changes can increase the carrying capacity for cervids such as moose and white-tailed deer, which may result in increased predator populations and subsequently increased predation on caribou. Roads and other linear corridors with packed winter trails and off-road vehicle trails for recreational or other uses can enhance access to caribou habitats by both predators and white-tailed deer, thereby facilitating predation and the spread of potentially lethal parasites and diseases.

Boreal caribou habitat is dynamic and what is unsuitable habitat today may be suitable in the future as the forest matures and changes. Appreciation of these dynamics offers opportunities to work with fire management and forestry in an adaptive process that assists in cycling habitat through natural regeneration and silvicultural processes. Ensuring that landscape level forest harvesting and silvicultural planning occurs may provide opportunities to maintain a landscape suitable for caribou on a rotational basis. Such concepts need to be further investigated to learn if regenerated habitat in Manitoba will be functional as caribou habitat.

3. RECOVERY

3.1 Scope and Scale of the Recovery Strategy

Manitoba's recovery strategy provides broad policy and a provincial planning framework for the recovery and management of boreal caribou across their distribution in Manitoba (Figure 2 on page 6). Planning will ensure that both spatial and temporal components are considered in management unit action plans, which will also incorporate planning for local ranges, based on the guiding principles outlined in section 3.5.

3.2 Links to the National Boreal Caribou Recovery Strategy

In October 2012, Environment Canada posted the final version of the national boreal caribou recovery strategy. The national strategy contains broad strategies and general approaches that would help achieve boreal caribou population and distribution objectives identified by Environment Canada. Provinces and territories have the primary responsibility for management of lands, natural resources and wildlife. As such, the national strategy provides guidance for range action planning to be undertaken by provinces and territories. The successful recovery of boreal caribou will require collaboration and co-operation of provincial and federal governments in implementing strategies and approaches that are set out in both provincial and federal recovery strategies. The actions required to maintain or recover boreal caribou populations will be determined and managed by responsible provincial and territorial jurisdictions (Environment Canada, 2012).

Manitoba has committed to developing management unit action plans as part of the province's caribou recovery planning framework. Provinces and territories have agreed to complete action plans within three to five years of the posting of the national strategy. Action plans will describe how both federal and provincial strategies will be applied, outlining measures to manage boreal caribou populations, protect habitat and provide for the dynamic habitat requirements of caribou across their range.

This recovery strategy incorporates the most current data and management strategies being utilized in the boreal caribou recovery effort in Manitoba. As such, information shown in the national caribou strategy relating to Manitoba may not be current (ex: range boundary delineations). Upon posting of the final provincial recovery strategy, Manitoba will share updated information with Environment Canada to ensure that it is incorporated into revised versions of the national strategy.

3.3 Recovery Feasibility

The recovery of boreal caribou across all management units in Manitoba is considered both biologically and technically feasible. However, management units with local ranges that are currently isolated from neighbouring ranges (ex: Interlake) are at greater risk.

Many management units in Manitoba have a sufficient quantity of suitable habitat to support self-sustaining caribou populations. For those management units where sufficient suitable habitat is currently limited, habitat restoration can theoretically be achieved through resource and land use planning and dynamic habitat management (including fire suppression) in order to achieve a functional future forest condition suitable for boreal caribou.

By building on existing partnerships with industry, Aboriginal governments, non-government organizations and academia, the recovery of boreal caribou will be enhanced.

3.4 Recovery Goals

1. Self-sustaining populations of boreal caribou across all management units in Manitoba.
2. Management and protection of caribou habitat to sustain boreal caribou populations within Manitoba.

3.5 Recovery Objectives

1. Maintain local populations that are currently self-sustaining and promote recovery of local populations that are currently not self-sustaining.
2. Conserve large intact boreal caribou habitat at a coarse scale and increase boreal caribou habitat to ensure that sufficient habitat quality and quantity (in appropriate spatial and temporal distributions) exists across all management units to support self-sustaining local populations and habitat connectivity within and between local ranges and management units.
3. Where required, reduce or mitigate direct threats that have an impact on the survival of boreal caribou populations.
4. Increase understanding of boreal caribou ecology, threats and survival. Address major knowledge gaps by undertaking additional research and monitoring activities and traditional knowledge studies.
5. Increase outreach, communication and collaboration with governments, non-government organizations, Aboriginal people, industry, academia and the public.
6. Take steps to restore boreal caribou populations to their historical distribution where feasible.

3.6 Guiding Principles

Ecosystem management: Maintaining the structure and function of the boreal forest ecosystem is essential for the long-term recovery of boreal caribou and other species. We must address the cumulative effects of all factors negatively affecting boreal caribou, their use of habitats and their survival.

The precautionary principle: There is a need to err on the side of caution when dealing with boreal caribou conservation measures since unknown factors and interactions among these may have negative impacts. While the best available information should guide management decisions, a lack of information or scientific uncertainty should not delay actions deemed essential to achieving boreal caribou recovery.

Adaptive management: Use new information, knowledge and technologies to continually improve research programs, management and conservation practices.

Sustainability: Develop recovery strategies that ensure the long-term persistence of boreal caribou across the landscape. Action plans resulting from this recovery strategy will strive to ensure that the needs of boreal caribou are met and that human development is sustainable.

Commitment to boreal caribou maintenance: All land-users within boreal caribou management units in Manitoba, including government departments, Crown corporations, industry and Aboriginal people, share responsibility for and must be committed to the goals of this recovery strategy. Commitment and action by all parties is essential to meeting the recovery goals for boreal caribou in Manitoba.

3.7 Aboriginal People and Boreal Caribou

For thousands of years, boreal caribou have held cultural, spiritual, social and subsistence significance for many Aboriginal communities across Manitoba. Aboriginal people have a close relationship with the land and have knowledge of boreal caribou and other species within the boreal forest.

Manitoba is committed to engaging Aboriginal communities in boreal caribou recovery and conservation efforts through partnership opportunities in monitoring programs, recovery action planning and by ensuring traditional knowledge is woven throughout the entire process. Over the past 10 years, Aboriginal communities have participated on regional caribou committees and on various monitoring projects.

4. RECOVERY ACTIONS TO ENHANCE BOREAL CARIBOU CONSERVATION

Boreal caribou have come to represent the wild things and places that people across Canada want to protect. The continued persistence of boreal caribou across the landscape is an indicator of boreal forest health. To ensure the long-term persistence of boreal caribou across the boreal forest in Manitoba, a comprehensive and integrated provincial approach is required. Manitoba will employ landscape-level planning in its efforts to recover and sustain boreal caribou.

The purpose of recovery actions in this section are to:

- outline initiatives that will support boreal caribou recovery
- outline the broad actions the Manitoba government intends to take with respect to the protection and recovery of boreal caribou across the province
- provide a common approach to caribou recovery planning

4.1 A Framework Based on Management Unit Planning Approach

1. **Implementing a planning framework**
   Manitoba will implement a planning framework for managing boreal caribou using both management units and local ranges as the basis for evaluating habitat condition, assessing cumulative impacts and estimating population size and trends. Implementation of this framework provides the spatial and ecological context for current and future planning and management.
2. **Refining boundaries**
   Management unit and range boundaries will be refined as new scientific information and traditional knowledge becomes available. The approaches and criteria used to define management unit and range boundaries will be described in the individual management unit action plans.
3. **Assessing management units**
   Management unit assessments will be conducted on all units across Manitoba and will be included in associated management unit action plans. Management unit assessments will evaluate cumulative disturbance effects, population viability, habitat composition and structure, and future caribou habitat conditions.
4. **Developing action plans**
   By 2018, Manitoba will develop management unit action plans that will incorporate known local ranges. Priority planning will be given to management units that have been ranked with a high conservation status. Management unit action plans will be developed for high status units by 2016.
5. **Working together**
   Manitoba will work with Aboriginal governments, Ontario, Saskatchewan and Environment Canada to ensure effective and co-ordinated management and conservation of boreal caribou within management units and local ranges that border or cross jurisdictional boundaries.

4.2 Habitat Planning and Management

1. **Protecting habitat**
   Manitoba will prepare land use guidelines applicable to all development proposals and activities within caribou management units to ensure sufficient habitat is protected. The guidelines will also inform other provincial policies that address resource or recreational developments and Crown land use.
2. **Managing habitat quality, quantity and location**
   Manitoba will manage the quality, quantity and location of caribou habitat within caribou ranges, and across management units by managing at multiple spatial scales to meet habitat requirements and ensure cumulative effects are addressed in the planning process. Where habitat is sufficient to support self-sustaining populations, the goal will be to maintain the existing quantity, quality and distribution of habitat. Where habitat is insufficient, the goal will be to increase the quantity, quality and appropriate distribution of habitat.
3. **Developing access guidelines**
   Manitoba will develop policy guidelines to provide direction for decommissioning and removal of resource access roads in caribou ranges where necessary and feasible.
4. **Forest management planning**
   Using caribou habitat landscape planning guidelines, Manitoba will ensure that protection and forest management planning supports conservation of large suitable areas of caribou habitat through the development of dynamic caribou habitat plans within management units along with large core areas where forestry does not occur. Forest management planning must provide for a sufficient amount and arrangement of currently suitable habitat and future habitat. Forest planning will include silvicultural initiatives that may be effective at renewing caribou habitat, scheduling of harvest and deferrals, science-based modeling and precautionary planning in a dynamic caribou habitat schedule.
5. **Maximizing habitat protection**
   Parks, protected areas and other regulated land use planning initiatives (ex: *The East Side Traditional Lands Planning and Special Protected Areas Act*) within management units and caribou ranges will be considered for their contributions to habitat protection and will be included as components of a broad landscape approach to caribou conservation. Manitoba will ensure that caribou conservation and recovery planning is incorporated into management planning for all parks, protected lands and land use planning initiatives within the current distribution of boreal caribou.
6. **Including fire management strategies**
   Caribou conservation will be incorporated into fire management strategies and planning to address important elements of habitat that require protection and to manage fire to provide future caribou habitat where feasible.
7. **Identifying recovery habitat**
   Manitoba is committed to the identification and protection of boreal caribou recovery habitat within caribou management units and ranges across Manitoba. Where recovery habitat identification has not been completed, Manitoba will develop a schedule of analyses that will outline the steps required to identify recovery habitat. Recovery habitat, or a schedule of analyses to define recovery habitat, will be documented in individual management unit action plans.
8. **Ensuring habitat and genetic connectivity**
   Through landscape level boreal caribou habitat planning, Manitoba will ensure both habitat and genetic connectivity between management units and ranges, promoting genetic diversity and self-sustaining populations.

4.3 Population Monitoring and Management

1. **Improving population monitoring**
   Manitoba will enhance population monitoring programs to improve our understanding of caribou distribution, abundance and trends in response to anthropogenic and natural disturbances.
2. **Standardizing monitoring**
   Manitoba will develop and implement a standard provincial caribou monitoring program to provide updated data for boreal caribou across the province. This will include the development of standards and protocols for population estimate and demographic surveys.
3. **Developing population indicators**
   Manitoba will continue to monitor caribou populations and collect data that will support management unit and range assessments, including development of population indicators that would signal the need for a change in management actions.
4. **Investigating mortality factors**
   Manitoba will continue to monitor causes of caribou mortality and investigate factors influencing mortality rates, survivorship and persistence of boreal caribou populations.

4.4 Management of Other Wildlife Species

1. **Considering other ungulates**
   Manitoba will continue to assess the relationship between caribou and other ungulate prey species to support the development of management objectives for all ungulate species within boreal caribou management units.
2. **Managing predator populations**
   Manitoba will manage predator and alternate prey species (ex: moose, wolf and white-tailed deer) within boreal caribou management units primarily through habitat management. This will maintain natural boreal caribou densities and meet specific recovery goals and objectives. Population control measures will only be considered as a last resort when there is certainty that caribou populations are in serious decline and when these efforts will increase caribou survivorship and population stability.
3. **Reviewing population control**
   Manitoba will research and develop indicators that will guide the need for population control measures of predators and other ungulate species within caribou ranges.

4.5 Stewardship and Outreach

1. **Reporting**
   Manitoba will develop a boreal caribou science review and status report describing progress made towards recovery actions and commitments made in this recovery strategy. This report is expected by 2019 and will include population and habitat assessments for all management units in Manitoba, using the best available information.

2. **Public partnerships**
   Manitoba is committed to public involvement in monitoring and research projects through partnerships with academia, industry, government and non-government agencies. Results and data sharing will lead to improved understanding of boreal caribou ecology and improved recovery planning through a co-operative and adaptive management approach.
3. **Industry/community partnerships**
   Manitoba will continue to work with resource industries (ex: forestry, mineral exploration and renewable energy) and communities to increase awareness of boreal caribou and the need to include appropriate caribou mitigation measures as a component of resource development plans.
4. **Committee support**
   Manitoba will continue to support boreal caribou conservation efforts of regional caribou advisory committees through capacity building and funding initiatives.
5. **Education and outreach**
   Manitoba will continue to promote boreal caribou conservation and recovery to the public, Aboriginal peoples and industry through outreach, engagement, sharing of information and educational materials.

6. **Communication**
   Manitoba will continue ongoing communication with other government departments to foster co-ordinated policies that incorporate caribou conservation requirements in resource development activities.
7. **Provincial boreal caribou committee**
   Manitoba will establish a provincial boreal caribou committee to guide implementation of this recovery strategy and to co-ordinate development of action plans. The committee will provide provincial-level advice to government on boreal caribou recovery planning in Manitoba. Members will offer professional, technical and traditional experience and knowledge related to caribou ecology, forest ecology, conservation biology and forest management.
8. **Inter-jurisdictional cooperation**
   Manitoba recognizes that some management units and caribou ranges extend across provincial boundaries. Therefore, Manitoba is committed to working with Ontario, Saskatchewan and Aboriginal governments to share information and to ensure that the management of shared caribou populations is co-ordinated and leads to the continued persistence of boreal caribou populations that cross jurisdictions.

4.6 Legislation and Policy

1. **Legislative tools**
   Manitoba will review existing legislation and regulation, and develop new legislative tools as required to strengthen protection for boreal caribou and enhance habitat management across the boreal forest.
2. **Land use planning**
   Manitoba will ensure incorporation of boreal caribou conservation concerns in land use planning initiatives across the province.

5. MANAGEMENT UNIT PLANNING AND ASSESSMENT APPROACH

Manitoba Conservation and Water Stewardship supports an adaptive, landscape-management approach to the recovery of boreal caribou using the precautionary principle. Across Manitoba, the provincial distribution of boreal caribou has been divided into nine management units that represent geographic areas within which local caribou ranges exist (Figure 3 on page 6). Management unit delineations use data from collaring programs across Manitoba's caribou distribution and encompass known breeding aggregations of boreal caribou, or groups of aggregations whose movements demonstrate the potential for ongoing genetic exchange.

Management units (Figure 3 on page 6) contain local caribou populations or ranges that require planning and management approaches to ensure the persistence of caribou ranges on a landscape scale. Units must provide all their life history requirements. However, resource management decisions are typically made at scales smaller than what is relevant for caribou (ex: forest stand, site, block, etc.). To achieve recovery, the sum total of small-scale decisions must leave a functional landscape such that the integrity of both the management unit and range is maintained.

A management unit planning approach provides a framework to maintain caribou by ensuring that the net outcome of cumulative resource management and land use planning decisions sustain sufficient quality, quantity and location of caribou habitats. Caribou ranges form the basis for identifying and evaluating habitat condition and assessing caribou population trends resulting in range-specific management decisions related to recovery habitat (Environment Canada 2011).

Under this planning framework, management unit action plans will provide management direction at two geographic scales:

1) management unit (coarse scale protection and management)
2) local range (finer scale protection and management)

At the scale of the management unit, management direction and guidelines will address:

- protection and management of large suitable intact caribou habitats
- habitat rotation/planning across the landscape
- habitat connectivity between local ranges
- cumulative impacts at the landscape scale
- providing guidance on fire management

At the local range scale, management will be more prescriptive by:

- identifying and conserving recovery habitat (core use areas – winter, summer, calving, breeding) to be protected
- establishing guidelines for managing access
- preparing management guidelines for development activities

Common between these scales will be management unit and range assessments that assess cumulative impacts leading to the establishment of disturbance thresholds that aid in meeting planning objectives.

Provincial management unit and range assessments provide for quantitative and qualitative analyses leading to overall statements of range conditions that consider caribou and their habitats. Specifically, assessments provide opportunities to analyze and interpret the state of caribou populations and habitats within ranges, and consider other ecological factors that may influence range condition. Management unit and range assessments will use the best available information to support management decisions in an adaptive management process.

5.1 Management Unit Action Plans and Implementation Priorities

The goals and objectives outlined in this recovery strategy are to develop action plans that report on management unit and range assessments and provide planning, protection and management directions for management units and the ranges within them. Management unit action plans will identify recovery targets, goals and recovery habitat, along with the spatial and temporal disturbance goals for individual management units and ranges. The development of management unit action plans will be enhanced through engagement with Aboriginal peoples, government jurisdictions, non-government organizations, industry and the public. Action plans evolving from this recovery strategy will strive to ensure that the needs of caribou are met and human developments and actions are sustainable. Draft action plans for the Owl-Flintstone and Atikaki-Berens management units have undergone expert and public review, but will require revision that will reflect comments received, as well as changes in management approaches that are outlined in this strategy.

Manitoba is committed to developing action plans for all management units within the province. Action plans will be reviewed and updated every 10 years. However, if a significant natural event occurs (ex: large wildfire) prior to the 10-year review, the related action plan may be re-evaluated. As part of the review process, the minister will prepare a report outlining the progress in meeting the established goals and evaluating the status and outcomes of each of the management initiatives outlined in action plans. The report will be prepared prior to the writing and release of updated action plans.

Recovery efforts will initially focus on management units ranked as high conservation status (Table 1 on page 20) with the target of completing these management unit action plans in order of conservation priority. Action plans for management units ranked with a medium and low conservation status will be completed subsequently.. Management unit action plans will embrace the principles of adaptive management, changing as new information is acquired. Conservation status has been assessed based on anthropogenic and natural disturbance, estimated population size and trend, and projected levels of future development.

5.2 Conservation Status Assessments

Conservation status assessments for a species provides insight as to whether the species is persisting and how likely the species is to become extirpated in the near future. Multiple variables are included when assessing conservation status. These include the number of individuals, the overall increase or decrease in the population over time (lambda), recruitment rates and known threats. Assessment variables used provide a consistent and rigorous methodology for assigning conservation status.

The final status assessment relies on information from all assessed variables, rather than any single one, to assign a rank. Where two or more variables are at extreme values, the management unit is assessed with a greater need for management measures compared to other units. Disturbance is recognized to play a key role in caribou persistence across the landscape, but it is not the sole influence on the ranking.

Although the status ranks are subject to ongoing review as new information is collected and mitigation planning is implemented, this qualitative approach to conservation status assessments provides for consistency, repeatability and transparency of status assessments assigned.

In comparing the status assessments from the 2006 strategy, there may be a perceived increase in high ranked units (from three ranges to five management units). This increase does not necessarily reflect a worsening of conditions for boreal caribou in the corresponding areas. It is more a reflection of the methodology used to conduct the assessments and the specific combinations of ranges within management units.

Table 1. Conservation Status Assessments for Boreal Caribou Management Units in Manitoba

Management Unit	Delineated Ranges Within the Management Unit	Conservation Status Assessment	Assessment Variables[1,2]
INTERLAKE	Interlake	High	Population Size – LOW Population Trend – DECLINING Natural Disturbance – LIMITED Anthropogenic Disturbance – MODERATE Planned Development – LIMITED
THE BOG	The Bog	Medium	Population Size – ACCEPTABLE Population Trend – UNDER REVIEW Natural Disturbance – LIMITED Anthropogenic Disturbance – MODERATE Planned Development – HIGH
NAOSAP	Kississing, Naosap-Reed	High	Population Size – ACCEPTABLE Population Trend – UNDER REVIEW Natural Disturbance – HIGH Anthropogenic Disturbance – HIGH Planned Development – HIGH
KAMUCHAWIE	No currently defined ranges	Low	Population Size – UNKNOWN Population Trend – UNKNOWN Natural Disturbance – HIGH Anthropogenic Disturbance – LIMITED Planned Development – LIMITED
PARTRIDGE CROP	Harding, Wapisu-Wimapedi, Wheadon	High	Population Size – ACCEPTABLE Population Trend – UNDER REVIEW Natural Disturbance – HIGH Anthropogenic Disturbance – LIMITED Planned Development – HIGH
WABOWDEN	Wabowden, William Lake	High	Population Size – ACCEPTABLE Population Trend – UNDER REVIEW Natural Disturbance – MODERATE Anthropogenic Disturbance – HIGH Planned Development – HIGH
MOLSON	Molson, Charron Lake	Low	Population Size – ACCEPTABLE Population Trend – UNDER REVIEW Natural Disturbance – HIGH Anthropogenic Disturbance – LIMITED Planned Development – LIMITED
ATIKAKI-BERENS	Berens, Atiko, Bloodvein	Medium	Population Size – ACCEPTABLE Population Trend – UNDER REVIEW Natural Disturbance – LIMITED Anthropogenic Disturbance – MODERATE Planned Development – MODERATE
OWL-FLINTSTONE	Owl-Flintstone	High	Population Size – LOW Population Trend – UNDER REVIEW Natural Disturbance – HIGH Anthropogenic Disturbance – HIGH Planned Development – MODERATE

[1] *Justification definitions can be found in Appendix A.*

[2] *If two or more of the assessment variables are at their respective extreme values, the management unit is automatically ranked with a high conservation status.*

6. RECOVERY HABITAT

With the posting of the national recovery strategy for boreal woodland caribou in 2012, Environment Canada outlined broad national strategies and a broad identification of critical habitat that would ensure the long-term persistence of boreal caribou across Canada. SARA defines critical habitat as habitat necessary for survival or recovery of a listed wildlife species. SARA requires identifying critical habitat as fully as possible, based on the best available information and consistent with the goals and objectives of the national recovery strategy.

Environment Canada's 2012 Recovery Strategy for the Woodland Caribou *(Rangifer tarandus caribou)*, Boreal population, in Canada identified critical habitat for boreal caribou as the area within the boundary of boreal caribou ranges that:

- provides an overall ecological condition that allows for an ongoing recruitment and retirement cycle of habitat
- maintains a perpetual state of a minimum of 65 per cent of the area as undisturbed habitat
- provides for the habitat characteristics that are required by caribou to carry out life processes

Based on the methodology developed by Environment Canada (2011), a minimum of 65 per cent undisturbed habitat in a range is a disturbance management threshold, which provides a measurable probability (60 per cent) for a local population to be self-sustaining. In addition, the strategy recognizes that the precise location of the 65 per cent undisturbed habitats within a range will vary over time. Environment Canada states in the national strategy that habitat within ranges should exist in an appropriate spatial configuration such that boreal caribou can move throughout the range and access required habitat when needed.

While there is general agreement on caribou populations being sustainable or not sustainable in the low and high ends of the habitat disturbance gradient, respectively, there is no discrete habitat disturbance threshold separating sustainable from unsustainable.

Manitoba intends to protect and manage 65 to 80 per cent intact suitable boreal caribou habitat in management units. Manitoba will continue to manage disturbance in a manner that will provide for boreal caribou ranges to be self-sustaining through dynamic habitat planning for management units. Manitoba will strive to secure a continuous supply of suitable large habitat patches distributed both geographically and temporally across the landscape that enables long term range occupancy. By implementing management unit and range assessments to evaluate cumulative impacts and incorporate dynamic habitat planning, Manitoba will be able to achieve habitat objectives over the long term. Managing at both the management unit and range level takes into account three key elements:

1) local conditions and area specific considerations are incorporated into the planning process
2) multiple management scales inform the decision making process
3) local conditions can inform assessments and cumulative disturbance effects at both the management unit and range levels

Dynamic habitat planning that addresses cumulative impacts provides an opportunity to increase the probability of long-term persistence of caribou at the local range and the management unit scales in managed landscapes, thereby providing a future forest condition suitable for caribou occupancy.

As part of recovery planning, Manitoba will develop management unit action plans that will identify recovery habitat and disturbance thresholds for the management unit. Management direction for establishing disturbance thresholds will be drawn from a science-based approach, incorporate direction provided by this strategy and consider recommendations from the national caribou strategy.

For the purposes of this document, recovery habitat is defined as a geographic area that contains important life requisite habitat components that are required to maintain self-sustaining populations. Recovery habitat may also include currently unoccupied areas that may be required to ensure populations can be maintained as self-sustaining into the future. At a minimum, recovery habitat will include core-use areas currently occupied by caribou. Manitoba will also identify, protect and manage habitats including calving, nursery habitat and winter areas important for the long-term persistence of boreal caribou on the landscape.

To fulfill Manitoba's responsibility to identify recovery habitat for boreal caribou ranges in Manitoba, the following actions will be implemented:

1. For ranges where sufficient data is available and most of the analysis has occurred, Manitoba will complete the data analysis required for the identification and mapping of recovery habitat. This will be documented in management unit action plans.
2. For remaining ranges where no data analysis has occurred, Manitoba will initiate habitat use analysis that will lead to the identification and mapping of recovery habitat, with priority given to high-status ranges.

Manitoba is committed to undertaking the required steps that will lead to the identification of recovery habitat for all ranges. A schedule of studies required to define recovery habitat adequately for data deficient ranges will be developed. Recovery habitat, or an updated schedule of studies, will be identified within individual management unit action plans.

7. RECOVERY STRATEGY IMPLEMENTATION

Manitoba's recovery strategy is a comprehensive, 10-year plan that applies to the current distribution of boreal caribou. It recognizes that there are many challenges to boreal caribou conservation. The boreal forest provides many important cultural, economic and social benefits for people. Many of those benefits can put boreal caribou and their habitat at risk. Manitoba will ensure that management decisions balance the demand for boreal forest resource use with boreal caribou conservation.

Manitoba Conservation and Water Stewardship is responsible for the protection and management of boreal caribou in Manitoba. The Wildlife Branch is responsible for developing policy, management guidelines and overall direction for boreal caribou conservation and management. Industrial and recreational development proposals must be submitted to the Environmental Assessment and Licensing Branch of Manitoba Conservation and Water Stewardship, which is responsible for the evaluation of such proposals and setting the terms and conditions for each licence granted including mitigation and monitoring activities.

Aboriginal people, governments, non-government organizations, industry and the public, with an interest or expertise in caribou conservation, have been and continue to be actively involved in boreal caribou conservation. The conservation needs of boreal caribou will continue to be integrated into landscape planning and sustainable development regulatory processes. Action plans and this recovery strategy are living documents intended to respond to new knowledge in the management of boreal caribou.

All land-users within the boreal caribou range in Manitoba, including governments and Crown corporations, share in the stewardship of boreal caribou in Manitoba, as identified in the goals and principles of this document, for the benefit of future generations.

Because there are many elements to this recovery strategy, not all recovery actions will be funded and implemented simultaneously. Implementation will initially focus on the highest priority ranges and actions. Key benchmarks have been identified to help guide implementation of this recovery strategy (see below). Existing and new funding will be required to acquire the data needed to manage forests and protect caribou, and to implement the recovery action plans.

The recovery strategy will be reviewed and updated every 10 years.

Key Benchmarks for Implementing Manitoba's Recovery Strategy

- establishment of provincial boreal caribou committee
- completion of a standard monitoring program protocol
- completion of schedule of studies to identify recovery habitat for data deficient management units
- completion of action plans for high, medium and low status management units
- completion of boreal caribou science review and status report
- review and update of provincial boreal caribou recovery strategy

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APPENDIX A: MANAGEMENT UNIT STATUS ASSESSMENTS

Management unit (MU) status assessments are determined from a combination of descriptive values of five variables:

1) **Population size** - determined by combining estimated population sizes of delineated ranges within a management unit.
   - If each delineated range within a MU has a population estimate ≥ 100, population size of the MU is **acceptable**.
   - If one or more delineated ranges within a MU has a population estimate < 100, population size of the MU is **low**.
   - If there are currently no delineated ranges within a MU, population size of the MU is **unknown**.

2) **Population trend** - determined by combining estimated population trends of delineated ranges within a management unit.
   - The population trend of each individual delineated range within a MU is assessed as increasing, stable or decreasing. The population trend of the MU is determined as the lowest assessed range in that management unit. The MU is therefore assessed as **increasing, stable** or **decreasing.**
   - If data collection to assess population trend of delineated ranges is currently ongoing, population trend of the MU is **under review**.
   - If there are currently no delineated ranges within a MU, population trend of the MU is **unknown**.

3) **Natural disturbance** - determined as the percentage of naturally disturbed habitat, ≤ 50 years old, within a management unit.
   - If total natural disturbance is < 20 per cent, natural disturbance of the MU is **limited**.
   - If total natural disturbance is ≥ 20 per cent and < 40 per cent, natural disturbance of the MU is **moderate**.
   - If total natural disturbance is ≥ 40 per cent, natural disturbance of the MU is **high**.

4) **Anthropogenic disturbance** - determined as the percentage of anthropogenically disturbed habitat, ≤ 50 years old, within a management unit.
   - If total anthropogenic disturbance is < 5 per cent, anthropogenic disturbance of the MU is **limited**.
   - If total anthropogenic disturbance is ≥ 5 per cent and < 15 per cent, anthropogenic disturbance of the MU is **moderate**.
   - If total anthropogenic disturbance is ≥ 15 per cent, anthropogenic disturbance of the MU is **high**.

5) **Planned development** - determined from an assessment of known planned development that will occur within a management unit during the life of this recovery strategy (10 years). The assessment considers the various types and the number of developments, extensiveness and likelihood of occurrence. Planned development is assigned a value of **limited, moderate** or **high**.

APPENDIX B: MANAGEMENT UNIT AND RANGE BOUNDARY DELINEATIONS

Delineation of Management Units

Management units were initially delineated around caribou populations that had some level of association between animal movement patterns, broad scale survey data and genetic relatedness. Major geographic features such as river systems, lakes, large peat complexes and natural disturbance patterns guided further refinement of boundaries.

Range Boundary Delineations

Ranges were delineated based on 100 per cent minimum convex polygons using year round collar data, incidental observations, fecal collection survey data and aerial track survey data from the past 10 years. Range boundaries were based on monitoring studies conducted within Manitoba. Ranges delineated with hatched boundaries are based on limited quantities or types of data. These ranges require further collection of data to validate current delineations. Neither formal survey nor monitoring has occurred in the Kamuchawie management unit; therefore, no ranges have been delineated.

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