

Amended Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada

Woodland Caribou, Boreal population



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Note: The Woodland Caribou, Boreal population is referred to as “boreal caribou” in this document.

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 Registry¹](#).

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¹ www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

AMENDED RECOVERY STRATEGY FOR THE WOODLAND CARIBOU (*RANGIFER TARANDUS CARIBOU*), BOREAL POPULATION, IN CANADA (2020)

The Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada was posted on the Species at Risk Public Registry in October 2012 (Environment Canada, 2012a).

Under Section 45 of the *Species at Risk Act* (SARA), the competent Minister may amend a recovery strategy at any time. This Amended Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada (hereafter, “amended recovery strategy”) is for the purposes of:

- Identifying critical habitat in northern Saskatchewan’s Boreal Shield range (SK1).
- Updating population and habitat condition information, based on information previously published in the 5-Year Progress Report (Environment and Climate Change Canada, 2017).
- Other minor edits to update factual information and/or to improve internal consistency within the document.

At the time of final posting, this amended recovery strategy replaces the 2012 Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada (Environment Canada, 2012a).

PREFACE

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)² 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 Species at Risk (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 Woodland Caribou, Boreal population, and has prepared both the 2012 Recovery Strategy and this amended recovery strategy, as per section 37 of SARA.

Environment and Climate Change Canada's Canadian Wildlife Service led the development of the 2012 Recovery Strategy. Seven provinces, two territories, one Indigenous government, four wildlife management boards and the Parks Canada Agency contributed information for the recovery strategy. Additional effort was made by Environment and Climate Change Canada to engage Indigenous communities that the minister considered directly affected by the recovery strategy. These efforts included two rounds of engagement, one before and the second one after the proposed recovery strategy was posted on the SAR Public Registry, to gather information on boreal caribou and to provide communities with an opportunity to comment on the proposed recovery strategy. In the first round, 271 Indigenous communities were contacted and 161 engaged, and in the second round, 265 Indigenous communities were contacted and 87 engaged. In addition, 25 formal submissions were received from Indigenous communities and organizations.

Following the posting of the proposed recovery strategy on August 26, 2011, the standard 60-day public comment period was extended by 120 days to February 22, 2012 as a result of Environment and Climate Change Canada's desire to consult Indigenous communities prior to finalizing the recovery strategy. The high level of interest in boreal caribou resulted in the submission of 19,046 comments during and subsequent to the public comment period. The majority of these were received as copies of form letters initiated by environmental group's campaigns. A total of 192 more detailed and/or technical submissions were received from governments, wildlife management boards, Indigenous communities and organizations, industry stakeholders, environmental organizations and academia.

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 critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected. Environment and Climate Change Canada's Canadian Wildlife Service also led the development of this amended recovery strategy in order to identify critical habitat in northern Saskatchewan's Boreal Shield range (SK1). The work completed for the amended recovery strategy was done in

² www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2

collaboration with the Government of Saskatchewan, the Science and Technology Branch of Environment and Climate Change Canada, and the Parks Canada Agency. Prior to posting the proposed amended recovery strategy on the Species at Risk Public Registry, 34 Indigenous communities and 31 Indigenous organizations/governments located within and adjacent to SK1 were invited to share information, comments and dialogue on the draft amendment to the recovery strategy. At the time of posting the proposed amendment, 11 communities and five organizations/governments participated in information sessions and/or meetings.

Landscape level planning is essential for the recovery of boreal caribou. Provinces and territories have the primary responsibility for management of lands, natural resources and wildlife within boreal caribou ranges; however, this responsibility does vary in some parts of the country. For example, in the Northwest Territories, the Tłı̨chǫ Government manages land and resources (including wildlife) within Tłı̨chǫ Lands, as described in the Tłı̨chǫ Agreement (a combined comprehensive land claims and self-government agreement). There are also wildlife management boards that have been established under land claims agreements as the primary instrument for wildlife management in some regions of the country.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that are or 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 boreal caribou and Canadian society as a whole.

This recovery strategy is being followed by range plans or other similar documents and/or action plans that provide information on recovery measures that are being or will be taken by provinces and territories, Environment and Climate Change Canada and the Parks Canada Agency, other federal departments, wildlife management boards, Indigenous communities, stakeholders, and other organizations, to achieve the survival and recovery of boreal caribou. Environment and Climate Change Canada, for its part, released its Action Plan for boreal caribou in February 2018, which sets out the measures that the Government of Canada is taking and will take to support the recovery of boreal caribou (Environment and Climate Change Canada, 2018). In addition to this Action Plan, Parks Canada Agency site-specific Action Plans that address boreal caribou conservation and recovery efforts on lands administered by the Agency can be found on the SAR Public Registry. Implementation of this recovery strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGEMENTS

Environment and Climate Change Canada would like to express its gratitude to the Indigenous people who shared their knowledge about boreal caribou in support of the recovery of this species. Knowledge was shared by Indigenous Knowledge holders and Indigenous communities and organizations on boreal caribou life history, habitat use, population status, threats facing the species and conservation measures, and this information has been used in the development of this recovery strategy (see Appendices B and C). Indigenous people consistently indicated that conservation of boreal caribou is essential, as this species is integral to the culture, identity and survival of their communities. The Indigenous Knowledge that was shared may also be used to support the development of range plans and/or action plans for boreal caribou, where consent for such use is granted. Environment and Climate Change Canada appreciates that so many Indigenous people were willing to share their knowledge and experiences to help in the recovery of this species.

Gratitude is also extended to federal, provincial and territorial jurisdictions, the Tłı̨chǫ Government, and wildlife management boards with management responsibility for boreal caribou, for generously sharing information and providing expertise to develop this recovery strategy. The Boreal Caribou Working Group, comprised of Environment and Climate Change Canada staff from across Canada, contributed extensively by working with Canadians to gather information and support processes to collect Indigenous Knowledge used to inform the development of this recovery strategy, and by compiling material and drafting the recovery strategy. Appreciation is extended to Environment and Climate Change Canada's Wildlife and Landscape Science Directorate (WLSD), the boreal caribou Science Management Committee and boreal caribou science advisors, for their extensive efforts and contribution to the recovery strategy through the provision of the 2008 Scientific Review for the Identification of Critical Habitat for Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada, and the Scientific Assessment to Inform the Identification of Critical Habitat for Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada, 2011 Update. Thanks are also given to the National Boreal Caribou Technical Committee for providing advice and feedback on the science work that was undertaken by WLSD as part of the schedule of studies to inform the identification of critical habitat in northern Saskatchewan's Boreal Shield range (SK1). Acknowledgement and thanks are given to all other parties that provided advice and input used in the development of this recovery strategy, including the Species at Risk Advisory Committee (SARAC), Indigenous governments, communities and organizations, industry stakeholders, non-government organizations and academia.

EXECUTIVE SUMMARY

This recovery strategy is for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population herein referred to as “boreal caribou”, assessed in May 2002 as threatened and re-examined and confirmed as threatened in November 2014 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). This document is an amended version of the boreal caribou recovery strategy published by Environment and Climate Change Canada under the title Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada (Environment Canada, 2012a). At the time of final posting, the final version of this amended recovery strategy will replace the 2012 Recovery Strategy.

Boreal caribou are distributed broadly throughout the boreal forest, occurring in seven provinces and two territories and extending from the northeast corner of Yukon east to Labrador and south to Lake Superior. Boreal Caribou require large areas comprised of continuous tracts of undisturbed habitat rich in mature to old-growth coniferous forest, lichens, muskegs, peat lands, and upland or hilly areas. Large areas with suitable quality habitat allow boreal caribou to disperse across the landscape when conditions are unfavorable (e.g. natural fire disturbance, anthropogenic disturbance) and to maintain low population densities to reduce their risk of predation.

The geographic area occupied by a group of boreal caribou that are subject to similar factors affecting their demography and used to satisfy their life history processes (e.g. calving, rutting, wintering) over a defined time frame is referred to as a range. There are 51 boreal caribou ranges in Canada. Information available to delineate boreal caribou ranges varies in certainty and therefore ranges are categorized into three types: conservation units, improved conservation units and local population units. In this recovery strategy, the group of boreal caribou occupying any of the three types of ranges is referred to as a “local population” of boreal caribou.

Due to the specific life history characteristics they possess, boreal caribou are limited in their potential to recover from rapid, severe population declines. Habitat alteration (i.e. habitat loss, degradation, and fragmentation) from both anthropogenic and natural sources, and increased predation as a result of habitat alteration have led to local population declines throughout their distribution. Some local populations of boreal caribou are at risk because of other factors, mainly over-harvest. Threats are closely interrelated and act cumulatively to have direct or indirect impacts on boreal caribou and their habitat. Recovery of all boreal caribou local populations across Canada is technically and biologically feasible.

The recovery goal for boreal caribou is to achieve self-sustaining local populations in all boreal caribou ranges throughout their current distribution in Canada, to the extent possible. Achieving the recovery goal would allow for local population levels sufficient to sustain traditional Indigenous harvesting activities, consistent with existing Aboriginal and treaty rights. Ranges that are highly disturbed will take decades to recover from habitat alteration, as boreal caribou occur in mature boreal forest ecosystems that have evolved over centuries. Achieving this recovery goal for all local populations will take a number of decades.

To guide recovery efforts, the population and distribution objectives for boreal caribou across their distribution in Canada are, to the extent possible, to:

- Maintain the current status of the 15 existing self-sustaining local populations; and
- Stabilize and achieve self-sustaining status for the 36 not self-sustaining local populations.

Performance indicators are identified as a means by which progress towards achieving the population and distribution objectives can be measured. The critical habitat necessary to achieve the population and distribution objectives for the recovery and survival of boreal caribou is now fully identified within this amended recovery strategy, as critical habitat is identified for all 51 boreal caribou ranges.

Critical habitat was not identified in the Boreal Shield range (SK1) in the 2012 Recovery Strategy due to a lack of data on population size and trend, and the uniqueness of the disturbance regime (i.e. high fire and very low anthropogenic disturbance). As required under the *Species at Risk Act* (SARA), a schedule of studies was developed to identify critical habitat in SK1. That schedule of studies for SK1 is now complete.

Critical habitat for boreal caribou is identified as: i) the area within the boundary of each boreal caribou range that provides an overall ecological condition that will allow for an ongoing recruitment and retirement cycle of habitat, which maintains a perpetual state of a minimum of 65% of the area as undisturbed habitat in all ranges other than SK1, and a minimum of 40% undisturbed habitat in SK1; and ii) biophysical attributes required by boreal caribou to carry out life processes.

With the exception of SK1, this recovery strategy identifies 65% undisturbed habitat in a range as the disturbance management threshold, which provides a measurable probability (60%) for a local population to be self-sustaining. This threshold is considered a minimum threshold because at 65% undisturbed habitat there remains a significant risk (40%) that local populations will not be self-sustaining.

The disturbance management threshold for SK1 is 40% undisturbed habitat in the range, which provides a measurable probability (71%) for the local population to be self-sustaining. This threshold is considered a minimum threshold because at 40% undisturbed habitat there remains a risk (29%) that the SK1 local population will not be self-sustaining. Based on the best available information, SK1 is the first local population that is currently self-sustaining below the 65% undisturbed habitat threshold (based on 3 years of data). For this reason, and because of the uniqueness of the disturbance regime in SK1, a lower undisturbed habitat threshold has been identified for this range.

Environment and Climate Change Canada (2019) demonstrated that the SK1 local population is sensitive to small increases in anthropogenic disturbance and small decreases in adult survival. The analyses also showed that anthropogenic disturbance is not equivalent to fire, with the former having a stronger negative effect on population condition. Therefore, caution is warranted with respect to additional anthropogenic disturbance in this range. For SK1 critical habitat, activities that pertain specifically to increasing the level of anthropogenic disturbance in SK1 above 5% (while maintaining a minimum of 40% undisturbed habitat in the range) has been added to the list of factors that increase the likelihood that critical habitat will be destroyed. The range plan for SK1 should outline how total anthropogenic disturbance in the range will be maintained at or below 5%. In addition, the SK1 local population should continue to be

monitored to ensure that future changes in range condition (fire and anthropogenic disturbance) do not compromise the ability of the range to support a self-sustaining local population.

The recovery of boreal caribou requires actions that will vary according to both the habitat and population conditions within each boreal caribou range. This recovery strategy provides broad strategies and general approaches to achieve the population and distribution objectives, which will assist in the development of range plans and action plans. The suite of actions needed to maintain or recover the self-sustaining status of a boreal caribou local population will be determined and managed by the responsible jurisdictions in collaboration with Environment and Climate Canada, and consistent with this recovery strategy. The recovery actions most appropriate for a specific range will be governed by local opportunities and constraints, and the level of urgency for a given recovery action will be determined by both the population and habitat conditions within the range.

To guide the protection of critical habitat and the recovery of boreal caribou, range plans or other similar documents and/or action plans are being prepared by provincial and territorial jurisdictions. These plans provide detailed information on recovery measures that are being or will be implemented by provinces and territories, Environment and Climate Change Canada, other federal departments, wildlife management boards, Indigenous communities, stakeholders, and other organizations involved in the conservation, survival and recovery of boreal caribou. Success in recovering boreal caribou will depend on the commitment, collaboration and cooperation among all interested parties.

RECOVERY FEASIBILITY SUMMARY

Recovery of boreal caribou is considered to be both technically and biologically feasible across the species' distribution in Canada based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility.

Current evidence supports the conclusion that the recovery of all local populations is biologically and technically feasible. However, small local populations, and particularly those isolated from the core distribution of the national boreal caribou population, are at greater risk of not becoming self-sustaining. In these situations, a local population may have greater difficulty withstanding stochastic events, and may not experience enough immigration to maintain genetic diversity and therefore will be at greater risk of not persisting in the long-term. There may be other situations where recovery of a particular local population proves to be, over time and through unforeseen circumstances, not biologically or technically feasible and, as such, may affect the likelihood of achieving the population and distribution objectives.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

Yes. According to current best estimates, there are approximately 34,000 (see Section 3.2.2) boreal caribou across nine provinces and territories in Canada capable of successful reproduction and available to improve local population growth rates and abundance to achieve self-sustainability (Environment Canada, 2011b).

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

Yes. Some boreal caribou local populations have sufficient suitable habitat within their ranges. For other boreal caribou local populations where sufficient suitable habitat is currently unavailable to support local populations at a self-sustaining level, sufficient habitat could be made available through habitat management or restoration.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

Yes. The primary threat to most boreal caribou local populations is unnaturally high predation rates as a result of human-caused and natural habitat loss, degradation, and fragmentation. These habitat alterations support conditions that favour higher alternate prey densities (e.g. moose (*Alces alces*), deer (*Odocoileus spp.*)), resulting in increased predator populations (e.g. wolf (*Canis lupus*), bear (*Ursus spp.*)) that in turn increase the risk of predation to boreal caribou. This threat can be mitigated through coordinated land and/or resource planning, and habitat restoration and management, in conjunction with predator and alternate prey management where local population conditions warrant such action. In some ranges, over-exploitation through hunting can also be an issue. This threat can be avoided or mitigated through regulations and stewardship.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

Yes. Recovery techniques (e.g. protection and management of boreal forest habitat, habitat restoration, predator and alternate prey management, hunting regulations, stewardship initiatives)

are available to achieve the population and distribution objectives for boreal caribou, although there is uncertainty with regard to the effectiveness of some of these techniques, as they have not yet undergone a sufficiently long trial period.

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1 COSEWIC SPECIES ASSESSMENT INFORMATION

Date of Assessment: November 2014

Common Name (population): Caribou (Boreal population)

Scientific Name: *Rangifer tarandus*

COSEWIC Status: Threatened

Reason for Designation: This population occurs at naturally low densities in mature boreal forest habitats from Labrador to Yukon, with small, isolated populations at the southern part of the range, including along the Lake Superior coastline and in the Charlevoix region of Québec. Over the past century, local subpopulations have been lost; range contraction has proceeded from the south by up to 50% of historical range in some areas. Despite considerable conservation efforts, range-wide declines have continued since the last assessment in 2002, particularly in Alberta, northeastern British Columbia, and Labrador. Some populations remain poorly monitored, particularly those in the northern portion of the range. For 37 of 51 subpopulations where trend data are available, 81% are in decline, as indicated by negative population growth rates. Some of the most intensively managed subpopulations may remain critically imperiled. Reasons for decline are mainly due to increased predation and habitat loss, the latter stemming from the combination of anthropogenic (natural resource extraction) and natural (fires) disturbance. The proliferation of linear landscape features such as roads and seismic lines facilitates predation by wolves, and the conversion of mature – old conifer stands to younger seral stages promotes increases in alternate prey such as Moose and White-tailed Deer. Shifts in the northern distribution of White-tailed Deer, mediated by landscape change, also bring novel parasites into parts of the range of this population. In some regions, overhunting poses a threat to long-term conservation. Threats are closely interrelated and act cumulatively to impact this population. Population increases do not appear likely in one-third of subpopulations where disturbances exceed a threshold of viability. A >30% decline in population is projected in the near term.

Canadian Occurrence: Yukon, Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Newfoundland and Labrador.

COSEWIC Status History: The Boreal population was designated threatened in May 2000. Status re-examined and confirmed in May 2002 and November 2014.

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

In 2000, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, as threatened. The species was added to the List of Wildlife Species at Risk (Schedule 1) under SARA, at Proclamation, in 2003. In 2011, COSEWIC adopted new “Designatable Units” (DU) for caribou (*Rangifer tarandus*) in Canada using a number of variables to classify the different herds or groups of herds

(COSEWIC, 2011). These DU descriptions provided a clear and consistent scheme for identifying DUs due to the complexity of *Rangifer tarandus* in Canada. Woodland Caribou (*Rangifer tarandus caribou*), Boreal population is equivalent to COSEWIC’s DU6, which is called Caribou (*Rangifer tarandus*), Boreal population. The 2014 COSEWIC assessment for the species was completed under this new DU structure/name (COSEWIC, 2014). However, until such time as Schedule 1 of SARA is amended to reflect the new common and scientific names changes, the species remains Woodland Caribou (*Rangifer tarandus caribou*), Boreal population under SARA. In this recovery strategy, the Woodland Caribou, Boreal population is referred to as simply “boreal caribou”.

2 SPECIES STATUS INFORMATION

Boreal caribou are listed as threatened under Canada’s *Species at Risk Act* (SARA), based on an observed, estimated, inferred or suspected reduction in population size of > 30% over three caribou generations (approximately 20 years). Boreal caribou have been provincially/territorially ranked in most jurisdictions (see Table 1). Boreal caribou have not been ranked globally by NatureServe.

Table 1. Canadian status and provincial/territorial designations for boreal caribou.

Canadian Status	Provincial/Territorial Designation
SARA – Schedule 1 (Threatened)	NT – Threatened YT – Not Listed BC – Red Listed (Threatened – Endangered) AB – Threatened SK – Not Listed MB – Threatened ON – Threatened QC – Vulnerable (Special Concern – Threatened) NL – Threatened

3 SPECIES INFORMATION

Caribou and reindeer are members of a single species, *Rangifer tarandus*. The term “caribou” is used to describe the various subspecies present in North America, whereas “reindeer” refers to the domesticated, semi-domesticated or wild subspecies found in Eurasia (Hummel and Ray 2008). Although there is considerable variation in phenotypic traits in this species (e.g., body size, pelage colour, morphology), caribou and reindeer are able to interbreed and produce fertile, viable offspring (Hummel and Ray 2008). It should be noted that reindeer occur in North America, particularly Newfoundland, as a result of human introductions.

Banfield (1974) recognized four existing subspecies of caribou in Canada, including Peary Caribou (*Rangifer tarandus pearyi*), Barren-ground Caribou (*R. t. groenlandicus*), Grant’s Caribou (*R. t. granti*), and Woodland Caribou (*R. t. caribou*). A fifth subspecies, the Dawson’s Caribou (*R. t. dawsoni*), which occurred in Haida Gwaii (i.e. Queen Charlotte Islands, BC) is extinct. Each subspecies displays differences in morphology, behaviour, and areas of geographic

occurrence. Boreal caribou are among those caribou populations that were classified by Banfield (1974) as Woodland Caribou.

Boreal caribou are endemic to Canada, and are distributed across nine provinces and territories, including British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Newfoundland and Labrador, Northwest Territories, and Yukon (see Figure 1) (DU6; COSEWIC 2011).

3.1 Species Description

Like all Woodland Caribou, boreal caribou are a medium-sized (1.0-1.2 m shoulder height and weighing 110-210 kg) member of the deer family (*Cervidae*) (Thomas and Gray, 2002). Adults have a dark brown coat with a creamy white neck, mane, shoulder stripe, underbelly, underside of the tail, and patch above each hoof (Banfield, 1974; Boreal Caribou ATK Reports, 2010-2011). A distinctive characteristic of all caribou is large crescent-shaped hooves that provide flotation in snow and soft ground (e.g. peat lands), and assist in digging through snow to forage on lichens and other ground vegetation (Thomas and Gray, 2002). Antlers of boreal caribou are flattened, compact, and relatively dense. As a unique feature among the deer family, both male and female boreal caribou have antlers during part of the year, although some females may have only one antler or no antlers at all (Thomas and Gray, 2002; Boreal Caribou ATK Reports, 2010-2011). In comparison to Barren-ground Caribou, boreal caribou antlers are thicker and broader, and their legs and heads are longer.

3.2 Population and Distribution

Boreal caribou are forest-dwelling, sedentary caribou that occur only in Canada and are distributed broadly across the boreal forest (Thomas and Gray, 2002; Festa-Bianchet, 2011). The Canadian distribution of boreal caribou stretches from the northeast corner of Yukon east to Labrador, and extends as far south as Lake Superior (see Figure 1) (Environment Canada, 2008; Environment Canada, 2011b). Across Canada, the southern limit of boreal caribou distribution has progressively receded northward since the early 1900s (see Figure 1), a trend that continues today (Thomas and Gray, 2002; Schaefer, 2003; Festa-Bianchet et al., 2011). Indigenous Knowledge indicates that boreal caribou have moved northward as a result of habitat loss in the south (Boreal Caribou ATK Reports, 2010-2011).



Figure 1. Distribution (i.e. extent of occurrence) of boreal caribou in Canada. The current distribution of boreal caribou is shown in brown. The estimated southern extent of historical Woodland Caribou distribution is indicated by the dashed line.

3.2.1 Boreal Caribou Ranges

The geographic area occupied by a group of boreal caribou that are subject to similar factors affecting their demography and used to satisfy their life history processes (e.g. calving, rutting, wintering) over a defined time frame is referred to as a range (Environment Canada, 2011b). Boreal caribou are distributed across 51 ranges (see Figure 2 and Table 2) based on the best available information provided by the provincial and territorial jurisdictions, including observational and telemetry data, and biophysical analyses (Environment Canada, 2011b).

In this recovery strategy, “local population” refers to a group of boreal caribou occupying any of the three types of boreal caribou ranges (conservation unit, improved conservation unit, local population unit).

Environment and Climate Change Canada (2011b) identified three types of boreal caribou ranges, categorized based on the degree of certainty in the delineated boundaries. Eight ranges have been identified as “conservation units” (low certainty), 20 ranges as “improved conservation units” (medium certainty), and 23 ranges as “local population units” (high certainty) (see Appendix F). It is anticipated there will be changes to conservation units and improved

conservation units as more information becomes available. In this recovery strategy, “local population” refers to a group of boreal caribou occupying any of the three types of boreal caribou ranges (conservation unit, improved conservation unit, local population unit).

As a result of limited information on many of the ranges in Canada, only three transboundary ranges (a range that extends across a provincial or territorial boundary) have been defined: Northwest Territories range (NT1), Chinchaga range (AB1), and Lac Joseph range (NL1). As new and more refined information is continually being collected by jurisdictions, range delineation and population demographic information will be updated and may result in revisions to range boundaries and possibly more transboundary ranges.

Ranges can and do vary greatly in size; some cover very large areas (e.g. Northwest Territories range (NT1): 44,166,546 ha), whereas others are much smaller (e.g. Charlevoix range (QC2): 312,803 ha). Whether a range can support a self-sustaining local population is a function of both the amount and quality of habitat available for boreal caribou.

Of the 51 boreal caribou local populations, 15 are “self-sustaining”, 26 are “not self-sustaining” and 10 are “as likely as not self-sustaining”, based on Environment and Climate Change Canada’s (2011b) methodology and data from provincial and territorial jurisdictions (see Figure 3 and Appendix F). In the population and distribution objectives, “not self-sustaining” local populations refers to both the local populations assessed as “as likely as not self-sustaining” and those assessed as “not self-sustaining”. The assessment of the likelihood of self-sustainability may change when ranges that cross jurisdictional boundaries are combined. Range boundaries and integrated risk assessments will be updated annually based on new or more refined evidence provided by the provincial and territorial jurisdictions.

In some cases, there are discrepancies between the range boundaries as presented in Figure 2, which were based on information provided by provincial and territorial jurisdictions, and the information that was provided by Indigenous Knowledge holders. These will be addressed in

range plans and/or action plans (see Sections 7.3 and 9) where provinces and territories, Indigenous communities, and other people with knowledge of a particular boreal caribou range can work together to ensure range boundaries are based on the best available information.

Boreal caribou use of a range may change over time as a result of variation in ecological conditions (e.g. vegetation change as a result of natural disturbances, predator/prey dynamics) and patterns of human disturbance (e.g. industrial development) affecting the landscape. Variation in habitat conditions, resource availability, and the amount and arrangement of disturbance on the landscape, influences patterns of boreal caribou range use that result in either: a) a discrete range, where boreal caribou occupy a clearly defined area with little exchange with other ranges (e.g. Coastal range (ON6), Charlevoix range (QC2)); or b) a continuous range where boreal caribou are dispersed over a large area and may move more freely and over greater distances within the area characterized by common biophysical attributes (e.g. Northwest Territories range (NT1)).

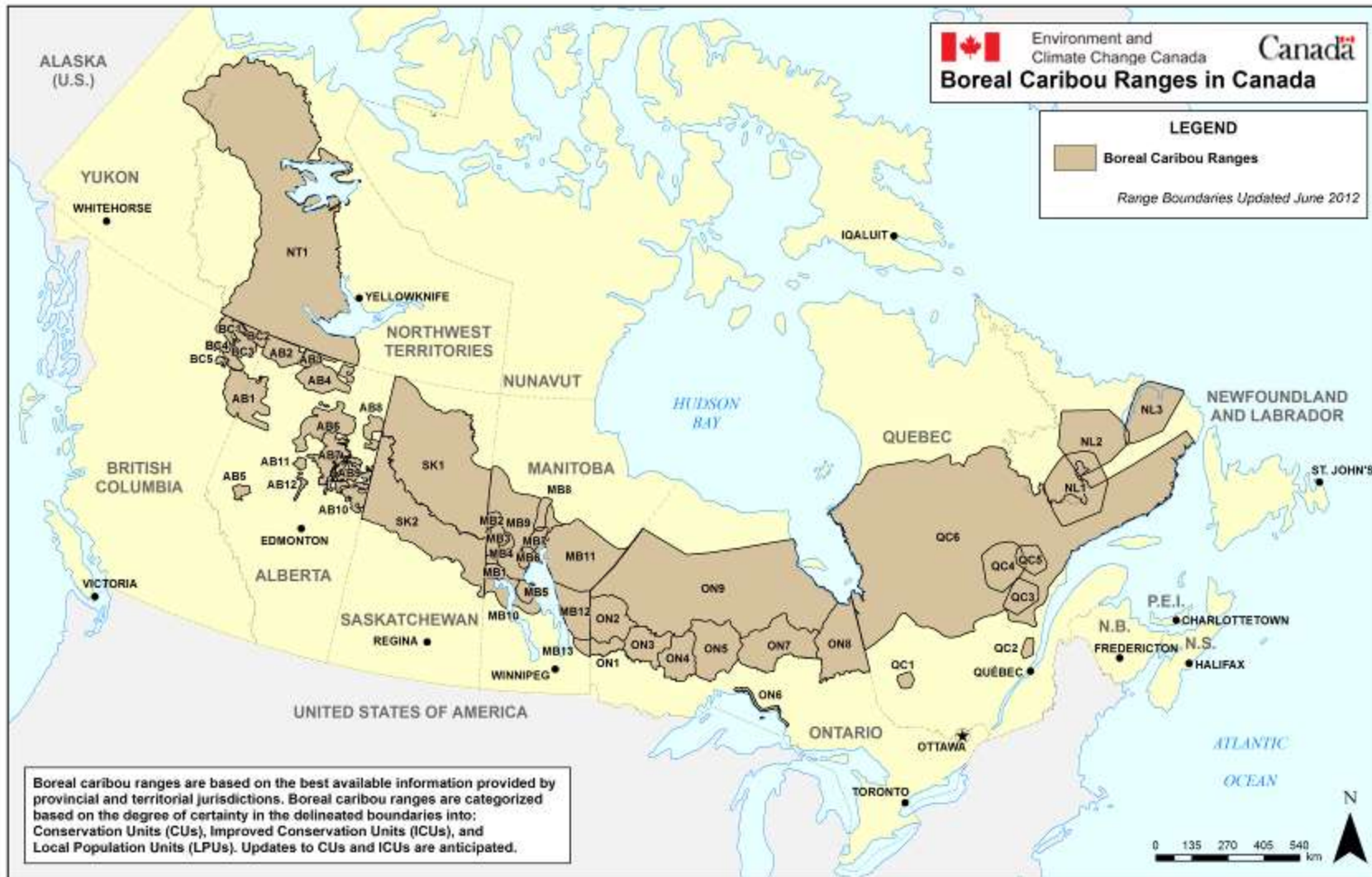


Figure 2. Geographic distribution of the 51 known ranges of boreal caribou in Canada as of June 2012.

Table 2. Range identification and range names for the 51 known ranges of boreal caribou in Canada.

Range ID	Range Name
NT1	Northwest Territories
BC1	Maxhamish
BC2	Calendar
BC3	Snake-Sahtahneh
BC4	Parker
BC5	Prophet
AB1	Chinchaga (incl. BC portion)
AB2	Bistcho
AB3	Yates
AB4	Caribou Mountains
AB5	Little Smoky
AB6	Red Earth
AB7	West Side Athabasca River
AB8	Richardson
AB9	East Side Athabasca River
AB10	Cold Lake
AB11	Nipisi

Range ID	Range Name
AB12	Slave Lake
SK1	Boreal Shield
SK2	Boreal Plain
MB1	The Bog
MB2	Kississing
MB3	Naosap
MB4	Reed
MB5	North Interlake
MB6	William Lake
MB7	Wabowden
MB8	Wapisu
MB9	Manitoba North
MB10	Manitoba South
MB11	Manitoba East
MB12	Atikaki-Berens
MB13	Owl-Flinstone
ON1	Sydney

Range ID	Range Name
ON2	Berens
ON3	Churchill
ON4	Brightsand
ON5	Nipigon
ON6	Coastal
ON7	Pagwachuan
ON8	Kesagami
ON9	Far North
QC1	Val d'Or
QC2	Charlevoix
QC3	Pipmuacan
QC4	Manouane
QC5	Manicouagan
QC6	Quebec
NL1	Lac Joseph
NL2	Red Wine Mountain
NL3	Mealy Mountain

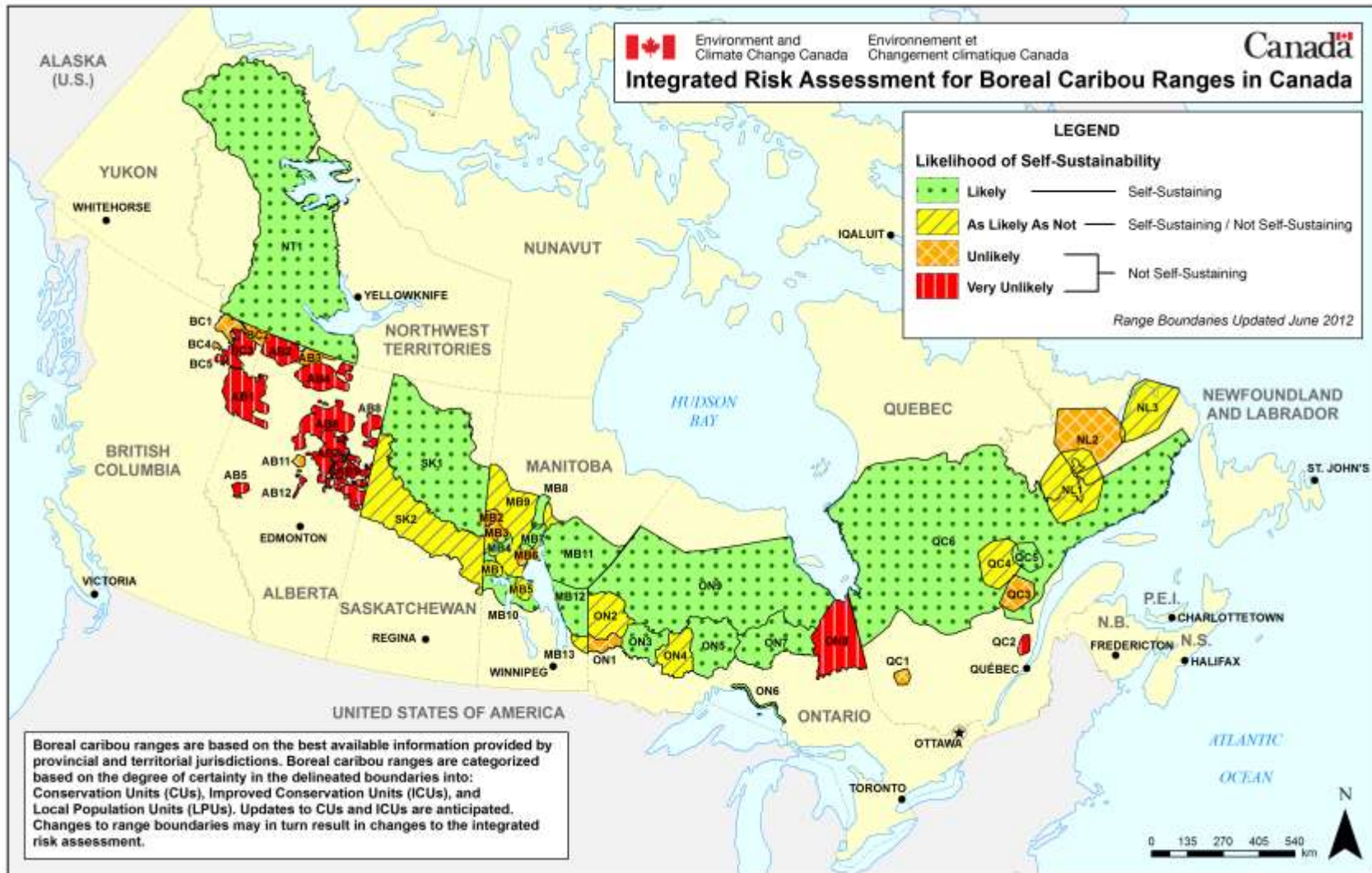


Figure 3. Integrated risk assessment for boreal caribou ranges in Canada as of June 2012, reflecting the capacity of each range to maintain a self-sustaining local population of boreal caribou. The likelihood of self-sustainability for the Boreal Shield range (SK1) has been updated from “unknown” to “likely” in this amended recovery strategy. The integrated risk assessments for the remaining ranges have not been updated.

3.2.2 Local Populations

Precise enumeration of the size of a boreal caribou local population is a challenge due to the large areas that boreal caribou occupy (often over thousands of square kilometres), the low densities at which they occur (making survey from aircraft challenging), and their relatively solitary habits (Environment Canada, 2008; Callaghan et al., 2010). Across Canada, densities average two to three animals per 100 km², but densities vary regionally and can be higher in areas with high quality habitat (Environment Canada, 2011b). The literature also reports that more than 300 boreal caribou are needed for self-sustaining local populations, thereby requiring ranges of at least 10,000 to 15,000 km² in size subject to type and quality of habitat (Environment Canada, 2011b).

Within ranges, boreal caribou are often found in small groups of fewer than 15 individuals. This will vary seasonally in accordance with life processes (e.g. calving, rutting, wintering) and based on local conditions within the range (Boreal Caribou ATK Reports, 2010-11). Boreal caribou typically form relatively mixed-sex groups; however, during calving periods females are generally solitary (Boreal Caribou ATK Reports, 2010-2011; Nagy et al., 2011).

Based on the best available information, the current overall number of boreal caribou in Canada is estimated to be approximately 33,000-34,000 individuals (Environment Canada, 2011b; COSEWIC, 2014). This number is based on mean local population size estimates as provided by the provincial and territorial jurisdictions. It is important to note that the overall national population size estimate is only a crude approximation, as population estimates over time are unavailable in most regions. Appendix F outlines the current population size and trend information for each of the 51 ranges, as provided by provincial and territorial jurisdictions (Environment and Climate Change Canada, 2017).

3.3 Needs of the Boreal Caribou

3.3.1 Habitat and Biological Needs

Boreal caribou require large range areas comprised of continuous tracts of undisturbed habitat. In general, boreal caribou prefer habitat consisting of mature to old-growth coniferous forest (e.g. jack pine (*Pinus banksiana*), black spruce (*Picea mariana*)) with abundant lichens, or muskegs and peat lands intermixed with upland or hilly areas (Stuart-Smith et al., 1997; Rettie and Messier, 2000; Courtois, 2003; Brown et al., 2007; Boreal Caribou ATK Reports, 2010-2011). Large range areas reduce the risk of predation by allowing boreal caribou to maintain low population densities throughout the range and by allowing them to avoid areas of high predation risk, such as areas with high densities of alternate prey species (e.g. moose and deer) and predators (e.g. wolf and bear) (Rettie and Messier, 2001; Brown et al., 2003; Whittington et al., 2011) (see Section 4.2). Boreal caribou use a variety of habitats to avoid predators, including muskegs and bodies of water, as well as mature and old-growth forests (Boreal Caribou ATK Reports, 2010-2011).

Boreal caribou select habitat that provides food, particularly terrestrial and arboreal lichens, during late winter and early spring, and avoid early stage, successional forests and recently disturbed areas (Schaefer and Pruitt, 1991; Stuart-Smith et al., 1997; Rettie and Messier, 2000;

Dunford et al., 2006; Boreal Caribou ATK Reports, 2010-2011), which have poor feeding options, impede movement, and attract other ungulates (Whitefeather Forest, 2006). In order to access forage during winters with deep or crusted snow, boreal caribou require habitat that has arboreal lichens and shallower snow (such as mature coniferous stands with closed canopies and upland or hilly areas exposed to wind), where it is easier to dig for ground lichens (Vandal and Barrette, 1985; Thomas and Armbruster, 1996; Courbin et al., 2009; Boreal Caribou ATK Reports, 2010-2011; Moreau et al., 2012).

Boreal caribou have specific habitat requirements during calving and post-calving periods. To calve, pregnant cows travel to isolated, relatively predator-free areas where nutritious forage is available, such as islands in lakes, peat lands or muskegs, lakeshores and forests (Boreal Caribou ATK Reports, 2010-2011). Unavailable, inadequate or degraded habitat affects the reproductive success of females as well as the survival of calves, and can result in population decline (Thomas and Gray, 2002; McCarthy et al., 2011; Pinard et al., 2012).

Boreal caribou shift their use of habitat and their distribution within the range in response to various natural processes (e.g. forest fire, food availability, weather conditions) and human activities (e.g. development, logging, recreation) (Boreal Caribou ATK Reports, 2010-2011; Environment Canada, 2011b). For example, any mature and old-growth forest stands lost to fire or tree removal practices will result in the degradation of suitable habitat in the short-term. In response to such changing environmental conditions, boreal caribou will shift within their range. Over time, a disturbed area may recover and become suitable for use by boreal caribou.

3.3.2 Connectivity

Connectivity of habitat both within a range and between ranges is essential for boreal caribou persistence on the landscape. Within a range, habitat connectivity allows for seasonal movement among habitats with the different resources needed by boreal caribou to satisfy their life history requirements (see Appendix H for examples of biophysical attributes), and for boreal caribou to use different areas as they respond to disturbance or as disturbed habitat recovers (Saher and Schmiegelow, 2005).

Connectivity between boreal caribou ranges allows for immigration and emigration between local populations, which increases gene flow, thereby helping to maintain genetic diversity and the species' subsequent resilience to environmental stressors (e.g. disease, severe weather). Studies have demonstrated that isolation of local populations as a result of disturbance to the landscape (i.e. any form of anthropogenic or natural habitat alteration), can result in a significant reduction in genetic diversity (Courtois et al., 2003; Weckworth et al., 2012). Connectivity between ranges also maintains recovery or rescue effects between boreal caribou ranges. Finally, connectivity within and between boreal caribou ranges will allow for movement in response to changing environmental conditions (e.g. climate change) (Racey and Armstrong, 2000; Courtois et al., 2003; McLoughlin et al., 2004; Pither et al., 2006; Boreal Caribou ATK Reports, 2010-2011).

3.3.3 Limiting Factors

Boreal caribou possess certain life history characteristics that limit their potential to recover from rapid, severe population declines. As a primary anti-predator survival strategy, boreal caribou spatially separate themselves from predators and alternate prey, maintaining low population densities across their range (Bergerud, 1988; Bergerud, 1996; Johnson et al., 2001; Environment Canada, 2008). Accordingly, continuous tracts of undisturbed habitat of suitable quality (i.e. with the required biophysical attributes) are needed to ensure self-sustaining local populations.

Boreal caribou have a low reproductive output relative to other ungulates and therefore are vulnerable to higher rates of mortality whether caused by predation or over-harvesting. Females typically do not produce young until three years of age and then have only one calf per year (Bergerud, 2000). In addition, while all age classes of boreal caribou are vulnerable to predation, calf mortality can be especially high, particularly within the first thirty days after birth (Bergerud and Elliot, 1986; Gustine et al., 2006). Calves disperse themselves over the landscape as an anti-predator tactic. In most cases predation is the main proximate factor limiting boreal caribou population growth, since the survival of calves to one year of age is usually low and is often insufficient to compensate for annual adult mortality in declining populations (Bergerud, 1974; Stuart-Smith et al., 1997; DeMars et al., 2011).

Small local populations with few adult females (and hence few births) and low calf survival have a low potential for population growth (Bergerud, 1980; Bergerud, 2000; McCarthy et al., 2011). In addition to being affected by reproductive and mortality rates related to their age distribution, small local populations can be disproportionately affected by stochastic events (e.g. environmental events such as winter icing or heavy snowfalls, fire, disease). Consequently, population growth is likely to be highly variable in small local populations, with an increased probability of extirpation (Caughley, 1994; Courtois et al., 2007).

4 THREATS

4.1 Threat Assessment

There are a variety of threats that directly and/or indirectly affect boreal caribou and their habitat across Canada. A summary of these threats and their national level of concern are provided below (see Table 3). The level of concern was determined using best available information, including Indigenous Knowledge and comments received through engagement with Indigenous communities. Threats and their level of concern differ between regions and local populations. For example, the level of concern for the effect of hunting on local populations is high in Labrador, while it remains medium nationally. Actions to mitigate threats are being or will be addressed in range plans and/or action plans (see Sections 7.3 and 9).

Many of the threats to boreal caribou and their habitat are related and may interact, in which case they can have cumulative impacts that may not be evident when threats are examined individually (Weclaw and Hudson, 2004; Boreal Caribou ATK Reports, 2010-2011; Badiou et al., 2011). Additionally, the impacts of threats on the size and distribution of boreal caribou local populations have a lag effect, which can take years to manifest (Vors et al., 2007).

Table 3. Threat assessment table for boreal caribou.

Threat	Level of Concern ¹	Extent	Occurrence	Frequency	Severity ²	Causal Certainty ³
Habitat Alteration (Disturbance)						
Habitat alteration (loss, degradation or fragmentation) as a result of human land-use activities	High	Widespread across Canada	Current	Continuous	High	High
Habitat alteration (loss, degradation or fragmentation) as a result of forest fire	Medium	Widespread across Canada	Current	Recurrent	Moderate	High
Natural Processes						
Predation	High	Widespread across Canada	Current	Continuous	High	High
Parasites and disease	Low	Localized across Canada	Anticipated	Unknown	Unknown	Low

Threat	Level of Concern ¹	Extent	Occurrence	Frequency	Severity ²	Causal Certainty ³
Biological Resource Use						
Hunting	Medium	Localized across Canada	Current	Seasonal	Moderate	Medium
Climate and Natural Disasters						
Climate change and severe weather	Medium	Widespread across Canada	Current	Unknown	Unknown	Low-Med
Other Threats						
Noise and light disturbance	Low-Med	Localized across Canada	Current	Recurrent	Unknown	Low
Vehicle collisions	Low	Localized across Canada	Current	Recurrent	Low	Low
Pollution	Low	Localized across Canada	Unknown	Unknown	Unknown	Low

1 Level of concern: qualifies the level of concern for managing the threat for the recovery of the species, consistent with the population and distribution objectives. This criterion considers all other criteria in the table.

2 Severity: reflects the population-level effect (i.e. high means a very large population-level effect; low means a limited population-level effect).

3 Causal certainty: reflects the degree of evidence that is known for the threat (i.e. high: available evidence strongly links the threat to stresses on population viability; medium: there is a correlation between the threat and population viability according to best available information; low: the threat is assumed or plausible).

4.2 Description of Threats

The threats to boreal caribou and their habitat identified in Table 3 are described below.

4.2.1 Habitat Alteration (Disturbance)

Habitat alteration occurs when changes are made on the landscape that adversely impact the ecosystem, either temporarily or permanently, reducing the overall function of habitat within the range for boreal caribou. Habitat loss is a change to a landscape that results in areas with no immediate or long-term future value to boreal caribou (e.g. conversion to agriculture, development of industrial facilities) whereas habitat degradation refers to a reduced but not total loss of habitat value for boreal caribou (e.g. reduction in the availability or quality of habitat following timber harvesting or seismic line development). Habitat fragmentation is the dissection of habitat by human-made linear features (e.g. roads, seismic lines, pipelines, hydroelectric

corridors) and polygonal features (e.g. forestry cut blocks) that may affect how boreal caribou use habitat or may result in a negative impact on the overall condition of a local population.

Environment and Climate Change Canada mapped total disturbance levels on boreal caribou ranges across their distribution in Canada as a predictor of self-sustainability for boreal caribou local populations. The total disturbance footprint was measured as the combined effects of fire that has occurred in the past 40 years and buffered (500 m) anthropogenic disturbance defined as any human-caused disturbance to the landscape that could be visually identified from Landsat imagery at a scale of 1:50,000. Although the effect of anthropogenic disturbance varies for individual ranges (i.e. in some ranges extending up to 14 km), Environment and Climate Change Canada (2011b) demonstrated that the application of a 500 m buffer to mapped anthropogenic features best represents the combined effects of increased predation and avoidance on caribou population trends at the national scale (Environment Canada, 2011b).

Data and approaches used to measure disturbance in Environment and Climate Change Canada's meta-analysis (2011b) were consistently applied across all provinces and territories. Disturbance data have been used for the purposes of this recovery strategy. Provinces and territories may have updated information and tools (e.g. Lidar remote sensing, detailed field sampling, other inventory techniques) to measure disturbance that were not considered in the national-level integrated risk assessment. Strong evidence validated by Environment and Climate Change Canada may be used to update disturbance measures and the integrated risk assessment.

Environment and Climate Change Canada (2011b) developed a methodology for consideration of disturbance management thresholds, which is described in more detail in Appendix E. With the exception of the Boreal Shield range (SK1), this amended recovery strategy identifies 65% undisturbed habitat in a range as the disturbance management threshold, which provides a measurable probability (60%) for a local population to be self-sustaining. This threshold is considered a minimum threshold because at 65% undisturbed habitat there remains a significant risk (40%) that a local population will not be self-sustaining.

For SK1, this amended recovery strategy identifies 40% undisturbed habitat in the range as the disturbance management threshold, which provides a measurable probability (71%) for the local population to be self-sustaining. This threshold is considered a minimum threshold because at 40% undisturbed habitat there remains a risk (29%) that the SK1 local population will not be self-sustaining (see Appendices D and E).

In any given range, habitat disturbance reduces the suitability of adjacent habitat, increase rates of predation, increase access to the land for hunting opportunities, and can act as barriers to boreal caribou movement (Chubbs et al., 1993; Smith et al., 2000; Dyer et al., 2001; Lander, 2006; Boreal Caribou ATK Reports, 2010-2011; Environment Canada, 2011b). In some cases boreal caribou may use areas of inadequate or degraded habitat (e.g. remnant habitat following certain types of forest fires, buffer habitat surrounding certain types of development), particularly in highly disturbed ranges where opportunities for movement to suitable undisturbed habitat are limited or unavailable. In these situations boreal caribou are at a higher mortality risk. In addition, large-scale disturbances to the landscape (e.g. intense forest fire, widespread forest harvest) can cause boreal caribou to cease their use of portions of the range.

4.2.1.1 Habitat Alteration (Loss, Degradation or Fragmentation) as a Result of Human Land-use Activities

Indigenous Knowledge and science identify disturbance primarily associated with the following human land-use activities as having a negative effect on boreal caribou local populations across Canada: forestry; oil and gas exploration and development; mining and mineral exploration and development; hydro-electric development; and tourism. These activities affect boreal caribou through a combination of direct and functional habitat loss, decreased habitat quality (i.e. habitat degradation), and development of linear features such as roads and seismic lines (i.e. habitat fragmentation) (Thomas and Gray, 2002; Vors et al., 2007; Boreal Caribou ATK Reports, 2010-2011).

The effects of habitat alteration may reduce the viability of a boreal caribou local population through the reduction of habitat quality and quantity, possibly leading to a reduction in the size of the range, and potentially resulting in the extirpation of a local population.

4.2.1.2 Habitat Alteration (Loss, Degradation or Fragmentation) as a Result of Forest Fire

Forest fires are required for boreal forest regeneration and have historically played a significant role in the local population size and distribution of boreal caribou within their range and across their Canadian distribution (Thomas and Gray, 2002; Dzus et al., 2010). Natural processes such as forest fires can directly alter habitat, making it unsuitable for boreal caribou (e.g. loss of mature conifer stands, loss of lichens and other forage plants, barriers to movement) (Environment Canada, 2011b). Boreal caribou generally do not return to burned areas for several decades until the forest is old enough to support lichens and other food sources, although they may make limited use of burned areas to feed on new growth (Boreal Caribou ATK Reports, 2010-2011).

Historically, when a forest fire occurred, boreal caribou would shift their use of habitat from the burned areas to areas that are more suitable. However, with the increase of industrial exploration and development, in a number of ranges there are fewer available suitable areas into which boreal caribou can move. When combined with human-caused disturbance, forest fires can threaten boreal caribou recovery even though they are a natural component of the boreal forest ecosystem. In some areas, forest fires have been reported as occurring more frequently than in the past (Whitefeather Forest, 2006; Boreal Caribou ATK Reports, 2010-2011).

4.2.2 Natural Processes

4.2.2.1 Predation

Across most of the distribution of boreal caribou, human-induced habitat alterations have caused an imbalance in predator-prey relationships resulting in unnaturally high predation rates. This is the major factor affecting the viability of most boreal caribou local populations (Bergerud, 1988; Stuart-Smith et al., 1997; Rettie and Messier, 1998; Schaefer et al., 1999; James and Stuart-Smith, 2000; Wittmer et al., 2005; Chabot, 2011). Based on the weight of evidence coming from science and Indigenous Knowledge, increased wolf and/or bear predation is the main proximate cause of boreal caribou decline across Canada (Bergerud, 1988; Edmonds, 1988; Seip, 1992;

Boertje et al., 1996; Boreal Caribou ATK Reports, 2010-2011; Pinard et al., 2012). However, in some parts of Canada, cougar (*Puma concolor*), coyotes (*Canis latrans*), lynx (*Lynx canadensis*), and eagles (*Haliaeetus leucocephalus* and *Aquila chrysaetos*) have also been identified as predators of boreal caribou, particularly calves (Thomas and Gray, 2002; Boreal Caribou ATK Reports, 2010-2011; McCarthy et al., 2011).

Human-caused habitat alterations have been shown to facilitate movement of predators within the boreal forest and hence can increase the abundance, distribution and hunting efficiency of species that prey on boreal caribou (James and Stuart-Smith, 2000; Neufeld, 2006; Boreal Caribou ATK Reports, 2010-2011). Additionally, although boreal caribou may not be the target prey species, they are taken opportunistically when encountered. In boreal caribou ranges with habitat alterations that provide favorable conditions for prey species such as deer and moose, predators such as wolves can increase in number, which can significantly reduce or even eliminate boreal caribou local populations (Seip, 1991; Seip, 1992; Wittmer et al., 2005; Courtois and Ouellet, 2007; Courbin et al., 2008; Boreal Caribou ATK Reports, 2010-2011). In addition to deer and moose, elk (*Cervus canadensis*), bison (*Bison bison*), and beaver (*Castor canadensis*) are other species that predators of boreal caribou commonly hunt and that have increased in number within the distribution of boreal caribou (Boreal Caribou ATK Reports, 2010-2011).

4.2.2.2 *Parasites and Diseases*

Viral, parasitic, and bacterial diseases can affect individual boreal caribou and may have effects at the local population level in certain parts of the country, although it is not thought to be one of the major threats affecting boreal caribou at the national level.

Other natural processes such as forest insects and disease can leave large areas of forest defoliated, and eventually dead, and may have an effect on boreal caribou habitat. In particular the mountain pine beetle (*Dendroctonus ponderosae*), which covers large areas of northeastern British Columbia and northern Alberta and threatens to move into Saskatchewan, could indirectly affect boreal caribou (Richie, 2008; Environment Canada, 2011a).

4.2.3 **Biological Resource Use**

4.2.3.1 *Hunting*

Hunting has and continues to contribute to the decline of boreal caribou (Bergerud, 1967; Kelsall, 1968; Bergerud, 1974; Bergerud, 1978; Courtois et al., 2007; Boreal Caribou ATK Reports, 2010-2011). Both targeted hunting and incidental harvest (when boreal caribou intermingle seasonally with legally hunted migratory caribou ecotypes) of boreal caribou are of concern in several areas, and may be contributing to local population declines and/or preventing recovery (Environment Canada, 2011a).

Although the extent of hunting is poorly understood in most areas, analyses of historical population trends, data from radio-collared animals, and current demographic information suggest that hunting remains a significant component of adult female boreal caribou mortality and hence is a primary threat in some ranges (Dzus, 2001; Schmelzer et al., 2004; Courtois et al., 2007). Hunting of boreal caribou is facilitated by the construction of roads and other linear

features and by the use of off-road vehicles that enable access to previously inaccessible areas (Boreal Caribou ATK Reports, 2010-2011). Moreover, Indigenous Knowledge indicates that technological advances in hunting tools (e.g. high-powered rifles and scopes) and in methods used to locate and access hunting sites (e.g. GPS, satellite tracking, aircraft, snowmobiles, trucks) have facilitated the chase of boreal caribou, resulting in a greater number of caribou being taken (Boreal Caribou ATK Reports, 2010-2011; Environment Canada, 2011a).

4.2.4 Climate and Natural Disasters

4.2.4.1 *Climate Change and Severe Weather*

Climate change has been identified by Indigenous Knowledge holders and scientists as a threat to boreal caribou and their habitat. Both groups indicate that there are many uncertainties surrounding the impacts of climate change and how climate change may interact with other threats. The long-term effects of climate change and the implications on boreal caribou habitat are unknown.

Greater weather variability and severe weather events, which are expected to increase with climate change, are likely to increase the frequency and severity of wildfires and cause more freeze-thaw cycles, freezing rain, deep snow, hot summer temperatures, and changes in the forest composition and food supply (Thomas and Gray, 2002; Vors and Boyce, 2009; Boreal Caribou ATK Reports, 2010-2011). In some areas, a shift in the timing and length of seasons, with earlier spring thaws and later freeze-ups, has been observed by many Indigenous Knowledge holders (Boreal Caribou ATK Reports, 2010-2011). Climate change will likely also lead to changes in habitat which, in the Northwest Territories, can increase permafrost melting.

Climate related changes in habitat favour deer and other prey species, which expand into boreal caribou range, increasing predator populations and predation of boreal caribou, and facilitating the spread of disease. Climate change may result in habitat change for boreal caribou, as it drives boreal forest composition to shift northwards, and results in other factors including the spread of forest insects that cause tree mortality (e.g. mountain pine beetle) (Johnston, 2009; Johnston, 2010).

4.2.5 Other Threats

Other threats that have a lower level of concern at the national scale (although they may be of greater concern for individual ranges) include:

Noise and Light Disturbance: Noise and light disturbance result in short-term behavioural and physiological responses of individual boreal caribou, including a startle response, elevated heart rate, and production of glucocorticoids. Sustained or repeated disturbance can result in avoidance of areas and the reduction in use of suitable habitat (Sapolsky, 1992; Creel et al., 2002).

Vehicle Collisions: In some areas, boreal caribou are vulnerable to mortality from vehicle or rail collisions (Brown and Hobson, 1998); however, on a national scale, vehicle collisions are not thought to pose a major threat to boreal caribou (Boreal Caribou ATK Reports, 2010-2011).

Pollution: The threat of pollution (e.g. from oil and gas, chemical spraying for forestry, pesticides, hydro, salt, dust and litter coming from the creation of roads) was identified as a concern through meetings held with Indigenous communities (Environment Canada, 2011a) and by Indigenous Knowledge holders (Boreal Caribou ATK Reports, 2010-2011). Very little is known about the severity of this threat to boreal caribou local populations.

5 POPULATION AND DISTRIBUTION OBJECTIVES

The national population of boreal caribou is currently made up of local populations distributed across 51 ranges in Canada (see Figure 2 and Table 2). Boreal caribou ranges are the fundamental units of conservation and management for boreal caribou recovery planning and actions (Thomas and Gray, 2002). The range is the appropriate unit of analysis for identifying critical habitat and other requirements for self-sustaining local populations of boreal caribou. The range represents the geographic area occupied by a group of individuals that are subject to similar factors affecting their demography and is used to satisfy their life history processes (e.g. calving, rutting, wintering) over a defined time frame.

5.1 Recovery of Boreal Caribou

5.1.1 Varying Ecological Conditions

Indigenous Knowledge and comments received through engagement with Indigenous communities identifies the need for continued presence of self-sustaining local populations in all boreal caribou ranges across Canada (Boreal Caribou ATK Reports, 2010-2011; Environment Canada, 2011a). This is reflected in the knowledge that all animals are connected to each other and that boreal caribou are essential to the balance of nature and for their role in the boreal ecosystem.

Boreal caribou encounter a wide variety of ecological conditions across their distribution. Taken together, all boreal caribou ranges contribute to ensuring that the full ecological gradient is represented and captures local adaptations to change. This allows for maintenance of the evolutionary potential of the species and accounts for the full spectrum of ecological interactions boreal caribou can have within the full array of ecological settings (Redford et al., 2011).

Science supports that conservation of a species such as boreal caribou is achieved by maintaining multiple local population units across a species' geographical range, in representative ecological settings, with replicate local populations in each setting that are self-sustaining, genetically robust, ecologically functional, and resilient to climate and other changes (Environment Canada, 2011b). Without connectivity, redundancy and representivity across several ecological scenarios there is an increased risk to the survival and recovery of boreal caribou.

Small local populations, particularly those isolated from the core distribution of the national population of boreal caribou, are at greater risk of not becoming self-sustaining or maintaining self-sustaining status. In these situations, a local population may have greater difficulty withstanding stochastic events, and may not experience enough immigration to maintain genetic diversity or adequate population size, and therefore will be at greater risk of not persisting in the long-term. Accordingly, different recovery actions (e.g. translocation, captive breeding) may be necessary to maintain and recover small local populations, and particularly those that are declining. There may be considerable uncertainty regarding the effectiveness of such recovery tools. It will be important to assess feasibility and conduct a risk assessment prior to undertaking any such activities.

There are several small local populations including Parker (BC4) and Prophet (BC5) in British Columbia, Nipisi (AB11) and Slave Lake (AB12) in Alberta, The Bog (MB1), Kississing (MB2), North Interlake (MB5), William Lake (MB6) and Owl-Flinstone (MB13) in Manitoba, and Red Wine Mountain (NL2) in Newfoundland and Labrador. Small isolated local populations include Little Smoky (AB5) in Alberta, Coastal (ON6) in Ontario, and Val D'Or (QC1) and Charlevoix (QC2) in Quebec (see Figure 2).

5.1.2 Connectivity Between and Within Boreal Caribou Ranges

Maintaining a long-term self-sustaining status for boreal caribou ranges depends on connectivity within and between ranges. Connectivity between ranges enables immigration and emigration between neighbouring boreal caribou local populations, which allows for the maintenance of local population size and genetic diversity. Maintaining genetic diversity is needed to maintain the resilience of a local population as described in Section 3.3.2.

Connectivity also allows wide ranging mammals like boreal caribou to adapt to changes in their natural environment (e.g. climate change, disturbance), recognizing that a contiguous population does not mean that each range must be physically connected to other ranges or that areas of habitat within a range must be physically connected to other areas. However, it does mean that the distance between ranges and between core habitat areas within a range should not be so large that no movement of boreal caribou could occur, though it may not be their preferred habitat type. Connectivity between ranges benefits gene flow and helps to maintain or increase population size. Connectivity within a range is important for seasonal movement and the use of habitat as boreal caribou respond to disturbance or as disturbed habitat recovers (Saher and Schmiegelow, 2005).

5.2 Objectives

5.2.1 Recovery Goal

The recovery goal for boreal caribou is to achieve self-sustaining local populations in all boreal caribou ranges throughout their current distribution in Canada, to the extent possible.

The recovery goal reflects the best available information, including scientific knowledge, Indigenous Knowledge and comments received through engagement with Indigenous communities. The goal is informed by the scientific principles of conservation and reflects the intent to recover all local populations. Achieving the recovery goal would allow for local population levels sufficient to sustain traditional Indigenous harvesting activities, consistent with existing Aboriginal and treaty rights. Feedback received from Indigenous communities indicated a strong support for this recovery goal.

Recovery for boreal caribou is the achievement of self-sustaining local populations, which are demographically and genetically viable connected local populations across the species' distribution. Current evidence supports the conclusion that the recovery of all local populations is biologically and technically feasible. As noted in Sections 3.3.3 and 5.1.1, small and isolated local populations are at greater risk of not becoming self-sustaining or maintaining self-sustaining status. There may be situations where recovery of a particular local population proves

to be, over time and through unforeseen circumstances, not biologically or technically feasible. Each boreal caribou local population contributes to the biodiversity, ecological functionality, and resilience of the species to environmental change, reducing the risk of species' extinction (Ray, 2011).

5.2.2 Population and Distribution Objectives

To guide recovery efforts, the population and distribution objectives (see Figure 4) are, to the extent possible, to:

- Maintain the current status of the 15 existing self-sustaining local populations (green dotted ranges); and
- Stabilize and achieve self-sustaining status for the 36 not self-sustaining local populations (blue hatched ranges).

“Not self-sustaining” local populations refers to the local populations assessed as “as likely as not self-sustaining” and those assessed as “not self-sustaining”. The population and distribution objective for the Boreal Shield (SK1) local population has been changed from “stabilize and achieve self-sustaining status” to “maintain self-sustaining status” in this amended recovery strategy, based on work carried out by P.D. McLoughlin (University of Saskatchewan, personal communications) and Environment and Climate Change Canada (2019) that indicates that the SK1 local population is self-sustaining.

5.3 Timelines to Recovery

Boreal caribou exist in mature boreal forest ecosystems that evolved over centuries, and in turn take decades to recover from disturbance. Reversing ecological processes detrimental to boreal caribou (e.g. habitat degradation and loss, the increase in predator and alternate prey populations), and instituting changes to management frameworks and ongoing land use arrangements, will often require time frames in excess of 50 to 100 years. Given these realities, while it is currently biologically and technically feasible to recover all local populations, under the best efforts of all parties, some local populations will not return to a self-sustaining status for a number of decades.

For several boreal caribou local populations, immediate actions to avoid extirpation are needed such that recovery can be achieved over time. Recovery will be monitored continuously and reported every five years (see Section 8).

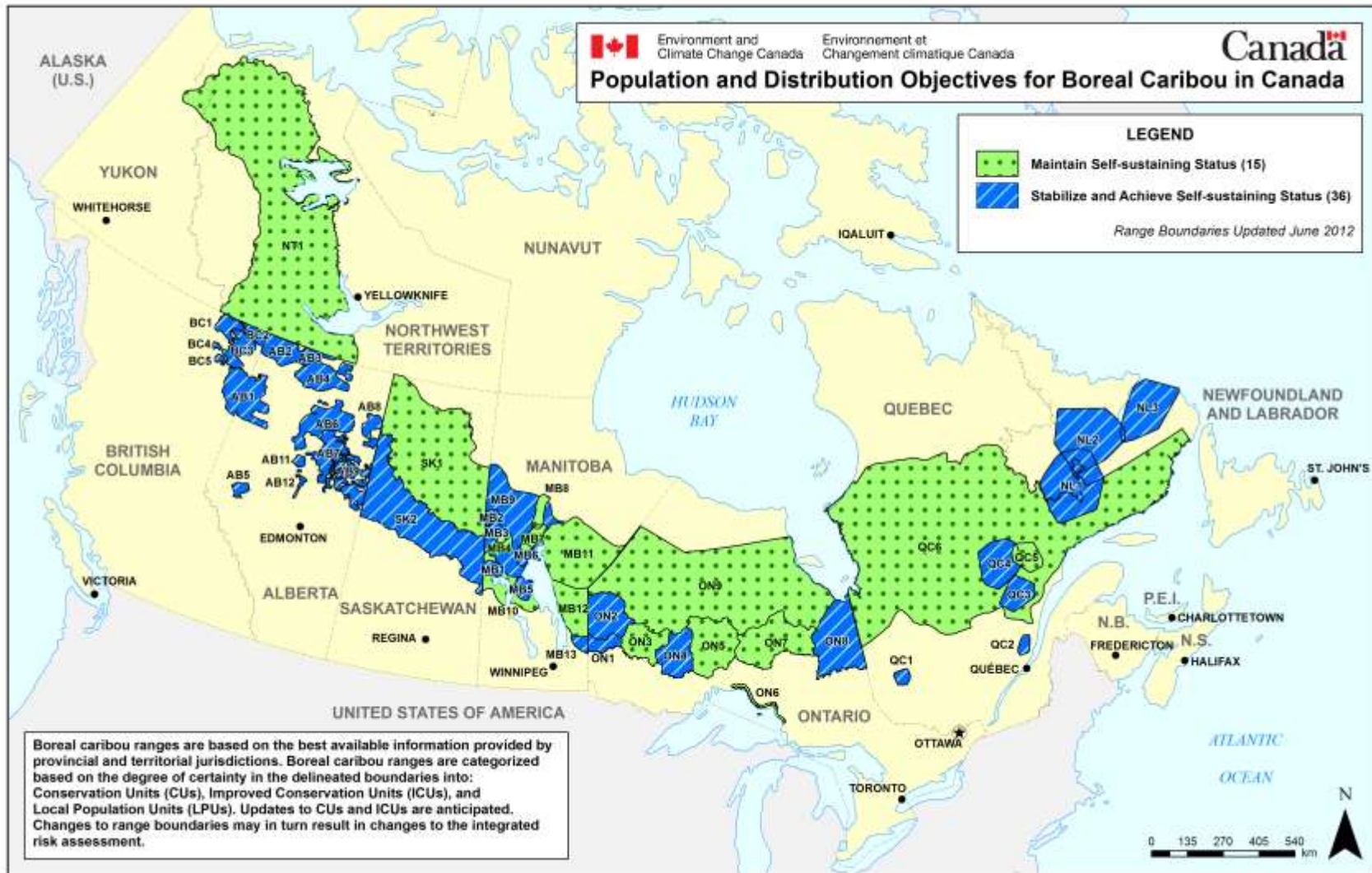


Figure 4. Population and distribution objectives for boreal caribou in Canada. The population and distribution objective for the Boreal Shield range (SK1) has been updated from “stabilize and achieve self-sustaining status” in the 2012 Recovery Strategy to “maintain self-sustaining status” in this amended recovery strategy.

5.4 Prioritizing Recovery Actions and Managing Risk

All local populations are included in the goal for the recovery of boreal caribou based on their contributions to connectivity, representivity and redundancy. Each local population also faces different challenges to maintain or achieve self-sustaining status. Successful recovery of boreal caribou will require practical considerations and implementation of recovery actions tailored for each range. Prioritization of recovery actions is being addressed at the range and/or action planning stage where the allocation of effort and the rate of risk reduction for individual ranges can best be determined.

Range and/or action planning considers a multitude of information and factors, such as regional ecological conditions, local population size and trend, boreal caribou movement between ranges, habitat condition between ranges, distribution of resources for restoration efforts, and others. In prioritizing recovery actions, consideration should be given to the current risk of extirpation of a local population, the length of time to achieve a self-sustaining status, ecological needs of connectivity, representivity and redundancy, as well as population and habitat conditions.

5.5 Achieving Recovery for Self-Sustaining Local Populations

Recovery is achieved for the 15 self-sustaining local populations by maintaining population and range conditions that support their self-sustaining status.

5.6 Achieving Recovery for Not Self-Sustaining Local Populations

Recovery is achieved for the 36 not self-sustaining local populations through a combination of coordinated habitat restoration and population management actions applied over time to return a local population to a self-sustaining status. For each not self-sustaining local population, the timeframe for achieving recovery will vary depending on whether the habitat condition and/or the population condition is/are a limiting factor.

For boreal caribou ranges where local populations are declining, stabilizing the local population by halting its decline will require immediate action. For all ranges wherein the local population size is small, achieving a stable population trend and recovering the population to a minimum of 100 animals³ will be necessary to mitigate risk of quasi-extinction. Although certain local populations with fewer than 100 animals may be stable and persist over the short-term where adequate suitable habitat supply is available, the long-term persistence of those populations is less certain. In some instances, continued human intervention may be required to achieve the minimum population size target.

In addition to managing local population size, habitat management will also be necessary. This recovery strategy identifies 65% undisturbed habitat in all ranges except SK1, and 40% undisturbed habitat in SK1, as the disturbance management threshold. This provides a

³ 100 animals provides a 0.7 probability of not reaching a quasi-extinction threshold of less than 10 reproductively active females under stable conditions over 50 years (Environment Canada, 2011b).

measurable probability (60% for all ranges with the exception of SK1, which has a 71% probability) for a local population to be self-sustaining (see Appendix E).

For boreal caribou ranges with undisturbed habitat below the threshold:

- Restoration of disturbed habitat to a minimum of 65% undisturbed habitat will be necessary in all ranges except SK1, where the threshold is set at 40% undisturbed habitat.

For boreal caribou ranges with undisturbed habitat equal to or above the threshold:

- Maintenance of a minimum of 65% undisturbed habitat will be necessary in all ranges except SK1, where maintenance of a minimum of 40% undisturbed habitat will be necessary.

There are 31 ranges that do not meet the disturbance management threshold of 65% undisturbed habitat (40% undisturbed habitat for SK1) (see Section 7.1). Of these ranges, local population trends are declining (16 local populations), stable (eight local populations) or unknown (seven local populations).

There are 20 ranges where the habitat condition meets or exceeds the disturbance management threshold. Of these ranges, four local populations are declining, two local populations are stable, and the trend of 14 local populations is unknown.

6 BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Currently Underway

Federal, provincial and territorial governments, wildlife management boards, Indigenous people, non-government organizations, and affected industries across Canada have taken and continue to take a range of actions to manage and protect boreal caribou and their habitat. Environment and Climate Change Canada's 5-Year Progress Report, published in October 2017, highlights progress made by governments, Indigenous people, and other partners and stakeholders in implementing the 2012 Recovery Strategy (Environment and Climate Change Canada, 2017). Examples of actions already completed or currently underway vary across Canada, and include:

- Identification and delineation of boreal caribou ranges and habitats within ranges;
- Assessment of the population size and/or trend and/or distribution of local populations of boreal caribou across Canada;
- Consideration of boreal caribou habitat requirements when planning and implementing forest harvesting and other industrial activities;
- Development and implementation of operating guidelines for industrial development within boreal caribou ranges;
- Land-use planning to identify areas within boreal caribou ranges where boreal caribou conservation is prioritized;
- Closed, restricted, and/or managed hunting by Indigenous and non-Indigenous people, on a voluntary basis or through regulations;
- Predator and alternate prey management in some ranges where local populations of boreal caribou are rapidly declining;
- Development of cooperative stewardship agreements and activities to support the engagement of Indigenous organizations and stakeholders in the monitoring, management, and conservation of boreal caribou;
- Preparation of outreach materials on boreal caribou and dissemination to interest groups and the general public;
- Research on boreal caribou ranges, habitat, ecology and limiting factors; and
- Continue to implement the Action Plan for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada – Federal Actions, including as it relates to the development of conservation agreements (Environment and Climate Change Canada, 2018).

Collectively, these actions, and the level of commitment associated with these actions, are an encouraging foundation upon which to build. Table 4 outlines the status of provincial and territorial recovery planning for boreal caribou.

Table 4. Status of boreal caribou recovery planning, as of April 2019, in provincial and territorial jurisdictions where boreal caribou occur.

Provincial/ Territorial Jurisdiction	Recovery Document	Recovery Goal/Objective
Northwest Territories	<ul style="list-style-type: none"> Recovery Strategy for the Boreal Caribou (<i>Rangifer tarandus caribou</i>) in the Northwest Territories, 2017 	<ul style="list-style-type: none"> Ensure a healthy and sustainable boreal caribou population across their territorial range that offers harvesting opportunities for present and future generations.
British Columbia	<ul style="list-style-type: none"> Implementation Plan for the Ongoing Management of Boreal Caribou in British Columbia, 2011 An updated recovery planning document is being collaboratively developed 	<ul style="list-style-type: none"> Decrease the expected rate of decline Significantly reduce the risk of extirpation for four populations within 50 years
Alberta	<ul style="list-style-type: none"> A Woodland Caribou Policy for Alberta, June 2011 Alberta Woodland Caribou Recovery Plan, 2004/05 – 2013/14 	<ul style="list-style-type: none"> Achieve self-sustaining woodland caribou herds and maintain the distribution of caribou in the province Ensure long-term habitat requirements throughout caribou ranges in the province
Saskatchewan	<ul style="list-style-type: none"> Conservation Strategy for Boreal Woodland Caribou (<i>Rangifer tarandus caribou</i>) in Saskatchewan, 2013 	<ul style="list-style-type: none"> Sustain and enhance woodland caribou populations, and maintain the ecosystems they require, throughout their current range
Manitoba	<ul style="list-style-type: none"> Manitoba's Boreal Woodland Caribou Recovery Strategy, 2015 	<ul style="list-style-type: none"> Self-sustaining local populations of boreal caribou across all management units Management and protection of caribou habitat to sustain boreal caribou populations
Ontario	<ul style="list-style-type: none"> Recovery Strategy for the Woodland Caribou (<i>Rangifer tarandus caribou</i>)(Forest-dwelling, Boreal Population) in Ontario, 2008 Ontario's Woodland Caribou Conservation Plan, 2009 	<ul style="list-style-type: none"> Maintain self-sustaining, genetically-connected local populations of Woodland Caribou (forest-dwelling boreal population) where they currently exist, improve security and connections among isolated mainland local populations, and facilitate the return of caribou to strategic areas near their current extent of occurrence
Quebec	<ul style="list-style-type: none"> Quebec Recovery Plan for Woodland Caribou, 2013-2023 	<ul style="list-style-type: none"> Maintain suitable habitat for caribou Maintain current distribution Achieve and maintain uniform distribution (> 11,000 caribou)
Newfoundland and Labrador	<ul style="list-style-type: none"> Recovery Strategy for Three Woodland Caribou Herds (<i>Rangifer tarandus caribou</i>; Boreal population) in Labrador, 2004 Updated Recovery Plan is being prepared 	<ul style="list-style-type: none"> Prevent extinction and improve status of current herds Determine and achieve viable, self-sustaining wild populations distributed throughout their available current and historical ranges for each of the three herds

6.2 Strategic Direction for Recovery

The following table (see Table 5) and narrative describe, at a national level, the broad strategies and general approaches to be taken and the research and management activities needed to address the threats to boreal caribou and achieve the population and distribution objectives for each range. Many strategies and approaches are interrelated and details on their implementation and their level of priority will differ across the country and by local population and habitat conditions. Sequencing and timing of specific recovery actions and their level of priority will be outlined and addressed in range plans and/or action plans (see Sections 7.3 and 9).

Table 5. Recovery planning table for boreal caribou

Threat or Limitation	Priority ⁵	Broad Strategy to Recovery	General Description of Research and Management Approaches
Landscape Level Planning			
Habitat alteration as a result of human land-use activities Habitat alteration as a result of natural processes	Urgent	Undertake landscape level planning that considers current and future boreal caribou habitat requirements	<ul style="list-style-type: none"> • Develop range plans (see Section 7.3) that outline range-specific population and habitat management activities with measurable targets to achieve recovery goal. • Undertake coordinated land and/or resource planning to ensure that development activities are planned (type, amount, and distribution) and implemented at appropriate spatial and temporal scales (e.g. consider sensitive periods/areas such as calving). • Plan to maintain habitat within and between boreal caribou ranges, to maintain connectivity where required. • Undertake coordinated planning among provincial and territorial jurisdictions that jointly manage ranges (i.e. transboundary ranges) to reach agreement on the overall strategic direction for local population recovery. • Develop range-appropriate cumulative effects assessment approaches. Very large ranges (Northwest Territories (NT1), Far North (ON9), and Quebec (QC6)) will require different approaches. • Communicate among governments, wildlife management boards, Indigenous communities and organizations, non-governmental organizations, and other organizations responsible for land and/or resource management and/or conservation within the boreal forest to ensure coordination of planning and management and, where applicable, facilitate cross-jurisdictional cooperation and implementation.
Habitat Management			
Habitat alteration as a result of human land-use activities Habitat alteration as a result of natural processes	Urgent	Manage habitat to meet current and future habitat requirements of boreal caribou	<ul style="list-style-type: none"> • Protect key areas for boreal caribou through appropriate habitat management and protection mechanisms (e.g. legislated protected areas, no development zones, mixed use zones, and conservation agreements). • Undertake coordinated actions to reclaim boreal caribou habitat through restoration efforts (e.g. restore industrial landscape features such as roads, old seismic lines, pipelines, cut-lines, temporary roads, cleared areas; reconnect fragmented ranges).

Threat or Limitation	Priority ⁵	Broad Strategy to Recovery	General Description of Research and Management Approaches
			<ul style="list-style-type: none"> • Measure and monitor disturbance on the landscape (see Section 4.2.1). Update range plans to reflect changes in habitat condition. • Where ranges are highly disturbed, identify areas that will be prioritized for boreal caribou recovery and targeted for early habitat reclamation. Incorporate management guidelines and actions into permitting conditions for activities identified as affecting boreal caribou or their habitat. • For ranges that are jointly managed (i.e. transboundary), undertake collaborative habitat management among responsible provincial and territorial jurisdictions to ensure equitable efforts are underway. • Encourage stewardship of boreal caribou habitat among industries, interest groups, and Indigenous communities and organizations. • Assess the impact of natural disturbance (e.g. forest fire) on the long-term habitat management of boreal caribou ranges. Where necessary, incorporate short- and long-term boreal caribou habitat considerations, along with other considerations, into forest fire management. • Monitor habitat and use adaptive management to assess progress and adjust management activities as appropriate.
Mortality and Population Management			
Predation	High	Manage predators and alternate prey	<ul style="list-style-type: none"> • Where necessary, apply predator management as an interim management tool, in conjunction with other management approaches (e.g. habitat restoration and management), to achieve boreal caribou local population growth. Alternate prey management may also be applied in conjunction with predator management. • Where applicable, consider effective indirect predator management techniques as an alternative to direct predator management (e.g. limiting predator access, penning of boreal caribou). • Where mortality and/or population management are implemented, monitor boreal caribou local populations and consider monitoring the effects on other impacted species.
Hunting	Medium	Manage direct human-caused mortality of boreal caribou	<ul style="list-style-type: none"> • Determine the extent of current hunting, and the effects of hunting on boreal caribou local populations. • In consultation with Indigenous people, develop and implement harvest strategies, where required to achieve boreal caribou recovery. • Assess and address impacts of hunting regulations for all boreal caribou ranges that overlap with other legally hunted Woodland Caribou ecotypes. • Reduce illegal hunting through stewardship, education and enforcement.

Threat or Limitation	Priority ⁵	Broad Strategy to Recovery	General Description of Research and Management Approaches
Population Monitoring			
Knowledge gaps: Population dynamics (trends, size, structure, and distribution)	High	Conduct population studies to better understand population structure, trends and distribution	<ul style="list-style-type: none"> • Where necessary, refine understanding of the structure and functioning of boreal caribou local populations. • Monitor population size and/or trend, as well as changes in boreal caribou distribution over time and in relation to habitat condition and disturbance. • Coordinate data collection, data-sharing, and planning between or among neighbouring provincial and territorial jurisdictions to establish transboundary ranges where appropriate. • Revise boreal caribou range delineations based on updated population information from science and Indigenous Knowledge.
Knowledge gaps: boreal caribou health and condition	Low - Medium	Monitor boreal caribou health and condition	<ul style="list-style-type: none"> • Gather information, monitor and manage the health and body condition of individual boreal caribou.
Knowledge gaps: boreal caribou sensory disturbance	Low - Medium	Monitor and manage sensory disturbance of boreal caribou	<ul style="list-style-type: none"> • Assess the extent, distribution, and possible consequences of sensory disturbance (e.g. aircraft traffic, snowmobiles, all-terrain vehicles, tourism, research, and equipment associated with oil and gas or forestry) on boreal caribou, and where required reduce its effects, particularly during sensitive periods (e.g. calving). • Minimize disturbance to boreal caribou during monitoring and research programs, and select monitoring and research techniques that are the least intrusive.

⁵ Priority: reflects the level of priority of the broad strategy on a national level. This priority for each local population may differ.

6.3 Narrative to Support the Recovery Planning Table

Recovery of boreal caribou will require the commitment, collaboration and cooperation among federal, provincial and territorial jurisdictions, wildlife management boards, Indigenous people, local communities, landowners, industry and other interested parties. It will be important to monitor habitat conditions, size and/or trend, and the distribution of boreal caribou local populations so that the effectiveness of individual range management regimes can be evaluated, and adjusted as necessary. It should also be recognized that it takes time for the impact of human developments and natural disturbances on boreal caribou to become evident. Therefore, range plans and/or action plans must take into account the likelihood of a delayed boreal caribou population and distribution response to anthropogenic or natural habitat alterations.

6.3.1 Landscape Level Planning

As the range has been identified as the most relevant scale at which to plan for the conservation of boreal caribou, undertaking landscape level land and/or natural resource planning is appropriate for effective management of cumulative effects of habitat disturbance within boreal

caribou ranges and for managing disturbance over time to ensure sufficient habitat is available for boreal caribou, both of which are more difficult in the context of individual project approvals. Range-level planning for boreal caribou should consider current and future human developments and determine detailed management activities that are tailored to the conditions of the range and the local population in question. Range plans and/or action plans should take into account natural disturbances and cumulative effects of development within and between boreal caribou ranges.

It will be important to undertake coordinated land and/or resource planning to ensure that development activities are planned and approved, taking into consideration the cumulative impacts of all current and future developments within a range. Assessing cumulative effects will require a different approach for large continuous ranges than for smaller discrete ranges. The impact of disturbance that may be concentrated in part of a large continuous range may be masked given the size of the range. Dividing the large areas into smaller management units may allow land managers to better understand where the disturbance is occurring and plan accordingly, in order to avoid irreversible range retraction and permanent breaks in range connectivity.

In light of the impacts that actions taken in neighbouring ranges have on boreal caribou, it will be important that provinces and territories take a collaborative approach to land and/or resource planning, particularly in ranges that are jointly managed (i.e. transboundary), to ensure an agreed upon direction to boreal caribou recovery is attained.

6.3.2 Habitat Management

Boreal caribou ranges will need to be managed to ensure their current and future ability to support self-sustaining local populations. The effectiveness of various management activities may vary between and within ranges due to differences in population condition and specific local conditions.

Management of the amount, type and distribution of human developments will be necessary. Both anthropogenic and natural disturbances will need to be monitored and measured. Methods may vary in accordance with the information and tools available to the provinces and territories. Anthropogenic disturbance (i.e. industrial and other human activities) will need to be managed in a manner consistent with land and/or resource planning that has taken into account the current and future habitat requirements of boreal caribou. Disturbed areas may need to be improved or restored to support population and distribution objectives within each boreal caribou range. Maintaining connectivity within and between habitat patches and ranges will be particularly important for boreal caribou. In certain cases, it may be necessary to identify and designate protected areas with biophysical attributes for boreal caribou. For ranges that are jointly managed by provinces and territories (i.e. transboundary), collaborative habitat management approaches will be necessary to ensure that equitable recovery efforts are underway. Though ranges may cross provincial and territorial boundaries, each jurisdiction remains accountable for activities carried out in their own range.

6.3.3 Mortality and Population Management

6.3.3.1 *Manage Predators and Alternate Prey*

Human-induced habitat alterations have upset the natural balance between boreal caribou and their predators, resulting in unnaturally high predation rates in some boreal caribou ranges. As a result, in some ranges, a population management approach involving management of other wildlife species (i.e. predators and alternate prey) may be required to stop boreal caribou declines and stabilize the local population in order to prevent their extirpation in the short-term. Where the condition of the local population warrants such measures, predator and in some cases alternate prey management may be applied as interim management tools, recognizing that a punctuated approach to mortality management may be necessary over a period of time while habitat conditions in the range recover. Where mortality management is applied, concurrent application of other management tools will be needed to achieve boreal caribou recovery. In particular, habitat restoration and management will be necessary to recover the range conditions to provide an adequate habitat supply system to support boreal caribou local populations. Predator and alternate prey management should be considered simultaneously. Alternate prey management applied in the absence of concurrent predator management has the potential to be harmful to boreal caribou conservation.

6.3.3.2 *Manage Direct Human-Caused Mortality of Boreal Caribou*

The extent of hunting and its effect on boreal caribou local populations is largely unknown across most of the distribution of boreal caribou. Therefore, it is important to first determine the level of hunting within a range in order to understand the potential impact of hunting on the viability of a local population. Attention should also be given to areas where boreal caribou ranges overlap with legally hunted caribou ecotypes, and hunting regulations for the legally hunted caribou ecotypes should be modified as appropriate. In areas where hunting is shown to have a negative effect on local population viability, harvest strategies should be developed, in consultation with Indigenous people, to achieve boreal caribou recovery.

6.3.4 Population Monitoring

6.3.4.1 *Conduct Population Studies to Better Understand Boreal Caribou Population Structure, Trends and Distribution*

There is considerable variation in the level of understanding of boreal caribou local population structure and trends across their distribution. While accurate population size and trend estimates are available for some local populations, for others, size and trend estimates are based primarily on professional judgement and limited data. For local populations where little is known, baseline population ecology studies such as boreal caribou collaring, aerial observations/counting, and on the ground monitoring activities are required to establish a baseline from which to plan and measure recovery progress. For all local populations, size and/or trend, and distribution should be monitored over time to test the efficacy of management actions and adapt those management actions as appropriate.

6.3.4.2 *Monitor Boreal Caribou Health and Condition*

Parasites and disease can affect individual boreal caribou and may have effects at the local population level in certain parts of the country. Pollution from oil and gas contaminated sites has also been shown to negatively affect the health of boreal caribou and may result in mortality if individuals consume toxins at waste sites. However, little is known about the severity of parasites, disease and pollution to individual boreal caribou or to boreal caribou local populations. Therefore, information on the health and body condition of boreal caribou should be monitored to better understand the relationship between these threats and the viability of local populations, and whether there is a need for additional recovery actions.

6.3.4.3 *Monitor and Manage Sensory Disturbance of Boreal Caribou*

The extent, distribution and effects of various sources of sensory disturbance (e.g. low-flying aircraft, snowmobiles, equipment associated with various industries) on individual boreal caribou and boreal caribou local populations should be assessed. Where required, management actions to reduce the effects of sensory disturbance on boreal caribou should be implemented and the effectiveness of the management actions should be monitored over time and adapted as necessary.

7 CRITICAL HABITAT

Under SARA, critical habitat is defined 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”. For boreal caribou, critical habitat identification describes the habitat that is necessary to maintain or recover self-sustaining local populations throughout their distribution. In some of the areas identified as critical habitat, the quality of habitat will need to be improved for recovery to be achieved.

Boreal caribou shift in their use of range over space and time, in accordance with changes in the location of biophysical attributes within the range as areas of disturbed and undisturbed habitat cycle on the landscape. For a local population to be self-sustaining over time, this habitat supply system (i.e. critical habitat) must function perpetually.

7.1 Identification of Critical Habitat for Boreal Caribou

7.1.1 Critical Habitat for All Ranges Except the Boreal Shield Range

Based on the foregoing, critical habitat for boreal caribou is identified for all boreal caribou ranges, except for northern Saskatchewan’s Boreal Shield range (SK1), (see Figure 5) as:

- The area within the boundary of each boreal caribou range that provides an overall ecological condition that will allow for an ongoing recruitment and retirement cycle of habitat, which maintains a perpetual state of a minimum of 65% of the area as undisturbed habitat; and
- Biophysical attributes required by boreal caribou to carry out life processes (see Appendix H).

Based on methodology developed by Environment and Climate Change Canada (2011b), a disturbance management threshold of 65% has been identified, which provides a measurable probability (60%) for a local population to be self-sustaining (see Appendix E). The precise location of the 65% undisturbed habitat within the range will vary over time. The habitat within a range should exist in an appropriate spatial configuration such that boreal caribou can move throughout the range and access required habitat when needed. The key to this identification is achieving and maintaining an overall, ongoing range condition that allows for the dynamic habitat supply system, containing the biophysical attributes upon which boreal caribou depend, to operate. It is this dynamic habitat supply system within the range boundaries that is the habitat condition necessary for the recovery of boreal caribou.

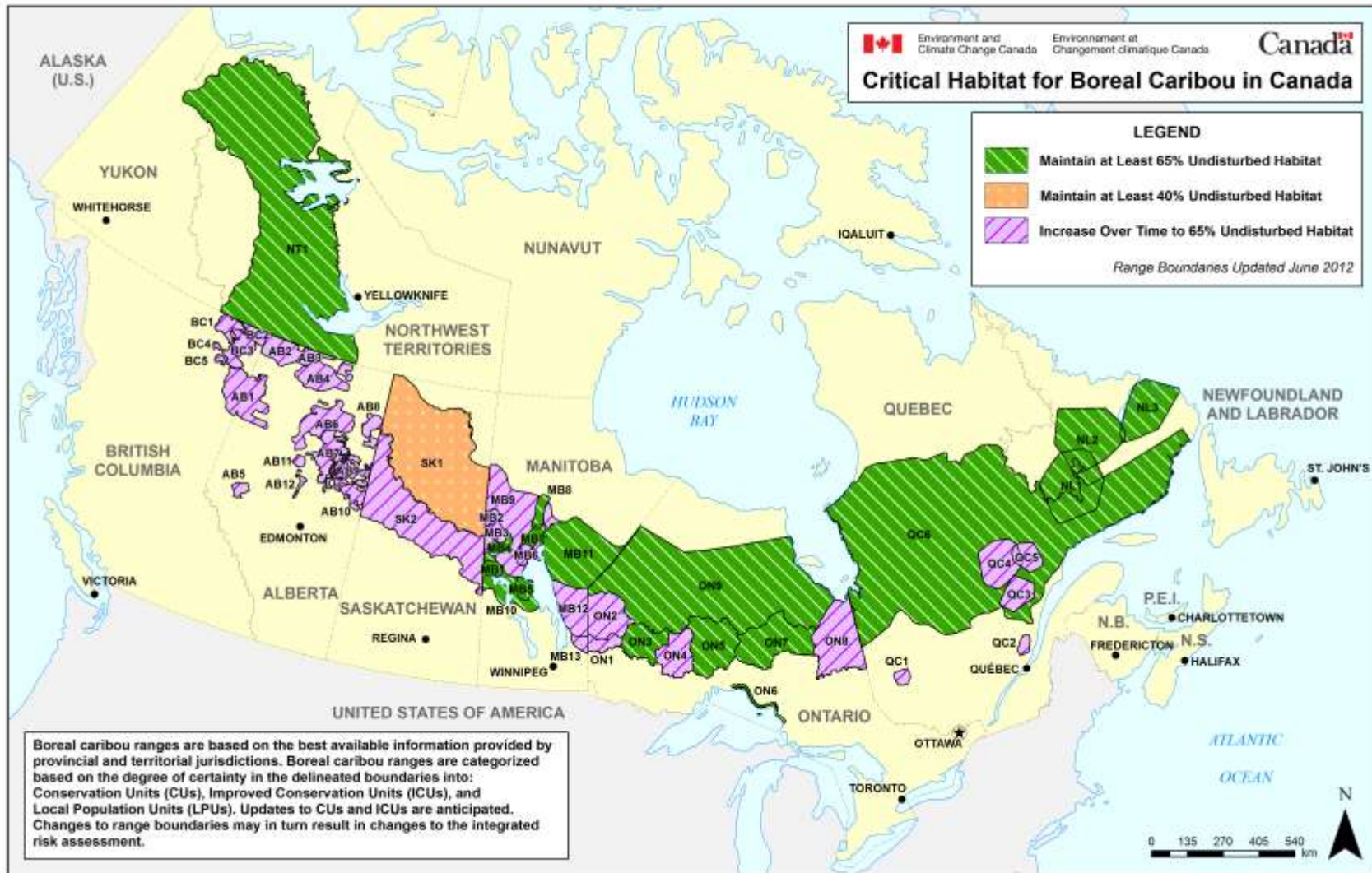


Figure 5. Critical habitat for boreal caribou in Canada as of 2019. Updated information includes the identification of critical habitat in SK1. MB6 and QC5 have also been updated from green to mauve based on habitat condition information previously published in the 5-Year Progress Report (Environment and Climate Change Canada, 2017).

7.1.2 Critical Habitat in Northern Saskatchewan's Boreal Shield Range (SK1)

Critical habitat was not identified in SK1 in the 2012 Recovery Strategy due to a lack of data on population size and trend, and the uniqueness of the disturbance regime (i.e. high fire and very low anthropogenic disturbance). As required under SARA, a schedule of studies was developed to identify critical habitat in SK1 and the schedule of studies is now complete (see Appendix D).

Critical habitat for boreal caribou in northern Saskatchewan's Boreal Shield range (SK1), (see Figure 5) is identified as:

- The area within the boundary of the SK1 boreal caribou range that provides an overall ecological condition that will allow for an ongoing recruitment and retirement cycle of habitat, which maintains a perpetual state of a minimum of 40% of the area as undisturbed habitat; and
- Biophysical attributes required by boreal caribou to carry out life processes (see Appendix H).

Based on three years of demographic data collected in SK1 between 2015 and 2017 by P.D. McLoughlin (University of Saskatchewan, personal communication), as part of the schedule of studies to identify critical habitat, additional analyses were completed by Environment and Climate Change Canada that indicate the SK1 local population is likely self-sustaining at current levels of disturbance (60% total disturbance), with a 71% probability of persistence (see Figure 3 and Appendix E). Environment and Climate Change Canada's analyses also show that the SK1 local population is sensitive to small increases in anthropogenic disturbance and sensitive to small decreases in adult survival. For these reasons, a higher probability of persistence was selected for critical habitat identification in SK1 (71%) than was selected for the other 50 ranges across Canada (60%) (Environment and Climate Change Canada, 2019).

The precise location of the 40% undisturbed habitat within the range will vary over time. The habitat within the SK1 range should exist in an appropriate spatial configuration such that boreal caribou can move throughout the range and access required habitat when needed. The key to this identification is achieving and maintaining an overall, ongoing range condition that allows for the dynamic habitat supply system, containing the biophysical attributes upon which boreal caribou depend, to operate. It is this dynamic habitat supply system within the SK1 range boundary that is the habitat condition necessary for the recovery of boreal caribou.

7.1.3 Components of Critical Habitat

The identification of critical habitat for boreal caribou is comprised of three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat. Appendix J provides critical habitat component information for each boreal caribou range.

Location

Location describes where critical habitat is found. For boreal caribou the relevant scale to identify critical habitat is the range, which delineates the area within which critical habitat is located. There are 51 ranges within the current distribution of the boreal caribou (see Figure 2 and Table 2).

Amount

Amount describes the quantity of critical habitat.

A strong relationship exists between habitat disturbance and whether a local population is stable, increasing or decreasing. As the quantity and/or severity of disturbance increases, there is increasing risk that a local population will be in decline (Environment Canada, 2011b), as further described in Appendix E.

Amount for all ranges except the Boreal Shield range: With the exception of the Boreal Shield range (SK1), this recovery strategy identifies a minimum of 65% undisturbed habitat in a range as the disturbance management threshold, which provides a measurable probability (60%) for a local population to be self-sustaining. This threshold is considered a minimum threshold because at 65% undisturbed habitat there remains a significant risk (40%) that local populations will not be self-sustaining.

Amount for the Boreal Shield range: For SK1, this recovery strategy identifies a minimum of 40% undisturbed habitat in the range as the disturbance management threshold, which provides a measurable probability (71%) for the local population to be self-sustaining. This threshold is considered a minimum threshold because at 40% undisturbed habitat there remains a risk (29%) that the local population will not be self-sustaining.

Habitat disturbance within a range needs to be managed by the responsible jurisdiction at a level that will allow for a local population to be self-sustaining. As there is variation in habitat and population conditions between boreal caribou local populations across their distribution, for some ranges it may be necessary to manage the range above the 65% undisturbed habitat threshold, while for other ranges, such as SK1, it may be possible to manage the range below the 65% undisturbed habitat threshold. However, there must be strong evidence, validated by Environment and Climate Change Canada, from population data collected over an extended period of time to support the management decision to establish a lower range-specific threshold (i.e. the lag effects of disturbance on a local population have been considered and accounted for).

In the absence of strong evidence to support lowering the undisturbed habitat threshold below 65%, the amount of critical habitat for all ranges, except SK1, is at least 65% undisturbed habitat. For management purposes, the amount of critical habitat may need to be maintained or restored, depending on the level of disturbance in a range.

- In ranges with undisturbed habitat below the threshold, initially, critical habitat is the existing habitat that over time would contribute to the attainment of 65% undisturbed habitat (40% undisturbed habitat for SK1).
- In ranges with undisturbed habitat equal to or above the threshold, critical habitat is at least 65% undisturbed habitat in a range (40% undisturbed habitat for SK1).
- The habitat that is included in the 65% undisturbed habitat (40% undisturbed habitat for SK1) will change over time given the dynamic nature of the boreal forest.

As previously reported in the 5-Year Progress Report, two ranges – the William Lake range (MB6) and the Manicouagan range (QC5) – changed from having greater than 65% undisturbed habitat to having less than 65% undisturbed habitat (Environment and Climate Change Canada, 2017). This change is reflected in both Figure 5 and Appendix J, where the amount of critical habitat for these two ranges changed from green (“maintain at least 65% undisturbed habitat”) to mauve (“increase over time to 65% undisturbed habitat”).

Section 4.2.1 describes the methodology used to measure disturbance for each range.

Type

Type describes the biophysical attributes of critical habitat.

Biophysical attributes are the habitat characteristics required by boreal caribou to carry out life processes necessary for survival and recovery. Biophysical attributes within and adjacent to core habitat areas of boreal caribou use will be more important to a local population than those that are isolated and less accessible to boreal caribou (i.e. spatially separated by a disturbance). The biophysical attributes for boreal caribou will vary over space and time with the dynamic nature of the boreal forest. In addition, particular biophysical attributes will be of greater importance to boreal caribou at different points in time. Certain biophysical attributes are required more by a local population during different life processes, seasons or at various times over the years.

Information from Indigenous Knowledge (Boreal Caribou ATK Reports, 2010-2011), habitat selection analyses, and scientific published reports (Environment Canada, 2011b) were used to summarize the biophysical attributes necessary for boreal caribou. Results are categorized by the habitat type (e.g. calving habitat, winter habitat) and are provided by ecozone in order to capture the ecological variation across the current distribution of boreal caribou (see Appendix H). In addition to variation across ecozones, the biophysical attributes necessary for boreal caribou will vary both between and within ranges. For certain ranges, more specific information was made available to describe biophysical attributes and this has been included in Appendix H.

7.2 Activities Likely to Result in the Destruction of Critical Habitat

SARA requires that a recovery strategy identify examples of activities likely to destroy critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by boreal caribou. Destruction may result from a single activity, multiple activities at one point in time, or from the cumulative effects of one or more activities over time.

Activities that are likely to result in the destruction of critical habitat, include, but are not limited to, the following:

- Any activity resulting in the direct loss of boreal caribou critical habitat. Examples of such activities include: conversion of habitat to agriculture, forestry cut blocks, mines, and industrial and infrastructure development.

- Any activity resulting in the degradation of critical habitat leading to a reduced, but not total loss of both habitat quality and availability for boreal caribou. Examples of such activities include: pollution, drainage of an area, and flooding.
- Any activity resulting in the fragmentation of habitat by human-made linear features. Examples of such activities include: road development, seismic lines, pipelines, and hydroelectric corridors.

7.2.1 Likelihood of Critical Habitat Destruction for All Ranges Except the Boreal Shield Range

The likelihood that critical habitat will be destroyed is increased if any one of the above activities, or combination thereof, were to occur in such a manner, place and time, that after appropriate mitigation techniques (see Appendix I) any one of the following were to occur:

- Compromise the ability of a range to be maintained at 65% undisturbed habitat;
- Compromise the ability of a range to be restored to 65% undisturbed habitat;
- Reduce connectivity within a range;
- Increase predator and/or alternate prey access to undisturbed areas; or
- Remove or alter biophysical attributes necessary for boreal caribou.

7.2.2 Likelihood of Critical Habitat Destruction for the Boreal Shield Range

For the Boreal Shield range (SK1), the likelihood that critical habitat will be destroyed is increased if any one of the above activities, or combination thereof, were to occur in such a manner, place and time, that after appropriate mitigation techniques (see Appendix I) any one of the following were to occur:

- Compromise the ability of the range to be maintained at 40% undisturbed habitat;
- Increase total anthropogenic disturbance within the range above 5% (while maintaining a minimum of 40% undisturbed habitat);
- Reduce connectivity within the range;
- Increase predator and/or alternate prey access to undisturbed areas; or
- Remove or alter biophysical attributes necessary for boreal caribou.

Based on Environment and Climate Change Canada's 5-Year Progress Report, and as reported in Appendix F, the SK1 range currently has 40% undisturbed habitat (or 60% disturbed habitat) (Environment and Climate Change Canada, 2017). The 60% total non-overlapping disturbance is comprised of 58% fire and 3% anthropogenic disturbance⁴. Analyses conducted by Environment and Climate Change Canada, using population data provided by the University of Saskatchewan, indicates that based on the three years of available population data there is a 71% probability that

⁴ When calculating total disturbance for a range, anthropogenic disturbance and fire disturbance that overlap are not counted twice in the total.

the SK1 location population is self-sustaining at the current levels of disturbance (P.D. McLoughlin, University of Saskatchewan, personal communication; Environment and Climate Change Canada, 2019). Environment and Climate Change Canada's analyses also investigated the changes in the probability of persistence with increasing levels of anthropogenic disturbance in the range. Results show that with an additional 2.5–3.0% anthropogenic disturbance, the probability of persistence of the SK1 local population drops from 71% to 60%, and to 50% when the additional anthropogenic disturbance reaches 5% (Environment and Climate Change Canada, 2019). The analyses did not consider the additional effects of fire disturbance due to the difficulties in managing wildfires.

Additional analyses by Environment and Climate Change Canada (2019) demonstrated that anthropogenic disturbance is not equivalent to fire, with the former having a stronger negative effect on population condition. This result, coupled with the analyses that showed that the local population is sensitive to small increases in anthropogenic disturbance and sensitive to small decreases in adult survival, indicates that caution is warranted with respect to additional anthropogenic disturbance in this range (see Appendix D) (Environment and Climate Change Canada, 2019). Therefore, for SK1 critical habitat, activities that pertain specifically to increasing the level of anthropogenic disturbance in SK1 has been added to the list of factors that increase the likelihood that critical habitat will be destroyed.

7.2.3 Cumulative Effects

A single project/activity may or may not result in the destruction of critical habitat; however, when considered in the context of all current and future development activities within and among ranges, the cumulative impacts may result in the destruction of critical habitat.

Mitigation of adverse effects from individual projects/activities will require a coordinated approach and management of cumulative effects within and among ranges. A cumulative effects assessment is essential to position the proposed project/activity in the context of all current and future development activities. The cumulative effects assessment will:

- Assess the impact of all disturbances (anthropogenic and natural) at the range-scale;
- Monitor habitat conditions, including the amount of current disturbed and undisturbed habitat (see Section 4.2.1), and amount of habitat being restored;
- Account for planned disturbances; and
- Assess the distribution of disturbance in large ranges for risk of range retraction in parts of the range.

For large continuous ranges, a different approach for assessing cumulative effects will be required than for smaller discrete ranges. Dividing the large areas into smaller management units will allow land managers to understand where the disturbance is occurring and avoid irreversible range retraction and a permanent break in range connectivity.

Determination of whether an activity is likely to result in the destruction of critical habitat will be facilitated by a range plan. For example, a range plan would identify activities that are likely to result in direct loss, degradation, and/or fragmentation of habitat, relevant to specific local

circumstances. Any development that does not align with the range plan would be considered an activity likely to destroy critical habitat.

7.3 Range Plans

Given the dynamic nature of boreal caribou habitat requirements, the landscape scale at which those requirements operate, and the highly variable present-day land management and ecological conditions that exist among all boreal caribou ranges, range-specific approaches to protecting critical habitat, and in many cases improving the condition of critical habitat for this species, are needed.

In light of jurisdictional responsibilities for land and natural resource management, it is expected that they will develop range plans. In areas where the responsibility for land and natural resource management varies, range plans will be developed collaboratively between all responsible authorities. Range plans may be stand-alone documents, or part of other planning documents including action plans. In September 2016, Environment and Climate Change Canada published the Range Plan Guidance for Woodland Caribou, Boreal Population to assist provincial and territorial jurisdictions in their preparation of range plans (Environment and Climate Change Canada, 2016). The Range Plan Guidance provides general guidance on the development of range plans and is consistent with the guidance provided in this recovery strategy.

Range plans will outline how the given range will be managed to maintain or attain a minimum of 65% undisturbed habitat in all ranges other than SK1, and 40% undisturbed habitat in the SK1 range, over time. Specifically each range plan should reflect disturbance patterns on the landscape, as measured and updated by the provinces and territories, and outline measures and steps that will be taken to manage the interaction between human disturbance and natural disturbance.

Difference between a range plan and an action plan

Action plans, which are required under SARA, provide the public and stakeholders with details on how the recovery strategy will be implemented. Action plans include a broad spectrum of subjects, such as: measures to address threats and to achieve population and distribution objectives; an evaluation of socio-economic costs and benefits to be derived from its implementation; and an approach for monitoring and reporting, etc. An action plan is not necessarily range-specific; it could cover multiple ranges or even specific recovery measures within a range. Range plans are documents that outline how a given range will be managed to ensure that critical habitat is protected from destruction.

Purpose of a range plan

The main purpose of a range plan is to outline how range-specific land and/or resource activities will be managed over space and time to ensure that critical habitat is protected from destruction. As such, each range plan should reflect disturbance patterns on the landscape, as measured and updated by the provinces and territories, and outline the measures and steps that will be taken to manage the interaction between human disturbance, natural disturbance, and the need to maintain or establish an ongoing, dynamic state of a minimum of 65% of the range as undisturbed habitat

in all ranges other than SK1, and 40% undisturbed habitat in the SK1 range, at any point in time to achieve or maintain a self-sustaining local population. While the general ecological principles and critical habitat dynamics described in the recovery strategy apply to all ranges, individual ranges also possess a unique mix of ecological and land use conditions (e.g. population condition, habitat condition and configuration, social and legal arrangements) that must be factored into decision making.

The range plans, consistent with this recovery strategy, will be one factor considered by the Minister of Environment and Climate Change in forming an opinion on whether the laws of the province or territory effectively protect critical habitat within each boreal caribou range. As such, range plans should contain the background information necessary for the Minister of Environment and Climate Change to make an informed assessment of whether critical habitat protection is in place or is being realistically pursued throughout the range. Specifically, range plans should indicate what laws of the province or territory, legislative and/or regulatory provisions, licences or other instruments issued under an Act or regulation, or contractually binding agreements the jurisdiction intends to use to protect critical habitat. In the absence of range plans, the minister will use the best available information and consult with the jurisdiction to determine whether critical habitat is effectively protected. If the minister is of the opinion that there are no provisions in or measures under SARA or another Act of Parliament that protect the critical habitat (including a section 11 agreement) and the laws of the provinces and territories do not effectively protect their critical habitat, the Minister of Environment and Climate Change is required to recommend that a protection order be made to the to the Governor in Council.

Range plans may form part of an action plan under SARA. However, in order to be adopted in whole or in part as an action plan by the Minister of Environment and Climate Change, the range plan and the process used to develop it will need to meet the requirements of section 48 (cooperation) and section 49 (content) of SARA. In addition, range plans will be used to inform reporting that is required under SARA on implementation and progress toward meeting the population and distribution objectives of this recovery strategy. Finally, range plans may be used to inform decisions related to environmental assessments, issuance of permits (either under SARA or other applicable legislation), and other similar approval processes.

Process for developing a range plan

The development of each range plan will be led by the responsible provincial or territorial jurisdiction. In areas where the management responsibility for land and natural resource management varies, range plans will likely be multi-jurisdictional led between all responsible authorities. Range plans should be developed in a collaborative manner with directly affected stakeholders and should also engage local land users. Jurisdictions are encouraged to use Indigenous Knowledge when developing range plans and should also apply the appropriate level of cooperation with Indigenous peoples as they would in any other resource management planning process that is undertaken within their province or territory. The exact process of collaboration that is used is the responsibility of each jurisdiction and may vary between jurisdictions.

Range plans may be updated by the jurisdictions over time to reflect changes in habitat and

population conditions for any given range. In particular, range plans should be updated following any significant natural disturbance event (e.g. forest fires).

Timelines for the development of range plans

Given the variation in management contexts, population and habitat information, and levels of risk across the geographic distribution of boreal caribou, the 2012 Recovery Strategy called for range plans to be completed by the responsible jurisdiction(s) within 3-5 years of the posting of the 2012 Recovery Strategy. Environment and Climate Change Canada continues to seek commitments to develop jurisdictional range plans or other similar documents through the development of conservation agreements.

For the Boreal Shield range (SK1), the Government of Saskatchewan should complete the range plan by June 2021.

What should be included in a range plan?

There is no single prescriptive approach to developing a range plan, and jurisdictions may select those approaches they consider most appropriate. Range plans should include such things as:

- Demonstration of how at least 65% undisturbed habitat (40% undisturbed habitat in SK1), will be achieved and/or maintained over time;
- For SK1, demonstration of how total anthropogenic disturbance in the range will be maintained at or below 5% (while maintaining a minimum of 40% undisturbed habitat) (see section 7.2.2);
- List of the laws of the province or territory (including any corresponding regulations, permits, licenses, etc.) and conservation measures (such as agreements, programs, compliance incentives, conservation leases, etc.) that will be used to prevent activities likely to destroy critical habitat;
 - include land tenure assessment for all areas of critical habitat within each range
 - where protection measures do not exist, the range plan should indicate the steps being taken to put them in place and the expected timeline for implementation
- Information on range-specific activities likely to destroy critical habitat within each range. This will involve identifying and assessing current projects/activities as well as any foreseeable future projects/activities, and should include a cumulative effects analysis;
- An approach for measuring disturbance to the landscape and monitoring critical habitat to ensure that protection mechanisms are in place and are working to prevent the destruction of boreal caribou critical habitat;
- An approach for monitoring population trends to ensure that local populations are responding positively to management techniques;
- An approach for monitoring natural disturbances, and habitat quality and quantity; and
- Identification of information needs and plans for addressing information gaps.

8 MEASURING PROGRESS

Under SARA, the competent minister must report on the implementation of a recovery strategy and the progress towards meeting its objectives every five years. Population and habitat conditions for boreal caribou will change over time given the changes to population demographics, the dynamic nature of the boreal ecosystem and the manner in which the species shifts in its use of the landscape over time. Accordingly, the five-year time frame for reporting on implementation allows for these changes to be included in an updated recovery strategy, and for subsequent range plans and action plans to be updated under an adaptive management framework.

Monitoring of boreal caribou local populations based on performance indicators will be essential to have the information necessary to evaluate the effectiveness of management actions and to make necessary adjustments through an adaptive management process over time.

8.1 Adaptive Management

The process of adaptive management planning and implementation acknowledges and supports the adjustment of management actions in light of new or more refined knowledge. Through adaptive management, knowledge gaps and uncertainties are identified, evaluated and reported as information needs, addressed through monitoring and research, and then implemented through revised and improved management actions.

The challenge of achieving the recovery goal of self-sustaining local populations of boreal caribou will vary by boreal caribou range given the habitat and population conditions and management context associated with each range. In order to ensure adaptive management is applied to boreal caribou recovery, cooperation with federal, provincial and territorial jurisdictions, wildlife management boards, Indigenous people, and others involved in the conservation, survival and recovery of boreal caribou is required.

8.2 Performance Indicators

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

The ultimate performance indicator of boreal caribou recovery is self-sustaining local populations throughout the entirety of their distribution in Canada. Performance indicators for this recovery strategy are that the population and distribution objective is met for each boreal caribou range, and that boreal caribou become less at risk. Recovery of all boreal caribou local populations is technically and biologically feasible; however given the challenges of recovery for boreal caribou, some local populations that are currently not self-sustaining will likely require a number of decades to return to a recovered state.

The performance indicators described below are provided as national guidelines to gauge the successful implementation of the recovery strategy. More detailed performance indicators that

reflect the specific local conditions (e.g. population condition, habitat condition, alternate prey/predator dynamics, mortality rates) of each boreal caribou range will need to be developed at the range plan and/or action plan stage.

General:

- a) Complete range plans for each range within 3-5 years of the posting of the 2012 Recovery Strategy (see Section 7.3).
- b) For SK1, complete the range plan by June 2021 (see Section 7.3).

Population Condition (population trend and size):

- a) Maintain current distribution of boreal caribou across Canada.
- b) Achieve and/or maintain a stable to increasing population trend as measured over five years (i.e. $\lambda \geq \text{stable}$) or other empirical data that indicates population trend is stable or increasing.
- c) Achieve a minimum of 100 animals⁵ for boreal caribou ranges with population estimates of less than 100 animals, or show progress towards this goal every five years.

Habitat Condition (amount and type of undisturbed habitat):

- a) For ranges that meet or exceed the undisturbed habitat threshold, maintain the undisturbed habitat that includes the biophysical attributes needed for boreal caribou to carry out life processes at a minimum of 65% (40% for SK1) of the total range.
- b) For ranges below the 65% undisturbed habitat threshold (40% for SK1), identify in a range and/or action plan specific areas of existing undisturbed habitat, as well as those areas where future habitat is to be restored to an undisturbed condition over reasonable, gradual increments every five years.
- c) Provide measurements of disturbance for each range that reflect the best available information, as provided by the provinces and territories, to update the recovery strategy accordingly every five years.

⁵ 100 animals provides a 0.7 probability of not reaching a quasi-extinction threshold of less than 10 reproductively active females under stable conditions over 50 years (Environment Canada, 2011b).

9 STATEMENT ON ACTION PLANS

As required by SARA, the Minister of Environment and Climate Change published the Action Plan for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada – Federal Actions on the Species at Risk Public Registry on February 13, 2018 (Environment and Climate Change Canada, 2018). The Action Plan presents the recovery measures that the federal government is taking or plans to take to help achieve the recovery goal and population and distribution objectives for the species, as identified in the 2012 Recovery Strategy (Environment Canada, 2012a). In addition to this Action Plan, Parks Canada Agency site-specific Action Plans that address boreal caribou conservation and recovery efforts on lands administered by the Agency can be found on the SAR Public Registry.

Action plans provide information on recovery measures that should be taken by Environment and Climate Change Canada and other federal government departments and agencies including Parks Canada Agency, Crown-Indigenous Relations and Northern Affairs Canada, Department of National Defence and the Canadian Forces among others, provincial and territorial jurisdictions, wildlife management boards, Indigenous people, stakeholders and other organizations involved in the conservation, survival and recovery of boreal caribou. Action plans provide the public and stakeholders with details on how the recovery strategy will be implemented. Action plans include a broad spectrum of subjects, such as: measures to address threats and to achieve population and distribution objectives; an evaluation of socio-economic costs and benefits to be derived from its implementation; and, an approach for monitoring and reporting. An action plan is not necessarily range-specific; instead it could cover multiple ranges.

Range plans are documents that outline how the habitat condition within a given range will be managed over time and space to ensure that critical habitat for boreal caribou is protected from destruction and therein, that each local population will either continue to be self-sustaining or become self-sustaining over time. In September 2016, Environment and Climate Change Canada published the Range Plan Guidance for Woodland Caribou, Boreal Population to assist provincial and territorial jurisdictions in their preparation of range plans (Environment and Climate Change Canada, 2016).

The Minister of Environment and Climate Change may adopt or incorporate parts of a range plan, an existing provincial or territorial plan, or other relevant planning documents that meet the requirements of SARA as an action plan. Where the Minister of Environment and Climate Change proposes to adopt an existing plan or a portion of it as a SARA action plan, it will be posted on the Species at Risk Public Registry for the prescribed 60-day comment period. Within 30 days after the expiry of the comment period, and considering the comments received, the minister will publish a final action plan.

9.1 Coordinated Approach

9.1.1 Provincial and Territorial Jurisdictional Leadership

Provinces and territories have the primary responsibility for management of lands and wildlife within boreal caribou distribution, however this responsibility does vary in some parts of the country. For example, in the Northwest Territories, the Tłı̨chǫ Government manages land and resources (including wildlife) within Tłı̨chǫ Lands, as described in the Tłı̨chǫ Agreement (a combined comprehensive land claims and self-government agreement). There are also wildlife management boards that have been established under land claims agreements as the primary instrument for wildlife management in some regions of the country. In addition, Parks Canada Agency has a significant role to play where boreal caribou exist within national parks and historic sites.

Range plans and/or action plans inform broader land-use planning and decision making, and require substantial inter-agency communication and cooperation. Coordination is particularly important for range and/or action plans that address boreal caribou recovery in transboundary ranges, and for ensuring connectivity within ranges and across the species current distribution is maintained.

9.1.2 Indigenous Involvement

The Minister of Environment and Climate Change must cooperate with affected Indigenous organizations for recovery strategies and action plans. Across Canada, cooperation with Indigenous people is key to the success in developing and implementing action plans.

In acknowledgement of existing Aboriginal and treaty rights, to the extent possible, details of harvesting plans for local populations, consistent with the principles of conservation, will be addressed in range and/or action plans. When applicable, harvesting plans will follow the required process under Land Claim Agreements or provincial/territorial laws. Indigenous involvement will be required to determine population targets that ensure stable boreal caribou local populations are maintained and recovery of local populations that are not self-sustaining is achieved, while providing for traditional Indigenous harvesting practices consistent with conservation and existing Aboriginal and treaty rights. A description of Environment and Climate Change Canada's approach to engaging with Indigenous people in the development of both the 2012 Recovery Strategy and the 2020 Amended Recovery Strategy for boreal caribou is provided in Appendix B.

9.1.3 Stakeholder Engagement

Success in the recovery of this species depends on the commitment, collaboration, and cooperation of many different constituencies that are or will be involved in implementing the broad strategies and general approaches set out in this recovery strategy and will not be achieved by Environment and Climate Change Canada, or any other jurisdiction, alone. All stakeholders, including the industry sector, environmental organizations, and private landowners should be engaged where appropriate in developing and implementing action plans.

9.2 Range Specific Actions

The recovery of boreal caribou requires actions that will vary by individual boreal caribou range based on the population and habitat conditions. Each range will require a range-specific path forward for the recovery of boreal caribou. As described under Section 7.3, range plans and/or action plans are needed to guide protection and management of critical habitat, and overall recovery actions, in each boreal caribou range.

Range plans describe how critical habitat will be protected. The 2012 Recovery Strategy called for these jurisdictionally-led range plans to be produced for each range within 3-5 years of the posting of the 2012 Recovery Strategy. Environment and Climate Change Canada continues to seek commitments to develop jurisdictional range plans or other similar documents through the development of conservation agreements for the species.

For the Boreal Shield range (SK1), the Government of Saskatchewan should complete the range plan by June 2021.

In the absence of range plans, the Minister of Environment and Climate Change will use the best available information and consult with the jurisdiction to make a determination on the state of protection of critical habitat for boreal caribou.

9.2.1 Habitat and Population Management

The broad strategies and general approaches to meet the population and distribution objectives (see Section 6), as set out in this recovery strategy, will inform the development of range plans and action plans, where detailed local-level planning will occur to guide the implementation of recovery actions.

The broad strategies and general approaches are designed to guide range and action planning based on the state of each boreal caribou range. Many approaches and strategic directions are inter-related and should be implemented as described in the range plans and action plans. Generally, for self-sustaining local populations, minimal management actions may be necessary, and strategically planned development could take place without threatening boreal caribou and the status of the local population. Where local populations are not self-sustaining, specific management action is needed, in some cases for many decades, until sufficient habitat is restored and the population condition is improved. Mortality management, including predator and alternate prey management, may be needed to help prevent extirpation of a boreal caribou local population in the interim while habitat management efforts are underway to restore the ecological conditions of the range necessary to support a self-sustaining local population.

Jurisdictions are accountable for the long-term planning and management of boreal caribou ranges with the implementation of different habitat and population management tools available at their discretion, depending on the specific local conditions. The implementation of habitat management practices, such as fire suppression, and mortality management practices, such as predator control, are at the discretion of jurisdictions, and the application of these tools will vary in accordance with jurisdictional policies and procedures.

10 GLOSSARY

Note: The following terms are defined in accordance with their use in this document.

Anthropogenic: caused by human activity.

Biological feasibility: recovery is determined to be biologically feasible under the following circumstances: individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance; sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration; and primary threats to the species or its habitat can be avoided or mitigated.

Biophysical attributes: habitat characteristics required by boreal caribou to carry out life processes necessary for survival and recovery (see Appendix H).

Current distribution (extent of occurrence): the area that encompasses the geographic distribution of all known boreal caribou ranges, based on provincial and territorial distribution maps developed from observation and telemetry data, local knowledge (including in some cases Indigenous Knowledge), and biophysical analyses.

Disturbance management threshold: at the scale of boreal caribou range, the habitat disturbance point below which conditions are such that the recovery goal will likely be met (i.e. acceptable level of risk), and above which the outcome is either highly uncertain or unacceptable.

Disturbed habitat: habitat showing: i) anthropogenic disturbance visible on Landsat at a scale of 1:50,000, including habitat within a 500 m buffer of the anthropogenic disturbance; and/or ii) fire disturbance in the last 40 years, as identified in data from each provincial and territorial jurisdiction (without buffer).

Existing habitat: the entire boreal caribou range area minus permanent alterations. See also *permanent alterations*.

Indigenous Knowledge (IK): IK includes, but is not limited to, the knowledge Indigenous peoples have accumulated about wildlife species and their environment. Much of this knowledge has accumulated over many generations.

Local population: a group of boreal caribou occupying a defined area distinguished spatially from areas occupied by other groups of boreal caribou. Local population dynamics are driven primarily by local factors affecting birth and death rates, rather than immigration or emigration among groups.

In this recovery strategy, “local population” refers to a group of boreal caribou occupying any of the three types of boreal caribou ranges (i.e. conservation unit, improved conservation unit, local population unit). See also *range*.

Not self-sustaining local population: in the population and distribution objectives “not self-sustaining local population” includes both the local populations assessed as “as likely as not self-sustaining” and those assessed as “not self-sustaining”.

Permanent alterations: existing features found within a range, such as industrial and urban developments, permanent infrastructure, and graded or paved roads that do not currently possess or have the potential to possess the biophysical attributes of critical habitat for boreal caribou.

Quasi-extinction: a population with less than 10 reproductively active females.

Range: the geographic area occupied by a group of individuals that are subject to similar factors affecting their demography and used to satisfy their life history processes (e.g. calving, rutting, wintering) over a defined time frame. Environment and Climate Change Canada (2011b) identified three types of boreal caribou ranges categorized based on the degree of certainty in the delineated range boundaries (i.e. conservation unit, improved conservation unit, local population unit).

Range plan: a document that demonstrates how the habitat condition within a given range will be managed over time and space to ensure that critical habitat for boreal caribou is protected from destruction and therein, that each local population will either continue to be self-sustaining or become self-sustaining over time.

Self-sustaining local population: a local population of boreal caribou that on average demonstrates stable or positive population growth over the short-term (≤ 20 years), and is large enough to withstand stochastic events and persist over the long-term (≥ 50 years), without the need for ongoing active management intervention.

Technical feasibility: recovery is determined to be technically feasible when recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

To the extent possible: current evidence supports the conclusion that the recovery of all local populations is technically and biologically feasible. There may be situations where recovery of a particular local population proves to be, over time and through unforeseen circumstances, not biologically or technically feasible and as such may affect the likelihood of achieving the population and distribution objectives for some local populations.

Undisturbed habitat: habitat not showing any: i) anthropogenic disturbance visible on Landsat at a scale of 1:50,000, including habitat within a 500 m buffer of the anthropogenic disturbance; and/or ii) fire disturbance in the last 40 years, as identified in data from each provincial and territorial jurisdiction (without buffer). Disturbance within the 500 m buffer would result in a reduction of the undisturbed habitat.

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APPENDIX A: 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](#). 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](#) (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that certain strategies may also inadvertently lead to environmental effects beyond the intended benefits, or have negative impacts upon other species. 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.

Boreal caribou are an umbrella species for the older-growth boreal forest at large. There are many species that share the same habitat requirements as boreal caribou and will benefit from the recovery actions outlined in this recovery strategy. This recovery strategy will benefit the environment and biodiversity as a whole by promoting the recovery of boreal caribou and by protecting and enhancing habitat.

The management measures outlined in this recovery strategy are those required to halt boreal caribou local population declines and to assist in stabilizing and recovering local populations. With respect to broader environmental impacts, certain management tools, most notably predator (e.g. wolves, bears) and alternate prey (e.g. moose, deer) management, may be required in areas with unnaturally high rates of predation on boreal caribou.

Short-term (i.e. 5–10 years) predator and alternate prey suppression has been used in wildlife management across North America over the past decades, with predator and alternate prey species generally demonstrating fairly rapid recovery once the measures have ceased.

The recovery strategy acknowledges that predator and alternate prey management may be required in some ranges to help stop boreal caribou declines and stabilize local populations that are at risk of extirpation. Where applied, predator and alternate prey management should be used as an interim management tool, in conjunction with other management tools (e.g. habitat restoration and management) to prevent extirpation and achieve population growth. Effective indirect predator management techniques (such as actions to limit the access of predators to boreal caribou) should be considered prior to undertaking direct predator and alternate prey management. When a predator or alternate prey management program is being planned, the conservation status of all affected species must be considered. Where implemented, the effects of mortality management activities on boreal caribou local populations should be monitored.

APPENDIX B: ENGAGEMENT WITH INDIGENOUS PEOPLE IN THE DEVELOPMENT OF THE RECOVERY STRATEGY FOR BOREAL CARIBOU

Once a species is listed as extirpated, endangered or threatened under SARA, a recovery strategy must be developed. Recognizing the important traditional, cultural, and spiritual role of boreal caribou in the lives of Indigenous people, Environment and Climate Change Canada sought engagement and input from Indigenous communities in the development of both the 2012 Recovery Strategy and the 2020 Amended Recovery Strategy for boreal caribou.

2012 Recovery Strategy (2009-2012)

Two rounds of engagement were undertaken, with a focus on seeking input and sharing information with Indigenous communities. In addition, Environment and Climate Change Canada supported processes to gather Indigenous Knowledge (see Appendix C). These two components were essential in the development of the 2012 Recovery Strategy. Nationally, Environment and Climate Change Canada contacted over 260 Indigenous communities located within and adjacent to the current distribution of boreal caribou during both rounds of engagement to invite them to participate in Environment and Climate Change Canada's process to develop the recovery strategy for boreal caribou.

Round 1 Meetings (2009-2011)

In the first round of engagement on the recovery strategy, Environment and Climate Change Canada contacted 271 Indigenous communities and 161 of them participated. Engagement at this early stage in the development of the recovery strategy provided Indigenous communities the opportunity to share comments, opinions, and information about boreal caribou. Environment and Climate Change Canada used this information to inform the development of the key elements of the recovery strategy, including: i) population and distribution objectives for boreal caribou; ii) threats to boreal caribou and their habitat; and iii) identification of boreal caribou critical habitat.

The information that Environment and Climate Change Canada received from Indigenous communities and from stakeholder meetings, meetings with the provinces and territories, scientific studies, and Indigenous Knowledge studies were used to draft the proposed recovery strategy (Environment Canada, 2011a).

Round 2 Meetings (2011-2012)

In the second round of engagement, Environment and Climate Change Canada contacted 265¹ Indigenous communities and 87 of those participated; in addition, Environment and Climate Change Canada received 25 formal submissions from Indigenous communities and organizations. This round of engagement provided the opportunity for comments and dialogue

¹ During the first round of engagement, 6 Indigenous communities indicated they did not require any further follow-up throughout this process. This accounts for the discrepancy in the number of Indigenous communities contacted during round 1 and 2.

on the proposed recovery strategy that was posted on the Species at Risk Public Registry on August 26, 2011. The required 60-day public comment period was extended by an additional 120 days until February 22, 2012 to allow time for Indigenous communities to better participate in the engagement process and provide comments on the proposed recovery strategy prior to finalization.

Environment and Climate Change Canada considered all feedback received from Indigenous communities, along with the over 19,000 comments received from government, industry, environmental organizations, and the public when finalizing the 2012 Recovery Strategy (Environment Canada, 2012b). Changes made to the proposed recovery strategy were a direct result of the feedback received during the public comment period, including the input received from Indigenous communities and organizations.

2020 Amended Recovery Strategy (2018 – 2019)

Environment and Climate Change Canada contacted 34 Indigenous communities and 31 Indigenous organizations/governments located within and adjacent to northern Saskatchewan's Boreal Shield range (SK1) to invite them to participate in the process to develop an amendment to the 2012 Recovery Strategy for boreal caribou to identify critical habitat in SK1. At the time of posting the proposed amendment to the recovery strategy on the Species at Risk Public Registry, 11 communities and five organizations/governments participated in information sessions and/or meetings. This engagement provided the opportunity for participating groups to share information, comments, and dialogue on the draft amendment to the recovery strategy.

APPENDIX C: INDIGENOUS KNOWLEDGE SUMMARY REPORTS ON BOREAL CARIBOU

SARA specifies that “... the traditional knowledge of the Aboriginal peoples of Canada should be considered (...) in developing and implementing recovery measures.” In the summer of 2009, Environment and Climate Change Canada made a commitment to ensure that Indigenous Knowledge from across the range of boreal caribou would inform the development of the recovery strategy. This commitment came from the recognition that Indigenous people possess significant and unique knowledge about boreal caribou biology, population trends, distribution, and threats facing the species, which could support recovery planning.

Environment and Climate Change Canada staff in each province/territory within the boreal caribou range began the process to have Indigenous Knowledge inform the recovery strategy by contacting Indigenous provincial and territorial organizations, Tribal Councils, and Indigenous consultants/facilitators to determine their interest in helping to gather Indigenous Knowledge. Additionally, each Indigenous community within and adjacent to the range of boreal caribou was contacted and followed up with, inviting them to participate in the process of developing the recovery strategy. As a result of these efforts, one of three basic processes was followed in the participating communities:

1. Local or regional Indigenous organizations interviewed knowledge holders;
2. Regional or local workshops coordinated by Indigenous facilitators were held; or
3. Indigenous Knowledge sharing was done in partnership with other initiatives (e.g. projects funded by Aboriginal Funds for Species at Risk).

All Indigenous contractors/communities/organizations that participated prepared summary reports based on interviews with knowledge holders. Environment and Climate Change Canada’s Boreal Caribou Working Group received all summary reports and reviewed these in detail to highlight information that could inform the recovery strategy. Knowledge provided that would be more applicable at the action planning stage was also identified and flagged by Environment and Climate Change Canada’s Boreal Caribou Working Group. The purpose of this step was to identify where and how the Indigenous Knowledge could support the recovery strategy and the subsequent range and/or action plans.

Each Indigenous Knowledge summary report received contains unique and geographically specific information that is representative of the knowledge and experiences shared by knowledge holders (Boreal Caribou ATK Reports, 2010-2011). Indigenous Knowledge with respect to boreal caribou life history, habitat use, population status, threats facing the species, and conservation measures was used to inform the recovery strategy. In addition, Indigenous Knowledge holders shared considerable detailed local knowledge about boreal caribou, which may be used to support range and/or action plans, if and where consent for such use is granted. In all cases, Environment and Climate Change Canada reconfirmed the intention of the use of Indigenous Knowledge in this document with knowledge holders.

APPENDIX D: SCIENTIFIC ASSESSMENTS OF CRITICAL HABITAT FOR BOREAL CARIBOU

2008 Scientific Review

In 2007, Environment and Climate Change Canada launched a science-based review with the mandate to identify boreal caribou critical habitat to the extent possible, using the best available information, and/or prepare a schedule of studies to complete this task. The results were summarized in a report entitled *Scientific Review for the Identification of Critical Habitat for Woodland Caribou (Rangifer tarandus caribou), Boreal Population, in Canada* (hereinafter referred to as the 2008 Scientific Review).

Identifying critical habitat for boreal caribou was framed as an exercise in decision analysis and adaptive management. Establishment of a systematic, transparent and repeatable process was central to the approach. The resultant Critical Habitat Framework was anchored by synthesis and analysis of available quantitative data and published scientific information on boreal caribou population and habitat ecology.

The 2008 Scientific Review established boreal caribou ranges as the appropriate scale at which to identify critical habitat, and applied a probabilistic approach to assessing the adequacy of the current range conditions to support a self-sustaining local population based on three lines of evidence: percent total disturbance, local population growth and local population size. Of the 57 local populations or units of analysis delineated at the time, 30 were assessed as ‘Not Self-Sustaining’ (integrated probability of less than 0.5), 17 as ‘Self-Sustaining’ (integrated probability of greater than 0.5), and 10 as “as likely as not self-sustaining” (integrated probability equal to 0.5).

Additional Scientific Activities

The 2008 Scientific Review established a foundation for the assessment of critical habitat; however, Environment and Climate Change Canada identified key areas for further exploration to improve the science foundation to inform the identification of critical habitat:

1. Implications to critical habitat identification of variation in approaches applied by provincial and territorial jurisdictions to delineate ranges.
2. Relative impacts of different disturbances and habitat types, and their configurations, on the ability of ranges to support self-sustaining local populations, and resultant critical habitat identification.
3. Identification of disturbance management thresholds for self-sustaining local populations.
4. Influence of future range conditions on disturbance management thresholds given the dynamic nature of disturbance in a given range.

The purpose of addressing these knowledge gaps was to further inform the identification of critical habitat for boreal caribou, using the best available information. To this end, Environment and Climate Change Canada undertook the work presented in the Scientific Assessment to Inform the Identification of Critical Habitat for Woodland Caribou (*Rangifer tarandus caribou*),

Boreal Population, in Canada: 2011 Update (herein referred to as the 2011 Scientific Assessment).

2011 Scientific Assessment: Concepts and Methodology

Similar to the 2008 Scientific Review, the 2011 Scientific Assessment was designed to provide a probabilistic evaluation of critical habitat relative to the set of conditions (demographic and environmental) for each range. The framework and components developed in the 2008 Scientific Review were expanded and enhanced through a suite of scientific activities including: enhanced disturbance mapping; habitat selection analysis; buffer analysis; meta-analysis of boreal caribou local population and habitat conditions; assessment of current conditions to support self-sustaining boreal caribou local populations using indicators of two ecological components of sustainability (stable or positive population growth and long-term persistence); representation of future conditions through application of a simple habitat dynamics model; and development of a methodology for establishing risk-based, range-specific disturbance management thresholds based on best available information.

Information to Support the Identification of Critical Habitat

The information to inform the identification of boreal caribou critical habitat provided in the 2011 Scientific Assessment for each range consists of the following four components:

1. The delineation and location of the range, and certainty in range delineation.
2. An integrated risk assessment based on multiple lines of evidence from three indicators, and application of hierarchical decision rules to evaluate the probability that current conditions on a range will support a self-sustaining local population. The result is expressed as a likelihood statement relative to achieving the population and distribution objectives.
3. Information to support the identification of disturbance management thresholds. Specifically, a consistent methodology for deriving such thresholds is provided, along with examples of their potential application, and discussion of their interpretation relative to the criteria and indicators evaluated.
4. A description of the biophysical attributes, defined as the habitat characteristics required by boreal caribou to carry out life processes necessary for survival and recovery. The results from the habitat selection analyses and other published reports were used to summarize biophysical attributes by ecozone.

The related goals of assessing the ability of ranges to support self-sustaining local populations, and establishment of disturbance management thresholds, must acknowledge uncertainties arising from the availability and reliability of information about current local population condition, as well as how local populations might respond to additional and often interacting stressors. The probabilistic approach applied in the 2011 Scientific Assessment explicitly incorporated the effects of uncertainties and data quality in the assessment process. This approach is consistent with the concept of adaptive management, which expresses probable outcomes as hypotheses. Monitoring and evaluation of realized outcomes informs adaptations of management strategies over time.

Key Findings

The information and analyses presented in the 2011 Scientific Assessment addresses limitations identified with implementation of the work presented in the 2008 Scientific Review. However, neither the approach nor the results of the 2011 assessment represent a fundamental shift from the 2008 Scientific Review's conclusion that range is the appropriate geographic delineation for critical habitat description. Further, the amount of total disturbance within a range remains the primary criteria for identifying critical habitat to meet a goal of self-sustaining local populations of boreal caribou.

Highlights of the application of the conceptual framework and associated analyses supporting the 2011 assessment include:

1. Nearly 70% of the variation in boreal caribou recruitment across 24 study areas spanning the full range of boreal caribou distribution and range condition in Canada was explained by a single composite measure of total disturbance (fire + buffered anthropogenic), most of which could be attributed to the negative effects of anthropogenic disturbance.
2. Of the 57 identified boreal caribou ranges in Canada at the time, 17 (30%) were assessed in the 'self-sustaining' category, 7 (12%) in the "as likely as not self-sustaining category", and 33 (58%) in the 'not self-sustaining' category.
3. Range-specific disturbance management thresholds can be derived from a generalized disturbance-population growth function in conjunction with range-specific information. A methodology was developed to extend the critical habitat description for consideration of disturbance management thresholds when acceptable risks are defined by managers.

In addition to these highlights, several important observations related to the availability of information emerged, and recommendations related to these are advanced:

1. Most boreal caribou ranges in Canada have not been fully described owing to a lack of standardized animal location data and poor understanding of movement within and between ranges. While a total of 57 ranges were still recognized at the time by provincial and territorial jurisdictions in Canada, changes to the delineation of boreal caribou ranges have been made since the 2008 Scientific Review, by various jurisdictions, based on different criteria. The issue of appropriate delineation of transboundary ranges remains unresolved.
2. Demographic data are lacking for many boreal caribou ranges in Canada. Monitoring and assessment programs to provide data on local population size, local population trend, recruitment and adult mortality are required to improve understanding of factors affecting boreal caribou survival and recovery, to increase certainty in assessment results, and to monitor response of local populations to recovery actions and to assess progress towards meeting the population and distribution objectives for boreal caribou across Canada.

In conclusion, significant advances were made to the conceptual and methodological design in the 2011 Scientific Assessment to address some key uncertainties or limitations identified in the 2008 Scientific Review. These advances improved the robustness of the results with respect to providing a scientific basis to inform the identification of critical habitat for boreal caribou across Canada.

Scientific Research to Inform Critical Habitat in Saskatchewan's Boreal Shield Range

The 2012 Recovery Strategy used the scientific foundation of the 2008 Scientific Review and 2011 Scientific Assessment as the basis for critical habitat identification for all boreal caribou ranges in Canada, except for northern Saskatchewan's Boreal Shield range (SK1) (Environment Canada, 2008; Environment Canada, 2011b; Environment Canada, 2012a). Critical habitat for SK1 was not identified in 2012 because population size and trend were unknown, and the high fire (55%) and low anthropogenic (3%) disturbance represented conditions not well represented in the data used to identify 65% undisturbed habitat in each range as the disturbance management threshold. The 2012 Recovery Strategy identified this knowledge gap in the schedule of studies.

Since the 2012 Recovery Strategy, three years of demographic data have been collected for SK1 and a number of other jurisdictions have also acquired additional recruitment and adult survival data, with better representation of the spectrum of combinations between anthropogenic disturbance and fire. Environment and Climate Change Canada also updated the disturbance mapping, based on 2015 imagery, facilitating temporal correspondence with the new demographic data. This new and larger dataset facilitated additional scientific analysis including (Environment and Climate Change Canada, 2019):

1. An evaluation of a subset of the 2011 recruitment models to distinguish the effects of buffered anthropogenic disturbance from the effects of fire.
2. An evaluation of the newly collected demographic data from SK1 in the context of the national models that predict recruitment as a function of disturbance.
3. An evaluation of the subset of 2011 models to investigate the potential influence of anthropogenic disturbance and fire on adult female survival.
4. A scenario analysis exploring the potential impacts of additional levels of buffered anthropogenic disturbance using updated information.

Key Findings (Environment and Climate Change Canada, 2019)

1. The model separating the effects of anthropogenic disturbance (buffered by 500m) from fire received the highest level of support explaining 39% of the variation in recruitment. Both anthropogenic disturbance and fire had significant negative effects; however, anthropogenic disturbance had a larger effect.
2. Both the total disturbance model (top model in 2011) and the model separating anthropogenic disturbance from fire adequately predict recruitment for SK1 (average observed recruitment falls within 95% confidence intervals).
3. In the evaluation of adult female survival, the top model included anthropogenic disturbance (buffered by 500m) only, explaining about 12% of the variation. Additional analysis are required to understand other potential factors that may be influencing adult female survival. Currently, SK1 has one of the highest rates of boreal caribou adult female survival reported in Canada. Additional analyses indicate that the probability of maintaining a self-sustaining population in SK1 is sensitive to decreases in adult female

survival. For example, the probability that SK1 is self-sustaining would drop to less than 20% if adult female survival fell from 0.91 to 0.87 (assuming no change in recruitment).

4. At current disturbance levels, the probability that SK1 is self-sustaining is 71%; the probability is based on the three years of recruitment and adult survival collected for SK1. The scenario analyses suggest that SK1 would fall to 60% chance of maintaining a self-sustaining population with an additional 2.5-3.0% anthropogenic disturbance. Continued population monitoring will be important in order to reduce uncertainty in population condition over the longer term and to monitor population response to future landscape change.

APPENDIX E: IDENTIFYING DISTURBANCE MANAGEMENT THRESHOLDS

This Appendix is derived from Environment and Climate Change Canada's Scientific Assessment (2011b), and has been adapted for the purposes of this recovery strategy. A methodology was developed for consideration of disturbance management thresholds (Environment Canada, 2011b) and is herein described. Establishing disturbance management thresholds requires a recovery goal and an acceptable level of risk from a management perspective.

The recovery goal for boreal caribou is to achieve self-sustaining local populations in all boreal caribou ranges throughout their current distribution in Canada, to the extent possible. Environment and Climate Change Canada (2011b) expressed this recovery goal as the likelihood of observing a mean lambda (population growth) over a 20-year period of a stable or increasing population and the likelihood of the population size remaining above a quasi-extinction threshold of 10 reproductively active females over a 50 year period. The likelihood of the population remaining stable or increasing over 20 years was based on two indicators: population trend and disturbance level within a boreal caribou range. In order to assess the influence of disturbance level on the population trend, a study was completed to develop a relationship that expresses the probability of a population being stable or increasing at varying levels of total range disturbance (see Figure E-1). This relationship was derived by combining information on the negative effects of disturbance on boreal caribou recruitment with a national mean annual adult survival rate for mature females. This relationship was used to inform the range condition required to meet the recovery goal which is a core element of the identification of critical habitat in this recovery strategy.

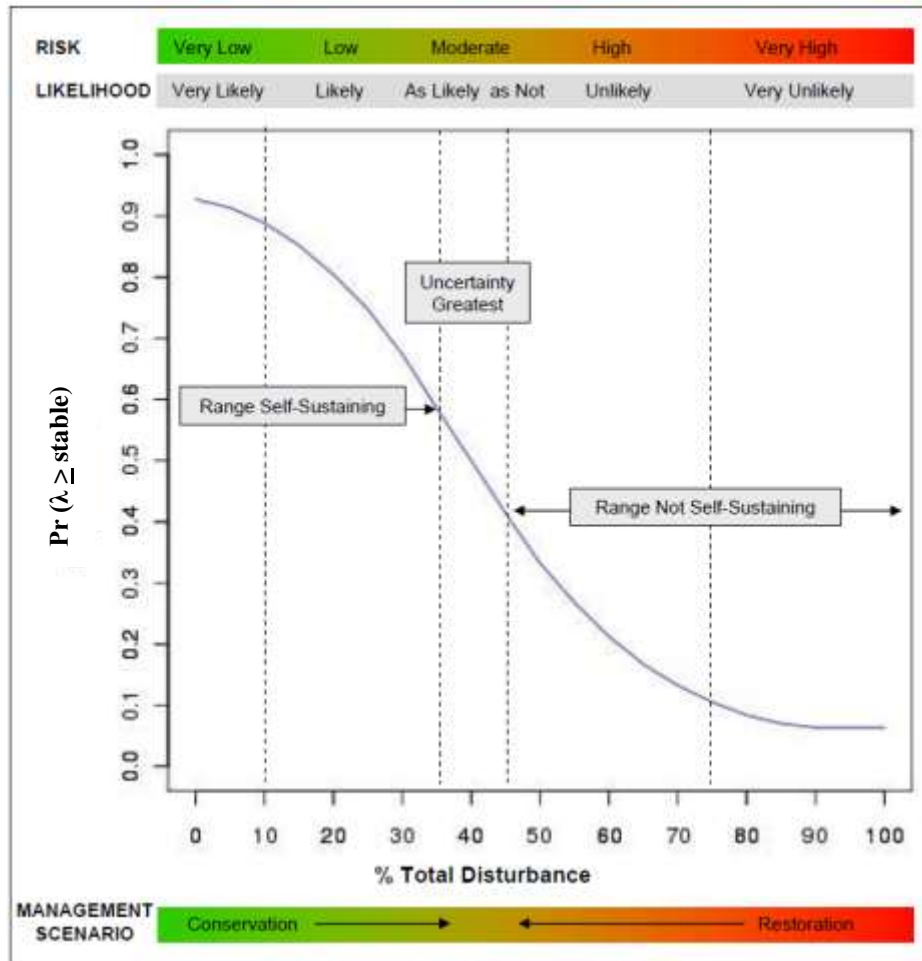


Figure E-1. Disturbance management thresholds: The probability of observing stable or positive growth ($\lambda \geq \text{stable}$) of boreal caribou local populations over a 20-year period at varying levels of total range disturbance (fires ≤ 40 years + anthropogenic disturbances buffered by 500 m). Certainty of outcome, ecological risk, and management scenarios are illustrated along a continuum of conditions.

The disturbance values associated with the likelihood of achieving a self-sustaining local population can be used to express the relative risk of not achieving a self-sustaining local population (see Table E-1). At this point, a given management objective or target must be specified in order to determine what is an acceptable level of risk from a management perspective.

Table E-1. Intervals of total range disturbance associated with varying levels of certainty in outcome and assigned risk relative to achieving stable or positive population growth.

Probability of Sustained Stable or Positive Growth ¹	Likelihood of Desired Outcome	Disturbance Interval	Level of Risk
≥ 90%	Very Likely	≤ 10%	Very Low
< 90 to ≥ 60%	Likely	> 10 to 35%	Low
< 60 to ≥ 40%	As Likely as Not	> 35 to 45%	Moderate
< 40 to ≥ 20%	Unlikely	> 45 to 75%	High
< 10%	Very Unlikely	>75%	Very High

¹ Intervals adapted from the International Panel on Climate Change 2005; time frame for assessing mean growth rate is 20 years.

A disturbance management threshold marks the point below which (i.e. at lower levels of disturbance) range conditions are likely to meet the recovery goal with an acceptable level of risk, and above which the outcome is either highly uncertain or unacceptable. In this recovery strategy a 0.6 or 60% probability of self-sustainability (i.e. population growth is stable/increasing) is applied resulting in a maximum disturbance management threshold of 35% total disturbance (or 65% undisturbed habitat as referenced throughout the recovery strategy) (see Figure E-1). A probability of 1.0 or 100 % is ideal, however, unrealistic since 0% total disturbance is virtually impossible even without anthropogenic disturbances. The maximum disturbance management threshold of 35% at 0.6 or 60% probability of self-sustainability is a reasonable starting point providing a likely certainty of recovery, given the available information on boreal caribou at this time. It is important to emphasize that this is a maximum disturbance management threshold because there is still a risk (0.4 or 40%) that local populations will not be self-sustaining. Local populations that have greater than 35% total disturbance (or less than 65% undisturbed habitat) will first be recovered to the 35% disturbance management threshold (i.e. to achieve 65% undisturbed habitat). The disturbance management threshold may be altered in the future as more information becomes available on the associated level of risk for boreal caribou local populations to meet the recovery goal outlined in this strategy.

For SK1, a minimum of 40% undisturbed habitat in the range is identified as the disturbance management threshold, which provides a measurable probability of 71% for the local population to be self-sustaining. Given that the analyses conducted by Environment and Climate Change Canada indicate that the population is sensitive to small increases in anthropogenic disturbance and sensitive to small decreases in adult survival, a higher probability of persistence was selected for critical habitat identification in SK1 (71%) than was selected for the other 50 ranges across Canada (60%) (Environment and Climate Change Canada, 2019). Continued population monitoring will be needed to reduce uncertainty in population condition over the longer term, particularly in light of future changes in range condition (e.g. increased fires associated with climate change).

APPENDIX F: SUMMARY OF BOREAL CARIBOU LOCAL POPULATION CONDITION AND HABITAT CONDITION

Table F-1 provides a summary of boreal caribou local population condition and habitat condition for each of the 51 boreal caribou ranges. Boreal caribou distribution (see Figure 2) and population and habitat condition information is based on the best available information including observational and telemetry data, and biophysical analyses, provided by provincial and territorial jurisdictions (Environment and Climate Change Canada, 2017). As a result of limited information on many of the ranges in Canada, only three transboundary ranges (a range that extends across a provincial or territorial boundary) have been defined: Northwest Territories range (NT1), Chinchaga range (AB1), and Lac Joseph range (NL1). As more refined information is being continually collected by jurisdictions, range delineation and population demographic information will be updated and may result in revisions to range boundaries and possibly more transboundary ranges. The assessment of self-sustainability may change when ranges that cross jurisdictional boundaries are combined. Range boundaries and integrated risk assessments will be updated annually based on new or more refined evidence provided by the provincial and territorial jurisdictions. In some cases, local population size estimates and trend data are based primarily on professional judgment and limited data, and not on rigorously collected field data.

The Range Type lists the different classification of local populations based on June 2012 range boundaries for boreal caribou provided by jurisdictions, which were subsequently classified into three types reflecting the level of certainty in range boundaries: Conservation Units (CU - low certainty), Improved Conservation Units (ICU- medium certainty), and Local Population (LP - high certainty).

Risk assessment is the status of self-sustainability of the local populations where SS=self-sustaining; NSS = not self-sustaining; NSS/SS = as likely as not self-sustaining.

Further explanation on disturbance is provided in Section 4.2.1.

Table F-1. Boreal caribou local population condition and habitat condition information. The population condition and habitat condition have been updated in this amended recovery strategy based on information previously published in the 5-Year Progress Report (Environment and Climate Change Canada, 2017).

Range Identification	Range Name	Range Type	Population Estimate relative to 100 ¹ (≥ 100, or < 100)	Population Trend	Disturbed Habitat (%)			Risk Assessment ⁵
					Fire ²	Anthropogenic ³	Total ⁴	
Northwest Territories								
NT1	Northwest Territories	ICU	≥ 100 ⁶	not available ⁷	28	9	35	SS
British Columbia								
BC1	Maxhamish	LP	≥ 100	stable ⁸	2	67	68	NSS
BC2	Calendar	LP	≥ 100	stable ⁸	16	53	61	NSS

Range Identification	Range Name	Range Type	Population Estimate relative to 100 ¹ (≥ 100, or < 100)	Population Trend	Disturbed Habitat (%)			Risk Assessment ⁵
					Fire ²	Anthropogenic ³	Total ⁴	
BC3	Snake-Sahtahneh	LP	≥ 100	stable ⁸	5	77	79	NSS
BC4	Parker	LP	< 100	declining ⁸	3	57	57	NSS
BC5	Prophet	LP	< 100	declining ⁸	10	78	78	NSS
Alberta								
AB1	Chinchaga (incl. BC portion)	LP	≥ 100	declining	9	79	80	NSS
AB2	Bistcho	LP	≥ 100	declining	40	58	75	NSS
AB3	Yates	LP	≥ 100	stable	42	20	55	NSS
AB4	Caribou Mountains	LP	≥ 100	declining	46	27	62	NSS
AB5	Little Smoky	LP	≥ 100	stable ⁹	0.4	96	96	NSS
AB6	Red Earth	LP	≥ 100	declining	40	48	72	NSS
AB7	West Side Athabasca River	LP	≥ 100	declining	5	70	72	NSS
AB8	Richardson	LP	≥ 100	stable	74	23	88	NSS
AB9	East Side Athabasca River	LP	≥ 100	declining	28	78	84	NSS
AB10	Cold Lake	LP	≥ 100	declining	33	76	87	NSS
AB11	Nipisi	LP	< 100	not available ¹⁰	9	75	77	NSS
AB12	Slave Lake	LP	< 100	not available ¹⁰	39	74	87	NSS
Saskatchewan								
SK1	Boreal Shield	CU	≥ 100 ¹¹	stable	58	3	60	SS
SK2	Boreal Plain	CU	≥ 100	not available ¹²	30	20	45	NSS/SS
Manitoba								
MB1	The Bog	ICU	≥ 100 ¹³	not available ¹⁴	6	14	19	NSS/SS
MB2	Kississing	ICU	≥ 100 ¹³	not available ¹⁴	39	15	54	NSS
MB3	Naosap	ICU	not available ¹⁵	not available ¹⁵	28	28	52	NSS
MB4	Reed	ICU	not available ¹⁵	not available ¹⁵	7	20	26	SS

Range Identification	Range Name	Range Type	Population Estimate relative to 100 ¹ (≥ 100, or < 100)	Population Trend	Disturbed Habitat (%)			Risk Assessment ⁵
					Fire ²	Anthropogenic ³	Total ⁴	
MB5	North Interlake	ICU	< 100	not available ¹⁴	4	14	18	NSS/SS
MB6	William Lake	ICU	< 100	not available ¹⁴	25	17	36	NSS
MB7	Wabowden	ICU	≥ 100	not available ¹⁴	10	20	28	SS
MB8	Wapisu	ICU	not available ¹⁵	not available ¹⁵	11	13	24	SS
MB9	Manitoba North	CU	not available ¹⁵	not available ¹⁵	23	11	33	NSS/SS
MB10	Manitoba South	CU	not available ¹⁵	not available ¹⁵	4	12	16	SS
MB11	Manitoba East	CU	not available ¹⁵	not available ¹⁵	26	3	29	SS
MB12	Atikaki-Berens	ICU	not available ¹⁵	not available ¹⁵	29	6	34	SS
MB13	Owl-Flinstone	LP	< 100	not available ¹⁴	25	18	39	NSS/SS
Ontario								
ON1	Sydney	ICU	< 100	declining	27	25	49	NSS
ON2	Berens	ICU	≥ 100	declining	31	6	37	NSS/SS
ON3	Churchill	ICU	≥ 100	declining	8	28	34	SS
ON4	Brightsand	ICU	≥ 100	declining	19	26	41	NSS/SS
ON5	Nipigon	ICU	≥ 100	declining	7	25	30	SS
ON6	Coastal	CU	≥ 100	declining	0	15	15	SS
ON7	Pagwachuan	ICU	≥ 100	stable	0.7	27	27	SS
ON8	Kesagami	ICU	≥ 100	declining	3	37	40	NSS
ON9	Far North	CU	≥ 100 ¹⁶	declining ¹⁶	15	1	16	SS
Quebec								
QC1	Val d'Or	LP	< 100	declining	0.2	65	65	NSS
QC2	Charlevoix	LP	< 100	declining	4	80	82	NSS
QC3	Pipmuacan	ICU	≥ 100	declining	11	60	68	NSS

Range Identification	Range Name	Range Type	Population Estimate relative to 100 ¹ (≥ 100, or < 100)	Population Trend	Disturbed Habitat (%)			Risk Assessment ⁵
					Fire ²	Anthropogenic ³	Total ⁴	
QC4	Manouane	ICU	≥ 100	stable	18	26	41	NSS/SS
QC5	Manicouagan	ICU	≥ 100 ¹⁷	stable ¹⁷	3	36	37	SS
QC6	Quebec	CU	≥ 100 ¹⁷	not available ¹⁸	20	13	32	SS
Newfoundland and Labrador¹⁹								
NL1	Lac Joseph	LP	≥ 100	not available ²⁰	12	2	14	NSS/SS
NL2	Red Wine Mountain	LP	≥ 100 ²¹	not available ²²	7	3	9	NSS
NL3	Mealy Mountain	LP	≥ 100	not available ²³	1	1	2	NSS/SS

¹ A minimum of 100 animals was used in the 2011 Scientific Assessment to evaluate when local populations might be vulnerable to extinction from stochastic events due to small size (Environment Canada, 2011b).

² Fire disturbance is any area where a fire has occurred in the past 40 years (without buffer).

³ For anthropogenic disturbance, a 500 meter buffer is applied to all linear and polygonal disturbances.

⁴ For total disturbance, both anthropogenic and fire disturbances that overlap are not counted twice in the total.

⁵ With the exception of the Boreal Shield range (SK1), the integrated risk assessments have not been updated in this amended recovery strategy.

⁶ The population size estimate for NT1 is 6000 to 7000 individuals.

⁷ Sub-regional collar-based monitoring programs, and traditional and community knowledge, suggests that boreal caribou population trends differ in various part of NT1. Generally speaking, population trends seem to be increasing or stable in northern NT1, and stable or decreasing in southern NT1. More information is available in the Northwest Territories' Recovery Strategy published in 2017 (http://www.nwtspeciesatrisk.ca/sites/default/files/nwt_boreal_caribou_recovery_strategy_2017_final_0.pdf).

⁸ In 2013-2014 there was a bacterial pathogen outbreak which caused local population declines in BC. Parker and Prophet ranges have not recovered from the outbreak. The other local populations have been recovering, but the current trend information may not reflect equilibrium conditions for these populations.

⁹ AB5 is stable in response to delivery of an annual wolf population reduction program.

¹⁰ Population trend is not available for AB11 and AB12 due to low collared female sample size, resulting in unreliable estimates of annual adult female survival.

¹¹ The population size estimate for SK1 is >5000 individuals.

¹² Monitoring data are insufficient in SK2 to establish a population trend.

¹³ The increase to ≥ 100 reflects an increased survey effort and does not necessarily indicate an improvement in overall status.

¹⁴ Population trend data for Manitoba ranges are under review by the province of Manitoba and were not available to be included in this amended recovery strategy.

¹⁵ The province of Manitoba delineated new range boundaries in 2015 (https://www.gov.mb.ca/sd/wildlife/sar/pdf/cariboustrategy_octfall2015.pdf). As a result, there are no updated population data available for these ranges. Population data for Manitoba's new provincial ranges are presented in the 5-Year Progress Report (Environment and Climate Change Canada, 2017).

¹⁶ ON9 was delineated into 6 new ranges by the province of Ontario in 2013 (<https://www.ontario.ca/document/range-management-policy-support-woodland-caribou-conservation-and-recovery>). Population data for these new provincial ranges are presented in the 5-Year Progress Report (Environment and Climate Change Canada, 2017).

¹⁷ The province of Quebec is in the process of updating range and population condition metrics for QC5 and QC6. Preliminary data are available in the 5-Year Progress Report for areas defined by Fortin et al. (2017) (Environment and Climate Change Canada, 2017).

¹⁸ It is not possible to estimate population trend for QC6 as a whole because of insufficient survey data across the range. Preliminary population trends are available in the 5-Year Progress Report for areas defined by Fortin et al. (2017) that fall within the QC6 range (Environment and Climate Change Canada, 2017).

¹⁹ The province of Newfoundland and Labrador is in the process of updating population condition metrics as part of an updated provincial recovery plan. The future reporting of survey results will be dependent on ongoing exercises to delineate subpopulations in Labrador.

²⁰ A recent survey was conducted in the NL1 range, but the data could not be analyzed in time for this amended recovery strategy.

²¹ The understanding of population structure for NL2 has changed since the 2012 Recovery Strategy. The increase to ≥ 100 animals is due to a shift from minimum population counts (associated with collar deployment and other field activities) to systematic surveys in portions of the range.

²² Preliminary data and expert opinion suggests that population trends in NL2 are generally increasing in the southern part of the range and declining in the northern part of the range.

²³ The understanding of population structure for NL3 has changed since the 2012 Recovery Strategy. A survey of NL3 is tentatively being planned during the next five years with Parks Canada Agency.

APPENDIX G: DETAILS ON THE IDENTIFICATION OF CRITICAL HABITAT FOR BOREAL CARIBOU

Table G-1 provides a summary of boreal caribou habitat condition for each of the 51 boreal caribou ranges. Boreal caribou distribution (see Figure 2) and habitat condition information is based on the best available information including observational and telemetry data, and biophysical analyses, provided by provincial and territorial jurisdictions (Environment Canada, 2011b). As a result of limited information on many of the ranges in Canada, only three transboundary ranges (a range that extends across a provincial or territorial boundary) have been defined: Northwest Territories range (NT1), Chinchaga range (AB1), and Lac Joseph range (NL1). As more refined information is being continually collected by jurisdictions, range delineation and population demographic information will be updated and may result in revisions to range boundaries and possibly more transboundary ranges. The assessment of self-sustainability may change when ranges that cross jurisdictional boundaries are combined. Range boundaries and integrated risk assessments will be updated annually based on new or more refined evidence provided by the provincial and territorial jurisdictions.

As described in Section 7.1, the identification of critical habitat for boreal caribou is comprised of three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

Table G-1. Boreal caribou critical habitat information. The habitat condition has been updated in this amended recovery strategy based on information previously published in the 5-Year Progress Report (Environment and Climate Change Canada, 2017).

Range Identification	Location	Amount					Type
	Range Name	Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Biophysical Attributes (see corresponding ecozone table in Appendix H)
			Fire ¹	Anthropogenic ²	Total ³		
Northwest Territories							
NT1	Northwest Territories	44,166,546	28	9	35	65	Taiga Plain Boreal Plain Southern Arctic Taiga Cordillera
British Columbia							
BC1	Maxhamish	710,105	2	67	68	32	Taiga Plain
BC2	Calendar	496,393	16	53	61	39	Taiga Plain
BC3	Snake-Sahtahneh	1,198,752	5	77	79	21	Taiga Plain
BC4	Parker	75,222	3	57	57	43	Taiga Plain
BC5	Prophet	119,396	10	78	78	22	Taiga Plain
Alberta							
AB1	Chinchaga (incl. BC portion)	3,162,612	9	79	80	20	Taiga Plain Boreal Plain

Range Identification	Location	Amount					Type
	Range Name	Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Biophysical Attributes (see corresponding ecozone table in Appendix H)
			Fire ¹	Anthropogenic ²	Total ³		
AB2	Bistcho	1,436,555	40	58	75	25	Taiga Plain
AB3	Yates	523,094	42	20	55	45	Taiga Plain
AB4	Caribou Mountains	2,069,000	46	27	62	38	Taiga Plain
							Boreal Plain
AB5	Little Smoky	308,606	0.4	96	96	4	Montane Cordillera
							Boreal Plain
AB6	Red Earth	2,473,729	40	48	72	28	Boreal Plain
AB7	West Side Athabasca River	1,572,652	5	70	72	28	Boreal Plain
AB8	Richardson	707,350	74	23	88	12	Boreal Shield (West)
							Boreal Plain
AB9	East Side Athabasca River	1,315,980	28	78	84	16	Boreal Plain
AB10	Cold Lake	672,422	33	76	87	13	Boreal Plain
AB11	Nipisi	210,771	9	75	77	23	Boreal Plain
AB12	Slave Lake	151,904	39	74	87	13	Boreal Plain
Saskatchewan							
SK1	Boreal Shield	18,034,870	58	3	60	40	Taiga Shield
							Boreal Shield (West)
SK2	Boreal Plain	10,592,463	30	20	45	55	Boreal Plain
Manitoba							
MB1	The Bog	446,383	6	14	19	81	Boreal Plain
MB2	Kississing	317,029	39	15	54	46	Boreal Shield (West)
MB3	Naosap	456,977	28	28	52	48	Boreal Shield (West)
							Boreal Plain
MB4	Reed	357,425	7	20	26	74	Boreal Shield (West)
							Boreal Plain
MB5	North Interlake	489,680	4	14	18	82	Boreal Plain
MB6	William Lake	488,219	25	17	36	64	Boreal Plain
MB7	Wabowden	628,938	10	20	28	72	Boreal Shield (West)
							Boreal Plain
MB8	Wapisi	565,044	11	13	24	76	Boreal Shield (West)

Range Identification	Location	Amount					Type
	Range Name	Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Biophysical Attributes (see corresponding ecozone table in Appendix H)
			Fire ¹	Anthropogenic ²	Total ³		
MB9	Manitoba North	6,205,520	23	11	33	67	Boreal Shield (West)
							Boreal Plain
MB10	Manitoba South	1,867,255	4	12	16	84	Boreal Plain
MB11	Manitoba East	6,612,782	26	3	29	71	Boreal Shield (West and West Central)
MB12	Atikaki-Berens	2,387,665	29	6	34	66	Boreal Shield (West Central)
MB13	Owl-Flinstone	363,570	25	18	39	61	Boreal Shield (West Central)
Ontario							
ON1	Sydney	753,001	27	25	49	51	Boreal Shield (West Central)
ON2	Berens	2,794,835	31	6	37	63	Boreal Shield (West Central)
ON3	Churchill	2,150,490	8	28	34	66	Boreal Shield (West Central)
ON4	Brightsand	2,220,921	19	26	41	59	Boreal Shield (West Central)
ON5	Nipigon	3,885,026	7	25	30	70	Boreal Shield (West and West Central)
ON6	Coastal	376,598	0	15	15	85	Boreal Shield (West Central and Central)
ON7	Pagwachuan	4,542,918	0.7	27	27	73	Hudson Plain
							Boreal Shield (West, West Central and Central)
ON8	Kesagami	4,766,463	3	37	40	60	Hudson Plain
							Boreal Shield (Central)
ON9	Far North	28,265,143	15	1	16	84	Hudson Plain
							Boreal Shield (West and West Central)
Quebec							
QC1	Val d'Or	346,861	0.2	65	65	35	Boreal Shield (Central)
QC2	Charlevoix	312,803	4	80	82	18	Boreal Shield (Southeast)

Range Identification	Location	Amount					Type
	Range Name	Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Biophysical Attributes (see corresponding ecozone table in Appendix H)
			Fire ¹	Anthropogenic ²	Total ³		
QC3	Pipmuacan	1,376,899	11	60	68	32	Boreal Shield (East)
QC4	Manouane	2,716,449	18	26	41	59	Boreal Shield (East)
QC5	Manicouagan	1,134,129	3	36	37	63	Boreal Shield (East)
QC6	Quebec	62,156,186	20	13	32	68	Boreal Shield (Central, East and Southeast)
							Taiga Shield
							Hudson Plain
Newfoundland and Labrador							
NL1	Lac Joseph	5,802,491	12	2	14	86	Taiga Shield
							Boreal Shield (East)
NL2	Red Wine Mountain	5,838,594	7	3	9	91	Taiga Shield
							Boreal Shield (East)
NL3	Mealy Mountain	3,948,463	1	1	2	98	Taiga Shield
							Boreal Shield (East)

¹ Fire disturbance is any area where a fire has occurred in the past 40 years (without buffer).

² For anthropogenic disturbance, a 500 meter buffer is applied to all linear and polygonal disturbances.

³ For total disturbance, both anthropogenic and fire disturbances that overlap are not counted twice in the total.

APPENDIX H: BIOPHYSICAL ATTRIBUTES FOR BOREAL CARIBOU CRITICAL HABITAT

Biophysical Attributes

Indigenous Knowledge (Boreal Caribou ATK Reports, 2010-2011), habitat selection analyses, and scientific published reports (Environment Canada, 2011b) were used to summarize biophysical attributes required by boreal caribou to carry out life processes necessary for survival and recovery. Results are provided by ecozone and ecoregion in order to capture the ecological variation across the distribution of boreal caribou.

Boreal Caribou Ranges by Ecozone and Ecoregion

Boreal caribou are distributed in the boreal forest across eight ecozones in Canada including: Taiga Plain, Montane Cordillera, Taiga Shield, Boreal Plain, Boreal Shield, Hudson Plain, Southern Arctic, and Taiga Cordillera. The largest ecozone, Boreal Shield, is further divided into five ecoregions: Boreal Shield West, Boreal Shield West Central, Boreal Shield Central, Boreal Shield East, and Boreal Shield South East (see Figure H-1).

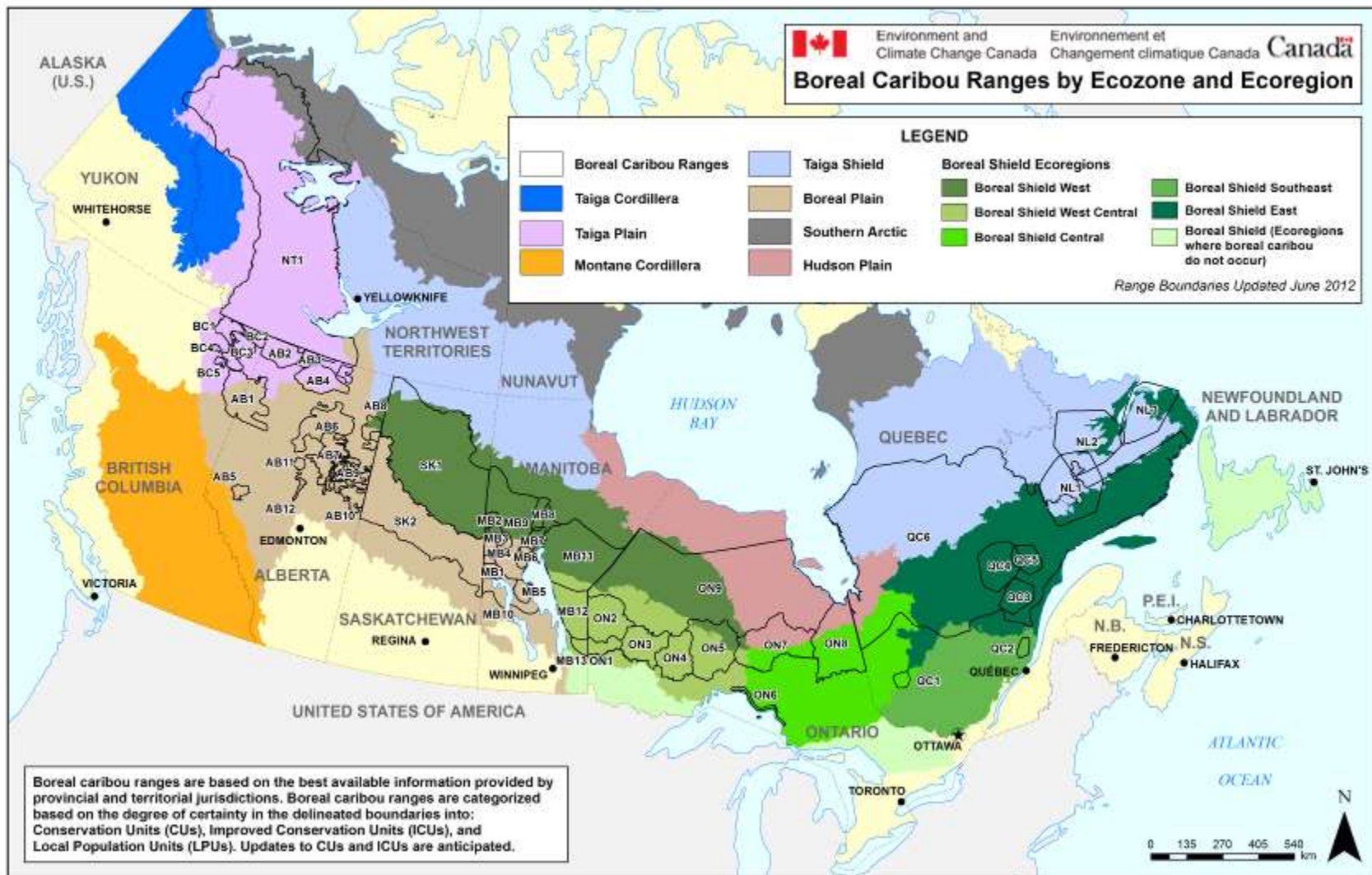


Figure H-1. Boreal caribou distribution across ecozones and ecoregions in Canada.

Biophysical Attribute Descriptions

The biophysical attributes for boreal caribou critical habitat are categorized by the types of habitat used by boreal caribou in accordance with seasonal and life-stage activity which include broad scale, calving, post-calving, rutting, wintering, and travel. This information is provided in the following tables by ecozone and ecoregion.

Biophysical attributes will vary both between and within boreal caribou ranges. As the biophysical attributes presented in this recovery strategy were developed at a national scale by ecozone and ecoregion, and not by local population, it is anticipated that each provincial and territorial jurisdiction may have or will develop over time, a more refined description of the biophysical attributes required for each range. Biophysical attributes specific to boreal caribou ranges in Labrador have been provided by the jurisdiction and are included in Table H-6 below.

Table H-1. Biophysical attributes for boreal caribou critical habitat in the Taiga Plain ecozone.

Type of habitat	Description
Broad scale	Mature forests (jack pine, spruce, and tamarack) of 100 years or older, and open coniferous habitat. Large areas of spruce peat land and muskeg with preference for bogs over fens and upland and lowland black spruce forests with abundant lichens, and sedge and moss availability. Flatter areas with smaller trees and willows, hills and higher ground.
Calving	Open coniferous forests, tussock tundra, low shrub, riparian, recent burned areas, south and west aspects and hills and higher locations. Muskegs, marshes, staying close to water sources. Caribou observed on small islands of mature black spruce or mixed forests within peat lands, in old burns at the edge of wetlands, in alder thickets with abundant standing water and on lake shores.
Post-calving	Muskegs or areas with access to muskegs, open meadows on higher ground, close to water (lakes and rivers) and mixed bush areas. Open coniferous forests with abundant lichens, low shrub, riparian, tussock tundra, sparsely vegetative habitat, recent burns and west aspects. Old burns and neighbouring remnant unburned forests selected in late spring and early summer.
Rutting	Open coniferous and mixed wood forests, low shrub, riparian, tussock tundra, recent burns and west aspect. Still use muskegs that harbor ground lichen and sedges, mixed bush areas, areas of higher ground. Regenerating burns and sparsely vegetated habitat.
Winter	Open coniferous forests (black spruce and pine) that provide adequate cover with abundant lichens, riparian areas. Caribou observed in muskeg areas in early winter. Spruce-lichen forests, fire regenerated, sparsely vegetated habitat, herbaceous and tall shrub habitat and sphagnum moss with scattered spruce. As snow depth increases, they remain more often in areas of dense pine or thickly wooded black spruce, with hanging lichen and remains access to open, mixed vegetation for ground forage.
Travel	Females show high fidelity to calving sites among years (i.e. within 14.5 km). Many caribou shift the pattern of use based on seasonal preferences, in large multi-habitat areas. Rates of movement increase during the rut and are greatest in winter.

Table H-2. Biophysical attributes for boreal caribou critical habitat in the Montane Cordillera ecozone.

Type of habitat	Description
Broad scale	Upland lodge pole pine, mixed conifer lodgepole pine/black spruce and treed muskeg areas with abundant lichens. Open, pine dominated stands of 80 years or more.
Calving	Areas closer to cut-blocks with a high proportion of larch are selected during calving. Lower mountain peaks.
Post-calving	Homogeneous areas of conifer dominated stands.
Rutting	No information on rutting habitat currently available.
Winter	Caribou use areas with a high proportion of larch and pine forests during winter.

Table H-3. Biophysical attributes for boreal caribou critical habitat in the Taiga Shield ecozone (see Table H-6 for biophysical attributes more specific to Labrador ranges).

Type of habitat	Description
Broad scale	Upland tundra dominated by ericaceous shrubs (<i>Ericaceae</i> spp.), lichen, grasses and sedges. Lowland tundra composed of peat land complexes (muskeg and string bogs), wetlands (swamps, marshes), lakes, rivers and riparian valleys. Dense mature jack pine and black spruce stands with balsam fir and tamarack present and open conifer forests with abundant lichens.
Calving	String bogs, treed bogs, small open wetlands (< 1 km ²), large muskeg, marshes along water bodies. Barren grounds. Calving on peninsulas and islands increases with amount of open water.
Post-calving	Forested wetlands. Hilly areas, coastal sites, along shorelines of water bodies (rivers, lakes, creeks), marshes with lichen availability.
Rutting	Open wetlands, swamps. Mature forests, mountainous terrain with forests of black spruce, tamarack and pine trees with abundant lichen.
Winter	Forested areas are used in years of low snow accumulation; otherwise winter habitat selection reflects general avoidance of deep snow, including use of tundra habitat at higher elevations in mountainous regions and bogs along lakes or oceans. Forested wetlands. Tundra uplands and sand flats in proximity to water. Barren grounds. Bog edges, glacial erratics and bedrock erratics with lichen and lakes. Some use of mature white spruce and fir stands as alternative to habitat with arboreal lichens. Mix of mature forest stands, mountainous terrain with forests of black spruce, tamarack and jack pine with abundant lichen.
Travel	Connectivity between selected habitat types important given reported patterns of movement among caribou. Some animals have been reported to travel up to distances of approximately 200 km, although the majority of animals appear to move shorter distances. Females show fidelity to post-calving sites returning to within 6.7 km of a given location in consecutive years.

Table H-4. Biophysical attributes for boreal caribou critical habitat in the Boreal Plain ecozone.

Type of habitat	Description
Broad scale	Late seral-stage (> 50 years old) conifer forest (jack pine, black spruce, tamarack), treed peat lands, muskegs or bogs, use dry islands in the middle of muskegs, with abundant lichens. Hilly or higher ground and small lakes. Restricted primarily to peat land complexes. Higher elevations (~1135 m). Selected old (>40 years) burns.
Calving	Bogs and mature forests selected for calving as well as islands and small lakes. Peat lands and stands dominated by black spruce and lowland black spruce stands within muskeg are used for calving.
Post-calving	Forest stands older than 50 yrs. Upland black spruce/jack pine forests, lowland black spruce, young jack pine and open and treed peat lands and muskeg are also selected during summer. Use lichen and low muskeg vegetation. In some areas, sites with abundant arboreal lichen are selected during summer.
Rutting	Mature forests. Upland black spruce/jack pine forests, lowland black spruce, young jack pine and open and treed peat lands and muskeg during summer.
Winter	Treed peat lands, treed bog and treed fen and open fen complexes with > 50% peat land coverage with high abundance of lichens. Use of small lakes, rock outcrops on lakes for lichen access. Mature forest > 50 years old. Upland black spruce/jack pine forests, lowland black spruce, young jack pine and open and treed peat lands.

Table H-4a. Biophysical attributes for boreal caribou critical habitat in the Boreal Shield West ecoregion.

Type of habitat	Description
Broad scale	Conifer/tamarack-dominated peat land complexes, muskegs or bogs, use dry islands in the middle of muskegs and upland moderate to dense mature conifer forests (jack pine, black spruce, tamarack) with abundant lichens. Hilly or higher ground, lots of smaller lakes in area.
Calving	Peat lands, stands dominated by black spruce, mature forest stands and treed muskeg all used for calving. Caribou will use islands, small lakes, lakeshores during calving.
Post-calving	Wooded lakeshores, islands, sparsely treed rock, upland conifer-spruce and treed muskeg are used in summer. Sites with a high abundance of arboreal lichen are important for foraging in some areas. Dense conifer and mixed forest are also used.
Rutting	Dense and sparse conifer and mixed forests. Open riparian habitats are also used during the rut.
Winter	Mature upland spruce, pine stands and treed muskeg. Jack pine dominated forests. Caribou select sparse and dense conifer, mixed forests and treed bogs. In some areas caribou will select habitat with greater visibility and further away from forest edges.
Travel	Some males move > 100 km during the rutting season. Traditional travel routes between summer and winter ranges occur in large peat land complexes. Caribou migrate in a north to south pattern.

Table H-4b. Biophysical attributes of boreal caribou habitat in the Boreal Shield West Central ecoregion.

Type of habitat	Description
Broad scale	Mature conifer uplands and conifer/tamarack dominated lowlands. Conifer/tamarack-dominated peat lands, muskegs with abundant arboreal lichens, upland mature conifer forests stands with abundant terrestrial lichen and rocky areas with sparse trees. Elevations of 300 m. Intermediate values of Normalized Difference Vegetation Index ¹ . Selection for old (>40 years) burns.
Calving	Forested wetlands/treed bog, old burns, sparse conifer and dense spruce. Need lichen availability. Peat lands, raised hillrocks with large muskeg areas, forested islands and shorelines of large lakes selected during calving. Jack pine or jack pine/black spruce forests also used for calving.
Post-calving	Peat land with forested islands, islands, and shorelines selected during summer. Mature, dense forest stands.
Rutting	Semi-open and open bogs and mature conifer uplands selected during rutting. Terrestrial lichens and arboreal lichens, sedges and bog ericoids (<i>Andromeda glaucophylla</i> , <i>Chamaedaphne calyculata</i> , <i>Kalmia polifolia</i> , and <i>Ledum groenlandicum</i>) are important sources of forage.
Winter	Mature coniferous stands. Areas with a high proportion of lakes (> 5-100 ha) with convoluted shorelines. Caribou forage in areas with high lichen abundance and fewer shrubs in jack pine and black spruce stands with low tree densities, low basal areas and short heights. Caribou select open bogs, intermediate to mature jack pine rock ridges, jack pine habitats with lichens and lakes, but move to jack pine ridges in mature conifer stands with lichen when winter conditions prevent foraging in bogs. Arboreal lichens, terrestrial lichens, sedges and ericaceous species are an important source of forage.
Travel	Travel mainly in conifer forests, avoiding open habitats (e.g. lakes, disturbed areas, etc.) when migrating from summer to winter habitat. Use frozen lakes for travel during winter/spring, in some instances to reach islands for calving. Spring migration is not restricted to specific travel routes. Some move at a range of 100 km during the rutting season. Caribou moved 8-60 km away after logging operations were begun.

Table H-4c. Biophysical attributes for boreal caribou critical habitat in the Boreal Shield Central ecoregion.

Type of habitat	Description
Broad scale	Late seral-stage black spruce-dominated lowlands and jack pine dominated uplands. Open black spruce lowlands. Low-density late seral-stage jack pine or black spruce forests and black spruce/tamarack-dominated peat lands with abundant terrestrial and moderate arboreal lichens. Caribou also use areas with dry to moist sandy to loamy soils and shallow soils over bedrock. Elevations of 300 m. Intermediate values of Normalized Difference Vegetation Index ¹ . Selection for old (>40 years) burns.
Calving	Open canopies of mature black spruce and mesic peat land with ericaceous species for calving are selected for calving in the Claybelt region. Females with calves selected areas with more abundant ericaceous shrubs and terrestrial lichens during the summer compared to females without calves.
Winter	Large areas of contiguous forests dominated by black spruce. Open conifer forests or forests with lower tree densities where terrestrial and arboreal lichen are abundant and there is significant less snow (e.g. shorelines) are also selected.

Table H-4d. Biophysical attributes for boreal caribou critical habitat in the Boreal Shield East ecoregion (see Table H-6 for biophysical attributes more specific to Labrador ranges).

Type of habitat	Description
Broad scale	Conifer-lichen moss forests on poorly-drained sites and mature conifer uplands with abundant terrestrial lichen. Black spruce, jack pine and balsam fir stands present with abundant lichen. Water bodies and wetlands (swamps, marshy areas with tamarack). Mountains or rolling hills. Elevations of 300 m. Intermediate values of Normalized Difference Vegetation Index ¹ . Selection for old (>40 years) burns.
Calving	Open wetlands, peninsulas and islands. Sedges, ericaceous species, bryophytes, alder and larch selected in spring. Balsam fir, dense black spruce stands, spruce-fir forests older than 40 years, and dry bare land with high lichen densities. Mature conifer stands, as well as wetlands (marshes, peat moss areas). Higher altitudes used for calving in this area rather than lake or water bodies.
Post-calving	Open and forested wetlands (marshes, swamps), and continued use of peninsulas and islands. Hilly areas, coastal sites, shorelines (rivers, lakes, creeks). Aquatic plants, dwarf birch (<i>Betula glandulosa</i>), deciduous shrubs, ericaceous species and moss.
Rutting	Open wetlands selected, swamps. Terrestrial and arboreal lichens, forbs, sedges, mosses and coniferous and deciduous shrubs. Balsam fir stands, dense spruce stands, mature and regenerating conifer stands, other forest stands (tamarack, pine) with abundant lichens, wetlands (swamps) and dry bare lands.
Winter	Forested wetlands. Some use of upland-tundra for loafing. Mountainous terrain. Dry bare land, wetlands, mature conifer forests with lichen, balsam fir stands, dense spruce stands, and mixed spruce-fir forests older than 40 years selected in southern areas. Observed along frozen bodies of water. Use of mature forests protected from harvesting increases probability of encounters with wolves that select the same habitats in winter. Shallow snow depths selected in late winter.
Travel	Caribou move greater distances during the rutting season.

Table H-4e. Biophysical attributes for boreal caribou critical habitat in the Boreal Shield Southeast ecoregion.

Type of habitat	Description
Broad scale	Late seral-stage black spruce-dominated lowlands and jack pine-dominated uplands, Balsam fir stands, marshlands and abundant lichen.
Calving	Open, medium-closed conifer forests. Elevations of 300 m. Intermediate values of Normalized Difference Vegetation Index ¹ . Selection for old (>40 years) burns.
Rutting	Dense and open mature conifer forests of spruce, tamarack, jack pine and young conifer forests between 30 – 50 years old.
Winter	Open stands of balsam fir, balsam fir-black spruce, black spruce, black-spruce-tamarack and jack pine stands older than 70 yrs. Dry bare lands, 30-50 year old stands of balsam fir or fir-black spruce, as well as 50 year old jack pine stands, and arboreal and terrestrial lichens.

Table H-5. Biophysical attributes for boreal caribou critical habitat in the Hudson Plain ecozone.

Type of habitat	Description
Broad scale	Habitats selected generally to reduce predation risk. Shrub rich treed muskeg and mature conifer forests abundant in lichens. Shorelines of deep lakes and rivers (birch trees). Poorly drained areas dominated by sedges, mosses and lichens, as well as open black spruce and tamarack forests. Elevations of 150m. Intermediate levels of ruggedness ¹ and Normalized Difference Vegetation Index ² .
Calving	Mature conifer stand with and without lichens and muskegs. Preference for higher altitudes compared to habitat use during other periods.
Post-calving	Fens, bogs and lakes.
Rutting	Wetlands and conifer stands with lichen. Mature and regenerating conifer stands are also used, albeit to a lesser degree. Caribou use hills in the lowlands, treed islands in muskegs with several different tree species.
Winter	Dense and mature conifer forests with lichens and wetlands. Peat lands dominated by open bogs and terrestrial lichens. Large patches of intermediate and mature black spruce, shrub-rich treed muskeg and mixed conifer stands all used in late winter.
Travel	Movements greatest in fall/winter when caribou transition from calving to winter habitat. Long range movements are greater in areas with high moose densities, presumably to reduce predation risk.

¹ Vector ruggedness is a metric used to capture variability in slope and aspect.

² Normalized Difference Vegetation Index (NDVI) is an index that provides a standardized method of comparing vegetation greenness between satellite images.

NOTE: A small portion of boreal caribou critical habitat in the northern portion of the Northwest Territories range falls within the Southern Arctic ecozone and the Taiga Cordillera ecozone. Currently, there is no information available on boreal caribou habitat use or biophysical attributes in either of these ecozones. Biophysical attributes in the Taiga Plain ecozone are used to describe the type of habitat needed for the identification of critical habitat for boreal caribou in the Southern Arctic and Taiga Cordillera ecozones.

Biophysical attributes specific to Labrador ranges, containing detailed information as made available by the jurisdiction.

Table H-6. Biophysical attributes of boreal caribou critical habitat in the Taiga Shield ecozone and Boreal Shield East ecoregion, specific to Labrador ranges.

Type of habitat	Description
Broad scale	<p>Subarctic and boreal forests. Tundra and low shrubs at high elevations. Numerous lakes, peatlands (string, plateau and basin bogs, ribbed and ladder fens) and peatland complexes of several wetland types adjacent and contiguous to each other, broad river valleys. Lichen woodlands, new and regenerating burns. Intermediate values of Normalized Difference Vegetation Index¹.</p> <p><u>Lac Joseph (NL1)</u> Mid and low subarctic forests characterized by open coniferous forests, eskers and upland plateaus. Black spruce dominant; jackpine and trembling aspen occur sporadically. Poorly-drained sites characterized by extensive ribbed fen-string bog complexes bordered by black-spruce sphagnum stands. Well drained sites and river uplands often containing open lichen woodlands. Lakes comprising approximately 15% of range, including Lac Joseph, Lake Ashuanipi and Atikonak Lakes.</p> <p><u>Red Wine Mountain (NL2)</u> High boreal forest and alpine areas in addition to low subarctic forest. Boreal forest portions contain productive, close-canopied boreal forests, with deep river valleys. Black spruce predominant, while some balsam fir, white birch, and trembling aspen also occur. Dominant topographical features are the Red Wine Mountains (600m- 900m asl), and an extensive upland boreal plateau consisting of a mosaic of extensive string bogs and open conifer forest (400 m asl). Alpine areas with tundra vegetation; larch and black spruce on lower valley slopes.</p> <p><u>Mealy Mountain (NL3)</u> Extensive tree-less coastal barrens and offshore islands with tundra-like vegetation, and extensive string bogs and open pools of water, with hummocks dominated by scrub spruce and Labrador tea on the Eagle River Plateau. Mid-boreal forest characterized by closed-canopied black spruce and balsam fir forests. Eskers which occasionally support ribbons of lichen woodland. Dominant topographical feature is the Mealy Mountain range (1000m asl), containing alpine areas with tundra vegetation.</p>
Calving	<p>Muskegs, lakes and islands, peninsulas of large lakes, or combinations of these features. Mature, dense conifer stands (>90 years) with a sphagnum, forb or shrub understory, particularly when in proximity to wetlands or lakes.</p>
Post-calving and summer	<p>Immediately post calving: wetlands and areas with open water, and adjacent areas of mature, dense coniferous forest. Summer (July through September) and early fall: broader array of vegetation communities in the vicinity of their calving areas, including mature coniferous forests with a shrub or moss/forb understory, treed bogs and some open-canopied woodlands with an extensive shrub understory. Open and forested wetlands (muskeg, treed bogs) and continued use of peninsulas and islands, shorelines (rivers, lakes, creeks). Riparian plants, dwarf birch (<i>Betula glandulosa</i>), willow, ericaceous shrubs, forbs grasses and sedges for forage.</p>

Type of habitat	Description
Rutting	<p>Wetlands and areas with open water, and adjacent areas of mature, dense coniferous forest. Mature coniferous forests with a shrub or moss/forb understory, treed bogs and some open-canopied woodlands with an extensive shrub understory.</p> <p>Open and forested wetlands (muskeg, treed bogs) and continued use of peninsulas and islands, shorelines (rivers, lakes, creeks).</p> <p>Riparian plants, dwarf birch (<i>Betula glandulosa</i>), willow, ericaceous shrubs, forbs and sedges for forage.</p>
Winter	<p>Early winter (November through January): lichen woodlands and lichen-shrub woodlands. Occasional use of wetlands.</p> <p>Late winter: lichen woodlands, ice-covered water bodies (for rest and as a refuge), and regenerating burns (with shrub and <i>Cladina mitis</i> understory) in some cases.</p> <p>Extensive use of coastal barrens in Mealy Mountain range.</p> <p>Some use of Alpine areas in Red Wine Mountain and Mealy Mountain range.</p>
Travel	<p>During spring and fall migration, select open habitats that are easy to travel through. In particular, during spring migration select for (frozen) wetlands and burns, and during fall migration added open lichen woodlands to the latter cover classes.</p> <p>Most females travel up to 20 km from winter areas to calving sites, but can move by as much as 120 km.</p>

¹ Normalized Difference Vegetation Index (NDVI) is an index that provides a standardized method of comparing vegetation greenness between satellite images.

APPENDIX I: MITIGATION TECHNIQUES TO AVOID DESTRUCTION OF CRITICAL HABITAT

Mitigation of the adverse effects that may result from a proposed project on boreal caribou could include different techniques. These techniques include avoiding destruction of undisturbed habitat or biophysical attributes necessary for the species to carry out life processes, reducing noise or pollution, or minimizing disturbance by adapting its shape or adjusting the timing of the disturbance. Table I-1 provides examples of considerations and possible mitigation techniques when planning development within a boreal caribou range.

Table I-1. Examples of considerations when planning development within a boreal caribou range and possible mitigation techniques.

Considerations when planning development	Examples of possible mitigation techniques
Threshold of disturbance in the short- and long-term	Minimize the footprint of development, consider locations where habitat is already disturbed; restore habitat to provide continual availability of undisturbed habitat over time.
Ecological factors	Avoid destruction of biophysical attributes (see Appendix H).
Spatial configuration	Minimize disturbance by adapting its shape (small polygon vs. linear).
Sensory disturbances	Mitigation of noise, light, smells, vibrations to prevent harassment of boreal caribou.
Pollution	Mitigate pollution through scrubbers or other techniques. Some types of pollution may be especially of concern (e.g. air pollution that increases acidity may affect lichens on which boreal caribou depend for food).
Timing of disturbance	Certain types of disturbance could occur only in seasons when boreal caribou are not using the area or do not respond negatively to the activity.
Induced effects	New access roads in previously undisturbed areas may induce further disturbance by opening territory to more development, recreational users, etc. This could be prevented by an access management plan that could include limiting access, decommissioning roads, etc.
Corridors that support predator movement	Impact may be reduced by using techniques that prevent use of corridor by predators (no compaction of snow, immediate replanting of trees, etc.).
Increases in predator and/or alternate prey populations	Mortality management techniques may be considered where the killing of predators would be a final, necessary option implemented temporarily, along with habitat restoration.

APPENDIX J: CRITICAL HABITAT FACTSHEETS



Illustration © Judie Shore

CRITICAL HABITAT FACTSHEETS: NORTHWEST TERRITORIES

Critical Habitat Identification: Northwest Territories Range (NT1)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

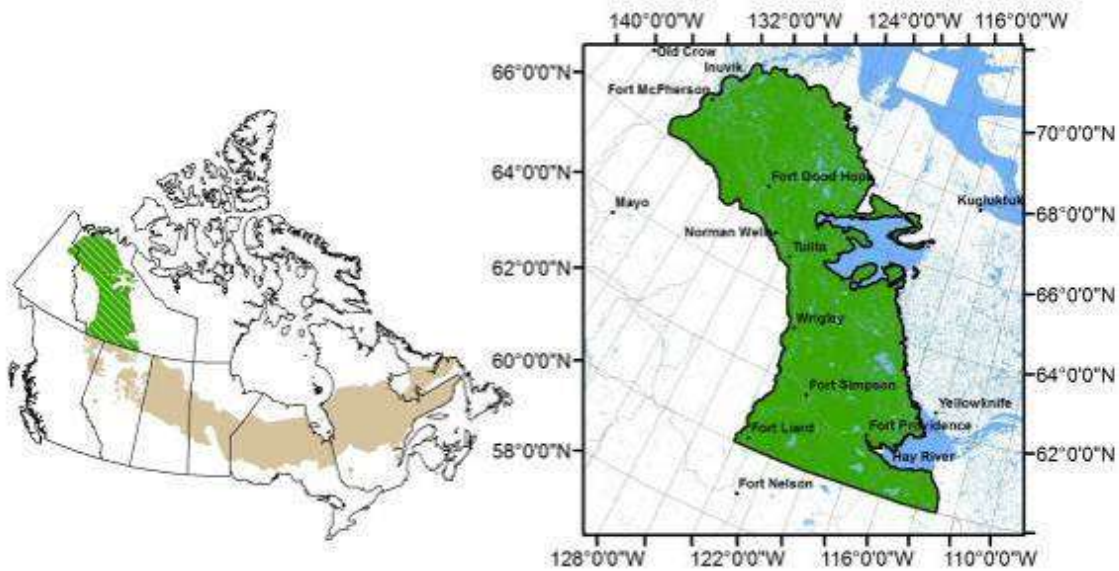


Figure J-1. Key map of the general location of the range.

Figure J-2. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
44,166,546	28	9	35	65	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Plain
	Boreal Plain
	Southern Arctic
	Taiga Cordillera

¹ See Appendix H

CRITICAL HABITAT FACTSHEETS: BRITISH COLUMBIA

Critical Habitat Identification: Maxhamish Range (BC1)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

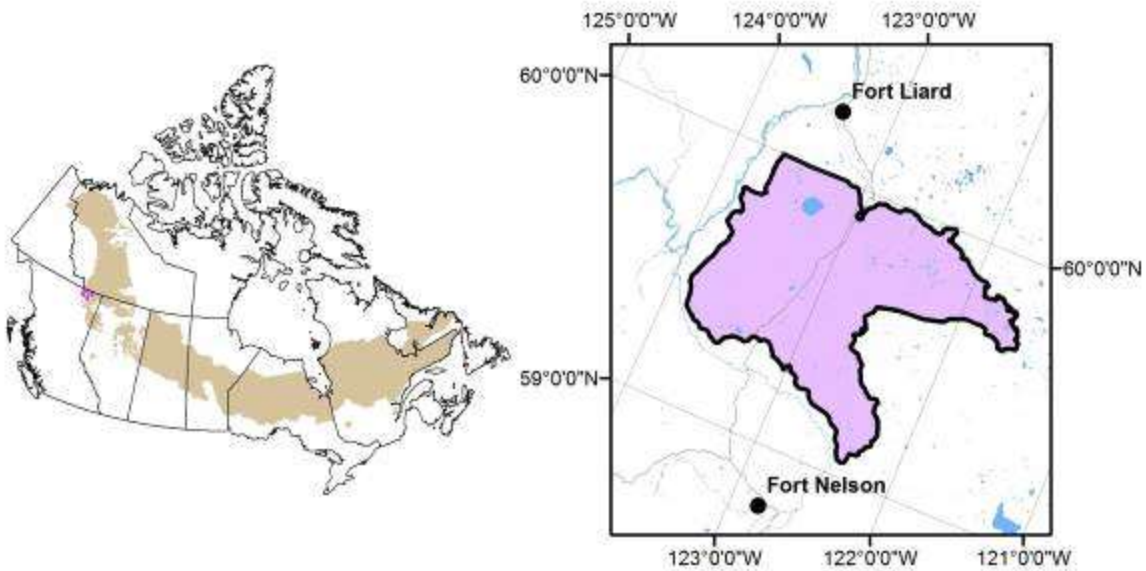


Figure J-3. Key map of the general location of the range.

Figure J-4. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
710,105	2	67	68	32	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Plain
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¹ See Appendix H

Critical Habitat Identification: Calendar Range (BC2)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

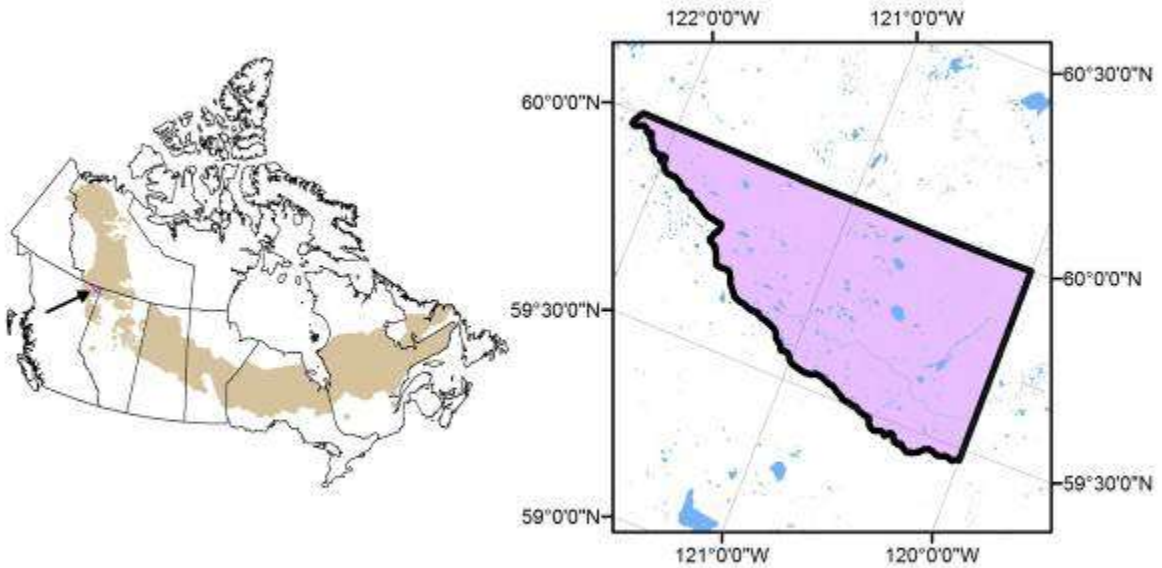


Figure J-5. Key map of the general location of the range.

Figure J-6. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
496,393	16	53	61	39	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s) ¹ :	Taiga Plain
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¹ See Appendix H

Critical Habitat Identification: Snake-Sahtahneh Range (BC3)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

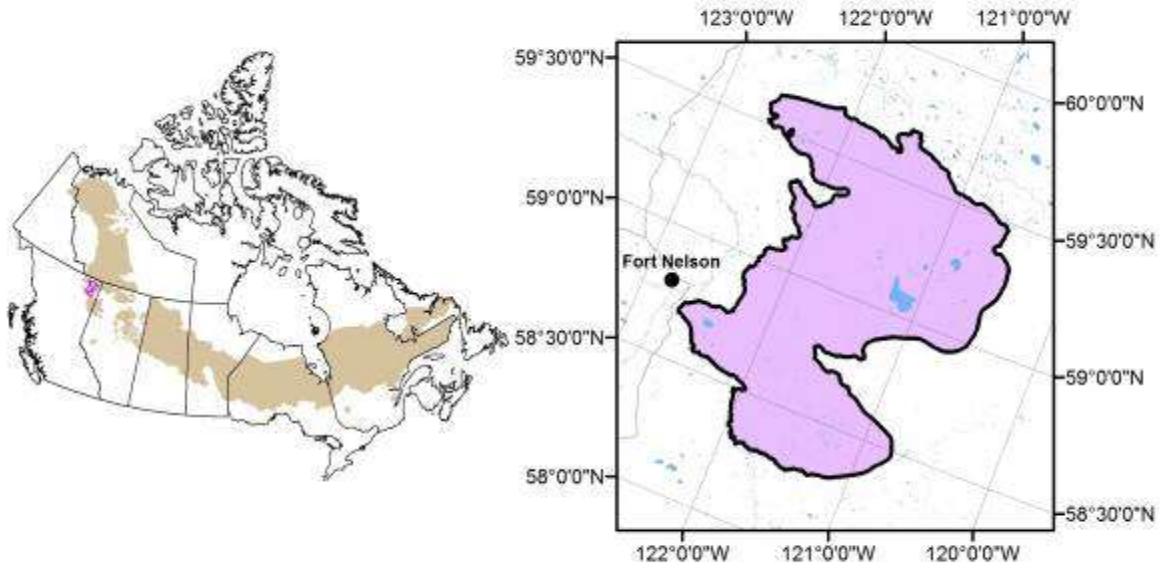


Figure J-7. Key map of the general location of the range.

Figure J-8. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
1,198,752	5	77	79	21	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Plain
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¹ See Appendix H

Critical Habitat Identification: Parker Range (BC4)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-9. Key map of the general location of the range.

Figure J-10. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
75,222	3	57	57	43	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Plain
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¹ See Appendix H

Critical Habitat Identification: Prophet Range (BC5)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

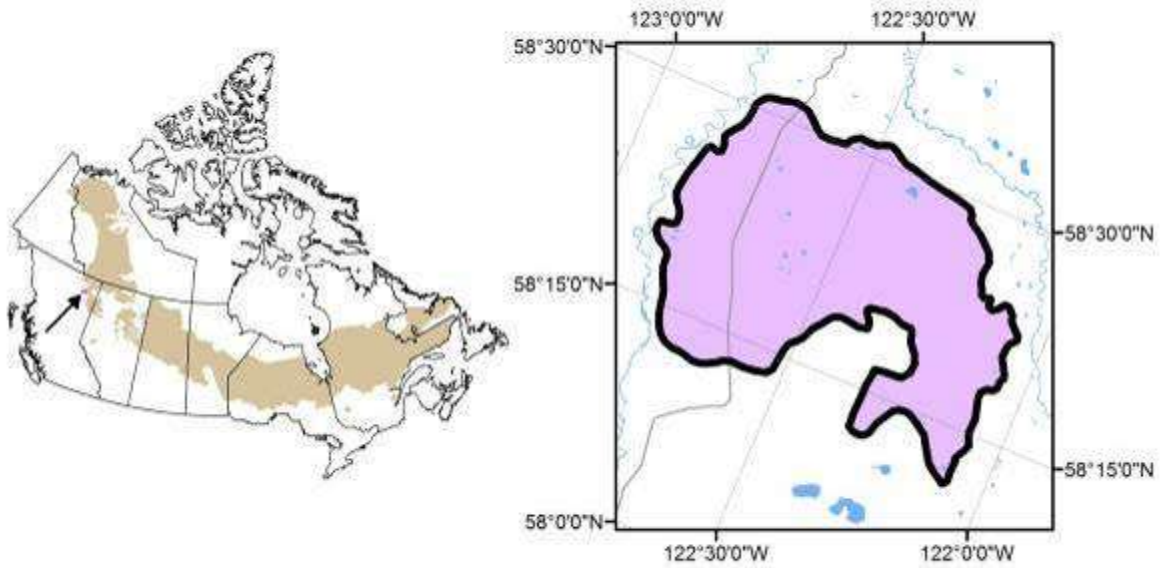


Figure J-11. Key map of the general location of the range.

Figure J-12. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
119,396	10	78	78	22	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Plain
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¹ See Appendix H

CRITICAL HABITAT FACTSHEETS: ALBERTA

Critical Habitat Identification: Chinchaga Range (incl. BC portion) (AB1)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-13. Key map of the general location of the range.

Figure J-14. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
3,162,612	9	79	80	20	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Plain
	Boreal Plain

¹ See Appendix H

Critical Habitat Identification: Bistcho Range (AB2)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

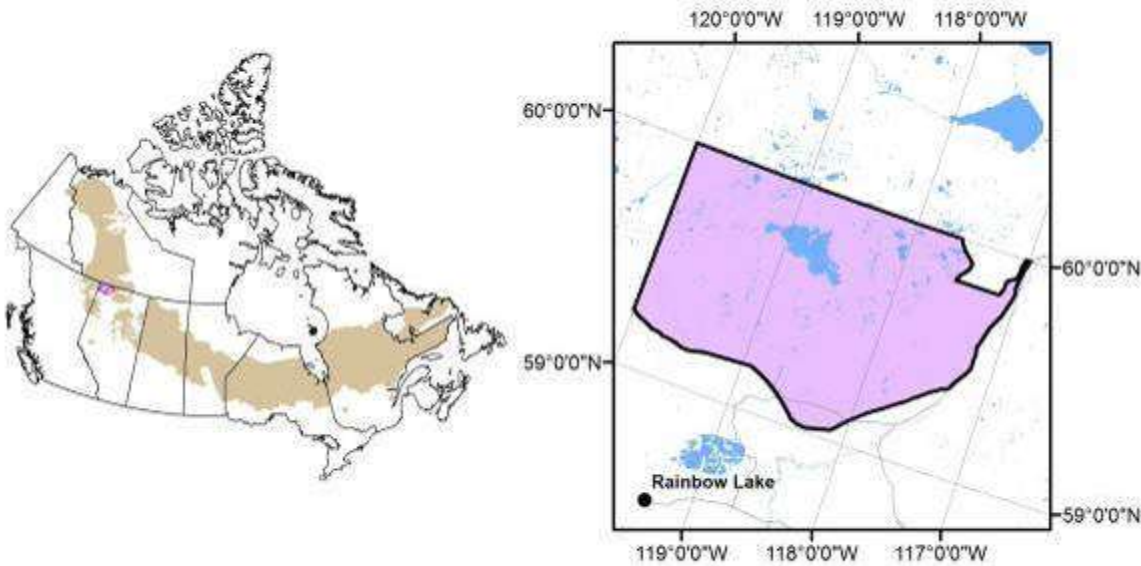


Figure J-15. Key map of the general location of the range.

Figure J-16. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
1,436,555	40	58	75	25	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Plain
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¹ See Appendix H

Critical Habitat Identification: Yates Range (AB3)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-17. Key map of the general location of the range.

Figure J-18. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
523,094	42	20	55	45	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Plain
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¹ See Appendix H

Critical Habitat Identification: Caribou Mountains Range (AB4)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

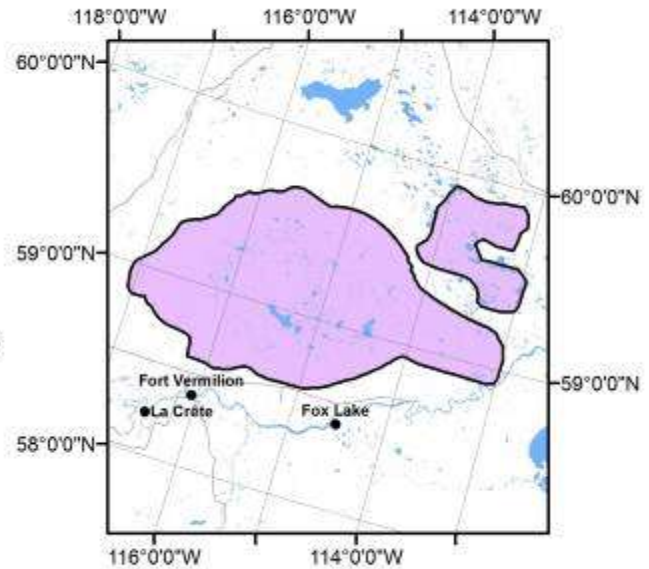


Figure J-19. Key map of the general location of the range.

Figure J-20. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
2,069,000	46	27	62	38	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Plain
	Boreal Plain

¹ See Appendix H

Critical Habitat Identification: Little Smoky Range (AB5)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

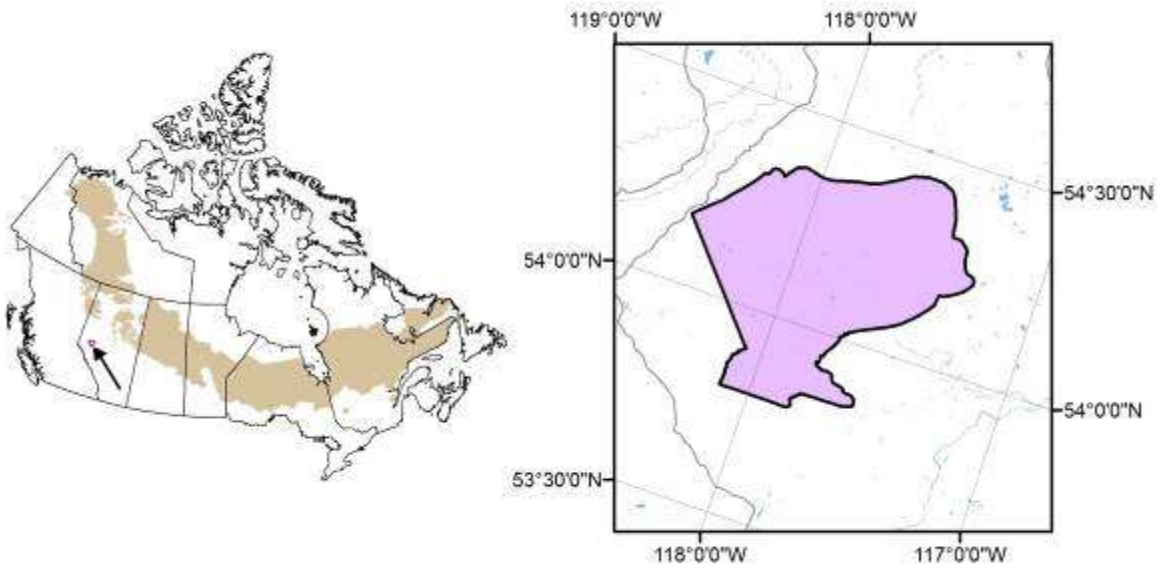


Figure J-21. Key map of the general location of the range.

Figure J-22. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
308,606	0.4	96	96	4	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Montane Cordillera
	Boreal Plain

¹ See Appendix H

Critical Habitat Identification: Red Earth Range (AB6)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

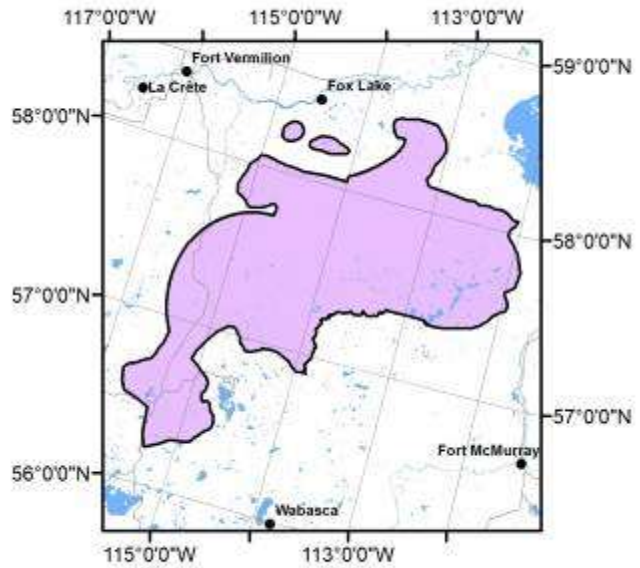


Figure J-23. Key map of the general location of the range.

Figure J-24. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
2,473,729	40	48	72	28	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Plain
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¹ See Appendix H

Critical Habitat Identification: West Side Athabasca River Range (AB7)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

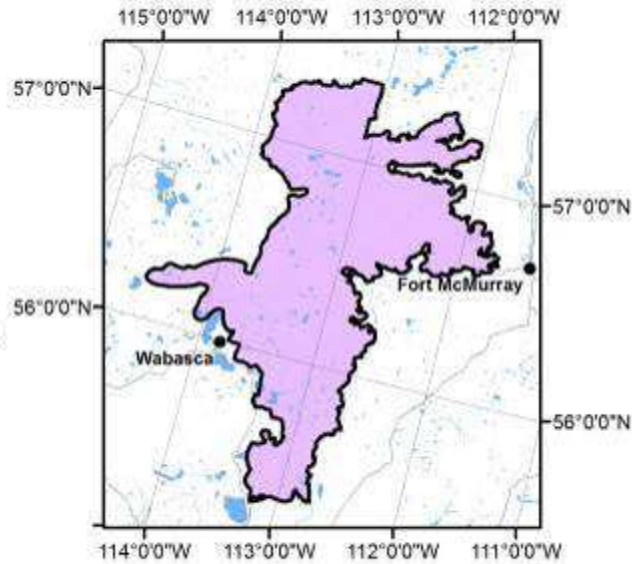


Figure J-25. Key map of the general location of the range.

Figure J-26. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
1,572,652	5	70	72	28	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Plain
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¹ See Appendix H

Critical Habitat Identification: Richardson Range (AB8)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

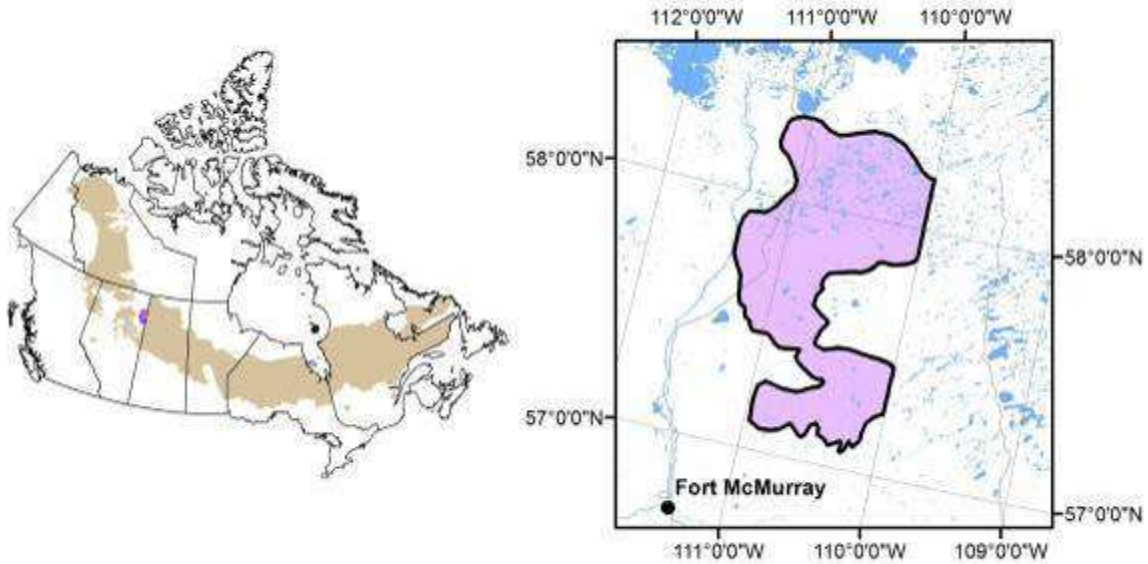


Figure J-27. Key map of the general location of the range.

Figure J-28. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
707,350	74	23	88	12	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
	Boreal Plain
Ecoregion(s)¹:	Boreal Shield (West)

¹ See Appendix H

Critical Habitat Identification: East Side Athabasca River Range (AB9)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

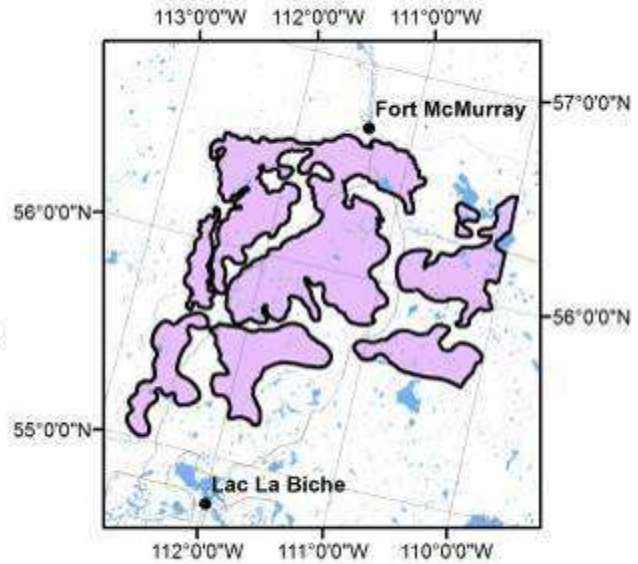


Figure J-29. Key map of the general location of the range.

Figure J-30. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
1,315,980	28	78	84	16	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Plain
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¹ See Appendix H

Critical Habitat Identification: Cold Lake Range (AB10)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

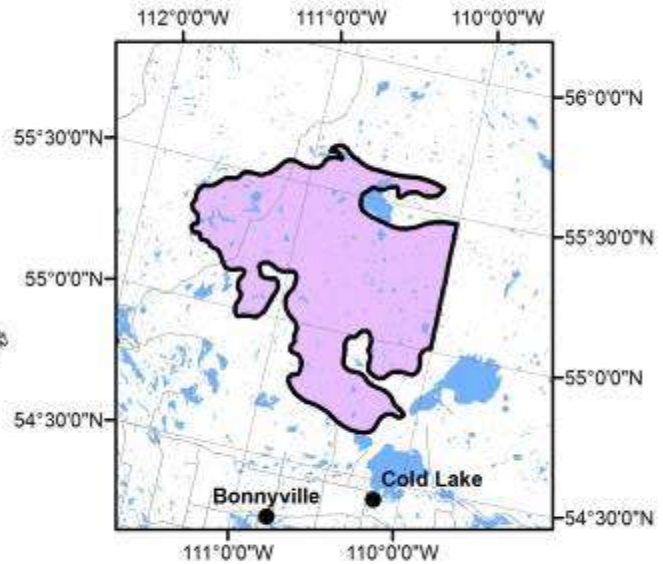


Figure J-31. Key map of the general location of the range.

Figure J-32. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
672,422	33	76	87	13	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Plain
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¹ See Appendix H

Critical Habitat Identification: Nipisi Range (AB11)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

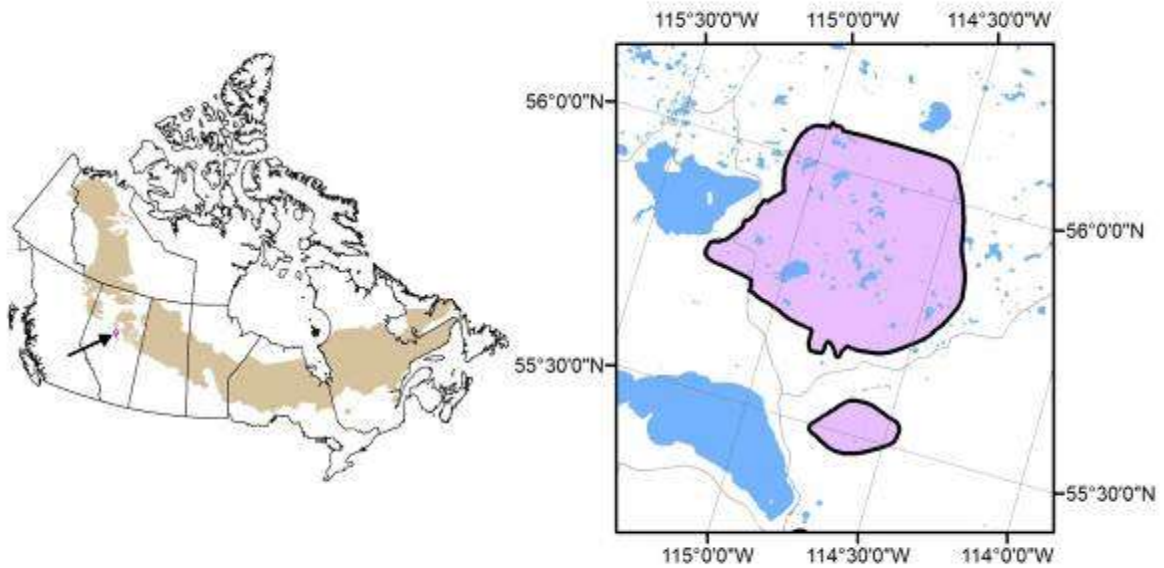


Figure J-33. Key map of the general location of the range.

Figure J-34. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
210,771	9	75	77	23	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Plain
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¹ See Appendix H

Critical Habitat Identification: Slave Lake Range (AB12)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-35. Key map of the general location of the range.

Figure J-36. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
151,904	39	74	87	13	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Plain
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¹ See Appendix H

CRITICAL HABITAT FACTSHEETS: SASKATCHEWAN

Critical Habitat Identification: Boreal Shield Range (SK1)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

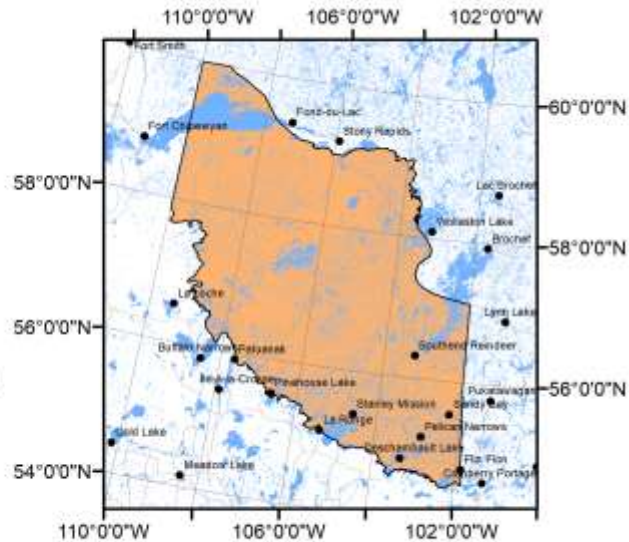


Figure J-37. Key map of the general location of the range.

Figure J-38. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
18,034,870	58	3	60	40	At least 40% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Shield
	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West)

¹ See Appendix H

Critical Habitat Identification: Boreal Plain Range (SK2)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-39. Key map of the general location of the range.



Figure J-40. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
10,592,463	30	20	45	55	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Plain
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¹ See Appendix H

CRITICAL HABITAT FACTSHEETS: MANITOBA

Critical Habitat Identification: The Bog Range (MB1)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

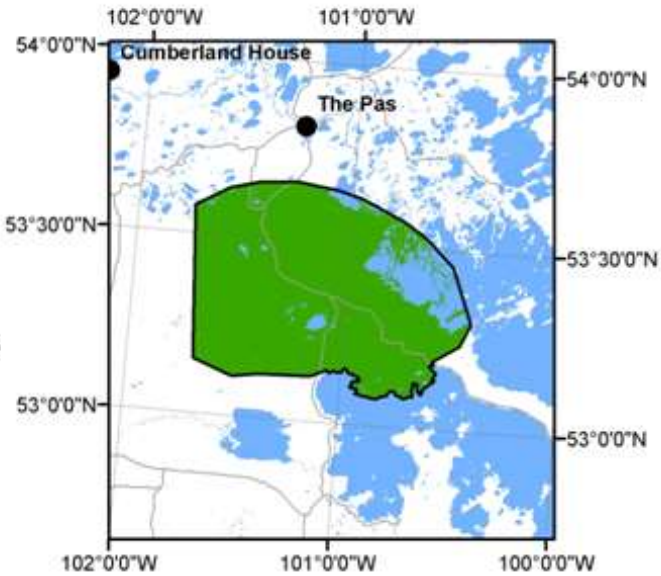


Figure J-41. Key map of the general location of the range.

Figure J-42. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
446,383	6	14	19	81	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Plain
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¹ See Appendix H

Critical Habitat Identification: Kississing Range (MB2)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

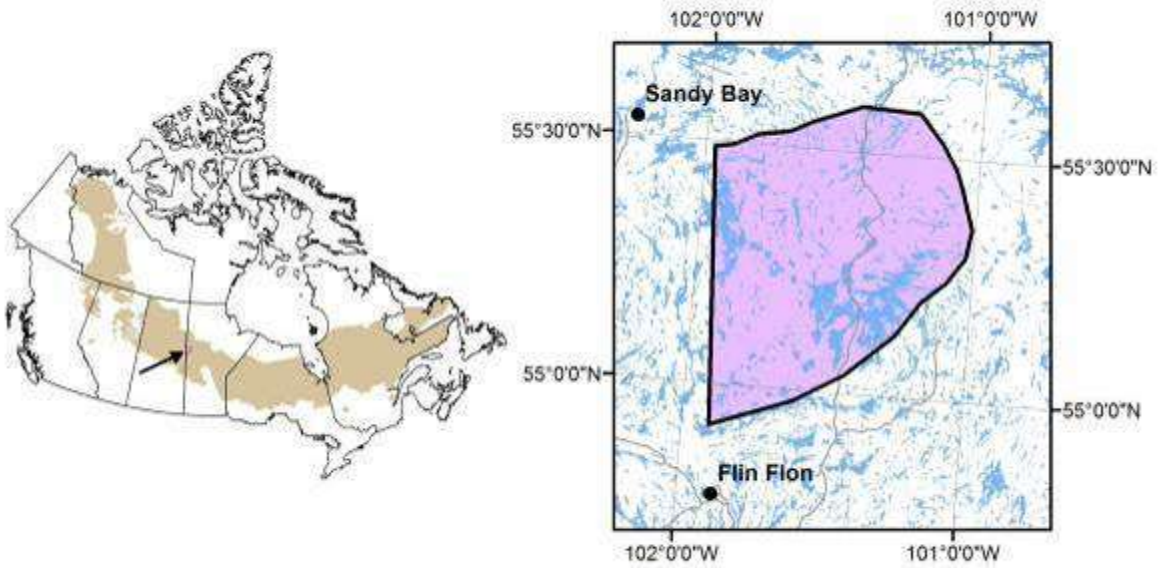


Figure J-43. Key map of the general location of the range.

Figure J-44. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
317,029	39	15	54	46	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West)

¹ See Appendix H

Critical Habitat Identification: Naosap Range (MB3)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-45. Key map of the general location of the range.

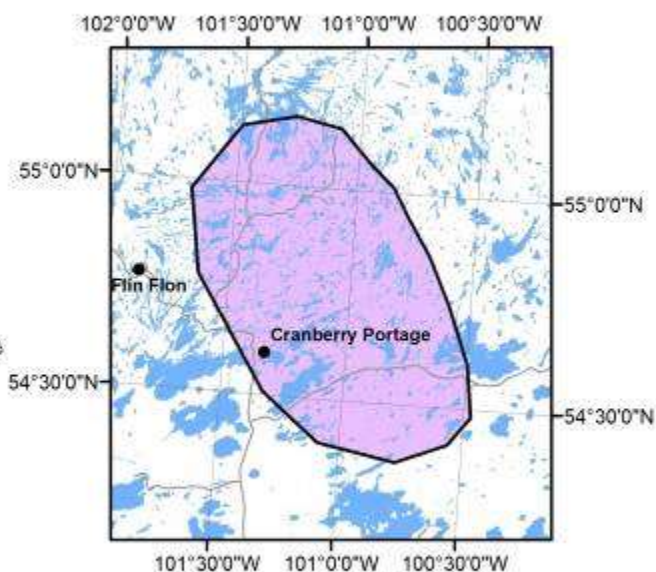


Figure J-46. The geographic boundary within which critical habitat is located

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
456,977	28	28	52	48	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
	Boreal Plain
Ecoregion(s)¹:	Boreal Shield (West)

¹ See Appendix H

Critical Habitat Identification: Reed Range (MB4)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

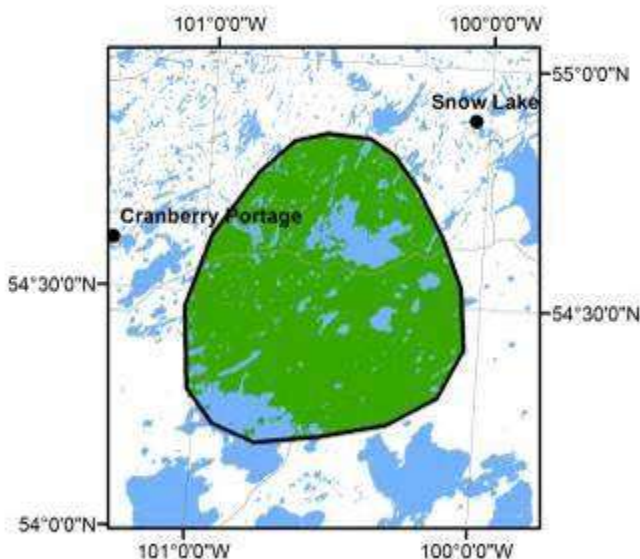


Figure J-47. Key map of the general location of the range.

Figure J-48. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
357, 425	7	20	26	74	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
	Boreal Plain
Ecoregion(s)¹:	Boreal Shield (West)

¹ See Appendix H

Critical Habitat Identification: North Interlake Range (MB5)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-49. Key map of the general location of the range.

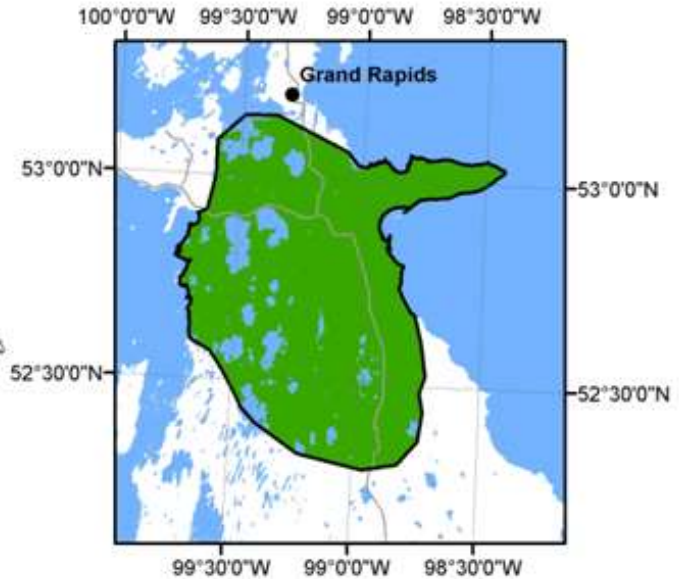


Figure J-50. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Critical Habitat Undisturbed
	Fire	Anthropogenic	Total		
489,680	4	14	18	82	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Plain
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¹ See Appendix H

Critical Habitat Identification: William Lake Range (MB6)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

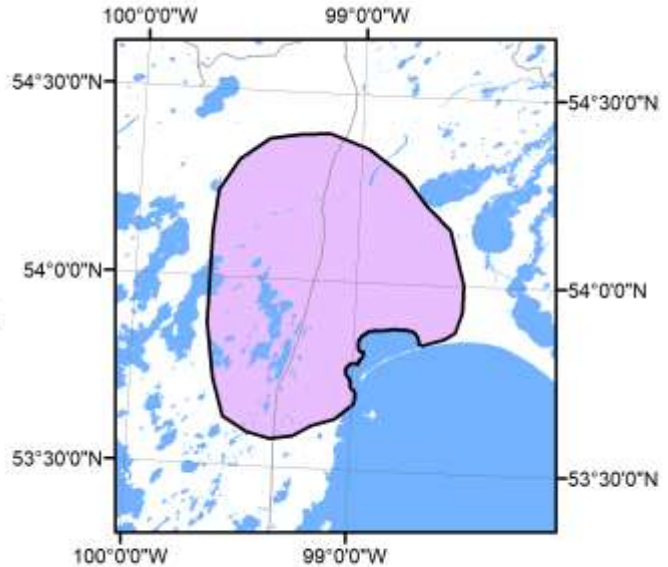


Figure J-51. Key map of the general location of the range.

Figure J-52. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
488,219	25	17	36	64	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Plain
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¹ See Appendix H

Critical Habitat Identification: Wabowden Range (MB7)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

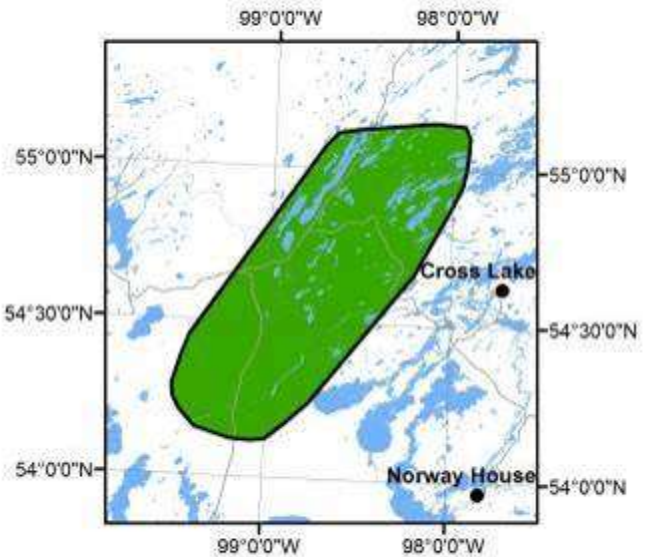


Figure J-53. Key map of the general location of the range.

Figure J-54. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
628,938	10	20	28	72	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozones(s)¹:	Boreal Shield
	Boreal Plain
Ecoregion(s)¹:	Boreal Shield (West)

¹ See Appendix H

Critical Habitat Identification: Wapisu Range (MB8)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

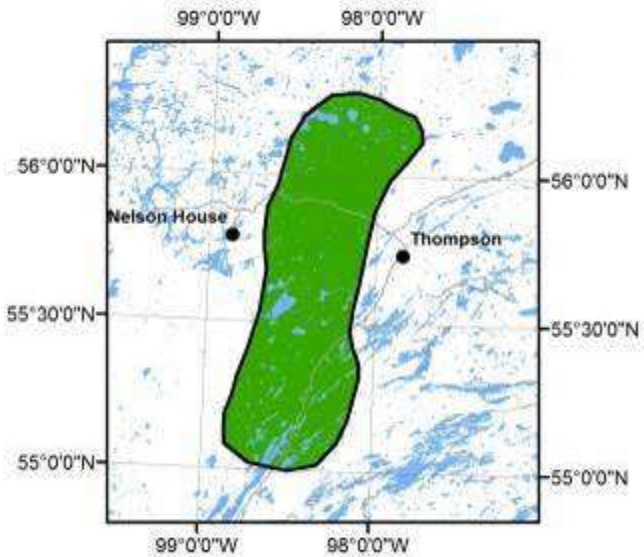


Figure J-55. Key map of the general location of the range.

Figure J-56. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
565,044	11	13	24	76	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West)

¹ See Appendix H

Critical Habitat Identification: Manitoba North Range (MB9)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

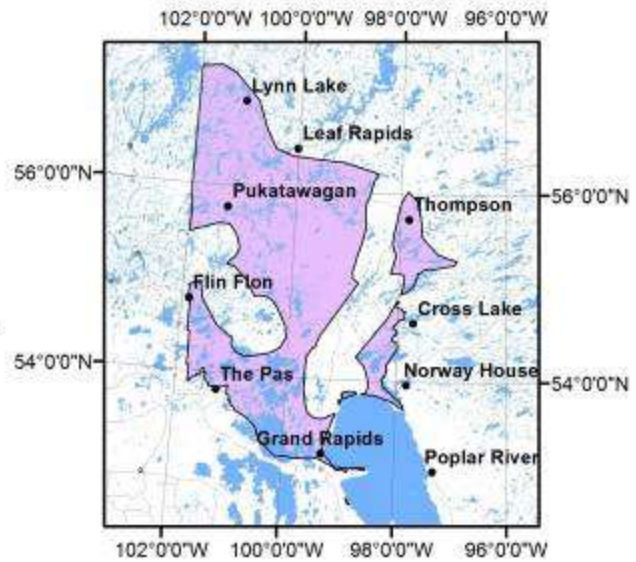


Figure J-57. Key map of the general location of the range.

Figure J-58. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
6,205,520	23	11	33	67	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield Boreal Plain
Ecoregion(s)¹:	Boreal Shield (West)

¹ See Appendix H

Critical Habitat Identification: Manitoba South Range (MB10)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

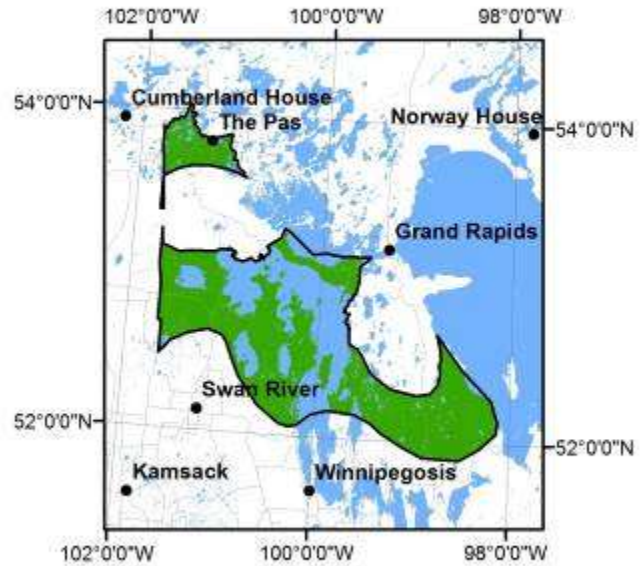


Figure J-59. Key map of the general location of the range.

Figure J-60. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
1,867,255	4	12	16	84	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Plain
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¹ See Appendix H

Critical Habitat Identification: Manitoba East Range (MB11)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-61. Key map of the general location of the range.

Figure J-62. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
6,612,782	26	3	29	71	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West)
	Boreal Shield (West Central)

¹ See Appendix H

Critical Habitat Identification: Atikaki-Berens Range (MB12)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

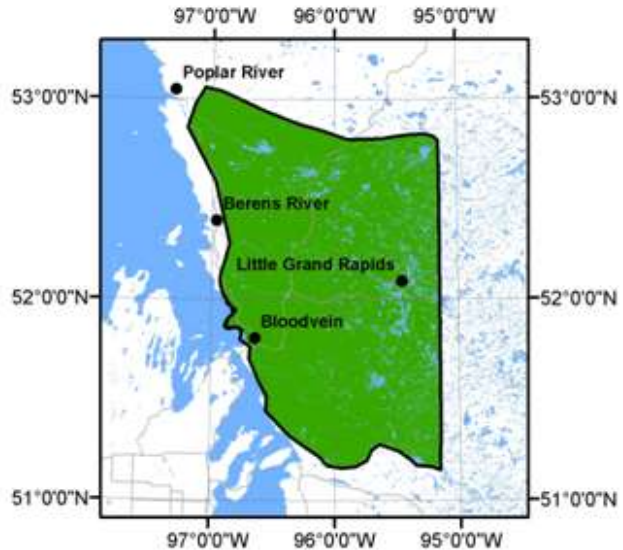


Figure J-63. Key map of the general location of the range.

Figure J-64. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
2,387,665	29	6	34	66	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s) ¹ :	Boreal Shield
Ecoregion(s) ¹ :	Boreal Shield (West Central)

¹ See Appendix H

Critical Habitat Identification: Owl-Flinstone Range (MB13)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-65. Key map of the general location of the range.

Figure J-66. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
363,570	25	18	39	61	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West Central)

¹ See Appendix H

CRITICAL HABITAT FACTSHEETS: ONTARIO

Critical Habitat Identification: Sydney Range (ON1)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-67. Key map of the general location of the range.

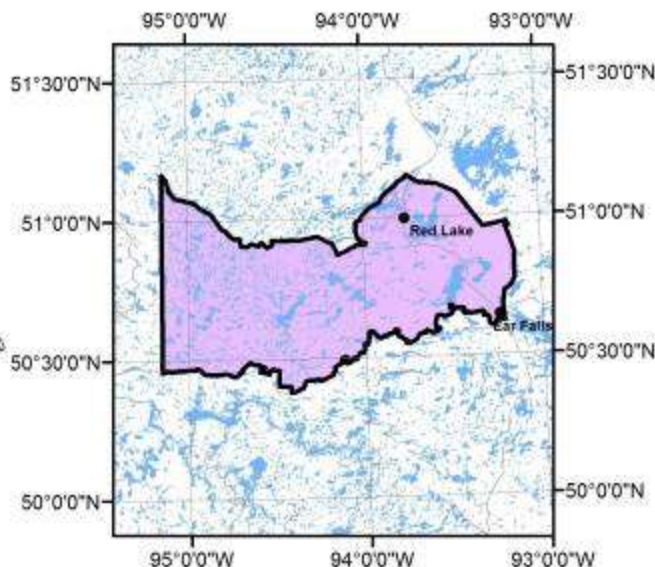


Figure J-68. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
753,001	27	25	49	51	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West Central)

¹ See Appendix H

Critical Habitat Identification: Berens Range (ON2)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

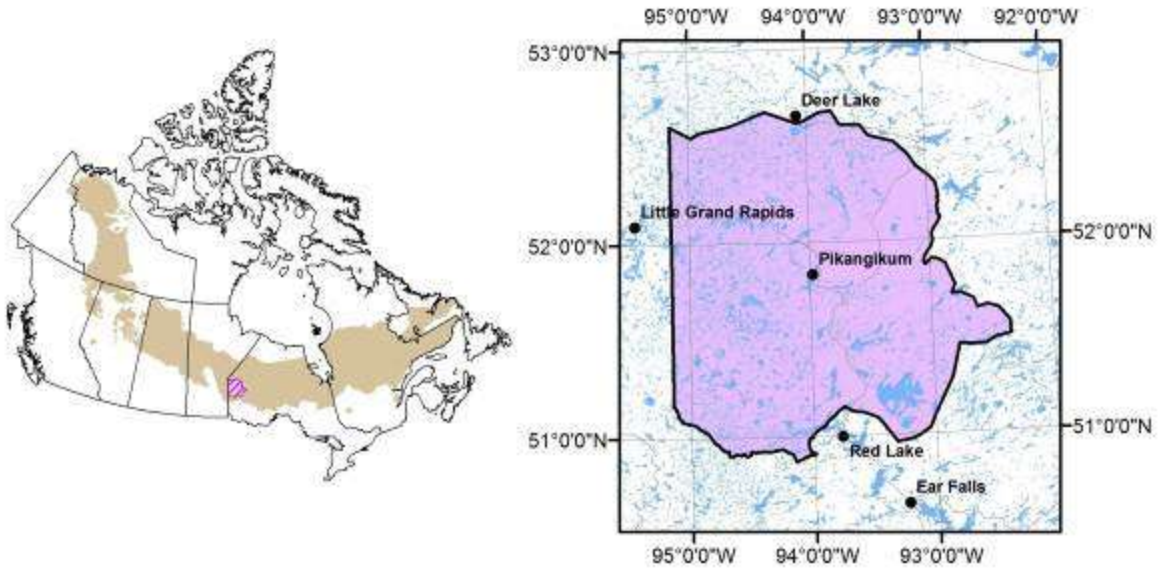


Figure J-69. Key map of the general location of the range.

Figure J-70. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
2,794,835	31	6	37	63	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West Central)

¹ See Appendix H

Critical Habitat Identification: Churchill Range (ON3)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

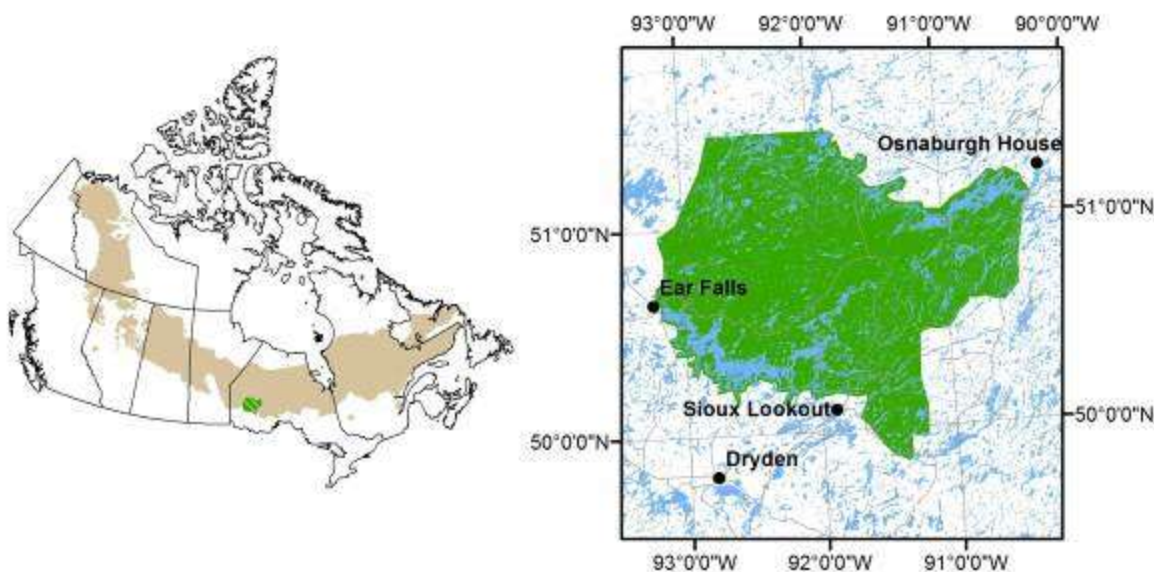


Figure J-71. Key map of the general location of the range.

Figure J-72. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
2,150,490	8	28	34	66	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West Central)

¹ See Appendix H

Critical Habitat Identification: Brightsand Range (ON4)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

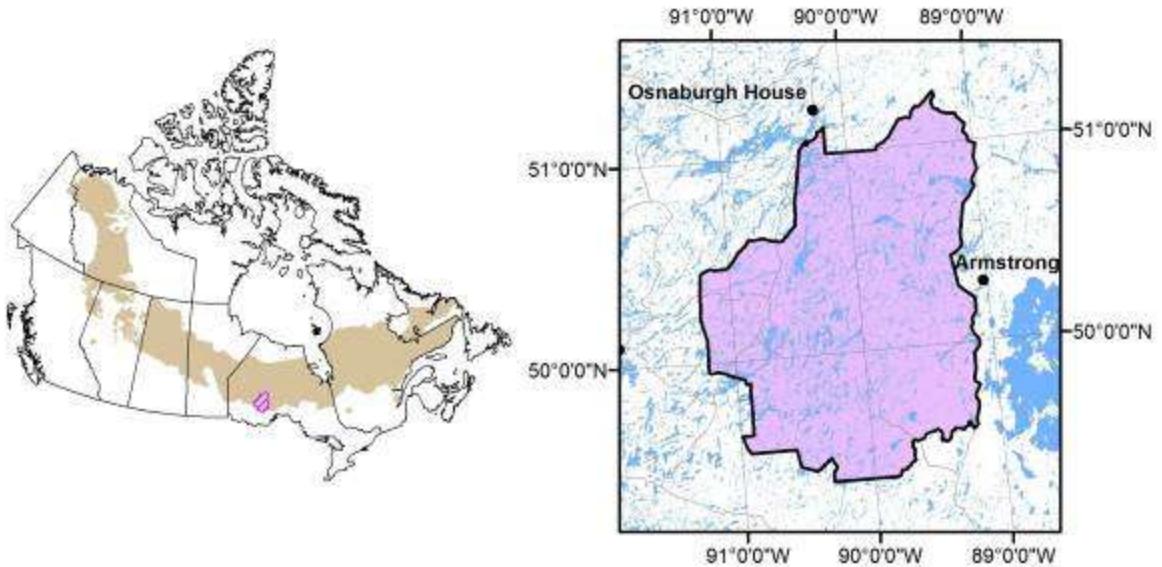


Figure J-73. Key map of the general location of the range.

Figure J-74. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
2,220,921	19	26	41	59	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West Central)

¹ See Appendix H

Critical Habitat Identification: Nipigon Range (ON5)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

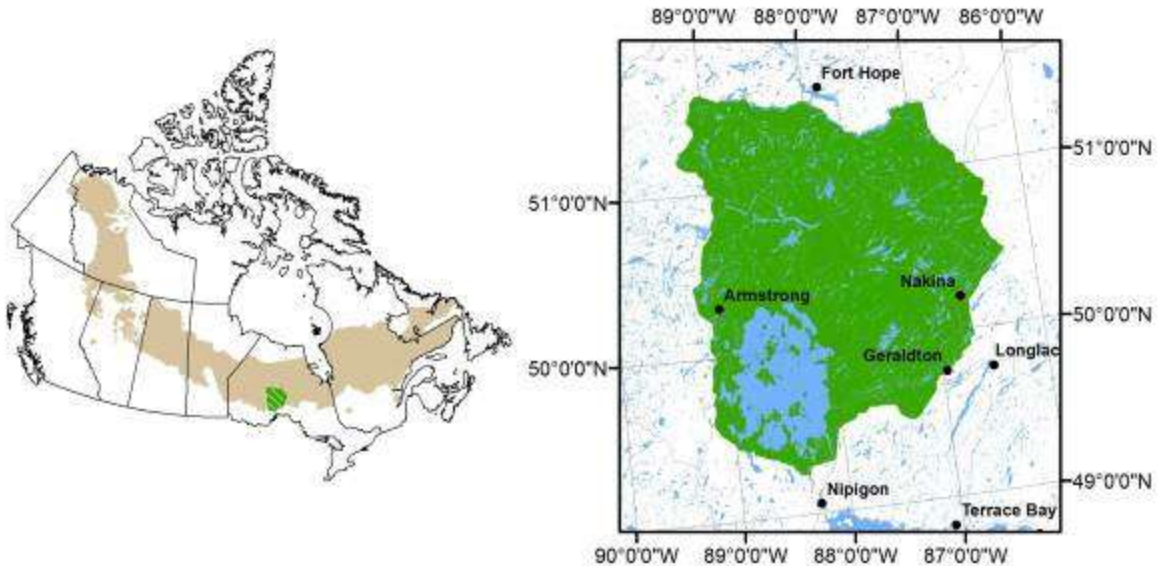


Figure J-75. Key map of the general location of the range.

Figure J-76. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
3,885,026	7	25	30	70	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West)
	Boreal Shield (West Central)

¹ See Appendix H

Critical Habitat Identification: Coastal Range (ON6)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

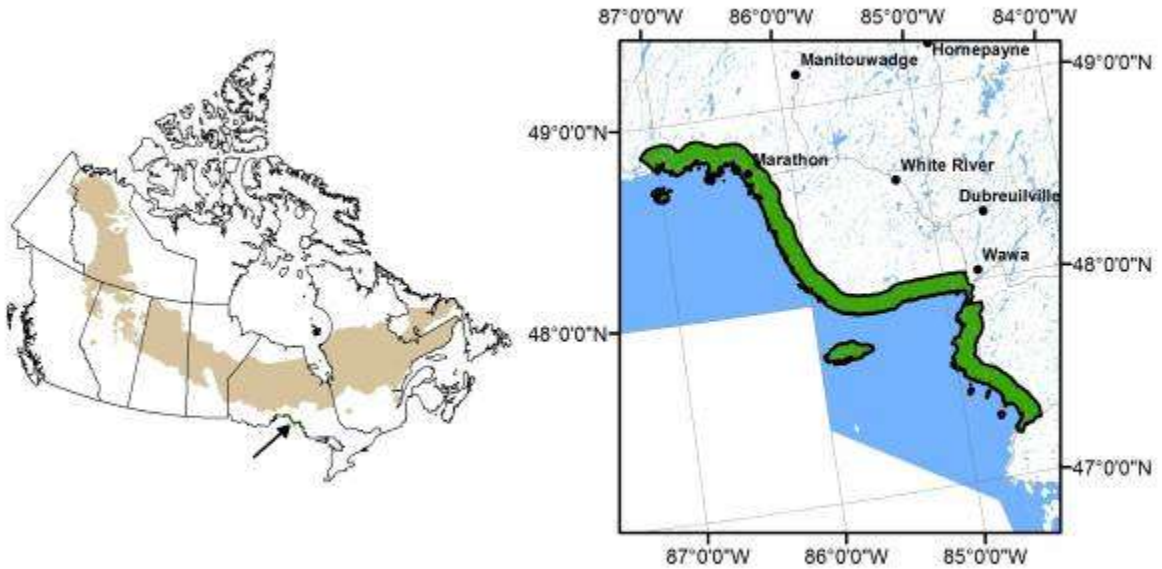


Figure J-77. Key map of the general location of the range.

Figure J-78. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
376,598	0	15	15	85	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West Central)
	Boreal Shield (Central)

¹ See Appendix H

Critical Habitat Identification: Pagwachuan Range (ON7)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-79. Key map of the general location of the range.

Figure J-80. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
4,542,918	0.7	27	27	73	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Hudson Plain
	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (West)
	Boreal Shield (West Central)
	Boreal Shield (Central)

¹ See Appendix H

Critical Habitat Identification: Kesagami Range (ON8)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-81. Key map of the general location of the range.



Figure J-82. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
4,766,463	3	37	40	60	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Hudson Plain
	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (Central)

¹ See Appendix H

Critical Habitat Identification: Far North Range (ON9)¹

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-83. Key map of the general location of the range.

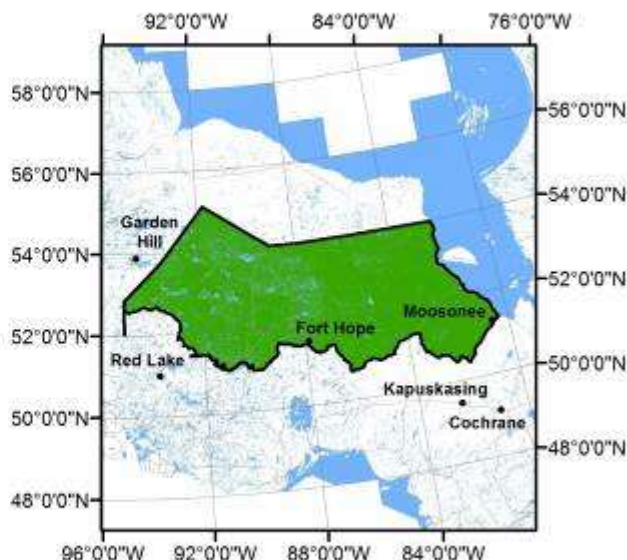


Figure J-84. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
28,265,143	15	1	16	84	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)²:	Hudson Plain
	Boreal Shield
Ecoregion(s)²:	Boreal Shield (West)
	Boreal Shield (West Central)

¹ The ON9 range was delineated into six new ranges by the province of Ontario in 2013 (<https://www.ontario.ca/document/range-management-policy-support-woodland-caribou-conservation-and-recovery>).

² See Appendix H

CRITICAL HABITAT FACTSHEETS: QUEBEC

Critical Habitat Identification: Val d’Or Range (QC1)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

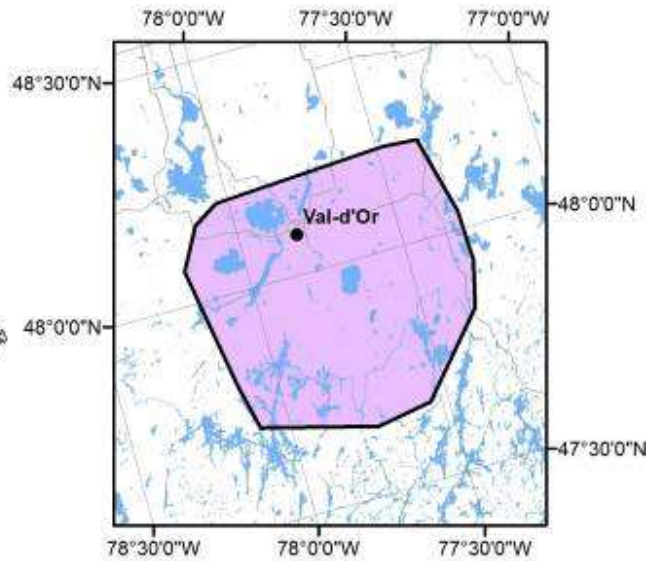


Figure J-85. Key map of the general location of the range.

Figure J-86. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
346,861	0.2	65	65	35	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (Central)

¹ See Appendix H

Critical Habitat Identification: Charlevoix Range (QC2)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

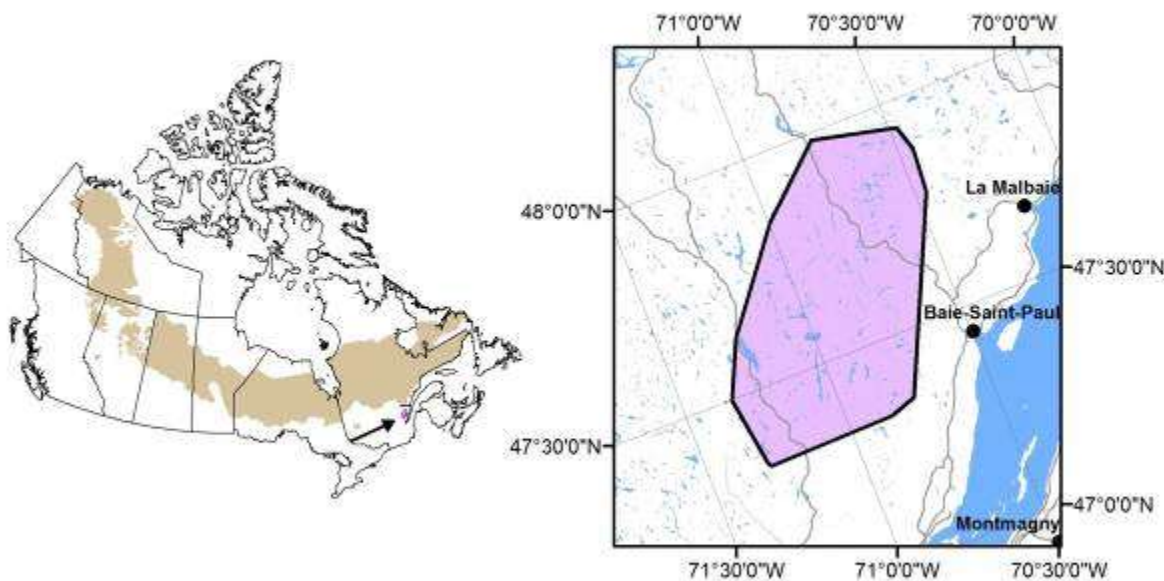


Figure J-87. Key map of the general location of the range.

Figure J-88. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
312,803	4	80	82	18	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (Southeast)

¹ See Appendix H

Critical Habitat Identification: Pipmuacan Range (QC3)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

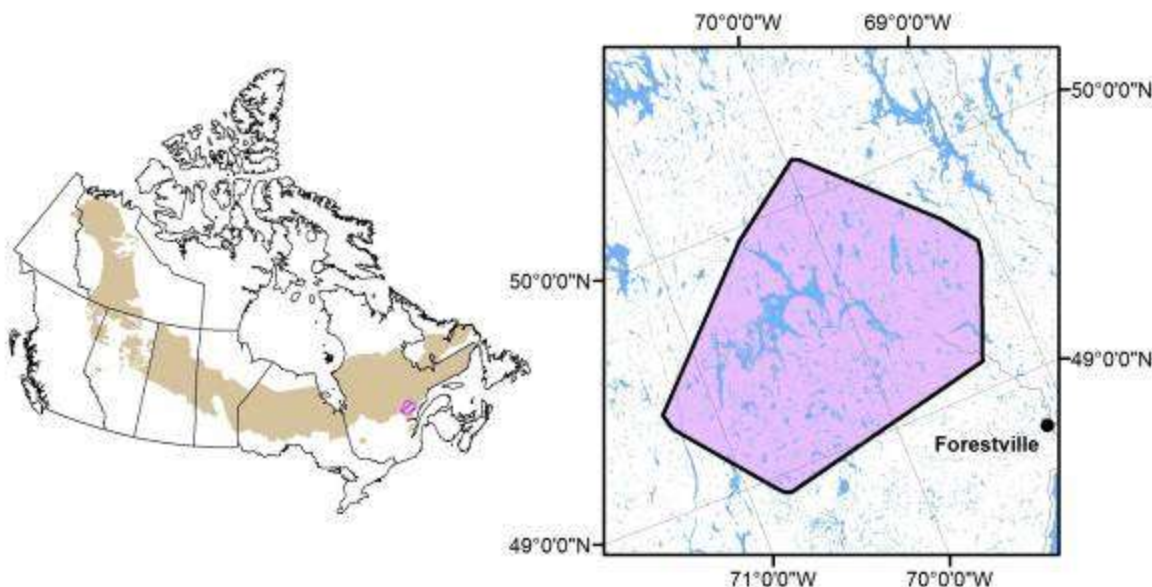


Figure J-89. Key map of the general location of the range.

Figure J-90. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
1,376,899	11	60	68	32	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (East)

¹ See Appendix H

Critical Habitat Identification: Manouane Range (QC4)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

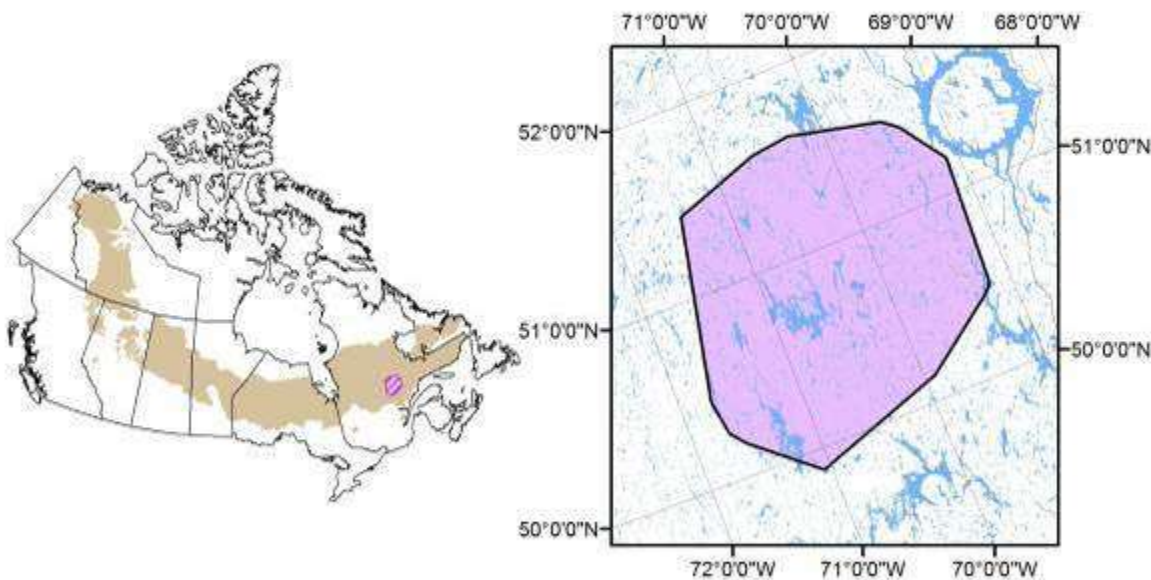


Figure J-91. Key map of the general location of the range.

Figure J-92. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
2,716,449	18	26	41	59	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (East)

¹ See Appendix H

Critical Habitat Identification: Manicouagan Range (QC5)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-93. Key map of the general location of the range.

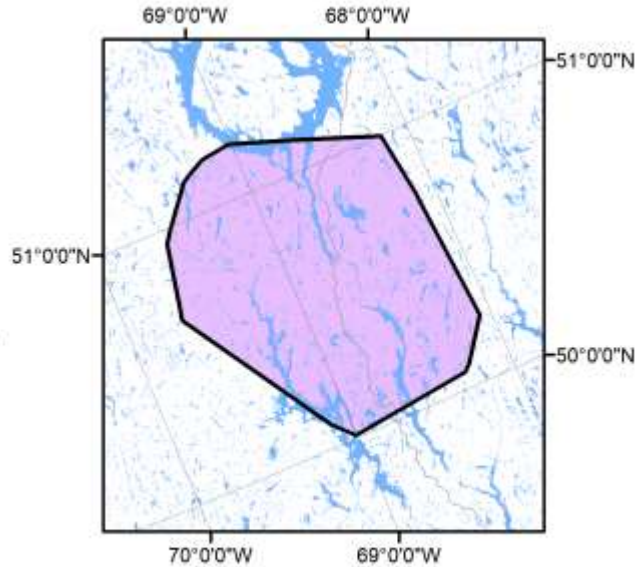


Figure J-94. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
1,134,129	3	36	37	63	Existing habitat that would contribute to at least 65% undisturbed habitat over time.

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (East)

¹ See Appendix H

Critical Habitat Identification: Quebec Range (QC6)¹

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-95. Key map of the general location of the range.



Figure J-96. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
62,156,186	20	13	32	68	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)²:	Boreal Shield
	Taiga Shield
	Hudson Plain
Ecoregion(s)²:	Boreal Shield (Central)
	Boreal Shield (East)
	Boreal Shield (Southeast)

¹ The range is likely made up of several populations for which the self-sustainability status may vary. New data are currently being collected by the provincial jurisdiction for this range. This may result in an update to the range delineation and/or the identification of new ranges, as well as a revision of their self-sustainability status following integrated risk assessment of new ranges or new range boundaries.

² See Appendix H

CRITICAL HABITAT FACTSHEETS: NEWFOUNDLAND AND LABRADOR

Critical Habitat Identification: Lac Joseph Range (NL1)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

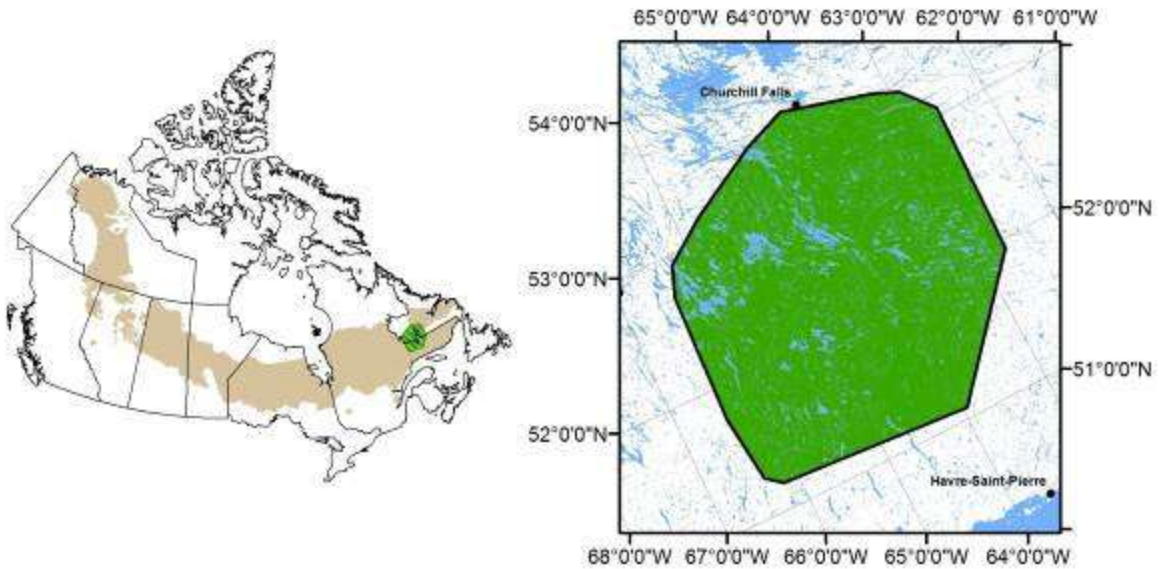


Figure J-97. Key map of the general location of the range.

Figure J-98. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
5,802,491	12	2	14	86	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Shield
	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (East)

¹ See Appendix H

Critical Habitat Identification: Red Wine Mountain Range (NL2)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.



Figure J-99. Key map of the general location of the range.

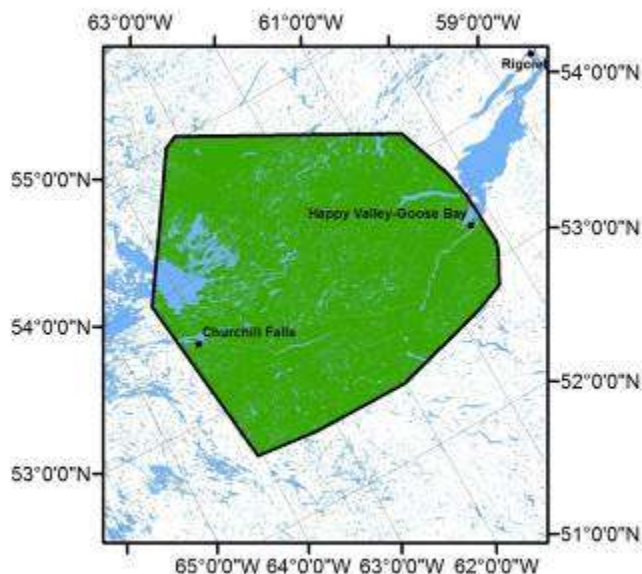


Figure J-100. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
5,838,594	7	3	9	91	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Shield
	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (East)

¹ See Appendix H

Critical Habitat Identification: Mealy Mountain Range (NL3)

The identification of critical habitat for boreal caribou is described by three components for each range: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

i) Location: Where critical habitat is found.

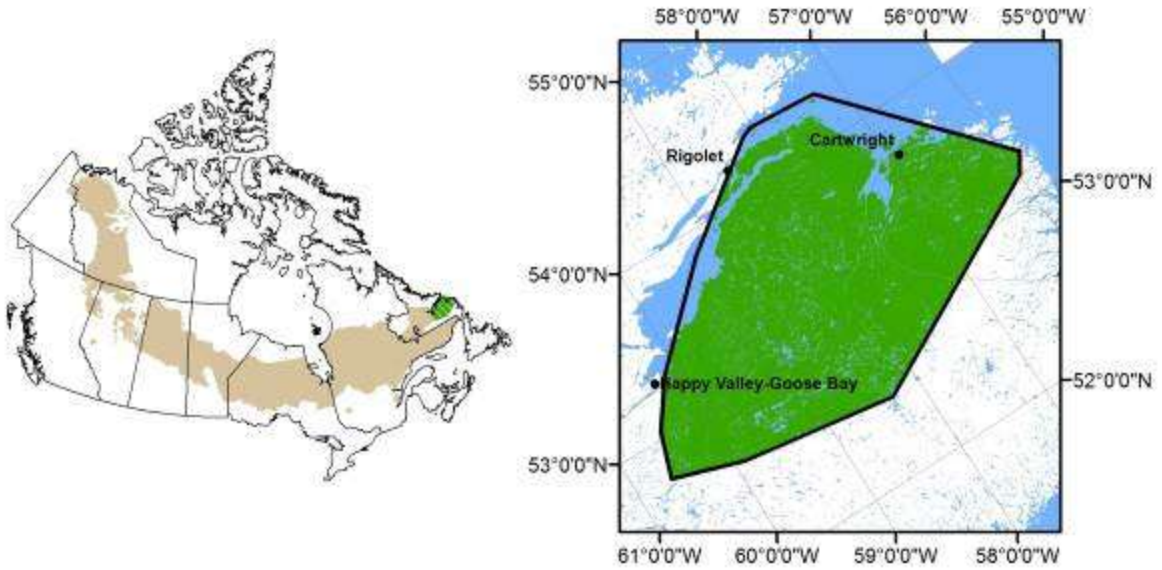


Figure J-101. Key map of the general location of the range.

Figure J-102. The geographic boundary within which critical habitat is located.

ii) Amount: Quantity of critical habitat.

Total Range Area (ha)	Disturbed Habitat (%)			Total Undisturbed Habitat (%)	Amount of Critical Habitat
	Fire	Anthropogenic	Total		
3,948,463	1	1	2	98	At least 65% undisturbed habitat

iii) Type: Biophysical attributes of critical habitat.

Ecozone(s)¹:	Taiga Shield
	Boreal Shield
Ecoregion(s)¹:	Boreal Shield (East)

¹ See Appendix H