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# Scientific Review

for the Identification of

Critical Habitat for Woodland Caribou

(*Rangifer tarandus caribou*), Boreal Population, in Canada



Canada 



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Recommended Citation:

Environment Canada. 2008. Scientific Review for the Identification of Critical Habitat for Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada. August 2008. Ottawa: Environment Canada. 72 pp. plus 180 pp Appendices.

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978-1-100-10680-9  
En14-7/2008E-PDF

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## Preface

The *Scientific Review for the Identification of Critical Habitat for Woodland Caribou (Rangifer tarandus caribou), Boreal Population, in Canada* was initiated to inform the development of a recovery strategy for this population of caribou. Although the review provides an analysis of the state of knowledge of boreal woodland caribou habitat and proposes a framework to support decision making, it does not provide enough guidance as to the amounts or spatial distribution of habitat disturbance that can be tolerated. Further, it has not incorporated Aboriginal traditional knowledge in a systematic way. The information provided is inadequate to enable the identification of critical habitat. Environment Canada is committed to identifying critical habitat for the boreal caribou in the recovery strategy. To that end, a series of western science studies are planned. These studies will form the basis, with other landscape information, to identify critical habitat. Expected completion date for this work is December 2010.

These western science studies will be informed by Aboriginal traditional knowledge that Environment Canada plans to collect through a series of regional workshops with Aboriginal peoples, culminating in a national workshop. The goal of these workshops will be to inform recovery planning and implementation. Environment Canada will work closely with national Aboriginal organizations to develop and hold these workshops.

Environment Canada is also planning consultations on key elements of a recovery strategy, including recovery goals and objectives, potential threat mitigation activities including land management regimes, industry best management practices, Aboriginal traditional practices, and other potential recovery activities. Consultation activities will include provinces and territories, wildlife management boards, Aboriginal groups, environmental non-governmental organizations, industry associations, and the public.

It is planned that the recovery strategy will be released in 2011. While these various streams of work are underway to inform its development, the information gathered to date on populations and threats will be widely shared to enable land managers to prudently manage the landscape in the interim.

Regular updates on progress of the work described above will be provided on the SARA Public Registry.





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## EXECUTIVE SUMMARY

Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population (herein referred to as boreal caribou), are formally listed as Threatened under the federal *Species at Risk Act* (SARA). The Act requires the Minister of Environment to prepare a Recovery Strategy for the species that includes, to the extent possible and based upon the best available information, an identification of its Critical Habitat and/or, if there is insufficient information available, a Schedule of Studies to determine that information. In August 2007, Environment Canada (EC) launched a science-based review with the mandate to identify Critical Habitat to the extent possible, using the best available science and/or prepare a Schedule of Studies.

This science-based review was framed as one of transparent decision-analysis and adaptive management. Thus, the Schedule of Studies produced is a key requirement of the process, designed to produce continuous improvement of results over time. The proposed Critical Habitat Identification for the spatial units associated with each boreal caribou local population is based on available quantitative data and published science, and the assumptions associated with the methodology applied. Other factors, such as the incorporation of Aboriginal traditional knowledge, and the extent to which assumptions taken in this report align with Environment Canada policy directives on Critical Habitat, may influence any potential final identification of Critical Habitat in the National Recovery Strategy.

Leading experts in landscape ecology, caribou biology, spatial habitat modeling, and population analysis were engaged to provide scientific advice on the identification of Critical Habitat for boreal caribou. Of these leading experts, 18 were part of a formal Science Advisory Group established to provide EC ongoing peer review throughout the process. An expanded group of experts contributed to the science review through a workshop held in Toronto in November 2007. A set of guiding principles was established to clearly identify the fundamental elements of the evaluation process.

SARA S.2 defines Critical Habitat 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 a recovery strategy or in an action plan for the species.*” As such, to identify Critical Habitat (CH), a recovery target must first be established. In this case, the target was expressed in the draft *National Recovery Strategy for Boreal Caribou* (Environment Canada, 2007) and provided to the EC team leading the science review. By definition therefore, for the purposes of the CH science review the Recovery Goal was that : “*boreal caribou are conserved and recovered to self-sustaining levels, throughout their current distribution (extent of occurrence) in Canada*”; and the more specific Population and Distribution Objective was: “*to maintain existing local populations of boreal caribou that are self-sustaining and achieve population growth of local populations that are not currently self-sustaining, to the extent possible, throughout the current distribution (extent of occurrence) of boreal caribou in Canada.*”



**Critical Habitat for boreal caribou was therefore defined as the resources and environmental conditions required for persistence of local populations of boreal caribou throughout their current distribution in Canada.** Identifying Critical Habitat for local populations was framed as an exercise in decision analysis and adaptive management. Establishment of a systematic, transparent and repeatable process was a central element of the approach. The report is structured around three major questions to be addressed in the identification of critical habitat: 1) What is the current distribution of boreal caribou in Canada; 2) Where are the local populations within the current distribution of boreal caribou in Canada; and 3) What habitat conditions are required for persistence of local populations of boreal caribou in Canada?

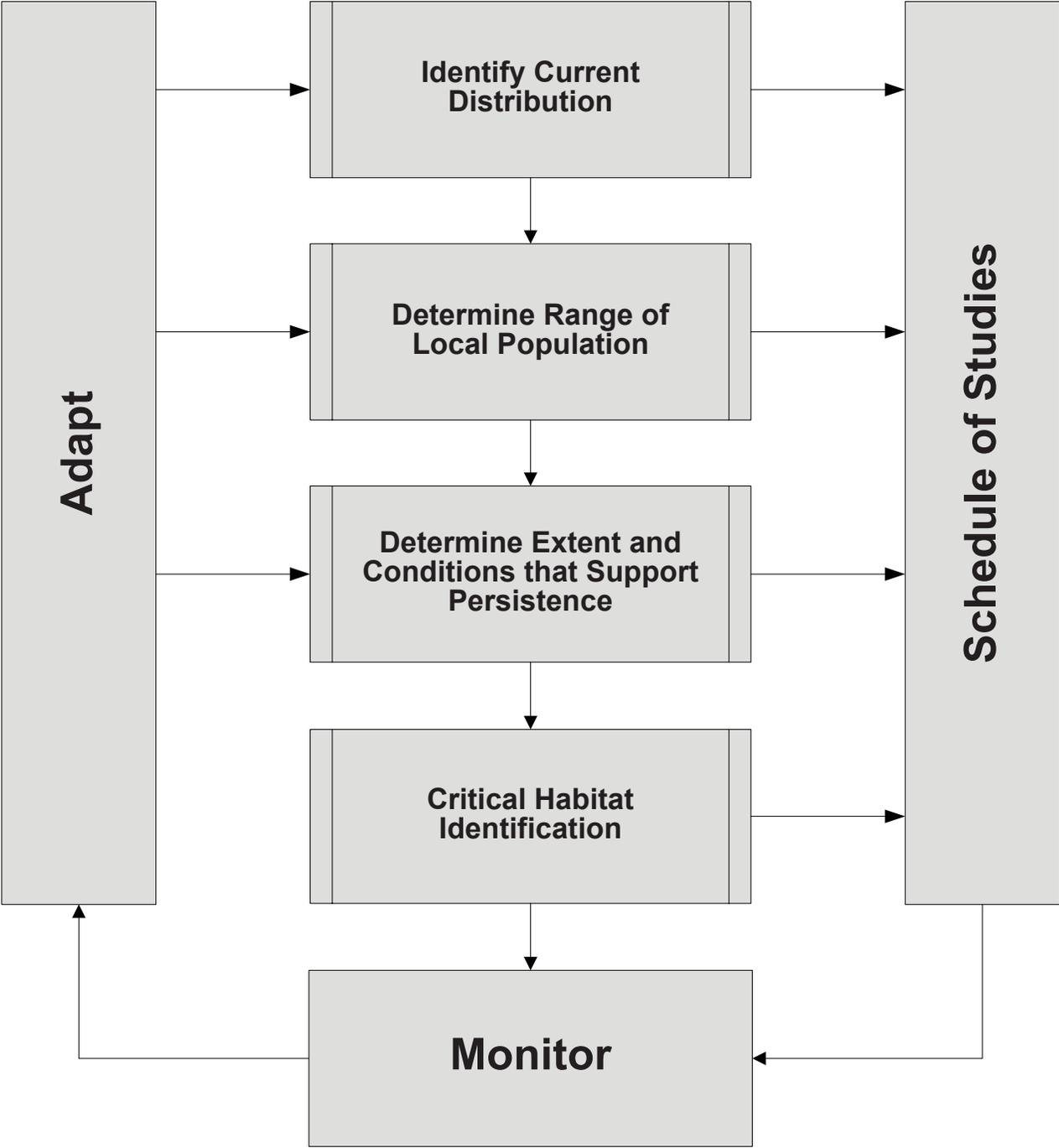
Consideration of scale is fundamental to identifying the resources and environmental conditions required for persistence of local populations of boreal caribou throughout their current distribution. Caribou select habitat at multiple spatial scales to meet their life history requirements. At fine spatial scales, microclimate and food availability are important factors influencing caribou habitat selection. However, the primary limiting factor on boreal caribou populations is predation, associated with natural or human-induced landscape conditions that favour early seral stages and higher densities of alternative prey, resulting in increased risk of predation to caribou. Habitat conditions at the scale of local population ranges affect the demography of boreal caribou (e.g., survival and reproduction), which ultimately determines whether or not a population will persist. Therefore, in context of the Recovery Goal for this species, **local population range is the relevant spatial scale for the identification of critical habitat that includes the habitat conditions (quantity, quality and spatial configuration) required by caribou.** This is not equivalent to saying that every element within the range is critical to support a self-sustaining boreal caribou population, in all instances. However, it does provide a spatial delineation of the area of consideration when assessing the current conditions and quantifying risk relative to the recovery goal of maintaining or restoring self-sustaining local populations, for assigning potential Critical Habitat outcomes, and for planning for the management of the habitat conditions necessary to support population persistence (e.g. maintaining the functional attributes of the range).



## **General conclusions from the review include:**

- 1) Critical Habitat for boreal caribou is most appropriately identified at the scale of local population range, and expressed relative to the probability of the range supporting a self-sustaining local population;
- 2) Range is a function of the extent and condition of habitat, where habitat includes the suite of resources and environmental conditions that determine the presence, survival and reproduction of a population;
- 3) Application of the Critical Habitat Identification Framework, for the 57 recognized local populations or units of analysis for Boreal caribou in Canada, yielded 3 proposed outcomes: Current Range, Current Range and Improved Conditions, or Current Range and Consider Resilience;
- 4) Like habitat selection by caribou, Critical Habitat identification for Boreal caribou is a hierarchical process with considerations across multiple spatial and temporal scales. Further elaboration of Critical Habitat outcomes at spatial scales finer than range, over specified time frames, may be achieved through spatial population viability analysis linked with dynamic landscape modelling;
- 5) Acknowledging that current knowledge and the dynamic nature of landscapes impart uncertainty, present findings should be monitored and assessed for the purposes of refinement and adjustment over time, as new knowledge becomes available (e.g., a Schedule of Studies as part of Adaptive Management).

A major product of this science review is a Critical Habitat Framework that can support decision analysis, focus future research efforts, and frame critical habitat identification in the context of adaptive management (Executive Summary Figure 1). It was anchored by synthesis and analysis of available quantitative data and published scientific information on boreal caribou population and habitat ecology, including population distribution, trends, habitat use, and conditions for persistence. Aboriginal knowledge was considered when accessible in published documents. However, a separate process to gather Aboriginal traditional knowledge was not undertaken as part of this review. The Framework was structured around the major questions identified above, and designed to incorporate the important stages of adaptive management. Application of the framework and associated decision analysis involved clear identification of knowledge gaps, necessary assumptions, and key uncertainties throughout the process, which were directed to a Schedule of Studies, as appropriate. As in any adaptive management framework, its strength lies not only in its specific output(s) at a given time, but its ability to accommodate different assumptions or new data, including but not limited to Aboriginal and Traditional Knowledge, that can be used in the framework to yield continuously improved outputs.



Executive Summary Figure 1: Critical Habitat Framework



The first step in application of the Critical Habitat Framework was to determine the current distribution of boreal caribou across Canada, in order to define the national scope of Critical Habitat Identification. Information from the National Recovery Strategy for Boreal Caribou was used for the present delineation, but an environmental niche analysis was also undertaken to identify areas of uncertainty and guide future refinements of the distribution.

The second step of the Critical Habitat Framework was delineating units of analysis within the current distribution. The population and distribution objective of the draft National Recovery Strategy specify local populations as the appropriate unit of analysis with respect to the recovery goal. Local population ranges are the spatial delineation of this analysis unit. Information on local population ranges was compiled from jurisdictions across the current distribution. Where local populations were part of a continuous distribution, or had not been defined, units of analysis encompassing the extent of occurrence of caribou within the regions were delineated.

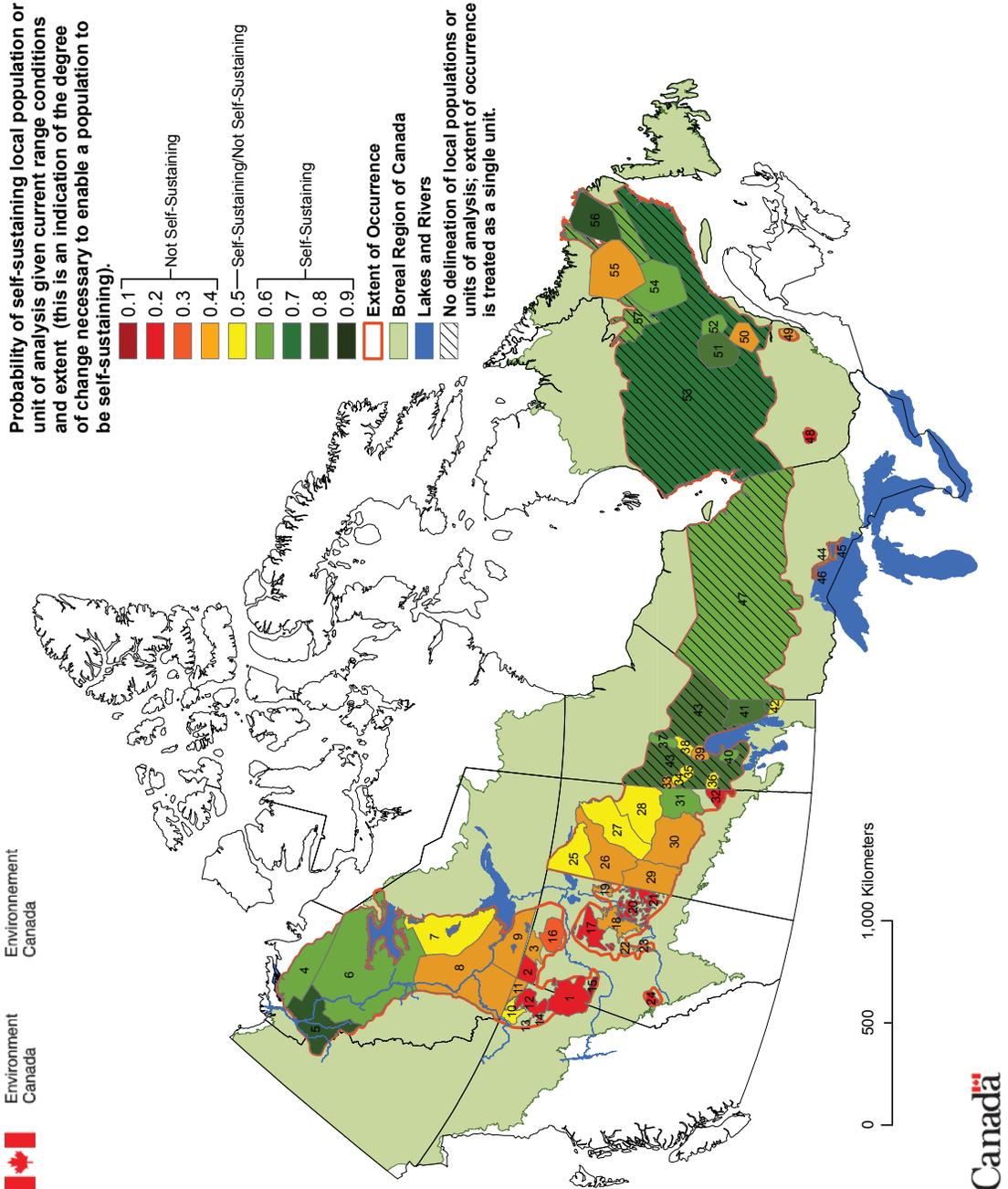
The third step in the Critical Habitat Framework determined the habitat required for persistence of boreal caribou local populations through assessment of measurable criteria of population and habitat condition for each local population range. Three measurable criteria related to persistence probability were assessed: 1) *population trend*, an indicator of whether a population is self-sustaining over a relatively short measurement period; 2) *population size*, an indicator of the ability of a population to withstand stochastic events and persist over the long-term; and 3) *range disturbance*, an indicator of the ability of a given range to support a self-sustaining local population.

These three criteria -- population trend, population size and range disturbance -- represent three lines of evidence used to evaluate local population ranges relative to their potential to support self-sustaining populations. Empirically based, categorical states were defined for each criteria: Population trend was either Declining, Stable, Increasing or Unknown; Population size categories were Very Small, Small, or Above Critical, based on a non-spatial population viability analysis; and Disturbance categories were Very Low, Low, Moderate, High or Very High, based on a national meta-analysis of boreal caribou demography and range disturbance. A probability of local population persistence was associated with each categorical state, for each criterion. Categorical states were then assigned to each local population based on available data, then combined in an integrated assessment to determine whether the weight of evidence supported a conclusion of the current range being sufficient or not sufficient to support a self-sustaining local population. Results of this evaluation are presented in Executive Summary Figure 2.

The fourth step in the Critical Habitat Framework was the proposed identification of Critical Habitat, based on the results of the assessment of the probability of the current range supporting a self-sustaining local population. The assessment was translated to proposed Critical Habitat Identification following a set of decision rules, and expressed as the range condition and/or extent required relative to current range condition and extent. Potential outcomes for each local population or unit of analysis included: Current Range - current range condition



Number	Local Population/Unit of Analysis	Integrated Probability
1	AB/BC Chinchaga	0.2
2	AB/NWT Bistcho	0.2
3	AB/NWT Steen River/Yales	0.4
4	NWT Inuvialuit	0.6
5	NWT/YK Gwich'in	0.8
6	NWT Sahtu	0.6
7	NWT North Slave	0.5
8	NWT Dehcho (N/SW)	0.4
9	NWT South Slave/SE Dehcho	0.4
10	BC Maxhamish	0.5
11	BC Calder	0.4
12	BC Snake Sahtaneh	0.2
13	BC Parker Core	0.4
14	BC Prophet Core	0.3
15	AB Deadwood	0.1
16	AB Caribou Mountains	0.3
17	AB Red Earth	0.2
18	AB West Side Athabasca River	0.4
19	AB Richardson	0.4
20	AB East Side Athabasca River	0.2
21	AB Cold Lake Air Weapons Range	0.2
22	AB Nipisi	0.4
23	AB Slave Lake	0.3
24	AB Little Smoky	0.2
25	SK Day-Athabasca	0.5
26	SK Cleanwater	0.4
27	SK Highrock-Key	0.5
28	SK Steephill-Foster	0.5
29	SK Pimrose-Cold Lake	0.4
30	SK Smoothstone-Wapawekka	0.4
31	SK Suggi-Amisk-Kississing	0.6
32	SK Pasqua-Bog	0.2
33	MB Kississing	0.4
34	MB Naosap	0.5
35	MB Reed	0.5
36	MB The Bog	0.5
37	MB Wapisiu	0.6
38	MB Watowden	0.5
39	MB William Lake	0.4
40	MB North Interlake	0.6
41	MB Aitkaki-Berens	0.7
42	MB Owl-Flintstone	0.5
43	Manitoba	0.7
44	ON North East Superior	0.4
45	ON Michipicoten	0.6
46	ON Slate Islands	0.6
47	Ontario	0.6
48	QC Val d'Or	0.2
49	QC Charlevoix	0.4
50	QC Pipmuacan	0.4
51	QC Manouane	0.7
52	QC Manicouagan	0.6
53	Quebec	0.7
54	LAB Lac Joseph	0.6
55	LAB Red Wine Mountain	0.4
56	LAB Mealy Mountain	0.8
57	Labrador	0.6



**Executive Summary Figure 2:** Probability that current range will support a self-sustaining population of boreal caribou, based on integrated probability assignments that considered population trend and size, and level of disturbance associated with anthropogenic activities and fire (see Section 2.6.5). This Figure is not an illustration of whether a population is recoverable or not, rather, it is an indication of the degree of habitat change necessary to enable a population to be self-sustaining (e.g. to persist without the need for ongoing management intervention).





and extent are required to maintain potential for self-sustaining population; Current Range and Consider Resilience – current range condition and extent may be sufficient to absorb additional disturbance while maintaining capacity to support a self-sustaining population; Current Range and Improved Conditions – current range condition and/or extent would need to be improved to restore potential to support a self-sustaining population.

The resultant proposed Critical Habitat identification for the 57 recognized local populations or units of analysis considered was:

- Current Range for 25 local populations or units of analysis;
- Current Range and Improved Conditions for 21 local populations or units of analysis;
- Current Range and Consider Resilience for 11 local populations or units of analysis.

Further elaboration of Critical Habitat outcomes for local populations can be achieved through spatial population viability analysis linked with dynamic landscape modelling (see Section 2.6.6 and Appendix 6.7). Incorporation of landscape dynamics is necessary to understand the conditions and management options associated with recovery (Current Range and Improved Conditions) and resilience (Current Range and Consider Resilience), as well as additional risks associated with present conditions (Current Range). Such evaluations may be undertaken with varying levels of complexity and concomitant requirements for data. It is clear from the present review that minimum data requirements could be met for most areas within the current distribution of boreal caribou in Canada, particularly when viewed in the context of adaptive management.

Application of the Critical Habitat Framework provided an assessment of all local populations or units of analysis within the current distribution of boreal caribou in Canada. Like habitat selection by caribou, critical habitat identification is a hierarchical process that must consider needs across multiple spatial and temporal scales. The national evaluation focused on the scale most appropriate for considering the persistence of local populations – the local population range. Consideration of components of critical habitat at finer scales is possible where local population information can be augmented.

In summary, this review was based on a set of guiding principles and undertaken by Environment Canada with the support of an expert Science Advisory Group that provided continuous peer-review. Development of a Critical Habitat Framework provided a formal structure for assembling and analyzing data relevant to Critical Habitat identification, and the foundation for continuous improvement of knowledge through the process of adaptive management. A weight of evidence approach was used to identify the most plausible outcome of combinations of population and habitat conditions relative to the recovery goal of self-sustaining local populations.