

Recovery Strategy for the Woodland Caribou, Southern Mountain population (*Rangifer tarandus caribou*) in Canada

Woodland Caribou, Southern Mountain population



2014

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(*Rangifer tarandus caribou*) au Canada »

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Note: The Woodland Caribou, Southern Mountain population is referred to as “southern mountain caribou” in this document.

¹ www.registrelep.gc.ca/default_e.cfm

PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (Government of Canada 1996) 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) (Government of Canada 2002), 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 five years after the publication of the final document on the Species at Risk Public Registry (Government of Canada 2013).

The Minister of the Environment and the Minister responsible for the Parks Canada Agency are the competent ministers under SARA for southern mountain caribou. The Minister of the Environment led the preparation of this recovery strategy as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Provinces of British Columbia and Alberta as per section 39(1) of SARA.

Success in the recovery of southern mountain caribou depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada, the Parks Canada Agency, or any other jurisdiction alone. The Provinces of British Columbia and Alberta, Aboriginal peoples, industry and others play an important role in managing natural resources and wildlife where southern mountain caribou are found. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the southern mountain caribou population and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada, the Parks Canada Agency, the provinces of Alberta and British Columbia, Aboriginal groups, and/or organizations involved in the recovery of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGMENTS

Environment Canada and the Parks Canada Agency would like to express their gratitude to the Aboriginal people who shared their knowledge about southern mountain caribou in support of the recovery of this species. Aboriginal people consistently indicated that conservation of southern mountain caribou is essential, as this species is integral to the culture, identity, and survival of their communities. Environment Canada appreciates the input of those Aboriginal groups and individuals who shared their knowledge and experiences to help inform this recovery strategy. Knowledge was shared by Aboriginal Traditional Knowledge holders and Aboriginal communities on southern mountain caribou life history, habitat use, population status, threats and conservation measures, and this information has been integrated, to the extent possible, into the development of this recovery strategy.

Numerous stakeholders, resource users, and members of the public also contributed their knowledge and expertise to the development of this recovery strategy. The opinions expressed on southern mountain caribou and their recovery are very much appreciated.

Darcy Peel and Stephen Hureau of Environment Canada led the preparation of the recovery strategy with contracted assistance from Deborah Cichowski, Glenn Sutherland and Scott McNay. A document of this nature requires the dedication and commitment of many organizations and individuals. Advice and information used to prepare the recovery strategy was obtained from staff of the Parks Canada Agency, the Provinces of British Columbia and Alberta, and Environment Canada, in addition to input from various experts on caribou. The following people are acknowledged for their valuable contributions to the development of, and consultation on, this document: Lucy Reiss, Greg Ferguson, Sean Butler, Undiné Thompson, Victoria Snable, Greg Wilson and Diane Casimir.

EXECUTIVE SUMMARY

This recovery strategy is for the Woodland Caribou (*Rangifer tarandus caribou*), Southern Mountain population, herein referred to as “southern mountain caribou”, assessed in May 2002 as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Southern mountain caribou occur in the southern two-thirds of British Columbia (BC) and in west-central Alberta, with one subpopulation ranging into northern Idaho and Washington in the United States.

In this recovery strategy, the geographic area occupied by a subpopulation is referred to as a range. Southern mountain caribou subpopulations and their ranges have been defined based on extensive studies of movements and seasonal habitat use of radio-collared caribou. In some areas, subpopulations have been organized into “local population units” (LPUs), which reflect likely larger historical subpopulations that have declined in number and become fragmented into the currently recognized subpopulations.

Southern mountain caribou are currently distributed across 38 subpopulations, comprising 24 LPUs. Most subpopulations have undergone long-term declines in numbers. The current overall number of southern mountain caribou is estimated to be approximately 5,800. In this recovery strategy, three groups of southern mountain caribou are recognized based on ecological and evolutionary distinctions between them: the Northern Group in west-central and north-central BC; the Central Group in east-central BC and west-central Alberta; and, the Southern Group in southeastern BC.

Southern mountain caribou occupy ranges consisting of highly diverse topography, terrain types, and environmental conditions. They require large ranges of relatively undisturbed, interconnected habitat where they can separate themselves (horizontally and by elevation) from predators; modify their use of habitat in response to various natural and human-caused habitat disturbances and human activities; and can access their preferred food sources. During winter, southern mountain caribou require large patches of mature and old forests with abundant lichens.

In the Southern Group, where the snowpack is deep, caribou predominantly use high elevation mature and old subalpine forests in mid and late winter where they forage on arboreal lichens. During early winter before snow has consolidated, and during spring, they use lower elevation mature and old forests (with some subpopulations moving down into cedar/hemlock forests in valley bottoms).

In the Central and Northern groups, caribou live in relatively shallow snow areas where they forage primarily on terrestrial lichens either in low elevation mature coniferous forests or on windswept alpine slopes during winter. They also forage on arboreal lichens in low elevation forests, forested wetlands, and in subalpine habitats. Many subpopulations in the Northern and Central Groups travel long distances between winter and summer ranges, while others winter and summer within the same general area. Most southern mountain caribou calve in high elevation habitats.

Southern mountain caribou also require ‘matrix’ range. Type 1 matrix range consists of areas within an LPU’s annual range that have not been delineated as summer or winter range, and may include seasonal migration areas and areas of lower use compared to delineated seasonal ranges. Type 2 matrix range consists of areas surrounding annual ranges where predator/prey dynamics influence caribou predation rates within the subpopulation’s annual range. Type 2 matrix range may also include areas with trace occurrences of caribou, dispersal zones between subpopulations, and dispersal zones between LPUs.

Due to the specific life history characteristics they possess, southern mountain caribou are limited in their potential to recover from rapid, severe population declines. Habitat alteration (i.e., habitat loss, degradation, and fragmentation) from both human-caused and natural sources, and increased predation as a result of habitat alteration, have led to declining numbers throughout their distribution. Threats are closely interrelated and act together to have direct or indirect impacts on southern mountain caribou and their habitat. Recovery of all southern mountain caribou LPUs has been determined to be technically and biologically feasible.

This recovery strategy sets overall population targets based on recent capacity of annual ranges to support caribou, with those targets being: 4,600 caribou for the Northern Group, 2,000 caribou for the Central Group, and 2,500 caribou for the Southern Group – a total of 9,100 caribou. This represents a more than 50% increase in numbers from the current total population estimate.

The recovery goal for southern mountain caribou is to achieve self-sustaining populations in all LPUs within their current distribution. Achieving the recovery goal should result in sufficiently large local caribou populations to support traditional Aboriginal harvesting activities, consistent with existing Aboriginal and treaty rights of Aboriginal peoples of Canada. Realizing this recovery goal for all LPUs will take a number of decades, especially for LPUs where levels of disturbance are high.

To guide recovery efforts, the population and distribution objectives are, to the extent possible, to:

- stop the decline in both size and distribution of all LPUs;
- maintain the current distribution within each LPU; and
- increase the size of all LPUs to self-sustaining levels and, where appropriate and attainable, to levels which can sustain a harvest with dedicated or priority access to aboriginal peoples.

Performance indicators are identified as a means by which progress towards achieving the population and distribution objectives can be measured.

Critical habitat necessary to achieve the population and distribution objectives for southern mountain caribou is partially identified in this recovery strategy for all LPUs. Critical habitat for southern mountain caribou is identified as the habitat possessing those biophysical attributes required by southern mountain caribou to carry out life processes and which is found within:

- the high elevation winter and/or summer (spring, calving, summer, fall/rut) range delimited by the LPU boundaries for all Groups;

- the low elevation summer (spring, calving, summer, fall/rut) range delimited by the LPU boundaries for the Northern Group;
- the low elevation early winter and/or spring range delimited by the LPU boundaries for the Southern Group;
- the LPU boundaries of the Northern and Central Groups, which provides for an overall ecological condition for low elevation winter range and Type 1 matrix range 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; and,
- Type 2 matrix range for all Groups, and Type 1 matrix range for the Southern Group that provides for an overall ecological condition that will allow for low predation risk, defined as wolf population densities less than 3 wolves/1000 km².

The threshold of a minimum of 65% undisturbed area within low elevation winter range and Type 1 matrix range is taken from analyses undertaken for boreal caribou ranges. While this approach can be considered as use of best available information, a schedule of studies is included in this strategy to acquire information specific to southern mountain caribou to determine the level of undisturbed habitat in seasonal and matrix ranges that are required to sustain recruitment and reduce adult mortality.

The recovery of southern mountain caribou requires actions that will vary according to both the habitat and population conditions within each LPU. This recovery strategy provides broad strategies and general approaches to achieve the population and distribution objectives, which will assist in the development of subsequent action plans.

As required by SARA, the Minister of the Environment and the Minister Responsible for the Parks Canada Agency will complete one or more action plans under this recovery strategy, which will be included on the Species at Risk Public Registry by December 31, 2017.

RECOVERY FEASIBILITY SUMMARY

Recovery of southern mountain caribou is considered to be both technically and biologically feasible across the species' distribution in Canada based on the following four criteria outlined in the draft SARA Policies (Government of Canada 2009):

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 5,800 southern mountain caribou across BC and Alberta. These animals are capable of successful reproduction and are available to improve LPU growth rates and abundance, thereby achieving self-sustainability.

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

Yes. Some LPUs of southern mountain caribou have sufficient suitable habitat within their ranges. For other LPUs where sufficient suitable habitat is currently unavailable, sufficient habitat could be made available through habitat management and/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 LPUs of southern mountain caribou 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 americanus*], deer [*Odocoileus* spp.], elk [*Cervus elaphus*]), resulting in increased predator populations (e.g., wolf [*Canis lupus*], bear [*Ursus* spp.], cougar [*Puma concolor*]) that in turn increase the risk of predation to southern mountain 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 LPU conditions warrant such action.

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 forested habitat, habitat restoration, predator and alternate prey management, hunting regulations, stewardship initiatives) are available to achieve the population and distribution objectives for southern mountain caribou. There is uncertainty with regard to the effectiveness of some of these techniques, as they have not yet undergone a sufficiently long trial period.

Although current evidence supports the conclusion that the recovery of all LPUs is biologically and technically feasible, small LPUs (e.g. LPUs with <50 animals), particularly those isolated from the core southern mountain caribou population, are at greater risk of not becoming self-sustaining. In these situations, a LPU may have greater difficulty withstanding threats such as increased predation resulting from altered predator/prey dynamics, or mortality from avalanches and other natural events. Such LPUs may not experience enough immigration to maintain genetic diversity and therefore will be at greater risk of not persisting over the long-term. The cumulative effects of habitat changes from resource and other developments increases the level

of threat. It is possible that, over time and through unforeseen circumstances, there may be situations where recovery of a particular LPU proves not to be biologically or technically feasible. This would affect the likelihood of achieving the population and distribution objectives.

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1 COSEWIC² SPECIES ASSESSMENT INFORMATION

Date of Assessment: May 2002

Common Name (population): Woodland Caribou (Southern Mountain population)

Scientific Name: *Rangifer tarandus caribou*

COSEWIC Status: Threatened

Reason for Designation: Local herds in the Southern Mountain population are generally small, increasingly isolated, and subject to multiple developments. Their range has shrunk by up to 40% and 13 of 19 herds are declining. The most southerly herds are likely to disappear. Many herds are threatened by decreasing habitat quantity and quality, harassment, and predation.

Canadian Occurrence: British Columbia (BC) and Alberta

COSEWIC Status History: The Southern Mountain population was designated threatened in May 2000. This population was formerly designated as part of the "Western population" (now de-activated). Status was re-examined and confirmed in May 2002.

2 SPECIES STATUS INFORMATION

The Woodland Caribou, Southern Mountain population (*Rangifer tarandus caribou*), herein referred to as "southern mountain caribou", is listed as threatened (2003) under Canada's *Species at Risk Act* (SARA) (Government of Canada 2013).

Southern mountain caribou are found predominantly in Canada, occurring in BC and Alberta, but also extending partially into northern Idaho and Washington in the United States (US). NatureServe ranks southern mountain caribou as imperilled to critically imperilled at the national level (Table 1), but has not ranked southern mountain caribou at the global level (NatureServe 2013). In Alberta, southern mountain caribou are ranked as critically imperilled and are designated as Threatened under Alberta's *Wildlife Act*. In BC, the "northern" ecotype is ranked as vulnerable and the "mountain" ecotype is ranked as critically imperilled. The "northern" ecotype is on the BC Conservation Data Centre's (CDC) Blue list (special concern) and the "mountain" ecotype is on the Red list (threatened/endorsed). Caribou in Idaho and Washington are ranked critically imperilled, and were listed as Endangered in 1984 by the US Fish and Wildlife Service under the US *Endangered Species Act*.

² COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

Table 1. Status ranks for southern mountain caribou.

NatureServe Ranks		Canadian status	Provincial status
National (N)	Sub-national (S)		
Canada (N1N2) ¹ US (N1N2)	Alberta (S1) ² BC (S1 – mountain) BC (S3 – northern) Idaho (S1) Washington (S1)	SARA – Schedule 1 (Threatened)	BC (Red – mountain) BC (Blue – northern) Alberta (Threatened)

¹ N1N2 = imperilled to critically imperilled

³ S1 = critically imperilled; S3 = vulnerable

3 SPECIES INFORMATION

All caribou and reindeer in the world belong to one species, *Rangifer tarandus*. In Canada, caribou are found in all provinces and territories except for New Brunswick, Nova Scotia and Prince Edward Island (Figure 1). Four subspecies of caribou are currently recognized: Woodland Caribou (*R. t. caribou*); Peary Caribou (*R. t. pearyi*); Barren-ground Caribou (*R. t. groenlandicus*); and Grant's Caribou (*R. t. granti*; Banfield 1961). Dawson's Caribou (*R. t. dawsoni*) occurred on Haida Gwaii (i.e., Queen Charlotte Islands, BC) before their extinction in the early 1900s (Spalding 2000). Although Banfield's (1961) subspecies classification is commonly used, a review and revision of the taxonomy of caribou is needed (COSEWIC 2011).

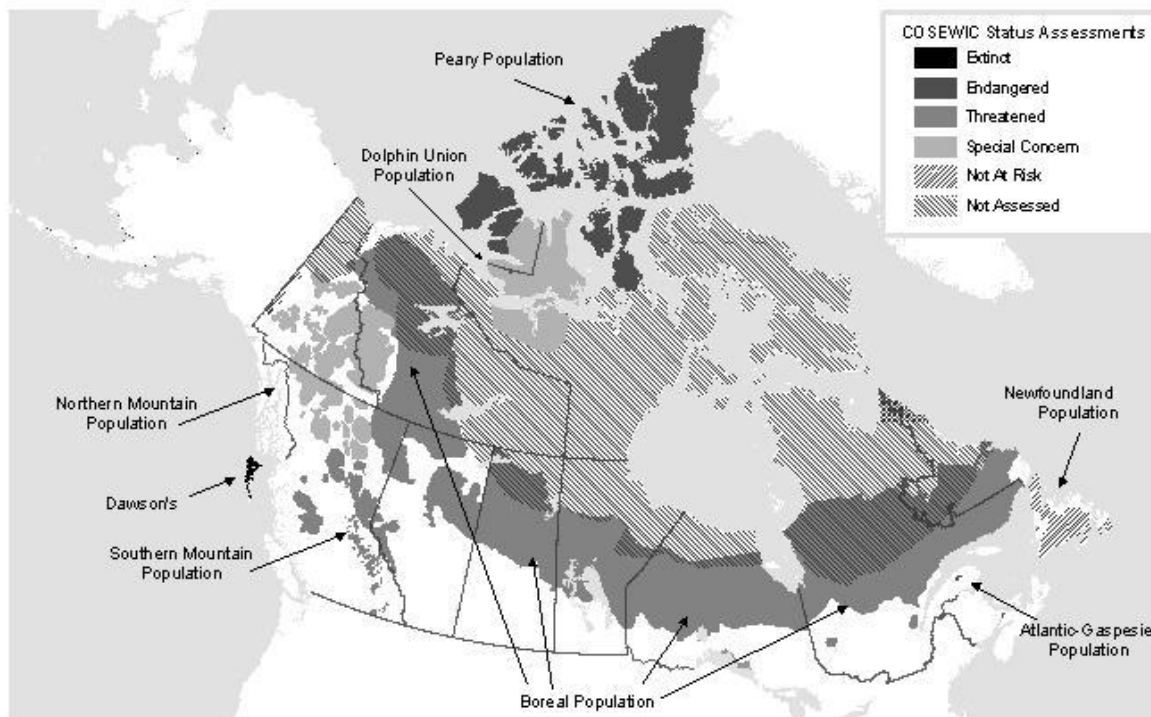


Figure 1. Distribution of caribou in Canada.

Based on the classification system used by COSEWIC in its 2002 assessment, Woodland Caribou are separated into six geographically distinct populations in Canada: Northern Mountain, Southern Mountain, Boreal, Forest-tundra, Atlantic-Gaspésie, and Newfoundland (COSEWIC 2002, Figure 2). This recovery strategy addresses the recovery of the southern mountain population of woodland caribou in Canada, which is located within the Southern Mountain National Ecological Area (SMNEA) in BC and Alberta (Thomas and Gray 2002).

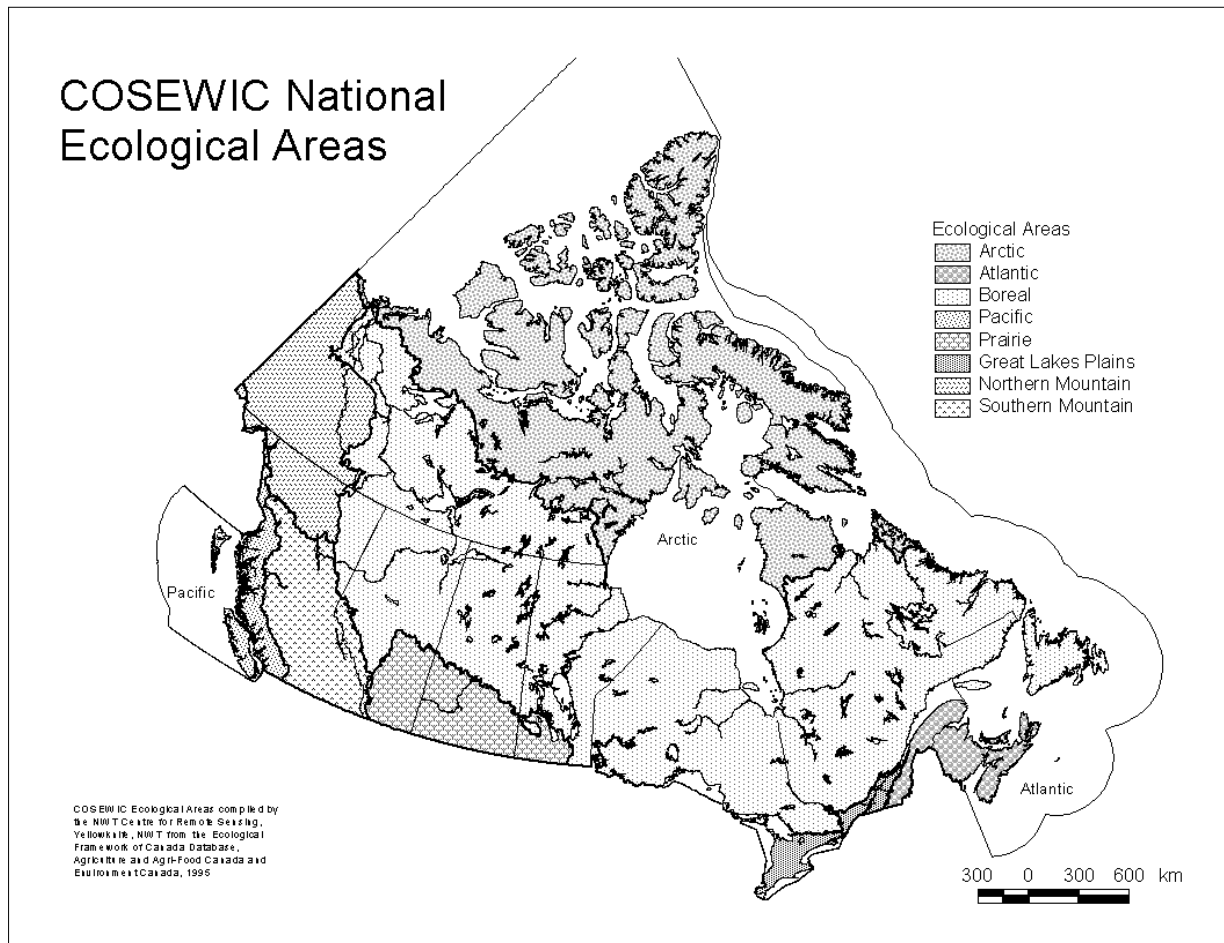


Figure 2. National Ecological Areas established by COSEWIC in 1994.

Two “ecotypes” of caribou are recognized by the provinces within the southern mountain caribou population. These ecotypes broadly reflect adaptive behaviours of caribou (e.g., feeding, migration) to a variety of ecological conditions (e.g., amount and duration of snow cover, topography/terrain).

In BC, caribou that live in areas of relatively shallow snowpack and which feed primarily on terrestrial lichens (but also on arboreal lichens), are called ‘northern’ ecotype caribou, while caribou that live in deep snow areas and feed primarily on arboreal lichens are ‘mountain’ ecotype caribou (Stevenson and Hatler 1985, Heard and Vagt 1998). In Alberta, caribou that

feed primarily on terrestrial lichens and spend at least part of their annual cycle in the mountains are similar to BC's 'northern' ecotype but are called 'mountain' caribou (ASRD&ACA 2010).

In 2011, COSEWIC defined 12 Designatable Units (DUs) for caribou across Canada. DUs are discrete and evolutionarily significant units of caribou defined to address issues with the current taxonomy and with classification of ecotypes (COSEWIC 2011). That report splits southern mountain caribou into 3 DUs: Northern Mountain (DU7), Central Mountain (DU8), and Southern Mountain (DU9). The current southern mountain caribou population includes all of DU8 and DU9, but only the southern portion of DU7. The DU structure for caribou in western Canada is being reviewed as part of the update to the COSEWIC status report and subsequent reassessment in 2014.

In this recovery strategy, to retain the ecological and evolutionary distinction between the 3 DUs, southern mountain caribou in the Northern Mountain (DU7), Central Mountain (DU8) and Southern Mountain (DU9) DUs will be referred to as the Northern Group, Central Group and Southern Group, respectively (Table 2).

Table 2. Relationship of provincial, SARA and COSEWIC designations for southern mountain caribou. Grey shading indicates southern mountain caribou.

Terrain/ Winter feeding strategy	Ecotype name	Location	Nationally Significant Population by National Ecological Area (SARA)	COSEWIC Designatable Unit (2011)	Southern mountain caribou Groupings
Shallow snow/ terrestrial lichen	BC: Northern Alberta: Mountain	Northern BC	Northern Mountain	Northern Mountain	N/A ¹
		West central BC	Southern Mountain		Northern Group
		North central BC		Central Mountain	Central Group
		East central BC			
		West central Alberta			
Deep snow/ arboreal lichen	BC: Mountain	Southeastern BC	Southern Mountain	Southern Group	

¹ Not applicable

3.1 Species Description

Southern mountain 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). Caribou have large, rounded hooves and large, widely spaced dew claws which help them walk on and dig through snow to gain access to lichens, their primary food during winter (Thomas and Gray 2002). Both male and female caribou have antlers during part of the year, a unique feature among the deer family (Thomas and Gray 2002). Antlers are erect and spreading with males having a flattened brow tine that points down over the forehead (BC Ministry of Environment, Lands and Parks 2000).

3.2 Population and Distribution

3.2.1 Local Population Units (LPUs) and Subpopulations

The southern mountain caribou population currently includes 38 recognized individual subpopulations. Four of those subpopulations have been extirpated (i.e. subpopulation reduced to zero caribou) since 2002. In this recovery strategy, the 38 subpopulations have been organized into “local population units” (LPUs). The LPUs take into account that the subpopulations were historically larger in size and have been fragmented into the currently recognized subpopulations. For subpopulations that are not grouped with others into a larger LPU, the LPU is equivalent to the subpopulation.

The geographic area that is occupied by a subpopulation is referred to in this strategy as the subpopulation's annual range. The annual range of an LPU consists of the combined annual ranges of all subpopulations within that LPU. Within the annual range, geographic areas occupied by caribou are further differentiated by season of use into seasonal ranges (e.g., winter range, summer range).

LPUs have been established and mapped using two different methods in this recovery strategy. For the Southern Group, the LPUs have been adopted from the Government of BC's Mountain Caribou Recovery Implementation Plan, which refers to large, contiguous “Mountain Caribou Planning Units” rather than individual subpopulations. This results in the LPU often covering vast areas that are not currently occupied by a southern mountain caribou subpopulation. For the Northern and Central Groups, the LPUs have been established using the best available information and expertise about current and recently historic occupancy of geographic areas by southern mountain caribou subpopulations. This results in the LPU boundary largely equating to the boundary of the subpopulation(s) within it.

Annual LPU ranges, subpopulation boundaries, and seasonal ranges have been identified based on extensive studies of movements and seasonal range use of radio-collared caribou (e.g., Cichowski 1993, Terry and Wood 1999, Young and Roorda 1999, Poole et al. 2000, Young *et al.* 2001, Roberts et al. 2003, Culling et al. 2005, Wittmer et al. 2005a, Jones 2007, ASRD&ACA 2010, van Oort et al. 2011, Williamson-Ehlers 2012, Seip and Jones 2013). Many of those radio-telemetry studies were conducted after the 1980s with some initiated as recently as 2002. For those subpopulations, annual ranges often reflect current distribution and habitat use, and may not adequately describe historically used areas and seasonal use patterns. The only subpopulation with limited information on habitat use and distribution is the Scott subpopulation.

3.2.2 Historical Distribution, Numbers and Trends

Historically, the distribution of southern mountain caribou in BC and Alberta was much larger and extended further south into the United States (Figure 3). In BC, a conservative estimate of the reduction of the extent of distribution for all caribou types since the arrival of Europeans is 20%, with the major change in distribution occurring in the southern portion of the province in the area occupied by southern mountain caribou (Spalding 2000). Hummel and Ray (2008) report that southern mountain caribou have been extirpated from approximately 40% of their

historical extent of occurrence due to loss and change in habitats, primarily resulting from human activities. In Alberta, about 61% of the generalized maximum historical extent of occurrence of all caribou in the province is no longer occupied (Dzus 2001). Southern mountain caribou also occurred in most of the northwestern US states in the 19th century but are now extirpated (e.g. the last confirmed sighting of a caribou in Montana was in 1958), except for the South Selkirk subpopulation (US Fish and Wildlife Service 1993). However, the most recent survey of this subpopulation indicated that it is both small (estimate of 22 in 2014) and declining, raising concerns about the likelihood of the US portion of the annual range being occupied in the future (BC Ministry of Forests, Lands and Natural Resource Operations, unpublished data).

At the turn of the 20th century, the estimated number of caribou in all of BC was 30,000-40,000 (Spalding 2000). Aboriginal traditional knowledge holders stated that prior to the arrival of Europeans in north-eastern BC, caribou populations were so high that they were described to be “like bugs on the land” (Willson 2014). Historical records and more recent survey information suggest a general declining trend until about the 1940s, followed in some cases by an increase in numbers through to the 1960s, a subsequent decline in the late 1970s, an increase in the mid-late 1990s, and a decline to the present (Bergerud 1978, Stevenson & Hatler 1985, Seip & Cichowski 1996, Spalding 2000, Thomas & Gray 2002). These changes were more pronounced in the southern and central part of the province (i.e., within the boundaries of the southern mountain caribou population) than in the north. As a result of these changes, many Aboriginal groups have stopped hunting southern mountain caribou due to their concerns for the long-term survival of this species.

Limited historical population estimates are available for individual subpopulations in west-central Alberta, but Alberta Sustainable Resource Development & Alberta Conservation Association (2010, and references therein) cite “a significant decline in the number and size of caribou populations in Alberta”.

Changes in caribou numbers from the early 1900s until the 1970s have been attributed to changes in numbers and distribution of other prey, changes in numbers of predators, and overhunting. In southern and central BC, moose (*Alces americanus*) were largely absent or present at low densities until the late 1800s when they started becoming more common (Spalding 1990, Santomauro et al. 2012). The increase in moose provided predators with an alternate prey source. In the 1950s and 1960s, wide-scale predator poisoning programs targeting wolves (*Canis lupus*) and coyotes (*Canis latrans*) were conducted (Cringan 1957, Bergerud 1978, Edmonds 1988, Bergerud and Elliott 1998). Large legal harvests of caribou in the late 1960s and early 1970s in BC and Alberta (Bergerud 1978, Edmonds and Bloomfield 1984) combined with recovering wolf populations and adverse weather probably caused caribou population decreases in the 1970s.

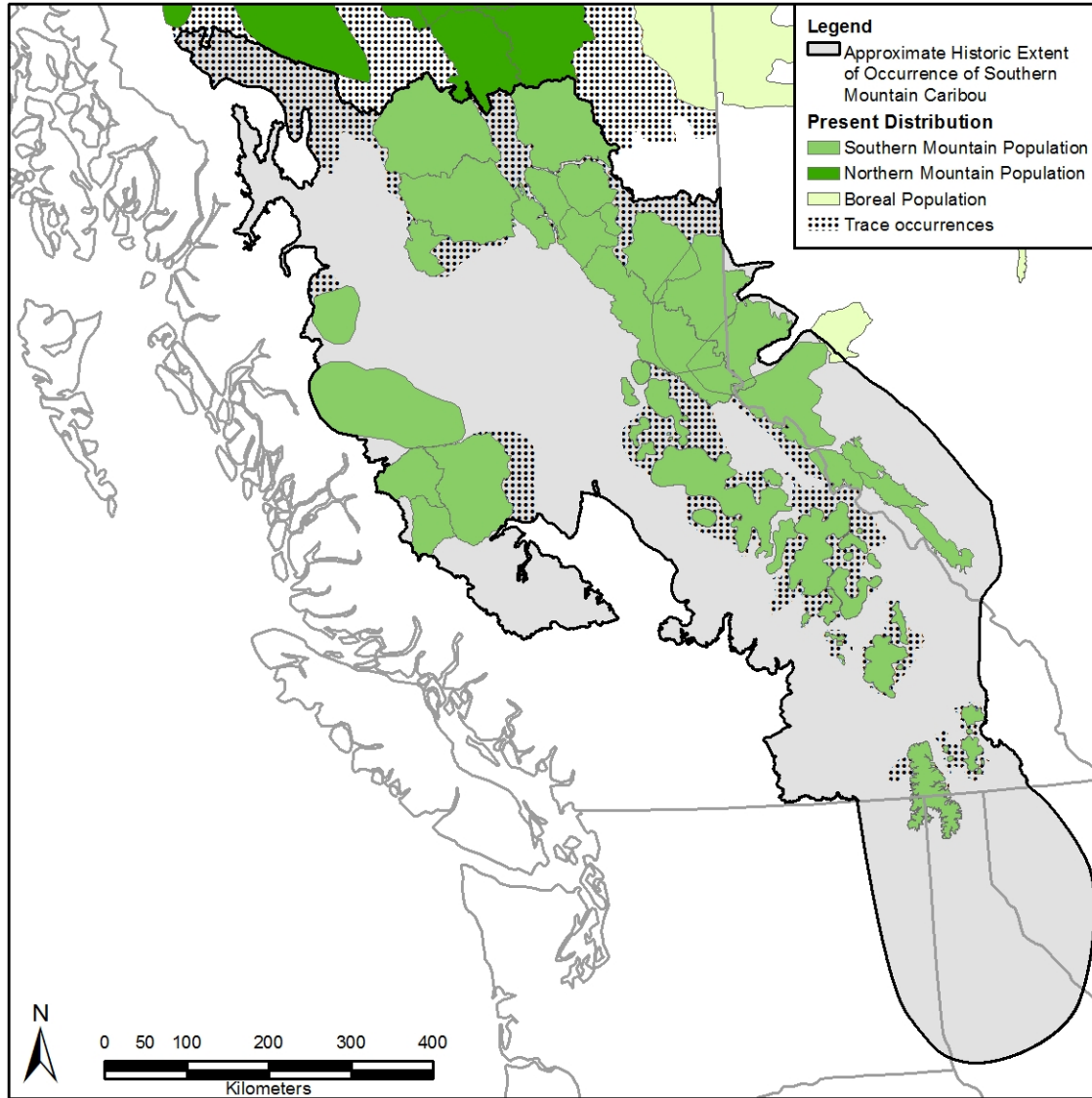


Figure 3. Current distribution and approximate historical extent of occurrence of southern mountain caribou; parts of the current distribution of adjacent Boreal and Northern Mountain Caribou populations are also shown.

3.2.3 Population numbers and trends

The 34 currently existing (extant) and 4 extirpated subpopulations of southern mountain caribou, comprising the 24 LPUs, are distributed across the southern two-thirds of BC and in the west-central portion of Alberta (Figure 4). One LPU's annual range (South Selkirks) also extends partially into northern Idaho and Washington, USA.

Reliable current size and trend information is available for most southern mountain caribou subpopulations and LPUs. For some subpopulations, however, reliable surveys are difficult to conduct because a large number of the caribou are found below treeline during all seasons where they are harder to detect because of dense forest cover.

Based on the best available information, the current overall number of southern mountain caribou in Canada is estimated to be approximately 5,800 (Table 3). This is a total of all caribou in the LPUs, not only the mature individuals. Only the Itcha-Ilgachuz and Graham subpopulations are estimated to consist of 500 or more caribou. Over half (18 of 34) of the extant subpopulations consist of 50 or fewer caribou. All but two of the subpopulations with known long-term trends have declined, and four of those are currently extirpated. Of the 24 LPUs that are a combination of one or more subpopulations, ten have fewer than 100 caribou.

In the Northern Group, surveys for the Itcha-Ilgachuz and Telkwa subpopulations date back to the 1970s and 1960s respectively. Fewer estimates are available for the other subpopulations. However, population trend information is available for some subpopulations based on survey data, or on radio-collared caribou mortality rates and calf recruitment.

In the Central Group, surveys of the Kennedy Siding, Burnt Pine, Moberly, Quintette and the eastern portion of the Scott subpopulations are conducted during late winter when caribou are using high elevation alpine and subalpine habitat (Seip and Jones 2013). Surveys of the Tonquin, Brazeau and Maligne subpopulations are conducted in the fall when caribou are using high elevation alpine habitat. No reliable surveys have been conducted for the Narraway, Redrock-Prairie Creek and A La Peche subpopulations because many of the caribou in those subpopulations use low elevation forested habitat during winter, making them difficult to count. Population trends for subpopulations in the Central Group are based on mortality rates of radio-collared caribou and late winter calf recruitment counts. These have been tracked annually since at least 2002/03 for most subpopulations, and as far back as 1998/99 for the Redrock Prairie Creek and A La Peche subpopulations (ASRD&ACA 2010, Seip and Jones 2013, AESRD unpublished data).

In the Southern Group, population surveys are conducted during late winter when caribou are using high elevation subalpine habitat. Numerous surveys have been conducted for all subpopulations since the early 1990s.

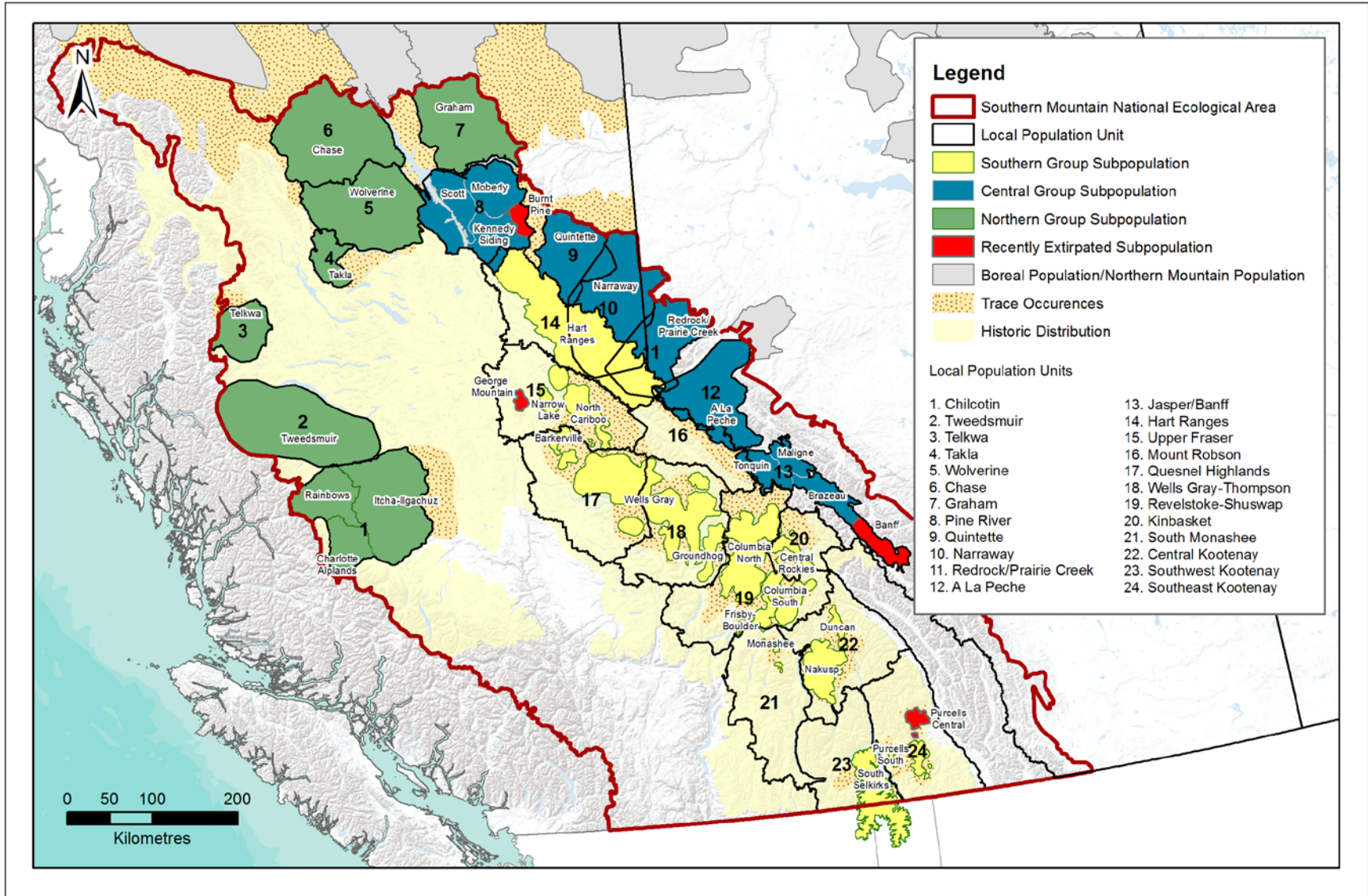


Figure 4. Current distribution of southern mountain caribou local population units (LPUs) and subpopulations.

Table 3. Population size¹ (total animals) and trend information for southern mountain caribou subpopulations in Canada (BC and Alberta (AB)).

# ²	Pro v	Local population unit (LPU)	Subpopulation	Population estimate ³		Population Trend ⁴	
				Estimate	Year	Current	Long-term
<i>Northern Group</i>							
1	BC	Chilcotin	Rainbows	50	2008	Decreasing	Decreasing
	BC		Charlotte Alplands	7	2012	Decreasing	Decreasing
	BC		Itcha-Ilgachuz	1685	2014	Decreasing	Increasing ⁵
2	BC	Tweedsmuir	Tweedsmuir	300	2002	Decreasing	Decreasing
3	BC	Telkwa	Telkwa	19	2013	Decreasing	Decreasing
4	BC	Takla	Takla	122	2004	Unknown	Unknown
5	BC	Wolverine	Wolverine	341	2010	Unknown	Decreasing
6	BC	Chase	Chase	475	2009	Unknown	Unknown
7	BC	Graham	Graham	708	2009	Stable	Unknown
	BC	Northern Group Total		3707		Unknown	Unknown
<i>Central Group</i>							
8	BC	Pine River	Scott	43	2014 ⁶	Unknown	Unknown
	BC		Moberly	22	2014	Decreasing	Decreasing
	BC		Kennedy Siding	30 ⁷	2014	Decreasing	Decreasing
	BC		Burnt Pine	0	2014	Extirpated	Decreasing
9	BC	Quintette	Quintette	106 ⁸	2014	Decreasing	Decreasing
10	BC/ AB	Narraway	Narraway	96 ⁹	2012	Decreasing	Decreasing
11	AB	Redrock/Prairie Creek	Redrock/Prairie Creek	127 ⁹	2012	Decreasing	Decreasing
12	AB	A La Peche	A La Peche	88 ⁹	2012	Decreasing	Decreasing
13	AB	Jasper/Banff	Tonquin	38	2013	Decreasing	Decreasing
	AB		Maligne	5	2013	Decreasing	Decreasing
	AB		Brazeau	8	2013	Decreasing	Decreasing
	AB		Banff ¹⁰	0		Extirpated	
	BC/ AB	Central Group Total		563		Decreasing	Decreasing
<i>Southern Group</i>							
14	BC	Hart Ranges	Hart Ranges	459	2013	Decreasing	Decreasing
15	BC	Upper Fraser	North Cariboo Mountains	222	2011	Decreasing	Decreasing
	BC		George Mountain ¹¹	0		Extirpated	Decreasing
	BC		Narrow Lake	47	2014	Stable	Decreasing
16	BC	Mount Robson	Mount Robson ¹²	0		N/A	N/A
17	BC	Quesnel Highlands	Barkerville	90	2012	Increasing	Increasing
			Wells Gray (North) ¹³	259	2013	Decreasing	Decreasing
18	BC	Wells Gray- Thompson	Wells Gray (South) ¹³	133	2013	Decreasing	Decreasing

			Groundhog	13	2013	Decreasing	Decreasing
19	BC	Revelstoke-Shuswap	Columbia North	183	2013	Stable	Decreasing
	BC		Frisby-Boulder	13	2013	Decreasing	Decreasing
	BC		Columbia South	7	2013	Decreasing	Decreasing
20	BC	Kinbasket	Central Rockies	3	2008	Decreasing	Decreasing
21	BC	South Monashee	Monashee	4	2011	Decreasing	Decreasing
22	BC	Central Kootenay	Duncan	2	2012	Decreasing	Decreasing
	BC		Nakusp	64	2014	Decreasing	Decreasing
23	BC	Southwest Kootenay	South Selkirks	22	2014	Decreasing	Decreasing
24	BC	Southeast Kootenay	Purcells Central ¹⁴	0		Extirpated	Decreasing
	BC		Purcells South	19	2014	Stable	Decreasing
	BC	Southern Group Total		1540		Decreasing	Decreasing
SMNEA Total				5810			

¹ Population estimates are estimates of total animals in the population. COSEWIC Status Reports for southern mountain caribou designatable units include only the number of mature individuals in the main body of the report although total population estimates can be found in the appendices

² Number corresponds to Local Population Unit number in Figure 4

³ Population estimates based on survey data unless otherwise noted and includes all age classes

⁴ Long-term trend based on a three generation (27 years) trend based on survey data for Southern and Northern Groups, and on population vital rates (radio-collared adult mortality, late winter calf recruitment) for Central Group and Tweedsmuir subpopulation of the Northern Group; current trend based on interviews with jurisdictional experts

⁵ Although the long-term trend is a net increase, the population has declined approximately 42% from its peak in 2003 to 2012 (COSEWIC *in draft*)

⁶ A survey was conducted for the eastern portion of the Scott subpopulation in 2014, but the west side was estimated in 2007 based on anecdotal sightings. The estimate for the western portion of the Scott subpopulation may be lower than presented here but no new information is available to confirm

⁷ Midpoint between estimate of 25-35

⁸ Midpoint between estimate of 98-113

⁹ Population estimates are based on the 2009 population estimate of 100 caribou for the Narraway, 212 caribou for the Redrock-Prairie Creek and 135 caribou for the A La Peche subpopulations (ASRD&ACA 2010) and then extrapolated to 2012 using annual population growth rate estimates from Alberta Ministry of Environment and Sustainable Resource Development (unpublished data)

¹⁰ Extirpated in 2009

¹¹ Extirpated in 2003; range no longer managed for caribou

¹² The Mount Robson LPU includes only small portions of the Central Group's Tonquin and A La Peche subpopulation ranges; population size and trend estimates for those subpopulations are included in the Central Group

¹³ Although Wells Gray is currently recognized as one subpopulation, the northern portion is included in the Quesnel Highlands LPU and the southern portion is included in the Wells Gray – Thompson LPU

¹⁴ Extirpated in 2005

3.3 Needs of the Southern Mountain Caribou

3.3.1 Habitat and biological needs

Southern mountain caribou require large ranges of relatively undisturbed, interconnected habitat where they can separate themselves (horizontally and by elevation) from predators; modify their geographic use in response to various natural and human-caused habitat disturbances and human activities; and access their preferred food sources.

Caribou select habitat at several scales and different subpopulations of southern mountain caribou differ in how they use their habitat. At the landscape scale, predator avoidance is the most important factor influencing selection (Johnson et al. 2002, Gustine et al. 2006a). In the Southern Group, caribou select high elevation habitats throughout most of the year, while predators and other prey are found primarily at low elevations; the greatest degree of overlap occurs during spring (Seip 1992a, Stotyn 2008, Steenweg 2011). Spatial separation from predators and other prey is especially critical during calving and early summer when calves are most vulnerable. During calving, caribou that disperse into high elevation alpine and subalpine habitat or to islands in lakes where predators are less abundant have higher newborn calf survival than caribou that calve below treeline (Bergerud et al. 1984, Bergerud 1985, Seip and Cichowski 1996). Females tend to return to the same location to calve each year.

During winter, southern mountain caribou require large patches of mature and old forests with abundant lichens. Old forest supports fewer primary prey species such as moose, elk (*Cervus elaphus*), and deer (*Odocoileus* sp.), so predator numbers (e.g., wolves, cougars [*Puma concolor*]) are also lower, resulting in fewer interactions with caribou during winter. Old and mature forests also have good sightlines because the trees are not as dense as in younger stands, making detection of predators easier. Also, lichens are more abundant in old and mature forests than in young forests. Subpopulations with high levels of recent habitat disturbance and very young forests and lower levels of old growth forest on their ranges have been shown to have lower survival rates (Wittmer et al. 2007).

In the Southern Group, the snowpack is deep and southern mountain caribou predominantly use high elevation mature and old subalpine forests in mid and late winter when the snowpack has hardened. This enables them to forage on arboreal lichens (primarily *Bryoria* spp.) that would otherwise be unreachable (Seip 1990, 1992a, Simpson et al. 1997, Hamilton et al. 2000, Terry et al. 2000, Apps et al. 2001). During early winter before snow has consolidated, they move to mid to low elevation mature and old forests (with some subpopulations moving as low as cedar/hemlock forests in valley bottoms) where they forage on arboreal lichens on fallen trees, lichen litterfall, and shrubs and forbs that remain accessible in snow wells (Seip 1992a, Mowat et al. 1998, Terry et al. 2000). Except for the South Selkirk and South Purcell subpopulations, caribou in the Southern Group also use lower elevation areas during spring, but return to higher elevations where they calve and spend the summer (Seip 1990, 1992a, Simpson et al. 1997, Hamilton et al. 2000).

Southern mountain caribou of the Central and Northern groups live in relatively shallow snow areas. They forage primarily on terrestrial lichens either in low elevation mature coniferous forests or on windswept alpine slopes during winter. In summer they are mostly at higher elevations in the mountains (Edmonds and Bloomfield 1984, Cichowski 1993, Brown et al. 1994, Terry and Wood 1999, Wood and Terry 1999, Young and Roorda 1999, Backmeyer 2000, Poole et al. 2000, Stronen 2000, Johnson et al. 2002, Szkorupa 2002, Culling et al. 2005, Jones 2007, Shepherd et al. 2007, Williamson-Ehlers 2012). During winter, these caribou primarily dig through the snow (crater) to access terrestrial lichens (*Cladina* spp. [preferred], *Cladonia* spp., *Cetraria* spp., and *Stereocaulon* spp.), but they also forage on arboreal lichens in low elevation forests, forested wetlands, and in subalpine habitats, especially during times when snow conditions are less favourable for cratering. Many subpopulations travel long distances between winter and summer ranges, while others winter and summer within the same general area. In Alberta, some caribou in the A La Peche and Redrock/Prairie Creek subpopulations no longer use the low elevation foothills portions of their annual ranges where habitat disturbance is high, and instead are living in the mountains year-round (Smith 2004). Currently, adult survival is higher for caribou that live year-round in the mountains than it is for those that migrate to low elevation ranges in the foothills (Hebblewhite et al. 2010a), but the subpopulations are still declining (Alberta Environment and Sustainable Resource Development, unpublished data). During spring migration, caribou generally use low elevation snow-free or low snow areas (Steventon 1996).

During spring and summer, southern mountain caribou are found mostly at high elevations although portions of some subpopulations also use low elevation habitat. In spring and summer, southern mountain caribou eat a wide variety of forbs, grasses, lichens, fungi, and the leaves of some shrubs (Simpson 1987, Seip 1990, Cichowski 1993, Thomas et al. 1996).

In addition to seasonal ranges within their annual range, southern mountain caribou also require matrix range. Two types of matrix range are described in this recovery strategy. Type 1 matrix range consists of areas within an LPU's annual range that have not been delineated as summer (e.g. spring, calving, summer, fall/rut) or winter range. Type 1 matrix may include seasonal migration areas (or portions of migration areas) and areas of lower use compared to delineated seasonal ranges. Type 2 matrix range consists of areas surrounding annual ranges where predator/prey dynamics influence predation within the subpopulation's annual range. Type 2 matrix range may also include areas of trace occurrences of caribou, dispersal zones between subpopulations, dispersal zones between LPUs.

The function of Type 1 matrix range is to provide some forage, connectivity between seasonal ranges, security from human disturbance, and a low risk of predation. The reason for identifying Type 1 matrix range is that habitat connectivity within an annual range allows for seasonal movement among habitats that have the different resources needed to satisfy life history requirements. This allows caribou to respond to habitat disturbance or habitat recovery (Saher and Schmiegelow 2005). Connectivity within annual ranges also allows for movement in response to changing environmental conditions (e.g. climate change).

Type 2 matrix range influences predator/prey dynamics within southern mountain caribou annual ranges and provides connectivity between subpopulations within and among LPUs. Recovery of southern mountain caribou requires that Type 2 matrix range be recognized and managed to maintain a low predation risk. Although caribou primarily use high elevation areas and/or habitat types where they are spatially separated from other prey and predators (Seip 1992a, Stotyn 2008, Hebblewhite et al. 2010a, Steenweg 2011, Robinson et al. 2012, Williamson-Ehlers 2012), the habitat/prey/predator dynamics at lower elevations, and in areas adjacent to annual ranges, contribute to prey/predator dynamics and mortality on caribou within their annual ranges. This is because predators move beyond valley bottoms and also use higher elevations, especially during summer and fall (Whittington et al. 2011). At the broad scale, wolf predation on caribou in the Southern Group occurs primarily at low elevations (Apps et al. 2013).

In addition, Type 2 matrix range provides connectivity between subpopulations within and among LPUs and thereby allows for immigration and emigration, which helps to maintain genetic diversity and the species' consequent resilience to environmental stressors (e.g., disease, severe weather). Weckworth et al. (2012) have demonstrated that isolation of subpopulations as a result of disturbance to the landscape (i.e., any form of human-caused or natural habitat alteration) can result in a significant reduction in genetic diversity. In addition, connectivity among annual ranges maintains the possibility of 'rescue effects', thereby facilitating recovery.

Table 4 summarizes features of southern mountain caribou seasonal and matrix range.

Table 4. Features of southern mountain caribou seasonal and matrix range.

Range	Southern Group¹	Central Group²	Northern Group²
High elevation summer (e.g. spring, calving, summer, fall/rut) range	<ul style="list-style-type: none"> • alpine areas, subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • alpine areas, subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • alpine areas, subalpine parkland and subalpine forests
Low elevation summer (e.g. spring, calving, summer, fall/rut) range	<ul style="list-style-type: none"> • spring - low elevation forests of cedar, hemlock, spruce (for LPUs in rugged terrain) • Avalanche chutes 	<ul style="list-style-type: none"> • Not applicable 	<ul style="list-style-type: none"> • low elevation forested and unforested habitats • islands in lakes
High elevation winter range	<ul style="list-style-type: none"> • subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • windswept alpine slopes • subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • windswept alpine slopes • subalpine parkland and subalpine forests • lakes
Low elevation winter range	<ul style="list-style-type: none"> • early winter - old and mature cedar-hemlock forests on gentle slopes (for LPUs in rugged terrain) 	<ul style="list-style-type: none"> • low elevation forested habitats (pine, spruce, pine/spruce mixed stands, black spruce stands), wetlands, forested wetlands 	<ul style="list-style-type: none"> • low elevation forested habitats (pine, spruce, pine/spruce mixed stands, black spruce stands), meadows, wetlands, forested wetlands

			• lakes
Matrix range (Type 1)	<ul style="list-style-type: none"> • low or mid elevation forested and unforested habitats • may include high elevation alpine areas, subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • low or mid elevation forested and unforested habitats • may include high elevation alpine areas, subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • low or mid elevation forested and unforested habitats • may include high elevation alpine areas, subalpine parkland and subalpine forests
Matrix range (Type 2)	<ul style="list-style-type: none"> • low elevation forested and unforested habitats • may include high elevation alpine areas, subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • low elevation forested and unforested habitats • may include high elevation alpine areas, subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • low elevation forested and unforested habitats • may include high elevation alpine areas, subalpine parkland and subalpine forests

¹ Adapted from Hart and Cariboo Mountains Recovery Implementation Group (2005)

² Adapted from Northern Caribou Technical Advisory Committee (2004)

3.3.2 Limiting factors

The reproductive output of woodland caribou is low relative to other ungulates, so it takes longer for their populations to increase than for other ungulates, making them more vulnerable to higher rates of mortality. 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 southern mountain caribou are vulnerable to predation, calf mortality can be especially high, particularly within the first 30 days after birth (Bergerud and Elliot 1986; Gustine et al. 2006b). In most cases predation is the main proximate cause³ limiting southern mountain 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 (Edmonds and Smith 1991, Seip 1992b, Wittmer et al. 2005b).

Small subpopulations with few adult females (and hence few births) and low calf survival have a low potential for population growth (Bergerud 1980; Bergerud 2000). In addition to being affected by reproductive and mortality rates related to their age distribution, small subpopulations can be disproportionately affected by random events such as avalanches, fire, and disease (e.g., the last 5 caribou in the Banff subpopulation died in an avalanche in 2009). Consequently, population growth is likely to be highly variable in small subpopulations, with an increased probability of extirpation (Caughley 1994).

³ the proximate cause is defined as the cause that is immediately responsible for the event (in this case, predation is what is causing caribou to die)

4 THREATS

4.1 Threat Assessment

There is a variety of threats that directly and/or indirectly affect southern mountain caribou and their habitat. In this strategy, threats to southern mountain caribou were assessed using the International Union for the Conservation of Nature (IUCN) Threat Calculator. In the IUCN Threat Calculator, only the direct impacts of threats on population numbers are considered. Therefore, for threats that result in habitat alteration (such as industrial activities and fire) only direct impacts are considered in the ranking for those threats. For example, direct impacts from habitat alteration could include loss of forage leading to poorer caribou condition and reduced survival, or displacement to habitats where mortality due to avalanche is higher. The threat calculator only addresses new threats that will occur within southern mountain caribou ranges in the next 10 years.

The indirect impacts of habitat alteration leading to altered predator/prey dynamics and higher predation rates on caribou are considered only under predation (problematic native species). Aboriginal groups and others have frequently expressed to Environment Canada that two of the greatest threats to caribou recovery are habitat loss and predation.

Tables 5-7 summarize threats assessed for the Northern, Central and Southern Groups respectively, based on best available scientific information and some Aboriginal traditional knowledge. Many of the threats to southern mountain 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. The overall level of threat to southern mountain caribou, based on cumulative impacts of threats calculated by the IUCN Threat Calculator, is: High for the Northern Group, Very High for the Central Group, and Very High for the Southern Group.

Although the IUCN Threat Calculator only assesses direct impacts, the following sections of the recovery strategy include a discussion of both direct and indirect impacts of threats to provide a more complete understanding of the effects of each type of threat on southern mountain caribou.

Table 5. Threats assessed for the Northern Group of southern mountain caribou using the IUCN Threats Calculator.

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
1 Residential & commercial development						
1.1	Housing & urban areas	Negligible	Negligible	Slight	High	<ul style="list-style-type: none"> • Some impact of Houston on Telkwa and Anahim Lake on Itcha-Ilgachuz and Rainbow subpopulations
2 Agriculture & aquaculture						
2.1	Annual & perennial non-timber crops	Negligible	Negligible	Slight	High	<ul style="list-style-type: none"> • Mostly hay
2.3	Livestock farming & ranching	Unknown	Small	Unknown	High	<ul style="list-style-type: none"> • Guide-outfitter horses grazing in backcountry • Cattle grazing and feral horses in Itcha-Ilgachuz area
3 Energy production & mining						
3.1	Oil & gas drilling	Low	Small	Slight	High	<ul style="list-style-type: none"> • Primarily in Graham annual range
3.2	Mining & quarrying	Low	Small	Slight	High	<ul style="list-style-type: none"> • Proposed mine(s) in Tweedsmuir annual range • Proposed mineral exploration in Graham annual range • Coal deposits in Telkwa annual range • Significant mineral exploration and a possible mine in Takla annual range
3.3	Renewable energy	Low	Small	Moderate-Slight	High	<ul style="list-style-type: none"> • Windfarm potential in Graham annual range
4 Transportation & service corridors						
4.1	Roads & railroads	Medium	Pervasive	Moderate	High	<ul style="list-style-type: none"> • Expected expansion of roads due to logging and mountain pine beetle salvage logging, especially in Itcha-Ilgachuz, Tweedsmuir, Takla, Wolverine and Chase annual ranges, and potential increase in vehicle collisions
4.2	Utility & service lines	Negligible	Restricted	Negligible	High	<ul style="list-style-type: none"> • Proposed oil and gas pipelines in Graham, Chase, Wolverine, Takla and Telkwa annual ranges • Potential expansion of existing transmission lines • Potential development of new transmission lines to service new mining operations
5 Biological resource use						
5.1	Hunting & collecting terrestrial animals	Negligible	Pervasive	Negligible	High	<ul style="list-style-type: none"> • No licensed hunting except for Itcha-Ilgachuz, Chase and Wolverine subpopulations where there is a 5 point bull restriction • Some First Nations harvest • Some poaching

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
5.3	Logging & wood harvesting	Medium-low	Large	Moderate-slight	High	<ul style="list-style-type: none"> Increased forest harvesting expected on most annual ranges for mountain pine beetle salvage
6 Human intrusions & disturbance						
6.1	Recreational activities	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> Includes snowmobiling, all-terrain vehicle (ATV) use, backcountry skiing, hiking Snowmobiling is a concern for Itcha-Ilgachuz, Telkwa, Rainbow, Charlotte Alplands Increased levels of use are expected with an increased level of access created by industrial development, particularly mountain pine beetle salvage harvesting
6.3	Work & other activities	Negligible	Pervasive	Negligible	High	<ul style="list-style-type: none"> Ground surveys (e.g., geology, forestry), aerial surveys, etc.
7 Natural system modifications						
7.1	Fire & fire suppression	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> Fire is a natural disturbance on low elevation winter ranges
7.2	Dams and water management/use	Negligible	Small	Negligible	High	<ul style="list-style-type: none"> Tweedsmuir caribou migrate across the Nechako Reservoir where log debris can be extensive along some shorelines
7.3	Other ecosystem modifications	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> Increased populations of moose and deer due to habitat alteration Mountain pine beetle disturbance on most low elevation winter ranges and spruce bark beetle disturbance in some areas High incidence of pine rusts on some low elevation winter ranges; treatment is to drag scarify, which affects terrestrial lichens
8 Invasive & other problematic species & genes						
8.1	Invasive non-native/alien species	Unknown	Unknown	Unknown	Unknown	<ul style="list-style-type: none"> Potential for new animal diseases/parasites introduced from domestic animals, game farming or invading wildlife Very little is known about this threat
8.2	Problematic native species	High	Pervasive	Serious	High	<ul style="list-style-type: none"> Primary predators include wolves, bears, wolverines, cougars Increased predation expected due to: habitat alteration within and adjacent to annual ranges from industrial activities (forest harvesting, mining, windfarms, oil and gas) and infrastructure (pipelines, transmission lines) resulting in habitats favoured by other prey such as deer and moose, which in turn sustain higher numbers of predators; and facilitated access for predators into caribou annual ranges from expansion of roads and other linear infrastructure, and packed trails due to winter recreational activities
10 Geological events						
10.3	Avalanches/landslides	Low	Restricted	Slight	High	<ul style="list-style-type: none"> Avalanches are a concern for Telkwa, Chase, Wolverine and Takla

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
11 Climate change & severe weather						
11.1	Habitat shifting & alteration	Unknown	Unknown	Unknown	Unknown	• Expected increase in elevation for treeline and changes to low elevation habitats but actual change in vegetation structure not expected in the next 10 years
11.4	Storms and flooding	Unknown	Unknown	Unknown	Unknown	• Potential increased risk of thaw (or rain) then freezing events resulting in increased ice crusting and difficulty in accessing ground forage during winter

¹ Impact is calculated based on scope and severity. Categories include: very high, high, medium, low, unknown, negligible

² Scope is the proportion of the population that can reasonably be expected to be affected by the threat within the next 10 years. Categories include: Pervasive (71-100%); Large (31-70%); Restricted (11-30%); Small (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Large-Restricted = 11-70%).

³ Severity is, within the scope, the level of damage to the species (assessed as the % decline expected over the next three generations [27 years for southern mountain caribou]) due to threats that will occur in the next 10 years. Categories include: Extreme (71-100%); Serious (31-70%); Moderate (11-30%); Slight (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Moderate to slight = 1-30%).

⁴ Timing describes the immediacy of the threat. Categories include: High (continuing); Moderate (possibly in the short term [<10 years or three generations]); Low (possibly in the long term [>10 years or three generations]); Negligible (past or no direct effect); Unknown.

Table 6. Threats assessed for the Central Group of southern mountain caribou using the IUCN Threats Calculator.

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
1 Residential & commercial development						
1.3	Tourism & recreation areas	Low	Small	Slight	High	• Potential expansion of existing ski hills
3 Energy production & mining						
3.1	Oil & gas drilling	Low	Pervasive	Slight	High	• Extensive in Quintette, Narraway, Redrock/Prairie Creek, A La Peche
3.2	Mining & quarrying	Medium	Large	Moderate	High	• High coal potential; expected expansion of activities in Narraway, Quintette, Redrock/Prairie Creek, A La Peche, Burnt Pine
3.3	Renewable energy	Medium-Low	Large	Moderate-Slight	Moderate	• Windfarm potential on most annual ranges
4 Transportation & service corridors						
4.1	Roads & railroads	Low	Pervasive	Slight	High	• Expected expansion of roads due to oil and gas, mining and logging, leading to a potential increase in vehicle collisions (vehicle collisions already a problem for A La Peche on Hwy 40)
4.2	Utility & service lines	Negligible	Restricted	Negligible	High	• Proposed oil and gas pipelines within and adjacent to most annual ranges

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
						<ul style="list-style-type: none"> • Potential expansion of existing transmission lines • Potential development of new transmission lines to service new mining operations
5 Biological resource use						
5.1	Hunting & collecting terrestrial animals	Negligible	Pervasive-Large	Negligible	High	<ul style="list-style-type: none"> • No licensed hunting • Some First Nations harvest • Some poaching
5.3	Logging & wood harvesting	Medium-Low	Large	Moderate-Slight	High	<ul style="list-style-type: none"> • forest harvesting occurring within and adjacent to most annual ranges • expected increase in mountain pine beetle salvage on low elevation winter ranges
6 Human intrusions & disturbance						
6.1	Recreational activities	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> • Includes snowmobiling, all-terrain vehicle (ATV) use, backcountry skiing, hiking, fixed-wing and helicopter access into backcountry
6.3	Work & other activities	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> • Ground surveys (e.g., geology, forestry), aerial surveys, etc.
7 Natural system modifications						
7.1	Fire & fire suppression	Not calculated	Small	Moderate-Slight	Low	<ul style="list-style-type: none"> • Fire is a natural disturbance on low elevation winter ranges • Lower risk in high elevation winter ranges where fire disturbance is infrequent
7.2	Dams and water management/use	Negligible	Small	Negligible	High	<ul style="list-style-type: none"> • Williston Reservoir bisects a large part of the Scott annual range
7.3	Other ecosystem modifications	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> • Increased populations of moose and deer due to habitat alteration • Mountain pine beetle disturbance on most low elevation winter ranges
8 Invasive & other problematic species & genes						
8.1	Invasive non-native/alien species	Unknown	Unknown	Unknown	Moderate	<ul style="list-style-type: none"> • Potential infection of chronic wasting disease introduced via game farming
8.2	Problematic native species	Very High	Pervasive	Extreme	High	<ul style="list-style-type: none"> • Primary predators include wolves, bears, wolverines • Increased predation expected due to: habitat alteration within and adjacent to annual ranges from industrial activities (oil and gas, forest harvesting, mining, windfarms) and infrastructure (pipelines, transmission lines) resulting in habitats favoured by other prey such as deer and moose, which in turn sustain higher numbers of predators; and facilitated access for predators into caribou annual ranges from expansion of roads and other linear infrastructure, and packed trails due to winter recreational activities

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
9 Pollution						
9.6	Excess energy	Negligible	Pervasive	Negligible	High	• Noise from gas plants, etc. especially in Narraway, Quintette, Redrock/Prairie Creek, A La Pêche
10 Geological events						
10.3	Avalanches/landslides	Low	Small	Slight	High	• Avalanches have been responsible for about 6% of mortality in the Jasper subpopulations; the last 5 caribou in the Banff subpopulation were killed in a single avalanche
11 Climate change & severe weather						
11.1	Habitat shifting & alteration	Not calculated	Unknown	Unknown	Low	• Expected increase in elevation for treeline and changes to low elevation habitats but actual change in vegetation structure not expected in the next 10 years

¹ Impact is calculated based on scope and severity. Categories include: very high, high, medium, low, unknown, negligible

² Scope is the proportion of the population that can reasonably be expected to be affected by the threat within the next 10 years. Categories include: Pervasive (71-100%); Large (31-70%); Restricted (11-30%); Small (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Large-Restricted = 11-70%).

³ Severity is, within the scope, the level of damage to the species (assessed as the % decline expected over the next three generations [27 years for southern mountain caribou]) due to threats that will occur in the next 10 years. Categories include: Extreme (71-100%); Serious (31-70%); Moderate (11-30%); Slight (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Moderate to slight = 1-30%).

⁴ Timing describes the immediacy of the threat. Categories include: High (continuing); Moderate (possibly in the short term [<10 years or three generations]); Low (possibly in the long term [>10 years or three generations]); Negligible (past or no direct effect); Unknown.

Table 7. Threats assessed for the Southern Group of southern mountain caribou using the IUCN Threats Calculator.

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
2 Agriculture & aquaculture						
2.1	Annual & perennial non-timber crops	Negligible	Negligible	Slight	High	•
2.3	Livestock farming & ranching	Negligible	Small	Negligible	High	• Mostly due to horses; some cattle grazing
3 Energy production & mining						
3.1	Oil & gas drilling	Negligible	Negligible	Unknown	Moderate	• Shale gas potential in the Kootenays in the long term
3.2	Mining & quarrying	Low	Small	Moderate	High	• Mostly in the Barkerville, Kootenay and Kamloops areas
3.3	Renewable energy	Low	Restricted-Small	Moderate	Moderate	• Potential for independent power projects (e.g., run of the river) in the Columbia South and Columbia North annual ranges • Potential for wind-farms

4 Transportation & service corridors						
4.1	Roads & railroads	Medium-Low	Pervasive	Moderate-Slight	High	<ul style="list-style-type: none"> • Several subpopulations already cross busy roads (e.g., Highway 3, Mica Dam road) • Potential twinning of the Trans-Canada Highway
4.2	Utility & service lines	Low	Small	Slight	High	<ul style="list-style-type: none"> • Potential transmission lines for independent power projects • Potential twinning of the Kinder-Morgan oil pipeline • Proposed oil and gas pipelines in Hart Ranges annual range • Expansion of existing transmission lines • Potential development of new transmission lines to service new mining operations
5 Biological resource use						
5.1	Hunting and collecting terrestrial animals	Negligible	Pervasive	Negligible	High	<ul style="list-style-type: none"> • No licensed hunting • Potentially some First Nations harvest • Some poaching
5.3	Logging & wood harvesting	Medium-Low	Large-Restricted	Moderate-slight	High	<ul style="list-style-type: none"> • Most forest harvesting expected in valley bottoms but some high elevation habitat will also be affected, especially in the Barkerville, Columbia North, Columbia South, Frisby-Boulder and Central Rockies annual range
6 Human intrusions & disturbance						
6.1	Recreational activities	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> • Includes snowmobiling, heli-skiing (including flight paths to and from ski areas), cat-assisted skiing, all-terrain vehicle (ATV) use, backcountry skiing, hiking • Primary concerns are snowmobiling and heli-skiing with some subpopulations exposed to both
6.2	War, civil unrest & military exercises	Negligible	Negligible	Serious-Moderate	High	<ul style="list-style-type: none"> • Mt Revelstoke/Glacier areas military run avalanche control
6.3	Work & other activities	Negligible	Large	Negligible	High	<ul style="list-style-type: none"> • Ground surveys (e.g., geology, forestry), aerial surveys, avalanche control, etc.
7 Natural system modifications						
7.1	Fire & fire suppression	Low	Small	Moderate-slight	High	<ul style="list-style-type: none"> • Generally lower risk in high elevation winter ranges where fire disturbance is infrequent; however, several large fires have burned high elevation range in the southern area
7.2	Dams and water management/use	Negligible	Small	Negligible	High	<ul style="list-style-type: none"> • Existing reservoirs may reduce dispersal
7.3	Other ecosystem modifications	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> • Increased populations of moose and deer due to habitat alteration • Some concern about mountain pine beetle and spruce bark beetle disturbance at low elevations

						<ul style="list-style-type: none"> Subalpine fir beetle and 2-year cycle spruce budworm in Barkerville and Wells Gray
8 Invasive & other problematic species & genes						
8.2	Problematic native species	Very High	Pervasive	Extreme	High	<ul style="list-style-type: none"> Primary predators include wolves, bears, wolverines, cougars Increased predation expected due to: habitat alteration within and adjacent to annual ranges from industrial activities (forest harvesting, mining) and infrastructure (pipelines, transmission lines) resulting in habitats favoured by other prey such as deer and moose, which in turn sustain higher numbers of predators; and facilitated access for predators into caribou annual ranges from expansion of roads and other linear infrastructure, and packed trails due to winter recreational activities
10 Geological events						
10.3	Avalanches/landslides	Medium	Large	Moderate	High	<ul style="list-style-type: none"> Avalanches have been responsible for up to 15% of mortalities in the Columbia North, Columbia South, Frisby-Boulder and Central Rockies
11 Climate change & severe weather						
11.1	Habitat shifting & alteration	Unknown	Pervasive	Unknown	High	<ul style="list-style-type: none"> Expected increase in elevation for treeline and changes to low elevation habitats but actual change in vegetation structure not expected in the next 10 years

¹ Impact is calculated based on scope and severity. Categories include: very high, high, medium, low, unknown, negligible

² Scope is the proportion of the species that can reasonably be expected to be affected by the threat within the next 10 years. Categories include: Pervasive (71-100%); Large (31-70%); Restricted (11-30%); Small (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Large-Restricted = 11-70%).

³ Severity is, within the scope, the level of damage to the species (assessed as the % decline expected over the next three generations [27 years for southern mountain caribou]) due to threats that will occur in the next 10 years. Categories include: Extreme (71-100%); Serious (31-70%); Moderate (11-30%); Slight (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Moderate to slight = 1-30%).

⁴ Timing describes the immediacy of the threat. Categories include: High (continuing); Moderate (possibly in the short term [<10 years or three generations]); Low (possibly in the long term [>10 years or three generations]); Negligible (past or no direct effect); Unknown.

4.2 Description of Threats

Threats are described below in descending order of direct impact to southern mountain caribou population trend (Tables 5-7).

4.2.1 Predation

(IUCN# 8.2 Problematic native species)

The most significant, immediate direct threat to all three Groups of southern mountain caribou is unsustainable predation. Increased predator abundance has resulted from habitat alteration due to industrial activities (Tables 5-7). Industrial activities such as forest harvesting, mining and mineral exploration and development, and oil and gas exploration and development remove or destroy southern mountain caribou habitat (mature and old forests) and create early seral⁴ habitats favoured by other prey species such as moose and deer. Since wolf populations are sustained by moose and deer (Seip 1992b, Stotyn 2008, Williamson-Ehlers 2012), increased numbers of those prey species support higher numbers of wolves than would occur naturally in ecosystems dominated by older forests. Although southern mountain caribou may not be the main target prey species, they are taken opportunistically when encountered. In ranges with habitat alterations that provide favourable conditions for other prey species, predators such as wolves can increase in number, which can significantly reduce or even eliminate southern mountain caribou subpopulations (Seip 1991; Seip 1992; Wittmer et al. 2005b).

Predation risk is also affected by roads and linear features associated with industrial and recreational activities. In the Central Group, encounter rates between wolves and caribou increased with proximity to linear features (Whittington et al. 2011). In the Southern Group, wolf predation on caribou occurs in association with roads at the fine scale (Apps et al. 2013).

Wolves are the primary predator of southern mountain caribou (Edmonds 1988, Seip 1992b, McNay 2009, Whittington et al. 2011), but bears (*Ursus* sp.), cougars and wolverine (*Gulo gulo*) can be locally and/or seasonally important. Cougars and bears are a significant source of mortality for some subpopulations in the Southern Group (Kinley and Apps 2001, Wittmer et al. 2005b, Stotyn 2008) and bear and wolverine predation are important sources of mortality in some Northern Group subpopulations (Cichowski and MacLean 2005, McNay 2009).

4.2.2 Industrial activities (habitat alteration)

(IUCN #3.1 Oil and gas drilling, 3.2 Mining and quarrying, 3.3 Renewable Energy, 5.3 Logging and Wood Harvesting)

Although the impacts of industrial activities do not generally result in direct mortality of southern mountain caribou, indirect impacts include facilitated movement of predators through caribou annual ranges and altered predator/prey dynamics due to habitat alteration, which lead to

⁴ early seral refers to the condition of habitat that occurs directly after disturbance; early seral habitats are generally composed of grasses, forbs, shrubs and seedling trees.

increased predation rates on caribou. Where infrastructure is involved (e.g., open pit mines, roads) or habitat is converted to other uses (e.g., agriculture), habitat alteration is essentially permanent. Fire-adapted forest habitat can take 60-80 years to recover following a harvest. More than 100 years may be required for high elevation subalpine habitat or low elevation cedar-hemlock forests to once again become suitable habitat for southern mountain caribou. For the Southern Group, forest harvesting not only converts old and mature forests in to young forests, but in many areas, low elevation cedar/hemlock stands are being converted to pine, spruce or Douglas fir (*Pseudotsuga menziesii*). Industrial activities can also affect caribou directly through impacts on forage lichens (Kranrod 1996, Sulyma 2001, Miège et al. 2001, Stevenson and Coxson 2007).

Habitat alteration resulting from industrial activities on southern mountain caribou annual ranges has been linked to: reduced spatial separation between caribou and other prey or predators (Peters 2010); reduced occupancy (Smith et al. 2000, Apps and McLellan 2006, Wittmer et al. 2007); reduced adult caribou survival (Smith 2004, Wittmer et al. 2007); and population declines (Wittmer et al. 2007).

The effects of habitat alteration due to industrial activities may reduce the viability of a southern mountain caribou subpopulation through increased predation rates within caribou annual ranges or displacement of caribou to areas of higher predation risk. This could lead to a reduction in the size of the annual range and potentially result in the extirpation of a subpopulation. In any given annual range, habitat alteration due to industrial activities reduces the suitability of adjacent habitat (Smith et al. 2000; Williamson-Ehlers 2012). In some cases southern mountain caribou may use areas of inadequate or degraded habitat (e.g., buffer habitat surrounding certain types of development), particularly in highly disturbed annual ranges where opportunities for movement to suitable undisturbed habitat are limited or unavailable (Williamson-Ehlers et al. 2013). In these situations southern mountain caribou are at a higher mortality risk. In addition, large-scale industrial disturbances to the landscape (e.g., widespread forest harvesting) can cause southern mountain caribou to discontinue their use of portions of the range (Smith et al. 2000).

Forest harvesting and mineral exploration and development are the primary industrial activities that affect southern mountain caribou. For the Northern Group and some subpopulations in the Central Group, salvage harvesting of mountain pine beetle-killed stands and mid-term timber supply issues are contributing to increased pressure to harvest within or directly adjacent to important caribou habitat. Coal exploration and development, oil and gas exploration and development, and wind-farms are primarily a threat to subpopulations in the Central Group, but wind-farms have also been proposed in subpopulation annual ranges in the Southern Group. In addition, independent power projects (IPPs) have been proposed in some areas in the Southern Group. These IPPs will affect low elevation spring and early winter ranges in cedar-hemlock forests.

4.2.3 Roads and other linear features

(IUCN # 4.1 Roads and railroads, 4.2 Utility and service lines)

Roads impact caribou directly through vehicle collisions and increased access for regulated and unregulated hunting (Brown and Ross 1994). Mortality due to vehicle collisions has been an issue for the A La Peche subpopulation in the Central Group, and for the South Selkirk and Columbia North subpopulations in the Southern Group, but most southern mountain caribou subpopulations experience no or extremely low levels of this type of mortality.

Roads and linear features such as pipelines, seismic lines, and hydro transmission lines also affect southern mountain caribou indirectly through habitat fragmentation and potentially by improving the efficiency of movement for some predators. Linear features can also support permanent early seral habitat favoured by other prey species. For example, grass seeding on road and transmission line right-of-ways provides forage for other prey species. Southern mountain caribou avoid roads and other linear features (Oberg 2001, Hebblewhite et al. 2010a, DeCesare et al. 2012, Williamson-Ehlers 2012) and avoidance extends well beyond the actual development footprint (Williamson-Ehlers et al. 2013).

4.2.4 Recreational activities

(IUCN #6.1 Recreational activities)

Recreational activities that affect southern mountain caribou include: snowmobiling, heli-skiing, cat-assisted skiing, alpine/downhill skiing, backcountry skiing/snowshoeing, ATV use, hiking, hunting of southern mountain caribou (Itcha-Ilgachuz, Wolverine, Chase), and hunting of other species within southern mountain caribou annual ranges. Recreational activities can affect caribou through displacement (Wilson and Hamilton 2003, Powell 2004, Seip et al. 2007), increased levels of stress (Freeman 2008), creation of packed trails during winter that facilitate predator access to caribou habitat (Powell 2004), and increased vigilance and movement after human-caused sensory disturbance (Powell 2004). Displacement could force caribou into areas where mortality risk is higher. In the Southern Group, caribou were absent from an area that had extensive snowmobile use, even though the area contained high quality caribou habitat (Seip et al. 2007). Increased levels of stress hormones have been found in caribou up to 10 km away from winter recreational activities (Freeman 2008). Continued stress could lead to poor body condition and potentially lower survival and reproductive rates (Simpson and Terry 2000).

Environmental conditions can affect how caribou react to recreational activities. In Scandinavia, reindeer favoured areas of insect relief that were located far from human activity, but used insect relief areas where hiking levels were high if they did not have access to insect relief areas that were far from human activity (Skarin et al. 2004, Vistnes et al. 2008). In Newfoundland, during deep snow years, caribou responded more slowly and waited until snowmobiles were closer to them before fleeing than during lower snow years, presumably to conserve energy during years when it took more energy to move and food was less available (Mahoney et al. 2001).

Snowmobiling and heli-skiing are significant recreational activities that impact southern mountain caribou in the Southern Group. Snowmobiling is also a significant activity that impacts many subpopulations in the Central and Northern groups.

4.2.5 Natural disturbances (habitat alteration)

(IUCN #7.1 Fire and fire suppression, 7.3 Other ecosystem modifications)

Fire and forest insects are the primary natural disturbance on low elevation winter ranges of southern mountain caribou in the Northern and Central groups. Fire can directly alter habitat through loss of mature conifer stands, lichens and other forage plants, and by creating barriers to movement. Indirectly, fire converts mature and old forests into early seral habitat favoured by moose and deer. Historically, when disturbance from a wildfire occurred, southern mountain caribou would shift their use of habitat from affected areas to areas that were more suitable. However, with the increase in industrial activities in most annual ranges there are fewer suitable areas available into which southern mountain caribou can move. When combined with human-caused habitat alteration, fire can threaten southern mountain caribou recovery even though it is a natural component of the forest ecosystem.

The recent mountain pine beetle (*Dendroctonus ponderosae*) epidemic has affected most low elevation winter ranges of southern mountain caribou in the Northern and Central groups. Mountain pine beetles attack mature pine stands, which are used by caribou during winter. Although initially dwarf shrub abundance increased and terrestrial lichen abundance declined following mountain pine beetle attack (Cichowski et al. 2008, 2009, Seip and Jones 2010, Waterhouse 2011), abundance of dwarf shrubs has since declined and terrestrial lichen abundance has increased slightly (Cichowski and Haeussler 2013). Despite reduced terrestrial lichen abundance and a reduced canopy, southern mountain caribou continue to use beetle-killed stands to crater for terrestrial lichens (Cichowski 2010, Seip and Jones 2010). Continued research is needed to follow the ecosystem changes and caribou response to those changes as trees start to fall.

Pine rusts are also a concern on some low elevation winter ranges. The treatment for pine rusts is drag scarification (i.e. mechanical disruption of the forest floor), which impacts terrestrial lichens.

4.2.6 Hunting

(IUCN #5.1 Hunting and collecting terrestrial animals)

Licensed hunting is closed for southern mountain caribou, with the exception of three Northern Group subpopulations (Chase, Wolverine, Itcha-Ilgachuz). Hunting for those subpopulations is regulated using hunting season length and a minimum 5-point bull size restriction. First Nations subsistence hunting occurs in some areas. The extent of unlicensed hunting is not known but suspected to be low for most subpopulations.

4.2.7 Other Threats

Other threats that have a lower level of concern for all southern mountain caribou (although they may be of greater concern for individual subpopulations) include:

Climate change (IUCN# 11.1 Climate change – habitat shifting and alteration): The long-term effects of climate change and the implications on southern mountain caribou and their habitat are unknown. Greater weather variability and severe weather events are expected to increase with climate change and are likely to: increase the frequency and severity of wildfires and forest insect outbreaks; cause more freeze-thaw cycles, freezing rain, deep snow, and hot summer temperatures; and, result in changes to forest composition and food supply (Vors and Boyce 2009). Although climate change is not expected to result in major habitat shifts in the short term, climate-related changes in habitat are expected to favour deer and other prey species, thereby increasing predator populations and predation on southern mountain caribou, and facilitating the spread of diseases and parasites. Climate change may result in habitat change for southern mountain caribou, as it drives sub-boreal forests to shift northwards and subalpine forests to shift upslope, which could potentially negatively affect caribou in the long term. However, impacts of climate change on southern mountain caribou in the short term are expected to be low compared to other immediate threats faced by southern mountain caribou.

Avalanches (IUCN# 10.3 Avalanches/landslides): Avalanches are a known cause of southern mountain caribou mortality, especially in the Southern Group. In the Central Group, the last five caribou in the Banff subpopulation were killed in an avalanche in 2009 (Hebblewhite et al. 2010b), and an avalanche killed some caribou in the Brazeau subpopulation. In the Northern Group, at least three avalanche related mortalities have been noted for the Telkwa subpopulation (BC Ministry of Forests, Lands and Natural Resource Operations, unpublished data).

Parasites and Diseases (IUCN# 8.1 Invasive non-native/alien species): Viral, parasitic, and bacterial diseases can affect individual southern mountain caribou and may have effects at the subpopulation level, although it is not thought to be one of the major threats currently affecting southern mountain caribou.

Noise and Light Disturbance (IUCN# 9.6 Excess energy): Noise and light disturbance result in short-term behavioural and physiological responses of individual southern mountain caribou, including a startle response, elevated heart rate, and increased production of stress hormones. Sustained or repeated disturbance can result in avoidance of areas and the reduction in use of suitable habitat. Continued stress could lead to poor body condition and potentially lower survival and reproductive rates (Simpson and Terry 2000).

5 POPULATION AND DISTRIBUTION OBJECTIVES

5.1 Recovery Goal

The recovery goal for southern mountain caribou is to achieve self-sustaining populations in all LPUs within their current distribution.

The recovery goal reflects the best available information. Recovery for southern mountain caribou focuses on the LPU rather than the subpopulation because LPUs address the fragmented distribution of currently recognized subpopulations, and the need for connectivity between subpopulations. Though the scale for planning the recovery of southern mountain caribou is based on the LPUs, the recovery goal and objectives (below) intend to maintain each subpopulation that is currently recognized, including those subpopulations that were extirpated since the last COSEWIC assessment in 2002.

The number of caribou in most LPUs has recently declined and the potential for annual ranges within LPUs to support caribou is thought to be higher than that reflected by current population sizes. The current population estimate for southern mountain caribou is approximately 5,800 caribou. This recovery strategy sets overall population targets based on recent capacity of annual ranges to support caribou, with those targets being: 4,600 caribou for the Northern Group, 2,000 caribou for the Central Group, and 2,500 caribou for the Southern Group – a total of 9,100 caribou. This represents a more than 50% increase in numbers from the current total population estimate. Population targets may be revised upwards in the future should the evidence supports such a revision.

Achieving the recovery goal should allow for sufficiently large LPU population levels to sustain traditional Aboriginal harvesting activities, consistent with existing Aboriginal and treaty rights of Aboriginal peoples of Canada. Feedback received from Aboriginal communities indicated strong support for the restoration of their traditional uses of caribou.

The recovery of southern mountain caribou is biologically and technically feasible, although it may be difficult in some LPUs; particularly recently extirpated subpopulations and those which have significant disturbance within their annual range.

Aboriginal groups and others have expressed to Environment Canada that recovery of southern mountain caribou must include the expansion of their current distribution into geographic areas that were historically occupied. Considering the changes to forest habitats within those areas, the predator/prey dynamics within them, and the amount of human development and activity occurring, such an expansion will be very difficult to accomplish. Future consideration will be given to pursuing the expansion into non-occupied areas in additional recovery planning, through an updated recovery strategy or through action plans; however, any opportunity to expand distribution will be dependent upon first achieving the objectives of this recovery strategy.

5.2 Population and Distribution Objectives

To guide recovery efforts, the population and distribution objectives are, to the extent possible, to:

- stop the decline in both size and distribution of all LPUs;
- maintain the current distribution within each LPU; and
- increase the size of all LPUs to self-sustaining levels and, where appropriate and attainable, to levels which can sustain a harvest with dedicated or priority access to aboriginal peoples.

LPU are considered to be “self-sustaining” when:

- the LPU on average demonstrates stable or positive population growth over the short term (≤ 20 years), and is large enough to withstand random events and persist over the long term (≥ 50 years), without the need for ongoing active management intervention; and,
- there is an increase to at least 100 caribou within LPUs that currently consist of fewer than 100 caribou, and there is no reduction in the number of caribou within LPUs that currently consist of over 100 caribou.

Given that LPUs are expected to vary considerably in their potential rate of recovery, immediate effort is required to determine more specific population size targets over the above timeframes at the LPU scale, including desired sizes larger than 100 animals (e.g., > 300 animals where that may be possible).

5.3 Timelines to Recovery

Southern mountain caribou exist in mature forest ecosystems that evolved over centuries, and that in turn take decades to recover from habitat alteration. Reversing ecological processes detrimental to southern mountain 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 timeframes in excess of 50 to 100 years. Given these realities, while it is currently biologically and technically feasible to recover all LPUs under the best efforts of all parties, some LPUs are unlikely to return to self-sustaining status for a number of decades.

For several southern mountain caribou LPUs, 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).

5.4 Prioritizing Recovery Actions and Managing Risk

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

Action planning will consider a multitude of information and factors, such as regional ecological conditions, LPU size and trend, caribou movement between annual ranges and between LPUs, habitat condition between annual ranges and between LPUs, distribution of resources for restoration efforts, and others. In prioritizing recovery actions, consideration should be given to the current risk of extirpation of a LPU, the length of time to achieve self-sustaining status, ecological needs of connectivity, representativeness and redundancy, as well as population and

habitat conditions. Consideration should also be given to insuring the return to a harvestable surplus of caribou to be reincorporated into the “seasonal rounds” of hunting, gathering and other resource use by First Nations and Metis people in BC and Alberta (McNay et al. 2013).

For southern mountain caribou LPUs that are declining, stabilizing the LPU by halting its decline will require immediate action. Although certain LPUs with fewer than 100 animals may be stable and persist over the short term where adequate suitable habitat is available, the long-term persistence of caribou in those LPUs is less certain. In some instances, continued human intervention may be required to achieve the minimum target of 100 animals. For the Southern and Central groups, if a LPU becomes extirpated, recovery of the LPU will need to be achieved by increasing neighbouring LPUs such that they expand into the areas where caribou have been extirpated, or by reintroduction. Currently, none of the LPUs within those two groups is viable enough to sustain removals of animals for augmentations or re-introductions to other LPUs, but sufficient numbers may be achievable via captive breeding.

6 BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Currently Underway

Federal and provincial governments, Aboriginal people, non-government organizations, and affected industries in BC and Alberta have taken a range of actions to manage and protect southern mountain caribou and their habitats. Examples of actions already completed or currently underway include:

- identification and delineation of southern mountain caribou ranges and habitats within ranges;
- assessment of the population size and/or trend and/or distribution of subpopulations of southern mountain caribou in Canada and straddling the Canada-U.S. border;
- consideration of southern mountain caribou habitat requirements when planning and implementing forest harvesting and other industrial activities, including prohibition of forest harvesting and road building activities in 2.2 million ha (e.g. Ungulate Winter Ranges, protected areas) to protect high suitability habitat for southern mountain caribou in the Southern Group in BC;
- consideration of southern mountain caribou habitat when planning and implementing prescribed fires in national parks and on other lands, including conducting prescribed fires in areas away from caribou habitat to maintain a safe distance between caribou and predators;
- closure to snowmobiling of 1 million ha of high elevation habitat within ranges of southern mountain caribou in the Southern Group in BC;
- development and implementation of operating procedures for helicopter and snowcat skiing in southern mountain caribou in the Southern Group in BC;

- cessation of the setting of early season ski tracks that lead into caribou winter range, and periodic seasonal trail and road closures in national parks;
- development and implementation of operating guidelines for industrial development within southern mountain caribou ranges;
- land-use planning to identify areas within southern mountain caribou ranges where southern mountain caribou conservation is prioritized;
- voluntary cessation of hunting by Aboriginal people;
- preparation of the Action Plan for the Klinse-Za Herd of Woodland Caribou (part of the Pine River LPU) by the West Moberly First Nations;
- hunting closures for most southern mountain caribou subpopulations and restrictions in areas that remain open to hunting;
- reduced speed zones on highways in important caribou habitat;
- predator and alternate prey management projects in some ranges where subpopulations of southern mountain caribou are declining;
- population augmentation through translocations and reduction of early calf mortality through maternal penning;
- development of cooperative stewardship agreements, memoranda of understanding, and activities to support the engagement of Aboriginal organizations, recreational stakeholders, and other stakeholders in the monitoring, management, and conservation of southern mountain caribou;
- incorporation of strategies to minimize recreational disturbance to caribou in provincial park management plans;
- preparation of outreach materials on southern mountain caribou and dissemination to interest groups, recreational organizations, and the general public;
- education of park visitors on how to avoid disturbing caribou; and,
- research on southern mountain caribou ranges, habitat, ecology and limiting factors.

Collectively, these actions, and the level of commitment associated with these actions, are an encouraging foundation upon which to build.

Table 8 outlines the status of provincial and federal planning initiatives for southern mountain caribou. In addition, the US Fish and Wildlife Service developed a recovery plan for the South Selkirk subpopulation for the US portion of their annual range (US Fish and Wildlife Service 1993). Existing direction from the provincial and federal planning initiatives that is consistent with the recovery of southern mountain caribou has been taken into consideration in this recovery strategy.

Table 8. Status of southern mountain caribou recovery planning in provincial and federal jurisdictions where southern mountain caribou occur.

Provincial/ Federal Jurisdiction	Recovery Document	Recovery Objective
BC	<ul style="list-style-type: none"> • A Strategy for the Recovery of Mountain Caribou in BC (2002) 	<ul style="list-style-type: none"> • A viable metapopulation of 2,500-3,000 mountain caribou distributed throughout their current range in BC.
	<ul style="list-style-type: none"> • Implementation Plan for the Ongoing Management of Southern mountain caribou in BC, 2011 (Southern Group) 	<ul style="list-style-type: none"> • Decrease rate of decline • Reduce risk of extirpation for four populations within 50 years
	<ul style="list-style-type: none"> • Implementation Plan for the Ongoing Management of South Peace Northern Caribou (<i>Rangifer tarandus caribou</i> pop. 15) in BC, 2013 (Northern and Central Groups) 	<ul style="list-style-type: none"> • Increase the population of the South Peace populations of mountain caribou to $\geq 1,200$ animals within 21 years.
Alberta	<ul style="list-style-type: none"> • A Woodland Caribou Policy for Alberta, June 2011 (Central Group) 	<ul style="list-style-type: none"> • Self-sustaining populations and maintain distribution
	<ul style="list-style-type: none"> • Alberta Woodland Caribou Recovery Plan, 2004/5 – 2013/14 (Central Group) 	<ul style="list-style-type: none"> • Ensure long-term habitat requirements within ranges
Federal	<ul style="list-style-type: none"> • Conservation Strategy for Southern Mountain Caribou in Mountain National Parks, November 2011 (Central Group, Southern Group) 	<ul style="list-style-type: none"> • Achieve an ecologically functioning local population of southern mountain caribou in Banff and Jasper National Parks through maintenance of herds of 25-40 animals within historic range within and adjacent to the parks and ecologically connected to adjacent populations. • Maintain Southern Mountain caribou on the landscape in and around Mount Revelstoke and Glacier National Parks
	<ul style="list-style-type: none"> • Technical Compendium to the Conservation Strategy for Woodland Caribou (<i>Rangifer tarandus caribou</i>), Southern Mountain Population, on Parks Canada Lands, September 2011 (Central Group, Southern Group) 	<p>Jasper:</p> <ul style="list-style-type: none"> • Increase or maintain local populations of southern mountain caribou to a level that restores natural population processes (e.g., dispersal, migration). • Maintain at least 500 southern mountain caribou in Jasper National Park over the next 100 years, spread among the 4 currently occupied regions in the park. <p>Banff:</p> <ul style="list-style-type: none"> • Achieve a local population of 25-40 southern mountain caribou in the short term (10-15 years) within current and historic range in and adjacent to Banff National Park, including the North Saskatchewan drainage south to the Trans-Canada Highway, the Siffleur Wilderness area and adjacent provincial lands.

		<ul style="list-style-type: none"> • Maintain the local population of 25-40 southern mountain caribou over the long term (15-50 years), with occurrence of interchange of animals between local population in Banff and south Jasper National Parks. <p>Mount Revelstoke and Glacier:</p> <ul style="list-style-type: none"> • In collaboration with partners, maintain caribou persistence. • In collaboration with partners, maintain and/or increase connectivity of caribou habitat.
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6.2 Strategic Direction for Recovery

Table 9 and the following narrative describe the broad strategies and general approaches, as well as research and management activities needed to achieve the population and distribution objectives for southern mountain caribou. Strategies and approaches are often interrelated and details on their implementation and their level of priority will differ by LPU and habitat condition. Timing of specific recovery actions and their level of priority will be outlined and addressed in subsequent action plans (see Section 9). The overall approach is to conduct population management actions in the short term, concurrent with habitat restoration activities, until suitable habitat is restored. To achieve the population and distribution objective “to stop the decline in both size and distribution of all LPUs”, immediate action is required on strategies that have been prioritized as “urgent” in Table 9.

Table 9. Recovery planning table for southern mountain caribou

Threat or Limitation	Priority ¹	Broad Strategy to Recovery	General Description of Research and Management Approaches
Mortality and Population Management			
Predation	Urgent	Manage predators and primary prey	<ul style="list-style-type: none"> • Where necessary, apply predator management as a management tool coordinated with other management approaches (e.g., habitat restoration and management, management of primary prey populations), to achieve southern mountain caribou LPU growth. • Focus predator management on wolves for all LPUs, and on cougars for those LPUs where cougar predation is a significant mortality factor • Consider effective indirect predator management techniques as an alternative to direct predator management (e.g., maternal penning) to protect newborn calves in selected southern mountain caribou subpopulations in combination with an effective wolf control strategy to manage predation once the caribou cows and calves are released. • Where predator management and indirect predator management techniques are being implemented, monitor and

Threat or Limitation	Priority ¹	Broad Strategy to Recovery	General Description of Research and Management Approaches
			conduct research on effects on southern mountain caribou subpopulations, and consider monitoring the effects on other impacted species.
Hunting	Medium	Manage direct human-caused mortality of southern mountain caribou	<ul style="list-style-type: none"> • Determine the extent of current hunting where it occurs, and the effects of hunting on southern mountain caribou LPUs. • In consultation with Aboriginal people, develop and implement harvest strategies, where required to achieve southern mountain caribou recovery. • Assess and address impacts of hunting regulations for all southern mountain caribou annual ranges that overlap with other legally hunted Woodland Caribou ecotypes. • Reduce illegal hunting through stewardship, education and enforcement.
Roads and linear features	Medium	Manage vehicular traffic and road maintenance	<ul style="list-style-type: none"> • Where applicable, develop highway zoning and operations guidelines to minimize potential collisions between caribou and vehicles
Small LPU size	Medium	Augment / reintroduce caribou	<ul style="list-style-type: none"> • Consider augmenting LPUs if caribou are available from viable source LPUs or captive breeding programs. • Consider reintroducing caribou into currently unoccupied areas if threats have been addressed and caribou are available from viable source LPUs or captive breeding programs.
Landscape Level Planning			
Predation Industrial activities (habitat alteration) Roads and linear features Natural disturbance (habitat alteration)	Urgent	Undertake landscape level protection and planning that considers current and future southern mountain caribou habitat requirements	<ul style="list-style-type: none"> • Develop action plans, at minimum one for each Group, that outline population and habitat management activities with measurable targets to achieve the recovery goal. • Undertake coordinated land and/or resource planning to ensure that all development activities are planned (type, amount, and distribution), coordinated (e.g., conducted at the same time in a geographic area), and implemented at appropriate spatial and temporal scales (e.g., consider sensitive periods/areas such as movements between seasonal ranges, calving, etc.) and in a manner that protects southern mountain caribou critical habitat. • Plan to maintain and restore habitat within and between southern mountain caribou annual ranges, to maintain connectivity where required. • Undertake coordinated planning among provincial, federal and international jurisdictions that jointly manage LPUs (i.e., provincial trans-boundary LPUs, provincial-National Parks, Canada-U.S boundary) to reach agreement on the overall strategic direction for LPU recovery. • Develop cumulative effects assessment approaches that are appropriate for southern mountain caribou LPUs. (E.g. southern mountain caribou LPUs on the west-side of the Rocky Mountain divide may require different approaches than LPUs on the east-side because of the different patterns of

Threat or Limitation	Priority ¹	Broad Strategy to Recovery	General Description of Research and Management Approaches
			seasonal range use by LPU's utilizing the west vs. east-slopes.) <ul style="list-style-type: none"> Communicate among governments, Aboriginal communities and organizations, non-governmental organizations, and other organizations responsible for land and/or resource management and/or conservation within the southern mountain caribou LPU's to ensure coordination of planning and management and, where applicable, facilitate cross-jurisdictional cooperation and implementation.
Habitat Management			
Predation Industrial activities (habitat alteration) Roads and linear features Natural disturbance (habitat alteration)	Urgent	Manage habitat to meet current and future habitat requirements of southern mountain caribou	<ul style="list-style-type: none"> Protect key high elevation summer (spring, calving, summer, fall/rut) and winter critical habitat for southern mountain caribou through appropriate habitat management and protection mechanisms (e.g., legislated protected areas, no development zones, and conservation agreements). Undertake coordinated actions to reclaim southern mountain caribou habitat in all currently utilized seasonal ranges through restoration efforts (e.g., restore industrial landscape features such as roads, old seismic lines, pipelines, cut-lines, temporary roads, cleared areas; reconnect fragmented annual ranges) to make it less suitable for other prey species. Measure and monitor habitat alteration to southern mountain caribou habitat. Update action plans to reflect changes in habitat condition. Where seasonal ranges are highly altered, identify areas that will be prioritized for southern mountain caribou recovery and targeted for early habitat reclamation. Incorporate management guidelines and actions into permitting conditions for activities identified as affecting southern mountain caribou or their habitat. For LPU's that are jointly managed (i.e., provincial transboundary, international transboundary), undertake collaborative management among responsible federal, provincial and international jurisdictions and agencies to ensure equitable efforts are underway. Encourage stewardship of southern mountain caribou habitat among industries, interest groups, and Aboriginal communities and organizations. Assess the impact of natural disturbance (e.g., forest fire, mountain pine beetle, pine rusts) on the long-term habitat management of southern mountain caribou annual ranges. Where necessary, incorporate short- and long-term southern mountain caribou habitat considerations, along with other considerations, into fire management and silvicultural planning. Monitor habitat and use adaptive management to assess progress and adjust management activities as appropriate.

Threat or Limitation	Priority ¹	Broad Strategy to Recovery	General Description of Research and Management Approaches
Managing Recreational Activities			
Recreational activities Predation	Urgent	Manage access and timing of recreational activities in caribou habitat to minimize trails and caribou displacement.	<ul style="list-style-type: none"> Assess effectiveness of current regulations and guidelines in minimizing the impacts of recreational users on caribou. Where needed, in consultation with recreational stakeholder groups, the public, and provincial and federal agencies, develop recreational use plans that minimize impacts on, and facilitate recovery of caribou.
Population Monitoring			
Knowledge gaps: Population dynamics (trends, size, structure, and distribution)	Urgent	Conduct population studies and research to better understand population structure, trends and distribution	<ul style="list-style-type: none"> Refine understanding of the structure and functioning of southern mountain caribou subpopulations and LPUs, by conducting combined analyses of phylogeographic and subpopulation genetic structure that include all southern mountain caribou. Collect population information (size, trend, etc.) for a minimum of two years in LPUs where population condition is unknown, or has not been collected for more than five years. Establish a baseline population size and trend (i.e., population condition) estimate for each LPU. Monitor population size and/or trend, as well as changes in southern mountain caribou distribution over time and in relation to habitat condition and disturbance. Coordinate data collection, data-sharing, and planning between or among neighbouring federal, provincial and international jurisdictions to establish and refine transboundary LPUs where appropriate. Conduct operational trials of mortality management (e.g. maternal penning) and where feasible population enhancement (augmentation) options to test risks and effectiveness.
Knowledge gaps: climate change	Medium	Assess effects of climate change on caribou health and habitat conditions	<ul style="list-style-type: none"> Coordinate monitoring of climate-related habitat disturbances with provincial and federal programs assessing ecosystem vulnerability to climate change to develop a better understanding of the habitat conditions on each annual range. Assess the potential for climate-related northward expansion and/or increased prevalence/intensity of existing and novel diseases and parasites that could affect individual caribou health.
Knowledge gaps: southern mountain caribou sensory disturbance	Medium	Monitor and manage sensory disturbance of southern mountain 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 the equipment associated with industrial exploration and development) on southern mountain caribou, and reduce its effects, particularly during sensitive periods (e.g., seasonal range migrations, calving).

Threat or Limitation	Priority ¹	Broad Strategy to Recovery	General Description of Research and Management Approaches
			<ul style="list-style-type: none"> Minimize sensory disturbance to southern mountain caribou during monitoring and research programs, and select monitoring and research techniques that are the least intrusive.
Knowledge gaps: southern mountain caribou health and condition	Low-medium	Monitor southern mountain caribou health and condition	<ul style="list-style-type: none"> Gather information on the health and body condition of individual southern mountain caribou when handling animals or investigating mortalities.

¹ Priority reflects the level of priority of the broad strategy for all southern mountain caribou. This priority for each LPU may differ.

6.3 Narrative to Support the Recovery Planning Table

Recovery of southern mountain caribou will require commitment, collaboration and cooperation among federal, provincial and international jurisdictions, Aboriginal people, local communities, landowners, industry and other interested parties. It will be important to monitor habitat conditions and the distribution, size and trends of southern mountain caribou LPUs so that the effectiveness of management regimes can be evaluated and adjusted as necessary. It will take time for the impact of human developments and natural disturbances and population and habitat restoration activities to become evident. Therefore, action plans must take into account the likelihood of a delayed response in southern mountain caribou numbers and distribution to human-caused or natural habitat alterations and restoration activities, and include short-term management actions to prevent further declines.

6.3.1 Mortality and Population Management

6.3.1.1 *Manage Predators and Their Primary Prey*

Human-induced habitat alterations have created favourable conditions for other prey such as moose and deer and subsequently increased populations of predators, resulting in unnaturally high predation rates on southern mountain caribou. For most southern mountain caribou, habitat alteration is continuing, especially in those areas where mountain pine beetle salvage harvesting is occurring. As a result, for some LPUs predation rates are much higher than can be sustained and are unlikely to decline unless habitat recovers. A population management approach involving management of other wildlife species (i.e., predators and their primary prey) is almost certainly required in the short term to stop southern mountain caribou declines and stabilize some LPUs to prevent their extirpation. Where the condition of the LPU warrants such measures, management of predators and their primary prey should be applied as interim management tools until habitat conditions in the range recover.

Habitat management that leads to restoration of forested landscapes will be necessary to recover the seasonal range conditions and predator densities necessary to maintain southern mountain caribou LPUs. Management of predators and their primary prey should be considered

simultaneously. Primary prey management applied in the absence of concurrent predator management has the potential to be harmful to southern mountain caribou conservation. Predator management without concurrent primary prey management and habitat restoration also may not be effective. Predator management through increased hunting of predators has been implemented in some southern mountain caribou LPUs, but this action alone will likely not reduce predator abundance sufficiently to achieve desired population trends or size targets for southern mountain caribou. More direct intensive, widespread and on-going predator management programs will be necessary in the short term to halt southern mountain caribou declines.

6.3.1.2 Manage Direct Human-Caused Mortality of Southern Mountain Caribou

Licensed hunting is closed for all but three southern mountain caribou subpopulations. Where hunting occurs, it is important to monitor the level of hunting in order to understand the potential impact of hunting on the viability of a LPU, including potential impacts on other subpopulations within that LPU. Should regulated hunting be determined to be having a negative effect on the population growth of the three subpopulations where it is still permitted, it should be closed at least until the population trajectory becomes positive. Attention should also be given to areas where southern mountain caribou annual ranges overlap with northern mountain caribou and to areas where licensed hunting is permitted. Additionally, hunting regulations for northern mountain caribou should be modified as appropriate. In areas where hunting both occurs and is shown to have a negative effect on LPU and subpopulation viability, harvest strategies should be developed, in consultation with Aboriginal people, to achieve southern mountain caribou recovery.

6.3.1.3 Augment/reintroduce Southern Mountain Caribou

For some LPUs with small population sizes, investment in intensive management options (e.g., maternal penning, augmentation) may be required to achieve recovery goals. Where threats have been addressed in currently unoccupied areas, re-introductions may be possible. A captive breeding program may be considered where viable sources for augmentation or re-introduction are not available.

6.3.2 Landscape Level Planning

Effective and coordinated landscape level planning of all activities is required to ensure successful recovery of southern mountain caribou. Landscape level planning should be used for addressing the cumulative effects of habitat alteration and for managing habitat and sensory disturbance. Action planning for southern mountain caribou should consider current and future human developments and determine detailed management activities that are tailored to the conditions of the LPUs in question. Action plans should take into account natural disturbances and cumulative effects of development within and between southern mountain caribou LPUs. Within LPUs that contain more than one subpopulation, habitat alteration within and between subpopulation annual ranges will also need to be considered to avoid irreversible range retraction and permanent breaks in range connectivity.

Since actions taken in one LPU may impact neighbouring LPUs, it will be important that provincial and federal agencies take a collaborative approach to planning, particularly with jointly managed LPUs (e.g., transboundary LPUs).

6.3.3 Habitat Management

Southern mountain caribou annual ranges will need to be managed and restored to ensure their current and future ability to support self-sustaining LPUs. The appropriateness and effectiveness of various short and long-term management activities may vary between and within LPUs due to differences in the population condition and specific local conditions.

Management of the amount, type and distribution of human developments will be necessary. Both human-caused 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 federal agencies involved. Disturbed areas may need to be improved or restored or offset (including growing disturbed areas back to a mature condition) to support population and distribution objectives within each southern mountain caribou LPU. Maintaining or restoring connectivity within and between habitat patches, seasonal ranges, and LPUs will be particularly important for southern mountain caribou throughout their distribution. For LPUs that are jointly managed by provinces and federal governments (i.e., transboundary LPUs), collaborative habitat management approaches will be necessary to ensure that compatible recovery efforts are underway. Though LPUs may cross provincial and international boundaries, each jurisdiction remains accountable for activities carried out within their own portion of a LPU.

6.3.4 Managing Recreational Activities

Increasing recreational use of back-country areas both within and outside protected areas has been recognized both provincially and federally as an important ecosystem and species conservation concern. Hiking, skiing (back-country, heli-skiing, cat-skiing, downhill ski resorts), heli-hiking, snowshoeing, snowmobiling, and off-road vehicle access increase opportunities for predators to access caribou habitat and may also displace caribou. Currently, some protected areas have guidelines in place for managing the timing and extent of recreational use during sensitive seasons or in areas where movements by caribou are restricted. For a number of LPUs, the annual extent of recreational use is poorly known. Since the use of remote areas for recreation is expected to increase, additional guidelines, management plans and tools for protecting southern mountain caribou need to be developed for activities and areas that are not addressed by existing tools or for areas where existing approaches are not effective.

6.3.5 Population Monitoring

6.3.5.1 *Conduct Population Studies to Better Understand Southern Mountain Caribou Population Structure, Trends and Distribution*

A considerable amount of information is available on numbers and trends of southern mountain caribou (see Section 3.2 Population and Distribution). While accurate population size and trend estimates are available for most subpopulations, for others, size and trend estimates are based on limited or out-of-date data. For the Southern Group, surveys that are used to estimate numbers

and trends have been conducted on all but one subpopulation in the last 3 years (see Table 3). Similarly, for the Central Group, subpopulations that use high elevation winter ranges and can be surveyed in late winter also have recent estimates, and current trends for most subpopulations in the Central Group based on calf recruitment from late winter surveys and adult mortality from ongoing radio-collared caribou studies are available. In the Northern Group many subpopulations are difficult to survey without the aid of radio-collared caribou. Because radio-collared caribou studies are often limited in duration, there are few current estimates of numbers and trends for subpopulations in the Northern Group. Regular monitoring of numbers and trends is needed, especially for subpopulations that are currently declining, that have undergone significant long-term declines, that consist of fewer than 100 animals, or that do not have current estimates of numbers and/or trends. For all subpopulations, population size and trends, and caribou distribution, should also be monitored over time to test the efficacy of management actions and adapt those management actions as appropriate.

In addition to monitoring southern mountain caribou numbers and trends, a better understanding of southern mountain caribou evolutionary lineages (phylogenetics) and genetic structuring is needed. Recent studies (e.g., McDevitt et al. 2009, Serrouya et al. 2012, Weckworth et al. 2012) have contributed substantially to this understanding for most of the subpopulations in the Central Group and many of the subpopulations in the Southern Group, but a study that includes all southern mountain caribou is needed.

Data to assess the effectiveness of alternative management measures to improve population dynamics (e.g., maternal penning, predator management/control, augmentation) comes from only a few studies, some of which have combined several measures in a single study (e.g., Smith and Pittaway 2011, Chisana Caribou Recovery Team 2010). Two maternal penning projects were recently initiated for southern mountain caribou (Pine River LPU, Revelstoke-Shuswap LPU). Monitoring the effectiveness of these two projects is essential for assessing their utility for halting declines and developing action plans.

6.3.5.2 Conduct Studies to Better Understand Climate Change on Southern Mountain Caribou

The assessment and monitoring of climate regimes and climate-related effects on caribou use of habitat, coupled with predicted shifts in vulnerability to climate-mediated disturbance and habitat dynamics, will be important in both action planning and monitoring of LPU recovery. Predicted effects of climate change in montane species include: shifting phenologies (plant and animal life cycle events influenced by seasonal and inter-annual variations in climate as well as habitat factors) among plant species; changing availability of access to forage through shifting snowpack depth and hardness; and, altered severity and timing of storm events creating hazards such as avalanches, rain-on-snow events, disturbances (e.g., fires) or intense storms during sensitive periods. Longer-term effects may include elevational shifts in availability of food on winter/summer ranges, shifts in distribution of other animals and plants, and changing successional pathways for forest and range vegetation communities. It is not well known how these effects may interact with southern mountain caribou movements and population dynamics, especially when populations are small.

Although parasites and diseases have not been reported as a significant direct cause of mortality for southern mountain caribou, climate change could result in increased prevalence, intensity and geographic distribution of parasites and diseases that can or could potentially infect southern mountain caribou. Parasites and diseases could potentially impact reproduction or result in a reduction in overall health of an individual animal, which could make it more susceptible to other mortality risks such as predation. An assessment of how climate change could affect parasites and diseases and their potential impacts on caribou will be important for assessing other potential mortality risks in the mid and long term.

6.3.5.3 Monitor and Manage Sensory Disturbance of Southern Mountain Caribou

The extent, distribution and effects of various sources of sensory disturbance (e.g., low-flying aircraft, snowmobiles, equipment associated with various industries and recreational users) on individual southern mountain caribou and southern mountain caribou subpopulations should be assessed and managed in conjunction with provincial and federal regulations and guidelines. Where required, additional management actions to reduce the effects of sensory disturbance on southern mountain caribou should be implemented and the effectiveness of the management actions should be monitored over time and adapted as necessary.

6.3.5.4 Monitor Southern Mountain Caribou Health and Condition

Parasites and disease can affect individual southern mountain caribou and may have effects at the LPU level in certain parts of their distribution. Pollution could also negatively affect the health of southern mountain 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 southern mountain caribou or to southern mountain caribou subpopulations. Therefore, information on the health and body condition of southern mountain caribou should be assessed when handling animals. This would assist in better understanding the relationship between these threats and the viability of subpopulations, and the determination of a need for additional recovery actions.

7 CRITICAL HABITAT

Under SARA, habitat is defined for wildlife as:

- the area or type of site where an individual or wildlife species naturally occurs or depends on directly or indirectly in order to carry out its life processes or formerly occurred and has the potential to be introduced.

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 southern mountain caribou, critical habitat identification describes the habitat that is necessary to maintain or recover self-sustaining LPUs throughout their distribution. In many of the areas identified as critical habitat, the quantity and quality of habitat will need to be improved for recovery to be achieved.

As a general overview of their habitat needs, southern mountain caribou occupy annual ranges consisting of highly diverse topography, terrain types, and environmental conditions. Typically, southern mountain caribou undertake elevational and horizontal movements between seasonal ranges in response to changing food availability and environmental conditions (e.g., snow depth, snow hardness). Consequently, six categories of range have been identified for southern mountain caribou:

- high elevation summer (spring, calving, summer, fall/rut) and/or winter range (all Groups);
- low elevation summer (spring, calving, summer, fall/rut) range (Northern Group);
- low elevation winter range (Northern and Central Groups);
- low elevation early winter and/or spring range (Southern Group);
- Type 1 matrix range within annual ranges (all LPUs in all Groups); and,
- Type 2 matrix range surrounding annual ranges (all LPUs in all Groups).

Although southern mountain caribou use each of these categories of range differently, the most significant function of all categories is to maintain a low and sustainable predation risk while maintaining access to food resources.

In the Southern Group, caribou spend most of their time in high elevation summer and/or winter range, where predation risk is less than at low elevations. However, matrix range within (Type 1) and outside (Type 2) of their annual ranges supports predators that are sustained by other prey, but that also sometimes kill caribou. Low elevation cedar-hemlock forests are also used by some Southern Group subpopulations in early winter and spring.

In the Central Group, empirical evidence and aboriginal traditional knowledge indicate historic use of low elevation winter range and matrix ranges. Some subpopulations still use high elevation summer and/or winter range as well as low elevation winter ranges, but for other subpopulations of this Group, the recent decline in numbers has resulted in caribou increasingly restricting their summer and winter ranges to higher elevations.

In the Northern Group, most subpopulations are relatively less affected by population decline and so both high elevations and low elevations are used. Type 1 matrix range is used more by this Group than by the other Groups, especially during migration periods.

High elevation subalpine summer and/or winter ranges are typically climax-type ecosystems that experience infrequent fire disturbance events, as are low elevation early winter and/or spring ranges in the Southern Group. Low elevation winter ranges in the Central and Northern Groups are more dynamic ecosystems, which normally experience naturally occurring periodic disturbances by fire and other disturbance agents. Low elevation winter ranges in the Central and Northern Groups are therefore expected to tolerate some level of habitat alteration, while

high elevation summer and/or winter ranges in all Groups and low elevation early winter/spring ranges in the Southern Group are not expected to be as tolerant to habitat alteration.

See Appendix C for information on biophysical attributes of critical habitat.

7.1 Identification of Critical Habitat for Southern Mountain Caribou

Critical habitat for southern mountain caribou is partially identified for all LPUs. Critical habitat is identified as the habitat possessing those biophysical attributes required by southern mountain caribou to carry out life processes (See Appendix C) and which is found within:

- the high elevation winter and/or summer (spring, calving, summer, fall/rut) range delimited by the LPU boundaries for all Groups;
- the low elevation summer (spring, calving, summer, fall/rut) range delimited by the LPU boundaries for the Northern Group;
- the low elevation early winter and/or spring range delimited by the LPU boundaries for the Southern Group;
- the LPU boundaries of the Northern and Central Groups, which provide for an overall ecological condition for low elevation winter range and Type 1 matrix range 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; and,
- Type 2 matrix range for all Groups, and Type 1 matrix range for the Southern Group that provide for an overall ecological condition that will allow for low predation risk, defined as wolf population densities less than 3 wolves/1000 km².

Existing, essentially permanent features such as maintained trails, roads and existing infrastructure (e.g., buildings), agricultural fields are not generally considered components of critical habitat, even where they occur within a critical habitat polygon.

Habitat disturbance⁵ leads to increased populations of moose, deer and elk, which prefer early seral habitats, with a consequent increase in the number of individual predators. In addition, linear features associated with human-caused disturbance can lead to greater predator efficiency. Much of a southern mountain caribou's annual cycle is spent in high elevation summer and/or winter range where natural disturbances such as fire are uncommon. Predation risk tends to be lower at higher elevations because predators spend most of their time in valley bottoms, where other ungulates are more abundant. Calving at high elevations is thus an important anti-predator strategy for caribou. Consequently, habitat alteration at high elevations, or habitat alteration at any elevation that provides access to higher elevations, can lead to increased predation on caribou and thereby compromise recovery objectives. While a maximum threshold of habitat

⁵ For critical habitat, disturbance is defined as the area affected by human-caused disturbance, including a 500 m buffer around the disturbance to account for avoidance by caribou (see Environment Canada 2011), and the area affected by natural disturbances such as fire and avalanches.

disturbance necessary for recovery in high elevation habitat has not yet been determined, the management of high elevation critical habitat should seek to minimize and mitigate disturbance levels to maintain predation below levels incompatible with southern mountain caribou recovery.

A threshold of 65% minimum undisturbed habitat was identified as a target disturbance level to guide habitat recovery actions for boreal caribou (Environment Canada 2012) based on methodology developed by Environment Canada (2011). This target threshold of 65% undisturbed habitat was determined to result in a 60% probability that a boreal caribou population would be self-sustaining (Environment Canada 2012). There is no such analysis for southern mountain caribou. However, as boreal caribou ranges and low elevation winter ranges and Type 1 matrix range for the Northern and Central Groups of southern mountain caribou all consist of fire-adapted ecosystems, the undisturbed threshold of 65% has been chosen as a reference disturbance level in this recovery strategy for identifying critical habitat for low elevation winter ranges and Type 1 matrix range for Northern and Central Groups. Over time, the precise location of the 65% undisturbed habitat within those ranges will shift as disturbed areas age into mature forests and other new disturbances occur. The habitat within those ranges should exist in an appropriate spatial configuration including large areas of contiguous undisturbed habitat such that southern mountain caribou can move throughout their low elevation winter range and through Type 1 matrix range to access required habitat when needed. Type 1 matrix range in the Central and Northern Groups has been identified as critical habitat for its function to provide an overall, ongoing condition that allows for the dynamic habitat supply system, within which the biophysical attributes upon which southern mountain caribou depend will be available.

Minimal disturbance for high-elevation winter and/or summer ranges in all Groups, and at least a 65% undisturbed habitat level for low elevation winter ranges and Type 1 matrix range in the Northern and Central Groups, are currently considered as necessary to achieve recovery of LPUs. However, in most cases, these disturbance levels alone are not sufficient for achieving self-sustaining conditions for southern mountain caribou in most LPUs. Although caribou in some LPUs rarely use Type 2 matrix range, maintaining the function of Type 2 matrix range is crucial to the survival and recovery of southern mountain caribou. Altered predator/prey dynamics occurring in response to increased levels of disturbance in Type 2 matrix range can lead to increased predation on caribou.

Wilson (2009) recommended that wolf densities for LPUs in the Southern Group be managed to <1.5 wolves/1000 km² to generate a significant, positive population response by southern mountain caribou. Hebblewhite et al. (2007) suggested that subpopulations of caribou in Jasper National Park are likely to persist when wolf densities are below 2.1-4.3 wolves/1000 km². In the absence of scientific studies defining a maximum density of wolves in Type 2 matrix range across all southern mountain caribou LPUs and for Type 1 matrix range in the Southern Group, the habitat condition necessary for the recovery of southern mountain caribou for Type 2 matrix range in all LPUs and Type 1 matrix range in the Southern Group is defined as a wolf density of <3 wolves/1000 km², based on a combination of Wilson (2009) and Hebblewhite et al. (2007). Options for achieving this outcome include: 1) reducing the amount of disturbed habitat; and 2) reducing the abundance of other prey and/or predators. Where cougars are a significant source

of mortality for southern mountain caribou, reducing cougar and other prey numbers will also be necessary.

7.1.1 Components of Critical Habitat

The identification of critical habitat for southern mountain caribou is comprised of three components for each LPU: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

Location

Location describes where critical habitat is found. For southern mountain caribou, the delineated LPU shows the area within which most critical habitat is located at a coarse scale, except for Type 2 matrix range that will likely be located outside of LPU boundaries for the Northern and Central Groups. There are 24 LPUs within the current distribution of the southern mountain caribou (see Figure 4 and Table 3).

Appendix B contains maps that show a partial identification of critical habitat for all LPUs. The critical habitat mapped in the appendix is based on the best available information and does not currently include all critical habitat that exists for each LPU. This is why some maps do not show any critical habitat at a fine scale within an LPU boundary. Some maps for LPUs in British Columbia do not show critical habitat within protected areas. This is due to the fact that caribou habitat has not been mapped at a fine scale on those lands yet. For these areas in British Columbia and all of Alberta, critical habitat is identified at a coarse scale using the LPUs. More detailed maps of critical habitat will be prepared for each LPU as the information becomes available, and will be included in a revised recovery strategy or in one or more action plans. For the Southern Group, all critical habitat is anticipated to be located within the LPU boundaries; for the Northern and Central Groups, some Type 2 matrix range is anticipated to be located outside of LPU boundaries; however, for both, the continued work on habitat will ultimately determine this.

Amount

Amount describes the quantity of critical habitat that is needed for the LPU to be self-sustaining.

This recovery strategy identifies critical habitat geospatial boundaries: i) to include high elevation summer and/or winter range within all LPUs in all Groups; ii) to include low elevation summer range for the Northern Group; iii) to include low elevation early winter and/or spring range for the Southern Group; iv) to include low elevation winter ranges and Type 1 matrix range for the Northern and Central Groups within which to maintain or achieve a minimum of 65% undisturbed habitat; and, v) to include Type 2 matrix range in all Groups and Type 1 matrix range in the Southern Group within which to maintain predator densities consistent with performance indicators.

To be clear, the 65% undisturbed threshold only applies to low elevation winter range and Type 1 matrix range for the Northern and Central Groups. There is no applicability of the 65% undisturbed threshold for the Southern Group, where the high and low elevation seasonal ranges are identified essentially as 100% of the remaining amount, and with minimal disturbance.

The 65% threshold for the low elevation winter range and Type 1 matrix range for the Northern and Central Groups will be revisited once studies determining an appropriate threshold for the applicable ranges have been completed, or evidence indicates that this disturbance level is not supporting recovery for an LPU. Studies will also be undertaken to determine potential disturbance thresholds for high elevation ranges that are necessary to meet the recovery objectives. In the meantime, management of high elevation critical habitat should seek to minimize and mitigate disturbance.

Habitat disturbance within low elevation winter range and Type 1 matrix range for the Northern and Central Groups needs to be managed by the responsible jurisdiction at a level that will allow for an LPU to be self-sustaining. As there is variation in habitat and population conditions between southern mountain caribou LPUs in the Northern and Central Groups, it may be necessary that some low elevation winter ranges and Type 1 matrix range be managed to a target above the 65% undisturbed habitat threshold, while for others it may be possible to manage below the 65% undisturbed habitat threshold. However, prior to any adjustment of this threshold in an amended recovery strategy or in an action plan, there must be strong evidence from population data collected over a reasonable period of time to support the management decision to establish a lower or higher range-specific threshold. For example, the lag effects of habitat disturbance on a LPU's population condition will need to be considered and assessed.

To meet the recovery goal, additional critical habitat will need to be identified for many LPUs because critical habitat is only partially identified in this recovery strategy. Critical habitat may need to be restored, depending on the level of habitat alteration, and the extent of any natural disturbances which may take currently undisturbed habitat off-line in this dynamic habitat supply system.

- In low elevation winter ranges and Type 1 matrix range in the Northern and Central Groups with less than 65% undisturbed habitat, critical habitat includes that which is currently undisturbed as well as adjacent habitats that over time would contribute to the attainment of 65% undisturbed habitat.
- In low elevation winter ranges and Type 1 matrix range in the Northern and Central Groups with 65% or more undisturbed habitat, critical habitat includes at least 65% undisturbed habitat in low elevation winter and Type 1 matrix range.
- In high elevation winter and/or summer ranges for all Groups, low elevation summer ranges for the Northern Group, and low elevation spring and/or early winter range for the Southern Group, critical habitat includes that which is currently undisturbed as well as adjacent habitat that over time would become undisturbed through restoration.

Type

Type describes the biophysical attributes of critical habitat.

Biophysical attributes are those habitat characteristics required by southern mountain caribou to carry out life processes. Information from habitat selection analyses and published reports were used to summarize the biophysical attributes of seasonal habitats necessary for southern mountain caribou (see Appendix C).

7.2 Schedule of Studies

A schedule of studies is required under SARA where available information is inadequate to fully identify critical habitat. The schedule of studies outlines the essential studies required to identify the critical habitat necessary to meet the population and distribution objectives for southern mountain caribou set in this recovery strategy.

As described above, the threshold of a minimum of 65% undisturbed area for low elevation winter ranges and Type 1 matrix ranges for Northern and Central Groups is taken from analyses of boreal caribou ranges. While this information provides a useful starting point to support recovery, further study is required to determine seasonal range disturbance thresholds specific to southern mountain caribou. Additional study is also required to determine potential disturbance thresholds for high elevation ranges that are necessary to meet the recovery objectives. The study will involve using existing information on population and habitat condition, developing a habitat disturbance/population relationship specific to southern mountain caribou, conducting population viability analyses, defining self-sustaining populations under current and future conditions, and characterizing critical habitat.

Not all range components are presently mapped, particularly in the Northern and Central Groups. Although much of the high elevation summer and/or winter range in the Southern Group is included in existing mapping, additional known habitat has yet to be mapped.

The long-term effects of the mountain pine beetle epidemic on the functioning of critical habitat are not well understood. Although caribou have continued to use mountain pine beetle-killed forests following needle loss (grey stage), it is unclear how habitat will function and how caribou and caribou forage will respond once trees fall. Continued monitoring of the effects of the mountain pine beetle epidemic on the ability of the critical habitat to function for caribou is needed.

The following schedule of studies (Table 10) is required to complete the identification of critical habitat for the three Groups of southern mountain caribou.

Table 10. Schedule of studies required to complete the identification of critical habitat for southern mountain caribou.

Description of Activity	Rationale	Timeline
<p>Complete mapping for high elevation summer and/or winter range in Northern and Central Group LPUs including current habitat disturbances.</p> <p>Complete mapping for low elevation summer range in Northern Group LPUs.</p> <p>Complete habitat mapping for southern mountain caribou in national and provincial parks where gaps still exist.</p> <p>Complete mapping of all high elevation summer and/or winter range for LPUs in the Southern Group.</p>	<p>A common attribute standard and mapping is essential for planning management activities for recovery and developing action plans.</p>	<p>2014</p>
<p>Complete mapping of Type 2 matrix range for subpopulations/LPUs where it is currently not mapped.</p>	<p>Type 2 matrix range has been mapped or partially mapped for some LPUs but not for all, particularly in the Central or Northern Group LPUs.</p>	<p>2014</p>
<p>Assess the data available to develop seasonal range specific disturbance thresholds for southern mountain caribou.</p> <p>Develop seasonal range specific disturbance thresholds for southern mountain caribou.</p>	<p>While best available evidence indicates that the disturbance threshold estimates developed for boreal caribou may be relevant to low elevation forested winter range, no specific analyses have been undertaken for southern mountain caribou. This would assist in developing action plans.</p>	<p>Review of data (historical, current) is required to estimate a seasonal-range disturbance threshold by mid-2014. If sufficient data exist to estimate a scientifically defensible threshold, then do the analysis by end of 2014.</p>
<p>Monitor the effects of the mountain pine beetle epidemic on caribou and caribou habitat through later stage of the grey attack stage and into the falldown stage.</p>	<p>The effects of later stages of the mountain pine beetle epidemic on the functioning of critical habitat are unknown.</p>	<p>Ongoing.</p>

7.3 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 southern mountain 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 (Government of Canada, 2009). In most cases, maintenance of existing, essentially permanent anthropogenic features will not be considered destruction of critical habitat.

Activities that are likely to result in the destruction of all categories of critical habitat, except Type 2 matrix range across all groups and Type 1 matrix range the Southern Group, include, but are not limited to, the following:

- Any activity resulting in the direct loss of southern mountain caribou critical habitat. Examples of such activities include: conversion of habitat to agriculture, 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 southern mountain caribou. Examples of such activities include: forestry cut blocks, pollution, drainage of an area, and flooding.
- Any activity resulting in the cumulative fragmentation of habitat by human-made linear features. Examples of such activities include: road development, seismic lines, pipelines, and hydroelectric corridors.
- Any activity that, if not sufficiently mitigated, results in displacement of southern mountain caribou from part or all of their seasonal ranges, and/or from the biophysical attributes of those ranges, that is sufficient to cause a reduction in their movements and/or reproductive success, or to lead to higher mortality leading to range retraction or population decline. (e.g. recreational activities, blasting, or logging activities)
- Any activity that, if not sufficiently mitigated, increases the likelihood of increased predator density in critical habitat (e.g., alteration of habitat to conditions favourable to other ungulates, such as through forest harvesting).
- Any activity that, if not sufficiently mitigated, facilitates predator access to and within critical habitat (e.g., snowmobiling, snowshoeing, backcountry skiing).

Activities that are likely to result in the destruction of critical habitat of Type 2 matrix range across all groups and Type 1 matrix range in the Southern Group include, but are not limited to, the following:

- any activity that, if not sufficiently mitigated, increases the likelihood of increased predator density in the LPU (e.g., alteration of habitat to conditions favourable to other ungulates, such as through forest harvesting); and/or,
- any activity that, if not sufficiently mitigated, reduces the effectiveness of predator management (e.g. forest harvesting, road development, seismic lines, pipelines, and hydroelectric corridors).

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, including mitigation activities, within and among LPUs, 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 LPUs. A cumulative effects assessment/plan would be able to position the proposed project/activity in the context of all current and future development activities, and is therefore strongly recommended. Ideally, the cumulative effects assessment/plan would:

- assess the impact of all disturbances (human-caused and natural) at the LPU scale;

- monitor habitat conditions, including the amount of currently disturbed and undisturbed habitat, and amount of habitat being restored;
- account for planned disturbances, including associated mitigation; and,
- assess the distribution of disturbance in large LPUs for risk of range contraction.

The determination that an activity is or is not likely to result in the destruction of critical habitat will be facilitated by an action plan. For example, an action plan would identify activities that are likely to result in direct loss, degradation, and/or fragmentation of habitat, relevant to specific local circumstances.

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 southern mountain caribou will change over time given the changes to population demographics, ecosystem dynamics, and the manner in which the species shifts its use of the landscape over time. Most southern mountain caribou LPUs have undergone significant declines over the last 20 years, and are at risk of further declines. Some are at high risk of extirpation within the next five years. In addition, one of the population and distribution objectives is to immediately stop the decline in both numbers and current distribution of all LPUs. Due to the immediate need of actions required to halt the decline, monitoring of implementation and effectiveness should be conducted on an annual basis and reported on every five years.

Monitoring of southern mountain caribou LPUs based on performance indicators will be essential in order 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. Adaptive management identifies knowledge gaps, uncertainties, successes and failures, which are then evaluated to prioritize future information needs to improve outcomes and inform ongoing learning. As learning continues, implementation activities continue using revised and improved management actions.

The challenge of achieving the recovery goal of self-sustaining LPUs of southern mountain caribou will vary by southern mountain caribou LPU given the habitat and population conditions and management context associated within each LPU. To ensure adaptive management is applied to southern mountain caribou recovery, cooperation with federal and provincial governments, Aboriginal people, and others involved in the conservation, survival and recovery of southern mountain caribou will be 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 southern mountain caribou recovery is self-sustaining LPUs throughout the entirety of their distribution in Canada. Performance indicators for this recovery strategy are that the population and distribution objectives are met for each LPU, and that southern mountain caribou become less at risk. Recovery of all southern mountain caribou LPUs is deemed technically and biologically feasible; however given the challenges of recovery for southern mountain caribou, some LPUs 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 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 southern mountain caribou LPU will need to be developed at the action plan stage.

General:

- a) Complete one or more action plans by December 31, 2017 (see Section 9).

Population Condition (population trend and size):

- a) Maintain current distribution within all southern mountain caribou LPUs.
- b) Achieve and/or maintain a stable to increasing population trend within one generation (eight years) for all LPUs, as evaluated using population estimates or other empirical data that indicate population trend is stable or increasing.
- c) Achieve a minimum of 100 animals for southern mountain caribou LPUs with population estimates of fewer than 100 animals, or show progress towards this goal every five years.

Habitat Condition (amount and type of undisturbed habitat):

- a) For low elevation winter ranges and Type 1 matrix range in the Northern and Central groups with 65% or more undisturbed habitat, maintain at least 65% of the low elevation winter range and Type 1 matrix range as undisturbed habitat that includes the biophysical attributes needed for southern mountain caribou to carry out life processes.
- b) For low elevation winter ranges and Type 1 matrix range in the Northern and Central groups with less than 65% undisturbed habitat, within three years identify in an action plan specific areas of existing undisturbed habitat, as well as those areas where future habitat is to be restored to an undisturbed condition.

- c) For high elevation winter and/or summer ranges for all groups, low elevation summer range for the Northern and Central groups, and low elevation spring and/or early winter range for the Southern Group, maintain the level of undisturbed habitat that includes the biophysical attributes needed for southern mountain caribou to carry out life processes.
- d) For high elevation winter and/or summer ranges for all groups, low elevation summer range for the Northern and Central groups, and low elevation spring and/or early winter range for the Southern Group, identify in an action plan specific areas where future habitat is to be restored to undisturbed suitable condition.
- e) For Type 2 matrix range in all Groups, and Type 1 matrix range in the Southern Group with wolf population densities <3 wolves/1000 km², maintain the biophysical attributes and/or management actions needed to maintain wolf densities below this level.
- f) For Type 2 matrix range in all Groups, and Type 1 matrix range in the Southern Group with wolf population densities >3 wolves/1000 km², identify in an action plan management actions (including habitat restoration) required to achieve this density.

9 STATEMENT ON ACTION PLANS

As required by SARA, the Minister of the Environment and the Minister Responsible for the Parks Canada Agency will complete one or more action plans under this recovery strategy, which will be included on the Species at Risk Public Registry by December 31, 2017. Action plans provide the public and stakeholders with details on how the recovery strategy will be implemented. They 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.

Consideration will be given to the development of range plans, where desirable and appropriate, for low elevation winter range and Type 1 matrix range within Northern or Central Group LPUs. Such plans would outline the measures and steps to be taken to manage the interaction between human disturbance, natural disturbance, and the need to maintain sufficient suitable habitat. Range plans may be stand-alone documents, or may form part of other planning documents including action plans under SARA.

9.1 Coordinated Approach

9.1.1 Provincial Jurisdictional Leadership

Provinces have the primary responsibility for management of lands and wildlife within southern mountain caribou distribution. Range plans and/or action plans will inform broader land-use planning and decision making, and will require substantial inter-agency communication and cooperation. Coordination will be particularly important for range and/or action plans that address southern mountain caribou recovery in transboundary ranges, and for ensuring that connectivity within annual ranges and across the species current distribution is maintained.

9.1.2 Aboriginal Involvement

SARA requires the Minister of the Environment to cooperate with affected Aboriginal organizations for recovery strategies and action plans. Across Canada, cooperation with Aboriginal governments and communities will be key to success in developing and implementing action plans.

Environment Canada acknowledges existing Aboriginal and treaty rights. To the extent possible, details of caribou harvesting plans for LPUs will be addressed (where consistent with the principles of conservation) in action plans flowing from this recovery strategy. When applicable, harvesting plans will follow the required process under Land Claim Agreements or provincial laws. Aboriginal involvement will be required to determine population targets that ensure stable southern mountain caribou LPUs are maintained and recovery of LPUs that are not self-sustaining is achieved, while moving to allow for traditional harvesting practices consistent with conservation and existing Aboriginal and treaty rights of Aboriginal peoples of Canada.

9.1.3 Stakeholder Engagement

Success in the recovery of this species depends on the commitment, collaboration, and cooperation of many different constituencies that will be involved in implementing the broad strategies and general approaches set out in this recovery strategy and will not be achieved by Environment 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.

10 GLOSSARY

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

Aboriginal Traditional Knowledge (ATK): ATK includes, but is not limited to; the knowledge Aboriginal peoples have accumulated about wildlife species and their environment. Much of this knowledge has accumulated over many generations. This is also often referred to as traditional ecological knowledge (TEK).

Annual range for a subpopulation: The geographic area that is occupied by a subpopulation.

Annual range for an LPU: The combined annual ranges of all subpopulations within that LPU.

Arboreal lichens: lichens that grow on trees.

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 southern mountain caribou to carry out life processes necessary for survival and recovery (see Appendix C).

Current distribution (extent of occurrence): the area that encompasses the geographic distribution of all known southern mountain caribou subpopulation ranges, based on provincial distribution maps developed from observation and telemetry data.

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

Early seral: the condition of habitat that occurs directly after disturbance; early seral habitats are generally composed of grasses, forbs, shrubs and seedling trees

Extant: a subpopulation or LPU still in existence

Extirpated: a subpopulation or LPU that currently contains no individuals

Group: a group of southern mountain caribou LPUs that are ecologically and evolutionarily distinct, which correspond to COSEWIC's Designatable Units (DUs) (COSEWIC 2011). The Northern Group is made up of that portion of the Northern Mountain DU within the Southern Mountains National Ecological Area, and includes LPUs in west-central and north-central BC.

The Central Group is made up of LPUs in the Central Mountain DU, and includes LPUs in east-central BC and west-central Alberta. The Southern Group is made up of LPUs in the Southern Mountain DU, and includes LPUs in southeastern BC.

Local Population Unit (LPU): a cluster of subpopulations that reflects a likely larger historical subpopulation that has since declined and that has been fragmented into the currently recognized subpopulations; for subpopulations that are not clustered with other subpopulations into a larger LPU, the LPU is equivalent to the subpopulation

Matrix range:

Two types of matrix range are recognized:

- Type 1 matrix range consists of areas within an LPU's designated annual range that have not been mapped as summer (e.g. spring, calving, summer, fall/rut) or winter range. Type 1 matrix may include seasonal migration areas (or portions of migration areas) and areas of relatively lower use compared to delineated seasonal ranges.
- Type 2 matrix range consists of areas surrounding annual ranges where predator/prey dynamics influence predator/prey dynamics in the subpopulation's annual range. Type 2 matrix range also may include areas of trace occurrences of caribou, dispersal zones between subpopulations, dispersal zones between LPUs.

Proximate cause: the cause that is immediately responsible for the event (e.g., predation is what is causing caribou to die)

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

Subpopulation: a group of southern mountain caribou occupying a defined area distinguished spatially from areas occupied by other groups of southern mountain caribou.

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.

Terrestrial lichens: lichens that grow on the ground.

To the extent possible: current evidence supports the conclusion that the recovery of all LPUs is technically and biologically feasible. There may be situations where recovery of a particular LPU 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 LPUs.

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

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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.

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.

Southern mountain caribou are an umbrella species for the older-growth forest at large. There are many species that share the same habitat requirements as southern mountain 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 southern mountain caribou and by protecting and enhancing habitat.

The management measures outlined in this recovery strategy are those required to halt southern mountain caribou population declines in LPUs and to assist in stabilizing and recovering local populations units. 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 southern mountain caribou.

This recovery strategy acknowledges that predator and alternate prey management are required in some LPUs to help stop southern mountain caribou declines and stabilize LPUs 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 southern mountain 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 southern mountain caribou LPUs should be monitored.

This recovery strategy will contribute to the achievement of the goals and targets of the *Federal Sustainable Development Strategy for Canada*. In particular, the strategy directly contributes to the Government of Canada's commitment to restore populations of wildlife to healthy levels, protect natural spaces and wildlife, and protect the natural heritage of our country.

APPENDIX B: MAPS OF CRITICAL HABITAT FOR SOUTHERN MOUNTAIN CARIBOU LOCAL POPULATION UNITS (LPUs)

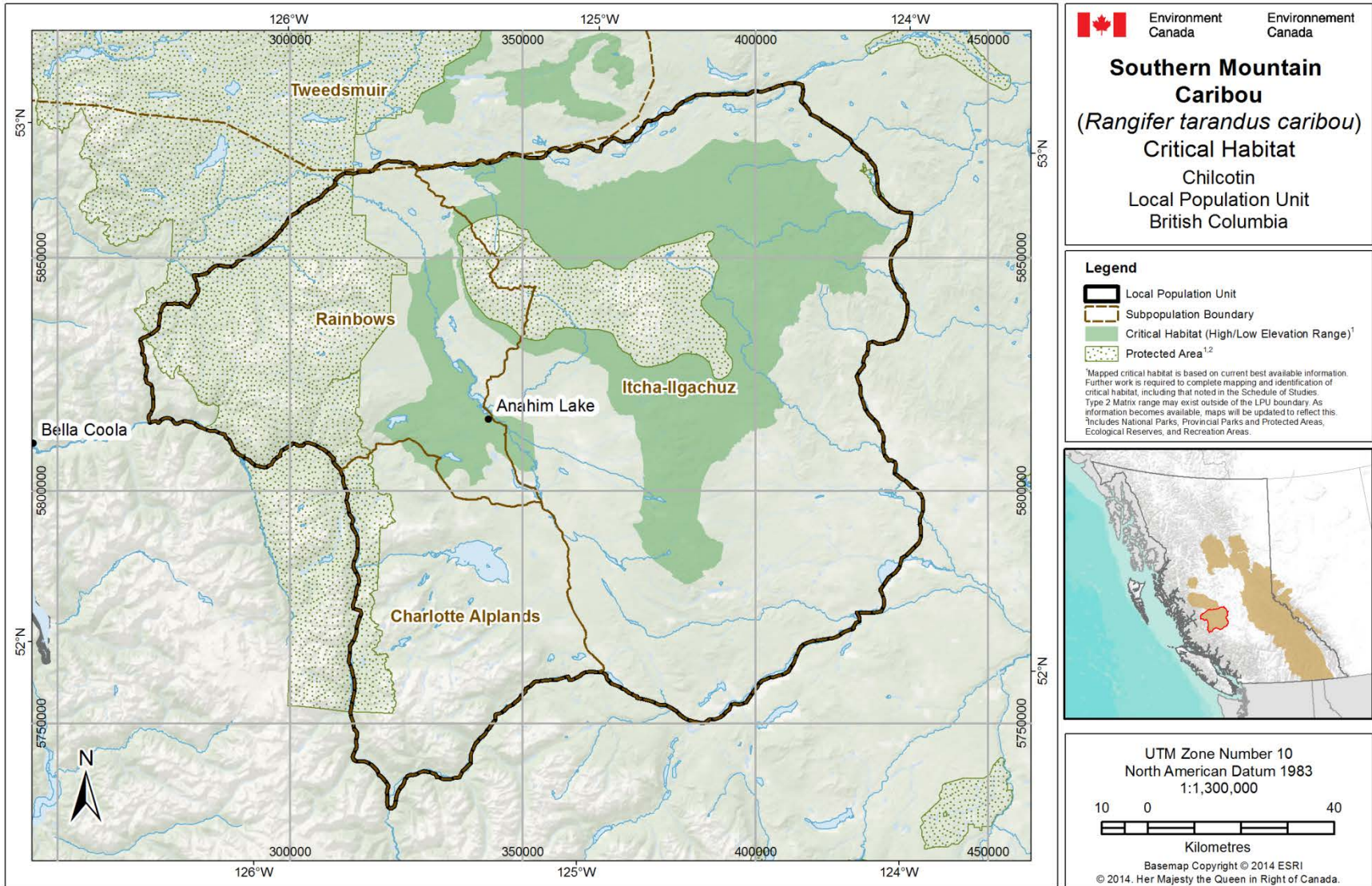
The 24 maps in this Appendix depict critical habitat for southern mountain caribou to the extent possible based on best available information.

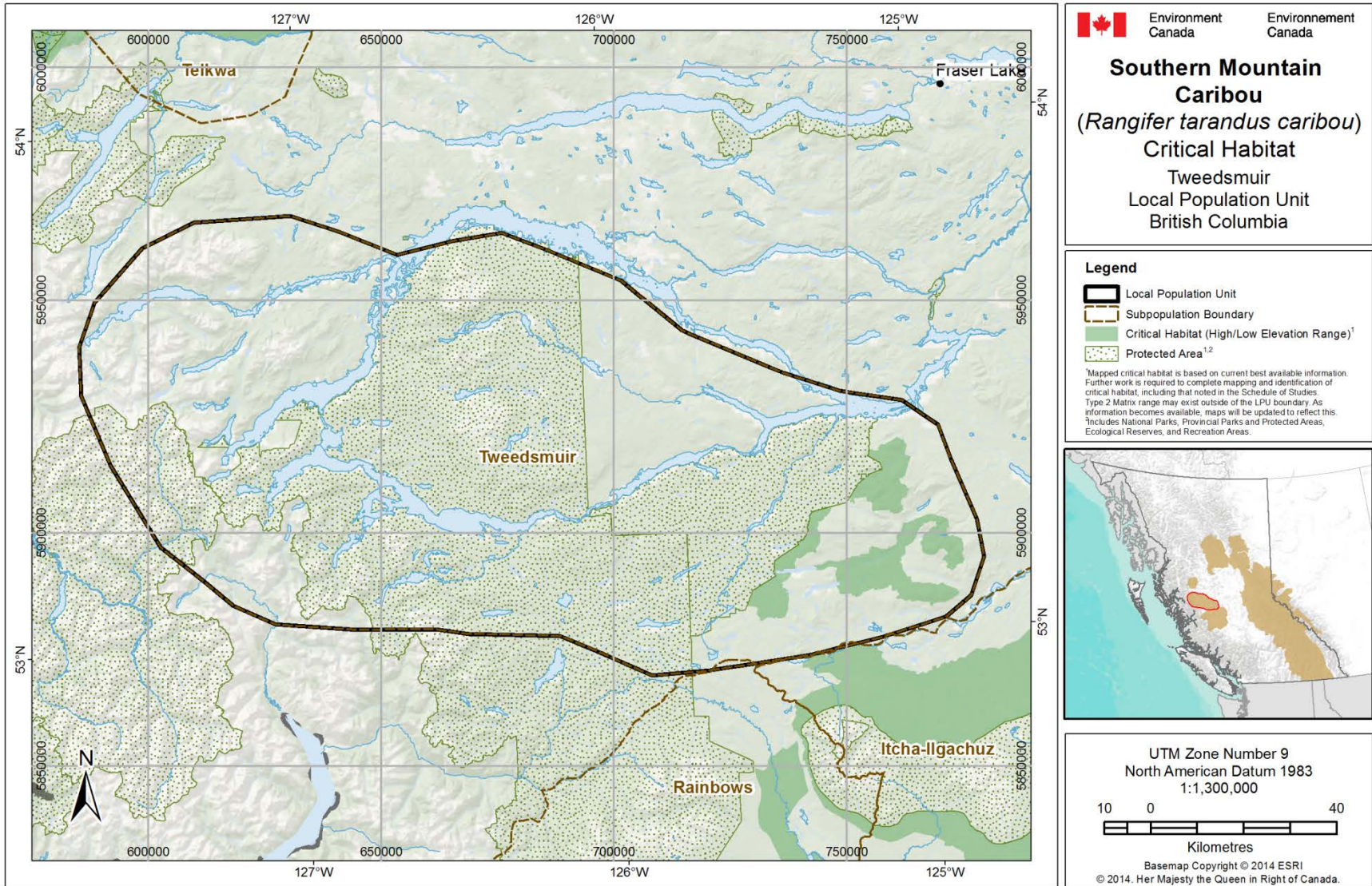
The available information is inadequate to identify the critical habitat necessary to meet the population and distribution objectives set in the recovery strategy. Therefore, the maps depict only a partial identification of critical habitat. Full identification of critical habitat will only be possible upon completion of the schedule of studies in section 7.2.

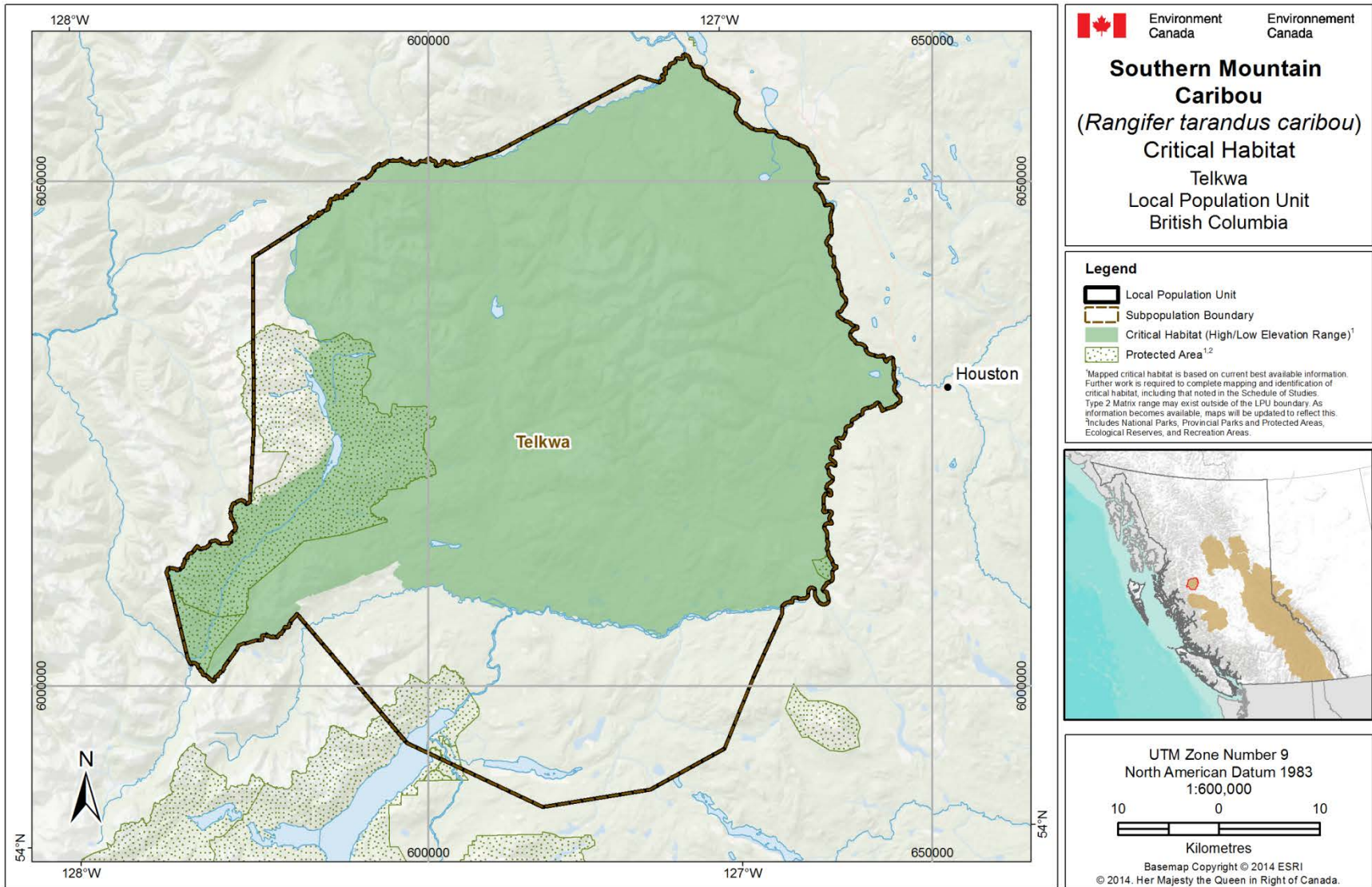
The data used to create the 24 maps is that which is publically available, or has been provided directly to Environment Canada by the responsible jurisdiction or landowner. The maps will be updated as additional data is obtained and analyzed, leading to the full identification upon completion of the schedule of studies.

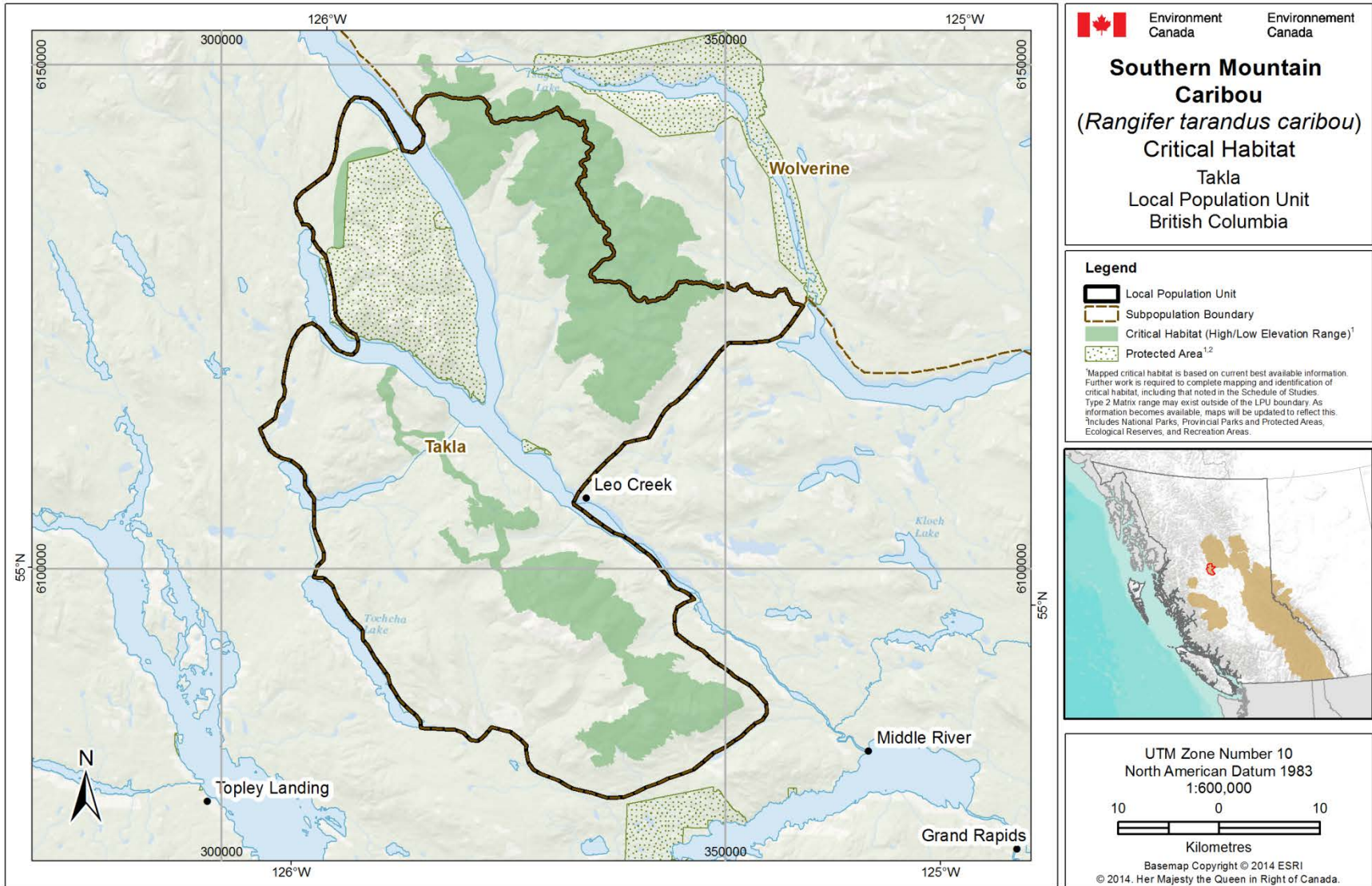
Each map depicts within its extent all the critical habitat that has been mapped for southern mountain caribou, not just the critical habitat for the LPU that map focuses on.

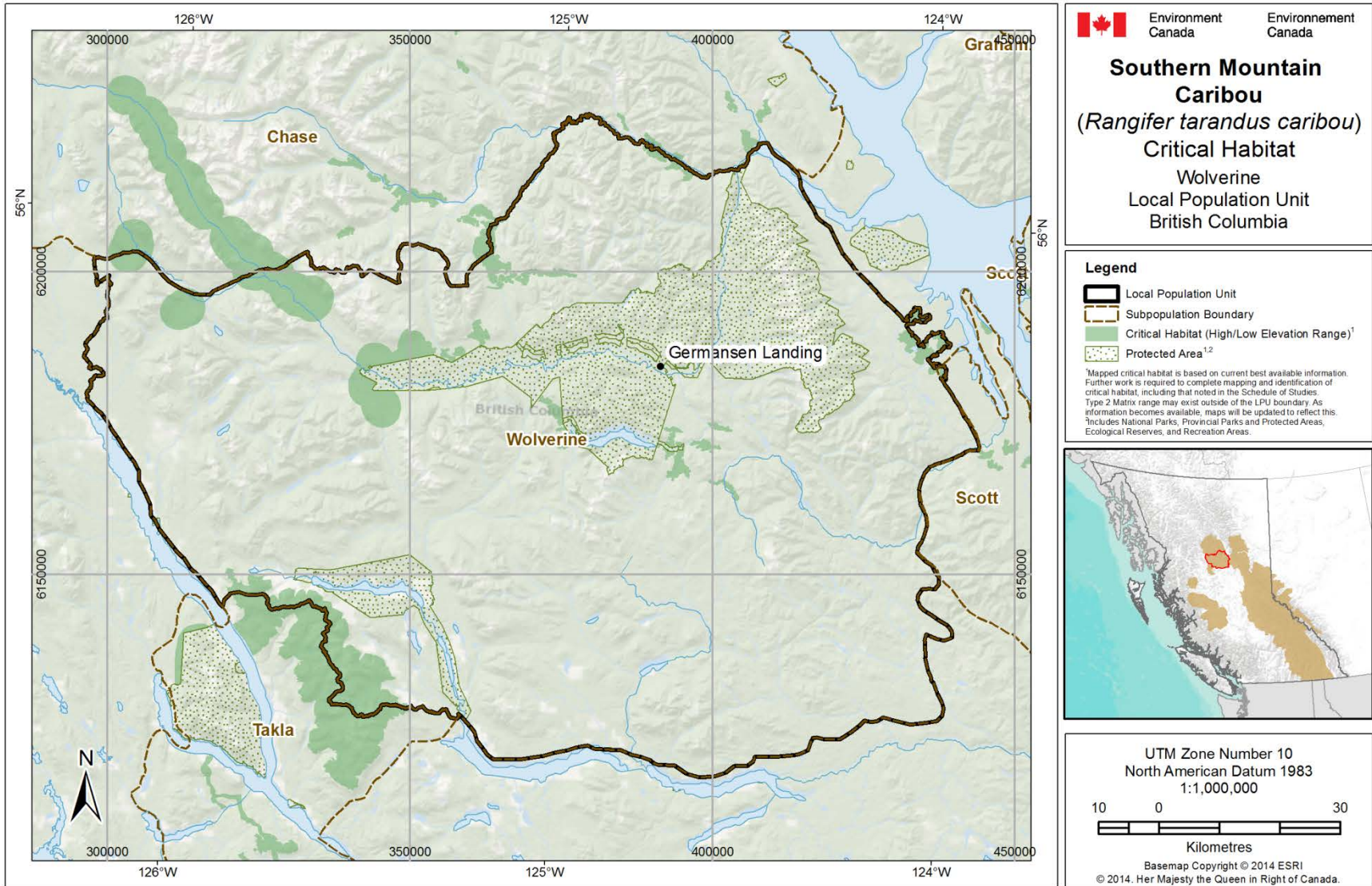
The LPU boundary is the geographic area within which most critical habitat for an LPU is located. As per section 7.1, critical habitat is identified as the habitat possessing those biophysical attributes required by southern mountain caribou to carry out life processes (See Appendix C) and which is found within the applicable ranges that are delimited by the LPU boundaries for all Groups, and Type 2 matrix range which may occur outside of the LPU boundaries. Therefore, not all of the geographic area within an LPU boundary is critical habitat.

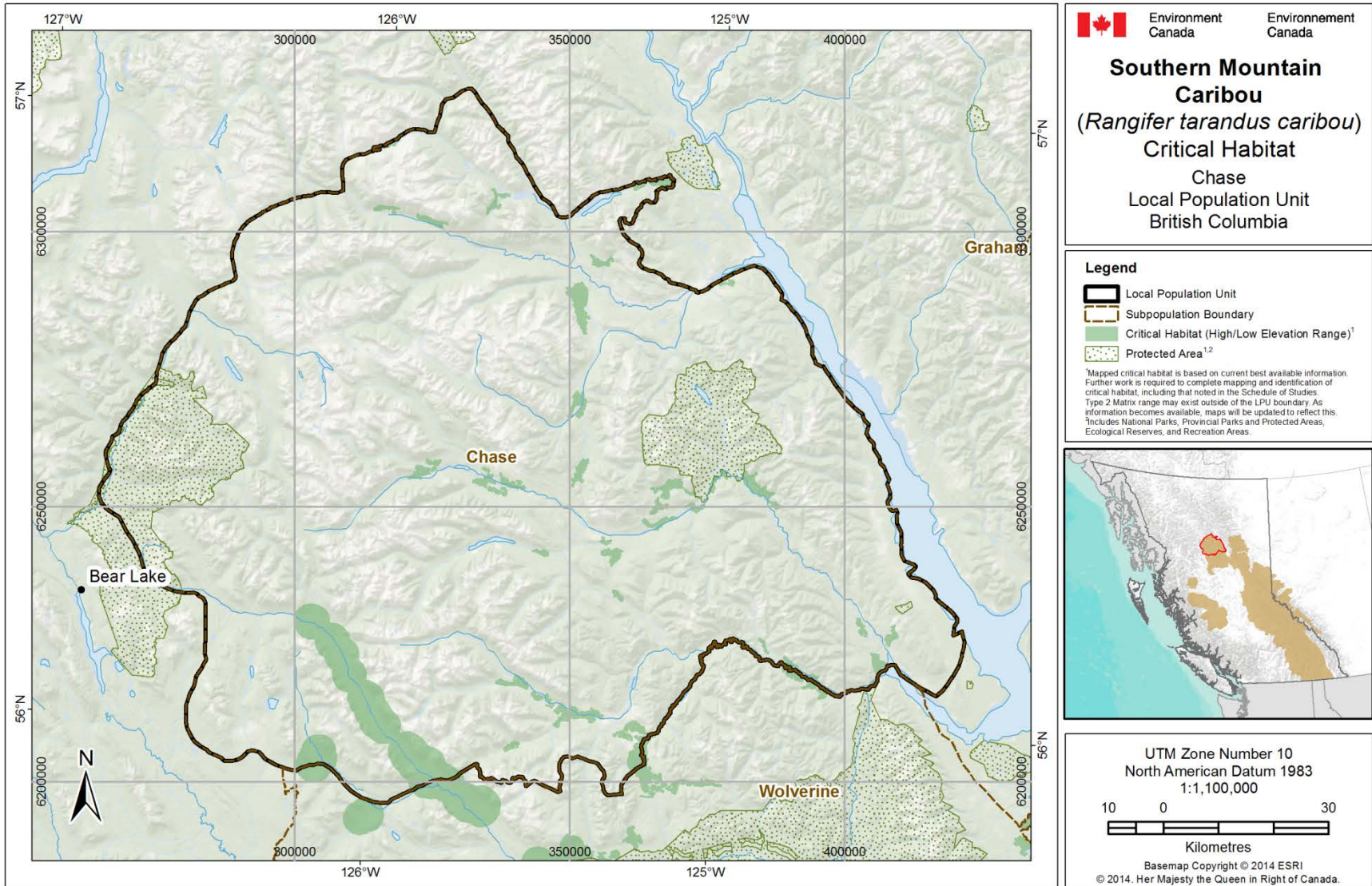


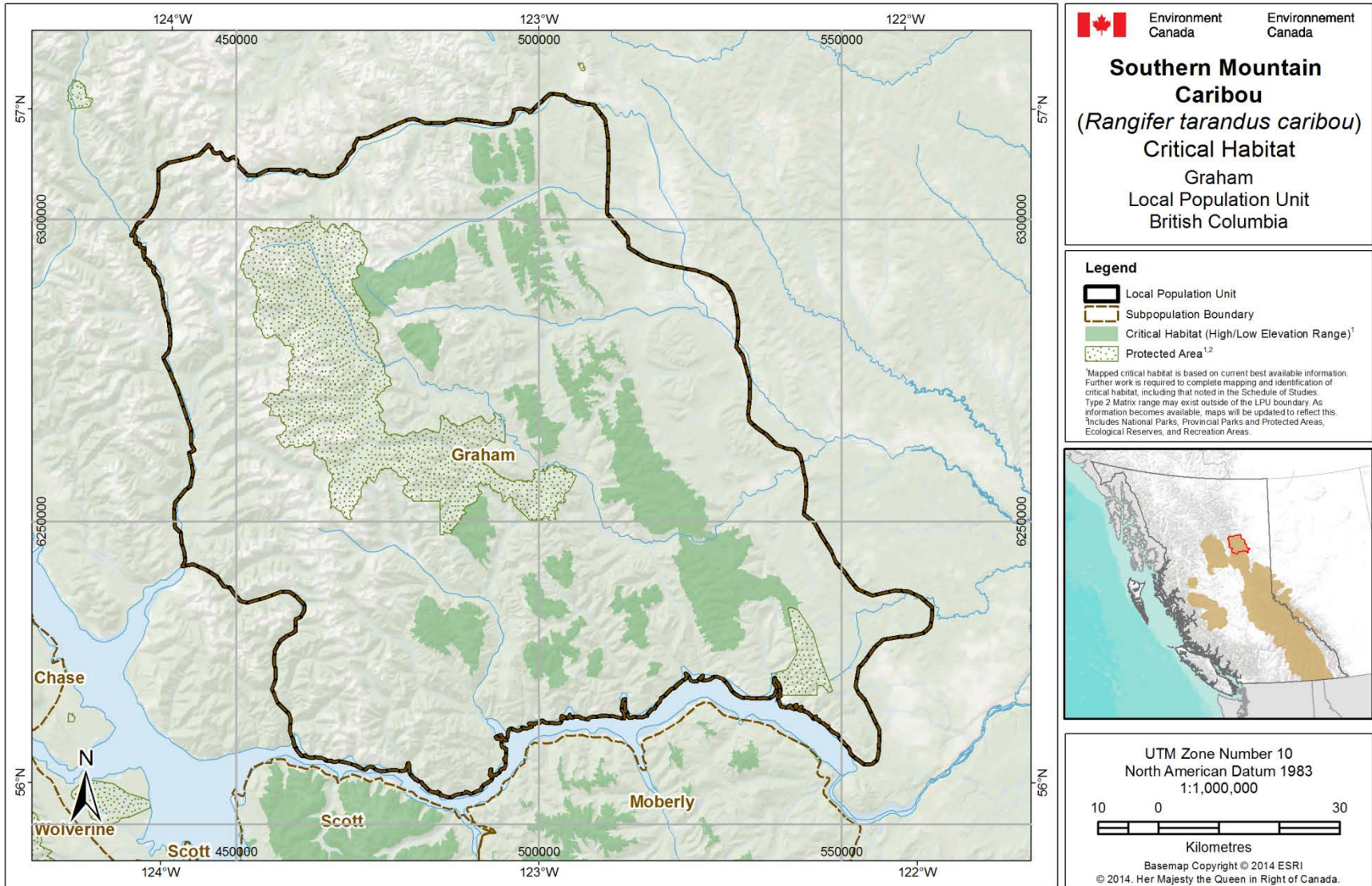


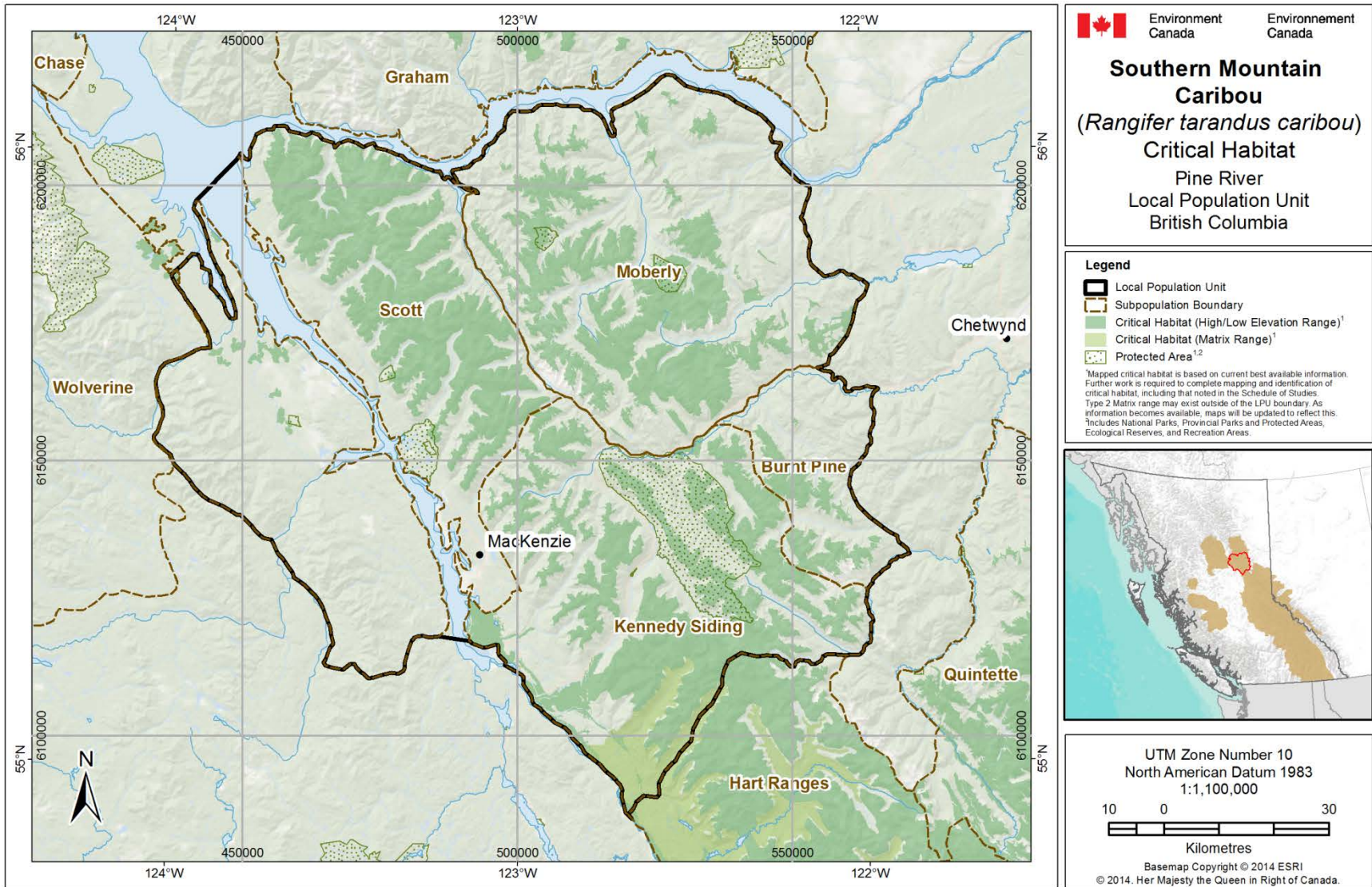


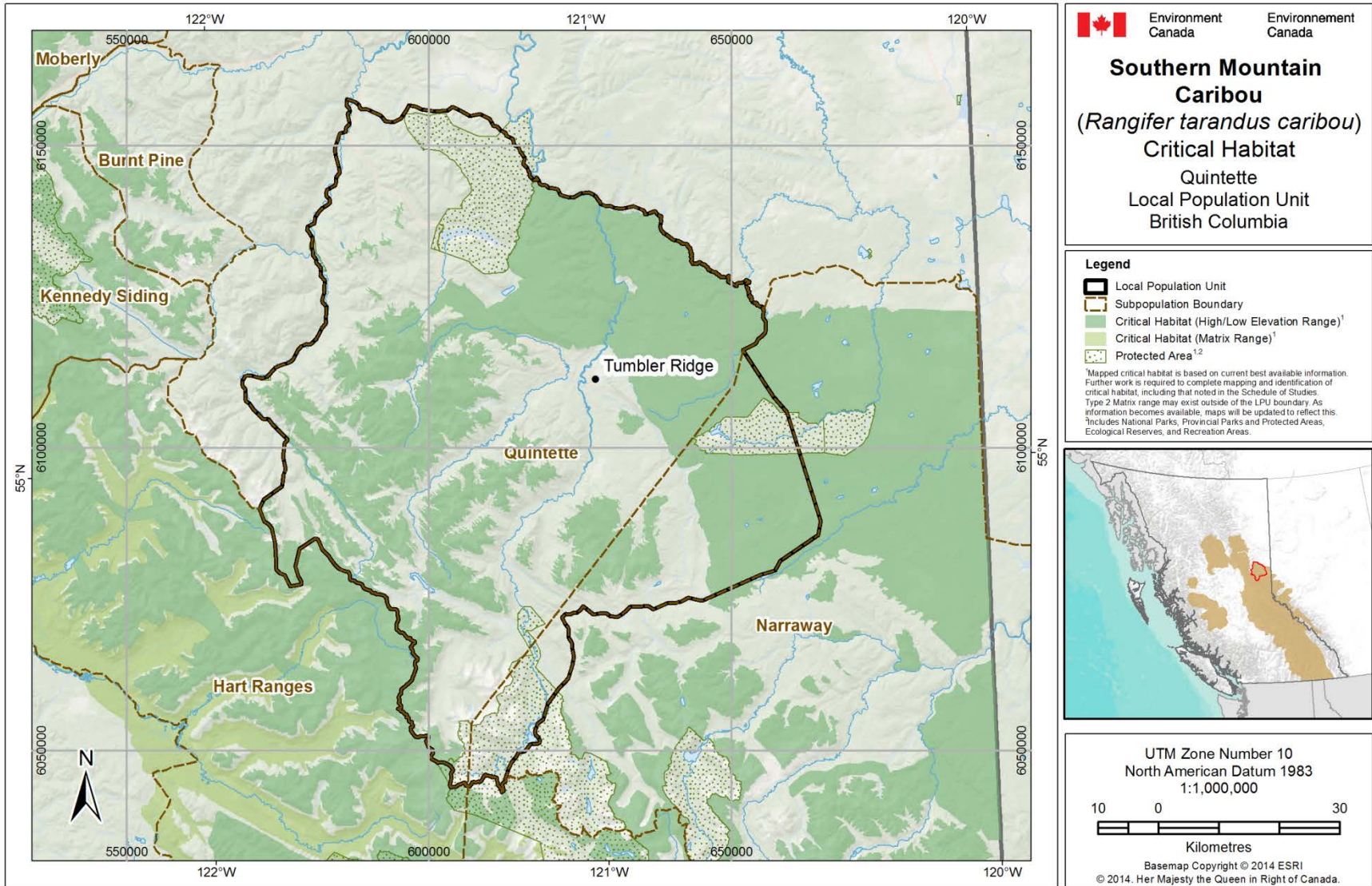


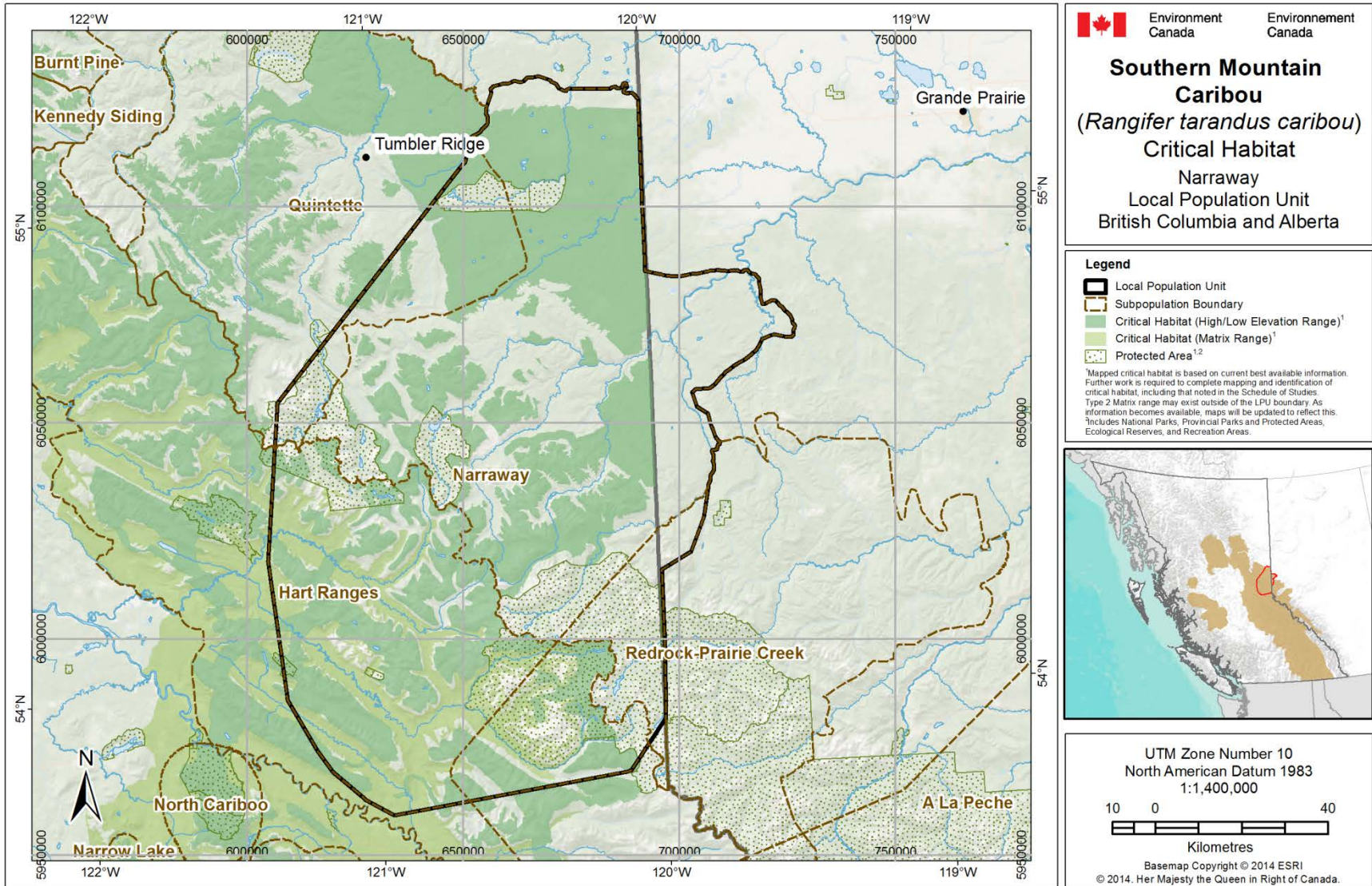


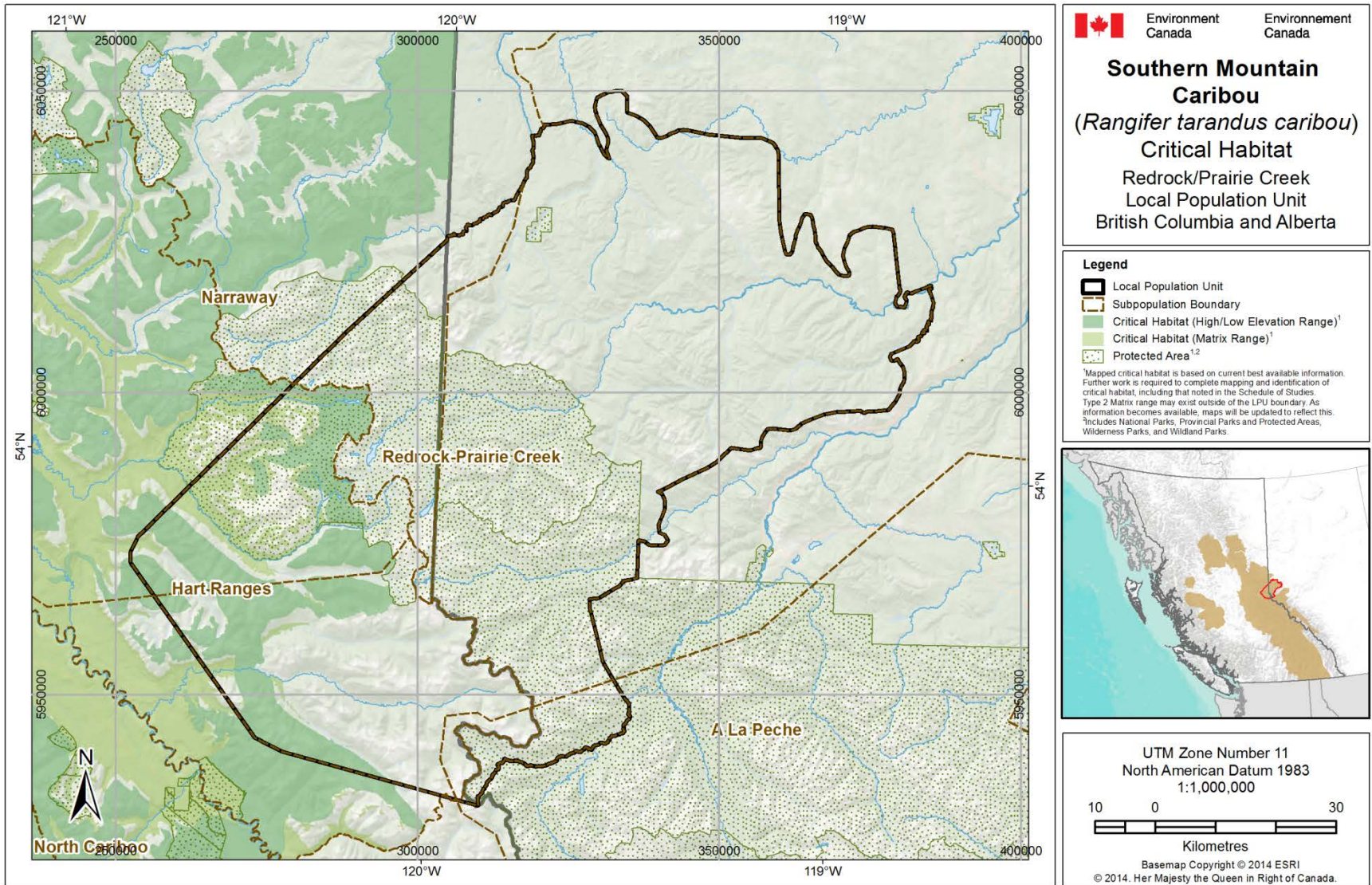


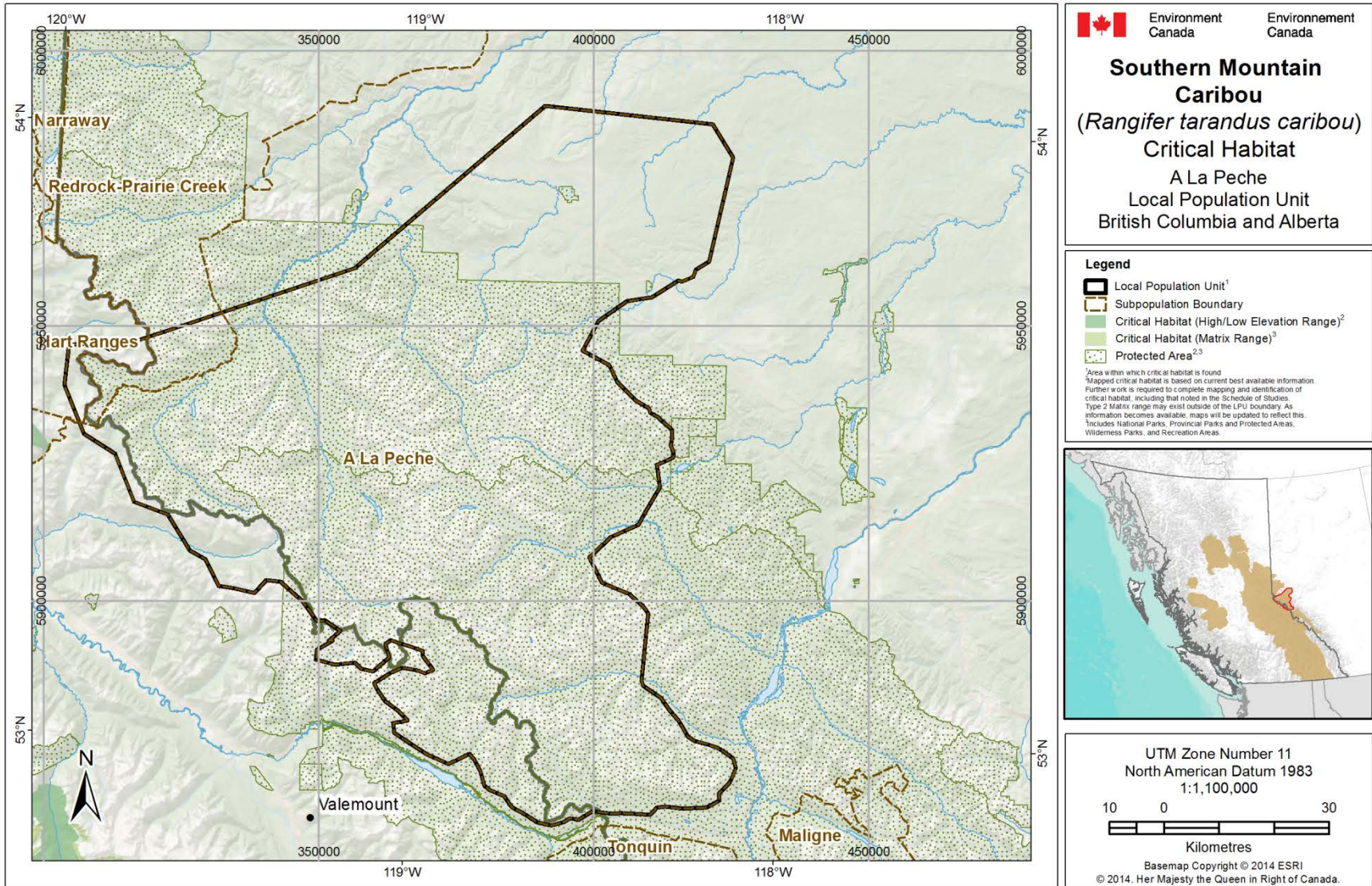


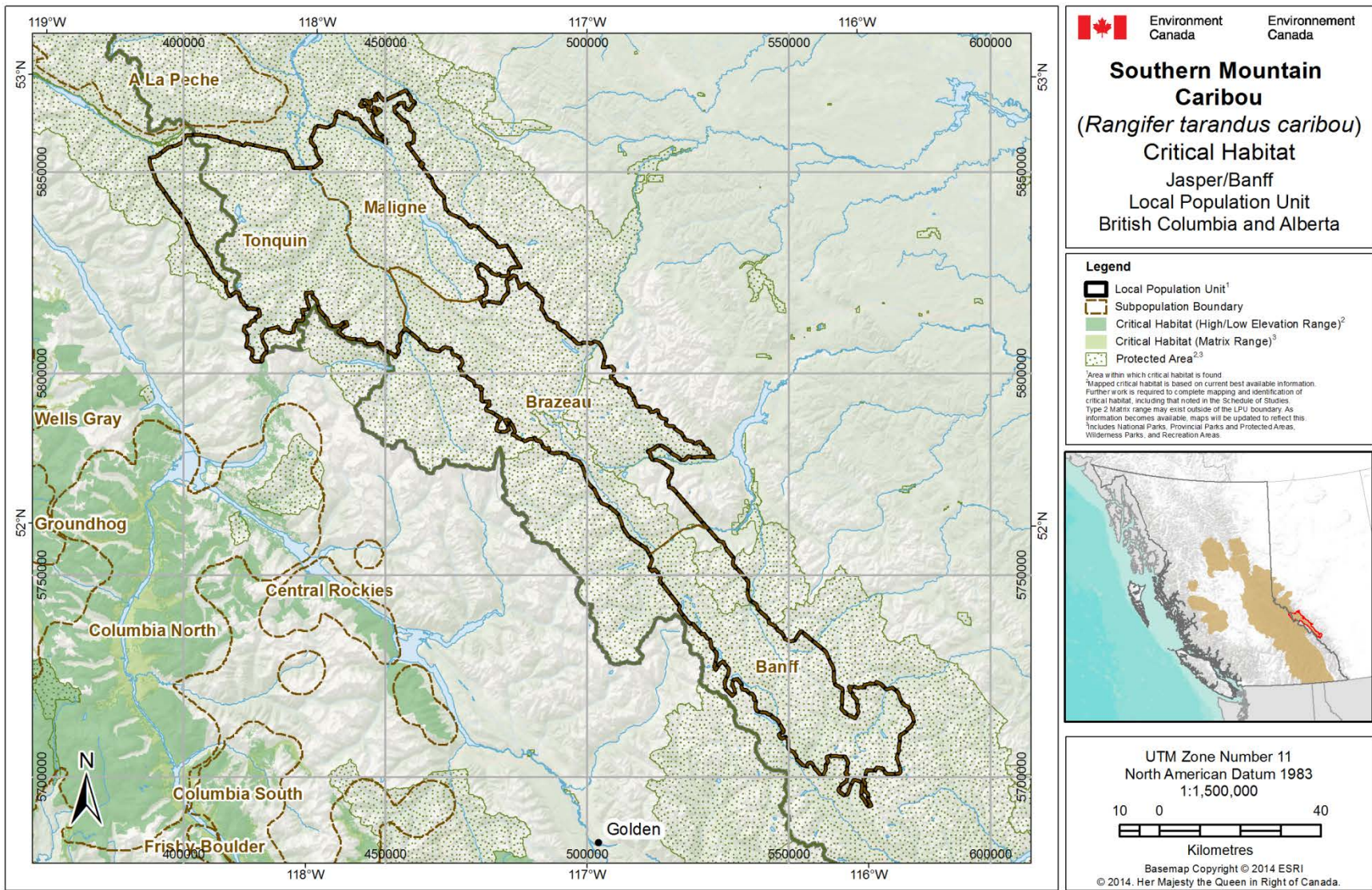


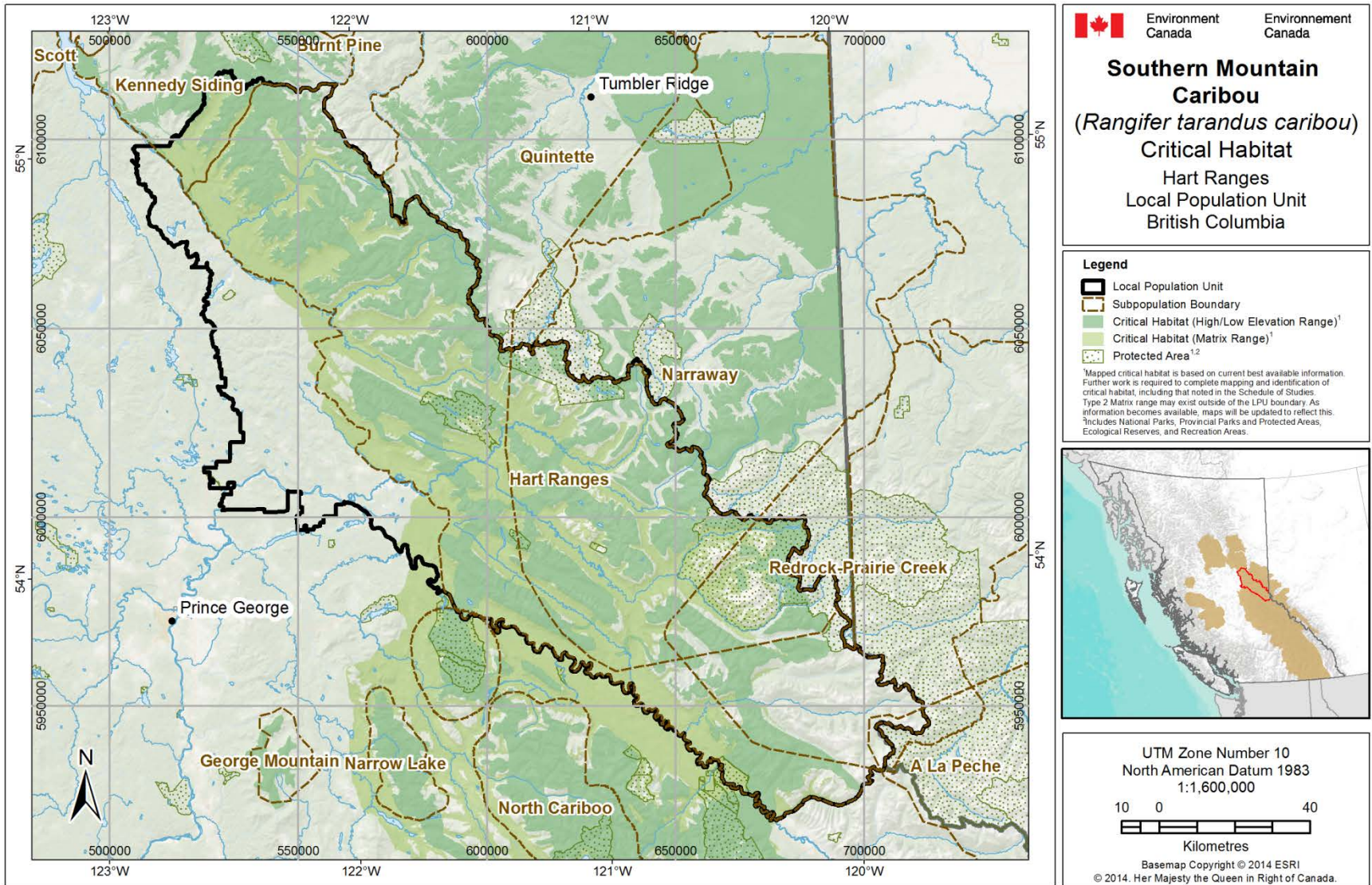


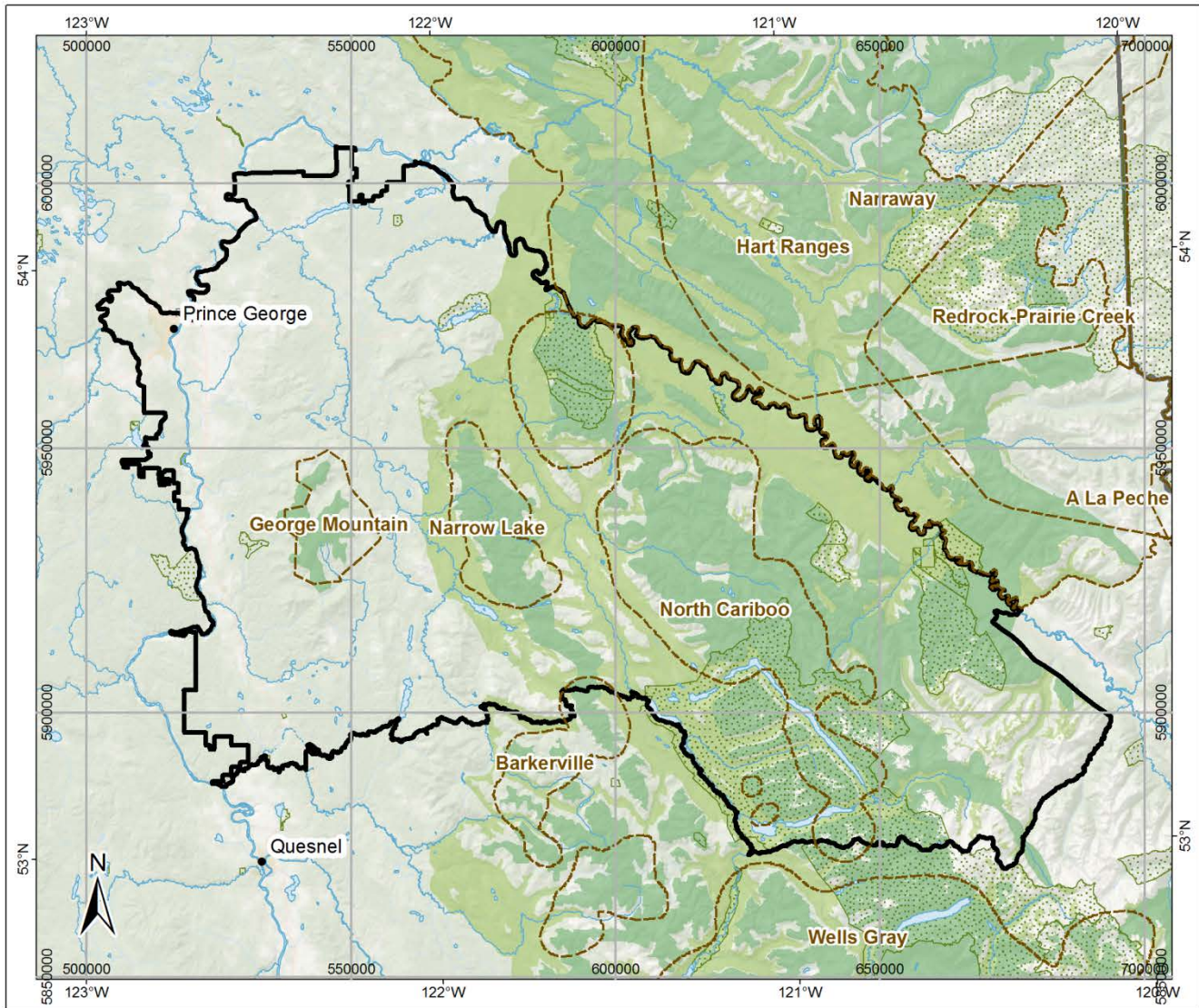


















 Environment Canada / Environnement Canada
Southern Mountain Caribou
(Rangifer tarandus caribou)
Critical Habitat
 Upper Fraser
 Local Population Unit
 British Columbia

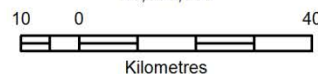
Legend

-  Local Population Unit
-  Subpopulation Boundary
-  Critical Habitat (High/Low Elevation Range)¹
-  Critical Habitat (Matrix Range)¹
-  Protected Area^{1,2}

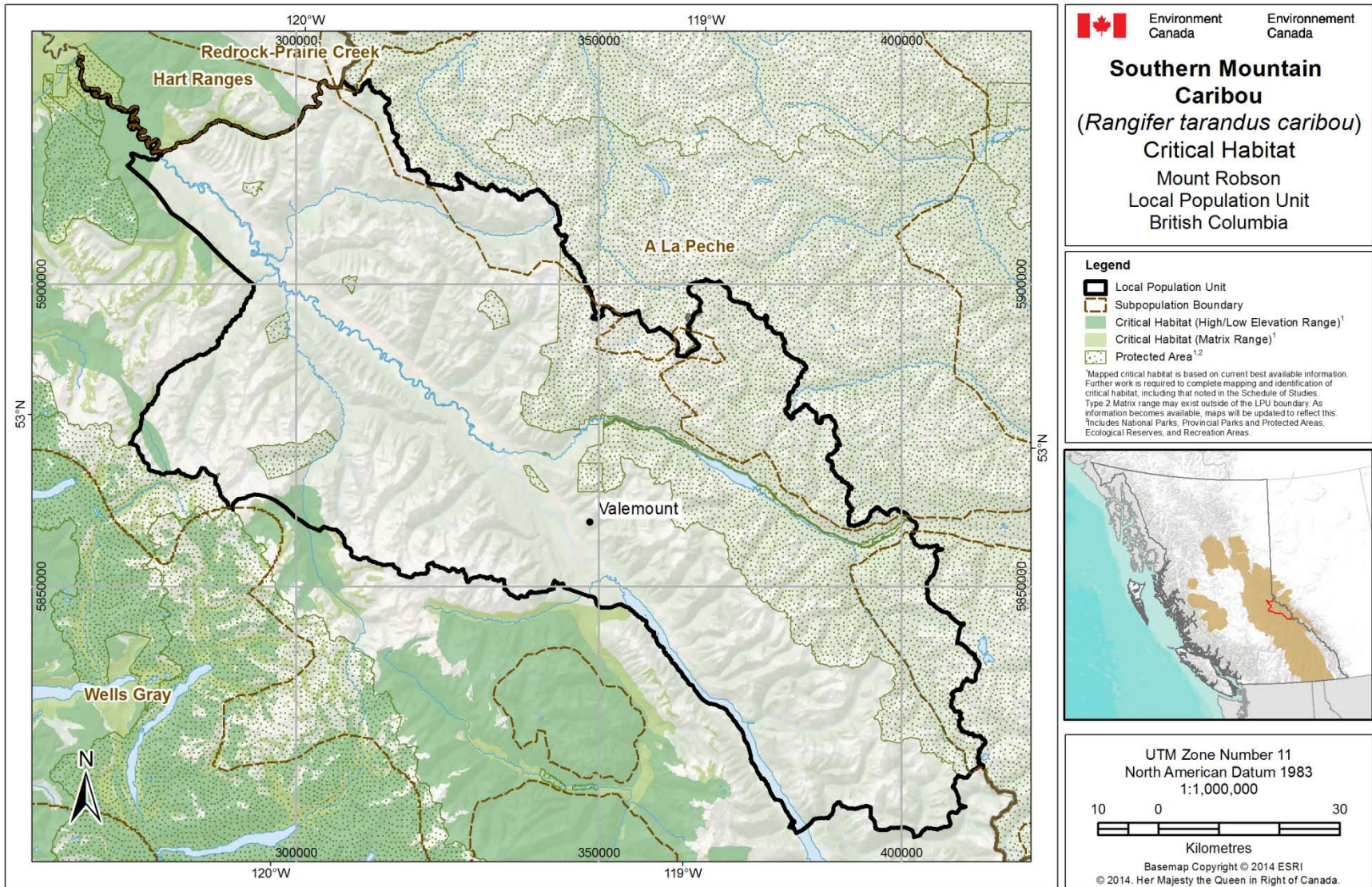
¹Mapped critical habitat is based on current best available information. Further work is required to complete mapping and identification of critical habitat, including that noted in the Schedule of Studies. Type 2 Matrix range may exist outside of the LPU boundary. As information becomes available, maps will be updated to reflect this. ²Includes National Parks, Provincial Parks and Protected Areas, Ecological Reserves, and Recreation Areas.

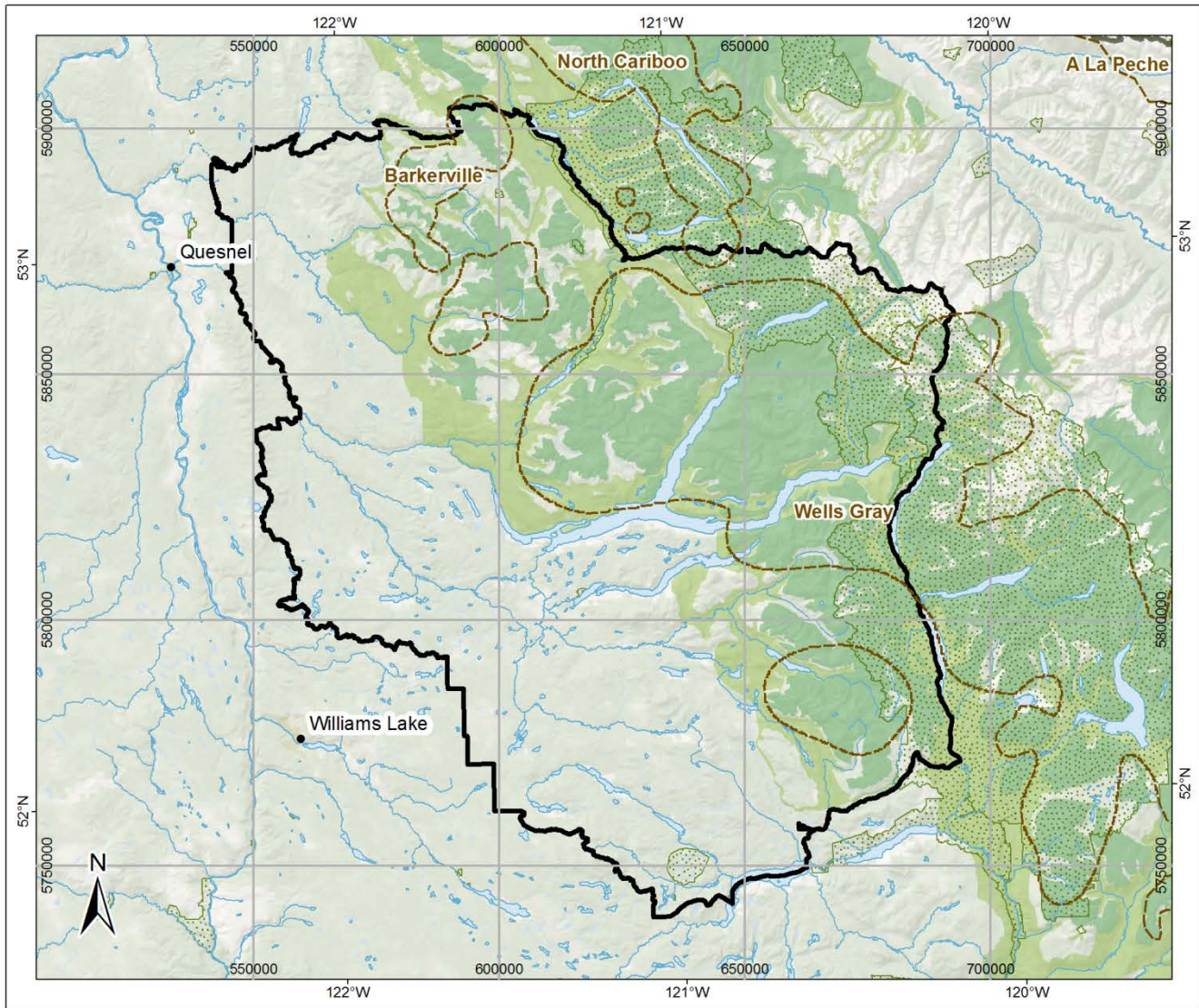



UTM Zone Number 10
 North American Datum 1983
 1:1,300,000








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 Environment Canada / Environnement Canada
Southern Mountain Caribou
(Rangifer tarandus caribou)
Critical Habitat
 Quesnel Highlands
 Local Population Unit
 British Columbia

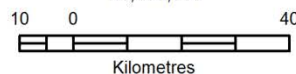
Legend

-  Local Population Unit
-  Subpopulation Boundary
-  Critical Habitat (High/Low Elevation Range)¹
-  Critical Habitat (Matrix Range)¹
-  Protected Area^{1,2}

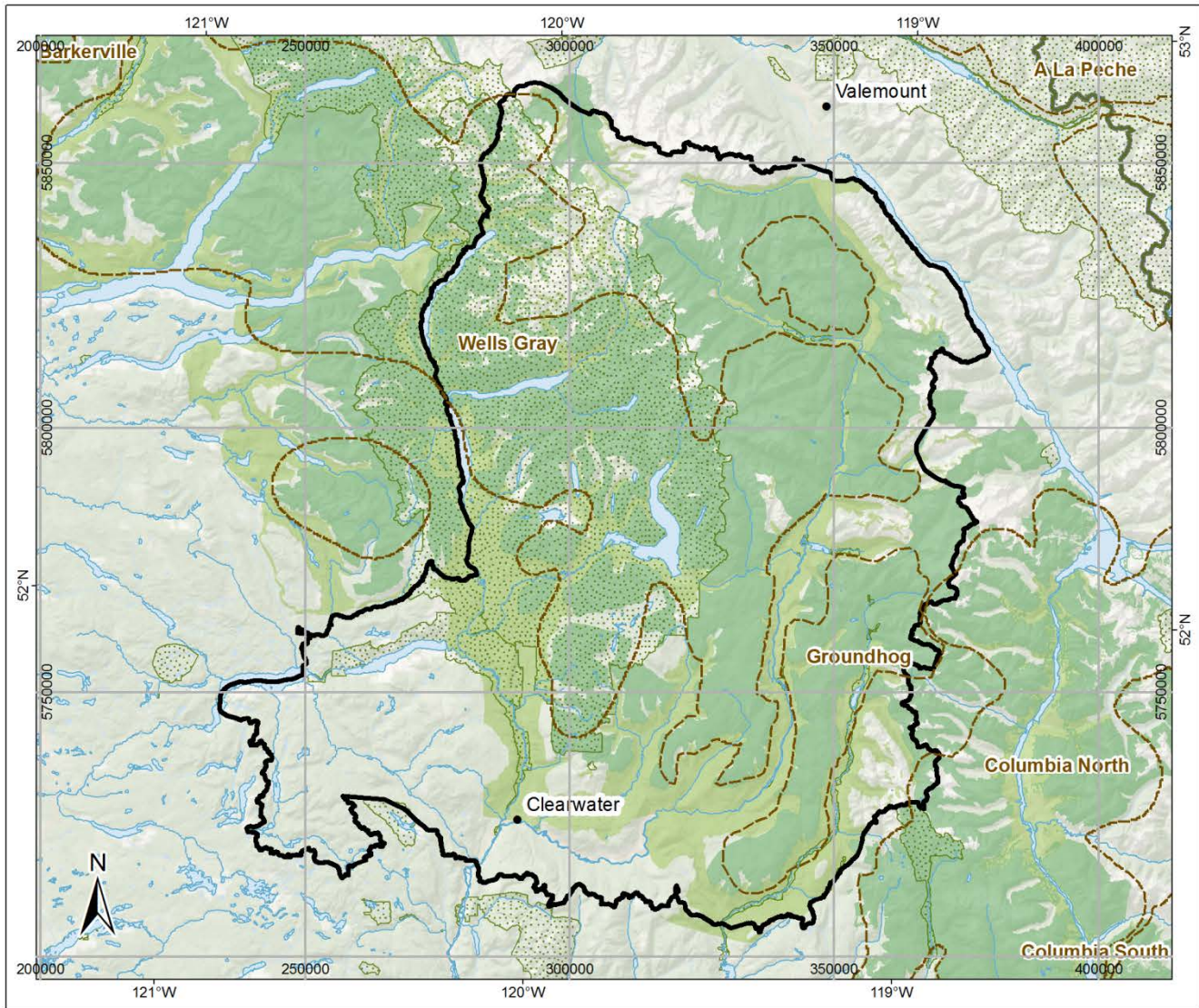
¹Mapped critical habitat is based on current best available information. Further work is required to complete mapping and identification of critical habitat, including that noted in the Schedule of Studies.
²Type 2 Matrix range may exist outside of the LPU boundary. As information becomes available, maps will be updated to reflect this.
 Includes National Parks, Provincial Parks and Protected Areas, Ecological Reserves, and Recreation Areas.




UTM Zone Number 10
 North American Datum 1983
 1:1,400,000








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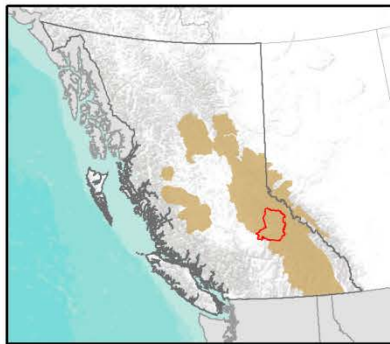
 Environment Canada / Environnement Canada

Southern Mountain Caribou
(Rangifer tarandus caribou)
Critical Habitat
 Wells Gray-Thompson
 Local Population Unit
 British Columbia

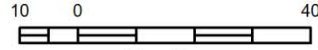
Legend

-  Local Population Unit
-  Subpopulation Boundary
-  Critical Habitat (High/Low Elevation Range)¹
-  Critical Habitat (Matrix Range)¹
-  Protected Area^{1,2}

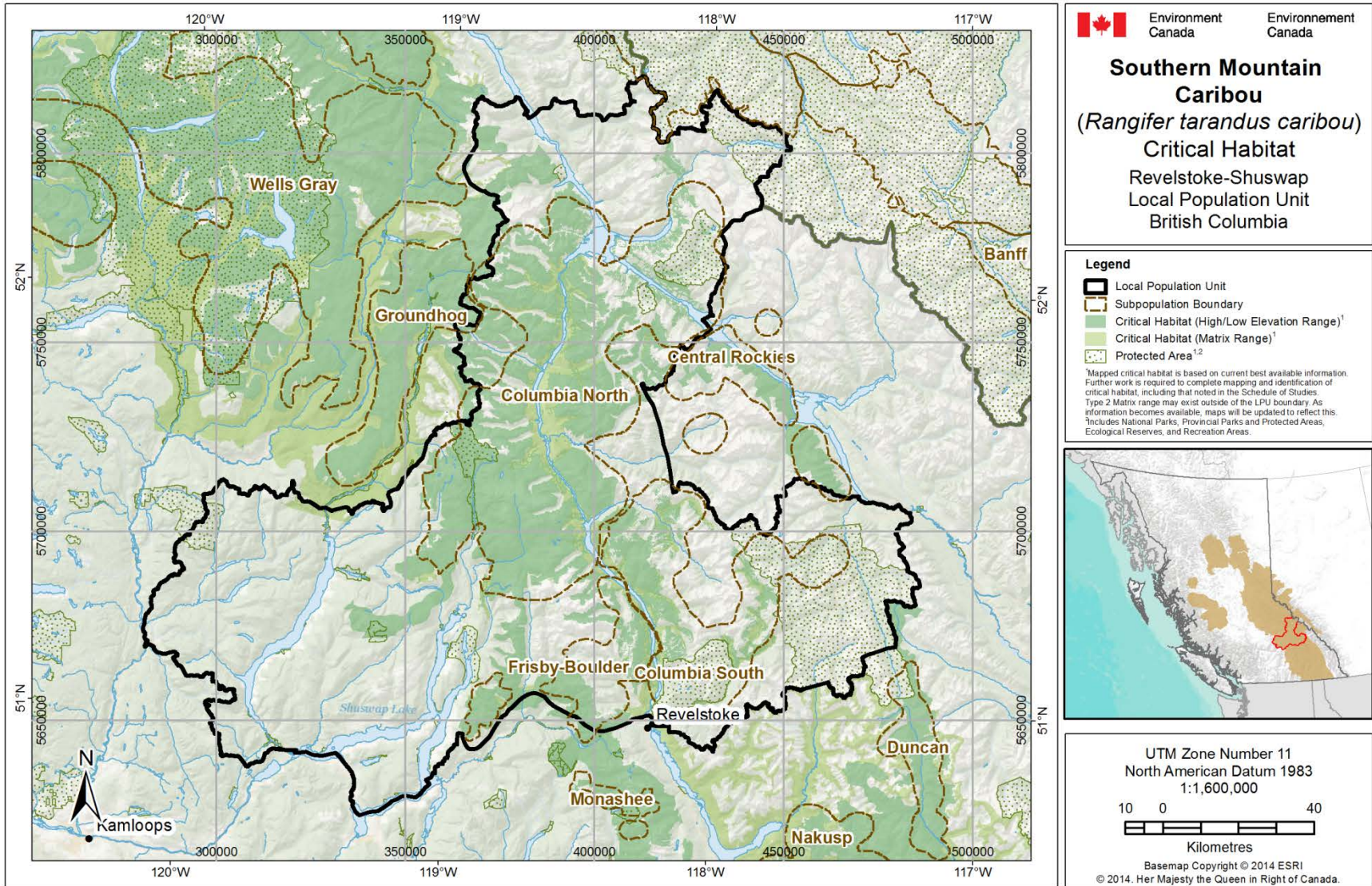
¹Mapped critical habitat is based on current best available information. Further work is required to complete mapping and identification of critical habitat, including that noted in the Schedule of Studies. Type 2 Matrix range may exist outside of the LPU boundary. As information becomes available, maps will be updated to reflect this.
²Includes National Parks, Provincial Parks and Protected Areas, Ecological Reserves, and Recreation Areas.

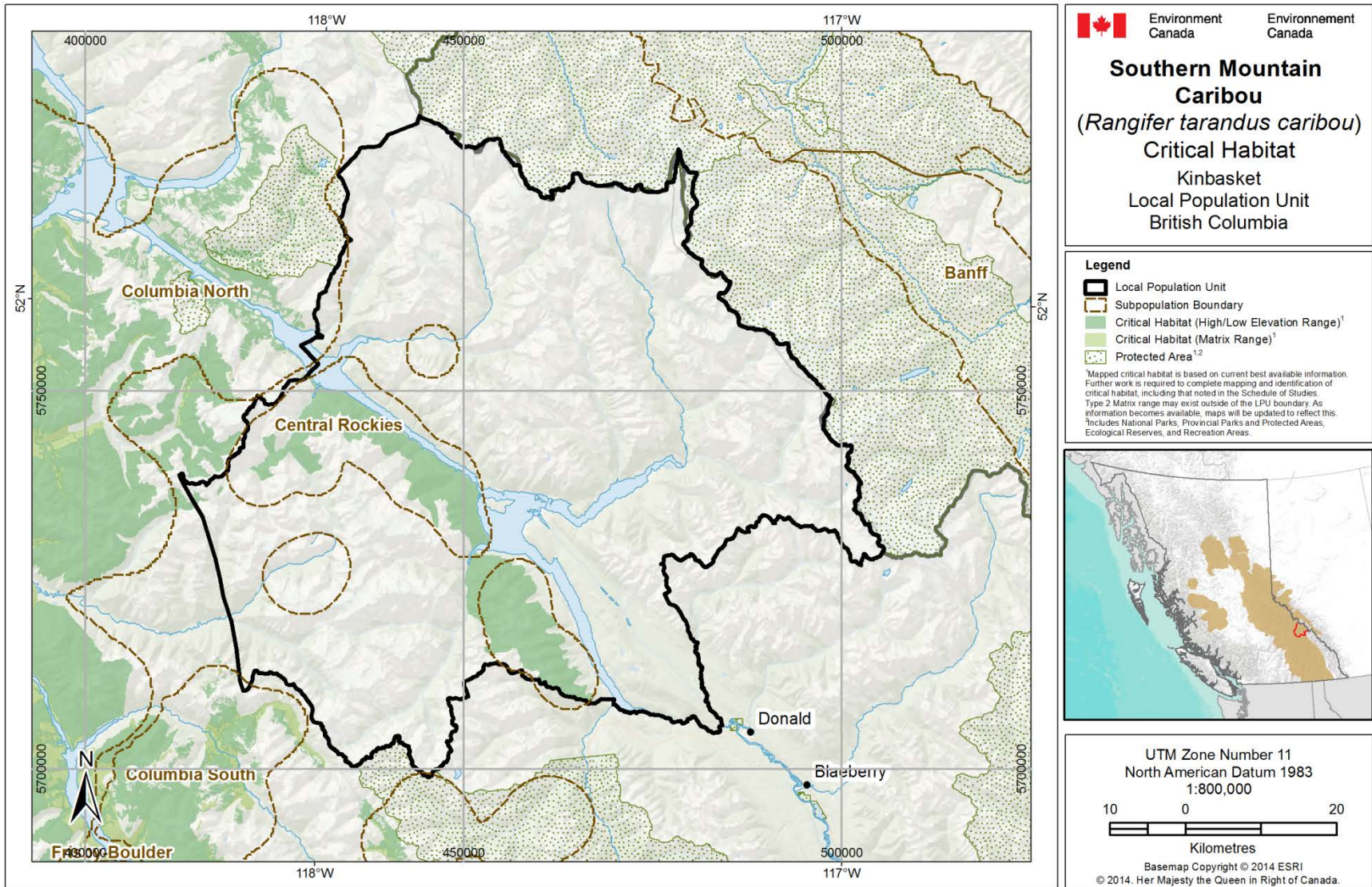


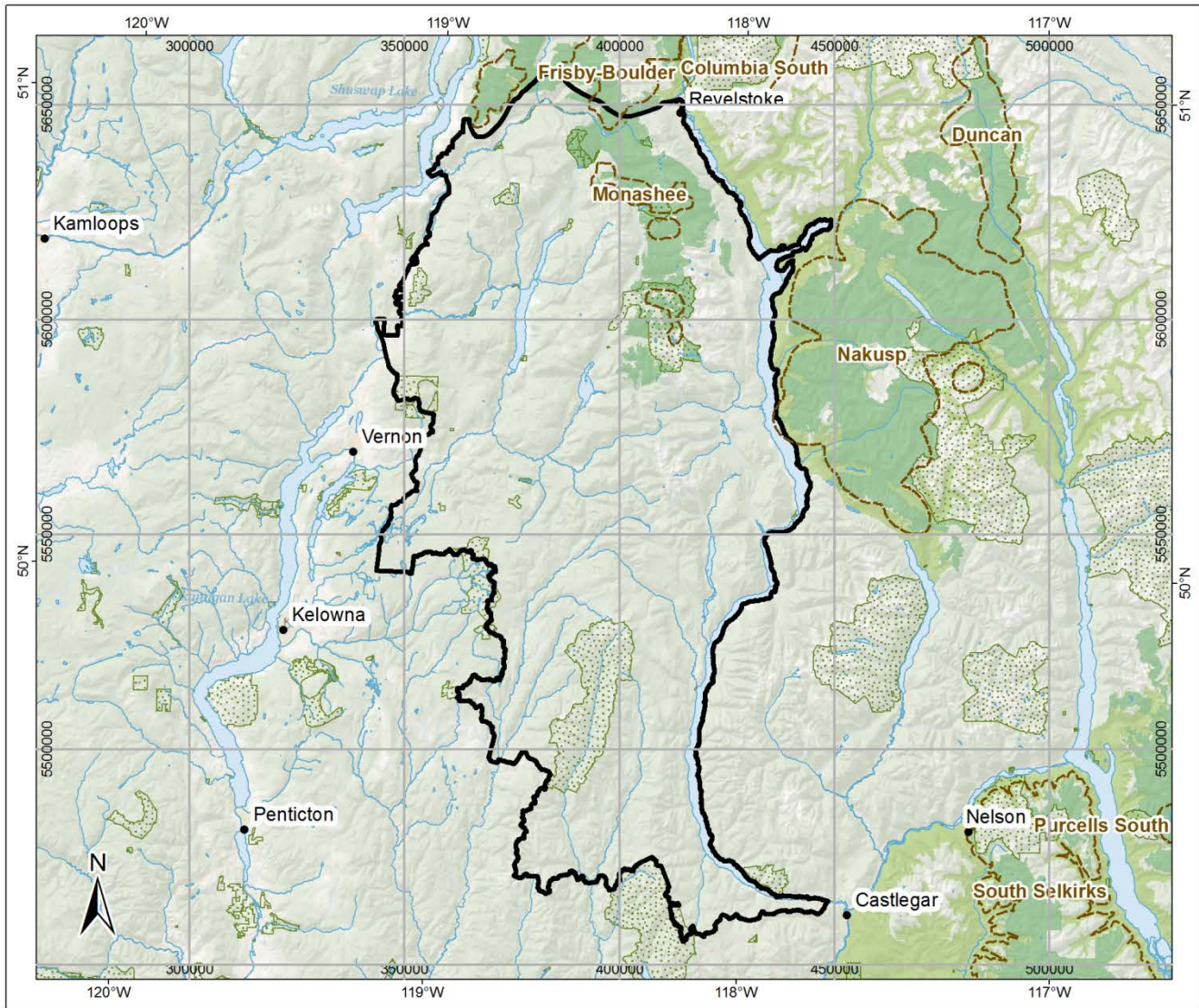
UTM Zone Number 11
 North American Datum 1983
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 Kilometres

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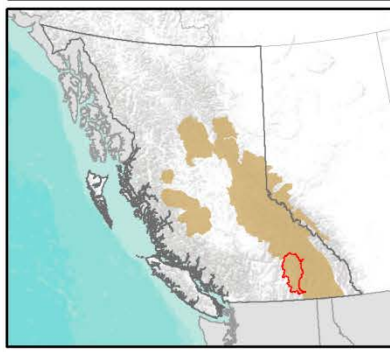


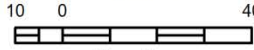
 Environment Canada / Environnement Canada
Southern Mountain Caribou
(Rangifer tarandus caribou)
Critical Habitat
 South Monashee
 Local Population Unit
 British Columbia

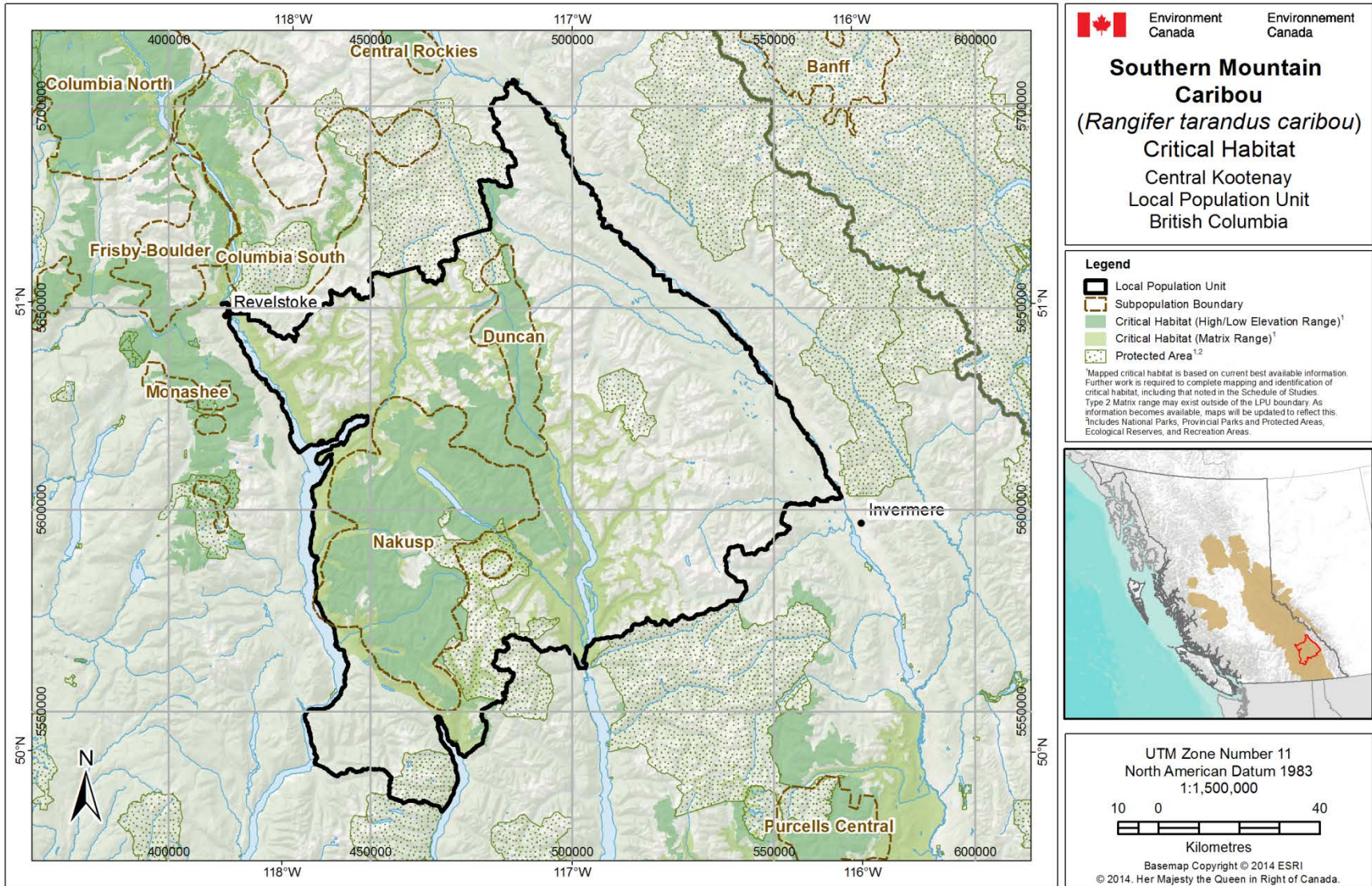
Legend

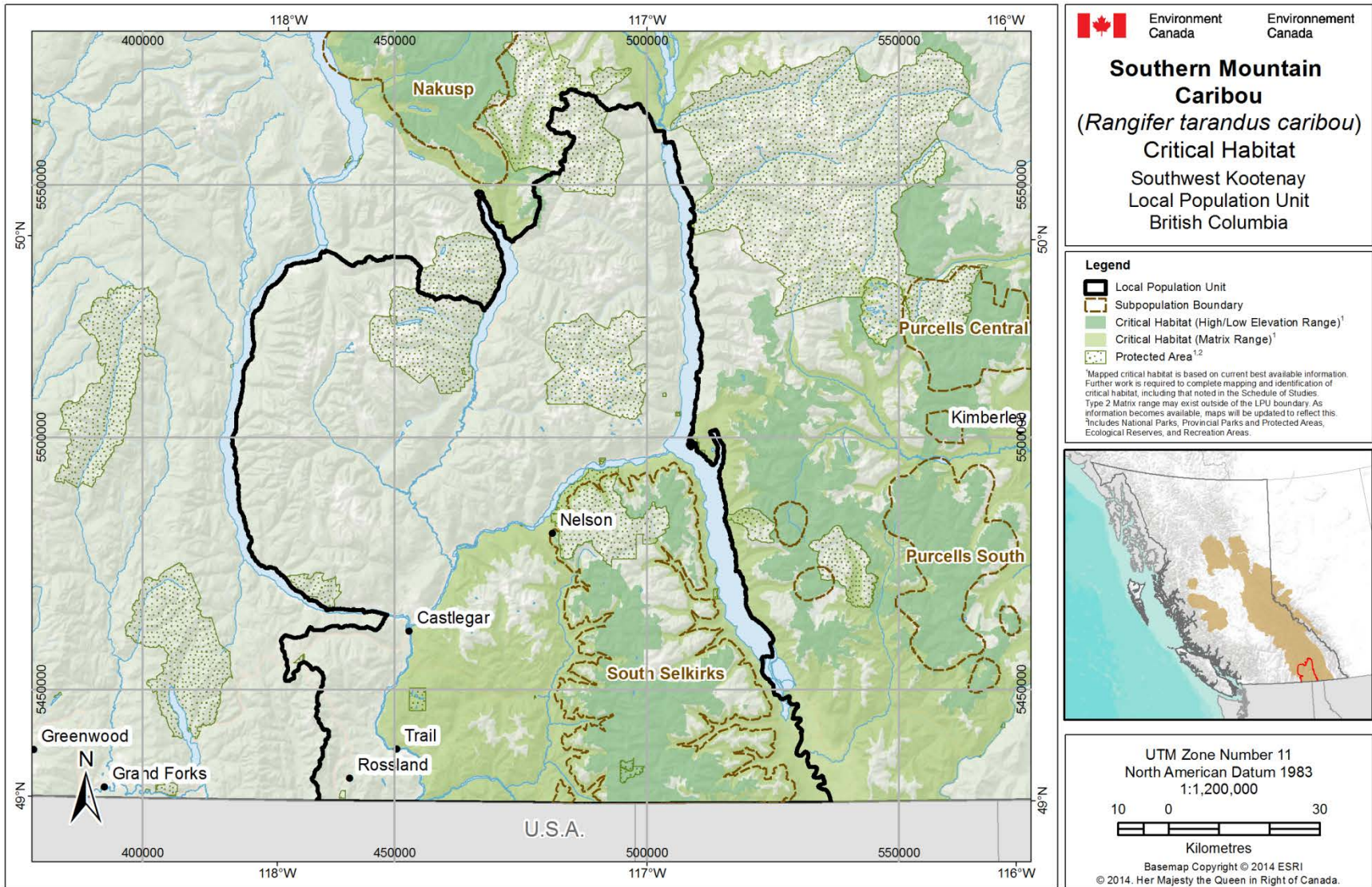
-  Local Population Unit
-  Subpopulation Boundary
-  Critical Habitat (High/Low Elevation Range)¹
-  Critical Habitat (Matrix Range)¹
-  Protected Area^{1,2}

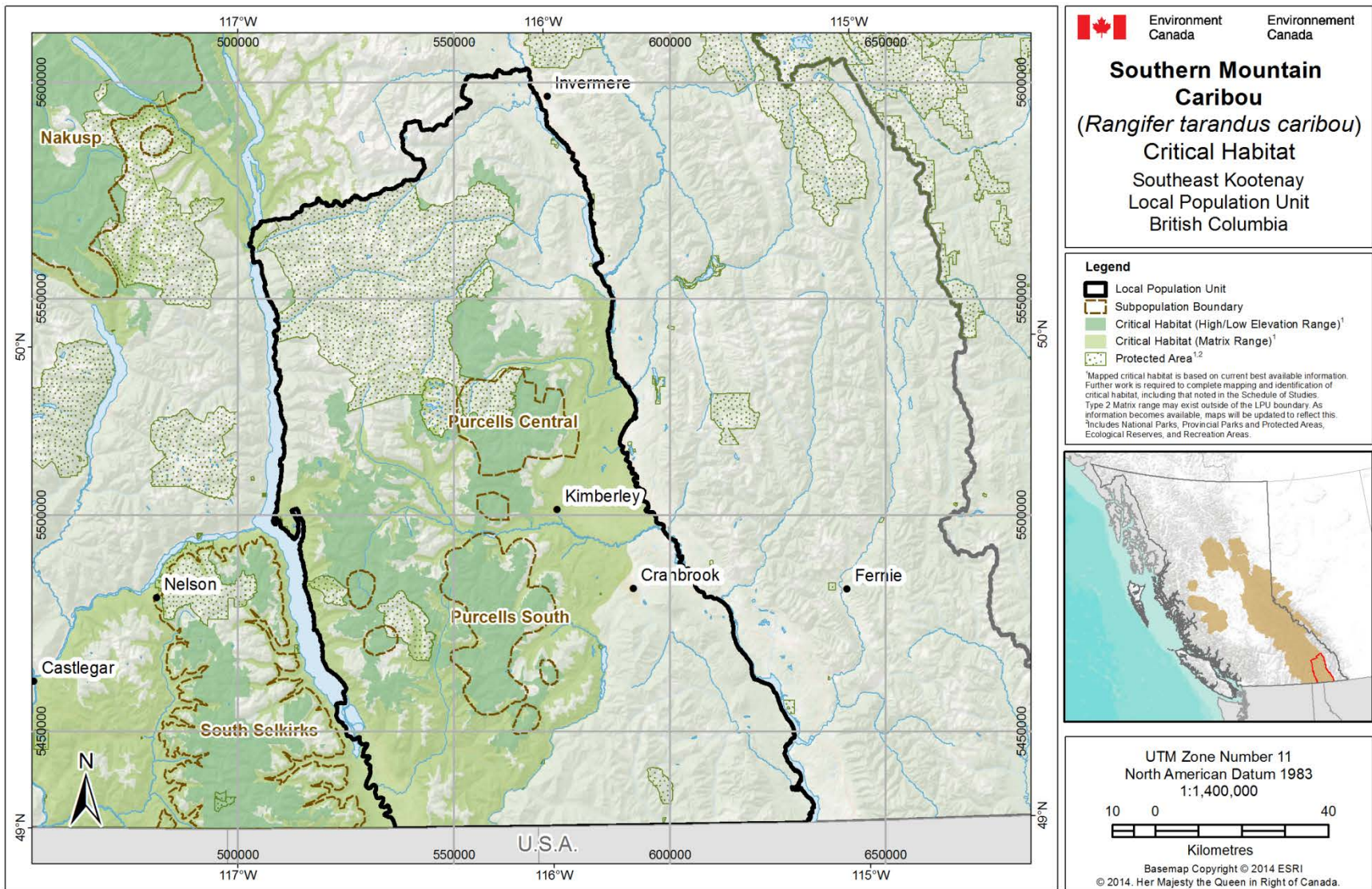
¹Mapped critical habitat is based on current best available information. Further work is required to complete mapping and identification of critical habitat, including that noted in the Schedule of Studies. Type 2 Matrix range may exist outside of the LPU boundary. As information becomes available, maps will be updated to reflect this.
²Includes National Parks, Provincial Parks and Protected Areas, Ecological Reserves, and Recreation Areas.



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 North American Datum 1983
 1:1,600,000

 Kilometres
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APPENDIX C: BIOPHYSICAL ATTRIBUTES FOR SOUTHERN MOUNTAIN CARIBOU CRITICAL HABITAT

Biophysical Attributes

Scientific published reports were used to summarize biophysical attributes required by southern mountain caribou to carry out life processes necessary for survival and recovery. Attributes are provided by southern mountain caribou Group in order to capture the ecological variation across the distribution of southern mountain caribou.

Biophysical Attribute Descriptions

The biophysical attributes for southern mountain caribou critical habitat are categorized by the types of habitat used. This is in accordance with seasonal and life-stage activity which include spring migration, calving, summer, rutting, early winter, and late winter. This information is provided in the following tables by Group.

Biophysical attributes will vary both between and within southern mountain caribou ranges. Since the biophysical attributes presented in this recovery strategy were developed at the Group scale and not by subpopulation, Environment Canada is committed to working with each provincial jurisdiction to provide affected decision makers and stakeholders with additional guidance on how specific activities are likely to affect the biophysical attributes of critical habitat.

Table C-1. Attributes for southern mountain caribou critical habitat (CH) in the Northern Group.

CH		Function	Features	Attributes
Summer Range (Spring)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests • Mineral licks 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Relatively snow-free or low snow areas with minimal obstructions • Access to terrestrial lichens, arboreal lichens, emergent vegetation • Mineralized soils, wetlands
	Low Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • Low elevation pine, pine/spruce, spruce, meadows, wetlands, forested wetlands • Mineral licks 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Relatively snow-free or low snow areas with minimal obstructions • Access to terrestrial lichens, arboreal lichens, emergent vegetation • Mineralized soils, wetlands
Summer Range (Calving)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests. 	<ul style="list-style-type: none"> • Very low predation risk • No sensory disturbance • Access to terrestrial lichens, arboreal lichens, emergent vegetation
	Low Elevation	<ul style="list-style-type: none"> • Security • Foraging 	<ul style="list-style-type: none"> • Lower and mid elevation forested habitats (pine, spruce, mixed stands, wetlands, forested wetlands). • Islands in lakes. 	<ul style="list-style-type: none"> • Very low predation risk • No sensory disturbance • Access to terrestrial lichens, arboreal lichens, emergent vegetation
Summer Range (Summer)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel • Insect relief 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests. 	<ul style="list-style-type: none"> • Very low predation risk • No sensory disturbance • Windy areas for insect relief • Snow patches for insect relief • Access to terrestrial lichens, arboreal lichens, forbs, grasses, alpine sedges • Minimal physical obstructions
	Low Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel • Insect relief 	<ul style="list-style-type: none"> • Lower or mid elevation forested habitats (pine, spruce, fir, cedar, hemlock, mixed stands), wetlands, forested wetlands. • Islands in lakes 	<ul style="list-style-type: none"> • Very low predation risk • No sensory disturbance • Windy areas for insect relief • Access to terrestrial lichens, arboreal lichens, forbs, grasses, sedges • Minimal physical obstructions
Summer Range (Fall/Rut)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests. 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, forbs, grasses, alpine sedges • Minimal physical obstructions
	Low Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • Lower or mid elevation forested habitats (pine, spruce, fir, cedar, hemlock, mixed stands), wetlands, forested wetlands. • Islands in lakes 	<ul style="list-style-type: none"> • Very low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, forbs, grasses, alpine sedges • Minimal physical obstructions
Winter Range (Early)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel 	<ul style="list-style-type: none"> • Windswept alpine slopes • High elevation subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, horsetails

CH		Function	Features	Attributes
Winter)			<ul style="list-style-type: none"> • Lakes 	<ul style="list-style-type: none"> • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions
	Low Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel 	<ul style="list-style-type: none"> • Low elevation forested habitats (pine, spruce, pine/spruce mixed stands), meadows, wetlands, forested wetlands. • Lakes 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, horsetails • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions
Winter Range (Late Winter)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel 	<ul style="list-style-type: none"> • Windswept alpine slopes • High elevation subalpine parkland and subalpine forests • Lakes 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, horsetails • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions
	Low Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel 	<ul style="list-style-type: none"> • Low elevation forested habitats (pine, spruce, pine/spruce mixed stands, black spruce fringes around wetlands), meadows, wetlands, forested wetlands. • Lakes 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, horsetails • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions
Matrix Range	Type 1	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests • Lower or mid elevation forested habitats (pine, spruce, fir, cedar, hemlock, mixed stands), meadows, wetlands, forested wetlands. 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, forbs, grasses, sedges • Relatively snow-free or low snow areas with minimal physical obstructions (spring migration) • Minimal physical obstructions
	Type 2	<ul style="list-style-type: none"> • Security • Travel (dispersal) 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests • Low elevation forested habitats (pine, spruce, pine/spruce mixed stands, black spruce fringes around wetlands), meadows, wetlands, forested wetlands. 	<ul style="list-style-type: none"> • Low predation risk • Low predator abundance

Table C-2. Attributes for southern mountain caribou critical habitat (CH) in the Central Group.

CH		Function	Features	Attributes
Summer Range (Spring)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests • Mineral licks 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Relatively snow-free or low snow areas with minimal obstructions • Access to terrestrial lichens, arboreal lichens, emergent vegetation • Mineralized soils, wetlands
Summer Range (Calving)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests. 	<ul style="list-style-type: none"> • Very low predation risk • No sensory disturbance • Access to terrestrial lichens, arboreal lichens, emergent vegetation
Summer Range (Summer)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel • Insect relief 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests. 	<ul style="list-style-type: none"> • Very low predation risk • No sensory disturbance • Windy areas for insect relief • Snow patches for insect relief • Access to terrestrial lichens, arboreal lichens, forbs, grasses, alpine sedges • Minimal physical obstructions
Summer Range (Fall/Rut)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests. 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, forbs, grasses, alpine sedges • Minimal physical obstructions
Winter Range (Early Winter)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel 	<ul style="list-style-type: none"> • Windswept alpine slopes • High elevation subalpine parkland and subalpine forests • Lakes 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, horsetails • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions
	Low Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel 	<ul style="list-style-type: none"> • Low elevation forested habitats (pine, spruce, pine/spruce mixed stands), meadows, wetlands, forested wetlands. • Lakes 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, horsetails • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions
Winter Range (Late Winter)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel 	<ul style="list-style-type: none"> • Windswept alpine slopes • High elevation subalpine parkland and subalpine forests • Lakes 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, horsetails • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions
	Low Elevation	<ul style="list-style-type: none"> • Security • Foraging 	<ul style="list-style-type: none"> • Low elevation forested habitats (pine, spruce, pine/spruce mixed stands, black spruce fringes) 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance

CH		Function	Features	Attributes
		<ul style="list-style-type: none"> • Travel 	around wetlands), meadows, wetlands, forested wetlands. <ul style="list-style-type: none"> • Lakes 	<ul style="list-style-type: none"> • Access to terrestrial lichens, arboreal lichens, horsetails • Access to ice/free water/slush • Canopy snow interception (travel) • Minimal physical obstructions
Matrix Range	Type 1	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests • Lower or mid elevation forested habitats (pine, spruce, mixed stands), wetlands, forested wetlands. 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, forbs, grasses, sedges • Relatively snow-free or low snow areas with minimal physical obstructions (spring migration) • Minimal physical obstructions
	Type 2	<ul style="list-style-type: none"> • Security • Travel (dispersal) 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests • Low elevation forested habitats (pine, spruce, pine/spruce mixed stands, black spruce fringes around wetlands), meadows, wetlands, forested wetlands. 	<ul style="list-style-type: none"> • Low predation risk • Low predator abundance

Table C-3. Attributes for southern mountain caribou critical habitat (CH) in the Southern Group.

CH		Function	Features	Attributes
Summer Range (Spring)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • High elevation subalpine parkland, and high and mid elevation subalpine forests • Mineral licks 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to abundant arboreal lichens, emergent vegetation • Mineralized soils, wetlands
	Low Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • Low elevation old forests of cedar, hemlock and spruce • Avalanche chutes • Burns • Mineral licks 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to abundant arboreal lichens, arboreal lichens on fallen trees, lichen litterfall, shrubs, forbs • Mineralized soils, wetlands
Summer Range (Calving)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests. 	<ul style="list-style-type: none"> • Very low predation risk • No sensory disturbance • Access to terrestrial lichens, arboreal lichens, emergent vegetation
Summer Range (Summer)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel • Insect relief 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests. 	<ul style="list-style-type: none"> • Very low predation risk • No sensory disturbance • Windy areas for insect relief • Snow patches for insect relief • Access to terrestrial lichens, arboreal lichens, forbs, grasses, sedges • Minimal physical obstructions

CH		Function	Features	Attributes
Summer Range (Fall/Rut)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests. 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to terrestrial lichens, arboreal lichens, forbs, grasses, alpine sedges • Minimal physical obstructions
Winter Range (Early Winter)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel 	<ul style="list-style-type: none"> • High elevation subalpine parkland, and high and mid elevation subalpine forests 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to abundant arboreal lichens • Minimal physical obstructions
	Low Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel 	<ul style="list-style-type: none"> • Low elevation old forests of cedar, hemlock and spruce 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to arboreal lichens, arboreal lichens on fallen trees, lichen litterfall, falsebox (<i>Paxistima myrsinites</i>) • Minimal physical obstructions
Winter Range (Late Winter)	High Elevation	<ul style="list-style-type: none"> • Security • Foraging • Travel 	<ul style="list-style-type: none"> • High elevation subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to abundant arboreal lichens • Minimal physical obstructions
Matrix Range	Type 1	<ul style="list-style-type: none"> • Security • Foraging • Travel (migration) 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests • Low elevation old forests of cedar, hemlock and spruce 	<ul style="list-style-type: none"> • Low predation risk • Low sensory disturbance • Access to arboreal lichens and other vegetation • Minimal physical obstructions
	Type 2 ¹	<ul style="list-style-type: none"> • Security • Travel (dispersal) 	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests • Low elevation forests (cedar, hemlock, spruce). 	<ul style="list-style-type: none"> • Low predation risk • Low predator abundance

¹Historically, Type 2 matrix habitat contained good quality range for southern mountain caribou in the Southern Group prior to extensive habitat alteration due to industrial activities

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