

# A Strategy for the Recovery of **Mountain Caribou** in British Columbia



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Prepared by  
**The Mountain Caribou  
Technical Advisory  
Committee**

Recovery Team for the  
Arboreal Lichen–Winter  
Feeding Ecotype of  
Woodland Caribou  
(*Rangifer tarandus caribou*)  
within the  
Southern Mountains  
National Ecological Area



**BRITISH  
COLUMBIA**

Ministry of Water, Land and Air Protection

VERSION 1.0 SEPTEMBER, 2002

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## DISCLAIMER

The Recovery Strategy for Mountain Caribou in British Columbia was prepared by the Mountain Caribou Technical Advisory Committee (MCTAC) to identify recovery strategies that are deemed necessary, based on sound biological principles, to protect and recover Mountain Caribou. It does not necessarily represent official positions of agencies and/or the views of all individuals involved in the document's preparation. Recovery actions to achieve the goals and objectives identified in the recovery strategy document are subject to the priorities and budgetary constraints of participating agencies and organizations. Goals, objectives and recovery approaches may be modified in future to accommodate new objectives or findings.

## ACKNOWLEDGEMENTS

Planning for the recovery of Mountain Caribou, with its long history of public interest and political controversy, has benefited from the efforts of a wide variety of people over the past decade. Greg McKinnon, formerly of the BC Ministry of Environment, Lands and Parks, developed the first outline in 1994 (McKinnon 1996). Bill Harper, formerly of the BC Ministry of Environment, Lands and Parks, supervised the preparation of three background strategy documents (Pacquet 1997, Simpson et al. 1997, Robinson 1997).

Preparation of this strategy benefited from correspondence with numerous other caribou specialists, including John Youds and Doug Heard from the BC Ministry of Water, Land and Air Protection, Harold Armleder and Bruce McLellan from the BC Ministry of Forests, Susan Stevenson from Silvifauna Research and Keith Simpson from Keystone Wildlife Consulting.

In addition to writing earlier drafts of this strategy, Ian Hatter completed this final version and acted as chair of MCTAC for the duration of the document's development. James Quayle drafted several versions of the recovery strategy and served as co-chair in 2001/2002. Kristin Karr provided GIS support and Gail Harcombe provided publication support. Dave Fraser and Kari Nelson provided input and direction on the recovery planning process. Financial support for the development of the strategy was provided by the British Columbia Habitat Conservation Trust Fund (HCTF).

## PREFACE

In May 2002, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Woodland Caribou within the Southern Mountains National Ecological Area (SMNEA) as Threatened. Two ecotypes of Woodland Caribou, mountain and northern, occur within the SMNEA. This document outlines a Strategy for the Recovery of the Mountain Caribou<sup>1</sup>. A second strategy to address recovery of the Northern Caribou ecotype in BC is under preparation. An “umbrella” National Recovery Strategy that will address Woodland Caribou<sup>2</sup> recovery is also under development.

This document is intended to provide direction for Mountain Caribou recovery based on the best available science. However, establishing a scientifically sound, cause-effect relationship in wildlife biology is extremely difficult, and poses an even greater challenge to recovery of species-at-risk where the potential to acquire statistically reliable sample sizes, or conducted replicated experiments, is diminished. Until such studies are completed, professional biologists must rely on their scientific knowledge, the general principles of their discipline, and the informed opinion of their expert peers. This “first-cut” approach to making conservation-based decisions, without the benefit of full scientific certainty, has more recently been referred to as the ‘precautionary principle’ This principle, as stated in the National Framework for the Conservation of Species at Risk is: *where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize a threat.* In reality, some level of uncertainty is associated with almost all conservation-based decisions.

Two documents that describe the current state of scientific knowledge and management practices for Mountain Caribou and their habitat are: *Toward a Mountain Caribou Management Strategy for British Columbia: Habitat Requirements and Sub-population Status* (Simpson et al. 1997) and *Mountain Caribou in Managed Forests: Recommendations for Managers, Second Edition* (Stevenson et al. 2001). These documents, as well as numerous other reviews of Mountain Caribou in British Columbia (e.g., Bergerud 1978, Stevenson and Hatler 1985, Seip and Stevenson 1987, Simpson et al. 1994, Stevenson et al. 1994, Seip and Cichowski 1996, Heard and Vagt 1998), have provided much of the technical background for the recovery strategy. In many cases, the authors of these reports have used limited field studies or observations to provide a preliminary diagnosis of the cause of a decline in a caribou population, and to propose solutions to reverse the decline. Throughout this document we have tried to indicate the level of scientific certainty associated with their statements. These include insertions into the text indicating where they may be a lack of scientific study to support a supposition, MCTAC footnotes that provide further clarification on the scientific basis to statements in the text, and the cautious and deliberate use of English

<sup>1</sup>The term “Mountain Caribou” used herein refers to the ecotype of Woodland Caribou that occupies southeastern British Columbia. Edmonds (1991) suggested referring to these caribou as the “Mountain/Arboreal ecotype” while Thomas and Gray (2001) referred to them as the “arboreal lichen-winter feeding ecotype. Both are attempts to avoid confusion with the popular name “mountain caribou,” which has been applied to caribou occupying mountains in other jurisdictions in Canada.

<sup>2</sup> Where discussion is not specific to “Mountain Caribou,” the term “Woodland Caribou” has been used to indicate the subspecies *Rangifer tarandus caribou* and the term “caribou” the species *R. tarandus*.

to indicate the level of uncertainty, e.g. “perceived threat”, “may displace caribou” or “the authors speculate.”

Notwithstanding the need to make decisions based on the precautionary principle, ecosystem management principles and dominant scientific consensus, MCTAC respects and supports the plea by Caughley and Gunn (1996:223) that “the scientific approach be adhered to and assumptions shunned in so far as this may be possible.” Specifically they recommend the following series of steps in endangered species recovery analysis:

1. Confirm that the species is presently in decline or that previously it was more widely distributed or more abundant.
2. Study the species’ natural history for knowledge of and a feel for its ecology, context, and status.
3. When confident that this background knowledge is adequate to avoid silly mistakes, list all conceivable agents of decline.
4. For each agent, measure its level where the species now is and where the species used to be in time or space.
5. Test the hypothesis by experiment to confirm that the putative agent is causally linked to the decline.

The provincial recovery strategy only addresses steps 1 through 3. Steps 4 and 5 should be addressed through recovery action plans for local populations. An effective recovery action plan will also need to apply adaptive management, develop cooperative stewardship arrangements with local stakeholders, and identify the economic and social consequences associated with recovery.

During the course of writing this document, a new government was elected in British Columbia (June 2001). Prior to 2001, wildlife management activities were the responsibility of the Ministry of Environment, Lands and Parks (MELP). This ministry was divided into the Ministry of Water, Land and Air Protection (MWLAP) and the Ministry of Sustainable Resource Management (MSRM) in 2001. This information may be helpful to readers who consult the bibliography or wish to contact sources.

The change in government will also result in major changes to government protocols, policy and institutions. Currently, changes are proposed, or have been made, to the Forest Practices Code (FPC), to strategic land use planning, including Land and Resource Management Plans (LRMPs) and Higher Level Plans (HLPs), and to funding sources, such as Forest Renewal British Columbia (FRBC). These changes will require future amendments to the recovery strategy and may also have significant effects on how recovery actions are implemented.

## EXECUTIVE SUMMARY

The Strategy for Recovery of Mountain Caribou is a document for planning recovery actions for the Mountain Caribou, an arboreal lichen–winter feeding ecotype of the Woodland Caribou (*Rangifer tarandus caribou*) found primarily in southeastern British Columbia. It is intended to support a National Recovery Strategy for Woodland Caribou. The national strategy will include, but is not limited to, Mountain Caribou. The national strategy is the first part of a two-part National Recovery Plan for Woodland Caribou; the local population-specific Recovery Action Plans is the second part.

Section I provides the introduction and background information. The British Columbia Conservation Data Centre (CDC) placed the Mountain Caribou on the provincial Red List in 2000. The CDC Red List includes species that are candidates for legal status as provincially Threatened or Endangered. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated caribou in the Southern Mountains National Ecological Area (SMNEA), including all Mountain Caribou, on their Threatened list in May 2000 and reaffirmed this designation in May 2002. The COSEWIC designation includes species that are candidates for formal national Threatened status under the new federal *Species at Risk Act* (SARA)<sup>3</sup>. A small, transboundary population of Mountain Caribou in the South Selkirks was officially designated as Endangered in the United States in 1984. Thus, BC has provincial, national and international responsibilities for maintaining Mountain Caribou.

Section II, Evaluation of Conservation Status, first identifies factors contributing to vulnerability and Threatened status, then examines the role of Mountain Caribou in the ecosystem and interactions with humans. Historically, Mountain Caribou were apparently more widely distributed and abundant than today. One estimate is that Mountain Caribou have been extirpated from 43% of their historic BC range. British Columbia currently has an estimated 1900 Mountain Caribou distributed in 13 local populations that collectively form a metapopulation. Widespread habitat alteration, past over-hunting and increased predation are believed to have contributed to the disappearance of Mountain Caribou from portions of their historic range in BC. Today, the primary threat to Mountain Caribou appears to be fragmentation of their habitat. Associated with this fragmentation are potential reductions in available winter food supply, increased human access and associated disturbance, and alteration of predator-prey relationships. For these reasons, forest practices are currently considered to be the greatest habitat management concern. Increasing interest in mechanized backcountry recreation poses a more recent potential threat to caribou.

General considerations for recovery under Section II outlines a conservation ranking for local populations and presents a conservation approach that employs the metapopulation concept, the precautionary principle, adaptive management and ecosystem management principles. The most effective means to satisfactorily resolve conflicts between management of habitat for Mountain Caribou and competing land uses is to use existing information and conservation principles over the short term, employ adaptive management over the longer term and ensure full participation of all relevant stakeholders in the decision-making process.

<sup>3</sup> As of August 2002, SARA has passed third reading in Parliament and is expected to receive Royal Assent by November 2002.

Recovery Goals and Objectives under Section III identifies three goals and associated objectives to advance the recovery of Mountain Caribou: Recovery goals include: (1) a metapopulation of 2500-3000 caribou distributed throughout their current range in BC; (2) enhancement of identified local populations; and (3) public support for the recovery of Mountain Caribou and their habitats. Goal 3 recognizes that integrated resource management and public interest and involvement are key to recovery.

In Section III, Provincial Approaches for Recovery, 20 recovery approaches and associated recovery actions are identified. For each approach, the status, the recovery actions proposed and some possible concerns with implementing the actions are identified.

Section IV, Recovery Strategy Implementation, identifies three general principles for realizing the recovery goals and objectives. These include ensuring that recovery actions will be science-based, that recovery will be based on shared stewardship and that recovery will be based on financial capacity. It is recognized that maintaining Mountain Caribou and their habitat in perpetuity throughout their range will require the cooperation of government agencies, the forest industry, commercial recreation operators, local communities, First Nations and non-government organizations (NGOs). An implementation schedule (Table 12) is provided which identifies the priority for recovery approaches, possible co-operators, target date for completion and required funding. The schedule should be used in the regular monitoring of all provincial recovery actions and as a basis for the funding of recovery measures. The schedule should also be reviewed on an annual basis to evaluate progress and to update activities according to changing circumstances.

A major purpose of the Strategy for Recovery of Mountain Caribou is to outline a strategy that will lead to down-listing of Woodland Caribou from their Threatened status under COSEWIC for the SMNEA. Implementing the provincial approaches for recovery will require an estimated \$3.5 million over five years. The recovery strategy should be updated as new information becomes available, and revised every five years until down-listing has been achieved.



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# SECTION I

## INTRODUCTION AND BACKGROUND

### 1. Introduction

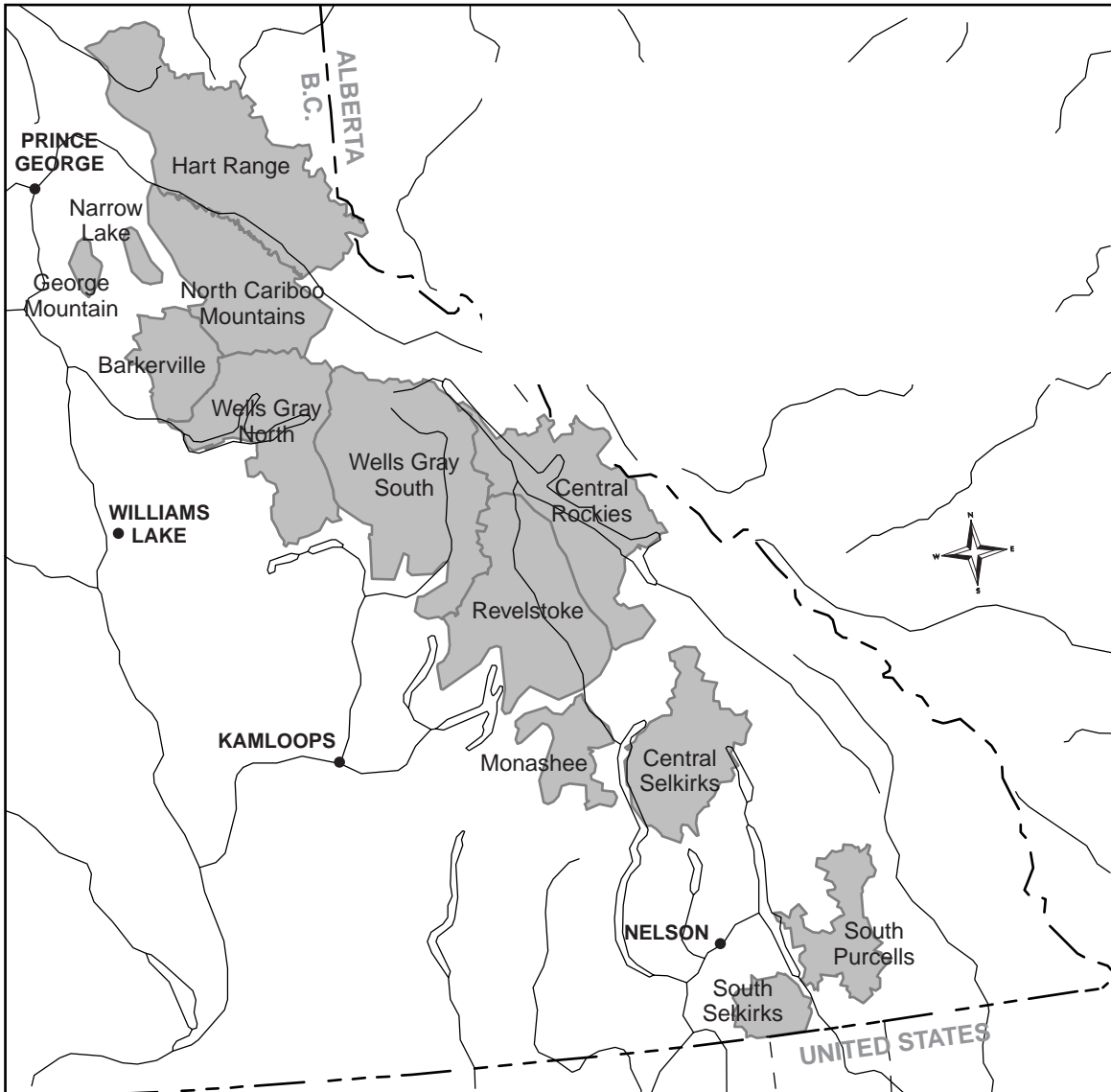
All caribou in British Columbia (BC) belong to the woodland subspecies (*Rangifer tarandus caribou*), but they can be further divided into three ecotypes, based on differences in habitat use, behaviour and migration patterns (Heard and Vagt 1998). The range of the arboreal lichen–winter feeding ecotype (hereafter referred to as “Mountain Caribou”) corresponds closely with the distribution of the Interior Wet Belt in southeastern and east-central British Columbia (Hatter and Kinley 1999, Stevenson et al. 2001:3). Mountain Caribou are characterized by their use of high-elevation habitat in late winter, where they rely almost exclusively on arboreal lichens for forage. The entire population of about 1900 Mountain Caribou lives in British Columbia, although about 35 of them also range into northern Idaho and Washington (Figure 1). Other ecotypes in the province include the Northern Caribou (~ 15 000 animals), which lives in central and northern BC, and the Boreal Caribou (~ 700 animals), which is restricted to the lowlands of northeastern BC (Heard and Vagt 1998).

In 1993, Mountain Caribou were featured on the provincial Blue List of “species at risk” by the Conservation Data Centre (CDC) because of past declines in distribution and abundance. Blue-listed taxa are considered vulnerable or sensitive and in need of special management to ensure their survival. In 2000, Mountain Caribou were elevated to the Red List because of continuing declines in abundance and current threats (Appendix 1). As a Red-listed ecotype, these caribou are candidates to be legally designated as having Threatened or Endangered status under the provincial *Wildlife Act*. The northern and boreal ecotypes are both currently Blue-listed.

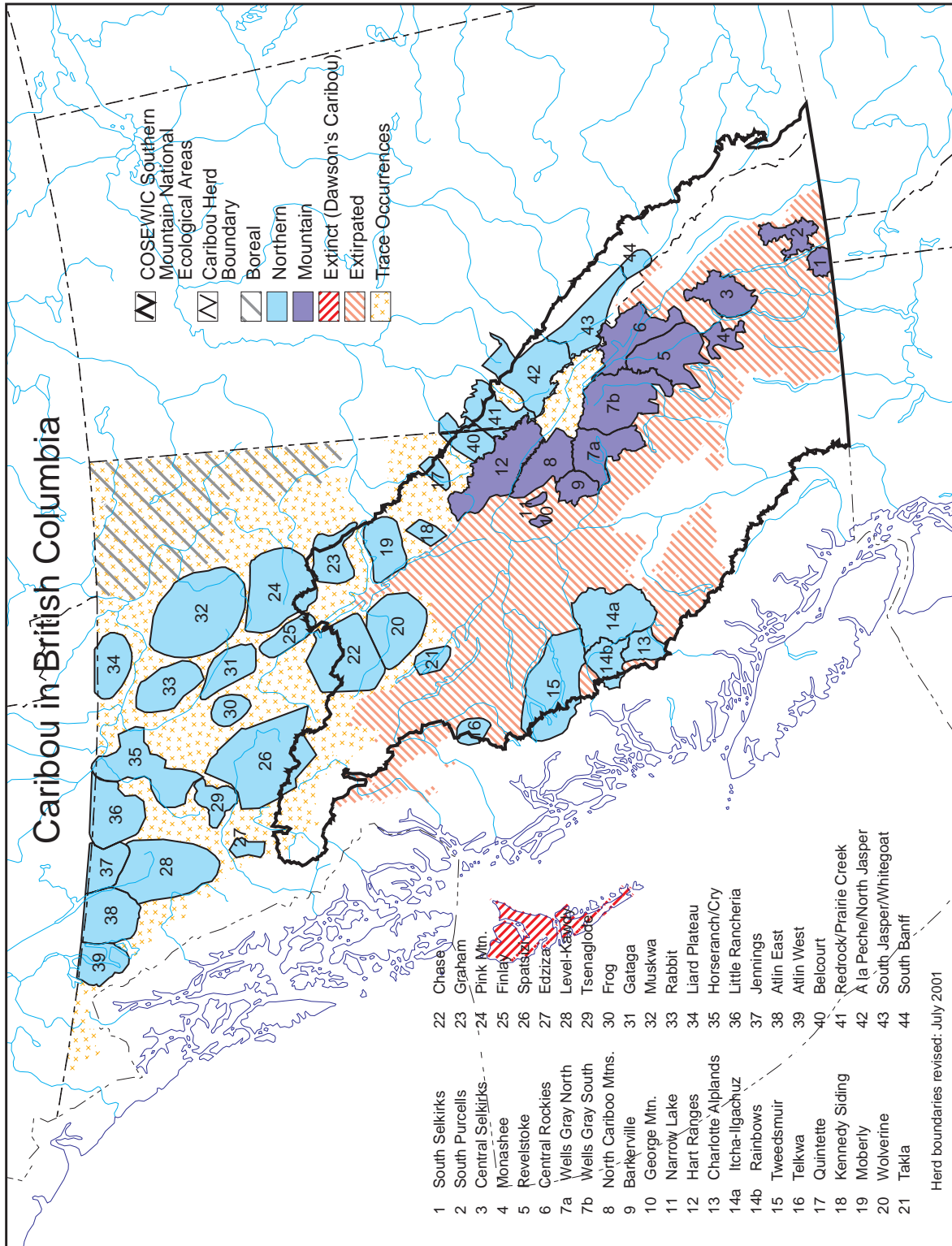
In 1996, British Columbia signed the National Accord for the Protection of Species at Risk. This accord provides the framework for the proposed federal

*Species at Risk Act* (SARA). Furthermore, it recognizes the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a source of independent advice on the status of species at risk nationally. In May 2000, COSEWIC designated Woodland Caribou within the Southern Mountains National Ecological Area (SMNEA) as nationally Threatened (Appendix 2). This area includes all Mountain Caribou in BC, 13 local populations of Northern Caribou from west-central and central BC and four local populations from west-central Alberta (Figure 2). As a signatory to the National Accord, BC is obligated to develop a recovery plan that addresses the threats to the species and its habitat. In May 2002, COSEWIC confirmed the designation for Woodland Caribou within the SMNEA as nationally Threatened, based on an updated status report (Thomas and Gray 2001).

The transboundary local population of the South Selkirk Mountains in BC and the United States (Washington and Idaho) was officially designated as Endangered in the United States by the US Fish and Wildlife Service (USFWS) in 1984, under the *Endangered Species Act* of 1973. Prior to federal listing by the USFWS, the Idaho Fish and Game Commission listed the South Selkirks caribou as Threatened or Endangered in 1977 and the Washington Game Commission designated the species as Endangered in 1982. Recovery of the South Selkirks population is an interagency effort coordinated by the USFWS, which includes research and management contributions from the Washington Department of Fish and Wildlife, the Idaho Department of Fish and Game, the US Forest Service and the BC Ministry of Water, Land and Air Protection (MWLAP). Recovery actions are based on an approved recovery plan (USFWS 1993). Thus, British Columbia has provincial, national and international responsibilities for maintaining Mountain Caribou.



**Figure 1. Current distribution of 13 local populations of Mountain Caribou.**



**Figure 2. Current distribution of local populations of Woodland Caribou in BC by ecotype.** Local populations from Alberta within the COSEWIC Southern Mountains National Ecological Area are also identified

## SECTION II

# EVALUATION OF CONSERVATION STATUS

### 2. Factors contributing to Vulnerability and Threatened Status

#### 2.1 Population Considerations

##### 2.1.1 Life History

The following description of Mountain Caribou life history was extracted from Bergerud (1980, 1992, 1996, 2000), Edwards and Ritcey (1960), USFWS (1993), Seip and Cichowski (1996) and Flaa and McLellan (2000).

The productivity of caribou is low compared to other cervids in North America because caribou only have one young per year and calves and most yearlings commonly are not pregnant. The population growth rate ( $\lambda$ ) rarely exceeds 1.26, or 26% per year. The mean pregnancy rate of females ranges from 82.5% for animals older than 1.5 years to 85% for animals older than three years. Gestation is about 230 days and calves are born in late May or early June. Pregnant females seek secluded sites in alpine and subalpine habitats to calve, presumably as a strategy to avoid predators. Calf mortality during the first few months of life is high, frequently approaching 50% or greater. Causes of calf mortality may include inclement weather, predation, abandonment and accidents. Calves generally make up 27-30% of the population at birth, but by recruitment age (one year old, after which mortality generally stabilizes to adult levels), their proportion is generally less than 20%. Unhunted populations are considered stable when calves make up about 15% of the local population in late winter, while higher or lower proportions indicate increasing or decreasing populations, respectively. Females generally live 10-15 years and males 8-12 years in unhunted populations. Adult female mortality rates average about 15%, but can vary annually from almost 0% to 30%. Causes of adult mortality include predation, poaching, starvation, accidental deaths

(e.g., avalanches), motor vehicle collisions and other unknown causes. In some local populations of the Mountain Caribou ecotype, most adult mortality occurs during summer and early autumn and is primarily predator-related (including wolves, Cougars and bears). In other local populations, it may occur year-round and include both predation and accidental deaths.

Mountain Caribou are functionally polygynous, with adult males defending harems of 6-10 cows with calves. The breeding season is usually short and peaks during early to mid October. After the rut, adult males generally segregate themselves and remain so throughout the year. Unlike some other caribou, Mountain Caribou generally remain in relatively small, incohesive groups. Group size ranges from single females during the calving season to groups of approximately 25 during late winter. The largest groups are encountered during the rut and late winter, whereas spring and summer groups are generally small (two to five individuals). Tactics used by caribou to minimize interactions with predators include seasonal migrations to subalpine areas and habitat segregation with conspecifics.

The food habits of Woodland Caribou are unique in the deer family. Although Mountain Caribou eat a wide variety of foods, foraging during winter is limited almost exclusively to arboreal lichens (*Alectoria sarmentosa* and *Bryoria* spp.). Falsebox (*Pachistima myrsinites*) is also a significant forage source during the early winter in some areas. While other shrubs such as willows (*Salix* spp.) and *Vaccinium* spp. may be used, they are of lesser importance. During the remainder of the year, Mountain Caribou feed extensively on a variety of foods including grasses, sedges, horsetails, flowering plants and leaves of numerous shrubs.



### 2.1.2 Historical Status

Historically, Mountain Caribou were more widely distributed throughout the mountainous region of southeastern BC (Spalding 2000). Habitat loss, habitat fragmentation, hunting, poaching and predation probably have contributed to the reduction of their current range (Stevenson and Hatler 1985, Seip and Cichowski 1996, Heard and Vagt 1998, Spalding 2000). One estimate is that Mountain Caribou have been extirpated from approximately 43% of their historic BC range (BC MELP 2001).

There are no reliable estimates of the number of Mountain Caribou at the time of first European contact. However, based on an analysis of anecdotal information, Mountain Caribou appear to have declined in all portions of their range, although the timing and extent of these declines are unclear and presumably varied by geographic area. The following description of the decline of Mountain Caribou has been extracted from Spalding (2000:33-34):

*“The first noted declines of caribou occurred in the Okanagan and southern Kootenays, which started soon after the arrival of Europeans in British Columbia. By the first decade of the 20th century numbers were lower than during the late 19th century. In the Okanagan, this decline continued until*

*sometime in the late 1950s, when caribou finally disappeared from the mountains east of Okanagan Lake. Caribou numbers within the remainder of the Kootenay region declined prior to 1918, but appeared to have increased during the 1930s. Numbers remained stable until about 1960, after which there was a second decline. Within the Cariboo region, the historical data suggests a marked decline in numbers beginning in the mid 1930s. Numbers remained low for about a decade and then began a slow increase. Caribou numbers within what is now Wells Gray Park and vicinity began to drop in the mid 1930s, similar to the decline in the Cariboo region. However, the evidence suggests this decline was not as severe, that numbers remained low for about five years, and then began a slow increase into the 1970s. Mountain Caribou in other locations have all declined. However, the historical data lacks precision, and it has not been possible to determine when the declines began and what happened during the ensuing years.”*

### 2.1.3 Current Abundance and Distribution

The first provincial estimate for Mountain Caribou was 1490 animals by Bergerud (1978). More recent estimates have been higher, but the earlier estimates are considered to be much less reliable (Table 1). While numbers may have increased from the mid

**Table 1. Summary of published provincial estimates of Mountain Caribou.**

Year	Estimated No. of Caribou	Reliability <sup>a</sup>	Source
1978	1490	Low	Bergerud 1978
1985	1450	Low	Stevenson and Hatler 1985
1991	1900-2000	Low	Edmonds 1991
1996	2300	Moderate	Heard and Vagt 1998
1997	2450	Moderate	Hatter 2000
2002	1900	High	See Table 2

<sup>a</sup> A recent review of all existing Mountain Caribou survey data (Hatter and Quayle in prep.) was only able to verify seven surveys conducted on local populations between 1983 and 1987, while 14 were verified between 1988 and 1992, 30 between 1993 and 1997, and 29 between 1997 and 2002. Standardized surveys for Mountain Caribou started in the early 1990s. Thus, reliability of population estimates prior to 1993 must be considered as low due to the paucity of survey data and lack of standardized survey techniques. The reliability of the 1996 and 1997 estimates are considered moderate, as all 13 local populations had been identified for surveys. The reliability of the 2002 estimate is considered high, as all local populations were surveyed in March/April 2002 using standardized census techniques.

1980s to the mid 1990s, it is likely that most of the “apparent” increase shown in Table 1 is from more intensive survey effort, which, combined with recent radio-telemetry studies, has enabled a more accurate estimate of Mountain Caribou numbers (Hatter and Quayle in prep.).

Currently, Mountain Caribou exist in 13 local populations, which collectively form a metapopulation (Figure 1). The 2002 estimate for Mountain Caribou is about 1900 animals. Attempts at population reconstruction suggest that Mountain Caribou have decreased over the short-term and the current trend is down (Table 2).

Several local populations are adjacent to each other

and are thought to be connected through habitat corridors. They include Revelstoke, Wells Gray North, Wells Gray South, North Cariboo Mountains and Hart Ranges, all of which currently are relatively secure. From a broad, conservation perspective, these constitute the geographic core of the current Mountain Caribou range. Other local populations currently exist outside of this “core” range. Most of these isolated populations are small, with five populations having 35 or fewer animals. These local populations are at high risk of extirpation. While extirpation of small, local populations such as the South Selkirks, South Purcells, Monashee, Central Rockies and George Mountain would only slightly reduce Mountain

**Table 2. Current estimates of population size, trend and density of Mountain Caribou.**

Local Population	Population Size <sup>a</sup> and Reliability		Population Trend <sup>b</sup>			Reliability of Trend <sup>c</sup>			Current Range (km <sup>2</sup> ) <sup>d</sup>	Density (caribou/1000 km <sup>2</sup> ) <sup>e</sup>
			LT	ST	CT	LT	ST	CT		
South Selkirks	35	H	S	D	S	L	H	H	1 500	23
South Purcells	20	H	D	D	S	L	H	H	2 962	7
Central Selkirks	130	H	D	D	D	L	H	H	4 813	27
Monashee	10	L	D	D	D	L	L	L	2 082	5
Revelstoke	225	H	S	D	D	L	H	H	7 863	29
Central Rockies	20	L	D	D	D	L	L	M	7 265	3
Wells Gray North	220	H	S	D	S	L	H	M	6 346	35
Wells Gray South	325	M	S	S	S	L	L	L	10 381	31
North Cariboo Mts	350	M	S	S	D	L	L	L	5 911	59
Barkerville	50	H	I	S	S	L	M	M	2 535	20
George Mountain	5	M	D	D	D	L	M	L	440	11
Narrow Lake	65	H	I	S	S	L	M	M	431	151
Hart Ranges	450	M	S	S	S	L	L	L	10 261	44
<b>Total</b>	<b>1905</b>	<b>H</b>	<b>S</b>	<b>D</b>	<b>D</b>	<b>L</b>	<b>M</b>	<b>M</b>	<b>62 790</b>	<b>30</b>

<sup>a</sup> Numbers are estimated 2002 late-winter population. Reliability of estimates is subjectively determined, as not all local population estimates are done in a manner that allows calculation of confidence intervals. Reliability: H = high, M = moderate, L = low.

<sup>b</sup> Population Trend:

LT = long-term trend (>20% change in 20 years), declining (D), increasing (I) or ~ stable (S)

ST = short-term trend (>20% change in 7 years), decreasing (D), growing (G) or ~ stable (S)

CT = current trend (>10% change in past 2 years), down (D), up (U) or ~ stable (S)

<sup>c</sup> Reliability of trend is subjectively determined. H = high, M = moderate, L = low.

<sup>d</sup> Current range available to Mountain Caribou based on known or suspected occupancy.

<sup>e</sup> Density = (population size/current range) x 1000

Caribou numbers, loss of these populations would result in a substantial reduction in the provincial distribution of Mountain Caribou.

#### 2.1.4 Genetic Variation

Recent analysis of microsatellite DNA has provided some information about the genetic variation within and among both the mountain and northern ecotypes of Woodland Caribou (Table 3). To date, genetic analyses have only included two local populations of Mountain Caribou — Revelstoke and the South Purcells — although some preliminary work has also been done in the South Selkirks (not shown). The Revelstoke population appears to have a relatively high level of genetic variation relative to Northern Caribou populations of similar size (e.g., Wolverine, Tweedsmuir). In contrast, the genetic variation within the South Purcells local population is markedly low relative to the other local populations.

Heterozygosity within the South Purcells population stands out as uniquely low. The chance that any two

individuals are genetically identical is at least 600 times more likely in the South Purcells than in the other sampled local populations of Woodland Caribou. Genetic variation has likely declined further, since the sample was taken when there were still 50-80 animals in the South Purcells instead of the present 20. In terms of inbreeding depression, a Woodland Caribou born in the South Purcells is more likely to be homozygous when inheriting a deleterious gene. Such deleterious genes may affect the recovery of a small population, but it is also possible that such genes may have already been purged during the population decline (Lacy 1997). Spalding (2000) reports that, between 1900 and 1910, Mountain Caribou numbers in the “south Kootenays” declined from “moderate” to “few,” a level which they have maintained to present. Thus, Mountain Caribou have persisted in the South Purcells at low levels for nearly a century and, although the local population may appear to lack genetic diversity, it is unknown whether this will affect its recovery.

**Table 3. Genetic variation in Woodland Caribou local populations. based on eight microsatellite loci.**

Ecotype: M = Mountain; N = Northern. “Prob. of Identity” is the probability that any two individuals in the local population are genetically identical (from K. Zitlau, Univ. of Alberta, pers. comm.).

Local Population	Eco-type	Current est. Size	Sample Size	Avg. Alleles	Heterozygosity (%)	Prob. of Identity (1 in)
South Purcells	M	20 <sup>a</sup>	27	4.6	52.7	143 136
Revelstoke	M	225	20	7.1	78.8	2 124 610 670
Itcha-Ilgachuz	N	2900 <sup>b</sup>	17	5.6	73.7	86 915 604
Wolverine	N	400	20	6.6	74.3	246 571 054
Tweedsmuir	N	300	36	7.0	76.1	442 468 694
Finlay	N	200	16	8.3	82.5	41 033 042 665
Atlin East	N	800	24	8.0	82.5	36 563 698 359
Chase	N	700	24	9.3	82.6	112 120 534 461

<sup>a</sup> Population size was 50–80 individuals at the time of sampling.

<sup>b</sup> Based on 2002 postcalving survey that included 2120 adults and yearlings (population size was smaller at time of sampling).

Tests of genetic distance and similarity (Table 4) suggest very strong differentiation between all Woodland Caribou local populations that were sampled. The local population in the South Purcells is particularly distinct, with 100% of individuals correctly assigned to it. Such distinctiveness is surprising because Spalding (2000) suggests that the current local populations have only been separated (through habitat fragmentation) since the late 19th century. In terms of genetic distance, the two populations (Revelstoke and South Purcells) are more

similar to several northern ecotype local populations, than to each other. This suggests that these ecotypes may not be monophyletic, but rather developed their unique behaviours multiple times as they adapted to local conditions. From a genetic perspective, this suggests that there is currently no reason why animals from a healthy population of Northern Caribou could not be transplanted into a Mountain Caribou population. However, neither this statement nor Table 4 consider the behavioural and phenotypic attributes of ecotypes.

**Table 4. Distinctiveness of the Revelstoke and South Purcells Mountain Caribou populations relative to other Woodland Caribou populations in British Columbia based on Nei's standard genetic distance and frequency of correct assignment.**

Genetic Distance: small values indicate closely related populations.

Assignment Test: distinct populations have a large proportion of individuals assigned to the original population.

Sample size was 20 for Revelstoke and 27 for South Purcells. (Data from K. Zitlau, Univ. of Alberta, pers. comm.).

Local Population	Genetic Distance		Assignment Test	
	Revelstoke	South Purcells	Revelstoke	South Purcells
Revelstoke	0.0	0.56	19	0
South Purcells	0.56	0.0	0	27
Atlin East	0.61	0.69	0	0
Finlay	0.58	0.92	0	0
Itcha-Ilgachuz	0.46	0.70	0	0
Sustut/Chase	0.42	0.58	0	0
Tweedsmuir	0.40	0.79	0	0
Wolverine	0.43	0.70	1	0

### 2.1.5 Predation

Mountain Caribou local populations exist within a dynamic and complex predator-prey system where caribou, Elk (*Cervus elaphus*), Moose (*Alces alces*), White-tailed Deer (*Odocoileus virginianus*), Mule Deer (*O. hemionus*), Bighorn Sheep (*Ovis canadensis*) and Mountain Goat (*Oreamnos americanus*) provide food for Grey Wolf (*Canis lupus*), Grizzly Bear (*Ursus arctos*), Black Bear (*U. americanus*), Cougar (*Pumas concolor*), Coyote (*Canis latrans*), Wolverine (*Gulo gulo*) and Golden Eagles (*Aquila chrysaetos*). Although not restricted to

summer, recent studies (Seip and Cichowski 1996, Kinley and Apps 2001) have found predation during the summer can be a major cause of caribou mortality. In the northern portion of the caribou's range, increased Moose populations may be related to past and current caribou declines by sustaining greater numbers of wolves and a high predation rate on caribou (Seip 1992a). In the south, increased numbers of deer and Elk may be associated with increased Cougar predation on caribou (Kinley and Apps 2001, Katnik 2002).

The susceptibility of caribou to predation may also be

influenced by habitat fragmentation. Disturbance, whether it be human-caused or natural, disrupts forest contiguity and alters the distribution of early seral habitats. Such disturbance could be detrimental to caribou if it increases their contact with predators associated with other ungulates that use early seral stands, such as deer, Elk and Moose. While there are no scientific studies to verify this, Kinley and Apps (2001) did demonstrate higher mortality rates in the southern portion of the Purcells caribou range, where there was a higher road density, a higher proportion of disturbed habitats and a higher level of fragmentation<sup>4</sup>.

Seip (1992a) suggested that wolf predation can eliminate caribou from areas where the wolf population is sustained by other prey species, because there is no negative feedback on the number of wolves as caribou decline in numbers. If true, this suggestion would mean that wolves could persist on Moose, Elk or deer as they extirpate local caribou populations. Similarly, Cougar predation may have been responsible for the disappearance of the caribou within the Okanagan (Munro 1947, cited by Spalding 2000).

### 2.1.6 Weather and Disease

While inclement weather causing hypothermia of newborn calves has been postulated as a major source of mortality, there appears to be little direct evidence to support this claim (Bergerud 1996). Winters with deep snow may play a role in caribou declines, either through reduced nutrition from a relative food shortage, which lowers conception rates, and/or through increased winter and summer mortality rates of adults and calves (Bergerud 1996). Winters of exceptionally deep snow, followed by winters of below average snow depth, may also play a role in reducing arboreal lichen availability to Mountain Caribou (Goward in prep.). T. Goward (Enlivened Consulting Ltd., Clearwater, BC, pers. comm.)

suggests that the recent decline of Mountain Caribou may be attributed, at least in part, to these extreme weather events<sup>5</sup>.

Climatic change, and the resulting alteration of long-term weather patterns, may have profound effects on Mountain Caribou by changing vegetation composition and accelerating fire return. Thomas and Gray (2001) suggest that small local populations of caribou on the southern periphery of their range will be particularly vulnerable to future climatic warming and resulting weather variability.

Spalding (2000) reported evidence of caribou dying — apparently from disease — near McBride, BC in 1918, and Clearwater Lake, BC in the early 1930s. However, there are no records of any long-lasting population declines of caribou in the province resulting from disease. In contrast, disease has played a major role in caribou declines in eastern North America, where altered landscapes and mild winters allowed White-tailed Deer carrying the meningeal worm (*Parelaphostrongylus tenuis*) to expand north and infect caribou (Bergerud and Mercer 1989).

### 2.1.7 Consumptive and Subsistence Use

Spalding (2000:39) notes: “*Although there is no evidence supporting a single, universal factor causing early caribou declines, indications are that hunting with firearms, acting as an additive to the ever-present natural factors, particularly predation, triggered the major caribou losses observed during the first four decades of this century.*”

Although substantial declines had apparently occurred prior to the 1960s, very liberal hunting regulations were still in effect during the mid to late 1960s over most of the Mountain Caribou range. It is commonly believed that over-hunting caused or contributed to caribou declines in some areas, for example the Central Selkirks (Stevenson and Hatler 1985). Increases in hunting pressure were commonly

<sup>4</sup> MCTAC note: The decline in caribou numbers in the South Purcells can also be related to a more restrictive cougar hunting policy and associated increase in cougar numbers during the caribou decline.

<sup>5</sup> MCTAC note: This hypothesis is consistent with the recent local population declines and thus merits further investigation.

the result of new access or transportation methods.

A trend towards conservative harvest management in BC began in the late 1970s, with increasing hunting restrictions (including shortened seasons) and removal of opportunities to hunt both males and females. This approach reflected the low numbers of Mountain Caribou and general concerns by wildlife managers that caribou were vulnerable to legal hunting and poaching (Bergerud 1978). As a result, hunting became much more restricted, with harvesting either curtailed for specific populations or limited to large bulls. In 1978, it became compulsory to report harvested Mountain Caribou. Annual harvests between 1976 and 1991 averaged about 15, while between 1992 and 1994, the average annual harvest had dropped to six. In 1996, the remaining Mountain Caribou seasons were closed in the Kootenays, and, in 1998, a hunting moratorium was placed on the last remaining Mountain Caribou season in the province.

First Nations have hunted caribou for thousands of years, primarily for food and clothing, but there were other uses as well (BC MELP 1997). For example, in addition to clothing, tanned hides were also used to make containers for storage and transportation. Sinews were sometimes used as thread for sewing and as twine, and strands of caribou hide were used in snares. Caribou antlers and some bones were used to make arrow points, knives, scrapers, digging sticks and tool handles.

## 2.2 Habitat Considerations

Habitat considerations are only briefly reviewed here. The report *Mountain Caribou in Managed Forests: Recommendations for Managers, Second Edition* (Stevenson et al. 2001) provides an in-depth discussion and analysis of habitat considerations for Mountain Caribou.

### 2.2.1 Overview of Habitat Requirements

Mountain Caribou habitat use in BC can be described using four seasonal time periods. Exact dates vary annually for each local population depending on weather conditions. The following generalized seasons, their approximate dates, and factors limiting caribou numbers in each season are extracted from Simpson et al. (1997:3-4) and Stevenson et al. (2001:12-15).

#### EARLY WINTER (NOVEMBER TO MID JANUARY)

During the snow accumulation period, Mountain Caribou use valley bottoms and lower slopes in the Interior Cedar-Hemlock (ICH)<sup>6</sup> and lower Engelmann Spruce-Subalpine Fir (ESSF) biogeoclimatic zone forests. Lichen on fallen trees (wind throw) and lichen litterfall from standing trees are the primary sources of forage in the form of arboreal lichen. If available in ICH forests, evergreen shrubs such as falsebox are frequently browsed. Other shrubs and forbs that remain accessible in snow wells under large trees are also eaten during this period. A conifer canopy that intercepts snow and allows access to feeding sites is important.

Mountain Caribou experience the poorest mobility and food availability of any season during early winter because of the typically deep, soft snow. Extended poor snow conditions may cause direct mortality of bulls, which usually enter winter in relatively poor condition compared to females, or indirectly increase the post-natal mortality of calves by depressing the condition of pregnant cows.

#### LATE WINTER (MID JANUARY TO MID APRIL)

After the snowpack deepens and consolidates in late winter, Mountain Caribou are able to move on top of the snowpack to upper slopes and ridge tops, where they use subalpine parkland habitats (open-canopied mosaic of stunted subalpine fir [*Abies lasiocarpa*]) and stands dominated (>80%) by subalpine-fir. *Bryoria* spp. lichens are typically prolific on trees in

<sup>6</sup> MCTAC note: The Sub-Boreal Spruce (SBS) biogeoclimatic zone replaces the ICH zone in the northernmost portion of Mountain Caribou range.

these high-elevation stands. Arboreal lichen is the only food available and used during this period.

Mobility and food availability are generally considered to be relatively good in late winter due to consolidation of deep snowpack that provides the necessary platform for foraging (i.e., on arboreal lichens) in the lower branches of trees. However, in years with relatively low snowpacks or poor snow consolidation, food availability may be a problem. Although arboreal lichens provide a winter diet with relatively low protein content, they are highly digestible and provide an abundant source of energy. Mortalities in the Revelstoke population have resulted from avalanches during late winter (Flaa and McLellan 2000). Animals are highly visible and, therefore, may also be susceptible to disturbance by winter recreation activities during this period.

#### SPRING (MID APRIL TO MAY)

Mountain Caribou move to lower elevations to obtain fresh, green vegetation in spring. Spring ranges overlap with early- and late-winter ranges, but green vegetation, not lichen, is the main food source. The need to avoid predators at low elevations, mainly bears, wolves and Cougars influences habitat selection, particularly for females during the calving season in early June.

Animal mobility and food quality is usually excellent in spring, but use of the best feeding areas may be compromised by the overriding need to avoid predators. Pregnant cows, which require abundant, nutritious, early-spring food to support calves, may be confined to food-limited, but predator-free, higher-elevation ridge tops for calving. Males, by comparison, can be found taking advantage of better-quality forage areas at lower elevations. Caribou often forage in more open sites, although forested areas are also used.

#### SUMMER (JUNE TO OCTOBER)

Caribou move back to middle- and upper-elevation ESSF forests, ESSF parkland and alpine areas. Herb

and shrub foods used during summer are abundant and all habitats may be used.

In this season, bears are active and wolves and Cougars may also prey on caribou. Caribou calves are especially vulnerable to predation in summer.

#### REGIONAL DIFFERENCES IN HABITAT USE

Although many similarities in seasonal habitat use exist among local populations, differences in early-winter habitat vary the most (Terry et al. 1996, Simpson et al. 1997). In general, caribou that live in rugged mountainous terrain, like the Revelstoke population, make more pronounced elevational movements to use low-elevation ICH and mid-elevation spruce (*Picea* spp.)/subalpine fir forests (Apps et al. 2001). Caribou that live in the extreme north and south ends of Mountain Caribou range, and those living in highland — rather than mountainous — terrain, primarily use mid- and upper-elevation subalpine fir/spruce forests in early winter and make little or no use of the ICH zone (Apps et al. 2001)<sup>7</sup>.

Explanations for differences in early-winter habitat use among local populations remain unclear. The factors commonly used to explain different early-winter use patterns of caribou include topography and snow conditions, the relative dryness of the climate (and thus availability of ICH forests), habitat disturbance, and human occupation in low-elevation forests (Simpson et al. 1997, Apps and Kinley 1998).

Geographic differences in summer habitat use also occur. Many caribou use rugged alpine habitat if it is available, but in plateau areas, most caribou summer in the upper ESSF zone (Seip 1992a).

#### 2.2.2 Changes in Habitat Suitability and Capability

Habitat maps have been developed at 1:250 000 scale to depict Mountain Caribou habitat *capability* and *suitability*, based on ecosections, biogeoclimatic zones, subzones and variants (Demarchi et al. 2000a, 2000b; Figures 3 and 4). For these maps, habitat

<sup>7</sup>MCTAC note: Caribou in the Quesnel Highlands (Wells Gray North) also make use of low-elevation habitats during early winter.

capability ratings are made on the assumption that pristine old-growth forest provides optimal caribou habitat. Suitability ratings are adjusted downward from the capability ratings, based on estimates of current remaining old-growth forests and broad-scale alteration of the landscape (e.g., habitat fragmentation associated with industrial development). Differences in capability and suitability are thus intended, for this analysis, to provide a first approximation of the

possible extent of decline in the abundance and quality of caribou habitat over time<sup>8</sup>.

Mountain Caribou habitat suitability was substantially less than habitat capability within the Southern Interior Mountains ecoprovince, with a reduction of approximately 19,200 km<sup>2</sup> (38%) of very high, high and medium classes (Table 5). The greatest difference between habitat capability and suitability occurred within the high class (-71%).

**Table 5. Estimated area (km<sup>2</sup>) of historic and current habitat suitability for Mountain Caribou within the Southern Interior Mountains Ecoprovince.** (values based on Demarchi et al. 2000a, 2000b).

Historic Habitat Capability		Current Habitat Suitability		Percent Change	Change in Area
Class	km <sup>2</sup>	Class	km <sup>2</sup>	%	(km <sup>2</sup> )
Very High	12 261	Very High	7 726	-37	-4 535
High	12 357	High	3 602	-71	-8 755
Medium	25 607	Medium	19 688	-23	-5 919
Low	34 584	Low	30 909	-11	-3 675
Very Low	22 146	Very Low	40 697	+84	+18 551
Nil	8 314	Nil	12 647	+52	+4 333
<b>Total</b>	<b>115 268</b>	<b>Total</b>	<b>115 268</b>		

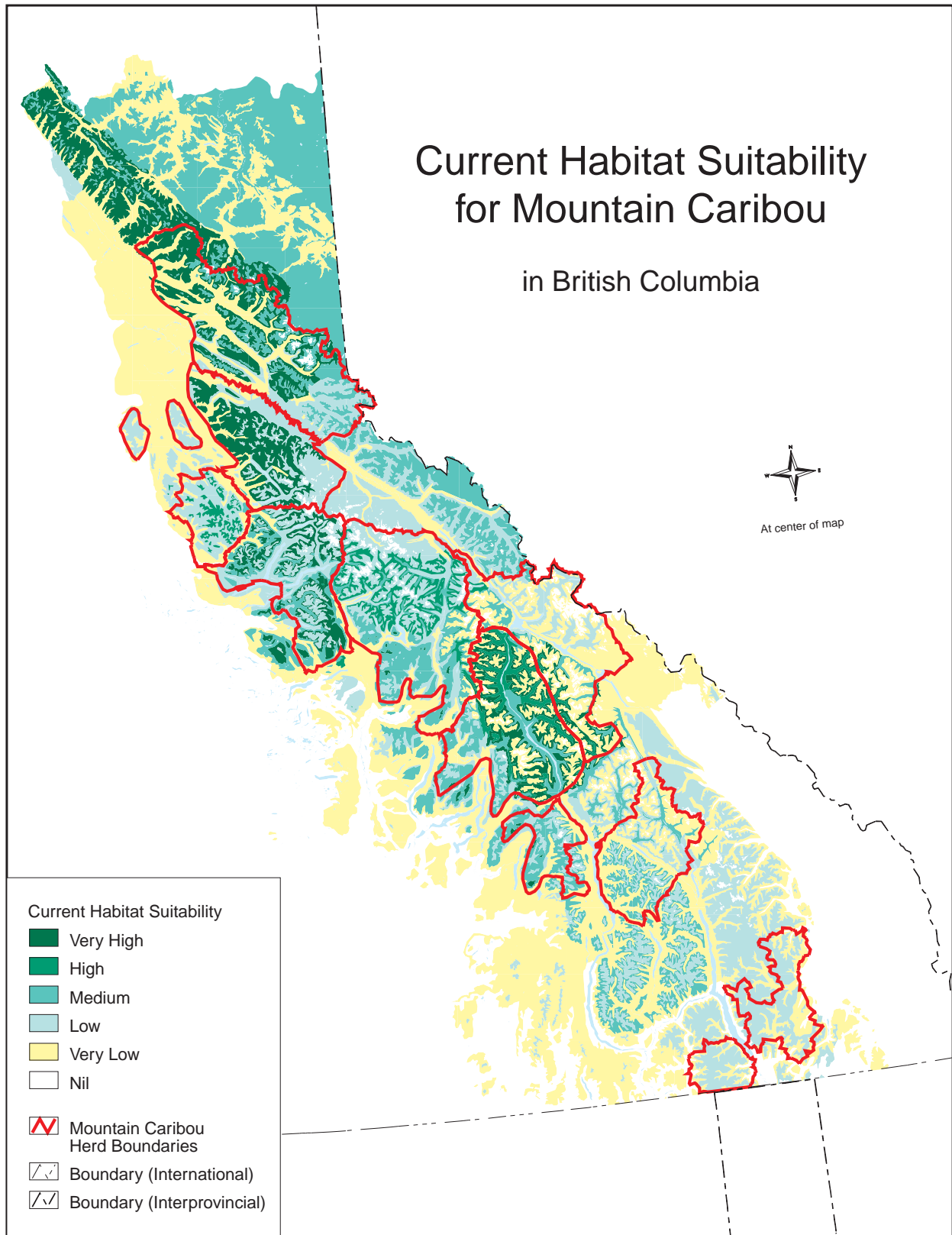
Note: area summaries do not include the COC, BRR, EKT or SPK ecosections within the SIM ecoprovince. Nil includes glaciers and lakes.

Based on the suitability analysis, none of the local populations from the South Selkirks, South Purcells, George Mountain or Narrow Lake ranges possessed medium or better suitability classes (Table 6). Local populations with ranges having a minimum of 25% suitable habitat classes included Central Selkirks, Monashee, Revelstoke, Wells Gray North, Wells Gray

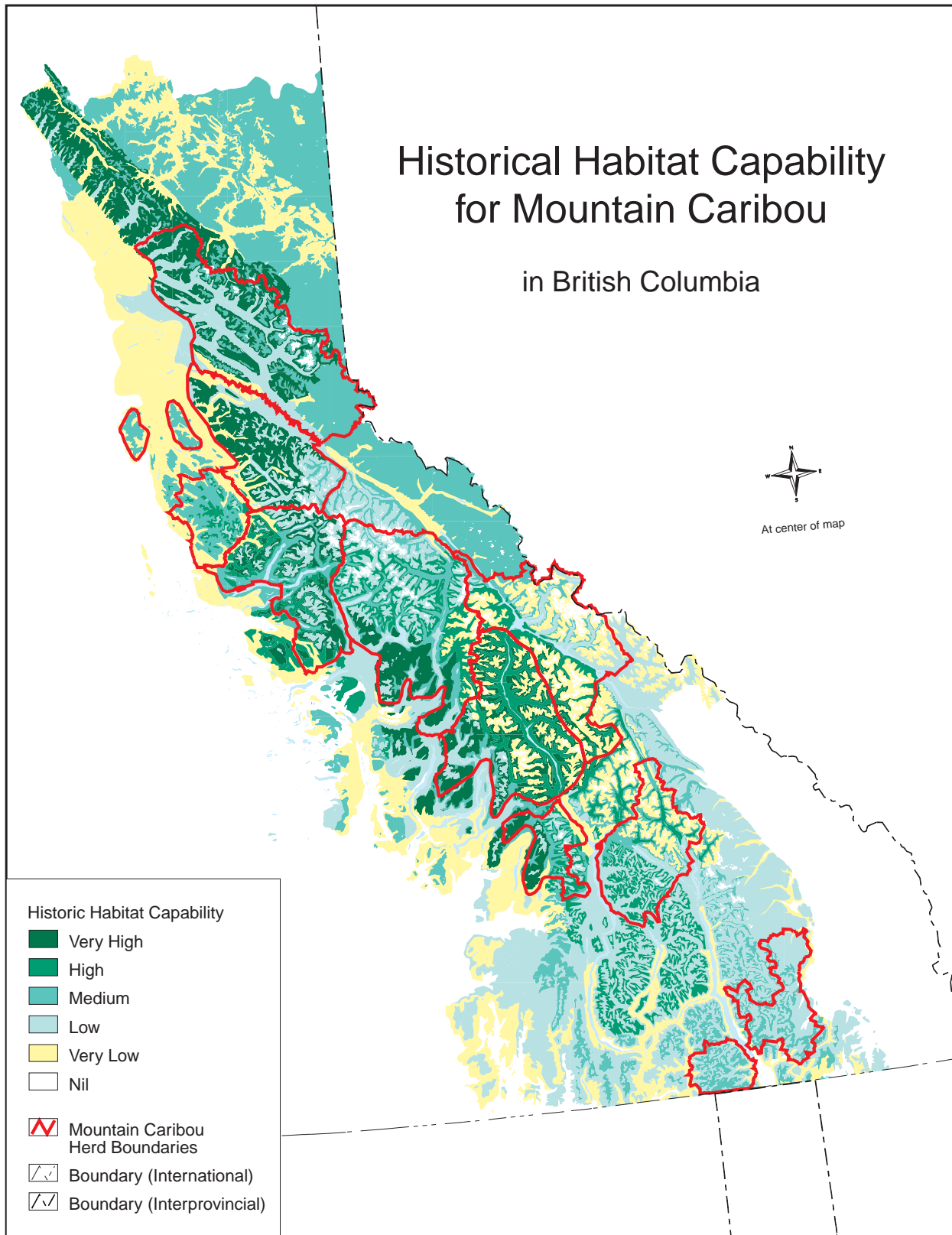
South, North Cariboo Mountains and Hart Ranges. The proportion of suitable habitat classes within a local population's current range appears to be a poor predictor of caribou density. For example, the local population at Narrow Lake has the highest observed density (Table 2), yet suitable habitat is rated as either low or very low.

<sup>8</sup> MCTAC note: Habitat suitability/capability models lack both spatial and temporal components, with little or no explicit quantification. Thus, hypothesis generation is poor compared to other modeling methods discussed in section 2.2.3. The amount of weight placed on the results in Tables 5 and 6 should be minimal, and the analysis used to primarily show the need for a better habitat supply model that is both precise and testable.





**Figure 3. Provincial Mountain Caribou habitat suitability map.**



**Figure 4. Provincial Mountain Caribou habitat capability map.**

**Table 6. Estimated area (km<sup>2</sup>) of suitable habitat within the current range of each local population of Mountain Caribou.** (Values based on Demarchi et al. 2000a, 2000b).

Local Population	Suitable Habitat (Very High, High and Medium)					
	VH		VH+H		VH+H+M	
	km <sup>2</sup>	%	km <sup>2</sup>	%	km <sup>2</sup>	%
South Selkirks	0	0.0	0	0.0	0	0.0
South Purcells	0	0.0	0	0.0	0	0.0
Central Selkirks	0	0.0	1	0.0	1153	25.2
Monashee	49	2.4	49	2.4	1093	53.4
Revelstoke	2236	29.8	3238	43.2	4993	66.6
Central Rockies	521	8.6	685	11.3	1345	22.2
Wells Gray North	1852	31.3	1854	31.3	3163	53.4
Wells Gray South	99	1.0	1992	20.9	4582	48.0
North Cariboo Mtns	2576	45.2	2576	45.2	2589	45.4
Barkerville	0	0.0	484	19.5	508	20.5
George Mountain	0	0.0	0	0.0	0	0.0
Narrow Lake	0	0.0	0	0.0	0	0.0
Hart Ranges	3606	36.0	3606	36.0	5 764	57.5

### 2.2.3 Identifying Essential Habitats

Essential habitats refer to those habitats occupied by caribou that are considered an important component for their survival. They are based on radio-telemetry data, aerial census data, caribou habitat requirements and biophysical mapping. Most essential habitats have been mapped at the regional level<sup>9</sup>. The following briefly summarizes previous and current efforts to identify and map these habitats.

Simpson et al. (1994) attempted to define essential habitat areas by examining the habitat use patterns of three small, isolated and generally decreasing local populations in the southern portion of Mountain Caribou range: the South Selkirk Mountains, the South Purcell Mountains and the Monashee Mountains. Their assessment suggested that caribou continued to use areas with up to 40% of the gross

area in snow, rock, alpine tundra or second-growth forest. Caribou also maintained use of forested habitat units where up to 40% of the area was young forest or natural openings. Most high-use habitats had >60% old-growth forest, but some areas with less old growth were occasionally used. Areas without old growth were rarely used in any area.

Where sufficient radio-telemetry and habitat mapping are available, more suitable approaches for identifying essential habitats may be HSI (Habitat Suitability Index) or MLR (multiple logistic regression) models, which can better reflect habitat selection patterns by seasonal time period within each local population (Antifeau 1998, Apps and Kinley 1998, Apps et al. 2001). Antifeau (1998) identified issues involved in the process of developing and applying caribou habitat suitability

<sup>9</sup> MCTAC note: The federal Species at Risk Act requires defining critical habitat, or the habitat that is necessary for the recovery of a listed wildlife species. A provincial recovery action (section 6.2.2) identifies the need to define and map critical habitat for Mountain Caribou.

models and considered MLR habitat suitability models superior to HSI models because they are based less on expert opinion of caribou-habitat relationships, and they can combine a large number of independent variables in a data-based, objective procedure<sup>10</sup>.

A preliminary HSI model was developed for the South Purcells local population, which was useful in identifying essential habitats (Apps and Kinley 1995). More recently, Apps and Kinley (2000) and Apps et al. (2001) developed multivariate habitat models to analyse caribou habitat selection across seasons and spatial scales. Spatial scale was an important parameter in describing caribou-habitat relationships, and seasonal differences in habitat selection were also apparent. Apps and Kinley (2000) included an additional distinction between habitat selection for “Highland” and “Mountain” physiographic zones in the Columbia Highlands and Northern Columbia Mountains ecoregions of BC. Within the Highland zone, caribou generally preferred relatively rugged, higher-elevation broad landscapes with old-growth subalpine fir. They especially preferred more open, broad landscapes of higher alpine composition during late winter, and north-east aspects were preferred at the broadest scale during summer. Although caribou in the Mountain zone preferred broad landscapes that were relatively rugged during late winter, spring and summer, gentle terrain was highly preferred at the finest scale during late winter and summer.

#### 2.2.4 Regional and Landscape-level Considerations

At the regional and landscape level, caribou are thought to require a perpetual supply of large, contiguous areas of suitable summer and winter habitat, with little or no vehicle access and disturbance, so that they can space out at low densities (30-50 caribou/1000 km<sup>2</sup>) and avoid predators and poachers (Bergerud 1992, Seip and

Cichowski 1996).

Stevenson et al. (2001:19) recommend the following approach to regional and landscape zoning for Mountain Caribou:

##### PREPARATION

- Identify and map seasonal ranges, fracture zones and linkage areas. Use telemetry locations, habitat suitability/capability models based on telemetry data, aerial surveys, local knowledge and general habitat characteristics.

##### DELINEATE

- No Harvest Zone - Map designated areas in which forest harvesting and other resource extraction is prohibited. Include large, contiguous blocks of high-elevation forest used as winter range or serving as linkage areas. Incorporating ICH is especially important where those forests are used extensively during winter.
- Special Caribou Management Zone - Map areas where timber harvesting and silvicultural practices will be designed to maintain caribou habitat values. Include peripheral winter range habitat and linkage areas.
- Integrated Resource Management Zone - Designate remaining areas as normal integrated resource management zones. The primary caribou management concern is to avoid enhancing Moose, deer and Elk populations close to caribou habitat.
- Linkage Zone - Map portions of the fracture zones between areas of caribou habitat that are the best remaining sites for corridors that will enable continued movement between population centres. These corridors may be managed through low levels of timber harvest or through extended rotations to provide mature forest characteristics across the fracture.

##### ACCESS MANAGEMENT

- Do not construct roads through no-harvest zones

<sup>10</sup>MCTAC note: However, both HSI and MLR techniques are also restricted to the context (spatial and temporal) under which the data were collected. A potentially more powerful technique is to develop a hierarchical habitat supply model (using both stand- and landscape-level considerations) and test predictions using empirical data.

unless absolutely necessary. Develop access management plans for special caribou management zones. Work with user groups to develop recreation/snowmobile access plans for both zones.

### 2.2.5 Stand-level Considerations

At the stand level, the overall goal for caribou habitat management is to maintain a stand that is suitable for use by caribou continuously through time. Stevenson et al. (2001) provide detailed recommendations for forest practices that consider stand-level changes of importance to caribou in both the ESSF and ICH biogeoclimatic zones. Stevenson et al. (2001) outline harvest methods, including single-tree and group selection, for the purpose of testing our ability to manage caribou habitat in perpetuity. They also discuss silvicultural systems that are purported to favour caribou through management options that consider opening sizes, composition of regenerating vegetation, wind-throw and retention of snags.

## 2.3 Effects of Human Activities and Land Use Practices

### 2.3.1 Forestry

While numerous factors have been associated with the historic decline in Mountain Caribou numbers, forestry has been recognized as the greatest concern to caribou habitat management over the past 20 years. Within the past 10 years the concern has increased, since logging has moved into high-elevation forest types, such as the ESSF zone. As a result, the demand for information concerning the effects of forest management in caribou habitat has increased dramatically. Stevenson et al. (2001:1) describe the issue:

*“The habitat requirements of mountain caribou, as they are understood today, are incompatible with most current forest management practices. To survive, mountain caribou need to be able to spread out over large areas of suitable habitat, where it is difficult for predators to find them. They strongly prefer old-growth forests to young forests in all seasons. Forest*

*harvesting can reduce and fragment areas of suitable habitat, making the caribou more vulnerable to predation. In addition, road access associated with timber harvest may lead to increased disturbance, human-induced mortality, and increased predation by wolves.*

*Suitable winter habitat for mountain caribou has characteristics of old forests (at least 150 years), including abundant arboreal lichens. Forests managed under any silvicultural system that eventually eliminates, or substantially reduces, the number of large, old, lichen-bearing trees will not provide winter habitat for caribou. Such silvicultural systems include clearcutting on normal rotations and selection systems with heavy, frequent stand entries.”*

Habitat management practices for Mountain Caribou have traditionally concentrated on providing lichens for winter foraging (Ritcey 1974). Although caribou winter habitat must provide adequate amounts of arboreal lichen, it is now recognized that food is not the primary limiting factor, and that the distribution of both the summer and winter habitats across the landscape is the most important factor for the long-term persistence of Mountain Caribou (Seip and Cichowski 1996). The density of Mountain Caribou appears to be related to their ability to become spatially separated from predators, particularly during the summer months (Seip and Cichowski 1996). Forest harvesting practices that produce a patchwork of different forest age classes, linked with a network of roads, may contain enough lichens to support a caribou population, but probably will not provide an environment where caribou can effectively avoid predators and poachers. A patchwork of early seral and mature forests may also put caribou in close proximity to predators by enhancing habitat for other prey species that prefer early seral forests (Seip 1992a). Concentrating caribou into small areas of suitable habitat may also make them easier for predators to locate (Seip 1991).

In 1988, the Mountain Caribou in Managed Forests (MCMF) program was initiated within the Prince George area by the Wildlife Branch of BC

Environment, the Ministry of Forests (MOF) and the local forest industry to address the question: “*Can forest stands be managed, through silvicultural systems and habitat enhancement techniques, to sustain both timber harvest and caribou habitat over the long term?*”

The goal of the program was to produce integrated solutions, based on the ecological requirements of Mountain Caribou, for managing for caribou and timber in east-central British Columbia. In the fall of 1990, the MCMF Advisory Committee met and identified the need to expand its membership to include the southeastern portion of the province with similar forestry-caribou habitat related issues and concerns. In 1994, the preliminary results of MCMF activities were summarized in *Mountain Caribou in Managed Forests: Preliminary Recommendations for Managers* (Stevenson et al. 1994). Since then, there have been significant changes to both the knowledge base and the regulatory framework within which forest management decisions are made. In spring 2001, an updated version was published (Stevenson et al. 2001)<sup>11</sup>.

### 2.3.2 Backcountry Recreation

Many biologists who study caribou and their habitat in the province are concerned about the potential impacts of backcountry recreation on caribou. High capability terrain for many forms of winter recreation, such as snowmobiling, heli-skiing, snow-cat skiing and backcountry skiing, tends to also be high capability terrain for wintering caribou (Simpson and Terry 2000). Alpine and subalpine terrain used by caribou in late winter (January to April) is preferential for recreation and easily accessible to high-powered snowmobiles and helicopters. Mid- and low-elevation early-winter range may also be disrupted by people travelling en route to the high country. Some caribou biologists have expressed concern over the potential for loud,

fast-moving activities to alarm animals, displacing them to poorer habitat and steeper, avalanche-prone terrain. Although not documented, it has also been speculated that chronic disturbance in an area could lead to reduced body condition and consequent population-level effects if reproductive rates, survival or recruitment are affected (Simpson and Terry 2000).

The concern over disturbing caribou in the backcountry intensifies as winter recreation grows increasingly important to the residents and businesses of many small communities in BC. The potential for winter recreation to affect local populations of caribou at-risk increases with the growing popularity of activities that bring recreationists into caribou habitat. Over the past decade there has been a substantial increase in backcountry recreation within Mountain Caribou habitat, increasing the urgency to learn more about the effect of these activities on caribou habitat use and survival. Expanding industrial road networks continue to open up new areas of previously inaccessible habitat to recreationists. A similar upward trend has also developed in the use of snow machines and helicopters to access roadless alpine areas and meet a growing demand for mountain vistas and powder snow. If not properly managed, such activities have the potential to result in disturbance from both recreationists and the vehicles that transport them.

At the heart of the recreation-caribou issue is a lack of understanding about the interaction between caribou and recreationists in the backcountry. Recreation use is difficult to quantify and there are numerous confounding factors (e.g., predation, habitat alteration) that influence fluctuations in caribou populations. As a result, good data to evaluate the effects of recreation on Mountain Caribou and form the basis for provincial management standards are simply not available. Funding constraints have limited study of this issue in the province to literature reviews, retrospective analysis and coalition of

<sup>11</sup> MCTAC note: The forest industry, including organizations such as the Interior Lumber Manufacturers’ Association (ILMA) and Northern Forest Products Association (NFPA), have recognized the potential benefits of encouraging and financially supporting caribou research and conservation initiatives, specifically to mitigate negative effects of forest harvesting on caribou.

anecdotal information (Simpson and Terry 2000; B. McLellan, BC MOF, pers. comm.; T. Kinley, MCTAC, pers. comm.). Studies of the short-term effects of recreation on other ungulate species in other jurisdictions provide evidence of some detrimental impacts (see section 3.3.1).

Until recently, there has been no strategic planning to guide the distribution of backcountry recreation activities on a provincial basis. This may be changing with the recent efforts of the Ministry of Sustainable Resource Management to begin recreation and tourism planning, particularly in the Kootenays. Normally, each backcountry recreation use must be addressed individually, forcing a management approach that has been largely reactive. In an effort to provide some better direction, a set of interim guidelines were adopted in 2000. The interim guidelines, which contain specific advice for conduct in Woodland Caribou habitat (see MWLAP Web site at <http://wlapwww.gov.bc.ca/>) are to assist government staff and recreationists in planning and managing non-consumptive commercial backcountry recreation, such as heli-skiing and snowmobiling<sup>12</sup>. When eventually finalized, the guidelines should reflect stakeholder support, provide for some regional flexibility and evolve as more is learned about the interactions between caribou and recreationists.

Commercial tourism operations and non-commercial recreation organizations, such as certain snowmobile clubs, have recognized the potential benefits of encouraging, if not requiring, their staff, guests and members to act in a responsible, educated manner while recreating in the backcountry, specifically to mitigate negative effects on caribou<sup>13</sup>. Although many recreationists in caribou habitat do not belong

to clubs or come from out of province, those recreationists involved in local clubs have a unique opportunity to adopt standards for the behaviour of their members while recreating in caribou winter habitat. There is tremendous potential for such groups to work with government biologists to learn more about how they can voluntarily improve their practices in the backcountry, if required, and moderate or cease use of certain areas at certain times of year. That same potential already exists with respect to some commercial tourism operations. Working together in this way requires flexibility, but provides better representation of different interests and can collectively lead to a solution that both recreationists and caribou can live with.

### **3. Role of mountain caribou in the ecosystem and interaction with humans**

#### **3.1 Ecological Considerations**

Because Mountain Caribou are so well suited to ecological conditions in the Interior Wet Belt, having a historic range that matched its boundaries almost exactly, they have been recognized as a “flagship species” of this area (Kinley 1999). No other large animal has a distribution so closely tied to this region. Mountain Caribou are also considered to be an indicator of the health of the Interior Wet Belt ecosystem because of their correspondent distribution, their use of a range of habitat types within this ecosystem and their sensitivity to ecological disturbance. Forest management in areas where Mountain Caribou live is often based on the premise that if caribou populations are maintained, the rest of that ecosystem’s flora and fauna will also survive.

<sup>12</sup> MCTAC note: These guidelines did not receive the support of tourism and recreation groups because they were developed without their consultation and did not reflect current “best practices.”

<sup>13</sup> MCTAC note: Both the BCHSSOA and BCSF promote ethical standards of conduct for backcountry recreation and have expressed an interest and willingness to be involved in recovery efforts for Mountain Caribou by: (1) monitoring and reporting on their use in caribou habitats; (2) informing backcountry recreationists on sensitive wildlife areas that should not be accessed for skiing or snowmobiling; and (3) co-operating in adaptive management trials to better understand the impact of their activities on Mountain Caribou.

## 3.2 Socio-political Considerations

Under the National Accord for the Protection of Species at Risk, British Columbia is committed to protect threatened and endangered species and their habitats and, furthermore, to undertake recovery actions to rebuild populations. Developing a recovery strategy is the first step. Implementation will require further management of caribou habitat, predator-prey interactions and intensive motorized and commercial recreation activities in winter.

With regard to further management of caribou habitat, recent Land Use Plans (LUPs) have incorporated caribou habitat management measures. Despite this, existing measures may be inadequate to maintain current caribou numbers. Furthermore, the existing measures to protect Mountain Caribou habitat are already sizeable — perhaps in the order of 1-2% of the provincial allowable annual cut (AAC) — and have already affected local economies and job opportunities in the forest sector.

Predation is a significant conservation concern for some local populations and managing predator-prey interactions is highly controversial. Currently, there is very little active management of carnivores affecting Mountain Caribou. Although predator control has the potential to increase caribou numbers, its use is severely limited by technical constraints and public opposition (Seip 1992b). Recent predator control programs in Alaska, Yukon and British Columbia have encountered public opposition due to animal rights concerns for large predators and opposition to human manipulation of natural ecosystems.

Management of backcountry recreation must recognize the many interests involved, as well as the limits to compromise that a threatened or endangered species will tolerate and still remain viable. Given the scope of players, from the commercial operator to the independent sportsperson, and the complications of imposing unilateral regulations, it appears that the first-choice for managing recreationists in caribou habitat is to

inform them of the problem and approach a solution cooperatively.

Each local population of Mountain Caribou is affected by different factors and, therefore, each needs custom tailored actions. For example, intensive winter recreation activities are a major concern for some populations, but less so for others. Predation is more important in some populations than in others. And it is likely that the conservation measures required for some populations will result in socially difficult choices due to required restraints on economic development. A recovery program for Mountain Caribou must carefully weigh the consequences between restraints on land development and use, controlling predators, and further regulation of forest management and backcountry recreation activities. This can most effectively be achieved at the local planning level.

## 3.3 Potential For Recovery of Mountain Caribou

### 3.3.1 Review of Major Threats

The major habitat variable that affects caribou numbers is believed to be distribution of suitable, contiguous habitat over a large area, sometimes summarized as “space” (Bergerud 1980, 1992; Bergerud et al. 1984b). The amount of space required by caribou to avoid predators appears to be significantly greater than the amount required to obtain sufficient forage. Space allows caribou to distance themselves from wolves, Cougars and bears; to use habitats where vegetation or snow conditions give them an advantage over predators; and to disperse themselves widely, decreasing searching efficiency for predators (Bergerud 1992, Stevenson et al. 1994).

The primary threat to Mountain Caribou appears to be loss of space, or fragmentation of their habitat. Associated with this are potential reductions in winter food supply, increased human access and associated disturbance, and higher predation rates. Most caribou populations are affected by a



combination of these threats, which act at both the stand level (e.g., lichen abundance) and landscape level (e.g., access and predation). Furthermore, these factors likely have cumulative effects on caribou populations, which may not be predictable by examining the effects of each factor separately.

#### FRAGMENTATION OF HABITAT AREAS

Woodland Caribou appear to use habitat as an important means of limiting the effect of predation (Bergerud et al. 1984a, Seip 1991, Bergerud 1992). For example, Mountain Caribou space out at low densities in subalpine and alpine habitats to reduce predation (Seip and Cichowski 1996). In addition, caribou are adapted to and select habitats specific to their needs, which tend to be poor habitat for other ungulates.

Habitat changes that occur after timber harvesting or forest fires often result in an increase in Moose, deer and Elk populations. Prevailing theory suggests that an increase in the abundance of alternative prey facilitates an increase in wolf density (Bergerud and Ballard 1988), and Cougar densities may also respond similarly. This, in turn, allows predators to exert a greater negative effect on caribou (Seip 1991). Even if there is not an increase in prey base in response to habitat change, any reduction in caribou habitat from logging or fire could concentrate caribou into the remaining area, and effectively increase their density. That reduction in their ability to space out may make it easier for predators to locate them (Seip 1991).

The ability of caribou to move through fragmented habitats or barriers is not well known. Simpson et al. (1997) reported that caribou appeared willing to cross up to 5 km of poor habitat to reach high-use, old-growth forests. Mature forest (60-120 years old) and shrubland (<20 years) were commonly used for movement, while immature forest (20-60 years) appeared to be avoided. Large human-made or fire-created openings 10-15 km wide have isolated the Narrow Lake and George Mountain local populations (Simpson et al. 1997, Heard and Vagt 1998). The

southern portion of the South Purcells caribou range appears to be isolated from the northern portion by recent fires and forest development in the St. Mary's drainage (T. Kinley, MCTAC, pers. comm.). Highways and roads may also limit caribou movements, particularly for female and young caribou moving between seasonal ranges (Simpson et al. 1994). Caribou north of Revelstoke appear unwilling to venture south of the Canadian Pacific Railway tracks and the Trans-Canada Highway, possibly due to the rail and highway corridors or to the dense, second-growth stands (Simpson et al. 1997). However, caribou appear to regularly cross Highway 16 east of Prince George between the North Cariboo Mountains and the Hart Ranges (D. Heard, BC MWLAP, pers. comm.), and caribou elsewhere in the world make regular migrations through greatly varied habitat conditions. Even if caribou do cross fragmented habitats, there may be costs associated with increased energy expenditure required to locate isolated foraging patches, as well as increased exposure to mortality and harassment by humans.

#### WINTER FOOD SUPPLY (ARBOREAL LICHENS)

The role that food plays in limiting caribou populations has been debated for many years. Currently, there is general acceptance that absolute quantity and quality of food does not limit growth of Woodland Caribou populations as long as there is adequate range available to deal with severe snow conditions or loss of lichen-producing habitat (Schaefer and Pruitt 1991, Seip 1991, Bergerud 1996).

Arboreal lichens provide a critical food source for all Mountain Caribou populations in BC during late winter and can be an important component of early-winter diets in some local populations (Rominger and Oldemeyer 1990). Studies suggest that stands more than 125 years old are required to support adequate amounts of arboreal lichens (Armleder and Stevenson 1996).

Although Mountain Caribou populations appear to be regulated at densities below habitat carrying capacity (Seip and Cichowski 1996), there is also a limit to how much lichen-producing habitat can be lost to

timber harvest or fires (stand level) and still provide adequate forage for caribou (landscape level). These concerns are more important in stands used by caribou in early winter that are commercially valuable. In late winter there is less conflict with forest management since more of the stands used by caribou at that time are non-merchantable (Armleder and Stevenson 1996).

#### HUMAN ACCESS AND ASSOCIATED DISTURBANCE

One of the major threats to Woodland Caribou is increasing road development and access into their habitat (Bergerud 1978, Johnson 1985, Seip 1991). The resulting threat may take several forms. Improved access to the summer calving range may increase risk of disturbance by humans during calving. Calving areas are the most sensitive of all habitats for caribou (Seip and Cichowski 1996) and require protection. Historically, over-hunting was primarily a result of road access associated with human industrial and recreational development (Bergerud 1978, Stevenson and Hatler 1985). While Mountain Caribou are currently not hunted, poaching losses, which are most common along roads during hunting season for other game species, remain a concern. Road kills can also be a concern, such as those that have occurred since the opening of Highway 3 across the range of the South Selkirks local population (Johnson 1976, Simpson et al. 1994).

The effects on caribou of disturbance from human activities are more difficult to document and remain controversial. Panic and strong escape reactions of Barren-ground Caribou (*R. t. granti*) to low-flying helicopters and small fixed-wing aircraft have been documented (McCourt et al. 1974, Calef et al. 1976). Low-altitude jet aircraft have caused disturbance and increased movement in Alaska (Maier et al. 1998). Hauling by logging trucks in Ontario apparently caused Woodland Caribou to move out of the haul road areas that were preferentially used by caribou in the years before and after hauling (Cumming and Hyer 1998). In Alberta, simulated petroleum

exploration noise was also found to increase energy expenditure by caribou (Bradshaw et al. 1997). Physical disturbance from such exploration, such as roads, drilling sites and seismic lines, resulted in avoidance of habitats well beyond actual development “footprints” (Dyer et al. 2001).

After noting the absence of studies showing that disturbance limits caribou populations, Bergerud et al. (1984b) concluded that disturbance should not pose a major threat provided sufficient space is available for caribou to escape unwelcome stimuli. They qualified this conclusion by adding that there is likely an upper limit to the tenacity of caribou to withstand disturbance. Eight years later, Harrington and Veitch (1992) demonstrated this upper limit for Woodland Caribou in Labrador, where calf survival in both the calving and post-calving periods was negatively correlated to the exposure of females to low-altitude jet flyovers. This led the authors to suggest that the greatest effects of disturbance on calf survival occur during critical periods when other stressors are also acting. Research on stress effects of recreation specific to caribou requires further development; however, a recent study in Yellowstone National Park (Creel et al. 2002) documented a significant increase in stress-related hormone levels in Elk and wolves during the snowmobile season. For Elk, these levels increased in concert with the daily number of snowmobiles. The authors also noted that despite these stress responses, there was no evidence that current levels of snowmobile activity were affecting the population dynamics of either species.

Studies such as Harrington and Veitch (1992) add support to a growing concern that excessive levels of recreational activity within caribou winter range may place animals under stress and displace caribou from suitable winter habitats (Stuart-Smith et al. 1996). Mountain Caribou in BC generally prefer more gentle terrain in winter, but areas of heavy use by snowmobiles or heli-ski operations, particularly within subalpine parklands, may displace caribou into steeper, more avalanche-prone terrain where mortality risks are higher (Simpson 1987; Seip, pers. comm.). The creation of trails in an area may also render

caribou vulnerable to predators (James and Stuart-Smith 2000). Compacted trails, such as those created by snowmobiling and snowshoeing, may provide easier travel corridors for wolves into late winter caribou habitats (Bergerud 1996).

The increasing interest in recreational snowmobiling, combined with better access from roads to high-elevation cutblocks and more powerful machines that are able to traverse most Mountain Caribou ranges, is believed to represent a significant threat to some Mountain Caribou populations. A recent review of the potential impacts of four winter backcountry recreation activities on Mountain Caribou, including snowmobiling, heli-skiing, snow-cat skiing and backcountry skiing, indicated that snowmobiling has the greatest perceived threat to Mountain Caribou (Simpson and Terry 2000). However, there is no documentation in BC that snowmobiling has permanently displaced caribou off winter ranges. Similarly, while there is potential for helicopters to disturb caribou, there is no demonstrated evidence that this has occurred in BC within areas of historic heli-ski use.

#### ALTERATION OF PREDATOR-PREY RELATIONSHIPS

Mountain Caribou local populations exist within a dynamic and complex predator-prey system. While Mountain Caribou populations probably fluctuate naturally, the increase in Moose populations in south-central BC during the 1900s has been associated with long-term declines in some caribou populations (Seip and Cichowski 1996).

Within a multiple predator-prey system, it is possible for predator numbers to remain relatively high even if predation (or human harvest) has drastically reduced one of the prey species. Caribou are extremely vulnerable to wolf predation, compared to most other ungulates (Seip 1991). Caribou usually occur at much lower densities, have larger home ranges and do not normally use habitats frequented

by Moose, deer or Elk. They do not use escape terrain as efficiently as Bighorn Sheep or Mountain Goats, and they have a low reproductive rate relative to Moose or Mule Deer. Therefore, caribou are usually the most vulnerable species in a multiple predator-prey system, the first to decline and the last to recover (Seip 1991). Seip (1992a) suggested that wolf predation can eliminate caribou from areas where the wolf population is sustained by other prey species, because there is no negative feedback on the number of wolves as caribou decline in numbers. Thus, wolves could persist on Moose, Elk or deer as they extirpate local caribou populations.

Industrial activities may alter predator-prey relationships and potentially could increase the total predation rate of caribou by<sup>14</sup>:

1. producing early seral stages with enhanced understory shrub and forb production, which may increase the abundance of other ungulates or change ungulate distribution within Mountain Caribou habitat, specifically:
  - a. increased shrub production at low elevations may increase ungulate populations (e.g., deer, Elk and Moose), which in turn may increase predator populations, leading to more predator-prey encounters with caribou during early winter; and/or
  - b. increased forb production at higher elevations may attract Moose, deer and Elk into Mountain Caribou habitat during summer. Predators following their prey into these higher-elevation areas may come into contact with caribou more frequently, leading to increased predation rates on caribou during summer.
2. restricting caribou to old-growth habitat patches, which may increase the search efficiency of predators.
3. providing easier access, through construction of roads, for predators to travel into caribou habitats and prey on caribou (James and Stuart-Smith 2000).

<sup>14</sup>MCTAC note: While modification of habitats by forest harvesting and its subsequent effect on predator-prey relationships remains a concern, there are currently no studies that have clearly demonstrated these impacts.

### 3.3.2 Current Population Protection Measures

#### PREDATOR MANAGEMENT

Predator management involves the regulation of predator numbers through hunting and trapping, and in exceptional cases may also include predator control. It seeks to maintain viable populations of both predators and prey. It has been used to increase recreational opportunities for predator hunting, provide economic benefits to licensed guide outfitters and trappers, and reduce conflicts between predators and humans.

Most viable predator populations currently have a hunting and/or trapping season. However, in some circumstances it has been necessary to increase these activities in order to conserve caribou by:

- increasing hunting bag limits for wolves and Cougars;
- extending the general open hunting season for wolves, Cougars and Black Bears;
- extending the wolf trapping season;
- removing quotas on the number of female Cougars that may be harvested (where in effect).

Predator control involves the direct reduction of predator populations, usually by government staff or contractors. The intent of predator control is usually to increase the populations of prey species such as ungulates.

A new MWLAP policy allows for control of individuals or populations of wildlife that pose a threat to the viability or recovery of a Red-listed species. This policy allows for lethal control, but identifies a preference for non-lethal means of control when native species are the target of control. Legal harvest of animals is preferred over lethal control. Preference is for selective removal of individual predators (e.g., Cougars or wolf packs) known to be preying on a Red-listed species.

#### MANAGING OTHER UNGULATE SPECIES WITHIN CARIBOU HABITAT

Habitat alteration through forest development (road building and logging) increases the abundance of forest stands in early seral stages, which may promote an increase in Moose, Elk, Mule Deer and White-tailed Deer populations. It has been speculated that this may result in more predators and a higher predation rate of caribou. Based on current Mountain Caribou population densities in British Columbia (~ 30/1000 km<sup>2</sup>), it is improbable that caribou densities are currently high enough to support predator populations in the absence of other ungulate prey.

A limited entry antlerless White-tailed Deer season was recently implemented for the portions of Wildlife Management Units 4-07 and 4-08 that occur within the range of the South Selkirks caribou. The objective is to reduce predation rates on caribou by controlling White-tailed Deer densities on their winter range, thus indirectly limiting Cougar numbers.

#### TRANSLOCATION

Translocations have been used to increase existing caribou populations (e.g., South Selkirks) or restore them to previously occupied habitat (e.g., Charlotte Alplands). Transplants may help to maintain a local population over its current range, even if they do not result in a net increase in overall numbers. For example, 103 animals were translocated into the South Selkirks between 1987 and 1998. While this local population is still endangered (~ 35 animals) transplants appear to have enabled it to persist.

Current MWLAP policy recognizes the value of transplant programs to reintroduce or augment wildlife within their former range, both within and outside the province. Its continued use, as a conservation measure, is determined under the following criteria:

- the proposed transplant site must provide sufficient and suitable habitat to support a viable population;

- prior study must establish that the introduction or augmentation will not adversely affect the numbers, health or utilization of currently present wildlife species at either the transplant source or the transplant site;
- prior study must establish that a reintroduction will not create intensive land use conflicts with other resource agencies or resource users; and
- the race or subspecies to be transplanted must be consistent with the historic range of the race or subspecies being introduced or augmented.

#### MOUNTAIN CARIBOU HARVEST MANAGEMENT

The provincial Wildlife Harvest Strategy (BC MELP 1996:3) recognizes that: “*conservation of natural diversity, distribution and viability of indigenous wildlife populations are the highest management*

*priorities.*” Red-listed species and subspecies are managed for recovery and are not normally harvested. Currently, there are no hunting seasons for Mountain Caribou.

#### ACCESS MANAGEMENT

For all local populations in areas with Land and Resource Management Plans (LRMPs) or Higher Level Plans (HLPs), access management guidelines to address general recreational activities within Mountain Caribou range have been developed (Table 7).

In response to recent concerns about potential impacts of snowmobiling and commercial recreation activities, a draft discussion paper has been prepared to identify interim recreation guidelines for caribou

**Table 7. Land Use Plans involved with Mountain Caribou habitat issues.**

Administrative Region	Local Population	Land Use Plan <sup>a</sup>	Plan Status
Thompson-Okanagan	Monashee	OSLRMP <sup>b</sup>	LRMP underway
	Wells Gray South	KLRMP	LRMP completed <sup>c</sup>
Kootenays	Revelstoke	KBLUP	plan completed
	Central Rockies	KBLUP	plan completed
	Central Selkirks	KBLUP	plan completed
	South Purcells	KBLUP	plan completed
	South Selkirks	KBLUP	plan completed
	Cariboo	Wells Gray North	CCLUP
Omineca	Barkerville	CCLUP	plan completed <sup>c</sup>
	Hart Ranges	PGLRMP	plan completed
	North Cariboo Mtns.	PGLRMP	plan completed
	Narrow Lakes	PGLRMP	plan completed
	George Mountain	PGLRMP	plan completed
	Central Rockies	RVLRMP <sup>d</sup>	plan completed

<sup>a</sup> KBLUP = Kootenay Boundary Land Use Plan, CCLUP = Cariboo-Chilcotin Land Use Plan, PGLRMP = Prince George LRMP, OSLRMP = Okanagan Shuswap LRMP, KLRMP = Kamloops LRMP, RVLRMP = Robson Valley LRMP

<sup>b</sup> Also includes some of Revelstoke and Wells Gray South.

<sup>c</sup> Declared a Higher Level Plan.

<sup>d</sup> Also includes part of Hart Ranges and North Cariboo Mountains.

(<http://wlapwww.gov.bc.ca/wld/comrec/crecintro.html>). This paper includes specific guidelines for operators working in Woodland Caribou habitat<sup>15</sup>.

### 3.3.3 Current Habitat Protection Measures

The current approach to protect Mountain Caribou habitat at the regional level is to maintain networks of:

- “core areas” or areas of no timber harvest to maintain arboreal lichens and limit access;
- “buffer zones” around core areas, including areas of selection logging and extended rotations; and
- “linkages” or movement corridors between core areas.

Some form of caribou habitat management guideline(s) or planning/operational direction is in place in most regions that support Mountain Caribou (Table 7). The potential impact of the guidelines on the forest industry vary, depending on the extent of conflict between caribou and timber, and the differing regional behavioural and movement patterns of caribou.

Current regional forest management prescriptions for Mountain Caribou can be summarized from LRMP and regional Land Use Plans (Table 8). Simpson et al. (1997) reported that at one time, prescriptions for most local populations included a high-elevation no-harvest zone, which in most areas corresponded approximately to the forest harvesting “operability line.” Under the Cariboo-Chilcotin Land Use Plan (CCLUP), a 20-year deferral of upper-elevation habitats has now been replaced with a zone that allows up to 35% modified timber harvesting of each CCLUP subunit. In other areas, where the inoperable high-elevation forests form a significant portion of the land area, there have been recent recommendations for either “no harvest” until

proven management strategies are developed (Prince George LRMP), or timber deferrals (Robson Valley LRMP). Other LRMPs have attempted to maintain 30-40% of the operable land base in age class 8 or older (>160 years) within high-elevation, late-winter habitats.

### MAPPING DISTRIBUTION AND HABITAT

Habitat suitability models are being developed in southeastern BC (e.g., South Purcells, Central Selkirks) to assist in operational planning and provide more detailed interpretation of forest cover values to Mountain Caribou within each seasonal period (see section 2.2.3). Terrestrial ecosystem mapping is also being conducted within the occupied ranges of some local populations to better identify caribou habitat attributes. To date, there has not been a standard provincial protocol developed for these approaches (but see section 6.2.2).

### 3.3.4 Degree of Habitat Management Required

Habitat management is considered key to maintaining viable Mountain Caribou populations. However, this does not imply that no resource development can take place within caribou habitats, as it is clear that caribou have survived in many areas coincident with industrial activities. Simpson et al. (1997) indicated that in order to successfully manage caribou habitat it is necessary to:

- clearly define habitat requirements;
- clearly define the geographical areas and habitats of importance to caribou;
- clearly define compatible management programs (including predator management); and
- assess population trends and define habitat supply limits that will ensure viability of the local populations.

<sup>15</sup> MCTAC note: When eventually finalized, the guidelines should reflect stakeholder support, provide for some regional flexibility and evolve as more is learned about interactions between caribou and recreationists.

**Table 8. Summarized regional forest management prescriptions (extracted from LRMP and regional Land Use Plans).**

Forest District/ Land Use Plan	Prince George LRMP	Robson Valley LRMP	Cariboo- Chilcotin LUP <sup>a</sup>	Kamloops LRMP <sup>b</sup>	Okanagan-Shuswap LRMP <sup>c</sup>	Kootenay Boundary LUP
Local populations affected by forest development plans	Hart Ranges, North Cariboo Mountains, George Mtn., Narrow Lake	North Cariboo Mountains, minor part of the Hart Ranges	Barkerville, Wells Gray North	Wells Gray South	Monashee, Revelstoke, Wells Gray South	Revelstoke, Central Rockies, Central Selkirks, South Purcells, South Selkirks
High-elevation and late-winter habitat (ESSF)	No harvest with areas identified as having high value to caribou until proven management strategies are developed in areas of medium habitat suitability. High valued areas are excluded from the TSR.	Deferred forest harvesting within high valued habitat for 10 years or until proven management strategies are developed in areas of medium habitat value.	Within caribou range, 65% of habitat identified as no-harvest areas. Remaining 35% designated for modified harvest (described below).	Maintain a minimum of 33% of the caribou habitat such that it retains old-growth attributes. Silviculture systems other than clearcutting recommended; clearcuts restricted to 15 ha.	No parkland harvesting. At least 20% of THLB <sup>d</sup> to be reserved now; 7-year research program will determine need for additional reserves or special management areas.	No harvest in parkland and designated caribou no-harvest areas. Elsewhere between parkland and the Caribou Line <sup>e</sup> , maintain 70% in age class 8 or older.
Transitional or early-winter habitat (ICH & ESSF)	In medium habitat implement alternative silviculture systems to maintain caribou habitat values over a 240-year rotation.	In medium habitat implement alternative silviculture systems to maintain caribou habitat values over a 240-year rotation.	In modified harvest areas, including key early-winter range, implement alternative silviculture systems to maintain caribou habitat values.	In transitional habitat maintain 20% of the area such that it retains old-growth attributes through tree islands, ecosystem networks and riparian buffers.	At least 20% of THLB <sup>d</sup> to be reserved now; 7-year research program will determine need for additional reserves or special management areas.	Below the Caribou Line <sup>e</sup> maintain 30% of the forested area in age class 8 or older (10% age class 9) and an additional 20% in alternative silvicultural systems to maintain caribou habitat values in the ESSF. In the ICH, 40% in age 8 or older (10% age class 9)
Movement corridors	Schedule harvesting to maintain the integrity of the corridor for caribou movement throughout the rotation.	Schedule harvesting to maintain the integrity of the corridor for caribou movement throughout the rotation.	No specific strategies; follow strategies for modified harvest areas.	Must be 1–1.5 km wide with at least 30% of the timber sufficient in age/size to intercept snow.	At least 30% of the timber within corridors must provide snow interception and exhibit pruning of lower branches.	No specific strategies except maintain continuous broad corridors of old-growth and mature at regular intervals to connect pockets of old growth forest.
Access management	Where there is harvesting in or adjacent to caribou habitat, minimize amount of open winter roads. Recommend constraint on backcountry recreation that is incompatible with caribou conservation.	Where there is harvesting in or adjacent to caribou habitat, minimize amount of open winter roads. Recommend constraint on backcountry recreation that is incompatible with caribou conservation.	Define parts of the caribou range sensitive to recreational activities, especially snowmobile use, and address through sub-regional planning.	No specific strategies, but some local recreation plans exist.	Manage summer and winter backcountry recreation through local planning. Develop access management plans. Include caribou concerns in mine planning.	Avoid access to parkland. Develop access plan for caribou area. Assess CBR <sup>f</sup> proposals. Work with snowmobile club to direct snowmobile access away from late-winter habitat.

<sup>a</sup> CCLUP Mountain Caribou Strategy, October 2000. <sup>b</sup> Kamloops LRMP, Appendix 10: Timber Harvesting Guidelines for North Thompson Caribou Habitat. <sup>c</sup> Okanagan-Shuswap LRMP Final Recommendations. Mountain Caribou Habitat RMZ. J. Morgan, MSRM, Kamloops, pers. comm. <sup>d</sup> Timber Harvesting Land Base. <sup>e</sup> The Caribou Line is the 1994 forestry operability line, frozen in time to facilitate discussion of guidelines. <sup>f</sup> Commercial Backcountry Recreation.

### 3.3.5 Biological Considerations Affecting Recovery

#### SCOPE FOR GROWTH OF EXISTING LOCAL POPULATIONS

Under natural predator-prey systems, Woodland Caribou in BC appear to stabilize at a density of about 30-50 caribou/1000 km<sup>2</sup> (Seip and Cichowski 1996). There is currently an estimated 62 800 km<sup>2</sup> of Mountain Caribou range occupied by local populations (Table 2). Assuming that local populations with less than 50 caribou/1000 km<sup>2</sup> could be enhanced to this density, there could be capacity to increase the metapopulation from 1900 to 3350 animals. However, most local populations already occupy ranges that have been fragmented to varying degrees by logging and access, and appear to have higher numbers of predators than may have occurred historically. Furthermore, a combination of both habitat and population management appears necessary to maintain local caribou populations at existing levels. Intensified population management prescriptions, including predator management or control, lowering the density of other ungulate species within caribou range, translocations, and access management may all be necessary to improve the status of small, local populations (e.g., George Mountain, South Purcells, Monashee, Central Rockies, South Selkirks).

#### POTENTIAL FOR INTRODUCTIONS AND RE-INTRODUCTIONS

The current potential to augment existing local populations through transplants from current Mountain Caribou range is limited. No local populations are currently increasing, suggesting that acquiring animals for transplant may put the viability of the source population in jeopardy. Furthermore, other population management measures, such as predator management or control, reduction in alternate prey and access management, may be required to provide a suitable environment in which to successfully transplant animals.

Transient factors, such as certain land use changes, have been at least partially responsible for the

extirpation of caribou from their former range (Spalding 2000; Figure 1). However, because most of this former range currently has low to medium suitability, the potential for reintroduction is considered to be low. Furthermore, the chance of a successful transplant is considered low, as the presence of a remnant population in the transplant area appears to provide a stabilizing effect that enhances retention of subsequently relocated individuals (Warren et al. 1996) and that allows established range use traditions to be passed on (Bergerud 1974).

An important factor in translocation projects is the choice of source animals, as geographic variation of behaviour and genetics (see section 2.1.4) within caribou can be considerable. Warren et al. (1996) reported on the success of translocating two woodland ecotypes, mountain and northern, from British Columbia into the southern Selkirk Mountains in northern Idaho to augment the existing remnant local population of Mountain Caribou. The mountain ecotype stock exhibited patterns of movement and habitat use similar to those of the resident population, while the northern ecotype stock exhibited more variable habitat use. This suggests that transplants using caribou that do not have similar habitat use patterns as the resident animals may require more individuals to establish a self-sustaining population. Warren et al. (1996) also reported that the mountain ecotype had a significantly higher survival rate at the release site than the northern ecotype.

Captive breeding may represent a viable alternative to translocation of wild animals. Husbandry procedures for reindeer are well developed and captive breeding of Woodland Caribou has been used to provide animals for reintroduction in Quebec (Jolicoeur 1995) and Alaska (Jones 1966). Procedures are needed that will increase the likelihood that the transplanted animals will remain where released. One program that appeared successful in Newfoundland was to release hand-reared calves (Bergerud 1974). These calves remained at the release site, as did wild calves transplanted to the Charlotte Alplands in west-central BC (Young and Youds 2000).



## 4. General Considerations For Recovery

### 4.1 Conservation Ranking of Local Populations

Simpson et al. (1997) summarized the current status of each local population based upon the following four major categories and associated measures:

#### 1. POPULATION VIABILITY (LONG TERM)

- population size
- population trend
- connectivity with adjacent populations

#### 2. HABITAT AND POPULATION THREATS

- forest harvesting
- access (including winter recreation conflicts)
- predation
- risk of forest fires

#### 3. HABITAT PROTECTION

- percent of habitat protected
- percent of habitat inoperable

- percent of habitat in special management for caribou

#### 4. HABITAT CONDITION

- percent capable
- percent suitable
- fragmentation of habitat

The biological criteria listed above were then used to rank the 13 local populations by category (Table 9; see also Simpson et al. 1997:19-20) and to determine an overall conservation value (high, moderate or low; Table 10). In general, larger local populations that were linked to adjacent populations received a higher conservation value.

Simpson et al. (1997:19-22) also ranked each local population based on the economic cost of conservation. The economic cost rank considers the potential impact to local communities based upon a relative estimated timber supply reduction required to ensure caribou conservation. It does not, however, consider the economic costs of other conservation actions, such as restrictions on winter recreation

**Table 9. Preliminary conservation assessment of Mountain Caribou local populations.**

(modified from Simpson et al. 1997, see Appendix 4)

Mountain Caribou Local Population	Viability	Threats	Habitat Protection	Habitat Condition
South Selkirks	Low	High	Medium	Low
South Purcells	Low	High	Medium	Medium
Central Selkirks	Medium	Medium	Medium	High
Monashee	Low	Medium	Medium	Low
Revelstoke	High	High	Low	High
Central Rockies	Low	Medium	Low	Medium
Wells Gray North	Medium	High	Medium	High
Wells Gray South	High	Medium	Medium	High
North Caribou Mtns.	High	Medium	High	High
Barkerville	Medium	High	Medium	Medium
George Mountain	Low	High	Medium	Medium
Narrow Lake	Low	Medium	High	Medium
Hart Ranges	High	Medium	High	High

**Table 10. Preliminary assessment of conservation and economic values and conservation priority of Mountain Caribou local populations.** (modified from Simpson et al. 1997)

Mountain Caribou Local population	Conservation Priority <sup>a</sup>	Conservation Rank <sup>b</sup>	Economic Cost Value <sup>c</sup>
South Selkirks	10	Low	Low
South Purcells	11	Low	Medium
Central Rockies	6.5	Medium	Medium
Monashee	12	Low	Low
Revelstoke	3.5	High	High
Central Selkirks	8	Medium	High
Wells Gray North	3.5	High	High
Wells Gray South	3.5	High	High
North Cariboo Mtns.	3.5	High	High
Barkerville	6.5	Medium	Medium
George Mountain	13	Low	Low
Narrow Lake	9	Medium	Low
Hart Ranges	1	High	Medium

<sup>a</sup> The lowest numbers indicate the highest priority (see text).

<sup>b</sup> Overall conservation ranking using all four criteria (from Table 9).

<sup>c</sup> Rank for minimum economic cost. L = lowest potential impact on timber supply reductions, M = moderate impact, H = greatest potential impact (from Simpson et al. 1997).

activities. Conflicts with conservation needs were identified to be most severe for the North Cariboo Mountains, Wells Gray North, Wells Gray South, Revelstoke and Central Selkirks (Table 10).

A “conservation priority” was established from both the conservation rank and economic rank. The local populations with the highest conservation priority (indicated by the lowest numeric score) were Revelstoke, Wells Gray North, Wells Gray South, North Cariboo Mountains and Hart Ranges.

## 4.2 Conservation Approach

Management of Mountain Caribou requires weighing the risks or threats of various management actions with conservation needs. To address this requires a conservation approach that considers a metapopulation structure for Mountain Caribou, employs the precautionary principle when necessary,

encourages adaptive management and employs ecosystem management principles.

### 4.2.1 Metapopulation Persistence

Often, species exist in a number of local populations that are either isolated from one another or have limited exchange of individuals. Such a collection of interacting local populations of the same species is called a metapopulation (Wells and Richmond 1995). Metapopulations occur naturally as a result of spatial heterogeneity, and through habitat loss and fragmentation. Dispersal between local populations enables a metapopulation to persist. Differences in productivity of local populations may lead to “sinks,” which are local populations that receive migrants but seldom produce any offspring or send emigrants to other populations. There is still considerable debate among conservation biologists

over the value of peripheral populations for conservation (Lesica and Allendorf 1995).

Within the context of Mountain Caribou, dispersal from larger local populations may augment or even “rescue” smaller local populations (i.e., prevent their extirpation and ensure genetic interchange for adaptability). Conversely, small local populations could be important for recovering larger local populations that suffer a catastrophic event. The current boundary of Woodland Caribou range in southern BC is the result of relatively recent human pressure (over the past 100 years) rather than historic limits of ecological tolerance. Local populations at the current periphery would have been at the core of the more expansive, historic range, so it may be inappropriate to label these local populations as functionally “peripheral.” Maintaining these local populations, as well as “habitat linkages” or dispersal routes between local populations that constitute the geographic core of the current Mountain Caribou range may be critical to the long-term persistence of the metapopulation<sup>16</sup>.

#### 4.2.2 Precautionary Principle

The precautionary principle states that all stakeholders have a responsibility to take precautionary measures to anticipate, prevent or minimize adverse effects to the environment. The lack of full scientific certainty as to impacts should not be an adequate reason to postpone measures that will protect the resource (Akçakaya et al. 1997)<sup>17</sup>.

Application of the precautionary principle to Mountain Caribou means that where there are potential threats to Mountain Caribou, lack of full scientific certainty should not be used as a reason for not taking actions to protect caribou and their habitat.

#### 4.2.3 Adaptive Management

Adaptive management, simply stated, is “learning by doing” (Walters and Holling 1990). In contrast to routine trial-and-error management, which tends to stumble from one policy to another based on an incomplete or inexplicit understanding of how an ecological system functions, adaptive management implies a structured approach to policy development and evaluation that places great importance on learning about system (e.g., caribou and habitat) responses to management. Nyberg (1998) proposed the following working definition for adaptive management:

*“Adaptive management is the systematic process for continually improving management policies and practices by learning from the outcomes of an operational program. Its most effective form — “active” adaptive management — employs management programs that are designed to experimentally compare selected policies or practices, by evaluating alternative hypotheses about the system being managed. The key characteristics of adaptive management include:*

- *acknowledgement of uncertainty about what policy or practice is “best” for the particular management issue;*
- *thoughtful selection of the policies or practices to be applied;*
- *careful implementation of a plan of action designed to reveal the critical knowledge;*
- *monitoring of key response indicators;*
- *analysis of the outcome in consideration of the original objectives; and*
- *incorporation of the results into future decisions.”*

While conventional research studies have improved our knowledge of Mountain Caribou and their

<sup>16</sup> MCTAC note: There is currently very little data to indicate the degree of dispersal of caribou between local populations.

<sup>17</sup> Section 38 of Bill C-5 (Species at Risk Act) also states: “In preparing a recovery strategy, action plan or management plan, the competent minister must consider the commitment of the Government of Canada to conserving biological diversity and to the principle that, if there are threats of serious or irreversible damage to the listed wildlife species, cost-effective measures to prevent the reduction or loss of the species should not be postponed for a lack of full scientific certainty.”

habitat, an adaptive management approach is likely necessary to provide long-term solutions to conserve caribou. Because the response time of Mountain Caribou habitats to alterations and management experiments is very slow, the results of these studies may not be known for decades. Consequently, interim habitat management guidelines for populations based on the best scientific information, the precautionary principle and ecosystem management principles are required until more definitive results from adaptive management experiments are available. Adaptive management, however, may produce optimal policy choices more quickly for backcountry recreation activities, because behavioural responses of caribou to disturbances can presumably be assessed in only a few years. Adaptive management also holds promise for clarifying the effects of predation on caribou, and of forest fragmentation on predator-prey relationships.

#### 4.2.4 Ecosystem Management

Ecosystem management is based on the premise that the more closely managed forests resemble natural forest conditions (i.e., age class distribution, patch

size distribution, stand structure), the greater the probability that relatively natural populations of all native species will be maintained (Seip 1998). Ecosystem management principles include: maintenance of all ecosystems in the managed forest; emulation of natural disturbance patterns on the landscape; and insurance that structure and function of forested ecosystems are conserved (Euler 1998). Forest planning models based on ecosystem management principles may allow for positive management action to be undertaken before complete understanding of wildlife habitat requirements are developed.

An ecosystem-based approach to managing Mountain Caribou habitat may hold the most promise for conserving caribou. This is based on the assumption that if natural ecosystem processes are conserved, and Mountain Caribou have evolved historically under those conditions, they have the best opportunity to continue to exist and remain healthy under these same natural conditions. Conserving ecosystems for Mountain Caribou simultaneously conserves other ecosystem values as well, such as production of freshwater in the ESSF.

## SECTION III

### MOUNTAIN CARIBOU RECOVERY

#### 5. Recovery Goals and Objectives

The vision of the Recovery Strategy is “the maintenance of caribou and their habitat in perpetuity throughout British Columbia’s Mountain Caribou range.” This vision reflects the social, cultural and economic values associated with Mountain Caribou — including people and caribou living in harmony. Goals and objectives have been formed in light of this vision, but tempered with the reality of the current demands of an expanding human populace and the resource-based economy that sustains it.

Goals have been set with the major purpose of eventually down-listing Woodland Caribou in the SMNEA from Threatened to Special Concern. For COSEWIC delisting, the decline in animal numbers must be stopped and populations must remain stable for at least three animal generations (about 20 years

in the case of caribou). Although the Mountain Caribou metapopulation is not in imminent danger of extinction, efforts are required to reverse current downward trends, particularly within the southern portion of its range.

**GOAL 1** A viable metapopulation of 2500-3000 mountain caribou distributed throughout their current range in BC<sup>18</sup>.

It is no longer possible to restore Mountain Caribou to their original abundance and distribution. However, it should be possible to ensure that a viable metapopulation is maintained and that Mountain Caribou remain an integral component of the large mammal fauna within the Southern Interior Mountains ecoprovince and Hart Ranges ecosection. Assuming that local populations with less than 50 caribou/1000 km<sup>2</sup> could be enhanced to this density, a goal of 3350

**Table 11. Threatened and endangered local populations as potential candidates for Recovery Action Plans.**

Local Population	At Risk Status <sup>a</sup>	No. of Caribou		Potential Connectivity
		Current	Potential <sup>b</sup>	
South Selkirks <sup>c</sup>	EN	35	75	Isolated; accredited recovery plan
South Purcells <sup>d</sup>	EN	20	148	C. Selkirks (?)
Monashee	EN	5	104	Revelstoke (?)
Central Selkirks	EN	130	268	S. Purcells (?)
Central Rockies	EN	20	363	Revelstoke and Central Selkirks
Barkerville	EN	50	127	Narrow Lakes, North Cariboo Mtns., Wells Gray N.
George Mtn.	EN	5	22	Isolated
Narrow Lakes	TR	65	65	Barkerville (?)

<sup>a</sup> Status: EN = Endangered, TR = Threatened. (Other local populations are classified as Vulnerable; see Appendix 3).

<sup>b</sup> Assumes a density of 50/1000 km<sup>2</sup> or current density (if greater).

<sup>c</sup> Has an accredited recovery plan (USFWS 1993).

<sup>d</sup> A draft recovery action plan is currently being prepared (Kinley 2001).

<sup>18</sup> MCTAC note: The short-term goal is to reverse the current decline in Mountain Caribou. The longer-term goal is to increase and maintain the Mountain Caribou metapopulation size between 2500 and 3000.

caribou could be achievable. However, given the need to consider other social and economic interests, a more modest goal is 2500-3000 Mountain Caribou.

**GOAL 2** Enhancement of identified local populations at risk.

Seven local populations are considered endangered (Table 11) and could become extirpated in the near future unless specific recovery measures are implemented. These local populations primarily occur along the periphery of the current range of Mountain Caribou. Local populations with existing, accredited recovery plans, such as the South Selkirks, should be a priority, as should those with potential habitat for >100 animals and/or connectivity to other local populations.

**GOAL 3** Public support for the recovery of mountain caribou and their habitats.

This goal recognizes that recovery of Mountain Caribou in British Columbia cannot succeed or be sustained without public support. Support requires educating the public-at-large about Mountain Caribou and encouraging the active involvement of local people who interact with caribou and/or their habitat. Activities that foster an appreciation for caribou and are compatible with population recovery, such as certain kinds of backcountry recreation and wildlife viewing, also should be encouraged as long as they are managed in a responsible manner.

Inevitably, maintaining or enhancing Mountain Caribou habitat will have socio-economic impacts on industries, the public and local communities. Responding to the challenge of integrating industrial activity and caribou recovery within designated areas will be a long-term process that must be based upon reliable knowledge and negotiation.

**SHORT-TERM RECOVERY OBJECTIVES**

The short-term (within the next 5 years) recovery objectives are to raise the profile of mountain caribou, protect and manage habitat, and restore the metapopulation<sup>19</sup>. Specifically:

1. Encourage support for conservation of caribou and their habitat through land use planning processes that include government agencies, the forest industry, the commercial backcountry recreation industry, non-government organizations, local communities and the public.
2. Establish local Recovery Action Groups (RAGs) to develop Recovery Actions Plans that consider: (a) socio-economic impacts of recovery (e.g., impacts to forestry, commercial recreation industries, backcountry recreationists and local communities)<sup>20</sup>; (b) probability of successful recovery; and (c) the contribution of the recovered local population's to maintaining a viable metapopulation of Mountain Caribou.
3. Support the current or planned silvicultural systems studies that will improve knowledge on integrating forest management for timber production with management for Mountain Caribou, as identified in the second edition of *Mountain Caribou in Managed Forests: Recommendations for Managers* (Stevenson et al. 2001).
4. Develop a habitat supply model to assist management planning of critical habitat for Mountain Caribou recovery.
5. Initiate a process for a multi-stakeholder committee to provide input and improve the interim backcountry recreation guidelines for Mountain Caribou.
6. Identify and support intensified predator-prey

<sup>19</sup> MCTAC note: Short-term recovery objectives are qualitative. Quantitative objectives for recovery will be developed following completion of Recovery Action Plans for local populations, and incorporated into the next revision of the Recovery Strategy for Mountain Caribou.

<sup>20</sup> MCTAC note: The forum for assessing socio-economic impacts of protecting caribou habitat (e.g., lost AAC) and regulating backcountry recreation within caribou habitat should continue to be regional and sub-regional land use planning processes. Until recently, backcountry recreation has not been included in many of these plans, although it should be. Land use decisions that are already made by Cabinet as HLPs must be recognized.

management as needed to recover local populations of Mountain Caribou.

7. Assess the long-term viability of Mountain Caribou and identify the most important linkages or dispersal routes between local populations for protection.
8. Establish local population objectives that support recovery and viability of the metapopulation through the development of Recovery Action Plans.
9. Develop a coordinated inventory program that surveys local populations at least every three years with, if possible, confidence limits.
10. Develop and implement a coordinated research strategy for Mountain Caribou with research needs listed in priority.

## 6. Provincial Approaches For Recovery

The provincial approaches (including recovery actions) for recovery of Mountain Caribou are identified below.

### 6.1 Raise the Profile of Mountain Caribou

#### 6.1.1 List Caribou within the SMNEA as Threatened under the *Wildlife Act*

##### STATUS

Government is attempting to ensure that BC legislation is consistent with the National Accord, including legal designation of threatened and endangered species. Amendments to the BC *Wildlife Act* have been identified to implement this commitment.

##### ACTIONS

1. Approve the current proposal to revise the *Wildlife Act* to allow designation of subspecies or significant populations.
2. Cabinet to identify COSEWIC-designated caribou as Threatened under the *Wildlife Act*, to increase awareness of the conservation need and to meet the commitment in the National Accord.

##### CONCERNS

Meet commitment to the National Accord for the Protection of Species at Risk.

#### 6.1.2 Participate in the National Recovery of Woodland Caribou

##### STATUS

Caribou in the Southern Mountains National Ecological Area, which includes land in both BC and Alberta, are currently designated as Threatened by COSEWIC. Under the National Accord for the Protection of Species at Risk, a plan for the recovery of caribou in the SMNEA is required. The Mountain Caribou Technical Advisory Committee (MCTAC), established prior to the COSEWIC listing, advises on conservation issues for Mountain Caribou in BC. Membership includes provincial ministries responsible for forestry and wildlife, and major non-government conservation and industry stakeholders.

##### ACTIONS

1. Update the terms of reference, and membership, of the MCTAC, so that it can become an advisory component of the JSC-SMNEA supporting the NRT for Woodland Caribou (see Appendix 6 and 7).
2. Participate in an overall framework or National Recovery Strategy linking regional/provincial strategies and localized recovery action plans (see Appendix 7).

##### CONCERNS

None identified.

#### 6.1.3 Establish Recovery Action Groups and Prepare Local Recovery Action Plans

##### STATUS

Recovery Action Groups which bring together local stakeholders and government agencies need to be formed to develop Recovery Action Plans for local populations or groups of local populations. Each local RAG must also deal with operational activities to promote recovery.

##### ACTIONS

1. Identify RAGs to operate under MCTAC to bring

together stakeholders with interests in specific local populations or groups of local populations identified as priorities (see Appendix 7). RAGs will prepare and eventually implement Recovery Action Plans specific to local populations or groups of local populations where recovery is deemed feasible.

2. Initiate local Recovery Action Plans, within identified socio-economic constraints, with involvement of all relevant regional stakeholders and agencies.
3. Adopt the South Selkirk Recovery Plan developed in the United States as a local Recovery Action Plan for the South Selkirks caribou<sup>21</sup> or revise the existing plan as needed.
4. Participate in development of standard criteria to assess socio-economic impacts of caribou habitat protection measures. Involve other ministries (e.g., Ministry of Competition, Science and Enterprise) and regional planning tables as appropriate.

#### **CONCERNS**

Conflicting interests of industry and conservation stakeholders. Time required to establish RAGs and to develop and implement recovery action plans.

### **6.1.4 Develop Communications Program**

#### **STATUS**

The National Accord requires improvement of the awareness of species at risk and encouragement of the public to participate in conservation programs. The existing communications program is out of date and inadequate given the recent listings.

#### **ACTIONS**

1. Revise existing caribou communication materials and prepare a communication plan.
2. Continue efforts to increase public awareness of Mountain Caribou through fact sheets, posters, brochures, radio, TV and print media;
3. Encourage the public to contribute toward, and participate in, Mountain Caribou conservation issues as much as possible.

4. Foster public support for recovery of specific Mountain Caribou local populations.
5. Develop cooperative recovery and management projects with stakeholders, including First Nations, conservation groups and resource development industries.

#### **CONCERNS**

Obtaining inter-agency consensus on the message. Potential protest from any sector that disagrees with the message.

### **6.1.5 Identify Funding Opportunities**

#### **STATUS**

Current funding is inadequate for initiating recovery actions, either at the provincial or local level. Existing special funds are not adequate for good management of some sectors such as intensive recreation.

#### **ACTIONS**

1. Review opportunities for new funding sources. Some possibilities include:
  2. A new surcharge, to be paid into the Habitat Conservation Trust Fund (HCTF), on commercial recreation operations, such as heli-hiking or snowmobiling. Some operators have suggested they would be willing to discuss this. Given the size of the commercial recreation industry, this potentially is a significant source of funding. Further discussion with HCTF and stakeholders is required.
  3. A new surcharge, to be paid into the HCTF, on ungulate hunting licenses. This would be similar to the current surcharge on bear hunting licenses used to fund the Grizzly Bear Conservation Strategy, but with the funds used to support conservation efforts for Red- and Blue-listed ungulates (i.e., an Ungulate Conservation Strategy Fund). There should be discussions with the BC Wildlife Federation (BCWF), Guide Outfitters Association of BC (GOABC) and other stakeholders to determine support for this initiative.

<sup>21</sup> The local population of Mountain Caribou within the South Selkirks ecosystem has an approved recovery plan (USFWS 1993).



4. A cooperative venture between appropriate ministries and the forest industry to develop a joint funding initiative for recovery actions.
5. A prioritized research submission to a provincial government-forest industry joint funding initiative, with the focus on research that may enable release of some deferred timber for harvesting over the long term, without compromising Mountain Caribou viability.
6. Federal Species at Risk funding opportunities, such as the Endangered Species Recovery Fund.

**CONCERNS**

Potential concern from some sectors over perceived increased taxation.

**6.1.6 Support Coordination of Recovery Efforts**

**STATUS**

Implementing recovery actions for caribou within the SMNEA (both regionally and locally) will require a recovery coordinator dedicated to this task.

**ACTION**

Acquire a caribou recovery coordinator to facilitate implementation of recovery actions<sup>22</sup>.

**CONCERNS**

Poor conservation and recovery in absence of a full-time recovery coordinator. Unable to effectively implement and coordinate recovery strategies and plans for Woodland Caribou in the SMNEA.

**6.1.7 Continue Participation in International Woodland Caribou Recovery Team**

**STATUS**

BC is currently a member of the International Woodland Caribou Recovery Team (including a Caribou Steering Committee and Caribou Recovery Team), which manages the South Selkirks caribou population in northeastern Washington, northern

Idaho and southern British Columbia. In addition, an International Mountain Caribou Technical Committee (IMCTC) has been established as an international, multi-agency group of researchers, biologists, resource managers, industry representatives, and other concerned people interested in recovering endangered mountain caribou in the southern Purcell Mountains of British Columbia and southern Selkirk Mountains (see <http://www.imctc.com>). Not only is the South Selkirks caribou population endangered in the United States, but, as the southernmost local population in the metapopulation, its persistence is important to maintenance of biodiversity within BC. Multi-jurisdictional cooperation is essential to meet the National Accord.

**ACTION**

Continue involvement in the International Mountain Caribou Recovery Team (including Caribou Steering Committee and Caribou Recovery Team) and the IMCTC.

**CONCERNS**

Loss of local populations of Mountain Caribou including an endangered, international caribou population.

**6.2 Protect and Manage Habitat**

The National Accord and *Species at Risk Act* require protection of habitat<sup>23</sup>. Currently, the major habitat threats are believed to be loss and fragmentation due to resource development activities, and human disturbance resulting from uncontrolled mechanized access on winter ranges (see section 3.3.1).

**6.2.1 Recommend Guidelines For Forestry and Backcountry Recreation in Caribou Habitat**

**STATUS**

Guidelines (i.e., best management practices and standards) are required to manage forestry and

<sup>22</sup> MCTAC note: The recovery coordinator need not be a government-funded position, but could be sponsored by a non-government organization dedicated to caribou conservation.

<sup>23</sup> The Accord requires legislation and programs that provide for effective protection of habitat for Threatened or Endangered species. SARA is the federal government's response to the Accord.

backcountry recreation in caribou habitat, as both are conservation concerns (see sections 2.3.1 and 2.3.2).

Guidelines for forest management within Mountain Caribou habitat were summarized in *Mountain Caribou in Managed Forests: Preliminary Recommendations for Managers* (Stevenson et al. 1994) and subsequently in a revised edition of the 1994 report (Stevenson et al. 2001).

The development and implementation of guidelines for backcountry recreation activities, such as snowmobiling or heli-skiing, is also underway. Government agencies may provide referral comments on applications for commercial recreation on Crown land and, in some cases, ministry endorsement may be required. However, there is very little management authority over non-commercial activities that also may have impacts. Inter-agency discussions and broad stakeholder consultation have recently been initiated with the objective of producing guidelines and approval criteria for backcountry users. A set of interim guidelines, which include protocols for caribou, have been recently implemented to provide guidance to regional staff and operators<sup>24</sup>. The success of these guidelines in minimizing effects on caribou will depend on cooperation with stakeholders and other agencies. In some areas, immediate action to control disturbance may be needed.

#### **ACTIONS**

1. Increase active liaison and partnerships between wildlife agency staff and backcountry users, particularly at the regional level (e.g., collection and sharing of field information, and participation in joint training sessions).
2. Encourage initiatives (e.g., research proposals, trail mapping, licensing of operators) from groups such as the BC Helicopter Skiing and Snowcat Operators Association (BCHSSOA) and the BC Snowmobile Federation (BCSF) to understand and improve interactions between caribou and recreationists in the backcountry.

3. With stakeholders, develop appropriate parameters to measure the response of caribou to backcountry operations, and identify appropriate “triggers” to initiate different management responses.

#### **CONCERNS**

Concerns from industry that revised guidelines might be more restrictive in light of CDC and COSEWIC listings. Concerns from recreationists and commercial operators over the adequacy and necessity of guidelines. Difficulty controlling non-commercial backcountry users in cases where exclusion from winter range may be critical.

### **6.2.2 Define and Map Critical Habitat**

#### **STATUS**

The National Recovery Strategy for Woodland Caribou requires that critical habitat be defined and mapped.

#### **ACTIONS**

1. Develop a definition of “critical habitat” for Mountain Caribou.
2. Develop standardized habitat mapping approaches for critical habitat.
3. Map critical habitat for each local population.

#### **CONCERNS**

Critical habitat must be described and identified in order to complete the National Recovery Strategy.

### **6.2.3 Develop and Implement Caribou Habitat Objectives in Land Use Plans**

#### **STATUS**

Recent Land Use Plans have incorporated some caribou habitat management measures. It is important that Land Use Plans contain adequate provisions for caribou habitat. A certain level of habitat protection should be consistent across the province, while still allowing for regional variations in habitat prescriptions based upon local population differences in habitat use (see section 2.2.1).

<sup>24</sup>MCTAC note: When eventually finalized after consultation and discussion, the guidelines should reflect stakeholder support, provide for some regional flexibility and evolve as more is learned about the interactions between caribou and recreationists.

## **ACTIONS**

1. Review habitat management measures for Mountain Caribou in all Land Use Plans, and recommend standardized measures as legally binding land use objectives where appropriate.
2. In cooperation with local RAGs, evaluate and assess the variety of integrated management options available for each population and assess both the conservation risk and economic implications.
3. Encourage the timely implementation of new initiatives such as the Working Forest, Sustainable Resource Management Plans (SRMPs) and Sustainable Forest Management Plans (SFMPs).

## **CONCERNS**

Concerns from industry about requirements for more land use planning.

### **6.2.4 Utilize Appropriate Tools to Achieve Habitat Objectives**

#### **STATUS**

In addition to Land Use Plans, there are currently several tools that may be used to protect habitat for Mountain Caribou.

Under the former Forest Practices Code (FPC) and the new Results Based Code (RBC), ungulate winter ranges are to be permanently established by 2003. Prior to implementation of the former FPC, numerous winter habitats for caribou were established as ungulate winter range and incorporated into previous Timber Supply Reviews (TSRs).

Mountain Caribou are currently being considered for inclusion in the Identified Wildlife Management Strategy, Version 2. This may lead to establishing landscape-level land use objectives for caribou habitat through “Strategic Management Recommendations” or “Coarse Filter Recommendations.”

Other opportunities to provide and maintain habitat for Mountain Caribou are also available. Numerous protected areas occur within Mountain Caribou range; the management plans for these areas provide

opportunities to maintain or enhance caribou habitat values. Similarly, it may be possible to better maintain or mitigate damage to caribou habitat by ensuring that caribou are routinely considered as part of environmental assessments for major projects.

## **ACTIONS**

1. Expedite the process to establish caribou winter range habitats that were “grandparented” as of October 1998, and encourage establishment of additional winter ranges that have been recognized in regional and sub-regional Land Use Plans.
2. Apply habitat supply modelling for caribou as input to Working Forest targets and other resource sector targets.
3. Accommodate caribou habitat in management plans for protected areas that occur within Mountain Caribou range.
4. Encourage proponents to apply habitat supply modelling for caribou to major development projects subject to review under the *Environmental Assessment Act*.

## **CONCERNS**

Industry concerns about impact on timber harvest supply. Progress to meet 2003 deadlines for ungulate winter range has been slow due to limited resources and competing priorities. Competing interests and differing biological emphasis for protected areas.

### **6.2.5 Establish Tools to Manage Access for Wildlife Conservation**

#### **STATUS**

Development of forestry roads throughout the province has increased the opportunity for motorized vehicles to gain access to previously remote areas of caribou habitat. Legislative and regulatory tools to manage access either do not provide decision authority to the Regional Fish and Wildlife Managers or are slow to implement because they require ministerial approval (e.g., *Wildlife Act*).

## **ACTIONS**

1. Provide a proactive means of managing access.  
Draft and recommend for approval a policy to

include objectives for access as part of Landscape Unit plans.

2. In co-operation with stakeholders, provide an expedient, reactive means of managing access when new problems are recognized. Revise existing legislation to allow for closure (where required) of access to areas for reasons of wildlife conservation.
3. Initiate closure of mechanized access into key threatened caribou winter range habitats, where non-legislated approaches have been unsuccessful.

#### **CONCERNS**

Industry and environmental concern about more provincial government approvals.

### **6.3 Restore the Metapopulation**

#### **6.3.1 Enforce Conservation Measures**

##### **STATUS**

The National Accord requires effective enforcement of conservation measures for species at risk. Currently, there is inadequate monitoring and enforcement of conservation measures.

##### **ACTIONS**

1. Provide adequate resources for monitoring and enforcement of conservation measures for Mountain Caribou.
2. Provide clear direction from higher levels of government as to the importance of enforcing conservation measures for Mountain Caribou.
3. Revise *Wildlife Act* to include a clear definition of “conservation.”

##### **CONCERNS**

Poor conservation and recovery in absence of good monitoring and enforcement.

#### **6.3.2 Manage Predators**

##### **STATUS**

Predation is a significant conservation concern for mountain caribou, but especially for those local populations with reduced distributions and lowered numbers. In some areas, significant economic

compromises have been or will be made with regard to timber harvest and access within caribou range; however, if predator management is not also addressed, caribou conservation may not be achieved. Currently, aside from hunting and trapping seasons, there is very little active management of predators that affect these caribou.

Predator control, the direct reduction of predator populations, is potentially highly controversial and socially volatile. But it is also a key tool in caribou conservation. Without developing and using it where appropriate, it might not be possible to maintain some local populations of Mountain Caribou. Despite their status on the Red List, controversy may occur if active predator control is instituted to protect Mountain Caribou in BC. Consequently, it is recommended that predator control only be considered for local populations of caribou where:

- they are at risk of extirpation or significant range reduction (e.g., <30 animals or <30/1000 km<sup>2</sup>, <15% calves during late winter, and population rate of decline >3%/year); or
- there is a Recovery Action Plan or equivalent management strategy for a local population that requires predator reduction to meet recovery objectives.

In addition, predator control should only be considered where:

- there is strong evidence that predator control will prevent extirpation or promote the recovery of a local population of Mountain Caribou; and
- predator populations are not considered to be at-risk and control efforts will not put the population at risk. In cases where a predator species is listed as at-risk, and it may pose a significant conservation threat, alternative means of control, such as translocation, should be utilized.

In areas where high rates of predation are a problem, consideration should also be given to managing habitat in order to minimize the effectiveness of predators (e.g., reducing the amount of early seral

habitat and/or minimizing habitat “edges” and fragmentation).

### **ACTIONS**

Some key activities or tasks are required in order for predator control to be a viable and publicly acceptable tool to support recovery of Mountain Caribou. Obviously, the nature and extent of these tasks will vary depending on the scale of the program proposed. For example, a large public relations campaign would not be required prior to removing a single Cougar, although maintaining a level of transparency may still be appropriate. The following measures should be considered prior to initiating predator control:

1. Inform the Public - As part of a communication strategy, public information can be developed in the form of media releases and/or information brochures that describe the significant conservation issues related to Mountain Caribou, including predation (and other factors). The focus of this information should not be predator management alone, but this issue needs to be addressed in terms of its importance in the broader context of Mountain Caribou recovery. Stakeholder meetings may also be held in communities to present caribou recovery planning issues to the public.
2. Outline the Issue - A decision-issue note that outlines the issues and options available to address predator management in relation to Mountain Caribou recovery should be developed for ministry executives.
3. Review Policy and Procedure - The MWLAP has a new policy on the control of wildlife that threatens species at risk. The new policy enables wildlife managers to more effectively address predation problems in relation to species or populations at risk in a timely manner.
4. Monitor Predators - Ideally, funding should be sought for development and implementation of a long-term monitoring program for predator populations (particularly wolves and Cougar) within Mountain Caribou range. For intensive control programs, monitoring the distribution and abundance of predator populations will be essential for developing a publicly acceptable predator management program. Monitoring will also be critical in tracking predation risk to caribou over time and across the different local populations. Research is required on how predator habitat use patterns respond to disturbances in caribou habitat, such as the increased early stages created by logging, road access development and the establishment of recreational trails.
5. Involve Stakeholders - First Nation and stakeholder discussions should be initiated provincially and regionally (where appropriate) to develop support for predator control options for conserving Mountain Caribou. Establishing the criteria for stakeholder support of lethal and non-lethal control options will be essential for implementation of a publicly acceptable predator-control program.
6. Initiate Pilot Studies - Small-scale pilot studies using innovative non-lethal control methods should be initiated to evaluate their effectiveness. Yukon and Alaska currently are using non-lethal predator control methods, but the applicability of these and other methods has not yet been investigated in BC.

### **CONCERNS**

1. If the predator management issue is not effectively addressed, efforts made on other Mountain Caribou recovery initiatives (e.g., protection of habitat, access management, transplants) may be jeopardized.
2. For intensive control programs, if the recommended predator monitoring, pilot study and stakeholder discussion work is not completed, there could be extreme protest from some environmental NGOs when predator control is initiated, albeit for conservation reasons.
3. If intensive alternate prey management programs are initiated without First Nation and stakeholder consultation, there could be concerns from these groups about managing other ungulate species to protect mountain caribou.
4. Ideally, where predator control measures are necessary, they will be short term until sufficient

population recovery has occurred. However, initiation of predator management measures to help recover Mountain Caribou may require more than short-term efforts in order to be effective (i.e., 5- to 10-year or longer programs may be necessary in some cases).

### 6.3.3 Manage Alternate Prey Species in Mountain Caribou Habitat

#### STATUS

Forest development within Mountain Caribou habitat increases the amount of early seral forest, which may both attract and promote an increase in local numbers of other ungulate species, such as deer, Elk and Moose. This influx may have consequences for Mountain Caribou by allowing their habitat to support more predators than would be possible with low levels of other ungulates. The result could be higher predation of caribou. The objective of managing prey species at lower levels is to reduce the number of local predators that may encounter Mountain Caribou. However, this remains largely speculative and requires more study (see section 3.3.1).

#### ACTIONS

1. Develop and implement a funding proposal to test the hypothesis that forest fragmentation alters predator-prey relationships, and puts caribou at increased risk of predation.
2. Commence First Nation and stakeholder discussions on the use of intensive alternate prey management in conjunction with lethal and non-lethal control of predators as a tool for conserving Mountain Caribou.
3. In areas occupied by local populations of endangered Mountain Caribou with approved Recovery Action Plans, consider:
  - maintaining or lowering alternate ungulate prey densities (deer, Elk and Moose) in caribou range, by making appropriate adjustments to hunting regulations and encouraging the harvest of these ungulates;
  - curtailing habitat enhancement activities that promote earlier successional habitats favoured by

other ungulate species; either on their winter range or within the summer range of caribou;

- encouraging hunter education to avoid caribou being mistaken for other ungulates when on overlapping range;
  - managing the distribution of early seral habitats to minimize scattering of fragments and consequently reducing the likelihood of Mountain Caribou and other ungulates occurring in close proximity.
4. Initiate an education and communication program to provide information on the possible consequences to Mountain Caribou if sympatric populations of Moose, Elk and/or deer are not reduced.

#### CONCERNS

1. Suppressing other ungulate species through hunting or habitat management, without full scientific certainty that it may help to preserve Mountain Caribou, may be opposed by some stakeholder groups and the general public.
2. Alternate prey management programs intended to indirectly reduce predator densities over time could potentially result in higher predation rates on caribou in the short term, unless these programs are implemented concurrently with predator control measures.

### 6.3.4 Monitor Size of and Movements among Local Populations

#### STATUS

Short-term recovery objectives include monitoring the size and distribution of the caribou metapopulation. Current inventory information for many caribou local populations is inadequate for proper conservation, and inventory frequency and quality are not consistent among populations.

#### ACTIONS

1. Establish a detailed and prioritized population monitoring program for Mountain Caribou using RISC-approved inventory techniques<sup>25</sup>.
2. Provide additional resources (e.g., seed funding) to initiate partnerships with other agencies and

stakeholders for population inventory where existing information is inadequate.

3. Establish a standard method for managing and archiving Mountain Caribou data from population and radio-telemetry inventory, habitat mapping and translocations.

#### **CONCERNS**

Lack of inventory or lack of consistency among inventories of local populations may lead to misleading conclusions and inappropriate or unnecessary management actions.

### **6.3.5 Direct and Promote Mountain Caribou Research**

#### **STATUS**

Several bodies, including the provincial government, industry and environmental NGOs (e.g., East Kootenay Environmental Society), are conducting caribou research. Some research projects have been operative for 10 years or more and are producing valuable long-term data. However, coordinated research studies are needed to answer key questions and existing long-term research must continue in order to provide information for the most effective conservation and balance with other resources.

#### **ACTIONS**

1. Identify resources (e.g., seed funding) to researchers so that they may partner with other agencies and stakeholders to implement current identified research needs (see Appendix 5).
2. Prepare a catalogue of past and current research and identify future needs.

#### **CONCERNS**

Lack of research could affect conservation and recovery. The potential consequences of curtailing further research include overly conservative decisions that will greatly impact other values, or incorrect or uninformed decisions which will not help recover Mountain Caribou.

### **6.3.6 Restrict Consumptive and Subsistence Use**

#### **STATUS**

Currently there is a moratorium on hunting Mountain Caribou. The following guidelines on Mountain Caribou hunting in BC are recommended for consideration:

- Maintain the existing moratorium on Mountain Caribou hunting as long as Mountain Caribou are Red-listed by the CDC or considered Threatened by COSEWIC.
- In the event of down-listing by the CDC and COSEWIC, obtain broad stakeholder support prior to re-instating Mountain Caribou hunting seasons in those areas that can support a sustained harvest.
- Following re-instatement of hunting continue to manage Mountain Caribou harvest conservatively, preferably through Limited Entry Hunting.

#### **ACTIONS**

1. Maintain existing moratorium on hunting of Mountain Caribou until Mountain Caribou are down-listed from COSEWIC and CDC Threatened status.
2. Consult with First Nations about voluntarily compliance with a moratorium on subsistence use.

#### **CONCERNS**

Concerns from hunting stakeholders and First Nations.

### **6.3.7 Transplant Wild Caribou**

#### **STATUS**

Transplants of caribou from some specific healthy populations into the most endangered populations could reduce chances of losing these populations. Experience shows that well-planned transplants may be successful (BC MELP 1998). In addition to current general criteria for wildlife transplants (see section 3.3.2), a number of criteria are recommended

<sup>25</sup> MCTAC note: Inventory should include both population inventory and telemetric inventory. Ongoing inventory or population monitoring is required to assess progress towards achieving Goal 1. Telemetry inventory is required to complete assessments on local population habitat use, seasonal movements and range occupancy. Population estimates should, if possible, provide confidence limits.

specifically for translocating Mountain Caribou in BC:

- A feasibility study should be initially conducted to determine that suitable habitat exists to support additional animals, and whether other population measures are required.
- Translocations of caribou to augment existing remnant populations (either <30 individuals or <30/1000 km<sup>2</sup>) should take precedence over transplants of caribou to formerly occupied habitat.
- The donor population should preferably be the same ecotype as the remnant population or genotypically suitable.
- The number of animals transplanted should be determined on a site-specific basis, but normally should be less than the size of the remnant population.
- Transplant composition should be >75% cows and should not exceed 5% of the current estimate of the donor population.
- The source site should have sufficient inventory information to demonstrate that the transplant will not have a negative impact on the donor population (e.g. current population size >400 caribou; calf recruitment >15%; population rate of change >1.0).
- The release site should be in the same vicinity as the remnant population.
- Multi-year transplant proposals should provide a progress report on the results of the previous year's transplant and demonstrate that the transplanted animals are successfully aiding recovery of the remnant population, prior to approval for the subsequent year's transplant.

#### **ACTIONS**

1. Assess the genetic distinctiveness of local populations to receive transplant animals and determine the most appropriate donor source(s). This action is partially complete (see section 2.1.4).

2. Establish priorities for translocations, in cooperation with local RAGs.
3. Develop transplant proposals through regional MWLAP offices, and provide broad public consultation.
4. Determine sources of transplant animals and secure authority to capture them for transplant.
5. Provide seed funding to partner with other agencies in order to conduct transplants.

#### **CONCERNS**

Availability of transplant caribou and genetic information about local populations. May be ineffective if predation continues to be the major limiting factor on caribou local populations. Mixing local populations may increase genetic variability at the possible cost of unique, local genes.

### **6.3.8 Evaluate and Potentially Initiate Captive Breeding**

#### **STATUS**

A major impediment to conducting caribou transplants is the lack of available or “surplus” Mountain Caribou from “source” populations. Currently there are no captive breeding facilities for Mountain Caribou in BC.

#### **ACTION**

A discussion paper (Simpson and Terry 2001) was prepared on the feasibility of using captive breeding and rearing of caribou as a recovery technique. A decision was made not to proceed with the establishment of a captive breeding facility at this time<sup>26</sup>.

#### **CONCERNS**

May be ineffective if major limiting factors (e.g., predation) cannot be improved or if captive stock is incapable of acquiring behaviours needed for survival in the wild.

<sup>26</sup>MCTAC note: This decision should be reviewed after 5 years or earlier should the Mountain Caribou metapopulation drop below 1000 mature animals.



## SECTION IV

# RECOVERY STRATEGY IMPLEMENTATION

Recovery strategy implementation should be based on the following three principles:

1. Recovery actions must be “science-based.” This means adhering to the conservation approach outlined in Section II. Specifically, the MCTAC supports:
  - a. applying the “metapopulation concept” to Mountain Caribou, as appropriate;
  - b. applying the “precautionary principle” as part of the conservation approach for Mountain Caribou where needed;
  - c. practising “adaptive management” to learn how to best integrate Mountain Caribou habitat requirements with other competing land uses and to manage limiting factors;
  - d. employing a comprehensive “ecosystem-based” approach for managing Mountain Caribou habitat and other components of biodiversity, wherever possible.
2. Mountain Caribou recovery must be based on shared stewardship. MCTAC is a multi-disciplinary team of biologists who represent specific government and stakeholder interests, but who also share a common concern to conserve caribou. Recovery action plans for local populations should continue to be based on this model so that all affected stakeholders can continue to work cooperatively to resolve outstanding issues and facilitate caribou recovery.
3. Mountain Caribou recovery must be based on financial capacity. Financial resources are limited, and the scope and breadth of recovery actions must recognize this. Numerous funding sources have contributed to caribou research and inventory. Their continued involvement will be critical to ensuring there is adequate financial capacity to implement recovery actions.

### **7. Implementation Schedule**

The implementation schedule (Table 12) outlines provincial recovery actions over the next five years. Total cost of implementation is estimated to be approximately \$3.5 million. The schedule should be used in the regular monitoring of all activities and as a basis for the funding of recovery actions. The schedule identifies priorities, possible co-operators, target date for completion and an estimate of the required funding. Actions and budgets should be revised regularly based on results achieved and new information.

#### **PRIORITY 1**

Action that is required immediately to respond to the nationally Threatened designation by COSEWIC, or to prevent extirpation or irreversible declines in local populations in the foreseeable future.

#### **PRIORITY 2**

An action required to prevent a significant decline in the metapopulation or habitat quality, or other significant negative trends short of extirpation.

#### **PRIORITY 3**

Other actions necessary to achieve recovery and down-listing by the CDC and COSEWIC.

### **8. Implementation Committee**

The Mountain Caribou Technical Advisory Committee was established to provide direction and guidance to natural resource managers and regional land use planning committees involved with Mountain Caribou (Appendix 6). It is recommended that the MCTAC, acting as a component to the Joint Steering Committee of the National Recovery Team (JSC-SMNEA), be the primary implementation committee for the Mountain Caribou Recovery Strategy (Appendix 7).

## 9. Implementation Summary

The following is a summary of the process that should be followed to implement the Mountain Caribou Recovery Strategy:

1. Utilize the MCTAC as the primary Implementation Committee for the Recovery Strategy for Mountain Caribou in British Columbia.
2. Continue to support regional land use planning processes (e.g., LRMPs, SFMPs, SRMPs) as the forum for negotiation and compromise on Mountain Caribou issues.
3. Initiate the provincial recovery approaches outlined in this document that are required to achieve the objectives of the Recovery Strategy.
4. Report annually on recovery actions implemented for Mountain Caribou. Assess their progress towards achieving the goals and objectives of the Recovery Strategy.
5. Update the Recovery Strategy as new information becomes available. Revise the Recovery Strategy every five years until Woodland Caribou in the SMNEA are downlisted from Threatened to Special Concern.

**Table 12. Implementation schedule for provincial actions in support of the Mountain Caribou recovery.**

Year 1 = 2002/2003. Asterixes (\*) indicate items where estimated cost can be shared with the proposed Northern Caribou recovery program.

Recovery Action	Description	Priority	Possible Cooperators <sup>a,b</sup>	Target Date	Estimated Cost (\$K)					
					Year 1	Year 2	Year 3	Year 4	Year 5	
<b>6.1 Raise the profile of Mountain Caribou</b>										
6.1.1	List Caribou within the SMNEA as Threatened under the <i>Wildlife Act</i>	3	MWLAP	Cabinet	Year 1	Nil				
6.1.2	Participate in the National Recovery of Woodland Caribou*	2	MCTAC NCTAC	RENEW Alberta	Ongoing	10.0	10.0	10.0	10.0	10.0
6.1.3	Establish RAGs and Prepare Local Recovery Action Plans	1	MCTAC MWLAP HSSOA NFPA ILMA	BCSF MOF BCWF GOABC PC	Complete all plans by Year 5	30.0	30.0	30.0	30.0	30.0
6.1.4	Develop Communications Program*	3	MCTAC MSRM	WLAP MOF	Ongoing	15.0	15.0	15.0	15.0	15.0
6.1.5	Identify Funding Opportunities	1	MCTAC MWLAP	MOF MSRM RENEW	Ongoing	Nil	Nil	Nil	Nil	Nil
6.1.6	Support Coordination of Recovery Efforts*	1	MWLAP		Ongoing	75.0	75.0	75.0	75.0	75.0
6.1.7	Continue Participation in International Woodland Caribou Recovery Team	2	MWLAP		Ongoing	5.0	5.0	5.0	5.0	5.0
<b>6.2 Protect and Manage Habitat</b>										
6.2.1	Recommend Guidelines for Forestry and Backcountry Recreation in Caribou Habitat	2	MCTAC MWLAP HSSOA	MOF MSRM BCSF	Year 2	10.0	10.0			
6.2.2	Define and Map Critical Habitat	1	MCTAC MWLAP	MOF MSRM	Year 2	30.0	30.0			
6.2.3	Develop and Implement Caribou Habitat Objectives in Land Use Plans	2	FPC Cabinet	MWLAP MSRM	Year 2	20.0	20.0			

<sup>a</sup> Possible cooperating government agencies/bodies include: FPC – Forest Practices Code Agencies; MCTAC – Mountain Caribou Technical Advisory Committee; MOF – Ministry of Forests; MWLAP – Ministry of Water, Land and Air Protection; MSRM – Ministry of Sustainable Resource Management; NCTAC – Northern Caribou Technical Advisory Committee; PC – Parks Canada; RENEW – Recovery of Nationally Endangered Wildlife; TNO – Treaty Negotiation Office, Ministry of Attorney General.

<sup>b</sup> Non-government cooperators include: BCWF – British Columbia Wildlife Federation; BCSF – British Columbia Snowmobile Federation; GOABC – Guide Outfitters Association of BC; HSSOA (BCHSSOA) – British Columbia Helicopter and Snowcat Sking Operators Association; ILMA – Interior Lumber Manufacturers' Association; IMCTC – International Mountain Caribou Technical Committee; NFPA – Northern Forest Products Association; UBC – University of British Columbia; UNBC – University of Northern British Columbia.

**Table 12. Implementation schedule for provincial actions in support of the Mountain Caribou recovery (continued).**

Year 1 = 2002/2003. Asterixes (\*) indicate items where estimated cost can be shared with the proposed Northern Caribou recovery program.

Recovery Action	Description	Priority	Possible Cooperators <sup>a,b</sup>	Target Date	Estimated Cost (\$K)		
					Year 1	Year 2	Year 3
6.2.4	Utilize Appropriate Tools to Achieve Habitat Objectives	2	FPC	Year 3	85.0	75.0	75.0
6.2.5	Establish Tools to Manage Access for Wildlife Conservation	2	MCTAC	Year 3	5.0	Nil	Nil
<b>6.3 Restore the Metapopulation</b>							
6.3.1	Enforce Conservation Measures	3	MWLAP	Ongoing	50.0	50.0	50.0
6.3.2	Manage Predators	1	MWLAP	Ongoing	80.0	80.0	80.0
6.3.3	Manage Alternate Prey Species in Mountain Caribou Habitat	2	MWLAP BCWF	Ongoing	20.0	20.0	20.0
6.3.4	Monitor Size and Movements among Local Populations	2	MSRM MCTAC	Ongoing	75.0	75.0	75.0
6.3.5	Direct and Promote Mountain Caribou Research	2	MCTAC MWLAP HSSOA NFPA ILMA	Ongoing	200.0	200.0	200.0
6.3.6	Restrict Consumptive and Subsistence Use	3	MWLAP BCWF	Year 2	10.0	10.0	
6.3.7	Transplant Wild Caribou	1	MCTAC BCWF IMCTC	Ongoing	60.0	60.0	60.0
6.3.8	Evaluate and Potentially Initiate Captive Breeding	2	MCTAC	Year 1	Nil		

<sup>a</sup> Possible cooperating government agencies/bodies include: FPC – Forest Practices Code Agencies; MCTAC – Mountain Caribou Technical Advisory Committee; MOF – Ministry of Forests; MWLAP – Ministry of Water, Land and Air Protection; MSRM – Ministry of Sustainable Resource Management; NCTAC – Northern Caribou Technical Advisory Committee; PC – Parks Canada; RENEW – Recovery of Nationally Endangered Wildlife; TNO – Treaty Negotiation Office, Ministry of Attorney General.

<sup>b</sup> Non-government cooperators include: BCWF – British Columbia Wildlife Federation; BCSF – British Columbia Snowmobile Federation; GOABC – Guide Outfitters Association of BC; HSSOA (BCHSSOA) – British Columbia Helicopter and Snowcat Sking Operators Association; ILMA – Interior Lumber Manufacturers' Association; IMCTC – International Mountain Caribou Technical Committee; NFPA – Northern Forest Products Association; UBC – University of British Columbia; UNBC – University of Northern British Columbia.

## SECTION V

### GLOSSARY

**At risk** – Refers to taxa that are vulnerable, threatened or endangered.

**Blue List** – List of vulnerable taxa that are candidates for the Red List in the foreseeable future and/or are generally suspected to be vulnerable due to limited information.

**Boreal Caribou** – The boreal ecotype of Woodland Caribou, which occurs in the relatively flat boreal forests of Canada, including the northeastern portion of BC. Boreal Caribou live in small, dispersed, sedentary bands rather than in discrete local populations (Heard and Vagt 1996).

**Capability (of habitat)** – What a given habitat is capable of supporting with manipulation of the seral stages, assuming management for maximization; capability under ideal conditions.

**Committee on the Status of Endangered Wildlife in Canada (COSEWIC)** – A body of government, non-government and academic experts who assess species at risk nationally.

**Critical habitat** – means the habitat that is necessary for the survival or recovery of a listed species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species (SARA definition).

**Ecotype** – A subdivision (e.g., a population or group of populations) within a species or subspecies that has adapted to specific landscapes or environments as expressed primarily by its movements and feeding behaviour (modified from Shackleton 1999 and Thomas and Gray 2001).

**Endangered** – Refers to a species facing imminent extinction or extirpation (COSEWIC definition).

**Essential Habitats** – means the habitats occupied by caribou that are considered an important component for their survival. Until the term “critical habitat” has been clearly defined, RENEW recommends that recovery teams avoid the use of the word “critical” and use instead “essential”.

**Extinct** – Refers to a species that no longer exists (COSEWIC definition).

**Extirpated** – Refers to a species that no longer exists in the wild in Canada, but occurs elsewhere (COSEWIC definition).

**Local population** – The basic unit of conservation and management. Local populations may be isolated due to barriers for dispersal, or semi-isolated, where some immigration/emigration occurs between populations (modified from Thomas and Gray 2001).

**Metapopulation** – A group of local populations with actual or potential immigration/emigration among them (Thomas and Gray 2001).

**Mountain Caribou** – An ecotype of Woodland Caribou found in the rugged mountains of the southeastern portion of British Columbia. Mountain Caribou are characterized by their almost exclusive reliance on arboreal lichens for food during late winter. Have also been referred to as the “mountain/arboreal ecotype” (Edmonds 1991) and the “arboreal lichen-winter feeding ecotype” (Thomas and Gray 2001).

**Mountain Caribou Technical Advisory Committee (MCTAC)** – A committee of biologists and technical experts who review, recommend and facilitate implementation of the Mountain Caribou recovery strategy.

**Northern Caribou** – The northern ecotype of Woodland Caribou, which occurs in the mountainous western and northern parts of BC, where snowfall is low relative to levels in Mountain Caribou habitat (Heard and Vagt 1996).

**Not at Risk (formerly “not in any category”)** – Refers to a species that has been evaluated and found to be not at risk (COSEWIC definition).

**Population** A group of individuals of a single biological species occupying a defined area (from Thomas and Gray 2001).

**Precautionary Principle** – This principle states that all stakeholders have a responsibility to take precautionary measures to anticipate, prevent or minimize adverse effects to the environment. The lack of full scientific certainty as to impacts should not be an adequate reason to postpone measures that will protect the resource (Akcakaya et al. 1997).

**Recovery Action Plan (RAP)** – A document that applies to a local population or group of local populations and identifies the specific projects and actions required to achieve the goals and objectives identified within this recovery strategy. A RAP has the participation and support of local stakeholders.

**Recovery of Nationally Endangered Wildlife (RENEW)** – National recovery program for species at risk.

**Red List** – List of taxa that are designated as Threatened or Endangered under the *Wildlife Act*, are candidates for this designation, or are extirpated but were once part of the natural fauna of BC.

**Southern Mountains National Ecological Area (SMNEA)** – A large area that includes the southern two-thirds of British Columbia and south-western Alberta, and used by COSEWIC to assess the national status of species and to designate species at risk.

**Special Concern (formerly “vulnerable”)** – Refers to a species that is of special concern because of characteristics that make it particularly sensitive to human activities or natural events (COSEWIC definition).

**Species** – Any indigenous species, subspecies, variety or geographically defined population of wild fauna or flora (COSEWIC definition).

**Sub-population** – A component of a population or local population whose individuals remain separated from others for part of a year or for many years (Thomas and Gray 2001).

**Suitability (of habitat)** – The current state of a given habitat; can indicate what has occurred to affect habitat potential. What the habitat can currently support or what is available under current conditions.

**Taxon (plural: Taxa)** – A formally named, related group of organisms at any level of classification (e.g., family, species, subspecies, ecotype).

**Threatened** – Refers to a species likely to become endangered if limiting factors are not reversed (COSEWIC definition).

**Viable population** – A population in a state that maintains its vigour and its potential for evolutionary adaptation (Soule 1987). This requires that the population be naturally regulated and subject to selective pressures.

**Vulnerable** – Refers to a species that is particularly sensitive to human activities and natural events.

**Woodland Caribou** – Animals of the subspecies *Rangifer tarandus caribou*, which occupy the southern portion of the range of *R. tarandus* from British Columbia to Newfoundland. Includes mountain, northern and boreal ecotypes.

## SECTION VI

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## APPENDIX 1

# CDC ELEMENT PROVINCIAL RANKING FOR WOODLAND CARIBOU, ARBOREAL LICHEN-WINTER FEEDING ECOTYPE

Elcode AMALC04013

Nation CA

Province BC

Taxa: RANGIFER TARANDUS POP 1

Common Name: Mountain Caribou, Southern Population Mountain Caribou

Example Exemplary Site: Wells Gray Provincial Park

animals. The number of mature individuals was estimated at 65% of the total population estimate, or 1238 (Hatter and Quayle in prep.) Note: The number of mature individuals is the number of individuals known, estimated or inferred to be capable of producing offspring that reach reproductive age.

**Extent of Occurrence:** 71 490 km<sup>2</sup> (range: 71 490 to 128 260)

**Comments:** In the Rocky Mountains, In the Rocky Mountains, Mountain Caribou range from north of Mount Robson south to the central Rockies northwest of Mount Columbia. They are also found on the east side of the upper Fraser River through the Quesnel Highlands, south of Prince George, through the Monashee Mountains to Whatshan Lake, and also through the Columbia and Purcell Mountains south to about Kitchener west of Kootenay Lake. In the Selkirk Mountains, Mountain Caribou occur as far south as Kaslo and the east side of northern Lower Arrow Lake, after which there is a break in the distribution until it begins again in the southern Purcells where animals from northwestern Washington and northeastern Idaho populations extend into British Columbia. The extent of occurrence is based on current habitat suitability within the range of Mountain Caribou, where 71 490 km<sup>2</sup> is the sum of low to very high suitability classes, and 128 260 km<sup>2</sup> is the sum of very low to very high classes.

**Area of Occupancy:** 62 790 km<sup>2</sup> (range: 56 510 to 69 070)

**Comments:** Area of occupancy is the current range occupied by all 13 local populations of Mountain Caribou based on known or suspected occupancy (Table 2, MCTAC in prep.).

**Environmental Specificity:** Moderate (range:

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### RANKING FACTORS

**Est. No. Of (Sub)populations in Province:** 13 (range: 12 - 13)

**Comments:** Heard and Vagt (1998) concluded that there are 12 local populations of the Mountain Caribou ecotype in British Columbia; Simpson et al. (1997) subdivided the caribou in the Wells Gray area into two local populations, resulting in 13 local populations. Currently, 13 are recognized for management purposes (MCTAC in prep.).

**Est. No. Of High Quality (Sub)populations in Province:** 3 (range: 0 - 5)

**Comments:** Based on criteria identified in Appendix 3 of the Mountain Caribou Recovery Strategy (MCTAC in prep.), seven local populations are considered to be endangered, one threatened, and five vulnerable. Of those identified as vulnerable, only three are considered to be currently stable. In other words, only three local populations appear to have reasonable viability.

**Abundance (mature individuals):** 1250 (range: 1000 to 1600)

**Comments:** In 2002, all local populations were surveyed resulting in an estimate of about 1900

Moderate to High)

**Comments:** Mountain Caribou require a perpetual supply of large, contiguous areas of suitable summer and winter habitat, with little or no vehicle access and disturbance, so that caribou can space out at low densities (30 - 50 caribou/1000 km<sup>2</sup>) and avoid predators and poachers (Seip and Cichowski 1996). Forest harvesting can reduce and fragment areas of suitable habitat, making the caribou more vulnerable to predation. In addition, road access associated with timber harvest may lead to increased disturbance, human-induced mortality, and increased predation by wolves. Suitable winter habitat for mountain caribou has characteristics of old forests (at least 150 years), including abundant arboreal lichens. Forests managed under any silvicultural system that eventually eliminates, or substantially reduces, the number of large, old, lichen-bearing trees will not provide winter habitat for caribou (Stevenson et al. 2001).

**% Long-term Reduction in Population Size:** 43%  
(range: 25% to 60%)

**Comments:** Although its absolute magnitude is unknown, there was a widespread decline in Caribou, including the Mountain Caribou, in the last century; this initial decline has been linked to the spread of Moose into the province and the subsequent increase in wolf numbers and predation rates on caribou (Seip 1992, Seip and Cichowski 1996). One estimate is that Mountain Caribou have been extirpated from approximately 43% of their historic range in BC and 60% of their historic range in BC and the United States (BC MELP 2001).

**% Short-term Reduction in Population Size:** 23%  
(range: 0% to 37%)

For Woodland Caribou, Thomas and Gray (2001) determined generation length from life tables to be about 6.7 years, or 20 years for 3 generations. Hatter and Quayle (in prep.) estimated the 1982 population at ~ 2460 for a 3 generation reduction of 23%. The rate of decline appears to have accelerated since 1995, and the current rate of decline is estimated at 10%/year (Hatter and Quayle, in prep). While there is

high uncertainty about the 3 generation decline (0 to 37%), there is little doubt of a decline since 1995 (I. Hatter, MCTAC, pers. comm.).

**Scope of Threats:** High (range: Moderate to High)

**Comments:** The primary threat to Mountain Caribou appears to be fragmentation of their habitat. Associated with this are potential reductions in winter food supply (arboreal lichens that grow in older forests), increased human access (disturbance and mortality), and high rates of predation (Seip and Cichowski 1996, Simpson et al. 1997, MCTAC in prep.). Forest practices are currently the greatest management concern, because Mountain Caribou require old-growth forests within the Engelmann Spruce-Subalpine Fir and Interior Cedar-Hemlock biogeoclimatic zones, which are being removed by logging (Simpson et al. 1997). Industrial development not only reduces or fragments caribou habitat, but new roads create access for human intrusion and disturbance. Mountain Caribou prefer more gentle terrain in winter, but areas of heavy use by snowmobiles or heli-ski operations, particularly within subalpine parklands, may displace caribou into steeper, more avalanche-prone terrain, where mortality risks are higher (Simpson and Terry 2000). Snowmobiling and snowshoeing, by compacting trails, may also provide easier travel corridors into late-winter caribou habitats for wolves (Bergerud 1996). The increasing interest in recreational snowmobiling, combined with better access from roads to high-elevation cutblocks and more powerful machines that are able to traverse most Mountain Caribou ranges, represents a more recent threat. All local populations, to varying degrees, face these threats.

In northern areas, there has been an increase in wolf predation as a result of the increase in the Moose population in south-central BC during the 1900s, which in turn has led to increased predation of caribou (Seip and Cichowski 1996, Heard and Vagt 1998). Further south, increases in deer and Elk populations may have led to increases in Cougar numbers and increased predation pressure on



Mountain Caribou (I. Hatter, MCTAC, pers. comm.).

**Severity of Threats:** Moderate (range: Low to High)

**Comments:** Mountain Caribou habitat suitability is substantially less than habitat capability, indicating substantial land use impacts on Mountain Caribou habitat (Tables 5 and 6, MCTAC in prep.). Several local populations are at high risk of extirpation.

**Immediacy of Threats:** High (range: Moderate to High)

**Comments:** All identified threats (see above) are currently operational (happening now). However, there is some indication of predation-related declines in southern populations may have abated (I. Hatter, MCTAC, pers. comm.).

**Global Number of Protected Occurrences:** 1 (range: 0 to 2)

**Comments:** A number of parks protect parts of local population ranges including: Purcell Wilderness Conservancy, Mount Revelstoke National Park, Glacier National Park, Wells Gray, Mount Robson, Goat Range, Bowron Lakes, Cariboo Mountains, West Arm, Kianuko and Monashee Provincial Parks. However, with the exception of the Wells Gray/Cariboo Mountains/Bowron Lakes park system, most parks provide only minimal protection of critical caribou habitats.

**Intrinsic Vulnerability:** Moderate (range: Moderate to High)

**Comments:** Mountain caribou are characterized as having a relatively low reproductive rate, long time to maturity and low dispersal capability compared to most other ungulates (MCTAC in prep.). There are also highly dependent on availability of arboreal lichens for forage during late winter. Another indicator of their intrinsic vulnerability is the difficulty in recovery of Mountain Caribou local populations. For example, despite the translocation of 103 animals into the South Selkirks between 1987 and 1998, this local population currently only has approximately 35 animals (I. Hatter, MCTAC, pers. comm.).

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## RANK AND REASONS

**Provincial Rank:** S2 (to be reviewed for 2003)

**Comments on Rank:** Population has undergone both long-term and short-term declines, and continues to decline. One estimate is that 60% of the historic range in British Columbia and the United States no longer supports Mountain Caribou. Dependent on old-growth coniferous forests with abundant arboreal lichens. Sensitive to large-scale logging, wolf and cougar predation as well as disturbance along transportation corridors and in recreation areas. The logging and other human activities which can reduce habitat quality and fragment habitat represent a significant threat to long term viability. Increasing use of snowmobiles at high elevations represents a more recent threat. There are few, if any, fully protected populations.

Approximately 99% of the world's Mountain Caribou ecotype lives in British Columbia. Six of thirteen local populations have 50 or fewer individuals.

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## NEEDS

**Inventory:** Routine inventories of the entire metapopulation (13 local populations), preferably at 3 year intervals, must be completed to maintain a good understanding of the numbers and trends of the Mountain Caribou.

**Protection:** Core caribou ranges and corridor/linkage areas within and between local populations require protection (Heard and Vagt 1998). The Mountain Caribou Recovery Strategy recommends maintaining networks of: "core areas" or areas of no timber harvest to maintain arboreal lichens and limit access; "buffer zones" around core areas, including areas of selection logging and extended rotations; and "linkages" or movement areas between core areas (MCTAC in prep.).

**Management:** Managers must consider Mountain Caribou when determining forest harvest regimes.

Corridors must be maintained to permit access to seasonal ranges (Heard and Vagt 1996). Simpson et al. (1997) recommend an interconnecting mosaic of reserves and integrated management areas to maintain long-term viability of the species. Additional research on habitat ecology is needed to further improve the understanding of habitat use and the effects of various silvicultural prescriptions to maintain key attributes of winter range. This information then needs to be incorporated into policy and management actions (Simpson et al. 1997). A population viability assessment is required to determine the probability of metapopulation extinction, and sub-population extirpations over the next 20, 33 and 100 years based on current and proposed management regimes. The impacts of snowmobile activities on caribou (behavioural and physiological responses to disturbance, displacement from critical habitats, population consequences of disturbance, and potential for habituation) needs to be investigated. The relationship between alternate prey (other ungulates), predators (wolf, Cougar, bear) and Mountain Caribou, particularly in a fragmented landscape and landscapes with early seral habitats should be researched further. Population management measures such as predator management or control, reduction in alternate prey and access management may be required to provide a suitable environment for sub-population recovery. These may have to be done in conjunction with translocation programs.

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## APPENDIX 2

# BASIS FOR COSEWIC LISTING OF WOODLAND CARIBOU IN THE SOUTHERN MOUNTAINS NATIONAL ECOLOGICAL AREA

The SMNEA Woodland Caribou scored as Threatened under the following criteria (from the COSEWIC operating manual Nov. 2001). A species needs to meet only one criterion to be listed.

### CRITERION C1

*Population size estimated to number fewer than 10 000 mature individuals and an estimated continuing decline of at least 10% within 3 generations [~ 20 years].*

Although meeting one criterion is enough for the Threatened listing, SMNEA Woodland Caribou probably also meet:

### CRITERION C2a<sup>27</sup>

Population size estimated to number fewer than 10 000 mature individuals; and continuing decline, observed, projected or inferred in numbers of mature individuals; and population structure severely

*fragmented (i.e. no local population estimated to contain more than 1000 mature individuals).*

\*For the purposes of the criteria, mature individuals are estimated by:

*“The number of mature individuals is defined as the number of individuals known, estimated or inferred to be capable of reproduction, excluding individuals that are environmentally, behaviourally or otherwise reproductively suppressed in the wild.*

*“In the case of populations with biased adult or breeding sex ratios it is appropriate to use lower estimates for the number of mature individuals which take this into account (e.g., the estimated effective population size).”*

IUCN Species Survival Commission. 1994. IUCN Red List Categories. World Conservation Union 22 pp.

<sup>27</sup> MCTAC note: In June 2002, a post-calving survey of the Itcha-Ilgachuz range (a local population of Northern Caribou located within the SMNEA) counted 2862 caribou, including calves. This more recent information suggests that Criterion C2a may no longer apply.

## APPENDIX 3

# DRAFT GUIDELINES FOR QUANTITATIVE RISK ASSESSMENT OF LOCAL POPULATIONS ADAPTED FROM IUCN CRITERIA FOR GLOBAL POPULATIONS

CRITERIA Past or future estimates of any of A, B or C:	ENDANGERED (EN)	THREATENED (TR)	VULNERABLE (VU)	NOT AT RISK (NAR)
<b>A. Numbers:</b>				
1: Current, trend ??	<50 adults	50–100 adults	101–1000 ad.	>1000 adults
2: xxx–yyy adults & yy% decline <sup>a</sup> in 20 yr	50–100 & decline >25%	101–250 & decline >20%	250–1000 & decline >10%	250–1000 & decline <10%
3: xxx–yyy adults & yy% decline <sup>a</sup> in 20 yr	101–250 & decline >50%	250–1000 & decline >30%		
<b>B. Area of occupancy<sup>b</sup></b>				
xxx–yyy km <sup>2</sup> & any of:	<1000 km <sup>2</sup> & conditions at left	1000–2000 km <sup>2</sup> & conditions at left	2000–20 000 km <sup>2</sup> & conditions at left	>20 000 km <sup>2</sup> & conditions at left are minor
1. Severe fragmentation				
2. Declining range quantity &/or quality				
3. Areas highly variable in size and no. of locations (sub-populations)				
<b>C. Limiting factors<sup>c</sup></b>				
1. Predation or	>15%	10–15%	5–10%	<5%
2. Other mortality(ad.) or	>10%	5–10%	3–5%	<3%
3. Habitat reduction from roads & developments	>50%	25–50%	10–25%	<10%

<sup>a</sup> Decline observed, estimated, inferred or suspected, based on: (1) direct observation; (2) index of abundance; (3) a decline in area of occupancy and/or quality of habitat; (4) actual or potential exploitation; or (5) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites. Period of decline is three generations (~ 20 years).

<sup>b</sup> Area of occupancy based on an average density of 0.05 caribou/km<sup>2</sup> (1 caribou/20 km<sup>2</sup>).

<sup>c</sup> Average percent per year over several years and ideally over 20 years. Other factors must be included in risk assessment, such as connectivity to other populations, management plans for the historical area of occupancy, other limiting factors, variability in numbers over time, climatic warming, etc.

Note: adult is >1 year old. (from D.C. Thomas, Thomas Wildlife Services, St. Albert, AB, pers. comm.)

## APPENDIX 4

### CRITERIA USED TO EVALUATE AND RANK EACH LOCAL POPULATION OF MOUNTAIN CARIBOU (FROM SIMPSON ET AL. 1997)

#### Viability

Local Population	Size	Trend	Connectivity	Average
South Selkirks	Low	Low	Low	Low
South Purcells	Low	Low	Low	Low
Central Selkirks	Medium	Medium	Low	Medium
Monashee	Low	Low	Low	Low
Revelstoke	High	Medium	High	High
Central Rockies	Low	Medium	Medium	Low
Wells Gray North	High	Low	High	Medium
Wells Gray South	High	Medium	High	High
North Cariboo Mountains	High	Medium	High	High
Barkerville	Low	Medium	Medium	Medium
George Mountain	Low	Medium	Low	Low
Narrow Lake	Low	Medium	Low	Low
Hart Ranges	High	Medium	High	High

#### Threats

Local Population	Natural Fires	Predators	Access <sup>a</sup>	Forestry	Average
South Selkirks	Medium	High	High	High	High
South Purcells	Low	High	Medium	Medium	Medium
Central Selkirks	Medium	Low	Low	Medium	Medium
Monashee	Medium	High	Medium	Low	Medium
Revelstoke	Low	Low	Medium	High	High
Central Rockies	High	High	Low	Medium	Medium
Wells Gray North	Low	High	Medium	Medium	Medium
Wells Gray South	Low	Medium	Medium	Medium	Medium
North Cariboo Mountains	Low	Medium	Medium	Medium	Medium
Barkerville	Low	Medium	High	High	High
George Mountain	Low	High	High	High	High
Narrow Lake	Low	Medium	Medium	Medium	Medium
Hart Ranges	Low	Medium	Medium	Medium	Medium

<sup>a</sup> Includes associated disturbance from backcountry recreation activities.

## Existing Habitat Protection

Local Population	% Protected	% Inoperable	% in Special Management	Average
South Selkirks	Low	Low	High	Medium
South Purcells	Low	Medium	High	Medium
Central Selkirks	Low	Medium	Medium	Medium
Monashee	Low	High	Low	Medium
Revelstoke	Low	Medium	Low	Low
Central Rockies	Low	Medium	Low	Low
Wells Gray North	Medium	Medium	Medium	Medium
Wells Gray South	Medium	Medium	Medium	Medium
North Cariboo Mtns.	Medium	High	High	High
Barkerville	Low	Low	Medium	Medium
George Mountain	Low	Low	High	High
Narrow Lake	Low	Medium	High	High
Hart Ranges	Low	High	High	High

## Habitat Condition

Local Population	% Capable	% Suitable	Fragmentation	Average
South Selkirks	High	Low	Low	Low
South Purcells	High	Medium	Medium	Medium
Central Selkirks	High	Medium	Medium	High
Monashee	Medium	Low	Low	Low
Revelstoke	High	High	Medium	High
Central Rockies	Medium	Medium	Low	Medium
Wells Gray North	High	High	High	High
Wells Gray South	High	High	High	High
North Cariboo Mtns.	High	Medium	High	High
Barkerville	High	High	Medium	Medium
George Mountain	Medium	Medium	Medium	Medium
Narrow Lake	High	High	Medium	Medium
Hart Ranges	High	High	High	High

# APPENDIX 5

## CURRENT IDENTIFIED RESEARCH NEEDS FOR MOUNTAIN CARIBOU

An inherent part of any successful implementation strategy must be an inventory and research component that is linked to both short- and long-term conservation goals. The following list of currently identified needs is modified from Simpson et al. (1997:23-25).

### Taxonomy

Caribou taxonomy is problematic and has not been reviewed since Banfield (1961). A modern study of geographic variation is needed to resolve the systematics of Woodland-Mountain caribou (Nagorsen 1990). It is particularly important to understand the actual genetic, morphological and behavioural differences between Woodland Caribou ecotypes to facilitate Woodland Caribou recovery, especially when this may require artificial mixing of animals through transplant or captive breeding.

- Is the mountain ecotype of caribou potentially a subspecies?
- What are the consequences of moving other ecotypes of caribou into Mountain Caribou habitat?
- What are the consequences of interbreeding ecotypes?

### Habitat Requirements

Although our knowledge of seasonal habitat use is fairly sound, there are a number of information needs that should be addressed in order to manage caribou and their habitat over the long term. The ability to provide caribou habitat requires an understanding of spatial and temporal dynamics of the landscape mosaic (habitat patches) that caribou use. Therefore, we need to know:

- How should mature and old forest components be

optimally managed for caribou over the long term (i.e., 500-year time frame)? What is the minimum percentage of mature and old forest needed by caribou? How much is enough? What spatial distribution is adequate? These are difficult questions that require long-term monitoring and a combination of retrospective and large-scale experimental management techniques.

- To what extent do young seral stands (40-80 years old) act as barriers to caribou seasonal movements and predator avoidance strategies? How does a landscape mosaic made up of different seral stages (matrix of habitat patches) affect caribou survival?
- What stand-level attributes are needed to meet caribou seasonal habitat requirements in the ICH and ESSF?
- To what degree has a general warming in climate since the end of the Little Ice Age in the 1800s contributed to long-term declines in caribou numbers within the southern portion of Mountain Caribou range? Do extreme annual variations in snowpack influence arboreal lichen availability and have a population-level impact on Mountain Caribou?

### Forest Management

A better understanding of how various forest management activities affect caribou behaviour and survival is needed. We already know caribou need old forests with lichen-bearing trees; however, we need to improve the predictability of the response of caribou to different forest management practices. Both landscape- and stand-level prescriptions will be required and should be linked together to meet management objectives identified in higher level plans. Therefore, we need to know:

- What are the implications for caribou given biodiversity emphasis options assigned during land use and/or landscape unit planning?
- How do mortality and recruitment rates differ between intensively managed and less intensively managed landscapes? Are heavily fragmented landscapes sink (mortality > recruitment) habitats?
- Can alternative silvicultural systems provide stand-level attributes required by caribou over the long term? Will caribou use managed stands?
- Can arboreal lichens be established in young managed stands (60-80 years old) to meet winter foraging needs?
- How do managed forests affect caribou foraging efficiency?
- Can high-elevation forests be regenerated sufficiently so that caribou habitat is maintained both spatially and temporally over the long term? More information is required on growth and yield in high-elevation forests.
- To what extent does managing for caribou and their habitat meet the needs of other species? What are the biodiversity implications of using caribou as an indicator or umbrella species?
- What is the relationship between forest fragmentation and the distribution of caribou, other ungulates and their predators? How sensitive are predation rates to fine-scale manipulation of predators, prey or habitat fragmentation? Are other ungulates and their predators now so abundant at broad scales that high predation continues regardless of attempts to separate predators and caribou at finer scales?
- Do the available TRIM and forest cover maps provide adequate information and spatial resolution to adequately map caribou habitat for management purposes (suitability/capability) or are the integrated biophysical maps more appropriate? What mapping scale(s) is/are most appropriate?
- What are the socio-economic implications of managing for caribou?

Answers to the above questions should provide some of the information required to develop habitat supply models to compare the effects of caribou management guidelines on timber supply as well as compare alternative timber supply scenarios.

## Population Structure

An understanding of population dynamics is crucial to any conservation strategy. By necessity such research needs to be long term to distinguish true population trends in population size and structure from the inherent “noise” present in most biological systems. In order to maintain caribou population viability (persistence over the long term) we need to know:

- What are the current and potential limiting factors for each local population?
- What role do corridors play in caribou seasonal movements and population dispersal?
- How does fragmentation of local populations affect genetic viability and metapopulation persistence?
- How much intra/inter-genetic variation exists within/between the local populations?

This kind of information on populations and habitat relationships should be linked to produce spatially explicit population models that consider the arrangement of habitats in space and time. Spatially explicit models may be particularly useful (assuming an accurate and reliable data base) because they can address questions of fragmentation, isolation and patch size. In addition, alternative management strategies that change the temporal and spatial distributions (e.g., age class distribution) of the landscape can be evaluated and ranked in terms of the risk they pose to caribou survival.

While caribou survey methodology is well developed (Resources Information Standards Committee [RISC], see <http://srmwww.gov.bc.ca/risc/index.htm>) there is still need to provide some logistical and technical improvements, including:



- Surveys should be coordinated between regions and done at least every three years.
- Restrict local population estimates to years with accompanying survey estimates.
- Report confidence limits on survey estimates:
  - From mark-resight if radio-collared caribou are present.
  - From caribou sightability model (still in need of development).
- Ensure RISC survey standards are followed for Mountain Caribou.
- Ensure all surveys are written up in standard report format.

### Access-Related Issues

The impacts of human activities, particularly those associated with winter recreation, require further research into both human impacts and better

management of human behaviour. Specifically, we need to know:

- What effect does winter recreation such as snowmobiling or heli-skiing have on caribou habitat use and winter survival? To what extent does habitat displacement occur? Are there population-level effects?
- Does increased human access to subalpine and alpine habitats result in harassment of and/or increased predation on Mountain Caribou?

Models based on timber supply and/or habitat supply should be expanded to include the effects of access and other human development activities (e.g., highways, railways, recreation) to produce cumulative effects models. These models attempt to assess the potential impacts of many development activities on the ability of landscapes to support viable populations of threatened species.

## APPENDIX 6

# PROPOSED UPDATED TERMS OF REFERENCE FOR MOUNTAIN CARIBOU TECHNICAL ADVISORY COMMITTEE

### PURPOSE

To facilitate the implementation of the provincial Mountain Caribou Recovery Strategy.

### COMMITTEE STRUCTURE

A committee of 15 biologists and technical experts including: MWLAP (4); MSRM (1); MOF (3); Parks Canada (1); Forest Industry (2); BCSF/BCHSSOA (1); BCWF/GOABC (1); EKES (1) and First Nations (1).

### OBJECTIVES

1. Review and recommend approval of the Recovery Strategy for Mountain Caribou to the National Recovery Team for Woodland Caribou by:

- reviewing the technical information contained within the Recovery Strategy for accuracy and completeness;
- ensuring that the scientific basis for current and proposed guidelines/ recommendations for conservation of Mountain Caribou is technically sound; and
- approving the implementation schedule of recovery actions for Mountain Caribou.

2. Facilitate implementation of the Recovery Strategy by:

- providing scientific advice to local RAGs and the NRT, as needed;
- reviewing progress on recovery and revising provincial recovery actions for Mountain Caribou based on results achieved and new information;

- reviewing project proposals for Mountain Caribou (e.g.; HCTF, Forest Investment Account);
- updating the Mountain Caribou statement in Volume 2 of the Identified Wildlife Management Strategy as new information becomes available;
- recommending changes to standardize Mountain Caribou habitat mapping, and participating in a habitat supply review for Mountain Caribou;
- providing scientific advice and recommendations to Land Use Plans as appropriate; and
- providing recommendations to improve recreation guidelines as new information becomes available.

### TIME FRAME

Objective 1 will be the primary focus of the MCTAC for the 2002/03 fiscal year. Tasks associated with implementation of the Recovery Strategy will be undertaken in fiscal years 2002/2003 to 2006/07.

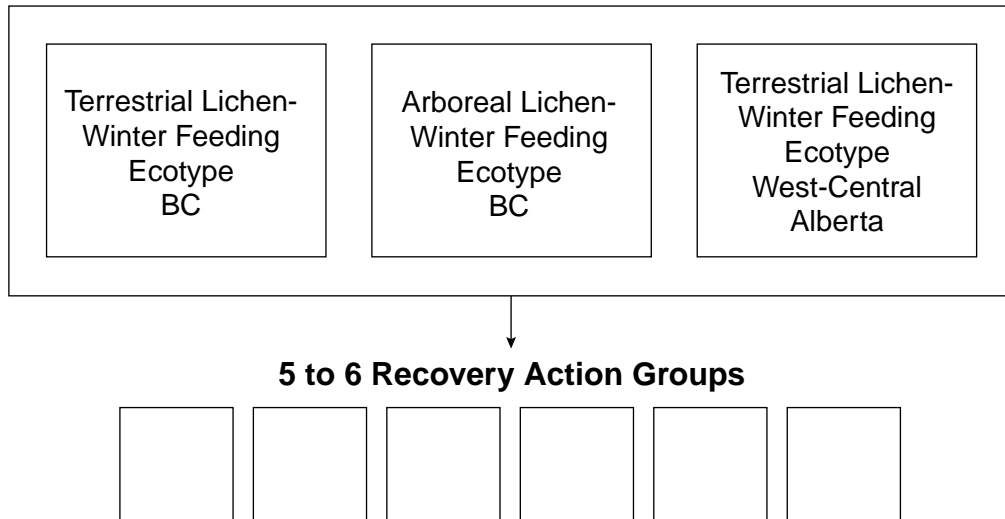
### REPORTING STRUCTURE

The MCTAC will not make caribou management decisions per se, but rather will serve as the scientific body for advising on Mountain Caribou recovery issues. Recommendations will be forwarded to the Director, Biodiversity Branch, MWLAP. The MCTAC will formally meet at least twice per year, or as requested by the Director, Biodiversity Branch. The terms of reference and membership will be reviewed at the end of the 2006/2007 fiscal year.

## APPENDIX 7

# PROPOSED COMMITTEE STRUCTURE FOR RECOVERY OF WOODLAND CARIBOU IN THE SOUTHERN MOUNTAINS NATIONAL ECOLOGICAL AREA

### Joint Steering Committee-SMNEA



#### National Recovery Team

- As proposed, one National Recovery Team for Woodland Caribou could serve as the NRT for all nationally listed Woodland Caribou populations in Canada. The NRT should include provincial and territorial government representatives, representatives of affected Wildlife Management Boards and national Aboriginal groups, significant national stakeholders and others as appropriate.
- The NRT will provide technical advice to the Canadian Wildlife Directors Committee, who in turn will provide advice to the Canadian Endangered Species Conservation Council.
- The mission of the NRT is to ensure coordination among regional/provincial recovery teams responsible for regional recovery planning and implementation, and to resolve technical issues to benefit Woodland Caribou throughout their extensive range.

- The NRT will be responsible for including recovery of caribou in the SMNEA as part of an overall framework or National Recovery Strategy linking regional/provincial strategies and specialized recovery action plans.
- The NRT will be responsible for establishing an ongoing five-year assessment of Woodland Caribou recovery.

#### Joint Steering Committee

- A sub-group of the NRT, the Joint Steering Committee (JSC-SMNEA) will steer recovery efforts at the SMNEA level.
- The JSC-SMNEA will include provincial government representatives from BC and Alberta, representatives from Parks Canada and the Canadian Wildlife Service, First Nations and other significant regional/provincial stakeholders as appropriate.

- The JSC-SMNEA will provide technical advice to the NRT.
- The JSC-SMNEA will develop the ecotype/ jurisdiction Recovery Strategies for caribou in the SMNEA, conduct ongoing five-year assessments on the regional status of Woodland Caribou, and coordinate and link local Recovery Action Plans (see below).
- The JSC-SMNEA will be made up of 3 ecotype/ jurisdiction Recovery Action Groups (RAGs): BC arboreal lichen-winter feeding<sup>28</sup>; BC terrestrial lichen-winter feeding<sup>29</sup>; and Alberta terrestrial lichen-winter feeding<sup>30</sup>.

### Local Recovery Action Groups

- Five to six additional local Recovery Action Groups (local RAGs) will be formed at the regional/sub-regional planning level within the SMNEA to focus on specific local populations or to undertake specialized functions such as public outreach or Aboriginal liaison.
- RAGs will include active involvement of local communities, industry and stakeholders as

appropriate, and will receive technical advice from the JSC-SMNEA.

- RAGs will complete Recovery Action Plans for local populations of Woodland Caribou. These documents will include socio-economic costs for recovery, provide direction to local land use planning tables, and identify and prioritize specific recovery actions.
- Suggested additional local RAGs for the SMNEA:
  - Terrestrial lichen-feeding ecotype in west-central BC;
  - Terrestrial lichen-feeding ecotype west of Williston Reservoir;
  - Terrestrial lichen-feeding ecotype in Rockies (BC and Alberta);
  - Northernmost local populations of arboreal lichen-winter feeding ecotype;
  - Revelstoke, Central Rockies, Monashee and Central Selkirks local populations of arboreal lichen-winter feeding ecotype;
  - South Selkirks and South Purcells local populations of arboreal lichen-winter feeding ecotype.

<sup>28</sup> The BC arboreal lichen-winter feeding caribou is synonymous with the BC Mountain Caribou ecotype, and thus MCTAC will act as the arboreal lichen-winter feeding component of the JSC.

<sup>29</sup> The BC terrestrial lichen-winter feeding caribou is synonymous with the BC Northern Caribou ecotype, and thus NCTAC will act as the BC terrestrial lichen-winter feeding component of the JSC.

<sup>30</sup> The west-central Alberta terrestrial lichen-winter feeding caribou includes those caribou from Alberta that are within the SMNEA, and thus an Alberta caribou committee will act as the Alberta terrestrial lichen-winter feeding component of the JSC. (Note: "Mountain Caribou" is deliberately not used here because BC and Alberta have different definitions for this term).

## APPENDIX 8

### ACRONYMS USED IN TEXT (NOT INCLUDING THOSE THAT APPEAR ONLY IN TABLES OR FOOTNOTES)

Annual Allowable Cut (AAC)  
BC Helicopter Skiing and Snowcat Operators Association (BCHSSOA)  
BC Snowmobile Federation (BCSF)  
BC Wildlife Federation (BCWF)  
Cariboo-Chilcotin Land Use Plan (CCLUP)  
Committee on the Status of Endangered Wildlife in Canada (COSEWIC)  
Conservation Data Centre (CDC)  
Engelmann Spruce-Subalpine Fir (ESSF)  
Forest Practices Code (FPC)  
Forest Renewal British Columbia (FRBC)  
Guide Outfitters Association of BC (GOABC)  
Habitat Conservation Trust Fund (HCTF)  
Higher Level Plan (HLP)  
Habitat Suitability Index (HSI)  
Interior Cedar-Hemlock (ICH)  
International Mountain Caribou Technical Committee (IMCTC)  
International Woodland Caribou Recovery Team (IWCRT)  
Joint Steering Committee of the SMNEA (JSC-SMNEA)  
Land and Resource Management Plan (LRMP)  
Ministry of Environment, Lands and Parks (MELP)  
Ministry of Forests (MOF)  
Ministry of Sustainable Resource Management (MSRM)  
Ministry of Water, Land and Air Protection (MWLAP)  
multiple logistic regression (MLR)  
Mountain Caribou in Managed Forests (MCMF)  
Mountain Caribou Technical Advisory Committee (MCTAC)  
National Recovery Team (NRT)  
non-government organization (NGO)  
Northern Caribou Technical Advisory Committee (NCTAC)  
Recovery Action Group (RAG)  
Recovery of Nationally Endangered Wildlife in Canada (RENEW)  
Resources Information Standards Committee (RISC)  
Results Based Code (RBC)  
Southern Mountains National Ecological Area (SMNEA)  
Species at Risk Act (SARA)  
Sustainable Forest Management Plan (SFMP)  
Sustainable Resource Management Plan (SRMP)  
Timber Supply Reviews (TSR)  
US Fish and Wildlife Service (USFWS)