

**Cariboo-Chilcotin  
Land Use Plan**

# Mountain Caribou Strategy

**Prepared by:**

**CCLUP Caribou  
Strategy Committee**

**Prepared for:**

**Cariboo Mid-Coast  
Interagency  
Management  
Committee**

**October 2000**





## SUMMARY AND KEY RECOMMENDATIONS

Mountain caribou are a red-listed species in BC which means that they are declining and at risk of extinction if current trends continue. Mountain caribou are also listed as threatened at the national level, which will require the province to address conservation concerns under federal endangered species legislation.

There are less than 2,500 mountain caribou in the world and about ninety-eight percent of these animals live in BC.

The results of recent surveys suggest that the mountain caribou population in the eastern Cariboo Region is facing a crisis situation, particularly south of Quesnel Lake. Portions of the sub-populations that occur in the region may be in imminent danger of extirpation. The population has suffered a long-term decline during the 1900's, more recently during the 1980's and further localized declines are now occurring.

**The Cariboo-Chilcotin Land Use Plan provided the following guidance in regard to mountain caribou management:** *“The overriding objective is to maintain habitat values for mountain caribou within the Cariboo Region.”* As part of the implementation of the Cariboo-Chilcotin Land Use Plan, the CCLUP Integration Report (March 1998) tasked the Caribou Strategy Committee to complete a caribou strategy which includes an identification of ‘modified harvest’ and ‘no harvest’ areas for caribou by June 2000.

This report presents the maps and background information to the eastern caribou strategy, explaining CCLUP targets for mountain caribou and presenting the rationale for any significant changes from the interim 1996 and 1998 Caribou Strategy Reports. This report also provides updated information on the definition of ‘modified harvest’ for mountain caribou, the recommended timber harvest management approaches and access and predator management recommendations.

In the strategy the ‘modified harvest’ and ‘no harvest’ areas were selected to best maintain caribou values while taking into account stakeholder values and making the best use of overlap opportunities. A large part of this task was a map-based exercise drawn at 1:20,000 scale showing proposed ‘no harvest’ and ‘modified harvest’ locations for the eastern caribou areas.

CCLUP targets for eastern caribou were clarified based on thorough review of boundaries, calculation of the productive forest land using geographic information systems (GIS) and direction received from the Cariboo-Mid-Coast Interagency Management Committee (IAMC). CCLUP targets for ‘modified harvest’ and ‘no harvest’ were utilized in determining an updated strategy that would help to maintain caribou and caribou habitat while following higher level plan and IAMC direction. At the landscape level, the identification of ‘modified harvest’ and ‘no harvest’ areas for eastern caribou utilized similar criteria as outlined in the 1996 caribou strategy report.

Additional radio-telemetry information was available for determining areas of high caribou use. A habitat suitability model derived from the radio-telemetry data was also used to update 'modified harvest' and 'no harvest' areas.

Stakeholder representatives from the Major Licensees and Conservation Council participated in the strategy update review process.

**The following is a list of key findings and committee recommendations that are referenced or contained within the body of the report** (highlighted throughout the report in boxes):

- ☐ Caribou are among the most intensively studied animals within the Cariboo Region. Three radio-telemetry studies have significantly overlapped within portions of the mountain caribou range. Beginning in 1993 and continuing to the end of May 2000 the latest project, undertaken by MELP, collected 3096 relocation points from 43 animals.
- ☐ Caribou are seldom found on slopes over about 60%, which are more prone to avalanches than more gentle terrain. Forested sites utilized by caribou were primarily old, open, short, sub-alpine fir leading stands on poor sites. Mature and old stands on slopes less than 45% are most heavily used by caribou (80% of telemetry re-locations are on slopes less than 45%).
- ☐ Early winter radio-telemetry data shows that early winter use is not always dispersed, but that there are a number of key areas that receive early winter caribou use, particularly in the vicinity of Quesnel Lake. Some of the key areas include Tasse Lake, Spanish Creek, Long Creek, Hilda Lake, Watt Creek, Roaring Creek, Isaiah Creek, Lynx Creek, Suey Mountain and Crooked Lake.
- ☐ From radio-telemetry research, map-based predictive multivariate habitat models were developed for each season (spring, summer, early winter and late winter) and zone (*highland* and *mountain*) to aid in the refinement of 'no harvest' and 'modified harvest' areas (Apps and Kinley 2000). Figures 3 to 6 summarize important mountain caribou habitat for each season generated from these models.
- ☐ Based on current knowledge, caribou habitat and populations can only be maintained if all of the following issues are addressed together:
  - ☐ Maintaining suitable caribou habitat within existing mountain caribou range
  - ☐ Limiting and regulating roaded access and motorized recreation in caribou habitat
  - ☐ Managing predation levels on caribou

- ❑ The committee recommends that the ‘modified harvest’ that occurs within caribou winter range be aggregated into specific areas in order to minimize the fragmentation of unharvested habitat.
- ❑ The committee, local forest industry representatives and MOF and MELP District staff have tentatively agreed to several significant changes in the caribou deferral line within the Quesnel District. These changes incorporate into the strategy several areas that were previously outside the identified caribou range including: the Mount Tom area, Lottie Lake and Eaglenest Ridge (Figure 11). The committee recommends that these adjustments be accepted as part of the overall caribou strategy.
- ❑ Due to the high risk associated with possible loss of early winter habitat areas, the committee recommends that CCLUP target is shifted from some less important high elevation areas, to insure key low elevation winter range areas receive special management emphasis. Where possible, these adjustments are through refinement of the historic deferral area to encompass adjacent early winter range. Two isolated areas (i.e. areas not directly connected to the historic deferral area) have also been identified. Some areas of high capability, but significantly fragmented by recent timber harvesting, were excluded. Early winter habitat requirements of caribou conflict with clear-cut logging. In order to maintain suitable habitat conditions for caribou, group selection is the recommended silvicultural system within ‘modified harvest’ areas of early winter range in the ICH.
- ❑ The Committee recommends that the location of ‘modified harvest’ and ‘no harvest’ areas depicted in Figure 12 form the basis of the eastern caribou habitat strategy. The ‘modified harvest’ areas were selected to best maintain caribou values while taking into account stakeholder values and making the best use of overlap opportunities to better meet all CCLUP targets, as directed by the committee Terms of Reference (see Appendix 1). The recommended ‘no harvest’ and ‘modified harvest’ areas meet the overall area based CCLUP targets for eastern caribou but not specific sub-unit targets.
- ❑ The committee recommends that CCLUP sub-unit targets for ‘modified harvest’ and ‘no harvest’ be adjusted to reflect the shift of target as outlined in Table 4.
- ❑ The consolidation of ‘modified harvest’ in the Quesnel Lake Sub-unit will create a large area of ‘modified harvest’ between Cariboo Mountains Park and Quesnel Lake, which is intended to serve as the major test area to insure the ‘modified harvest’ prescription provides caribou habitat over the long term. The presence of Quesnel Lake should limit recreational access into the area and minimize confounding factors in this proposed test. In order to allow this important test to successfully occur the committee recommends that motorized recreational access be carefully regulated or excluded from this area (see Appendix 6).
- ❑ The boundaries in the caribou strategy were drawn as accurately as possible at the 1:20,000 scale. In order to provide some flexibility at the operational level, the boundaries may be adjusted to address local topography, optimization of timber development, worker safety issues and the establishment of windfirm boundaries.

- ❑ Specific research designed to find ways of maintaining habitat in managed forests within mountain caribou range has been ongoing in the Cariboo Region since 1989. Based on all sources of information, including silvicultural systems research conducted in this and other regions, we are optimistic that the recommended silvicultural system (see section 5.3 on page 27 of this report) will be able to maintain caribou habitat and should have no problem producing the modeled timber yield expectations.
- ❑ ‘Modified harvest’ areas in the ESSF and ICH should be managed to maintain caribou habitat continuously through time and space through application of the recommended group selection silvicultural system (with 33% timber removal every 80 years).
- ❑ The following timber management approach is recommended in all ‘modified harvest’ areas:
  - ❑ An even flow of timber access across the entire caribou ‘modified harvest’ area by TSA is recommended.
  - ❑ This means that approximately 25% of the area would be available for ‘modified harvest’ every 20 years. Insect and/or disease outbreaks may require deviation from an even flow of timber. However, the impact to caribou should be carefully considered before any changes are made.
  - ❑ Within each district (excluding 100 Mile TSA) this is implemented by limiting harvest to a maximum of 1/3<sup>rd</sup> of the following areas in any 20-year period: TFL #52, Quesnel TSA, Williams Lake TSA north of Quesnel Lake and Williams Lake TSA south of Quesnel Lake.
  - ❑ Forest development in caribou range must be spatially and temporally concentrated. Aggregate harvesting in major parts of landscape units over short time periods (5 years), then de-build roads once the main silviculture activities are completed and do not enter the area again for 20 years or more.
  - ❑ Concentrate logging by harvesting large cut-blocks (e.g. 250 hectares) using the silvicultural system described in section 5.3.
- ❑ All cutblocks with slopes up to 40% must be harvested using the group or single-tree selection system. Even if ground skidding is not used, other logging methods must be employed to implement these selection systems on these slopes. However, ground based logging equipment (especially tracked skidders) can effectively operate on moderately steep slopes (41-50%). We strongly encourage the use of group selection even on 41-50% slopes to have the best chance of maintaining caribou habitat. Figure 10 shows that caribou use of slopes between 40-50% is very significant.
- ❑ In artificial regeneration, the pre-harvest stem distribution of *Abies* versus spruce should be reflected in the planted stock. Lodgepole pine should not be planted in mountain caribou habitat due to the self-pruning nature of pine, which holds less arboreal lichen.

- ❑ A timely resolution of the appraisal allowance issue in relation to the recommended silvicultural systems is essential to the successful implementation of the caribou strategy.
- ❑ For access management the committee makes a number of recommendations, including:
  - ❑ That timber harvest activities should be aggregated in significant parts of landscape units over short time periods (5 years), followed by de-building roads once the main silviculture activities are completed and not entering the area again for at least 20 years.
  - ❑ That an overall road access management plan be developed that addresses road closures and road deactivation within caribou winter range.
  - ❑ That non-commercial and commercial recreational uses of snowmobiles, all terrain vehicles and helicopters should be carefully regulated or excluded from 'no harvest' and 'modified harvest' caribou winter range areas, as indicated in Figure 13.
- ❑ Snowmobile activity on caribou winter ranges is considered a major conservation concern because of its potential displacement impact on caribou distribution (refer to Appendix 6 for details on mountain caribou and motorized recreation). Sensitive areas, where snowmobile and motorized recreation restrictions are necessary in order to maintain caribou use, are identified in Figure 13.
- ❑ Direct management intervention may be required to maintain caribou herds in areas where habitats have been degraded, predator levels are high due to alternate prey species abundance or where there is a high level of road access. Such 'compensatory' management (i.e. compensating for loss or alteration of habitat or changes in alternative prey densities) may require management actions such as reducing wolf and moose populations in highland areas where caribou and moose ranges overlap. If present trends continue and no compensatory management is undertaken, it is likely that the remaining caribou herds that summer in highland areas will become extirpated.
- ❑ Based on the presently declining population levels of mountain caribou in this region and the strong link between this decline and wolf predation, the committee recommends the following predator/prey management measures be developed, in consultation with stakeholders and First Nations, in the eastern caribou range:
  - ❑ Development of a modified regional moose management strategy that incorporates higher harvest rates for moose populations within and adjacent to the caribou range.
  - ❑ Concurrent to a reduction of moose population densities within caribou range, a wolf management program should be developed that specifically targets individual wolves or packs that are preying on caribou.

- ☐ Implementation of forest management practices that limit the establishment or persistence of favourable habitat which encourage moose populations within or adjacent to the eastern caribou range.
- ☐ The likelihood that mountain caribou will persist in this region at a viable population level into the future is dependent on a large number of factors or risks. A preliminary risk assessment is presented in the report. The committee recommend that a detailed conservation risk assessment be completed that identifies critical risks and assesses how well the eastern caribou strategy reduces these risks through modelling population viability under different conditions.
- ☐ Monitoring of the adaptive management trial (Mt. Tom, Quesnel Forest District), along with the continued assessment of the earlier research trials and evaluations of future harvesting under the strategy, should be conducted to verify that the dual objectives of caribou habitat maintenance and timber access are achieved. Regularly scheduled monitoring will ensure the tracking of progress towards desired goals and that the implementation of required adjustments occurs in a timely manner. Adequate funding for the monitoring program is essential.
- ☐ Ongoing monitoring of the caribou, moose and wolf populations is recommended.
- ☐ The committee recommends that the eastern caribou strategy be reviewed in detail every 5 years in order to determine if refinements are necessary.

## ACKNOWLEDGEMENTS

More than five years of research and planning – involving a multitude of people – has gone into preparation of the information in this report. Sincere thanks are extended to all those who have made a contribution to this important strategy for maintaining caribou in the eastern portion of the Cariboo Region.

The CCLUP Caribou Strategy Committee whose members included Harold Armleder, Chris Bauditz, Mike Folkema, Robin Hoffos, Heather Knezevich<sup>1</sup>, Mike Lloyd, Mike Pelchat, John Youds (chair) and Jim Young prepared this report. Invaluable GIS analysis and support was provided by Jennifer Ballentine and Maggie Isenor. The research of Teresa Newsome, Ordell Steen and Micheala Waterhouse provided essential support for the silvicultural recommendations. Diane Mousseau provided support in terms of editing and production of the document.

Caribou inventory information identified the need for major adjustments (new areas) to the historic caribou deferral area within the Quesnel District and thus an ad hoc committee was established to insure the adjustments (trading of areas) did not create significant concerns to local forest industry stakeholders. Without the cooperation and support of committee members' major adjustments would not have been achieved. Quesnel committee members included Peter Andrews (Weldwood), Lyle Badger (MOF), Steve Dodge (MOF), Larry Gardner (West Fraser), Cris Guppy (MELP), Al Moi (MOF), Jim Young (MELP) and Harold Armleder (MOF).

Since 1992, funding to undertake radio-telemetry, population surveys and silvicultural systems research within the range of eastern caribou was provided by Forest Renewal British Columbia (FRBC), Habitat Conservation Trust Fund (HCTF), Corporate Resource Inventory Initiative (CRII), BC Environment, BC Parks and Ministry of Forests. Local forest companies that have supported the eastern caribou inventory initiative, by providing FRBC funding through their multi-year agreements, have to date included Ainsworth Lumber Company Ltd., Riverside Forest Products Ltd. and West Fraser Mills Ltd.

During preparation of this report valuable input particularly on the map-based zoning was received from forest industry (represented by Karen Campbell and Gord Rattray) and conservation stakeholder groups (represented by Dave Neads).

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<sup>1</sup> Heather Knezevich was a valuable member of the Caribou Strategy Committee who made a significant contribution to the work of the committee. Heather passed away due to illness during the early stages of preparation of this report.



## SIGNATURE PAGE

### CCLUP MOUNTAIN CARIBOU STRATEGY

This report and its associated maps document the recommended strategy developed to date by the Caribou Strategy Committee. This strategy was developed based upon direction in the Cariboo-Chilcotin Land Use Plan, committee Terms of Reference and direction from the Inter-Agency Management Committee (IAMC).

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## 1 INTRODUCTION



The information and recommendations in this report have been prepared as draft recommendations to the Cariboo Mid-Coast Interagency Management Committee (IAMC).

The Cariboo-Chilcotin Land Use Plan (CCLUP) recognizes that mountain caribou in the eastern portion of the Cariboo Region are of provincial significance and are a species at risk. The regional population of mountain caribou is referred to as ‘eastern caribou’ in this report and other CCLUP documentation in order to distinguish them from western caribou herds in the region.

**Maintaining habitat values for mountain caribou has been identified as an overriding objective within the CCLUP.** In 2000, mountain caribou became red-listed (threatened) provincially and were also designated as threatened nationally.

As part of the implementation of the Cariboo-Chilcotin Land Use Plan, the IAMC tasked the Caribou Strategy Committee (referred to as ‘the committee’ hereafter in this report) with the development of a regional caribou strategy for Eastern and Itcha-Ilgachuz caribou by 2000. This included the initiation of appropriate research, inventory, ecosystem mapping and adaptive management activities. This report presents the strategy for eastern caribou. The strategy for Itcha-Ilgachuz caribou will be contained in a report to be released later.

The terms of reference for the committee included the following specific tasks (refer to Appendix 1 for details):

- ❑ To initiate research, inventory and mapping projects required to develop integrated caribou habitat management strategies.
- ❑ To complete a caribou strategy which includes an identification of ‘modified harvest’ and ‘no harvest’ areas for caribou. Within the context of the CCLUP and subsequent implementation direction, these strategies will attempt to develop the best options to maintain caribou habitat at the stand and landscape levels. The strategy will address the CCLUP requirement for ‘modified harvest’ areas including the identification of 35% of the existing deferral areas for ‘modified harvest’.



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- ❑ To develop integrated forest management approaches for caribou that address CCLUP targets and implementation direction, including identifying operational management strategies at the stand and landscape levels.
  - ❑ To develop and define “modified harvesting” for caribou habitat.
  - ❑ To define portions of the caribou range which are sensitive to snowmobile use.

The committee began work on these tasks in 1995. CCLUP targets for ‘modified harvest’ areas were derived for the eastern areas through GIS analysis and these were subsequently reviewed and approved by the IAMC. Consultation with stakeholder representatives was initiated in 1996, with follow-up meetings on draft versions of the maps in 1998 and 2000 (refer to Appendix 2 for details on stakeholder consultation). The 1998 interim strategy was reviewed and refined in the context of new caribou research information, new predictive ecological map information, the incorporation of trade areas in the Quesnel District and input received from stakeholder groups. Refer to Appendix 3 for a summary of major refinements to the strategy since the Caribou Strategy Update 1998.

The ‘modified harvest’ areas were selected to best maintain caribou values while considering stakeholder values, making the best use of overlap opportunities, and following direction from the higher level plan, the IAMC and the committee Terms of Reference. A large part of this task was a map-based exercise, and the key products are maps (derived at the 1:20,000 scale) showing proposed ‘no harvest’ and ‘modified harvest’ boundaries.

This report presents the maps and background information to the eastern caribou strategy, explaining CCLUP targets for mountain caribou and presenting the rationale for any significant changes from the interim 1996 and 1998 Caribou Strategy Reports. This report also provides updated information on the definition of ‘modified harvest’ for mountain caribou, the recommended timber harvest management approaches and access and predator management recommendations.



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## 2 BACKGROUND

### 2.1 General

The area known today as the Cariboo Region was named after the caribou that historically were much more abundant and widely distributed than at present. In an 1861 dispatch to the Duke of Newcastle, Governor Douglas mentioned...."Cariboo country, in speaking of which I have adopted the popular term and more convenient orthography of the word, though properly it should be written "Cariboeuf" or "Reindeer", the country having been so called from its being the favourite haunt of that species of the deerkind." Akrigg and Akrigg (1997) note that Cariboo is derived from cariboeuf or cerfboeuf, which is a French folk etymology for xalibu, an Algonquin Indian word meaning the "pawer or "scratcher".

The initial observation in the 1940's and 1950's that caribou were "wilderness" animals, dependent on large intact blocks of mature forest (Edwards 1954) has been validated with recent scientific studies. The early investigators thought that the loss of arboreal and terrestrial lichens was the primary cause of decline or that human disturbance without major habitat changes could precipitate the loss of caribou populations (Klein 1982). More direct mortality factors have been identified as the cause in virtually all-recent studies (Bergerud et al. 1984, Seip 1992a).

These factors in usual order of importance have primarily been 1) predation due to wolves or grizzly bears, 2) poaching or sport hunting or 3) accidental death, mainly in avalanches. Starvation, which would be expected if loss of forage was the primary cause, is virtually unknown from studies on radio-collared caribou. To minimize loss to these mortality factors requires special habitat management at the landscape level. Although winter habitats for caribou must provide adequate forage, it is also important how the habitat is distributed on the landscape.

An anti-predator strategy of caribou is to space out over very large areas so that it is harder for predators to find them. Caribou populations therefore exist at low densities. If the amount of mature and old forest that caribou can occupy is decreased, then the density of caribou in the remaining stands will be increased, probably resulting in greater predator efficiency. Predator efficiency may also be increased during winter if roads and snowmobile tracks provide easier travel routes for wolves.

As well, logging, like fire, converts mature and old forest into early successional stages, creating habitat favored by moose. An increase in numbers of moose (or other alternate prey) can support a larger predator population and can result in increased predation pressure on caribou. In southeastern British Columbia, predation pressure on caribou was lower in Wells Gray Park, where caribou were spatially separated from moose (the alternative prey), than in the Quesnel Highland where there was less spatial separation (Seip 1992a). In Ontario, the southern limit of woodland caribou has receded during the last 100 years, coincident with the northern range expansion of white-tailed deer and moose. Wolf predation has been implicated as the major limiting factor of woodland caribou populations in Alaska, Yukon, western Alberta, and southeastern British



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Columbia (Gasaway et al. 1983; Farnell and McDonald 1987; Edmonds 1988; Seip 1992a).

Mountain caribou in southeastern and east central BC feed on arboreal lichens during winter. As arboreal lichens are most abundant on old trees, mountain caribou are considered an old-growth obligate (dependent) species. 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 mountain caribou.

Caribou habitat management practices need to provide a continual supply of large, connected areas of suitable summer and winter habitat where there is little or no vehicle access and disturbance. Under these conditions, caribou can space out at low densities and avoid predators and poachers (Bergerud and Page 1987; Seip and Cichowski, 1996).

These habitat requirements have been incorporated into caribou guidelines in Ontario, Manitoba and Alberta. The forests in these provinces are more similar to those of the Itcha-Ilgachuz caribou herd, which primarily feeds on terrestrial lichens in dry pine and spruce. Habitat conditions of the eastern caribou do not occur in other provinces, but the spatial patterning implications are similar.

As an example, Ontario has adopted the principle of large cut-blocks (of up to 10,000 ha) as the primary caribou habitat management technique. These blocks are designed to achieve three effects:

- ☐ minimize fragmentation of unharvested or residual habitat,
- ☐ create large areas of habitat for the second rotation,
- ☐ minimize the quality of moose habitat (OMNR 1994).

Large blocks of older forest retain lichen, minimize access and do not create new moose forage that would increase wolf populations.

Large clear-cuts would not be appropriate in mountain caribou habitats because they would eliminate arboreal lichen and would enhance the moose population in this wetter climate area. However, the committee does recommend that the 'modified harvest' that occurs within caribou winter range be aggregated into specific large areas in order to minimize the fragmentation of unharvested habitat.

During the 1980's extensive areas of important habitat for caribou, generally above 1500 meters, were deferred from timber harvesting in the short and medium terms. The CCLUP has established that 65% of the forest land base within these previously deferred areas will not be available for timber harvest and that 35% will be available under modified harvesting practices. The deferrals were to remain in place until 2000, with the expectation that the caribou strategy will be completed and produce satisfactory integrated resource management solutions.

Dispersing 'modified harvest' across caribou range would be a poor caribou habitat management strategy as it would leave few areas undisturbed and would result in



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maximum access development. Aggregating the ‘modified harvest’ into specific areas is a far better caribou habitat management strategy because this will keep large areas of caribou habitat intact (undisturbed), thereby minimizing the overall impact on caribou and caribou habitat. Furthermore, this approach allows for a better scientific evaluation of the ‘modified harvest’ areas to determine whether suitable habitat for caribou can be maintained. For these reasons, the committee has chosen the latter approach for locating ‘modified harvest’ areas within caribou range.

**The regional mountain caribou habitat and population can only be maintained if all of the following issues are addressed together:**

- ☐ **Maintaining suitable caribou habitat within existing mountain caribou range**
- ☐ **Limiting and regulating roaded access and motorized recreation in caribou habitat**
- ☐ **Managing predation levels on caribou.**

Strategies for addressing each of these important factors in caribou conservation are presented in this report.

## **2.2 Mountain Caribou Distribution and Abundance**

Mountain caribou are a red-listed species in BC which means that they are declining and at risk of extinction if current trends continue. Mountain caribou are also listed as threatened at the national level that will require the province to address conservation concerns under federal endangered species legislation.

Mountain caribou are an ecotype of the woodland caribou, living most of the year in subalpine areas. In winter, very deep snow prevents the caribou from digging for food thus they feed almost exclusively on arboreal or tree lichens. Those lichens only become abundant in old-growth forests.

In BC the mountain caribou population occurs from just north of Prince George to the U.S. border and occupies the area commonly known as the interior wet-belt.

**There are less than 2,500 mountain caribou in the world and about ninety-eight percent of these animals live in BC.**

For conservation and management purposes Simpson (1997) divided the provincial population of mountain caribou into 13 herds or sub-populations (Figure 1). Of the existing 13 sub-populations:



- 
- ☐ Herds range in size from about 20 to 450 animals
  - ☐ Seven herds have populations of less than 60 individuals
  - ☐ Nine herds are considered stable
  - ☐ Four herds are declining.

The regional population of mountain caribou (referred to as “eastern caribou” in this report) occurs in the Quesnel Highland and Cariboo Mountains and is composed of portions of three sub-populations. The *North Cariboo Mountains sub-population* includes the Bowron wildlife inventory block and a larger contiguous area to the north and east within the Omineca Region. The *Barkerville sub-population* completely falls within the Barkerville inventory block. The *Wells Gray North sub-population* includes the Stevenson, Junction and Horsefly wildlife inventory blocks. Small portions of the Junction and Horsefly inventory blocks are within the Southern Interior Region (Figure 2).

Continuous, extensive high elevation caribou winter ranges occur on rounded subalpine mountaintops throughout the Quesnel Highland in the ESSF zone. Within the more rugged mountainous terrain of the Cariboo Mountains high elevation caribou winter ranges are present but are more restricted and discontinuous in nature. Figures 3 to 6 show areas used by caribou in summer, early winter, late winter and spring based on present radio-telemetry information. It is important to note that much of the winter range habitat for eastern caribou is located outside of protected areas and therefore will be subject to logging development. Herds that summer in higher elevation parks will also be at increased risk with logging development because the wintering areas that support these caribou are located outside parks.

The population once was much larger than present and herds roamed west as far as Dragon Mountain near Quesnel, in the vicinity of Horsefly and south of Canim Lake. One record reports an observation of approximately 2000 caribou on Isaac Lake around 1918 (Spalding 2000); this number of animals in the area is hard to comprehend today. These herds largely disappeared as the area became settled and developed. Moose began to colonize the region in the early 1900’s and were abundant in the area by 1930. Consequently, it is likely that wolf density increased after this time resulting in higher predation levels on caribou. In 1946 the caribou hunting season in the Cariboo Region was closed for the first time. During the 1950’s the population showed an increase which was undoubtedly aided by the wolf control program active during that period. A portion of the population in the Quesnel Lake area then declined during the mid-1980’s soon after the initiation of logging in the area. This recent decline has been linked to high levels of wolf predation and though the overall regional population of mountain caribou stabilized at approximately 300 – 350 animals during the early 1990’s further localized declines are now occurring.

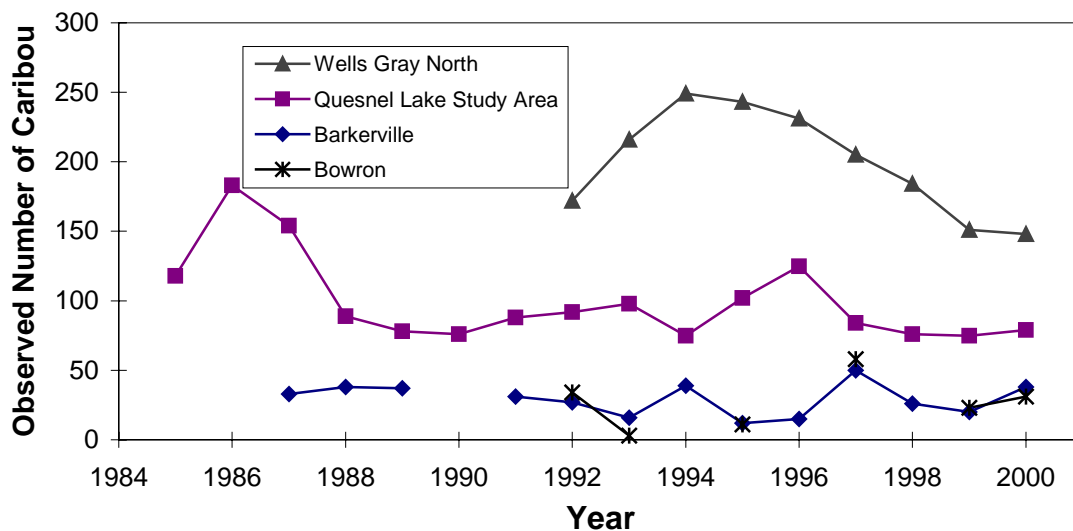
In order to monitor mountain caribou population trends and calf recruitment within the eastern portion of the region, annual surveys have been conducted in each census block since 1992 (Table 1). The majority of surveys occurred during the month of March when caribou are at their highest elevations of the year and easiest to find from a helicopter.



Observations of marked (radio-collared) animals suggest that usually about 85% of all animals present within an area will be seen during survey flights.

**The results of recent surveys suggest that the mountain caribou population in the eastern Cariboo Region is facing a crisis situation, particularly south of Quesnel Lake.** Portions of the sub-populations that occur in the region may be in imminent danger of extirpation (<30 animals and density lower than 30/1000 km<sup>2</sup>, <15% calves during late winter or population rate of decline > 3%/year).

While the Barkerville herd has remained relatively stable since 1992 at about 40 animals, it has a relatively low density of about 25 animals per 1000 km<sup>2</sup> (Table 1 and Figure 7). The Wells Gray North herd has declined from an estimated 300 animals in 1994 to less than 200 animals in 2000 (Young and Freeman, *in prep.*). Animal density has also declined from over 50 animals per 1000 km<sup>2</sup> to less than 40 animals per 1000 km<sup>2</sup>. Most of the observed decline has occurred in the Horsefly inventory block which has gone from a high count of 112 animals in 1994 to a record low count of 23 in 2000. Recent surveys within the Bowron inventory block show that there is considerable movement by this herd in and out of the region with about 30 animals usually resident in the Cariboo portion of the herd's range. Correcting for sightability would suggest this area has a rough density of about 20 animals per 1000 km<sup>2</sup>.



**Figure 7. Mountain Caribou survey results within the Cariboo Region, 1984 – 2000 (incomplete surveys of the Quesnel Lake Study Area in 1985 and 1989; incomplete survey of the Wells Gray North sub-population in 1992).**



**Table 1. Summary of observed caribou by census block for the Quesnel Highland and Cariboo Mountains Survey area (1992 - 2000).**

Sub-population	Census Block	Number Of Caribou Observed By Year (not corrected for sightability)								
		1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>N. Cariboo Mtns.</b>	<b>Bowron</b>	<b>34</b>	<b>3</b>	<b>N/S<sup>b</sup></b>	<b>11</b>	<b>N/S<sup>b</sup></b>	<b>58</b>	<b>N/S<sup>b</sup></b>	<b>23</b>	<b>31</b>
<b>Barkerville</b>	<b>Barkerville</b>	<b>27</b>	<b>16</b>	<b>39</b>	<b>12</b>	<b>15</b>	<b>50</b>	<b>26</b>	<b>20</b>	<b>38</b>
<b>Wells Gray North</b>	<b>Stevenson</b>	73	96	69	86	75	68	70	67	61
<b>Wells Gray North</b>	<b>Junction</b>	33	24	68	63	85	65	65	47	64
<b>Wells Gray North</b>	<b>Horsefly</b>	66 <sup>a</sup>	96	112	94	71	72	49	37	23
<b>Total Wells Gray North</b>	<b>Total</b>	<b>172</b>	<b>216</b>	<b>249</b>	<b>243</b>	<b>231</b>	<b>205</b>	<b>184</b>	<b>151</b>	<b>148</b>
<b>Wells Gray North</b>	<b>Quesnel Lake Study Area</b>	92	98	75	102	125	84	76	75	79
<b>Total in Region</b>		233	235	288	266	246	313	210	194	217

<sup>a</sup> incomplete survey

<sup>b</sup> Bowron census block not surveyed (N/S)

### 2.3 Mountain Caribou Seasonal Patterns of Habitat Use

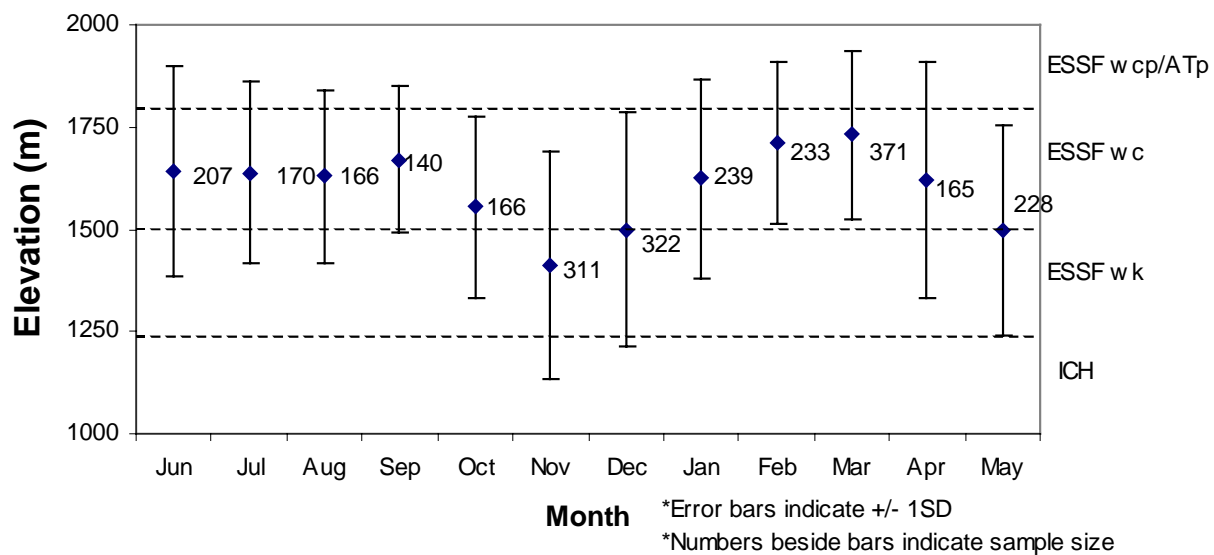
**Caribou are among the most intensively studied animals within the Cariboo Region. Three radio-telemetry studies have significantly overlapped within portions of the mountain caribou range.** Seip (1992) undertook a study in the Quesnel Lake area from 1984 to 1988 and collected 1780 relocations from 32 animals. From 1986 to 1989 a similar study was undertaken within Wells Gray Park (Seip 1990) resulting in 1385 relocation points being collected from 31 radio-collared animals. The home ranges of some of these animals extended into the eastern portion of the Cariboo Region. Beginning in 1993 and continuing to the end of May 2000 the latest project, undertaken by MELP, collected 3096 relocation points from 43 animals. The study area included a sample of animals from the Barkerville, Stevenson, Junction and Horsefly wildlife inventory blocks. Little effort has been directed towards monitoring habitat use within Bowron Lake Park because of its' protected status. However, collared animals from the most recent regional MELP project, and from a study to the north in the Omineca Region, have traveled into the area.

Mountain caribou habitat use patterns are usually described using four seasonal time periods (Simpson et al. 1997). Although there are similarities in habitat use across the range of mountain caribou both regionally and provincially, variations in terrain and snow conditions result in different strategies between individuals and sub-populations.



### *Summer/Fall (June to October) Habitat Use*

During early June, when female caribou are preparing to calve, they are usually widely dispersed near snowline within the ESSF zone. Although ground forage may be scarce at these elevations, due to snow cover, it is thought that this strategy provides an effective predator avoidance tactic that spatially separates caribou from wolves at the time when calves are born. During summer and fall herb and shrub foods become more important in the diet of mountain caribou and caribou are usually found in old forests (Seip 1992). During this period, caribou primarily use old stands of sub-alpine fir and Englemann spruce on cool, north aspects. Radio-collared caribou are often found between 1500 and 2000 meters elevation, on gentle slopes within the middle and upper subzones of the ESSF zone (Figure 8, Young and Roorda, 2000).



**Figure 8. Monthly elevation use of radio-collared caribou (from Young and Roorda, 2000).**

### *Early winter (November to mid January) Habitat Use*

Many mountain caribou living in high snowpack ecosystems make early winter movements to lower elevation forests in the ICH zone and at the ICH/ESSF ecotone during or before the first seasonal snowfall. They remain there until snow depths and hardness enable sufficient mobility to re-ascend to late-winter habitat at higher elevations (Rominger and Oldemeyer 1989). The deep, soft snow of early winter produces the poorest mobility and food availability of any season at higher elevations (Paquet 1997). At lower elevations caribou make extensive use of old growth and mature stands of western red cedar and western hemlock. These forest stands provide protection from intense early winter storms, intercept snowfall, provide lichen forage as litterfall, on standing trees and on wind-thrown trees, and provide a source of green vascular forage later in the season than higher elevation habitats. At mid and high-elevations, caribou that utilize the ESSF zone during early winter seem to have a preference for mature and old stands with a large amount of sub-alpine fir.



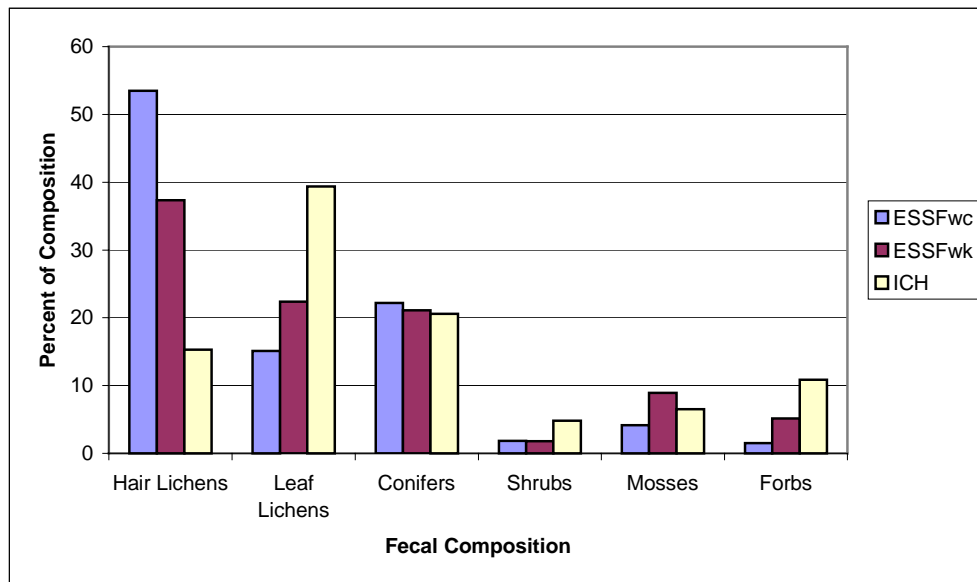
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Local radio-telemetry data has indicated that only a portion of the regional mountain caribou population shifts to lower elevations within the lower subzone of the ESSF and the ICH or SBS zone each year. Seip (1990) reported higher use of the ICH zone in the Cariboo Mountains as compared to Quesnel Highland habitats for caribou in Wells Gray Park. More recent data over a larger area confirm this trend with about 30 percent of early winter relocations in the ICH zone within the rugged Junction and Horsefly inventory blocks (Young and Roorda 2000). Caribou residing in the more subdued terrain within the Stevenson inventory block utilize the ICH zone less (13% of relocations), while caribou in the Barkerville herd rarely (3% of relocations) descend out of the ESSF zone into the SBS zone. Use of lower elevation habitats is also variable between years, with the highest use of the ICH (56% of relocations) observed during years of below normal snowfall levels and the lowest use (12%) observed in years with above average snowfall levels. This relationship is not well understood yet but may possibly be due to decreased availability of ground forage in lower elevation forests, or more favorable snow conditions (i.e. a deeper and more settled snowpack earlier) at higher elevations, during years of increased snowfall.

**Early winter radio-telemetry data shows that early winter use is not always dispersed, but that there are a number of key areas that receive early winter caribou use**, particularly in the vicinity of Quesnel Lake. Some of the key areas include Tasse Lake, Spanish Creek, Long Creek, Hilda Lake, Watt Creek, Roaring Creek, Isaiah Creek, Lynx Creek, Suey Mountain and Crooked Lake.

Early winter diet data from these areas (Figure 9) show that lichens are the largest component of the diet (55 %). The lichens in the diet include both arboreal lichens (hair lichens) and foliose lichens (leaf lichens). There is also an important forb (bunchberry) component to the diet. From both diet and tracking studies, shrubs appear to be used to a lesser extent, though other studies have shown that the dietary use of shrubs can be influenced by the snow accumulation rate (Rominger and Oldemeyer 1990). In some years shrubs such as falsebox and other evergreen shrubs can be more important. On-ground tracking work during the winter period in this area (Ashcroft 1996) and other areas (Rominger and Oldemeyer 1990) has shown that caribou search out wind-thrown trees on the early winter ranges in order to consume the lichens on these dead trees. Dead standing trees in these older forest stands are an important habitat element that contributes to wind-throw and provide a food source to caribou.





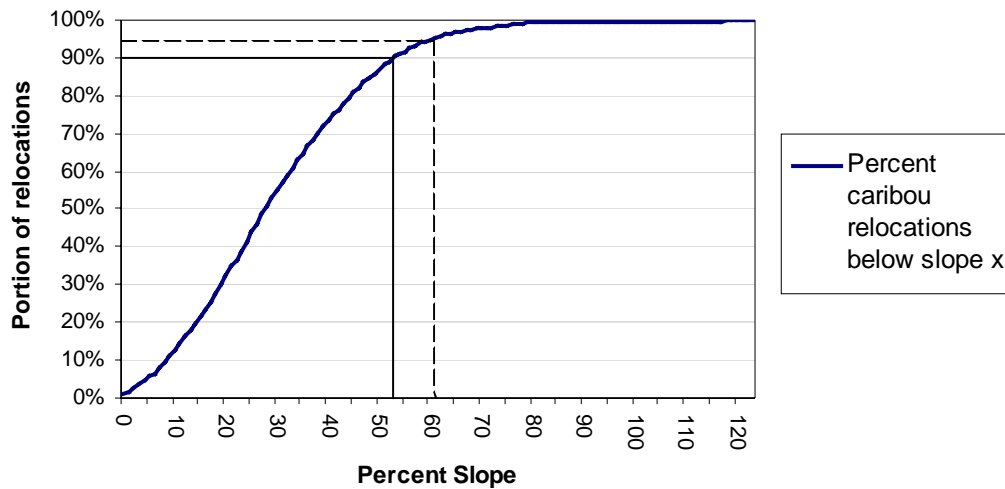
**Figure 9. Early winter diet of mountain caribou in the Cariboo Region.** (Samples collected from November 17, 1995 to January 25, 1996 and November 19 to December 18, 1996; sample sizes were ICHwk n=9; ESSFwk n=3 and ESSFwc & wcp n=14).

#### *Late winter (mid January to mid April) Habitat Use*

With increased depth and settling of snowpack, caribou return to higher elevations where stands of sub-alpine fir dominate the utilized landscape. The high elevation snowpack provides a supportive base for caribou to access arboreal lichen on standing trees. Arboreal lichens, dominated by *Bryoria spp.*, on both standing and down trees, are the only significant forage available and used by caribou during this season (Simpson et al. 1997). This finding is supported locally as samples collected by Seip (1992) from January to March contained only lichens and conifers. As during summer, local caribou are generally found at high elevations (1500 – 2000 meters) on gentle to moderate slopes, primarily within the middle and upper sub-zones of the ESSF (Figure 10).

**Caribou are seldom found on slopes over about 60%, which are more prone to avalanches than more gentle terrain. Forested sites utilized by caribou were primarily old, open, short, sub-alpine fir leading stands on poor sites (Seip 1992, Young and Roorda 2000). Mature and old stands on slopes less than 45% are most heavily used by caribou (80% of telemetry re-locations are on slopes less than 45%).**





**Figure 10. Radio-collared caribou habitat use (n=2713) in relation to percent slope (from Young and Roorda 2000).**

### ***Spring (mid April to the end of May) Habitat Use***

In late April and May, caribou again generally move to lower elevations. Warm aspects are used more often due to earlier snow melt and greening up of these aspects, which allows for improved diet quality. Caribou within the Barkerville and Stevenson inventory blocks remain at higher elevations, where risk of predation is lower, while caribou within the more rugged Junction and Horsefly inventory blocks descend to lower elevation south facing slopes (Apps and Kinley 2000). Recently logged or burned openings are used more in this season than any other (Young and Roorda 2000).

## **2.4 Habitat Suitability Index Modeling**

Multi-scale habitat modeling for mountain caribou utilizing telemetry data from over 150 animals and over 6000 radio-telemetry relocations was completed in early 2000 (Apps and Kinley 2000). This project utilized data from the Quesnel Lake area (Seip 1992), Wells Gray Park (Seip 1990) and from ongoing studies in the Cariboo Region (Young and Roorda 2000) and North Thompson (Apps and Kinley 1999) to develop predictive multivariate habitat models. Model habitat variables were selected from forest cover and terrain attributes. Selection was analyzed at four spatial scales from a broad or landscape level to a fine or stand level of analysis and across four seasons.

Univariate analysis showed that caribou in different areas selected some habitat variables differently. This analysis resulted in the designation of a *highland zone* (includes Barkerville and Stevenson wildlife inventory blocks) and a *mountain zone* (includes Junction and Horsefly wildlife inventory blocks) where caribou habitat needs are slightly different (Apps and Kinley 2000).



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Within the *highland zone*, caribou generally preferred relatively rugged, higher elevation broad landscapes composed of old-growth sub-alpine fir in all seasons. At most scales and across seasons caribou avoided areas of higher site index, younger stand age classes, and pine, Douglas-fir and deciduous species composition.

Within the *mountain zone*, caribou preferred higher elevations only during late winter and summer, and preferred low elevation broad landscapes of old-growth western red cedar and western hemlock and lower alpine composition during early winter. Stands of higher western red cedar, western hemlock, pine, deciduous and Douglas-fir composition were avoided at most scales during late winter and summer and younger stand age classes were avoided at various scales across seasons.

**Map-based predictive multivariate habitat models for each season (spring, summer, early winter and late winter) and zone (*highland* and *mountain*) were developed** to aid in the refinement of ‘no harvest’ and ‘modified harvest’ areas (Apps and Kinley 2000). Figures 3 to 6 summarize important mountain caribou habitat for each season generated from these models.

## 2.5 Habitat and Silvicultural Systems Research

**Specific research designed to find ways of maintaining habitat in managed forests within mountain caribou range has been ongoing in the Cariboo Region since 1989.** A pilot trial of a partial cutting approach designed to continuously maintain arboreal lichen was harvested in the winter of 1990/1991. This was followed by a comprehensive replicated research trial of a group selection system in 1992/1993. Many topics have been studied on this trial including: natural and artificial regeneration, windthrow, stand structure, snow dynamics, lichen abundance and growth, and breeding bird and small mammal response.

Organizational work on an adaptive management trial began in 1997 with harvesting scheduled to start in the winter of 2000/2001. This will involve about 1000 ha of harvesting over a period of at least 4 years. An adjacent 2000 ha will be left as a control. This stage will provide information on the use of large partially logged areas by caribou and will allow a better assessment of operational issues.

Current results of this body of research have been documented in various reports (Newsome 1999; Armleder et al. 2000; Newsome et al. 2000). Several other reports are in preparation or are being planned.



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Major results of the research conducted in the region, based on fifth year results include:

- ☐ **Planted spruce and subalpine fir seedling performance in openings from 0.1 to 1.0 ha is adequate to meet timber yield expectations;** performance is reduced at the very highest elevations bordering alpine parkland.
- ☐ Planted spruce should meet current free-growing and stocking standards in openings from 0.1 to 1.0 ha and subalpine fir can also meet the free-growing standards on most sites but at very high elevations in openings as small as 0.1 ha performance is questionable.
- ☐ **Results indicate the long-term yield that was modeled in the CCLUP Integration Report can be achieved.**
- ☐ Natural regeneration may be a suitable option in years of abundant cone and seed production but not in other years.
- ☐ **Lichen growth rates are somewhat reduced by the treatments and stand-level lichen biomass is reduced; however, it is predicted that caribou habitat will still be maintained.**
- ☐ **Windthrow has not been a problem with the treatments tested.**
- ☐ Small mammal diversity is not affected by the treatments although some shift in habitat use within treatments does occur.
- ☐ Breeding bird diversity is maintained by the treatments although some shift in habitat use within treatments does occur in some species.
- ☐ The need for continued monitoring of the replicated and adaptive management trials is highlighted.

Overall, the recommended group selection silvicultural system appears to be a viable option for both maintaining caribou habitat and timber production at the level modeled in the CCLUP Integration Report.

Besides research conducted in the Cariboo Region there is a considerable body of work from other areas that is highly relevant to the Quesnel Highland caribou. For example, much work has been done in the Prince George Forest Region in ESSF and ICH ecosystems similar to those in the Cariboo Forest Region (Jull et al. 1998, 1999; Stevenson et al. 1999) and in the Nelson Forest Region in ICH (Waters 1997). A complete review of the status of existing knowledge on mountain caribou in managed forests should be available soon (Stevenson et al. *In prep.*).

Major conclusions from other relevant research includes:

- ☐ Corroboration of research results in the Cariboo Region on the silvicultural viability of group selection and support for the recommended opening sizes and cutting cycles.
- ☐ Group selection with openings of 0.24 ha in the ICHwk has produced good seedling growth and survival.
- ☐ The recommended approach for group selection in the ICH is silviculturally viable.
- ☐ The group selection harvesting recommended in ICH is windfirm.



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- ❑ Single-tree selection is another option for the ESSF (at the same volume removal and cutting cycle the caribou strategy recommends for group selection).

**Based on all sources of information, including silvicultural systems research conducted in this and other regions, we are optimistic that the recommended silvicultural system (see section 5.3 on page 27 of this report) will be able to maintain caribou habitat and should have no problem producing the modeled timber yield expectations.**



### 3 CCLUP TARGETS FOR EASTERN CARIBOU

#### 3.1 General

CCLUP targets for eastern caribou by sub-unit were indicated in the 1996 Caribou Strategy Report though the report also identified a need to better define the area based CCLUP targets for eastern Caribou. Based on a thorough review of boundaries, GIS calculations of productive forest land base and direction received from the IAMC (Vanderburgh 1998), clarification of the CCLUP targets resulted in the ‘modified harvest’ and ‘no harvest’ targets indicated in Table 2 and outlined in the 1998 update. IAMC direction to the committee on CCLUP targets can be summarized as follows:

- ❑ The 65/35 split of ‘no harvest’ and ‘modified harvest’ within the previous deferral area should be applied by sub-unit to calculate the distribution of the ‘modified harvest’. As per the Integration Report direction, the calculation should also be made for the Enhanced Resource Development Zone sub-units where they fall above the high elevation line.
- ❑ Adjustments of the deferral line (ie. trading of areas both within and outside the line) may be appropriate, particularly where they are considered beneficial or neutral to caribou and timber as well as other CCLUP targets.
- ❑ Refinements or modifications to ‘Option A’ ( the location of ‘no harvest’ and ‘modified harvest’ areas identified as an interim habitat strategy in the 1996 Caribou Strategy Report) will form the basis of the caribou strategy.

**Table 2. Summary of approved 1998 CCLUP targets by sub-unit (areas in hectares of productive forest land).**

<b>CCLUP Sub-Unit</b>	<b>35% ‘Modified Harvest’</b>	<b>65% ‘No Harvest’</b>	<b>Deferral Area</b>
Cottonwood	3,922	7,285	11,207
Canim	2,681	4,978	7,659
Boss/Deception	7,352	13,655	21,007
Quesnel Highland	13,235	24,580	37,815
Quesnel Lake	20,999	38,998	59,997
<b>TOTAL</b>	<b>48,189</b>	<b>89,496</b>	<b>137,685</b>



### 3.2 Quesnel Forest District Trade Agreements

The above CCLUP targets for ‘modified harvest’ and ‘no harvest’ were utilized as a basis in determining a strategy that would help to maintain caribou and caribou habitat while following higher level and IAMC direction (Benton 1995). Additional radio-telemetry information has since become available for determining new areas of high caribou use (Figures 3 to 6). This resulted in the identification of several important, high use areas, within the range of the Barkerville Herd.

**The committee, local forest industry representatives and MOF and MELP District staff have tentatively agreed to several significant changes in the caribou deferral line within the Quesnel District.** These changes incorporate into the strategy several areas that were previously outside the identified caribou range including: the Mount Tom area, Lottie Lake and Eaglenest Ridge (Figure 11). The committee recommends that these adjustments be accepted as part of the overall caribou strategy.

These trades required the net conversion of 2660 hectares of ‘no harvest’ CCLUP target to 5320 hectares of ‘modified harvest’ CCLUP target (refer to Appendix 4 for a detailed summary of trade agreements within the Quesnel Forest District). This resulted in revision of the CCLUP targets as outlined in Table 3.

**Table 3. Summary of revised CCLUP targets by sub-unit (areas in hectares of productive forest land) – based on trades within the Quesnel District.**

<b>CCLUP Sub-Unit</b>	<b>‘Modified Harvest’ Target</b>	<b>‘No Harvest’ Target</b>	<b>Total Area with Caribou Target</b>
Cottonwood	5,658	6,882	12,540
Canim	2,681	4,978	7,659
Boss/Deception	7,352	13,655	21,007
Quesnel Highland	16,819	22,724	39,543
Quesnel Lake	20,999	38,597	59,596
<b>TOTAL</b>	<b>53,509</b>	<b>86,836</b>	<b>140,345</b>

### 3.3 Low Elevation, Early Winter Range

The CCLUP allowed for the delineation and management of mountain caribou early winter range, under the provisions of the Forest Practices Code, however no specific area based CCLUP target was identified for that purpose. The 1996 and 1998 Caribou Strategy updates recommended that important early winter range be addressed through



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sub-regional planning or be incorporated into Forest Ecosystem Networks or Old Growth Management Areas.

The recently developed Habitat Suitability Index models (Apps and Kinley 2000) have better defined important early winter range, including low elevation areas. Some of these areas are outside the historic deferral area.

**The committee recommends that CCLUP target is shifted from some less important high elevation areas, to insure key low elevation winter range areas receive special management emphasis.** Where possible, these adjustments are through refinement of the historic deferral area to encompass adjacent early winter range. Two isolated areas (i.e. areas not directly connected to the historic deferral area) have also been identified. Some areas of high capability, but significantly fragmented by recent timber harvesting, were excluded.

The refinement of the strategy to better define important early winter range habitats and apply CCLUP target to these areas will help address the travel corridor issue raised in the CCLUP 90 Day Report (1995). The close proximity of the early winter range areas to other areas of ‘modified harvest’ and ‘no harvest’ within caribou range will preclude the need to delineate specific travel corridors.



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## **4 HABITAT STRATEGY – RECOMMENDED LOCATION OF EASTERN CARIBOU CCLUP TARGET**

### **4.1 GIS Analysis Criteria**

The calculated productive forest land estimates for this analysis utilized a newer version of forest cover mapping than previous analyses. The projected date for inventory for these files was January 1, 1999. Also the most recent, more accurate line work outlining the boundaries for Parks and Protected Areas was utilized. When more than one line was available to delineate boundaries they were considered in the following priority: protected area line work, MOF District boundaries line work and, lastly, ownership boundaries line work. This resulted in the delineation of a few hectares of productive forest land outside the newer boundaries but inside the original CCLUP protected area boundaries and an increase in the estimated number of hectares of productive forest land within the historic deferral area. In addition, updated TFL and MOF District files from February 2000 were incorporated into the analysis. These refinements were made to develop the most accurate analysis possible, while insuring the approved CCLUP targets were being met.

Boundaries of ‘no harvest’ and ‘modified harvest’ areas were digitized at a scale of 1:20,000.

### **4.2 Criteria for Delineating Caribou Habitat Areas**

‘No harvest’ areas were selected based on the following criteria:

- ☐ Areas of moderate or high caribou use (from radio-telemetry studies).
- ☐ Areas of moderate to high suitability (from biophysical capability mapping and recently developed habitat suitability mapping)
- ☐ Relatively large areas were identified instead of small areas (i.e. large, contiguous areas of suitable habitat).

At the landscape level, the identification of ‘modified harvest’ as compared to ‘no harvest’ areas for eastern caribou utilized similar criteria as outlined in the 1996 caribou strategy report, as follows:

- ☐ Areas of lower current use were identified instead of areas of high use (from radio-telemetry studies).
- ☐ Areas of lower present suitability (but still important caribou habitat) were identified instead of areas of high suitability (based on biophysical capability mapping).



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- ☐ Areas of lower recreational accessibility were identified instead of areas of higher recreational accessibility (e.g. east side of North Arm of Quesnel Lake).
  - ☐ Relatively large areas were identified instead of small areas.
  - ☐ Peripheral areas were identified instead of central areas.
  - ☐ Delineation of boundaries considered the tentative trade agreements within the Quesnel District.

These criteria were selected to locate ‘modified harvest’ in areas that would pose the least risk to the overall regional mountain caribou population, based on current understanding of mountain caribou biology and conservation biology principles.

Detailed terrestrial ecosystem maps were not available for the complete area and therefore were not utilized during this review. However, the habitat suitability index mapping developed by Apps and Kinley (2000) was central to the refinement of both ‘no harvest’ and ‘modified harvest’ areas. The historic high elevation line was rationalized utilizing the following criteria:

- ☐ The seasonal habitat suitability index model maps (early winter, late winter, spring & summer) developed by Apps and Kinley (2000) from local radio-telemetry data for this general area.
- ☐ Input from the forest industry and the conservation sector that was considered neutral or beneficial for caribou.
- ☐ Generally, the lower limit of high elevation habitat is approximately 1500 meters elevation; thus this contour is often used to delineate the upper limit of conventional harvest.
- ☐ As steeper terrain is of lower quality to mountain caribou, in areas where it is encountered near the boundary of valuable caribou habitat, the upper limit of conventional harvest has been extended to 1600 and in some cases 1700 meters elevation.
- ☐ Cool aspects at mid elevations, with gentle terrain, are of high value to mountain caribou, thus in these areas conventional harvest may only extend up to 1300 or 1400 meters elevation.
- ☐ Where existing or approved logging occurs near the edge of valuable mountain caribou habitat, the upper edge of these openings has been utilised to delineate the upper limit of conventional harvest.
- ☐ The upper ends of several valleys were delineated for special management for mountain caribou (‘modified harvest’ or ‘no harvest’) to:



- ☐ Maintain relatively wide contiguous patches of valuable caribou habitat.
- ☐ Insure that movement between caribou habitat of high quality is maintained.
- ☐ Where the present suitability of an area near the edge of valuable habitat was identified as low, but the area is expected to have high capability in the long term, the outer edge of the area was used to delineate the upper limit of conventional harvest.

Figure 12 depicts the habitat strategy or zonation recommended by the committee. The ‘no harvest’ and ‘modified harvest’ areas identified in Figure 12 meet the overall area based CCLUP targets for eastern caribou but not specific sub-unit targets as outlined in Table 4.

**The committee recommends that CCLUP sub-unit targets for ‘modified harvest’ and ‘no harvest’ be adjusted to reflect the shift of target as outlined in Table 4.**

Several situations have resulted in approved cutblocks being located within the refined areas delineating ‘modified harvest’ and ‘no harvest’. For example, some areas along the edges of ‘no harvest’ have good long-term capability and therefore were left within the ‘no harvest’ area. The committee anticipates that these blocks will proceed as approved in all cases but one, where a licensee has agreed to delete the block in favour of line adjustments in another area (refer to Appendix 5 for details on the existing approved cutblocks).

**Table 4. Recommended eastern caribou strategy area summaries by sub-unit (areas in hectares of productive forest land).**

<b>CCLUP Sub-Unit</b>	<b>Recommended ‘Modified Harvest’ Target</b>	<b>Recommended ‘No Harvest’ Target</b>	<b>Recommended Total Caribou Target</b>
Cottonwood	4,857	6,948	11,805
Canim	965	4,938	5,903
Boss/Deception	4,688	11,751	16,439
Quesnel Highland	15,604	23,230	38,834
Quesnel Lake	27,395	39,969	67,364
<b>TOTAL</b>	<b>53,509</b>	<b>86,836</b>	<b>140,345</b>



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### 4.3 Rationale for Changes to the Interim Strategy

**The Committee recommends that the location of ‘modified harvest’ and ‘no harvest’ areas depicted in Figure 12 form the basis of the eastern caribou habitat strategy.**

The ‘modified harvest’ areas were selected to best maintain caribou values while taking into account stakeholder values and making the best use of overlap opportunities to better meet all CCLUP targets, as directed by the committee Terms of Reference (see Appendix 1).

The rationale for changes from earlier versions of the (interim) strategy is summarized, by CCLUP sub-unit, as follows:

#### *Cottonwood Sub-unit*

The 1998 clarification of CCLUP targets by the IAMC confirmed that there was to be a 35% ‘modified harvest’ target in this CCLUP sub-unit. Previously, in 1996, there was only ‘no harvest’ caribou target in this sub-unit. Thus the same criteria as used in 1996 were utilized in 1998 to locate the 35% ‘modified harvest’.

In 2000, in order to accommodate trades within the Quesnel District and the shifting of target to low elevation early winter range areas near Quesnel Lake, significant areas of ‘modified harvest’ were converted to ‘conventional harvest’ within the Rollie/Porter Creek area and north of Cariboo Lake. As a result of the trade agreements within the Quesnel District new areas of ‘modified harvest’ were created north of Lottie Lake, near Mt. Tom and Eaglenest Mountain. East of the Cariboo River a significant area of ‘no harvest’ was converted to ‘conventional harvest’ south of Black Stuart Mountain.

#### *Canim Sub-unit*

The 1998 clarification of CCLUP targets by the IAMC indicated that there was a 35% ‘modified harvest’ target in this CCLUP sub-unit. Previously, in 1996, there was only ‘no harvest’ caribou target in this sub-unit. The same criteria as used in 1996 were utilized in 1998 to locate the 35% ‘modified harvest’, particularly the criteria of identifying peripheral areas instead of central areas.

For 2000 in order to accommodate the shifting of target to low elevation, early winter range areas near Quesnel Lake, significant peripheral areas of ‘modified harvest’ were converted to ‘conventional harvest’ within the upper Horsefly River in the vicinity of Big Slide Mountain, Caput Mountain and Eureka Peak.

#### *Boss/Deception Sub-unit*

Between 1996 and 1998 there were no changes recommended in this CCLUP sub-unit because the ‘modified harvest’ was already close to the target.



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The general habitat strategy for this sub-unit has been revised in order to accommodate the shifting of target to low elevation early winter range areas near Quesnel Lake. To accommodate this shift, significant peripheral areas of 'modified harvest' were converted to 'conventional harvest' in the vicinity of Caput Mountain and Eureka Peak. In addition, large areas west of Boss Mountain and Watchman Mountain were converted from 'no harvest' to 'modified harvest'. The change near Boss Mountain resulted in an increase in the amount of 'modified harvest' within the 100 Mile House TSA.

The revised habitat strategy in this sub-unit is to designate areas of valuable caribou habitat adjacent to park first as 'no harvest', then 'modified harvest' and lastly 'conventional harvest', as viewed from east to west (moving from higher suitability to lower suitability areas).

### ***Quesnel Highland Sub-unit***

In 1998 the 'no harvest' area in this CCLUP subunit was increased to be closer to the confirmed target and the Nugget Mountain area was added to the 'no harvest' category following the criteria to select areas of higher relative use and larger, contiguous areas instead of small areas.

For 2000, most major adjustments were undertaken in recognition of the trade agreements within the Quesnel District. This resulted in new areas of 'modified harvest' being created in the vicinity of Mt. Tom and Eaglenest Mountain while other areas in the vicinity of Mount Anderson and Cow Mountain became 'conventional harvest'.

### ***Quesnel Lake Sub-unit***

Between 1996 and 1998 the most significant changes occurred within this CCLUP sub-unit. Expanded radio-telemetry data and consolidation of 'modified and no harvest' areas drove the largest changes. 'Modified harvest' was shifted from the Amos Creek, Devoe Creek and Black Stuart Mountain areas across the north arm of Quesnel Lake to Lynx and Penfold Creeks.

The consolidation of 'modified harvest' in the Quesnel Lake Sub-unit will create a large area of 'modified harvest' between Cariboo Mountains Park and Quesnel Lake, which is intended to serve as the major test area to insure the 'modified harvest' prescription provides caribou habitat over the long term. The presence of Quesnel Lake should limit recreational access into the area and minimize confounding factors in this proposed test. **In order to allow this important test to successfully occur the committee recommends that motorized recreational access be carefully regulated or excluded from this area (see Appendix 6).**



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For 2000, ‘modified harvest’ CCLUP target was shifted from high elevation areas into a few key areas of low elevation early winter range along both the north and east arms of Quesnel Lake. This was achieved by converting several areas to ‘conventional harvest’ throughout the Horsefly District.



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## 5 TIMBER HARVESTING STRATEGY

The range of the Eastern caribou has been well defined by years of radio-telemetry data (Figures 3 to 6). The vast majority of the current range of the regional mountain caribou population was included within the historical deferral area for caribou and in the adjacent parks. The exceptions to this included:

- ❑ areas that are used as low elevation early winter range in the Interior Cedar Hemlock (ICH) zone, and
- ❑ several areas outside the CCLUP caribou area that the committee is recommending as trade for lower value caribou areas (Figure 11) within the CCLUP caribou deferral.

The caribou strategy is recommending adjustments in ‘modified harvest’ and ‘no harvest’ boundaries to accommodate a significant portion of these areas that were not in the historical deferral, so that they can be managed to maintain caribou habitat values.

Given this setting, there should be a threefold approach for managing the habitat of the mountain caribou in the region:

### ***1. Park and ‘No Harvest’ Areas***

These areas provide a core habitat that will have little or no road access (some ‘salvage’ harvesting in ‘no harvest’ as acknowledged in the CCLUP Integration Report). This provides caribou not only with suitable space (habitat) in which to meet their needs but also a large area relatively free of harvest and harassment by humans (provided there is no use of snowmobiles and all terrain vehicles (ATV’s), and that other activities are adequately controlled). Since early seral habitat will be limited to that created through natural disturbance (or salvage harvesting as per the Integration Report), moose and deer populations will not be greatly enhanced which will help protect caribou from additional predation pressures caused by increased wolf numbers.

### ***2. ‘Modified Harvest’ Areas in the ESSF***

These areas will be managed to maintain caribou habitat continuously through time and space. All recommendations are fully compatible with the impacts modeled in the Cariboo-Chilcotin Land Use Plan Integration Report (1998). Harvesting approaches and forest management strategies are intended to discourage the enhancement of moose and deer habitat as increases in these ungulates can lead to more wolves and greater predation on caribou. Stringent access control measures will be necessary.

### ***3. ‘Modified Harvest’ Areas in the ICH (Low Elevation Early Winter Range)***

These areas represent a few of the most important low elevation early winter areas and will be managed to maintain caribou habitat continuously through time and space. Necessary ‘modified harvest’ capital for these areas was obtained by moving modified harvest hectares from the ESSF. All recommendations for ‘modified harvest’ are fully



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compatible with the impacts modeled in the Cariboo-Chilcotin Land Use Plan Integration Report (1998). Harvesting approaches and forest management strategies will also discourage the enhancement of moose and deer habitat. Stringent access control measures will be necessary.

Additional dispersed use of low elevation habitat occurs in old cedar hemlock stands in many other areas (Figure 4). It is recommended that caribou requirements in these areas be considered through provisions of the Forest Practices Code. It is recommended that these stands not be converted to pine and spruce (refer to section 5.4 Post-Harvesting Recommendations).

## 5.1 General Forest Development Recommendations Within the ‘Modified Harvest’ Areas

**The following timber management approach is recommended in all ‘modified harvest’ areas:**

- ☐ An even flow of timber access across the entire caribou ‘modified harvest’ area by TSA<sup>2</sup> is recommended.
- ☐ This means that approximately 25% of the area would be available for ‘modified harvest’ every 20 years<sup>3</sup>. Insect and/or disease outbreaks may require deviation from an even flow of timber. However, the impact to caribou should be carefully considered before any changes are made.
- ☐ Within each district this is implemented by limiting harvest to a maximum of 1/3<sup>rd</sup> of the following areas in any 20-year period, with one exception<sup>4</sup>: TFL #52, Quesnel TSA, Williams Lake TSA north of Quesnel Lake and Williams Lake TSA south of Quesnel Lake.
- ☐ Forest development in caribou range must be spatially and temporally concentrated. Aggregate harvesting in major parts of landscape units over short time periods (5 years), then de-build roads once the main silviculture activities are completed and do not enter the area again for 20 years or more.
- ☐ Concentrate logging by harvesting large cut-blocks (e.g. 250 hectares) using the silvicultural system described in section 5.3.

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<sup>2</sup> Excluding 100 Mile TSA because the area of ‘modified harvest’ for caribou is small.

<sup>3</sup> Calculated as follows: 20 year period divided by 240 years, expressed as a percent times 3 (33% volume removal).

<sup>4</sup> Excluding 100 Mile District because the area of ‘modified harvest’ is relatively small.



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## 5.2 Operational Location of Harvesting Boundaries

The caribou strategy's boundaries for 'no harvest' and 'modified harvest' areas have been developed to best maintain caribou habitat values within the planning framework of the CCLUP and, therefore, are integral to the overall strategy. These boundaries were located using caribou habitat modeling, topographical analysis, caribou research, local knowledge, and stakeholder input. Major revisions to these boundaries should only be considered as part of a comprehensive, overall review of the caribou strategy.

The boundaries in the caribou strategy were drawn as accurately as possible at the 1:20,000 scale. **In order to provide some flexibility at the operational level, the boundaries may be adjusted to address local topography, optimization of timber development, worker safety issues and the establishment of windfirm boundaries.**

The following recommendations are provided for making operational-level boundary adjustments:

- ☐ boundary adjustments of up to 200 m can be made using this process;
- ☐ these adjustments must be neutral or beneficial for maintaining caribou habitat;
- ☐ when a licensee proposes a boundary adjustment, either up or down, they must propose a similar adjustment in the opposite direction in the local area to balance the hectares involved;
- ☐ a proposed adjustment will require the approval of the DM and the DEO, or their designates;
- ☐ when an adjustment is approved, the changes should be sent electronically to the MELP regional office for boundary updating.

These adjustments will be tracked on an on-going basis and incorporated into the Mountain Caribou Strategy upon its next review.

## 5.3 Recommended Silvicultural Systems in 'Modified Harvest' Areas of Caribou Habitat

The best way to maintain caribou habitat in a managed forest is to apply the group or single-tree selection systems as described in this strategy (Table 5). Group selection can be applied on all moderate slopes through the use of appropriate logging methods as demonstrated in other regions of the province. Mature and old stands on slopes less than 50% are most heavily used by caribou (~85% of locations; Figure 10) and therefore should have the highest priority for maintaining habitat value through the application of group or single-tree selection. However, the logging methods necessary for applying group selection on steeper ground are often more difficult, expensive and require special equipment.



**All cutblocks with slopes up to 40% must be harvested using the group or single-tree selection system.** Even if ground skidding is not used, other logging methods must be employed to implement these selection systems on these slopes. However, ground based logging equipment (especially tracked skidders) can effectively operate on moderately steep slopes (41-50%). We strongly encourage the use of group selection even on 41-50% slopes to have the best chance of maintaining caribou habitat. Figure 10 shows that caribou use of slopes between 40-50% is very significant.

**The silvicultural systems recommendations are the same for ESSF and ICH areas.** All recommendations for ‘modified harvest’ are fully compatible with the impacts modeled in the Cariboo-Chilcotin Land Use Plan Integration Report (1998).

**Table 5. Recommended silvicultural systems in ‘modified harvest’ ESSF and ICH areas within mountain caribou habitat.**

SLOPE (%)	SILVICULTURAL SYSTEM <sup>1</sup>	TYPICAL LOGGING METHODS <sup>2</sup>
Gentle or moderate (0-40)	Group or single-tree selection	Ground skidding
Moderately steep (41-50)	Group or strip selection	Ground skidding, cable yarding or aerial yarding
Steep (>50)	Strip or group selection	Cable or aerial yarding

<sup>1</sup> group selection is the preferred silvicultural system at all slopes for maintaining caribou habitat.

<sup>2</sup> site conditions may influence specific logging method used.

### 5.3.1 ‘Modified Harvesting’ Approach in the ESSF and ICH on Gentle (0 – 40%) to Moderate Slopes (41-50%)

Both group selection and single-tree selection have the potential to maintain caribou habitat. A comparison of the merits of each system will be provided in Stevenson et al. (*In prep*). Group selection is recommended in this strategy for several main reasons:

- ☐ it is easier to successfully implement;
- ☐ it is less costly to harvest;
- ☐ the success of group selection is less dependent on the pre-harvest stand structure;
- ☐ it easily allows for the retention of safe, dead, lichen-bearing trees in the uncut parts of the stand; and
- ☐ there are regional examples and experience in applying it in the ESSF.



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This does not suggest that single-tree selection is never appropriate; if it is being contemplated, follow the recommendations in Stevenson et al. (*In prep*). Silvicultural systems recommendations for this slope range are provided in Table 6.

**Table 6. Harvesting recommendations for implementing a group selection silvicultural system in ‘modified harvest’ ESSF and ICH areas of mountain caribou habitat in the Cariboo Region.**

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**Group Selection Recommendations for ESSF and ICH**

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- ❑ **33% removal** on an area basis including skid trails but excluding roads and landings.
  - ❑ **80 year cutting cycle (240 year rotation).**
  - ❑ **Openings should be from 0.2 to 1.0 ha in size and should be at least 2 tree-lengths wide.**
  - ❑ Shape of the openings can vary to incorporate natural clumps of trees within the stand while allowing efficient skidding.
  - ❑ Distribute openings throughout the block so that the second and third entries can also be well distributed.
  - ❑ **Keep openings at least ~2 tree lengths apart where possible.**
  - ❑ Calculate the area in skid trails as this contributes to the 33% removal.
  - ❑ Flag boundaries of openings.
  - ❑ Use GPS to map openings and to track the target removal by area including skid trails.
  - ❑ Use designated skid trails between openings.
  - ❑ Retain standing dead trees within the safety regulations of WCB.
  - ❑ Harvest carefully to minimize damage to residual stems.
  - ❑ Conventional or no tail-swing fellerbunchers, or hand-falling can be used to implement the prescription.
  - ❑ Season of harvesting does not significantly impact caribou.
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### **5.3.2 ‘Modified Harvesting’ Approach in the ESSF and ICH on Moderately Steep (41 – 50%) and Steep Slopes (>50%)**

Stands on steep slopes are used less by caribou and are more challenging to harvest with a selection system. However, some cable and helicopter systems are compatible with implementing group selection prescriptions on steeper ground and are recommended to ensure the maintenance of caribou habitat. The harvesting prescription would be essentially the same as for gentler ground with any differences related only to conducting successful cable or helicopter logging operations.

The quality of caribou habitat will be eroded if the decision is made not to use the group selection systems on moderately steep slopes (41-50%). An alternative to at least maintain some habitat value, is a strip selection system with 33% of the cut-block harvested every 80 years (Table 7). This will result in part of each stand having older lichen-bearing trees at all times, thereby providing some habitat attributes for caribou. This approach is far less desirable than the other selection systems. Long strips are more likely than small openings to channel wind, increasing the risk of windthrow of trees and wind scouring of lichens. Strips will also modify the micro-climate of the adjacent uncut



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parts of the stand potentially reducing lichen growth more than group selection openings. At certain stages of stand development, they are more likely to interfere with caribou movements than small openings.

**Table 7. Harvesting recommendations for implementing a strip selection silvicultural system on steep slopes in ‘modified harvest’ areas of mountain caribou habitat in the Cariboo Region.**

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**Strip Selection Recommendations for Cable Yarding on Steep Slopes in the ESSF and ICH**

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- ❑ **33% removal** on an area basis excluding roads and landings.
  - ❑ **80 year cutting cycle (240 year rotation).**
  - ❑ Harvested strips should not be more than 2-3 tree lengths wide; uncut strips will be twice this width to meet the maximum 33% removal.
  - ❑ Retain standing dead trees within the safety regulations of WCB.
  - ❑ Harvest carefully to minimize damage to residual stems.
  - ❑ Season of harvesting does not significantly impact caribou.
  - ❑ Take appropriate steps to ensure that the residual stand will be windfirm.
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## **5.4 Post-Harvesting Recommendations**

### ***Species Selection For Regeneration***

Old ESSF and ICH forests in caribou range typically are multi-layered stands of moderately to highly shade-tolerant conifer species. In the ESSF, this species mix is spruce-subalpine fir, while in the ICH, this species mix is typically western red cedar-western hemlock. Older trees of these species and the associated stand structures are required to maintain caribou habitat. Artificial regeneration of harvested areas should favor these shade tolerant long-lived species.

### ***Site Preparation***

Mounding is the most commonly used method for creating warmer micro-sites and reducing vegetative competition for planted seedlings, and it is easily used with group selection systems. Other forms of site preparation are also available. To maintain caribou habitat, the clumpy stem distribution that is typical of ESSF forests should be maintained and encouraged. Clumpy mounding (either long double mounds or groups of 2-5 adjacent mounds) is recommended to promote an aggregated stem distribution in the harvested openings. Slash or brush should be piled away from the clumps in a manner that does not impede wildlife movement. Large accumulations of debris may require burning prior to planting.



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### ***Advance Regeneration***

For partial-cut systems in caribou habitat, retention of advance regeneration and larger residual stems provides age and size classes of trees not provided for many years by planted seedlings and newly-established natural regeneration. Several studies have shown that some advance regeneration and larger residual stems release well and provide vigorous, high-quality growing stock. Retained trees should meet the acceptability criteria<sup>5</sup>, as highly suppressed stems may not respond. Where necessary, the choice of harvest system, equipment, and harvesting layout should take into account objectives for post-harvest retention of these tree layers.

### ***Natural Regeneration***

Cone and seed production for spruce and subalpine fir in high elevation forests varies greatly in time and space. Natural regeneration can be successful in harvested openings of less than 1 ha, provided high seed production occurs shortly after logging and an appropriate seedbed is available. However, height requirements in stocking standards may need to be adjusted for high elevation forests. Unfortunately, the unreliability of cone and seed production at high elevations makes natural regeneration in any given year unpredictable.

### ***Artificial Regeneration***

In the ESSF seedlings should be planted to achieve a clumpy stem distribution. Although there is no single ideal pattern, an example might be planting an average of four seedlings per clump and spacing clumps approximately 5-7 metres apart to achieve a stocking of about 800-1200 stems per hectare. Minimum inter-tree spacing should be reduced to 1.0 metre to facilitate cluster planting although, on average, trees would be planted wider than 1 metre even within clumps. Planting on clumpy mounds (up to a maximum of 5 mounds) will achieve the desired spatial arrangement of stems. However, even without mounding, planting on naturally raised micro-sites may promote an aggregated stem distribution. Natural features such as raised micro-sites can enhance seedling growth.

In artificial regeneration, the pre-harvest stem distribution of *Abies* versus spruce should be reflected in the planted stock. **Lodgepole pine should not be planted in mountain caribou habitat due to the self-pruning nature of pine, which holds less arboreal lichen.**

In the ICH, stands should be regenerated with a species composition similar to natural late-seral stands. A diverse stand of long-lived species should be encouraged with western red cedar and western hemlock as dominant species, mixed with spruce, subalpine fir, and some Douglas-fir. Regeneration of short-lived, early-seral species such

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<sup>5</sup> Appendix 10 – Advanced Regeneration, Establishment to Free Growing Guidebook: Cariboo Forest Region.



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as lodgepole pine should be discouraged as their silvics, life cycle, and habitat attributes are undesirable for mountain caribou habitat.

Site preparation and vegetation management options in these openings are limited. Stock type selection should favor larger stock types where there is adequate soil depth. PSB 412 or 415D should be considered a minimum, with PSB512 recommended on higher brush hazard sites.

### ***Vegetation Management***

Brush hazard increases with increased light on many of these sites. Good site preparation is key to regeneration success on brush hazard sites. Manual brushing and ground based herbicide applications may be required to maintain the level of seedling growth required to meet ‘free growing’ minimum height standards. Ground-based herbicide applications must be delivered in a manner that reduces the potential drift onto lichens in the surrounding stand.

### ***Stocking Standards and Free Growing Guidelines***

Guidelines developed for clearcutting with a 120-year rotation may not be appropriate for partial cutting with extended rotation lengths of 240 years, especially at high elevations where caribou habitat is found. For example, if natural regeneration is used, then the stocking standards will have to reflect the length of time required for a seedling to reach an acceptable size. Also, planting guidelines may need adjustment to allow for variations in spatial distribution of seedlings to reproduce the clumpy nature of these high elevation stands. Survey techniques may also have to be adjusted to suit these different methods. Even if an extended regeneration period is a result of using this harvesting system, it will not be a long-term concern because the CCLUP Integration Report (1998) has modeled ‘modified harvesting’ to take 240 years to produce the same yield that clearcutting can in 120 years.

## **5.5 Appraisal Allowances for Implementing the Recommended ‘Modified Harvest’ Prescription**

Total costs (pre-harvesting to post-harvesting) associated with these silvicultural systems are considerably higher than conventional clearcutting. Licensees have indicated that the appraisal system does not adequately recognize these increased costs.

Actual cost data incurred from applying the recommended prescriptions in this region are currently limited to data obtained from the regional research trials harvested in 1992/3. Weldwood of Canada (Williams Lake) recorded logging costs; however, it is likely that the costs incurred implementing the research trial do not reflect operational scale harvesting. Some additional data are available from more recent trials with very similar prescriptions at Pinkerton Mountain in the Prince George Region. Detailed cost data associated with all phases of implementing the recommended silvicultural systems are



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expected to be gathered by FERIC on the adaptive management trial at Mount Tom in the Quesnel District in early 2001.

**A timely resolution of the appraisal allowance issue in relation to the recommended silvicultural systems is essential to the successful implementation of the caribou strategy.**



## 6 ACCESS MANAGEMENT RECOMMENDATIONS

Current knowledge suggests that the long-term persistence of mountain caribou is dependent upon the perpetual supply of large, contiguous areas of suitable summer and winter habitat, with little or no vehicle access and human disturbance. In such areas caribou can space out at low densities ( $\sim 40/1000 \text{ km}^2$ ) and reduce predation risk (Seip and Cichowski 1996).

The eastern caribou strategy partially addresses access management concerns by locating 'modified harvest' in large, aggregated areas. If followed, this strategy will minimize access development across the entire caribou winter range, thereby reducing the overall impact of access development on the caribou population.

**In addition to a broad-scale, landscape approach to address access concerns, the committee recommends the following access measures where timber harvesting proceeds within caribou range:**

- ☐ An aggregated cut (in time and space) in specific landscape units over short time periods (5 years), followed by de-building roads once the main silviculture activities are completed and not entering the area again for at least 20 years.
- ☐ The high end of the block size distribution as specified in the Biodiversity Guidebook (250 hectares) should be utilised for selection harvesting;
- ☐ Non-commercial and commercial motorised recreational access within caribou winter ranges are considered a major conservation threat due to disturbance and the potential displacement of the caribou. Both recreational and commercial recreational uses of snowmobiles, all terrain vehicles and helicopters should be carefully regulated or excluded from sensitive caribou winter range areas, as indicated in Figure 13.
- ☐ Access control points will need to be developed for each drainage (access control will need to include a combination of gates and bridge removal, depending on the circumstances).
- ☐ Motorised hunting access restrictions will need to be put in place in some situations.
- ☐ An overall road access management plan that addresses road closures and road deactivation (ideally road de-building) within caribou winter range should be developed. The objective is to have the minimum number and length of road within caribou habitat.
- ☐ The length of road kept open by snow ploughing during winter months should be minimised within caribou habitat.



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- ❑ Helicopter logging may be required in some areas in order to minimise road development.
  - ❑ Permanent road access development should be minimised throughout caribou range including lower elevation winter range. If roads are developed in these areas, seasonal access restrictions should be applied to minimise overlap with caribou seasonal use.

**Snowmobile activity on caribou winter ranges is considered a major conservation concern because of its potential displacement impact on caribou distribution** (refer to Appendix 6 for details on mountain caribou and motorized recreation). Sensitive areas, where snowmobiling restrictions are necessary in order to maintain caribou use, are identified in Figure 13.

Currently a planning process involving an IAMC technical planning team and local snowmobile clubs is underway. It is hoped that this process will help determine a snowmobile zoning strategy for the region, including the eastern caribou areas, that will maintain caribou use of suitable habitat.

A snowmobiling strategy must include a clear and effective enforcement strategy if caribou populations are to be maintained.



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## 7 PREDATOR MANAGEMENT RECOMMENDATIONS

Caribou populations in the boreal forests of North America have historically co-existed with predators, including wolves (Bergerud and Page 1987). Relative to other ungulates, caribou occur at low densities and spread out over large areas, effectively reducing the predation rate. However, this anti-predator strategy is only effective if caribou are the primary prey species in the area (Seip 1991) and have sufficient suitable habitat in which to spread out.

Mountain caribou in the eastern part of the Cariboo Region exist within a complex predator-prey system where caribou, moose, mule deer and mountain goat provide food for wolves, grizzly bear, black bear, cougar, coyote and wolverine. It is possible for predator numbers to remain relatively high in this multiple prey-predator system even when predation drastically reduces one of the prey species.

Caribou are extremely vulnerable to predation compared to most other ungulates (Seip 1991) because of their low densities and lower reproductive rate than moose or mule deer. Therefore, caribou are usually the most vulnerable species in a multiple prey-predator system and are the first to decline and the last to recover (Seip 1991).

Seip (1991) 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. In fact, forest-dwelling caribou have declined or been eliminated from large parts of their historic range in northern Ontario, Saskatchewan, Alberta and British Columbia during the 1900's. Increased wolf predation on woodland caribou populations appears to be related to the range expansion of moose in North America (Bergerud 1974, Seip 1990). In the Cariboo Region, moose did not become numerous until after the early 1900's.

Wolf predation appears to be the primary cause of declining caribou numbers in the Quesnel Lake area based on current regional population research associated with development of this strategy and previous work by Seip (1992). Wolves are sustained primarily by moose throughout the year, but become major predators on caribou during summer and early winter, when caribou, wolves and moose occupy similar areas.

Strategies such as seasonal migrations of caribou to alpine areas and habitat segregation between different ungulate species allow caribou to coexist through spatial separation from wolves and alternate prey (Bergerud et al. 1984; Seip 1990). However, changes to habitat through timber harvesting or fire, which enhance moose populations may negatively affect caribou populations by:

- ☐ Producing early seral stages with enhanced understory shrub and forb production, which increase the numbers of other prey species (e.g. moose) and in turn increase predator populations.
- ☐ Restricting caribou into old-growth habitat patches, which may increase the search efficiency of predators.



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- ❑ Providing easier access, through construction of roads, for predators to travel into caribou habitats.

It is essential that mountain caribou have adequate space to avoid excessive levels of predation. Movement away from areas of high prey numbers, both in elevation and in distance, appears to be critical to their long-term survival (Bergerud 1992).

**Direct management intervention may be required to maintain caribou herds in areas where habitats have been degraded, predator levels are high due to alternate prey species abundance or where there is a high level of road access.** Such 'compensatory' management (i.e. compensating for loss or alteration of habitat or changes in alternative prey densities) may require management actions such as reducing wolf and moose populations in highland areas where caribou and moose ranges overlap. If present trends continue and no compensatory management is undertaken, it is likely that the remaining caribou herds that summer in highland areas will become extirpated.

Wolves adjust their numbers on the basis of overall prey biomass (Van Ballenberghe et al. 1975; Keith 1983; Fuller 1989; Bergerud and Elliot 1998). As such, implementation of a moose density reduction program within caribou range, coupled with limited wolf management, could help to ensure the best probability of maintaining eastern caribou by lowering wolf density over the area.

**Based on the presently declining population levels of mountain caribou in this region and the strong link between this decline and wolf predation, the committee recommends the following predator/prey management measures be developed, in consultation with stakeholders and First Nations, within the eastern caribou range:**

- ❑ **Development of a modified regional moose management strategy that incorporates higher harvest rates for moose populations within and adjacent to the caribou range.** Such a strategy needs to be applied until caribou population densities recover to levels that can sustain wolf predation impacts. Moose populations in these areas should be managed at a lower, stable density over the long term.
- ❑ **Concurrent to a reduction of moose density within and adjacent to caribou range, a wolf management program should be developed.** This program needs to identify those individual wolves or packs that prey on caribou and implement measures that will decrease the magnitude of these impacts. Wolf removal and sterilization (to limit increases in the wolf population) are two measures that will need to be considered in order to ensure that caribou are not preyed upon at a higher rate, particularly during the early stages of moose density reduction. All parts of the caribou range should be under consideration for this program, though the areas south of Quesnel Lake should be the highest priority due to the significant decline in caribou numbers that has occurred there.



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- ☐ Development of a comprehensive access management strategy within caribou range in order to minimize permanent road development and restrict motor vehicle activities that overlap with seasonal caribou use, thereby preventing the enhancement of wolf travel corridors in caribou habitat.
  - ☐ Implementation of forest management practices that limit the establishment or persistence of favourable habitat which encourage moose populations within or adjacent to the eastern caribou range.



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## 8 CONSERVATION RISK ASSESSMENT

There is a risk that the mountain caribou sub-populations that occur in this region may not persist into the future. During the last 100 years, both the range and numbers of caribou in the eastern portion of the region have declined significantly.

**The mountain caribou population is now red-listed in the province, which is an acknowledgement that there is a risk of extirpation or extinction if current trends continue.** This risk of population extirpation is particularly high for *mountain* and *highland zone* caribou that have overlapping seasonal ranges with moose.

The overall strategy recommended in this report for eastern caribou is comprised of a number of individual, but interrelated, strategies that have been selected to provide the best opportunity for maintaining caribou, while taking into account stakeholder values and meeting the land use targets identified in the CCLUP. These individual strategies include a habitat strategy (i.e. which caribou habitat areas are identified as ‘no harvest’, ‘modified harvest’ or ‘conventional harvest’), a timber harvest strategy (i.e. how to maintain caribou habitat values in areas that are harvested), an access management strategy and a predator management strategy. These strategies must be applied together, as a package, in order to have the best chance of maintaining caribou into the future.

The likelihood that mountain caribou will persist in this region at a viable population level is dependent on a large number of risks and how these risks are managed. Tables 8 and 9 identify some of the most important risks to caribou population maintenance, (including: timber harvest, access development, recreational use and wolf predation) and assess these risks in relation to whether or not the eastern caribou strategy is successfully applied. Table 8 summarizes the estimated risks to caribou in the absence of a regional mountain caribou strategy, while Table 9 summarizes these risks given the entire application of the recommended strategy.

Many of the identified risks can be reduced if the eastern caribou strategy is effectively applied. For example, one risk of timber harvesting within and adjacent to caribou habitat areas is that this will increase the moose population if conventional logging and forest management practices are utilized. This is because conventional practices enhance understory shrub and forb production in early seral stages, consequently enhancing moose productivity in the area. Higher moose population levels in these areas could result in a larger wolf population and increased predation rates on caribou. Logging also can result in habitat loss and creates road access that can contribute to higher predation, increased human disturbances (through recreational access) and poaching. These risks can be reduced if the timber harvest, access and predator strategies recommended by the committee are applied. Hence, in this preliminary analysis the overall risk of timber harvest within caribou areas is generally deemed to be moderate if the eastern caribou strategy is adopted and applied over the long-term (very high if the strategy is not applied).



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The risk to caribou of increased motorized recreation (e.g. snowmobiles, ATV's, helicopters) within the caribou habitat areas are considered to be very high if regulations or restrictions are not developed. These risks can be reduced through development, implementation and enforcement of appropriate restrictions within caribou range for snowmobiling and commercial recreational use, as recommended by the strategy.

The risk of predation to caribou population maintenance is considered to be very high in the absence of the recommended strategy. If the predator management recommendations of the strategy are applied then the predation risk can be reduced substantially, though would still be considered to be high over the long term.

Each specific risk outlined in Tables 8 and 9 has a number of possible population consequences that have not been presently described and are recommended to be more fully modeled in a detailed assessment. As an example, there are a number of possible risks if early winter ranges were not to be maintained in suitable condition. Low elevation winter ranges are an important component of caribou habitat in the eastern part of the region. The habitat attributes offered by old growth/mature forest stands in the ICH and lower ESSF zones attract caribou from October through January, likely for energetic reasons (mobility, food availability, and shelter). Lichen availability is an important element of these habitats. Clear-cut logging will not maintain old growth/mature forest stand characteristics in the early winter range areas; second and third pass clear-cut logging and subsequent short rotations will virtually eliminate caribou habitat values in these areas. Therefore, unless mature/old growth forest stand attributes are maintained through the recommended harvesting prescription, there is a high risk of direct habitat loss and range shrinkage for the caribou that utilize these areas. If the opportunity to move to lower elevations under certain environmental conditions is eliminated, this could potentially impact on survival and condition of animals in certain years and subsequently could have impacts on calf production and survival for both individual animals and the population.

The potential population implications of the identified risks to maintaining caribou, and how well the eastern caribou strategy reduces these risks, need to be more fully explored through population viability modeling. **The committee recommends that a detailed conservation risk assessment<sup>6</sup> be completed that identifies critical risks and assesses how well the eastern caribou strategy reduces these risks through modeling population viability under different conditions.**

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<sup>6</sup> A formalized assessment of the likelihood of adverse outcome from particular events or hazards as they relate to the conservation of caribou. This assessment probably needs to incorporate population viability modeling.



**Table 8. Estimated risks<sup>7</sup> to the maintenance of the regional mountain caribou population, *given no applied land use plan targets or special management for caribou habitat*. This table is for comparative purposes with Table 9 to indicate how the recommended regional mountain caribou strategy can reduce the overall risk of impact to the caribou population.**

<b>Risks to Maintenance of the Caribou Population</b>	<b>Specific Hazard or Concern</b>	<b>Likelihood of Adverse Impact<sup>8</sup></b>	<b>Magnitude of Adverse Impact<sup>9</sup></b>	<b>Estimated Risk of Impact<sup>10</sup></b>	<b>Overall Risk<sup>11</sup></b>
Timber Harvest (or Fire)	Calving habitat suitability not maintained	2	4	<b>8</b> (High)	<b>10</b> (Very High)
	Summer habitat suitability not maintained	2	3	<b>6</b> (High)	
	Late winter habitat suitability not maintained	4	4	<b>16</b> (Very High)	
	Low elevation, early winter habitat suitability not maintained	4	3	<b>12</b> (Very High)	
	Moose habitat enhanced	4	3	<b>12</b> (Very High)	
Access Development and Recreational Use	Permanent plowed roads enhance predator efficiency and predation rate	3	2	<b>6</b> (High)	<b>8</b> (High)
	Off trail snowmobiles displace caribou from preferred habitats	4	3	<b>12</b> (Very High)	
	Increased road access results in increased human recreational activities within caribou range (excluding snowmobiling), with increased risk of disturbance	2	2	<b>4</b> (Moderate)	
	Motorized commercial recreational use in caribou range increases	3	3	<b>9</b> (Very High)	
Wolf Predation – Moose Abundance	Alternative prey populations increase which results in higher wolf densities	4	4	<b>16</b> (Very High)	<b>16</b> (Very High)
Natural Succession Forest Changes in the ‘no harvest’ Zone	All season habitat suitability not maintained	1	2	<b>2</b> (Low)	<b>2</b> (Low)

<sup>7</sup> These initial estimates of risk are based on the expert opinions of committee members.

<sup>8</sup> An estimate of the likelihood of an adverse impact on the caribou population from this risk or hazard event, rated as 1=Low, 2=Moderate, 3=High, 4=Very High

<sup>9</sup> An estimate of the magnitude of an adverse impact on the caribou population from this risk event. This is based on the estimated area, extent and intensity of the impact, rated as 1=Low, 2=Moderate, 3=High, 4=Very High

<sup>10</sup> Refer to Appendix 7 for a description of the method for calculating risk ratings.

<sup>11</sup> In this preliminary analysis, overall risk was determined by averaging the scores for individual risks. This assumes that all risks are of equal impact or weight which may not necessarily be true.



**Table 9. Estimated risks<sup>6</sup> to maintenance of the regional mountain caribou population, given entire application of the recommended strategy (i.e. all components of the strategy presented in this document) which incorporates land use plan targets and other measures for caribou. Applicable components or sections of the strategy are identified in brackets in Column 1.**

<b>Risks to Maintenance of the Caribou Population</b>	<b>Specific Hazard or Concern</b>	<b>Likelihood of Adverse Impact<sup>7</sup></b>	<b>Magnitude of Adverse Impact<sup>8</sup></b>	<b>Estimated Risk of Impact<sup>9</sup></b>	<b>Overall Risk</b>
Timber Harvest (or Fire) (Sec. 4. Habitat Strategy, Sec. 5. Timber Harvest Strategy)	Calving habitat suitability not maintained	1	4	<b>4</b> (Moderate)	<b>4</b> (Moderate)
	Summer habitat suitability not maintained	1	2	<b>2</b> (Low)	
	Late winter habitat suitability not maintained	2	2	<b>4</b> (Moderate)	
	Low elevation, early winter habitat suitability not maintained	3	2	<b>6</b> (High)	
	Moose habitat enhanced	3	2	<b>6</b> (High <sup>12</sup> )	
Access Development and Recreational Use (Sec. 6. Access Recommendations)	Permanent plowed roads enhance predator efficiency and predation rate	2	2	<b>4</b> (Moderate)	<b>4</b> (Moderate)
	Off trail snowmobiles displace caribou from preferred habitats	2	2	<b>4</b> (Moderate <sup>13</sup> )	
	Increased road access results in increased human recreational activities (excluding snowmobiling) within caribou range, with increased risk of disturbance	1	2	<b>2</b> (Low)	
	Motorized commercial recreational use in caribou range increases	2	2	<b>4</b> (Moderate <sup>14</sup> )	
Wolf Predation – Moose Abundance (Sec. 7. Predator Management Recommendations)	Alternative prey populations increase which results in higher wolf densities	2	3	<b>6</b> (High <sup>15</sup> )	<b>6</b> (High)
Natural Succession Forest Changes in the 'no harvest' Zone	All season habitat suitability not maintained	1	2	<b>2</b> (Low)	<b>2</b> (Low)

<sup>12</sup> Although the recommended strategy does reduce the risk of enhancing moose habitat within caribou range, there are still forest management practices (i.e. clearcutting) adjacent to caribou range that are likely enhancing moose populations.

<sup>13</sup> This rating assumes the development and implementation of appropriate snowmobile restrictions within caribou winter range, as recommended in the strategy – if this does not occur then this risk rating is Very High instead of Moderate.

<sup>14</sup> This rating assumes that motorized commercial recreational uses (e.g. snowmobiles, heli-skiing) are carefully regulated or excluded from caribou winter ranges, as recommended in the strategy – if this does not occur then this risk rating is Very High instead of Moderate.

<sup>15</sup> This rating assumes the successful reduction of moose density in caribou range and implementation of a wolf management program, as recommended in the strategy – if this does not occur then this risk rating is Very High instead of High.



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## 9 MONITORING AND INDICATORS

The CCLUP Mountain Caribou Strategy signifies a shift in management of mountain caribou from harvest deferral and study, to active management. This includes using ‘modified harvesting’ to maintain habitat within a managed forest environment.

Two forms of monitoring are necessary:

- ☐ Compliance monitoring to ensure the strategy is applied in its’ entirety, and
- ☐ Effectiveness monitoring to examine if the implementation of the strategy is maintaining caribou habitat and meeting CCLUP timber access assumptions.

A compliance monitoring process should be initiated by the statutory decision makers (SDM’s) once the recommended strategy is accepted and begins to be implemented. The Research Section of the MOF and the Wildlife Section of MELP should conduct effectiveness monitoring through continued re-measurement of research and adaptive management trials and ongoing caribou, moose and wolf population surveys.

Research to date has focused on identification of harvesting strategies that provide the level of access to timber envisioned in the CCLUP while minimizing the risk of negative habitat impacts. Many of the recommendations made in this report are based on the early results of research trials established in 1990 to 1993. While preliminary, the results indicate that proposed silvicultural systems will provide the desired level of timber access while still maintaining adequate habitat requirements. The research results are encouraging enough to initiate a substantive adaptive management trial at Mount Tom covering some 3000 hectares.

It is important to emphasize that the research over the last ten years represents a relatively short period (4%) of the 240-year rotation envisioned under this strategy. **Monitoring of the adaptive management trial, along with the continued assessment of the earlier research trials and evaluations of future harvesting under the strategy, should be conducted to verify that the dual objectives of caribou habitat maintenance and timber access are achieved.** Regularly scheduled monitoring will ensure the tracking of progress towards desired goals and that the implementation of required adjustments occurs in a timely manner.

The CCLUP has stated that the modified harvesting must at least produce as much timber over a 240-year period that would normally be produced in 120 years through conventional harvesting. Therefore, progress to meeting this goal should be periodically monitored. The status of the caribou, including population trend and recruitment, will



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also need to be monitored. Effectiveness indicators include: seedling performance<sup>16</sup>, growth and yield data, frequency and timing of caribou use of harvested areas, caribou population trend in the different herds, stability and persistence of adjacent unharvested areas and the impact of harvesting pattern on local hydrology and non-target wildlife.

**A commitment for funding the necessary monitoring will be essential to ensure the long-term success of the strategy.**

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<sup>16</sup> If normal free-growing specifications do not appear achievable, then customized specifications for modified harvesting need to be developed.



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## 10 FUTURE REVIEW

It is our hope, and the vision of the CCLUP process, that the recommended strategy should bring certainty to mountain caribou management in the Cariboo Region for the longer term (refer to Appendix 8 for some key questions and answers in relation to the strategy). The forest industry has expressed the desire that, once approved, the boundaries would be unchanged (excluding minor boundary adjustments as per section 5.2) for the next 15 years. Therefore, we do not anticipate making changes to the 'modified' and 'no harvest' areas again in a few years. Conversely, a periodic review of the strategy is beneficial to ensure that the recommendations are indeed having the desired results.

**The committee recommends that the eastern caribou strategy be reviewed in detail every 5 years in order to determine if refinements are necessary.**



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## 11 REFERENCES

- Akrigg, G.P.V. and H.B. Akrigg. 1997. British Columbia place names. UBC Press University of British Columbia, Vancouver.
- Apps, C.D. and T.A. Kinley. 1999. Interim scale – dependent habitat modeling for mountain caribou in the Thompson River Watershed, British Columbia, for Ministry of Environment, Lands and Parks, Kamloops, BC Canada
- Apps, C.D. and T.A. Kinley. 2000. Multiscale habitat modeling for mountain caribou in the Columbia Highlands and North Columbia Mountains Ecoregions, British Columbia for MELP, Williams Lake BC Canada
- Armleder, H.M., J.A. Young and J.A. Youds. 2000. A management strategy for mountain caribou—the Cariboo Region example. Proc. Symp. Biology and Management of Species and Habitats at Risk, Kamloops, B.C. Feb. 15-19. 1999. *In press.*
- Ashcroft, Greg. 1997. Mountain caribou behavior and micro-habitat characteristics in the Quesnel Highlands for MELP, Williams Lake. DWB Forestry Services Ltd.
- Benton, S. 1995. Memo of November 23, 1995 from IAMC Chair to Mike Carlson, Regional Manager, Ministry of Forests, providing direction regarding Eastern Caribou line adjustments.
- Bergerud, A.T. 1992. Rareness as an antipredator strategy to reduce predation risks for moose and caribou in wildlife 2001 populations. Edited by D.R. McCullough and R.B. Barrett. Elsevier, London. pp. 1008 – 1021.
- Bergerud, A.T. and J.P. Elliott. 1998 – Wolf predation in a multiple-ungulate system in northern British Columbia. Canada J. Zool. 76: 1551 – 1569.
- Bergerud, A.T., H.E. Butler and D.R. Miller. 1984. Antipredator tactics of calving caribou: dispersion in mountains. Can. J. Zool. 62:1566-1575.
- Bergerud, A.T. and R.E. Page. 1987. Displacement and dispersion of parturient caribou at calving as antipredator tactics. Can. J. Zool. 65:1597-1606.
- Edmonds, E.J. 1988. Population status, distribution and movements of woodland caribou in west central Alberta. Can. J. Zool. 66:817-826.
- Edwards, R.Y. 1954. Fire and the decline of a mountain caribou herd. J. Wildl. Manage. 18:521- 526.
- Farnell, R. and J. McDonald. 1987. The demography of Yukon's Finlayson caribou herd, 1982-1987. Yukon Renewable Resources, Whitehorse. Prog. Rep. 54 pp.



- 
- Fuller, T.K. 1989. Population dynamics of wolves in north-central Minnesota. Wildlife Manager No. 105.
- Gasaway, W.C., Stephenson, R.O., Davis, J.L., Shepherd, P.E.K. and Burris, O.E. 1983. Interrelationships between wolves, prey and man in interior Alaska. Wildlife Monograph 84.
- Harper, W.L. and D.S. Eastman. (*In Prep.*) Wildlife and commercial backcountry recreation in British Columbia: assessment of impacts and interim guidelines for mitigation. Osiris Wildlife Consulting. (Draft discussion paper prepared for Ministry of Environment, Lands and Parks, May 2000). 81 pp.
- Jull, M.J., D. Coxson, S. Stevenson, D. Lousier and M. Walters (compilers). 1998. Ecosystem dynamics and silvicultural systems in Interior Wetbelt ESSF and ICH forests. Proc., The Wet-belt ESSF and ICH Workshop, June 10-12, 1997, Univ. Northern British Columbia, Prince George, B.C. UNBC Press, Prince George, B.C. 71 pp.
- Jull, M.J., S. Stevenson and B. Sagar. 1999. Group selection in old cedar-hemlock forests: Five-year results of the Fleet Creek partial-cutting trial. BC Ministry of Forests / University of Northern British Columbia. Prince George Forest Region, Prince George, British Columbia. Forest Research Note No. PG-20. 8 pp.
- Jull, M.J. and A. Eastham. (*In Prep.*) Seven-year growth and survival of Engelmann spruce and subalpine fir planted seedlings in a subalpine silvicultural systems trial. (for submission to CJFR)
- Keith, L. B. 1983. Population dynamics of wolves. Canadian Wildlife Service Rep Series No. 45. Pg 66 – 77.
- Klein, D.R. 1982. Fire, lichens and caribou. J. Range Manage. 35:390-395.
- Ontario Ministry of Natural Resources. 1994. [Draft] Management guidelines for woodland caribou habitat. OMNR Northwest Region. Recommendations of NWR Caribou Task Team on behalf of Policy and Program Division. 17pp.
- Ministry of Forests. 1998. Risk management and statutory decision making handbook. Chapter 3 – Risk Assessment. Compliance and Enforcement Branch, Ministry of Forests, Victoria, B.C.
- Newsome, T.A. 1999. Group selection system for high elevation forests to maintain caribou habitat in the Cariboo Forest Region—Artificial regeneration. Unpubl. Report, Research Section, Cariboo Forest Region, Williams Lake, B.C. 32 pp.
- Newsome, T.A., H. M. Armleder, M. J. Waterhouse and O. A. Steen. 2000. Fifth year results from group selection harvesting in the ESSFwc3 on windthrow, artificial and natural regeneration. Cariboo Forest Region, Williams Lake, B.C. Extension Note No. 30, 6 pp.



- 
- Paquet, M.M. 1997. Towards a mountain caribou management strategy for British Columbia, background report. MELP, Wildlife Branch, Victoria, BC.
- Province of British Columbia. 1995. The Cariboo-Chilcotin Land-Use Plan. 90-Day Implementation Process Final Report, Victoria, B.C.
- Rominger, E.M. and J.L. Oldemeyer, 1989. Early winter habitat of woodland caribou, Selkirk Mountains, British Columbia. *J. Wildl. Manage.* 53: 238 - 243.
- Rominger, E.M. and J.L. Oldemeyer. 1990. Early winter diets of woodland caribou in relation to snow accumulation, Selkirk Mountains, British Columbia, Canada. *J. Zool.* 68: 2691 – 2694.
- Seip, D.R. 1990. Ecology of woodland caribou in Wells Gray Provincial Park. BC Ministry of Environment. Wildlife Bulletin No. B-68. 43 pp.
- Seip, D.R. 1991. Predation and caribou populations – *Rangifer* Vol. Spec. Issue No. 7: 46 – 57.
- Seip, D.R. 1992a. Factors limiting woodland caribou populations and their interrelationships with wolves and moose in southeastern British Columbia. *Can J. Zool.* 70:1494-1503.
- Seip, D.R. and D.B. Cichowski. 1996. Population ecology of caribou in British Columbia. *Rangifer* Vol. 16, Special Issue No. 9: >3 – 80.
- Simpson, K., E. Terry and D. Hamilton, 1997. Towards a mountain caribou management strategy for British Columbia – habitat requirements and sub-population status. Wildlife Working Report No. WR-90. MELP, Wildlife Branch Victoria BC
- Spalding D.J. 2000. The early history of woodland caribou (*Rangifer Tarandus caribou*) in British Columbia. Wildlife Bulletin No. B-100. MELP Wildlife Branch, Victoria, BC
- Stevenson, S.K., M.J. Jull, and R.M. Sagar. 1999. Selection silvicultural systems in mountain caribou habitat: logging and learning at Pinkerton Mountain. BC Ministry of Forests / University of Northern British Columbia. Prince George Forest Region, Prince George, B.C. Forest Research Note No. PG-19. 8 pp.
- Stevenson, S.K., H.M. Armleder, M.J. Jull, D.G. King. B.N. McLellan and D.S. Coxon. (*In prep.*) Mountain caribou in managed forests—second edition.
- Van Ballenberghe, V., Erickson, A.W., and Bymum, D. 1975. Ecology of the timber wolf in northeastern Minnesota. *Wildlife Manager* No. 43.



- 
- Vanderburgh, K. 1998. Memo of April 22, 1998, from IAMC Implementation Committee to Caribou Strategy Committee providing direction regarding eastern caribou targets.
- Young, J.A. and N.L. Freeman, *in prep.* Summary of the 1993 – 2000 mountain caribou census within the Quesnel Highland and Caribou Mountains, Cariboo Region. MELP, Williams Lake, BC
- Young, J.A. and L.M. Roorda, 2000. Towards Integrated Management Solutions: The Quesnel Highland Caribou Project (Radio-telemetry progress report, 1993 – 1999). MELP, Williams Lake, BC
- Waters, L. 1997. Case study: Patch cutting in old-growth to maintain early winter caribou habitat. Nelson Forest Region. British Columbia Ministry of Forests, Nelson B.C. Extension Note No. RS-029. 4 pp.



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## 12 APPENDICES

Appendix 1. Terms of Reference

Appendix 2. Stakeholder Input

Appendix 3. Major Refinements Since the Caribou Strategy Update 1998.

Appendix 4. Summary of Trade Agreements within the Quesnel Forest District.

Appendix 5. Existing Approved Cutblocks within the ‘Modified’ and ‘No Harvest’ Areas.

Appendix 6. Mountain Caribou and Motorized Recreation

Appendix 7. Risk Assessment Calculations

Appendix 8. Key Questions and Answers in Relation to the Caribou Strategy

Appendix 9. Historic High Elevation Deferral Area, as Recognized by the CCLUP

Appendix 10. 1996 ‘Option A’ as Recommended by the Caribou Strategy Committee

Appendix 11. 1998 ‘Option A’ as Recommended by the Caribou Strategy Committee



## APPENDIX 1. TERMS OF REFERENCE



Ste. 200 - 640 Borland St.  
Williams Lake, British Columbia V2G 4T1  
Telephone: (250) 398-4345

Inter Agency Management Committee

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March 30, 1998

John Youds, Chair  
Caribou Strategy Committee  
c/o 400 - 640 Borland St  
Williams Lake BC V2G 4T1

Dear John Youds:

The attached Terms of Reference for the Caribou Strategy Committee has been approved by the IAMC. The revisions to the earlier TOR reflect the results of the Integration process.

IAMC recognizes that the work that the committee is undertaking is extremely important and that the time frames for the completion of the various phases present some significant challenges. As indicated in the Terms of Reference, the IAMC Implementation Committee will be available to assist the committee.

We commend the committee for the work it has completed to date.

Yours truly,

A handwritten signature in dark ink, appearing to read "Gyl Connaty".

Gyl Connaty  
Acting Chair  
Inter Agency Management Committee

attachment

cc: Implementation Committee



## Caribou Strategy Committee Terms of Reference

**Purpose:** To address CCLUP requirements for integrated caribou habitat management.

1. Determine the research, inventory, ecosystem mapping and adaptive management work required to develop integrated management approaches for caribou habitat for Eastern and Itcha Ilgachuz caribou.
2. Ensure the initiation and completion of the appropriate research, inventory, ecosystem mapping, and adaptive management work
3. Based on the above work and CCLUP and IAMC direction, develop integrated forest management approaches for Eastern and Itcha-Ilgachuz caribou which address CCLUP targets and implementation direction.
4. Based on the above work and CCLUP and IAMC direction, complete a preliminary identification of modified harvest areas for caribou which will address commitments to 2005 by June 30, 1998. This work will be refined annually and will form the basis for the subsequent years' Forest Development Plans, however it will only provide firm direction for the first two years of each FDP. Only minor changes in year 2 would be anticipated. Flexibility to incorporate further research results for years 3, 4, and 5 of the FDP will be maintained.
5. Based on the above work and CCLUP and IAMC direction, complete a caribou strategy which includes an identification of modified harvest areas for caribou by June 30, 2000. The research to support this work will be completed by December 31, 1999. It is likely that the research will continue after 1999 and that this work will be refined in subsequent years as a result.

### Membership

MELP-Region  
3 Wildlife and Habitat staff  
MOF - District  
2 staff

MOF -Region  
1 Research 1 Planning

Other technical staff from MOF and MELP will work with the committee as required. Planners from BC Parks and MSBT will be kept informed and invited to work with the committee as needed.

See attachment #1

### Administration

The committee selects or confirms its own chairperson annually. The current chairperson is John Youds, Regional Wildlife Biologist, Environment and Lands (January 1998).

The committee may choose to strike a caribou technical sub-committee.



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## **Reporting**

The Committee will report to the IAMC through the Implementation Committee or as requested by IAMC. Members of the Implementation Committee will work with the committee and where needed facilitate the work of the committee and ensure IAMC direction is provided to the committee. If any unresolvable disagreements arise they will be referred to IAMC.

All recommendations will be provided as drafts to the IAMC for their approval.

## **Technical involvement by stakeholders**

The MLSC will be asked to provide a biologist to work with the committee and the technical sub-committee. The technical contact will not formally sit on the committee but will be expected to review information and provide input to committee and subcommittee members. Other stakeholders may also designate a technical contact.

## **Committee Mandate and Tasks**

1. The committee will initiate and/or ensure completion of research, inventory and mapping projects required to develop integrated caribou habitat management strategies for Eastern and Itcha-Ilgachuz caribou populations. Within the context of the CCLUP and subsequent implementation direction, these strategies will attempt to develop the best options to maintain caribou habitat at the stand and landscape levels. The strategies will address the CCLUP requirements for modified harvest areas including the identification of 35% of the existing deferral areas for modified harvest.
2. The modified harvest areas will be selected to best maintain caribou values while taking into account timber values and making the best use of overlap opportunities to better meet all CCLUP targets. Opportunities for modified harvest in the 3 TSAs will be assessed. The 35% modified harvest and 65% no harvest areas will be identified on 1:20,000 scale maps.
3. The committee will identify operational management strategies, including stand level and landscape level recommendations, for Eastern and Itcha-Ilgachuz caribou.
4. The committee will develop and define modified harvesting for caribou habitat.
5. The committee will define portions of the caribou range which are sensitive to snowmobile use.



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Products	Target Dates	
Input to STTAA	Short term	Completed
Interim Caribou Strategy	1995-1996	Completed
Updated Draft Identification of Modified Harvest Areas	June 1998	
Annual Progress Reports (to IAMC and RRB)	Annually in April	
Caribou Strategy (a) Itcha-Ilgachuz and (b) Eastern	June 2000	
• interim result of research and inventory to December 31, 1999, to be available for planning purposes		
Analysis of research and inventory data completed by December 2000		
(See Attachment #2; Workplan Timelines)		

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## APPENDIX 2. STAKEHOLDER INPUT AND CONSULTATION

In 1995 the CCLUP established the need for the development of a regional caribou strategy that would maintain habitat values for mountain caribou. Specific tasks that were identified included:

- ☐ Identify where the most appropriate locations for the 65% 'no harvest' and 35% 'modified harvest' should be within the historic deferral area.
- ☐ Make required adjustments to the historic deferral line.
- ☐ Develop a prescription for the 'modified harvest' area.
- ☐ Utilize the Forest Practices Code to manage low elevation habitat outside the historic deferral area.

Following completion of the CCLUP integration process, further direction was provided to the committee, including detailed terms of reference approved by the Cariboo Mid-Coast IAMC. This direction required the completion of the caribou strategy by 2000.

Throughout the development of the strategy there has been essentially three stages of consultation. The initial consultation occurred prior to the development of the first interim report that was completed in July 1996. The second round of consultation occurred prior to the completion of the second interim report in September 1998 and additional consultation occurred prior to the completion of the final report in 2000.

### *Input to the 1996 Interim Report*

During development of the initial interim report the caribou strategy committee met five times with the Short Term Timber Availability (STTAA) Committee to address integration of the two strategies. Major unresolved issues with the STTAA were summarized as follows:

- ☐ Concern over the need to schedule 'modified harvesting' over the long term that would result in impacting short-term timber availability.
- ☐ Concern over the need to aggregate 'modified harvest' into specific areas.
- ☐ Concern that some 'modified harvest' areas were immature and not available in the short term.

The 1996 report recognized that if mountain caribou are to be maintained, the strategy must not only address maintaining suitable habitat, but issues surrounding controlling access and predation levels. The initial report provided the first approximation of how 'modified harvest' and 'no harvest' target should be distributed and a description of the approach to harvesting within 'modified harvest' areas. Several key issues specific to the development of the strategy were also raised.



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### ***Input to 1998 Interim Report***

During the development of the 1998 update, stakeholder representatives from the Major Licensees and Conservation Council participated in the strategy update review process. There was a free exchange of technical information and maps, and several meetings were held with stakeholder representatives. During the review of locations for placement of the 'modified harvest' and 'no harvest' target the committee utilized maps of timber harvest opportunities provided by the MLSC to examine overlap opportunities. Stakeholder representatives were invited to make written and verbal presentations to the committee in regard to the draft working versions of the updated map. The MLSC technical representative made a presentation to the committee on concerns about the Eastern Caribou draft map and provided the committee with written input from four licensees that operate in the eastern area. Major stakeholder issues in the Eastern Caribou area were summarized as follows:

- ☐ Concern about the integration (overlap) of caribou targets with other CCLUP targets.
- ☐ Insufficient 'modified harvest' identified in some licensee areas.
- ☐ The need for ground level operational flexibility in 'modified harvest' areas.
- ☐ Specific proposed adjustments submitted by one licensee.
- ☐ Concern over wood quality/availability in some 'modified harvest' areas.
- ☐ Early winter ranges should be dealt with in sub-regional planning.

The 1998 update addressed stakeholder input in a number of ways, including:

- ☐ Some 'modified harvest' opportunities were identified in the 100 Mile House TSA.
- ☐ All trade areas in the Quesnel District were being suggested with full involvement of licensees.
- ☐ By identifying 'modified harvest' areas as large, contiguous areas covering a full range of elevation, slope, aspect and forest types, 'modified harvest' areas should fairly represent the range of stand conditions within the entire caribou area.
- ☐ A commitment was made to review specific proposed adjustments submitted by one licensee during the final line refinement phase.

In addition, the committee developed more detailed, updated information on the recommended 'modified harvest' approach, within the 1998 update document in order to address licensee concerns and questions in this area.

The committee has always been receptive to input from the stakeholder representatives even between the development of updates. The CLMA representative has on several occasions provided map-based input that the committee has considered in future updates.



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### *Input to the 2000 Report*

During the development of the final 2000 strategy stakeholder representatives from the Major Licensees and Conservation Council participated in the strategy review process. There was a free exchange of technical information and maps, and several meetings were held with stakeholder representatives. During the refinements to the ‘modified harvest’ and ‘no harvest’ target areas the committee utilized consolidated 5 year development plan maps for each of the Quesnel, Horsefly and 100 Mile House Districts. Stakeholder representatives were invited to make written and verbal presentations to the committee in regard to the draft working versions of the updated map. Major stakeholder issues for Eastern Caribou area were summarized as follows:

- ☐ The final document should clearly show the risks to maintaining caribou in relation to following CCLUP direction and the recommended strategy.
- ☐ It was expressed that there was limited opportunity for consultation.
- ☐ The ‘modified harvest’ approach within the ICH may not be viable.
- ☐ Areas made available through line adjustments were generally less productive, steeper ground which are more expensive to harvest and some areas are inoperable while areas incorporated within the line were the opposite.
- ☐ Areas made available resulted in reduced overlap with Visual Quality Objectives and Goal Two proposals.
- ☐ Some areas made available were immature and thus not available in the short term which affects short term timber availability.
- ☐ Moving target to lower elevation winter ranges effects timber supply as these stands are generally more productive than higher elevation stands.
- ☐ Insufficient ‘modified harvest’ identified in some licensee areas.

The 2000 strategy addressed previous and more recent stakeholder input in a number of ways, including:

- ☐ Additional ‘modified harvest’ opportunities were identified within the 100 Mile House TSA.
- ☐ Provided greater flexibility in the use of silvicultural systems on various slopes.
- ☐ Provided some flexibility to adjust boundaries at the operational level.
- ☐ Incorporated low elevation early winter ranges into the ‘modified harvest’ target.
- ☐ Reassessed all refinement line-work that was identified as a concern by licensees and adjustments made where impact was considered neutral to caribou.
- ☐ Provided a conservation risk assessment for maintaining mountain caribou.

Meetings were held with major licensee representatives on July 20<sup>th</sup>, and August 17<sup>th</sup> and September 5<sup>th</sup>, 2000. At the July meeting Caribou Strategy Committee members provided an update regarding the overall strategy development including an update of the recommended silvicultural systems on various slopes and operational boundary flexibility. Details surrounding refinements to the caribou habitat line work showing ‘modified harvest’ and ‘no harvest’ areas including rationale for changes were also presented. Digital files of draft maps were made available for review. In August forest industry representatives provided feedback to the committee regarding adjustments to the



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line work. Specific proposed adjustments were submitted by five licensees. Generally, the comments received suggested that the net effect of the adjustments had a negative impact to forest industry interests. Five licensees identified areas for potential adjustment. The caribou strategy committee reviewed each of these proposals. Where the change was considered neutral to caribou, the proposed adjustment was incorporated into the line revisions.

No significant concerns were noted, regarding the adjustments within the 100 Mile House TSA.

Within the Horsefly District several areas of concern were identified. Within the McKusky Creek drainage it was recommended that refinements to expand the ‘no harvest’ area on the south side of the valley be converted back to ‘conventional harvest’, and on the north side of the valley that an area of ‘modified harvest’ also be converted to ‘conventional harvest’. As a result, the ‘modified harvest’ area southeast of Eureka Peak was proposed to be switched to ‘no harvest’. These proposals were reviewed and as the changes were considered to have a negative impact to caribou were not supported. The proposal to convert a portion of Hawkley Creek from ‘modified harvest’ to conventional was supported and the target moved to just north of Caput Mountain. This change was considered to have a neutral impact to caribou as both areas had similar values.

Along the north and east arm of Quesnel Lake there was concern that ‘no harvest’ areas restricted timber availability in several areas. Specifically, in order of concern, near Martin Creek, the north side of Blue Lead Creek, the east side of Killdog Creek and the west side of Killdog Creek. These areas were reviewed and it was considered neutral impact to caribou to move some target from the Marten Creek area to the west side of Killdog Creek. It was also suggested that the adjustments to “modified harvest” in the headwaters of Lynx Creek where the line had been expanded to include more area and on the north side of Penfold Creek where the line had been pulled back be revisited. These areas were reassessed and it was considered neutral impact to caribou to move some target from Lynx Creek to the north side of Penfold Creek. This adjustment also improved the overlap with Visual Quality Objectives.

Several concerns were also identified in the Cariboo Lake area. Within the headwaters of Sellars Creek and Barkers Creek there was concern over loss of valuable operating areas and in the latter case a partially roaded area. It was proposed that the expanded ‘no harvest’ target in these areas be switched with less valuable and less developed timber areas within the headwaters of Ishkloo Creek and Roaring Creek. The line work in these areas was revisited and partial adjustments made to accommodate the expressed concerns. Concern was also expressed that the adjusted caribou target no longer overlapped with steep inoperable areas in the Tuckett Creek area nor with the proposed Goal 2 area at Maeford Lake. These areas were also revisited and as there were no significant identifiable caribou values within them, there was no justification to undertake further refinements. Also of concern was the expansion of the ‘no harvest’ line within several areas of the headwaters of Tuckett Creek. These areas were reviewed and no adjustments made. Lastly, concern was raised over expansion of the ‘no harvest’ line to include approved cutting permits in the Blackbear Creek area. The line work in this area



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was reviewed again and remains unchanged with the expectation that cutting permit approvals will be honoured (see Appendix 5).

Following the September 5<sup>th</sup> meeting one licensee provided additional feedback and requested the committee to revisit several areas of concern within the Little River drainage. These areas were all again reassessed and one small adjustment was made by shifting 'no harvest' target from one area in the headwaters of Tuckett Creek to the Roaring Creek drainage where it was considered neutral impact to caribou. Other suggested changes would have had a negative impact to caribou, thus they were not incorporated in the final line refinements.

The consultation process in the Quesnel District was different because of the desire of the caribou committee to trade large areas within the original deferral area for recently identified key habitat outside the deferral (some of which was in the Enhanced Development Zone). The Integration Committee directed that trades should be discussed in detail with industry. Therefore, consultation with major licensees within that area was much more comprehensive with a total of 23 meetings occurring since 1997. The initial approach was to make several significant adjustments (trades) that would be followed by line refinements of the remaining areas. With regards to the trade agreement within Weldwood of Canada's interest area, this process resulted in numerous mapping iterations that culminated in a scenario that was beneficial to caribou and had at least a neutral impact to timber interests. This was followed by several iterations of more detailed line refinements where adjustments were made when considered neutral to caribou and beneficial to the licensee. This resulted in no significant areas of concern remaining within Weldwood's interest area.

A slightly different approach evolved within the area encompassed by West Fraser's area based tenure (TFL 52). Following discussions regarding the more significant adjustments (trades) and the initial line refinements the licensee took the position that all adjustments, when considered in total, (whether the larger trades or line refinements) should have a neutral effect to long-term timber availability within the TFL. After review and refinement of several iterations and a detailed timber supply impact review this resulted in a scenario that was agreeable to the licensee. This scenario is considered overall, beneficial to caribou, but less than ideal considering the limited 'modified harvest' and 'no harvest' target.

The committee met with representatives of the Conservation Council on August 30, 2000 and provided an update regarding the overall strategy development. Details surrounding refinements to the caribou habitat line work showing 'modified harvest' and 'no harvest' areas, including rationale for changes, were also presented. Feedback from Conservation stakeholders was primarily strategic in nature and focussed on three issues. They requested that the final document clearly outline the risks to maintaining caribou in relation to following CCLUP direction and the recommended strategy. In addition, they believe that further operational testing of the timber harvesting approach within the 'modified harvest' areas should be undertaken before it is applied to the broader area available under the prescription. In addition, due to the present interpretation of the



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CCLUP in regard to the 70/30 formula within the SRDZ, there is concern that caribou targets will not be attainable.



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## **APPENDIX 3. MAJOR REFINEMENTS SINCE THE CARIBOU STRATEGY UPDATE 1998**

### **1. Recommended Location of CCLUP Targets for ‘Modified’ and ‘No Harvest’ areas**

Major changes are listed below while the rationale for adjustments to lines is provided in section 4 of the main report.

- ☐ Inclusion of a few, key low-elevation early winter ranges around Quesnel Lake.
- ☐ Conversion to ‘conventional harvesting’ of several large areas including: Keithley Creek Mountain, Yanks Peak, between Black Stuart Mountain and Little River, Big Slide Mountain, Caput Mountain, east of Eureka Peak.
- ☐ Significant addition of ‘modified harvest’ to the 100 Mile House TSA west of Boss Mountain.
- ☐ Conversion to ‘modified harvest’ of the area east and north of Watchman Mountain
- ☐ In the Quesnel TSA, conversion to ‘modified harvest’ of areas previously outside the caribou area including: Lottie Lake, Mount Tom/Hardscrabble Mountain, Eaglenest Ridge.
- ☐ In the Quesnel TSA, conversion to ‘conventional harvesting’ of several large areas including: Mount Anderson, between Little Swift and Swift Rivers, north part of Richfield Mountain.

### **2. Flexibility in the Use of Silvicultural Systems on Various Slopes**

Whereas the 1998 Update specified the use of group selection on all slopes less than 45%, the current strategy provides for more flexibility (Table 5). On steep slopes the 1998 Update allowed for the use of clearcutting with 50% reserves (120 year cutting cycle) with clearcut parts as narrow as possible. This has been changed to strip selection removing 33% of the volume on an 80 year cutting cycle. While both have the same long-term impact on timber (effectively a 240 year rotation) the new recommendations maintain caribou habitat in a more effective way by removing only one third versus one half of the volume at each entry.

### **3. Access Management Recommendations**

The current strategy includes a clear recognition of the potential risk that snowmobiling presents to the long-term viability of mountain caribou. A map (Figure 13) is provided which details both the caribou habitat with low caribou sensitivity available to snowmobiling interests and the remaining habitat sensitive to further impact by snowmobiling.

### **4. Predator Management Recommendations**

Predation is recognized as a major risk factor for caribou and the current strategy adds several recommendations to address predator/prey management, including: development of a modified regional moose management strategy that would incorporate higher harvest



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rates for moose within and adjacent to caribou range and development of a wolf management program to limit increases in the wolf population within caribou range.

## **5. Conservation Risk Assessment**

The mountain caribou is now red-listed in the province and, therefore, greater attention has been brought to conservation of the population. A preliminary conservation risk assessment has been included in the strategy report to examine how well the risks to mountain caribou conservation in the Cariboo Region are reduced with the recommended strategy. The committee has also recommended that a more detailed conservation risk assessment be completed that more fully explores potential population implications through population viability modeling.



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#### APPENDIX 4. SUMMARY OF TRADE AGREEMENTS WITHIN THE QUESNEL FOREST DISTRICT

The Caribou Strategy Committee proposed several major adjustments within the Quesnel District because recent caribou radio-telemetry data identified high use areas outside the historic deferral in the Barkerville area. Through a series of meetings between local licensees, District MOF and MELP staff and Caribou Committee representatives a tentative agreement has been reached to make major adjustments (trades) to where mountain caribou target is located within the District. As 'modified harvest' areas are recommended to be managed on a 240 year rotation (double the normal rotation) these areas are considered to have an Equivalent Excluded Area (EEA) of 0.5. The following tables list the areas in question and the resulting implications to caribou targets.

##### Weldwood of Canada Areas

###### Areas With Increased Caribou Target

Location	Change	Size	EEA	EEA Total
Mt Tom	con. to mod.	1699 ha.	0.5	849.5 ha.
Eaglenest	con. to mod.	962 ha.	0.5	481 ha.
<b>Total</b>		<b>2661 ha.</b>		<b>1330.5 ha.</b>

###### Areas With Decreased Caribou Target

Location	Change	Size	EEA	EEA Total
Little Swift R.	mod. to con.	107 ha.	0.5	53.5 ha.
Mt. Anderson	no har. to con.	642 ha.	1.0	642 ha.
Mt. Matthew	no har. to con.	154 ha.	1.0	154 ha.
Little Swift R.	no har. to con.	79 ha.	1.0	79 ha.
Van Winkle Mt.	no har. to con.	155 ha.	1.0	155 ha.
Black Stuart Mt.	no har. to con.	45 ha.	1.0	45 ha.
Connection Cr.	no har. to con.	30 ha.	1.0	30 ha.
Comet Cr.	no har. to con.	172 ha.	1.0	172 ha.
<b>Total</b>		<b>1384 ha.</b>		<b>1330.5 ha.</b>

The end result of the changes within the Weldwood of Canada interest area was to create 2,661 hectares of 'modified harvest' in new areas. Doing so required the moving of 107 ha. of 'modified harvest' target as well of the conversion of 1,277 hectares of 'no harvest' target to 'conventional harvest'. The overall effect was an increase in the 'modified harvest' target by **2,554** hectares and a decrease in the 'no harvest' target by **1,277** hectares.



## West Fraser Mills Areas

### Areas With Increased Caribou Target

Location	Change	Size	EEA	EEA Total
Eaglenest	con. to mod.	774 ha.	0.5	387 ha.
Lottie Lake	con. to mod.	706 ha.	0.5	353 ha.
Mt Tom	con. to mod.	2194 ha.	0.5	1097 ha.
Mt Tom add.	con. to mod.	146 ha.	0.5	73 ha.
Nugget Mtn. south	mod. to no har.	266 ha.	0.5	133 ha.
Aster Cr.	mod. to no har.	76 ha.	0.5	38 ha.
Swift River	con. to no har.	270 ha.	1.0	270 ha.
Aster Cr.	con. to no har.	24 ha.	1.0	24 ha.
<b>Total</b>		<b>4456 ha.</b>		<b>2375 ha.</b>

### Areas With Decreased Caribou Target

Location	Change	Size	EEA	EEA Total
Porter Cr.	mod. to con.	1528 ha.	0.5	764 ha.
Cariboo Mtn.	mod. to con.	178 ha.	0.5	89 ha.
Swift R.	mod. to con.	420 ha.	0.5	210 ha.
Richfield Mtn.	no har. to mod.	736 ha.	0.5	368 ha.
Nugget Mtn.	no har. to mod.	678 ha.	0.5	339 ha.
Swift R.	no har. to con.	92 ha.	1.0	92 ha.
Nugget Mtn.	no har. to con.	137 ha.	1.0	137 ha.
Swift R. band	no har. to con.	317 ha.	1.0	317 ha.
Van Winkle	no har. to con.	59 ha.	1.0	59 ha.
<b>Total</b>		<b>4145 ha.</b>		<b>2375 ha.</b>

The end result of the changes within West Fraser Mill's TFL was to generate 5,234 hectares of 'modified harvest' and 636 hectares of 'no harvest' in new areas. To achieve these results required the moving of 2,126 hectares of 'modified harvest' and 294 hectares of 'no harvest' plus the conversion of 1,414 hectares from 'no harvest' to 'modified harvest', 342 hectares from 'modified harvest' to 'no harvest' and 311 hectares from 'no harvest' to 'conventional harvest'. The net effect of these changes was to increase the 'modified harvest' target by **2,766** and decrease the 'no harvest' target by **1,383** hectares.

**When combined for both licensees the net change is an increase in the overall 'modified harvest' target by 5,320 hectares and a decrease in the overall 'no harvest' target by 2,660 hectares.**



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## **APPENDIX 5. EXISTING APPROVED CUTBLOCKS WITHIN THE ‘MODIFIED’ AND ‘NO HARVEST’ AREAS**

Several situations have resulted in approved cutblocks being located within the refined areas delineating ‘modified harvest’ and ‘no harvest’. For example, some areas along the edges of ‘no harvest’ have good long-term capability and therefore were left within the ‘no harvest’ area. The following is the anticipated future development of cutblocks known to the Caribou Strategy Committee as approved (Category A with approved Silvicultural Prescription) within designated caribou areas:

### ***Quesnel District***

Block 7 of CP 442 within FL20013 (Weldwood of Canada Ltd.– Quesnel) – this block is located on the south side of the Little Swift River within a ‘no harvest’ area. The committee anticipates this block to proceed as presently approved.

Block M of A45208 (Small Business) – this block is located in the Lostway Creek drainage within a ‘modified harvest’ area. The committee anticipates this block to proceed as presently approved.

### ***Horsefly District***

Block 5 of CP 214 and Block 1 of CP 223 within FL20017 (Weldwood of Canada Ltd. – Williams Lake) – these blocks are located along the ridge between Black Bear and Sellars Creeks within a ‘no harvest’ area. The committee anticipates these blocks to proceed as presently approved.

Block 3 of CP 12 within FL20015 (Riverside Forest Products Ltd.) – this block is located along the ridge between Bill Miner and Killdog Creeks within a ‘no harvest’ area. The committee anticipates this block to be deleted from the present development plan and not developed by the licensee in lieu of line adjustments made in the Hawkley Creek area (this refinement was proposed by the licensee).

### ***Summary***

We assume that all silvicultural obligations will be met to insure areas being harvested will establish free growing stands. In addition, we recommend that road development required to develop the above noted blocks within the ‘modified harvest’ and ‘no harvest’ areas will be temporary in design and de-built, as soon as possible, following timber harvesting.



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## APPENDIX 6. MOUNTAIN CARIBOU AND MOTORIZED RECREATION

Caribou populations can only be maintained if all of the following issues are addressed together:

- ☐ Maintaining suitable caribou habitat within existing mountain caribou range
- ☐ Limiting and regulating roaded and unroaded access in caribou habitat
- ☐ Managing predation levels on caribou

There will need to be concessions from all sectors that influence mountain caribou negatively, including winter recreationalists, if mountain caribou are to survive. This will mean creating separate zones for caribou winter range, and for snowmobiling and other forms of motorized recreation so that these two land uses can co-exist.

### *How does wildlife respond to disturbance?*

Wildlife exhibits a wide range of behavior around people. Whittaker and Knight (1998) suggest that wildlife have developed situation-specific responses because some combination of learning and genetics has made them successful. In general wildlife responses can be grouped into three categories:

- ☐ attraction
- ☐ habituation, or
- ☐ avoidance

Gilbert (1989) suggests that an animal can find human provided stimuli reinforcing (leading to attraction), aversive (leading to avoidance), or neutral (leading to habituation). The consequences of wildlife responses are not always immediate, direct or obvious.

### *Why is disturbance of such concern?*

It is generally recognized that most wild ungulates inhabiting the northern part of North America are in a negative energy balance during winter. As a result, severe or repeated human disturbance to ungulates could result in negative effects such as reduced growth rates, poor body condition or decreased reproductive rates, that may in turn reduce adult and calf survival rates (Webster 1997). Harassment may result in anything from slight increase in vigilance to panicked flight, with equally variable consequences to the animal (Jakimchuk 1980, Schideler et al 1986). Human activities such as hiking, snowmobiling, low altitude aircraft flights and All Terrain Vehicle use have all been shown to cause disturbance to wildlife (Webster 1997).



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### ***Why is there such a concern about snowmobiling in mountain caribou range?***

Simpson and Terry (2000) developed a conceptual framework that ranks the relative degree of threat from backcountry skiing, snowcat skiing, heli-skiing and snowmobiling to mountain caribou. Potential negative impacts were assumed to be greater for motorized activities as compared to non-motorized activities and assumed to increase as the size of the affected area increases. The very high magnitude of potential effects from snowmobiling is partly related to accessibility. As road access improves and expands over time, few areas will remain inaccessible to snowmobiling. Potential conflicts from other backcountry recreation activities are expected to occur over a smaller portion of mountain caribou range.

Snowmobile activity in mountain caribou winter range has the potential to influence animals in several ways:

- ☐ human use can displace mountain caribou from preferred habitat with a resultant increased risk of mortality.
- ☐ packed trails can provide improved access for predators and poachers resulting in increased mortality.
- ☐ direct harassment can increase energy expenditure or risk of injury.

In summary, snowmobile use in ungulate winter range could cause the daily energy expenditure of ungulates to increase, wolf predation to rise or the displacement of animals from traditional range to occur.

### ***Harassment Issue***

Snowmobile activity within ungulate winter range can increase the amount of energy expended when animals react to avoid close contact with machines and riders (Geist 1975). How animals respond and how much energy they expend depends on many factors (McLaren and Green 1985, Fancy and White 1986, Simpson 1987, Tyler 1991) including;

- ☐ the degree of previous harassment
- ☐ animal activity prior to disturbance
- ☐ snow depth and compaction
- ☐ visibility
- ☐ wind speed and direction, and
- ☐ topographic features

For ungulates in poor physical condition, or during particularly harsh winters, increased energy expenditure could seriously threaten winter survival.



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### ***Poaching Issue***

In areas where ungulates are not hunted, animals may become less wary to the presence of humans (MacArthur et al 1982). Increasing access by way of developing a network of roads and packed trails throughout an animal's range, makes them more likely to be encountered by humans (Lyon 1984, Frederick 1991, O'Neil 1993). As a result, ungulates become more vulnerable to poaching.

### ***Predation Issue***

Snowmobile trails provide hard packed travel corridors for predators to access habitat occupied by wintering wild ungulates (Neumann and Merriam 1972, Bloomfield 1979). Wolf predation, in particular, is often responsible for adult mortality and low calf survival in caribou populations (Gasaway et al. 1983, Stevenson and Hatler 1985, Bergerud and Ballard 1988, Seip 1991). Much of this mortality occurs during the summer and autumn seasons. During the winter months there is frequently minimal overlap between wolf and caribou winter ranges as moose are often the wolves primary prey and are often spatially separated from caribou. As such, snowmobile trail networks can provide new or improved mobility for predators to caribou winter range areas, which may increase predation rates, resulting in fewer animals. This concern has been observed locally during a wolf survey undertaken in the west Chilcotin during the 1998-99 winter where extensive use of snowmobile trails by wolves was observed in the vicinity of Itcha Ilgachuz Provincial Park (Roorda and Dielman *in prep.*). Furthermore, reducing snowmobile numbers in a given area does not eliminate predator access to winter range as a result of established snowmobile trails.

### ***Displacement of Mountain Caribou from Habitat***

During late winter (January -April) the subalpine parkland becomes the destination area for mountain caribou. The deep winter snow acts as a platform to allow caribou to reach high into trees for their winter forage - arboreal lichens. Mountain caribou prefer to be in high elevation old growth forests in areas of gentle terrain where they can not only find abundant forage but also avoid predation and minimize the risk of mortality from avalanches. Many snowmobile destination areas have similar physical characteristics.

In recent years, demands for subalpine and alpine recreational opportunities have increased throughout the province. Roads to high elevation cutblocks have resulted in increased recreational activity on caribou late winter ranges throughout the Quesnel Highland and Cariboo Mountains. Improved access along with increasing interest in recreational snowmobiling and more powerful machines that are able to traverse most mountain caribou ranges may represent a threat equal to forestry-related habitat loss.

As a result of snowmobile activity, ungulates have been observed to abandon habitat, increase home range size or increase activity during normally inactive periods (Dorrance 1975, Eckstein et al 1979, Simpson 1987). Although mountain caribou are known to



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shift between wintering areas during different years, locally, there is a large body of evidence accumulating that suggests that caribou are abandoning areas of preferred habitat within the Quesnel Highland due to increased snowmobile activity.

Three areas with a very long history of heavy snowmobile use are:

- ☐ Big Timothy Mountain
- ☐ Yanks Peak - Roundtop Mountain
- ☐ Groundhog Lake area near Wells

Mountain caribou have not been observed in these three areas during the late winter period for many years. It appears that the high levels of snowmobile use in these areas have reduced the effectiveness of the local habitat, making it less attractive to caribou. In effect, mountain caribou appear to have abandoned the core of these three snowmobiling areas.

In recent years snowmobile activity has expanded into new areas where radio-telemetry data and population surveys exist back to the mid 1980's. Three areas where there has been an observed decline in use or a shift to areas peripheral to the more recently established snowmobiling area include:

- ☐ Cameron Ridge
- ☐ Headwaters of Bill Miner Creek
- ☐ Mica Mountain

Observations suggest that caribou may tolerate low levels of snowmobile use, but avoid areas of repeated high use. As a result of increased snowmobile activity throughout their range, it appears animals are being displaced out of their traditional areas. There is a concern that alternative areas may be poorer quality habitat where caribou are at higher risk to mortality. Also, displacement results in shrinking the amount of winter range available to caribou. When caribou are forced to occupy smaller range it is thought that there is a corresponding decrease in population levels.



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### ***Management principals for assessing and reducing outdoor recreation impacts on mountain caribou***

Although the effects of snowmobiling on various ungulates have been investigated, the scientific literature available on the impacts of snowmobile activity and human disturbance on caribou is incomplete. Thus the following principles were utilized to develop management guidelines to reduce potential impacts between mountain caribou and snowmobiling.

- ☐ Adaptive Management Principle - where scientific studies are lacking, adaptive management should be employed to develop scientifically supportable guidelines for outdoor recreation activities.
- ☐ Environmental Stewardship – outdoor recreational activities must not impact environmental integrity, and only use land resources within their capacity to sustain use, while maintaining biological diversity.
- ☐ Precautionary Principle – where there are threats of serious or irreversible impacts to wildlife population viability, lack of full scientific certainty should not be used as a reason for postponing measures to regulate disturbance activities from motorized recreation.
- ☐ Scientific Basis Principle – management guidelines for sustainable use of wildlife must be scientifically based, and supportable from available research or field studies. Where adequate scientific studies are lacking upon which to base management recommendations, interim recommendations should be based on a combination of best professional opinion and the precautionary principle.

### ***Management Guidelines for Snowmobile Zoning within Mountain Caribou Range***

The regional caribou strategy committee recommend the following guidelines in an attempt to minimize conflicts between mountain caribou and snowmobiling.

- ☐ At the landscape level, a few small, intensively used areas will have less impact on caribou than several large areas receiving moderate use.
- ☐ **Designated snowmobile areas should ideally avoid high sensitivity caribou areas (refer to Figure 13).** High sensitivity caribou wintering areas were defined from radio-telemetry data, population surveys and habitat suitability modeling. Limited snowmobiling opportunities should adhere to the following direction:
  - ☐ **To maximize use of designated snowmobile areas, they should be strategically located to ensure their accessibility from several communities.** For example, Yanks Peak is accessible from both Wells (through the ‘modified harvest’ along Cunningham Creek) and Likely (via



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Keithley Creek), while Big Timothy Mountain is accessible from Williams Lake, Horsefly and 100 Mile House.

- ☐ **Rather than establishing new snowmobile use areas within habitat presently occupied by caribou, it generally would be preferable to maintain historic long-term snowmobiling areas that caribou no longer utilize.** Although areas such as Groundhog Lake, Yanks Peak and Big Timothy Mountain have high capability to support mountain caribou they have not been utilized for many years.
- ☐ **Snowmobile areas should avoid ‘no harvest’ areas as identified by the Regional Caribou Strategy.** These are considered high value caribou areas, where substantial compromise has already occurred through the Cariboo-Chilcotin Land Use Plan.
- ☐ **Snowmobile areas should avoid the ‘modified harvest’ land between the east arm and north arm of Quesnel Lake.** This will allow monitoring of the area to determine whether the ‘modified harvest’ approach continues to be utilized by caribou without the confounding effects of snowmobiling activity.
- ☐ **In areas of caribou low elevation winter range careful timing of snowmobile use may be adequate to protect caribou.** By not snowmobiling in these areas from Nov. 1 to Jan. 15 most conflicts could be avoided.
- ☐ **Where possible, snowmobile areas should be peripheral to caribou range.**
- ☐ **Designated snowmobile areas should also avoid other sensitive wildlife habitat such as Mountain Goat winter range.** Mountain goat areas are very rugged terrain that also pose safety concerns to snowmobilers.
- ☐ **An enforcement strategy must be developed that will insure the recommendations are followed.**

### ***References***

- Bergerud, A.T. and W.B. Ballard. 1988. Wolf predation on caribou: The Nelchina Herd case history, a different interpretation. *J. Wildl. Manage.* 52 (2): 344-357.
- Bloomfield, M.I. 1979. The ecology and status of mountain caribou and caribou range in central British Columbia. M.Sc. thesis, University of Alberta, Edmonton. 318p.



- 
- Dorrance, M.J., R.D. Jakimchuck & E.R. Carruthers. 1975. Effects of snowmobiles on white-tailed deer. *J. Wildl. Manage.* 39 (3): 563-569.
- Eckstein, R.G., T.F. O'Brien, O.J. Rongstad, & J.G. Bollinger. 1979. Snowmobile effects on movements of white-tailed deer: A case-study. *Envir. Conserv.* 6 (1): 45-51.
- Fancy, S.G. and R.G. White. 1986. Predicting energy expenditures for activities of caribou from heart rates. *Rangifer*, Special Issue No.1: 123-130.
- Frederick, Glenn P. 1991. Effects of forest roads on grizzly bears, elk and gray wolves: A literature review. USDA Forest Service Kootenai National Forest.
- Gasaway, William C., Robert O. Stephensen, James L. Davis, Peter Shepherd & Oliver E. Burris. 1983. Interrelationships of wolves, prey, and man in Interior Alaska. *Wildl. Monographs* (ISSN:0084-0173, no 84) 49p.
- Geist, V. 1975. Harassment of large mammals and birds. Rep. to the Berger commission submitted by Arctic Gas Study Ltd. Calgary, Alberta. 62p.
- Gilbert, B. K. 1989. Behavioral plasticity and bear-human conflicts. Pages 1-8 In Bear-People Conflicts Proceedings of a Symposium on Management Strategies. Northwest Territories Department of Renewable Resources, Whitehorse, Canada. In Whittaker, Doug and Richard Knight. Understanding wildlife responses to humans. *Wildlife Society Bulletin* 1998, 26(2):212-317.
- Jakimchuck, R.D. 1980. Disturbance to barren-ground caribou: A review of the effects and implications of human developments and activities. R.D. Jakimchuck Management Associates Ltd., Sidney, B. C. 121p.
- Lyon, Jack L. 1984. Road effects and impacts on wildlife and fisheries. In Proceedings of the Forest Transportation Symposium. Casper, Wyoming. Forest Service, Region 2, Denver. p98-118.
- MacArthur, R.A., V. Geist and Ronald Johnston. 1982. Cardiac and behavioural response of mountain sheep to human disturbance. *J. of Wildl. Manage.* 46: 351-358.
- McLaren, Margaret A. and Jeffrey E. Green. 1985. The reactions of muskoxen to snowmobile harassment. *Arctic*, 38 (3): 188-193.
- Neumann, Peter W and Merriam Gray. Ecological effects of snowmobiles. 1972. *Can. Field-Nat.* 86 (3): 207-212.



- 
- O'Neil, Grady. 1993. Access development in the Peace-Liard Sub-region (1975-1992) and it's potential impacts on wildlife: Draft. Ministry of Environment, Ft. St. John.
- Seip, Dale R. 1991. Predation and caribou populations. In Proceedings of the 5th North American Caribou Workshop, Yellowknife, N.W.T.
- Shideler, R.T., H.H. Robus, J.J. Winters & M. Kuwada. 1986. Impacts of human developments and land use on caribou: A literature review, I. A world-wide perspective. Alaska Dep. Fish & Game, Div. Habitat, Tech. Rep., 86-2.
- Simpson, Keith. 1987. The effects of snowmobiling on winter range use by mountain caribou. Wildlife Working Report WR-25. Wildlife Branch, Nelson BC.
- Simpson, K. and E. Terry. 2000. Impacts of backcountry recreation activities on mountain caribou. Wildlife Working Report WR-99, Wildlife Br., Victoria BC.
- Stevenson, S.K. and D.F. Hatler. 1985. Woodland caribou and their habitat in southern and central British Columbia, Volume 1. Land Management Report. No. 23. British Columbia Ministry of Forests, Victoria. 355p.
- Webster, Lara. 1997. The effects of human related harassment on caribou (*Rangifer tarandus*). Report prepared for the Ministry of Environment, Lands and Parks, Williams Lake, B. C. 33p.
- Whittaker, Doug and Richard Knight. 1998. Understanding wildlife responses to humans. Wildlife Society Bulletin. 26(2):312-317.



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## APPENDIX 7. RISK ASSESSMENT CALCULATIONS (FROM HARPER AND EASTMAN 2000)

There is a need to provide a consistent and explicit basis for assessing risks so that management attention can be focused on the most critical issues. To provide this perspective, we adopted the risk assessment procedure used by the Compliance and Enforcement Branch (Ministry of Forests 1998). Initial risk assessment is based on two considerations: 1) the likelihood of a detrimental impact, and 2) the magnitude of the consequences. Given the lack of quantifiable assessments in the literature, qualitative judgments were used.

Initial risk assessment has the following steps:

- 1) identifying the detrimental impacts
- 2) estimating the likelihood of an adverse impact (rated as very high, high, moderate and low)
- 3) estimating the magnitude of the consequences of the impact, based on the impact and the intensity of an event (rated as very high, high, moderate and low)
- 4) combining the likelihood of impact with the magnitude of the impact to arrive an overall assessment of risk (rated as very high, high, moderate and low).

Table 10 presents the rating system applied in this report. The resulting assessment is a list of hazards or risks that is explicit and ranked.

**Table 10. Method of calculating initial risk ratings based on the likelihood and magnitude of estimated impacts.**

LIKELIHOOD	x	MAGNITUDE	=	RISK*
Very High	x	Very High	=	Very High
Very High	x	High	=	Very High
High	x	Very High	=	Very High
High	x	High	=	Very High
Very High	x	Moderate	=	High
High	x	Moderate	=	High
Moderate	x	Very High	=	High
Moderate	x	High	=	High
Very High	x	Low	=	Moderate
High	x	Low	=	Moderate
Moderate	x	Moderate	=	Moderate
Low	x	Very High	=	Moderate
Low	x	High	=	Moderate
Moderate	x	Low	=	Low
Low	x	Moderate	=	Low
Low	x	Low	=	Low

- after Ministry of Forests 1998.



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## APPENDIX 8. QUESTIONS AND ANSWERS IN RELATION TO THE EASTERN CARIBOU STRATEGY

### 1. *Why is an extended rotation required to manage for lichens?*

To manage for arboreal lichen production in harvested forests in the eastern caribou area will require, in effect, a doubling of the rotation to 240 years, with 3 cutting cycles removing 33% gross volume every 80 years.

Group selection with 33% removal every 80 years will eventually produce a *multi-aged stand* made up of 1/3 trees 0 to 80 years, 1/3 trees 81 to 160 years, and 1/3 trees 161 to 240 years of age. The 0 to 80 year-old trees will not have significant lichen present. This is clear from looking at lichen distribution on younger trees. The 81 to 160 year-old trees will start to have some suitable substrates for lichen so fragments can securely attach and grow. Since lichen is slow growing, trees of this age range have less lichen biomass than older stands. The 161 to 240 year-old trees will have the substrates necessary for lichens and will be in this condition for sufficient time for lichen biomass to build to usable levels for caribou. It is important to remember that these are tree age distributions *within* stands and do not reflect stand ages as is used to assess seral stage distribution.

A stand managed in this way will have less lichen biomass than an uncut old forest; about half the biomass given the age distribution of the trees (Table 11). We are optimistic that this will still be acceptable habitat for caribou; however, we acknowledge a considerable level of uncertainty about this. We would describe this stand level management as a moderate risk of not maintaining caribou habitat.

**Table 11. The estimated proportion of ‘old’ stand lichen biomass in forest stands managed on a 240-year rotation with 33 % removal every 80 years.**

<i>Age of Trees Within Individual Stands</i>	<i>Proportion of Stand (A)</i>	<i>Proportion of ‘Old’ Stand Lichen Biomass by Age Class (B)</i>	<i>Proportion of ‘Old’ Stand Lichen Biomass (A X B)</i>
<b>0 – 80</b>	0.33	0.0 – 0.2	0.0 – 0.06
<b>81 – 160</b>	0.33	0.3 – 0.6	0.10 – 0.20
<b>161 – 240</b>	0.33	0.8 – 0.9	0.26 – 0.30
		<b>TOTAL:</b>	<b>36 – 56%</b>



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## 2. *Why limit timber removal to 33%?*

It is our technical assessment that any change to the removal per entry is unacceptable both from the caribou habitat and from the windfirmness standpoints.

Higher levels of timber removal would produce corresponding higher rates of lichen loss within the stand. Also, with higher volume removals the growth rate of lichen will probably decline as micro-climatic conditions less favorable to arboreal lichen are created. Additionally, research conducted in the Prince George region has shown that wind scouring of arboreal lichen increases with greater volume removal (Stevenson et al. 1994).

Harvest entries of more than 33% timber removal have a much greater risk of blowdown which not only impacts caribou habitat but also harvest opportunities.

## 3. *Why not shorten the cutting cycle to less than 80 years?*

It is important to remember that the integrated management prescription being advocated (33% removal every 80 years; 100% volume available in 240 years) is still quite risky and is estimated to reduce the stand lichen biomass to about half of the lichen biomass of an uncut stand (Table 11).

To shorten the cutting cycle to less than 80 years would not allow trees to reach a sufficient age for lichen establishment *and* remain long enough for lichen to grow to usable quantities. For example, in Table 12 we estimate that reducing the cutting cycle to 70 years (100% volume available in 210 years) would produce a stand with approximately 24-41% of the lichen biomass of an uncut old stand.

**Table 12. The estimated proportion of 'old' stand lichen biomass in forest stands managed on a 210-year rotation with 33 % volume every 70 years.**

<i>Age of Trees Within Individual Stands</i>	<i>Proportion of Stand (A)</i>	<i>Proportion of 'Old' Stand Lichen Biomass by Age Class (B)</i>	<i>Proportion of 'Old' Stand Lichen Biomass (A X B)</i>
<b>0 – 70</b>	0.33	0.0 – 0.15	0.0 – 0.05
<b>71 – 140</b>	0.33	0.2 – 0.4	0.07 – 0.13
<b>141 – 210</b>	0.33	0.5 – 0.7	0.17 – 0.23
		<b>TOTAL:</b>	<b>0.24 – 0.41</b>



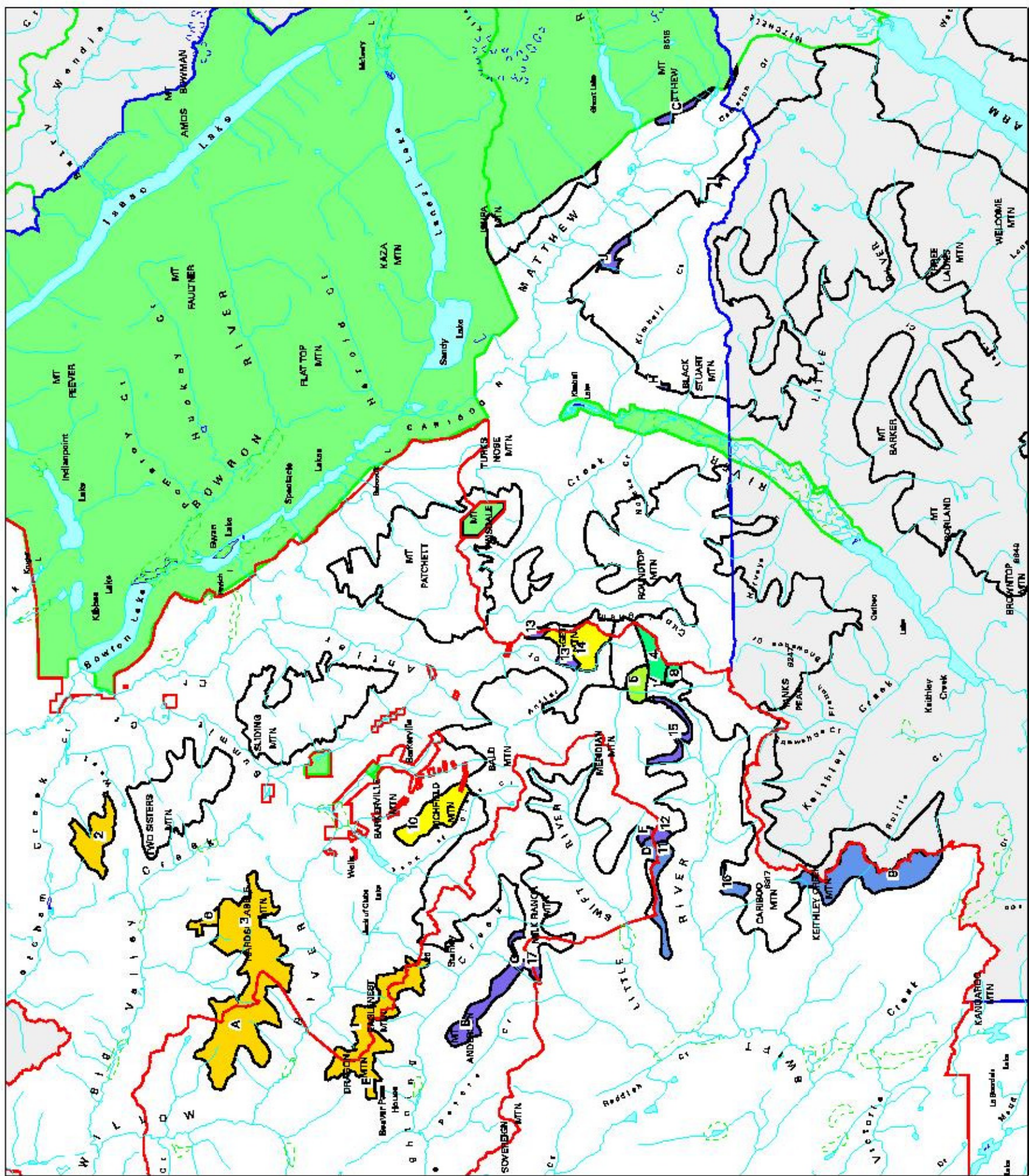
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***4. Has the Caribou Strategy Committee recognized professional accountability in the development of the strategy?***

The caribou strategy provides specific recommendations where specifics are necessary to achieve the goal of maintaining caribou habitat. It also allows flexibility to achieve objectives where flexibility is warranted, thereby allowing for the exercise of professional accountability. For example, the operational location of harvest boundaries (section 5), the selection of silvicultural systems from the choices in table 5, and the choice of post-harvest treatments are all decisions to which professional accountability would apply. While the strategy provides some specific goalposts plus considerable flexibility, the licensees will still have to submit plans to the SDM's which rationalize how they fit into both the caribou strategy and any overlapping SRP (Sub-Regional Plan).



Trade areas in the Quesnel Forest District, prior to final line refinements



Adjustments prior to final line refinement

- |  |                                    |                                |                                    |  |
|--|------------------------------------|--------------------------------|------------------------------------|--|
| Conventional harvest to Modified harvest | Conventional harvest to No harvest | Modified harvest to No harvest | No harvest to Conventional harvest | Modified harvest to Conventional harvest |
| Quesnel Forest District                  | TFL 52                             | Historic Deferral Area         | Provincial Park                    |  |

WEST FRASER MILLS LTD. AREA

- |                  |                  |
|------------------|------------------|
| 1 Eaglenest      | 10 Richfield Mtn |
| 2 Lottie Lake    | 11 Swift R.      |
| 3 Mt Tom         | 12 Swift R.      |
| 4 Nugget Mtn.    | 13 Nugget Mtn.   |
| 5 Swift River    | 14 Nugget Mtn.   |
| 6 Add. to Mt Tom | 15 Swift R.      |
| 7 Aster Cr.      | 16 Cariboo Mtn.  |
| 8 Aster Cr.      | 17 Van Winkle    |
| 9 Porter Cr.     |                  |

WELDWOOD OF CANADA LTD. AREAS

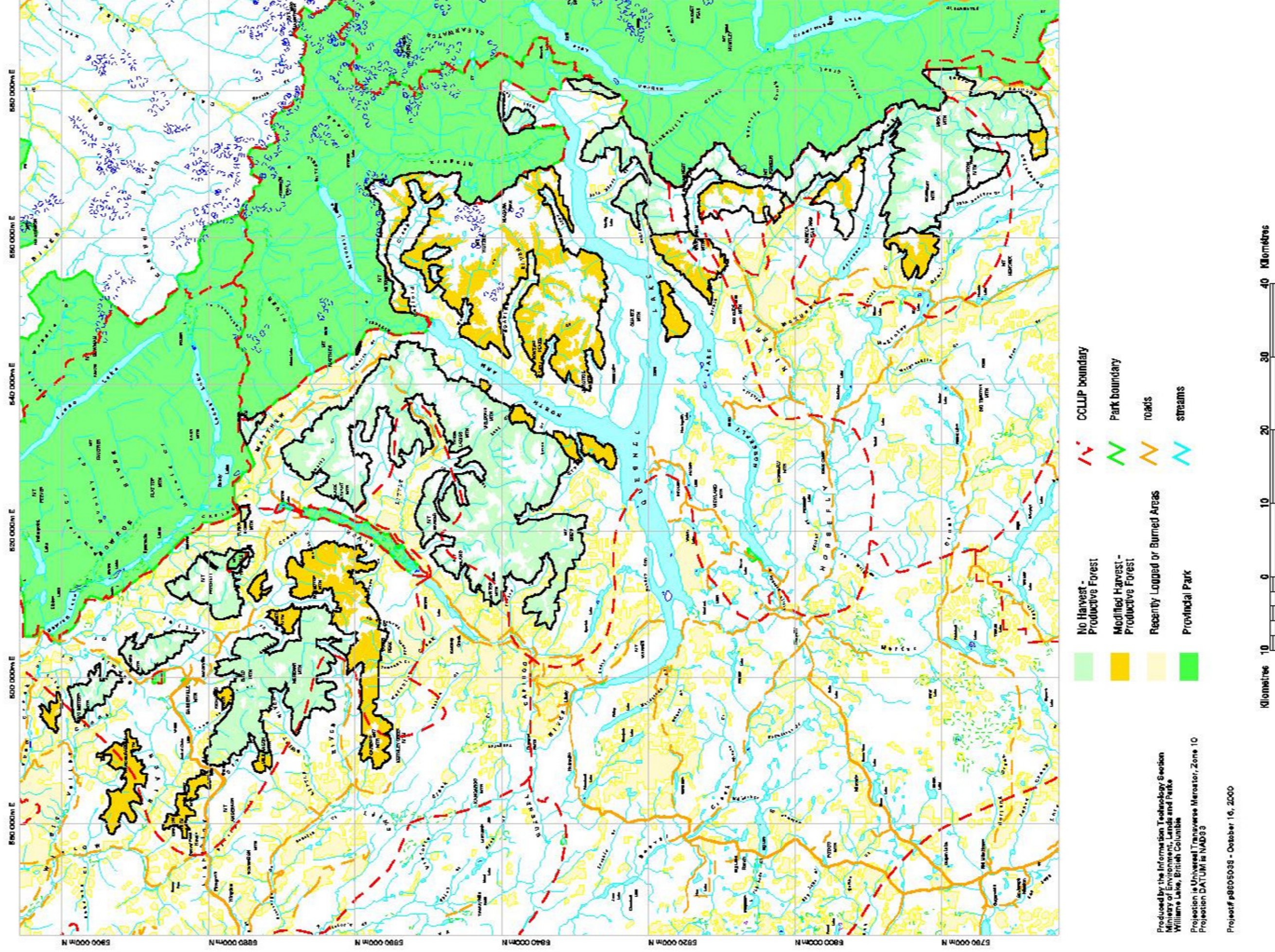
- |                  |
|------------------|
| A Mt Tom         |
| B Mt Anderson    |
| C Mt Matthew     |
| D Little Swift   |
| E Eaglenest      |
| F Little Swift   |
| G Van Winkle     |
| H Black Stuart   |
| I Connection Cr. |
| J Comet Cr.      |

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Williams Lake, British Columbia  
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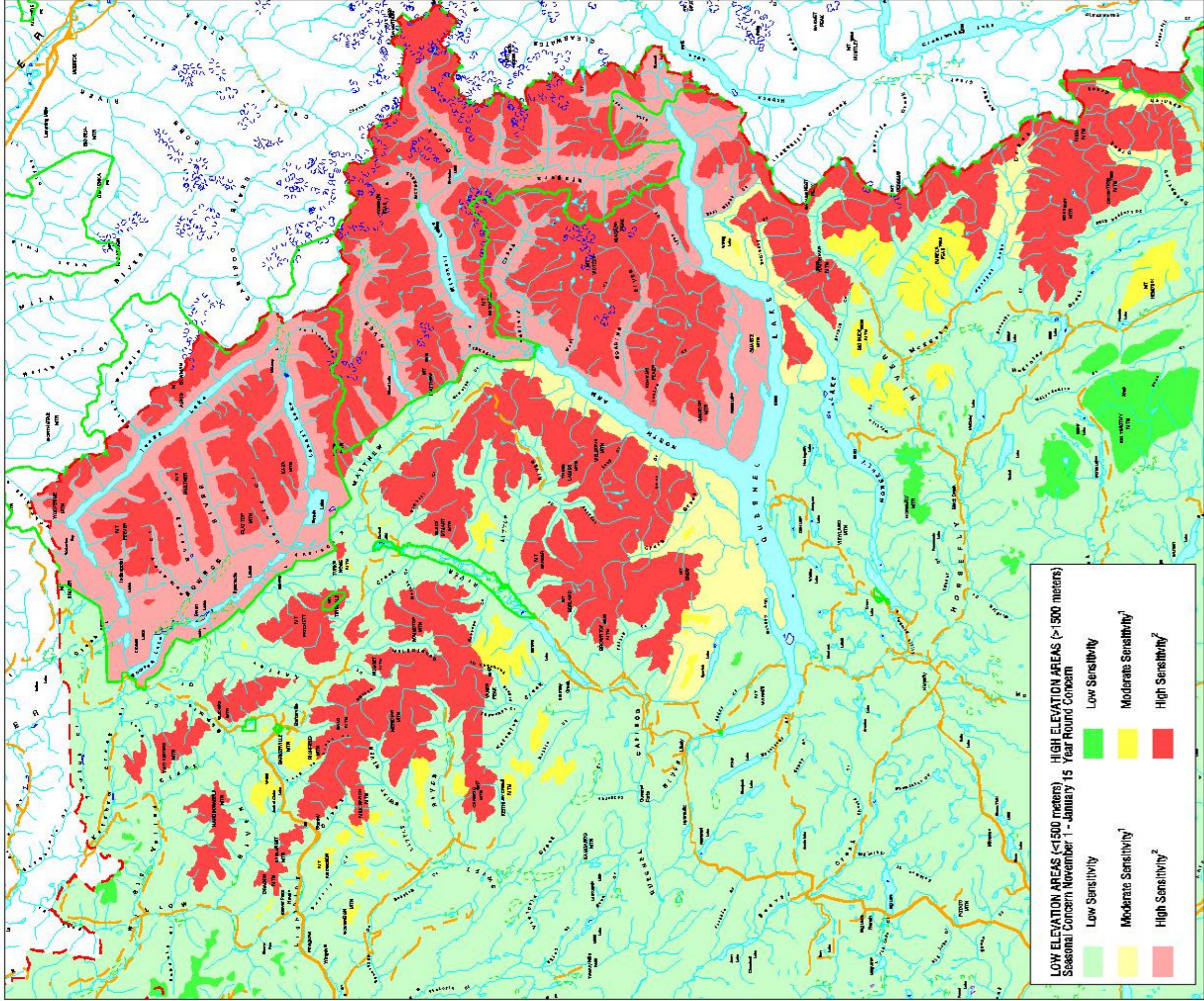
Project # 9805038 - October 16, 2000



# Areas of "No Harvest" and "Modified Harvest" for eastern caribou as recommended by the Caribou Strategy Committee, 2000

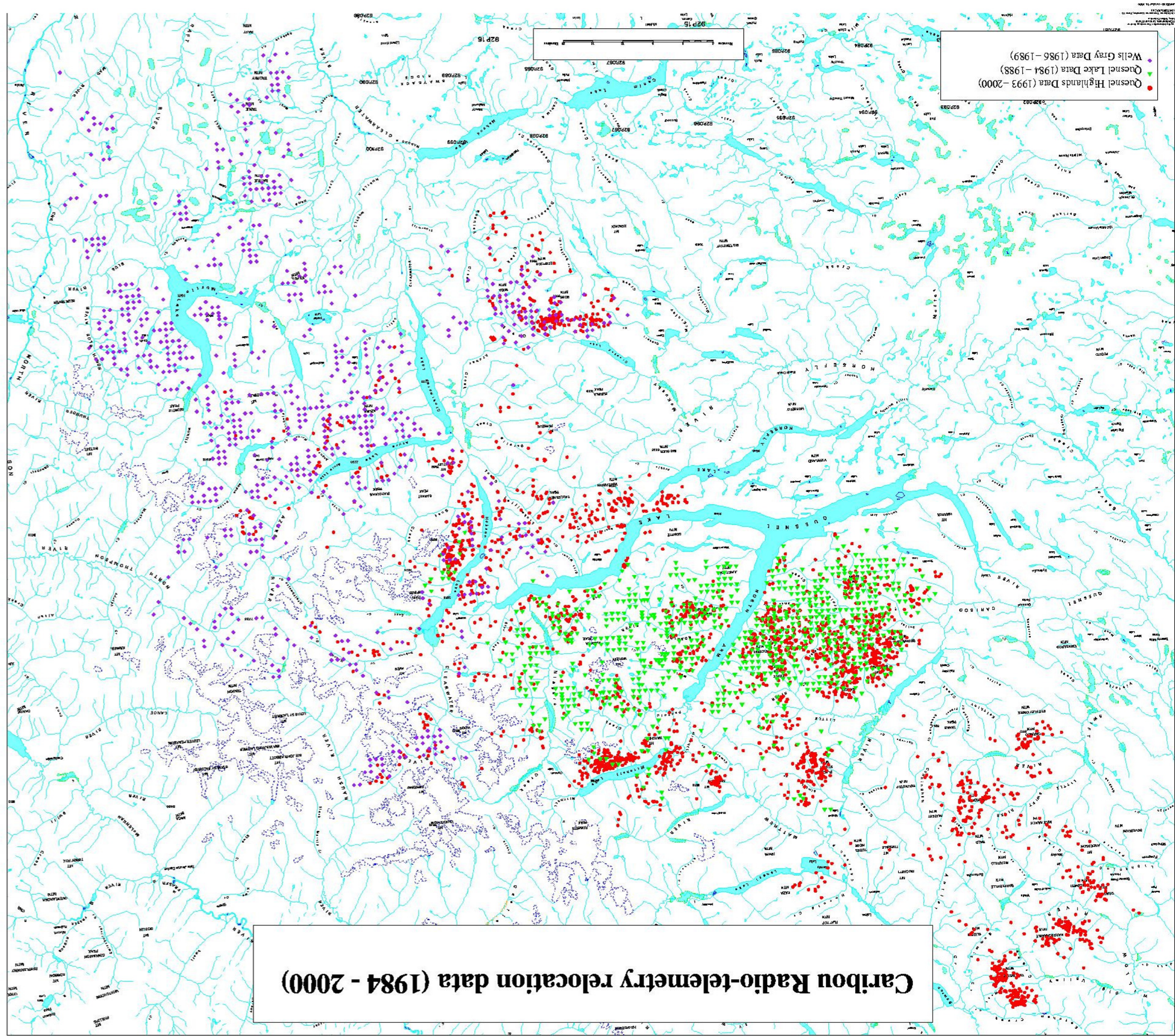


# Sensitive caribou areas where recreational uses of snowmobiles, ATVs and helicopters should be carefully regulated and/or excluded

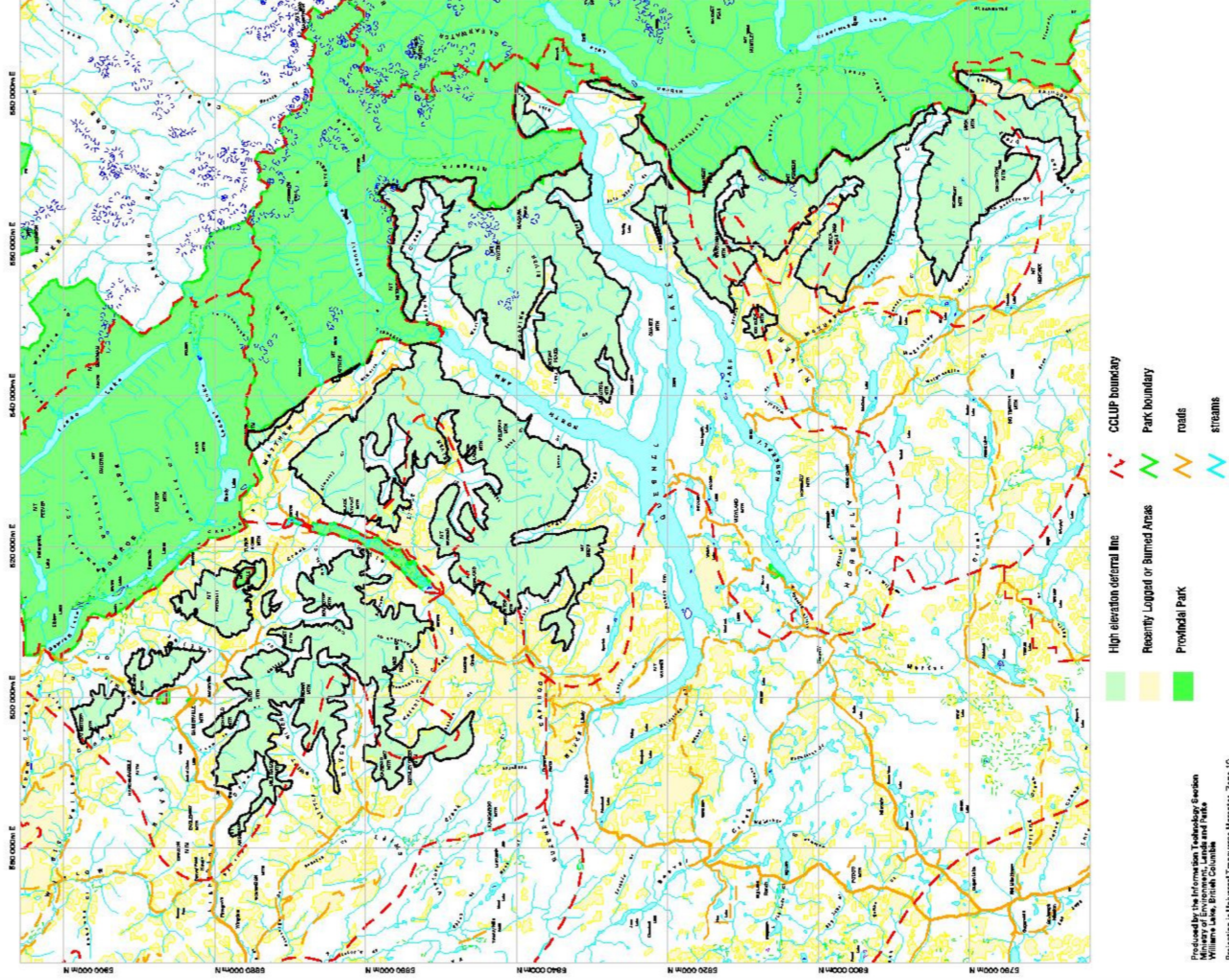


1 Moderate sensitivity areas may require some motorized recreation restrictions.

2 High sensitivity areas will require a combination of careful regulation and areas closed to motorized recreation in order to maintain caribou - refer to management guidelines within Appendix 6 for details.



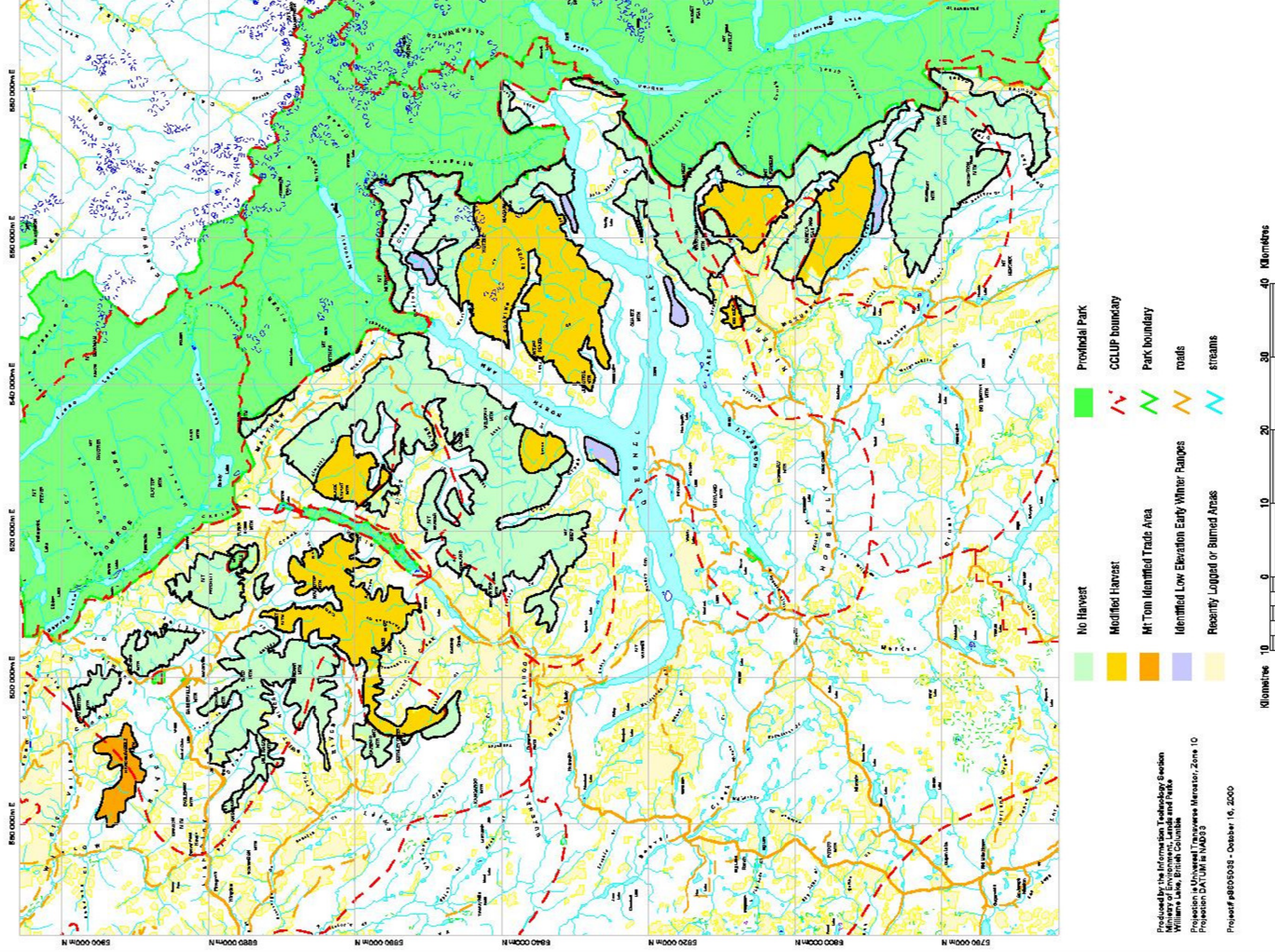
# Historic high elevation caribou deferral area, as recognized by the CCLUP



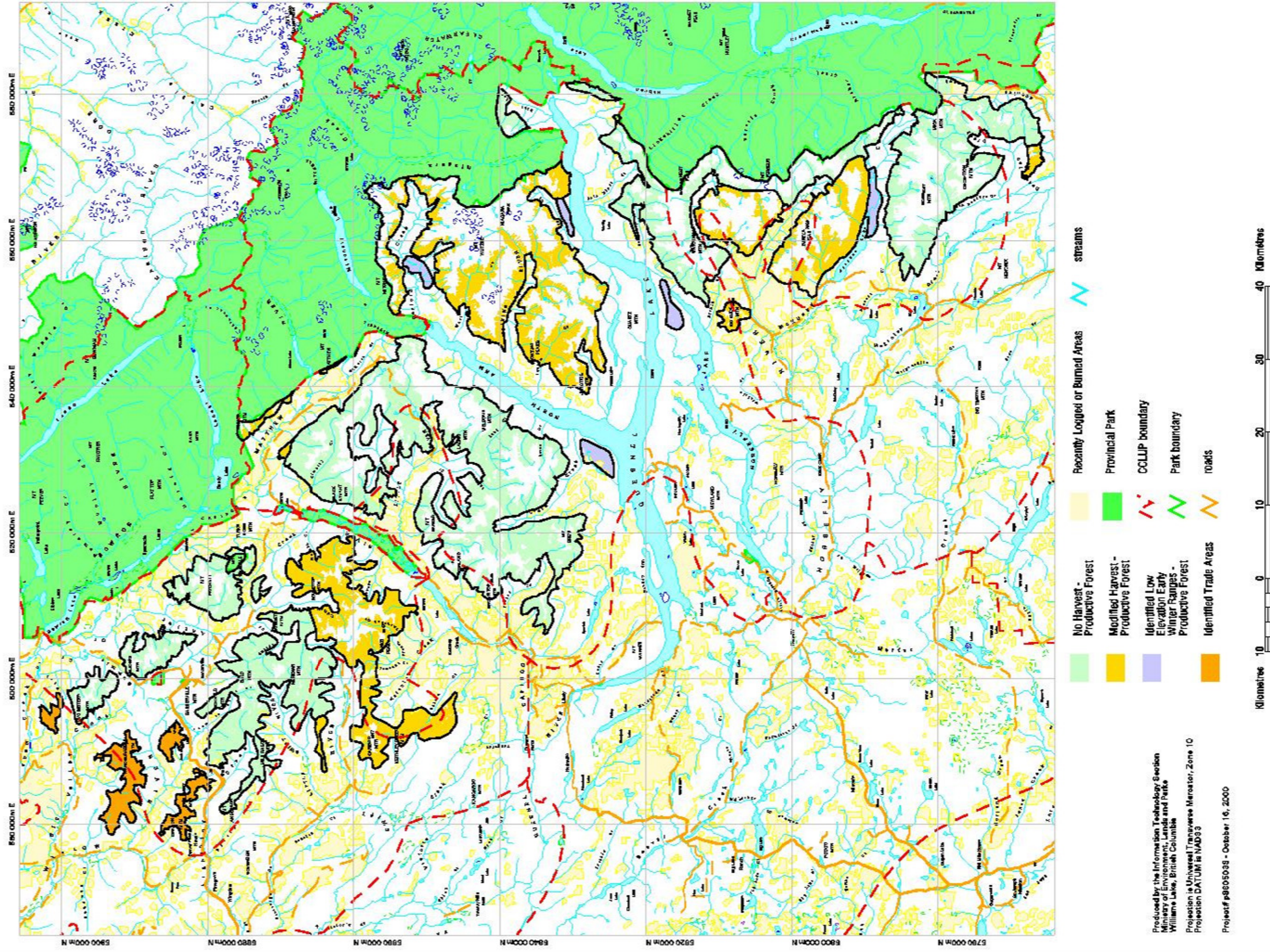
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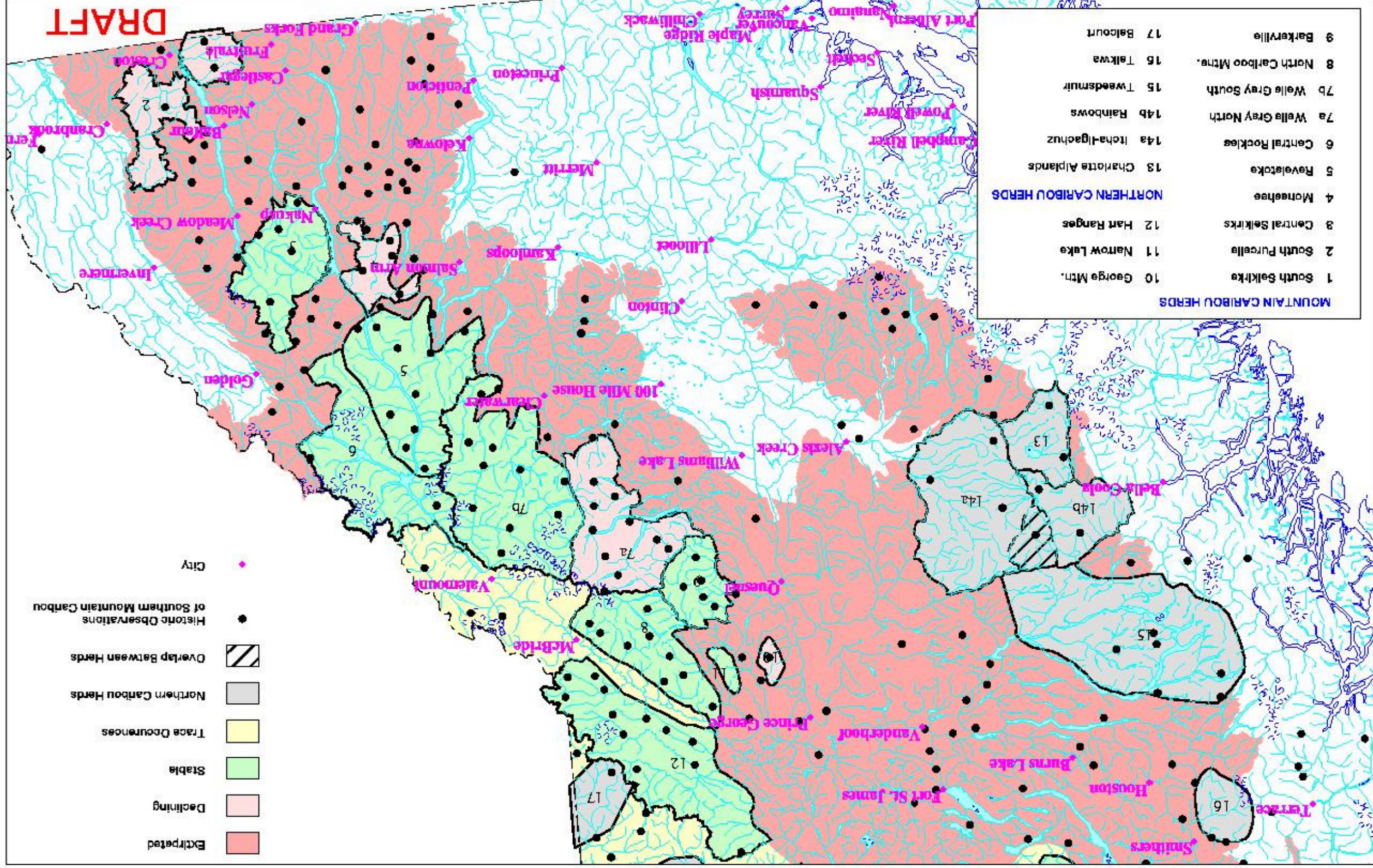
# 1996 Option "A", as recommended by the Caribou Strategy Committee



# 1998 Option "A", as recommended by the Caribou Strategy Committee



## Historic and current distribution of mountain caribou in southern BC

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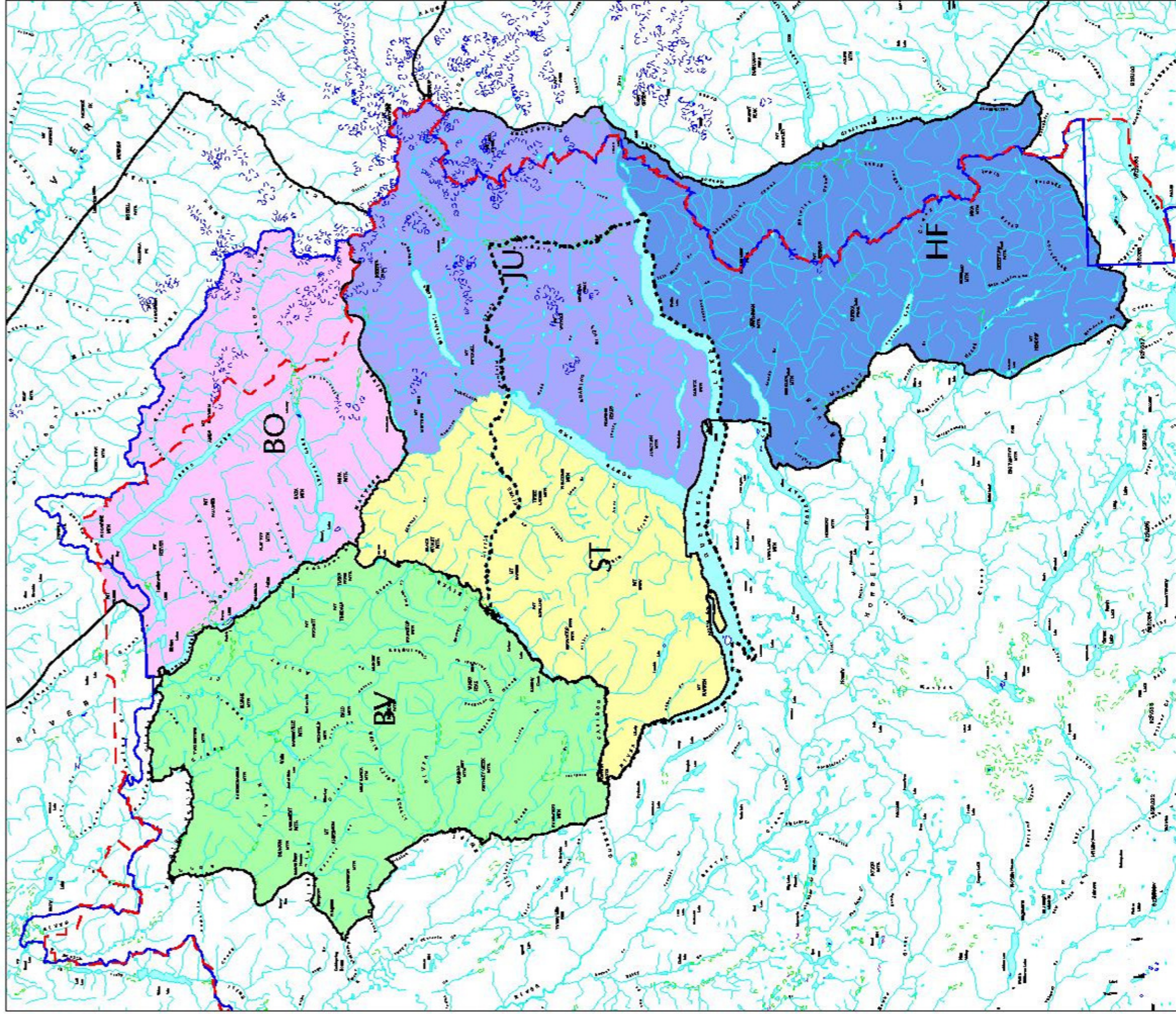
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Project# p9805038 - October 16, 2000

# Location of mountain caribou sub-populations and inventory blocks in the Cariboo Region



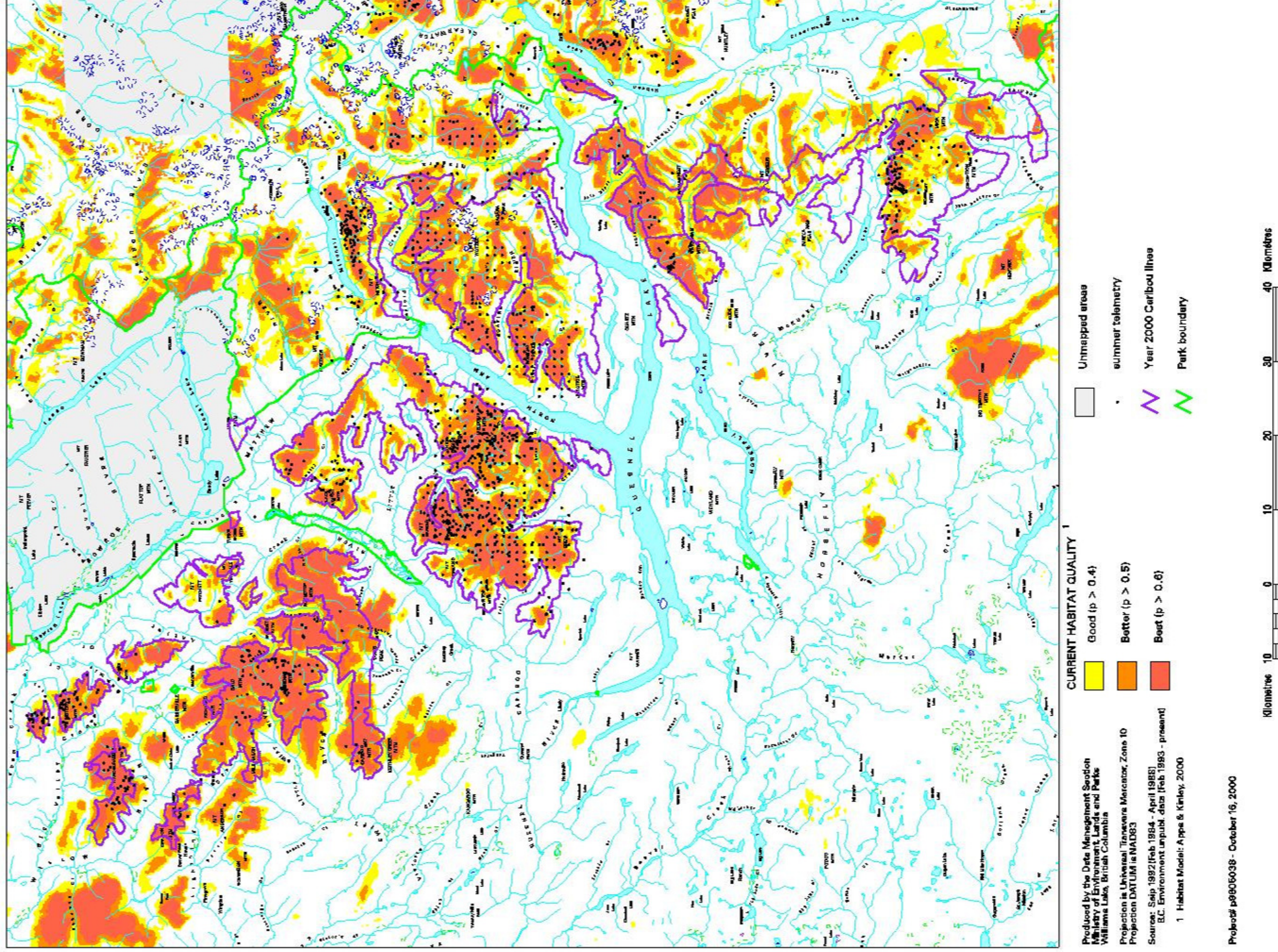
- BV Barkerville Census Block (and sub-population)
- ST Staverson Census Block (portion of Wells Gray North sub-population)
- HF Horseshy Census Block (portion of Wells Gray North sub-population)
- JU Junction Census Block (portion of Wells Gray North sub-population)
- BO Bowron Census Block (portion of North Cariboo Mountains sub-population)
- MELP Regional boundary
- CCLUP boundary
- Sub-population boundary
- Queenhel Lake Survey boundary

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Williams Lake, British Columbia

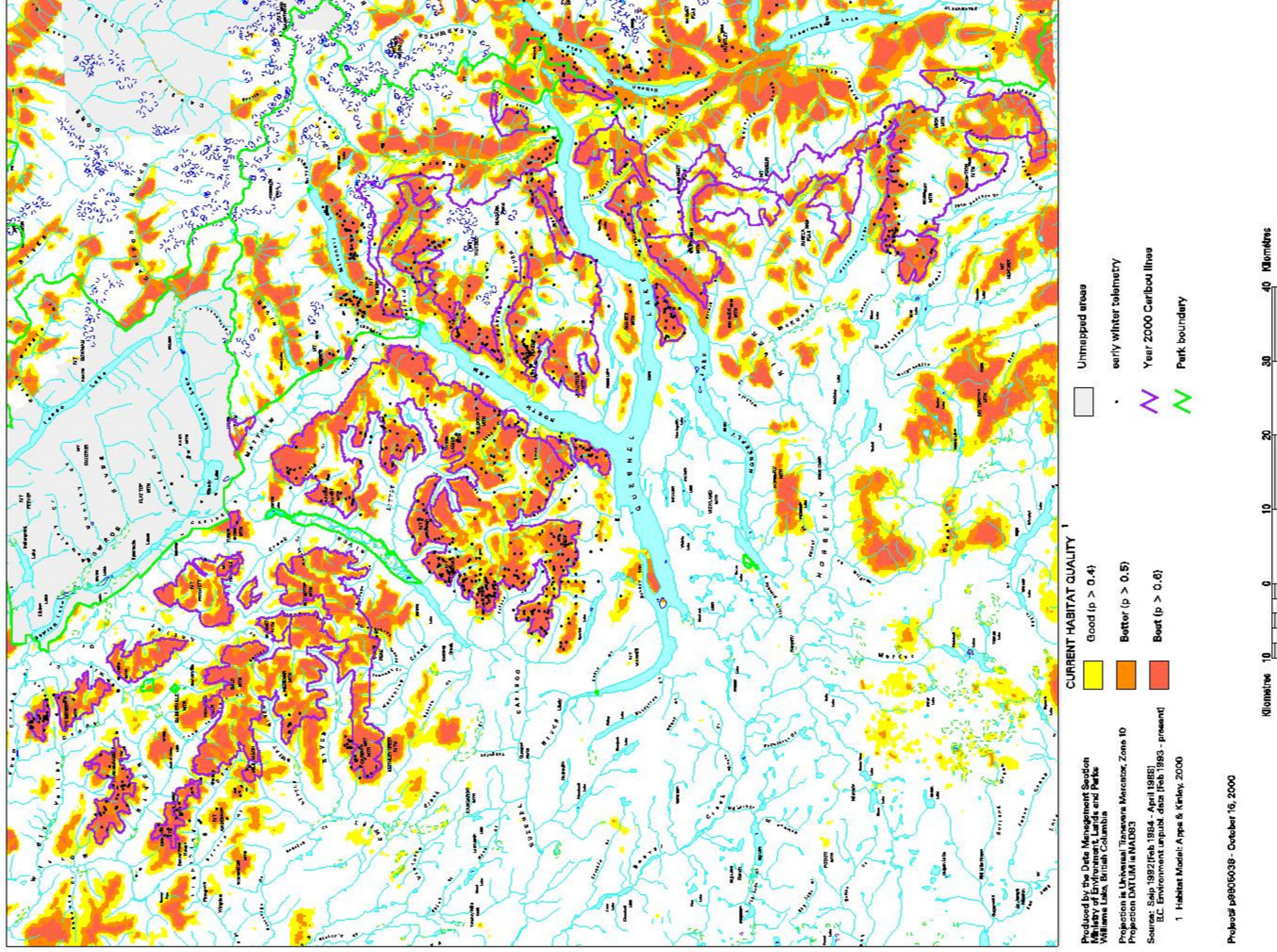
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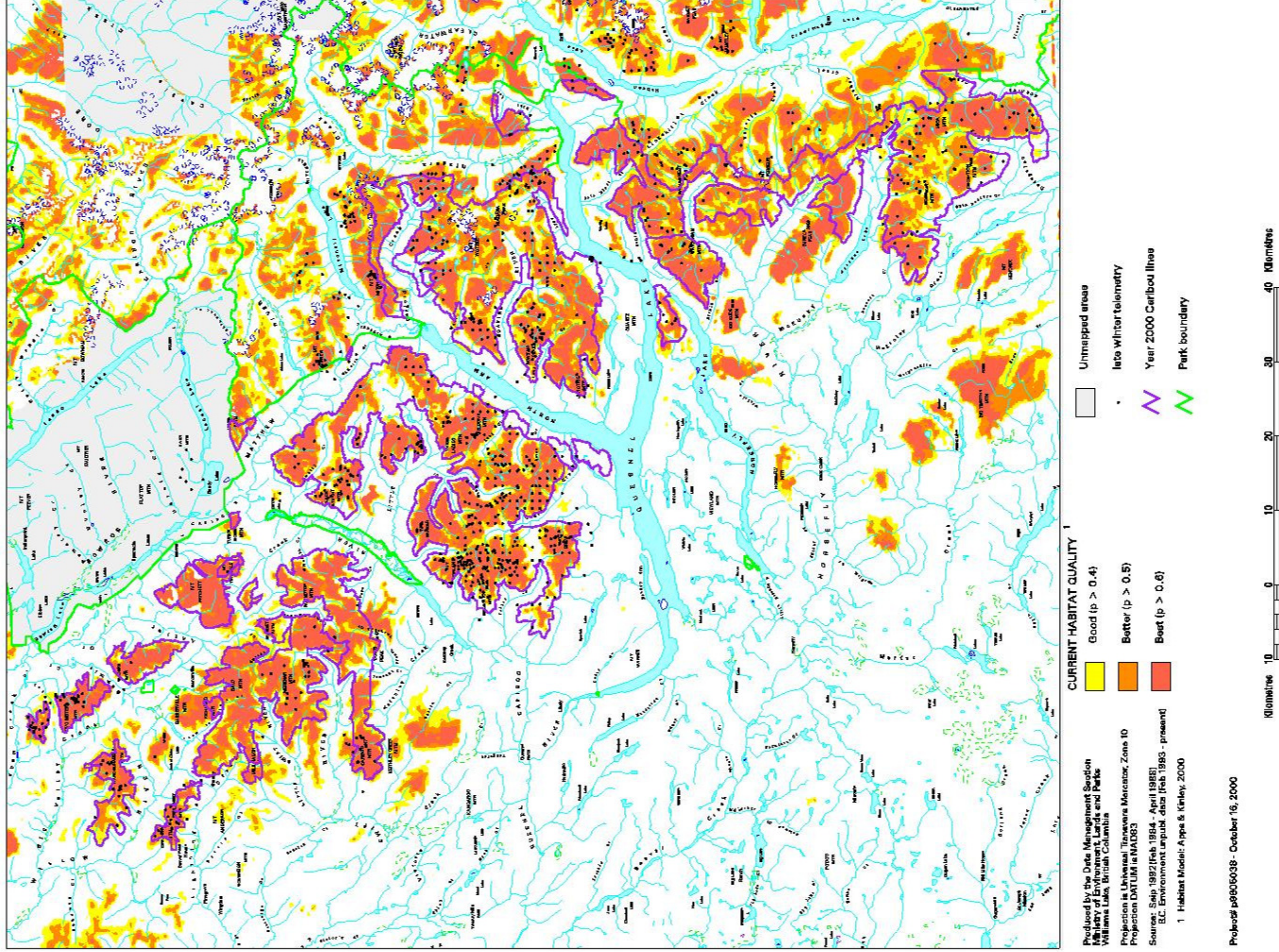
# Predicted summer caribou habitat suitability and radio-telemetry data



# Predicted early winter caribou habitat suitability and radio-telemetry data



# Predicted late winter caribou habitat suitability and radio-telemetry data



# Predicted spring caribou habitat suitability and radio-telemetry data

