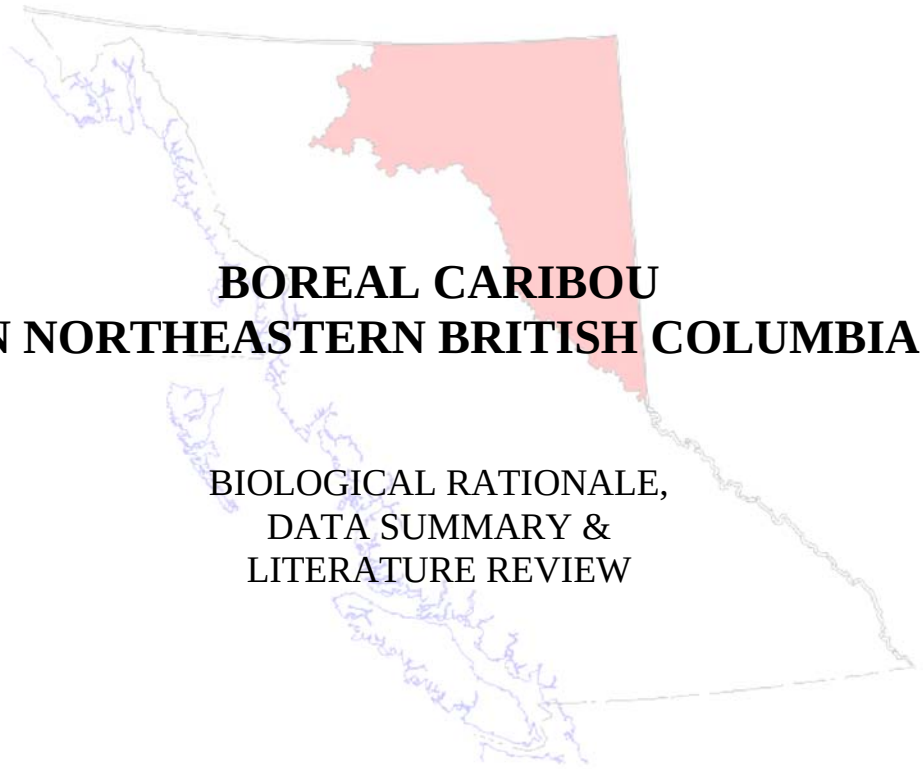

# BOREAL CARIBOU
# IN NORTHEASTERN BRITISH COLUMBIA

BIOLOGICAL RATIONALE,
DATA SUMMARY &
LITERATURE REVIEW

Report: May 2009

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## EXECUTIVE SUMMARY

The boreal ecotype of woodland caribou (*Rangifer tarandus caribou*) are red-listed as *threatened* by both Provincial and Federal Species at Risk listings. Their habitat, however, continues to be fragmented and lost due to the expansion of industry into the boreal forest. In British Columbia, boreal caribou can be offered some habitat protection under the *Forest and Range Practices Act*, which allows for the identification of both Ungulate Winter Range and Wildlife Habitat Areas for wintering, calving and rutting habitats. The purpose of this document is to summarize boreal caribou ecology and habitat requirements, and provide a rationale for the delineation of both Ungulate Winter Ranges and Wildlife Habitat Areas for boreal caribou in northeastern British Columbia.

## TABLE OF CONTENTS

Executive Summary ..... i
Table of Contents ..... ii
List of Figures ..... iii
List of Tables ..... iii
Introduction ..... 1
Ecology and Habitat Requirements ..... 3
Impacts ..... 5
  Forestry ..... 5
  Forest Fires ..... 6
  Petroleum Exploration ..... 6
Data Summary ..... 7
Habitat Protection ..... 8
  Species Designation ..... 8
  Habitat Protection Mechanisms ..... 9
  Rationale for Delineation of UWR & WHA Polygons ..... 9
Management ..... 14
  General Wildlife Measures ..... 14
    Winter Habitats ..... 14
    Calving and Rutting Habitats ..... 15
  Guidelines and Best Management Practices ..... 15
References ..... 17
Personal Communications ..... 20
Appendix I: General Wildlife Measure Definitions ..... 21

## LIST OF FIGURES

Figure 1. Distribution of woodland caribou (*Rangifer tarandus caribou*) across Canada. Figure taken from Thomas and Gray (2002). ..... 1
Figure 2. Distribution of boreal caribou in British Columbia. The dark green areas represent the core areas. ..... 2
Figure 3. Ungulate Winter Range and Wildlife Habitat Area polygons, proposed under the Forest and Range Practices Act, for boreal caribou in the Fort Nelson area. ..... 10
Figure 4. Impact analysis showing industrial footprint in boreal caribou core areas, northeastern British Columbia (Thiessen 2009). ..... 13

## LIST OF TABLES

Table 1. Current population estimates for the 6 boreal caribou ranges in northeastern British Columbia. Estimates were taken from BCTAC 2004. ..... 3
Table 2. Calf survival estimates, represented by calf:cow ratios, for fall and late-winter (10 month) recruitment counts conducted in 3 boreal caribou ranges in northeastern BC and estimates for boreal caribou across Alberta and Saskatchewan. ..... 4
Table 3. Summary of the spatial data available for boreal caribou ranges and associated core areas in northeastern British Columbia. ..... 8
Table 4. Preliminary impact analysis of oil and gas footprint in boreal caribou core areas in northeastern British Columbia. Areas in red indicate the suggested 61% impact rate is exceeded within the core area (Thiessen, in prep). ..... 12
Table 5. General wildlife measures (GWMs) for proposed ungulate winter range and wildlife habitat areas for boreal caribou in northeastern British Columbia. ..... 16

## INTRODUCTION

The boreal ecotype of woodland caribou (*Rangifer tarandus caribou*) have been designated as *threatened* on Schedule 1 of the federal *Species at Risk Act* (COSEWIC 2002), and in British Columbia are considered *threatened* and are red-listed by the Conservation Data Centre (CDC 2008). Boreal caribou exist across Canada, and within British Columbia, are only found in the northeastern corner of the province (Figures 1, 2). Across their range, boreal caribou populations have been declining and disappearing from areas where populations existed historically (Dzus 2001; Thomas and Gray 2002; McLoughlin et al. 2003). The primary factors affecting population decline include habitat loss, due to forestry, oil and gas, agriculture, human infrastructure, and predation (Thomas and Gray 2002; McLoughlin et al. 2003). In northeastern BC, the most current estimate of the boreal caribou population is approximately 1,512 individuals (BCTAC 2004; Table 1). These estimates, however, are considered imprecise due to the difficulty in observing boreal caribou and, therefore, a low accuracy of the total number of individuals in northeastern BC (Culling et al. 2006).

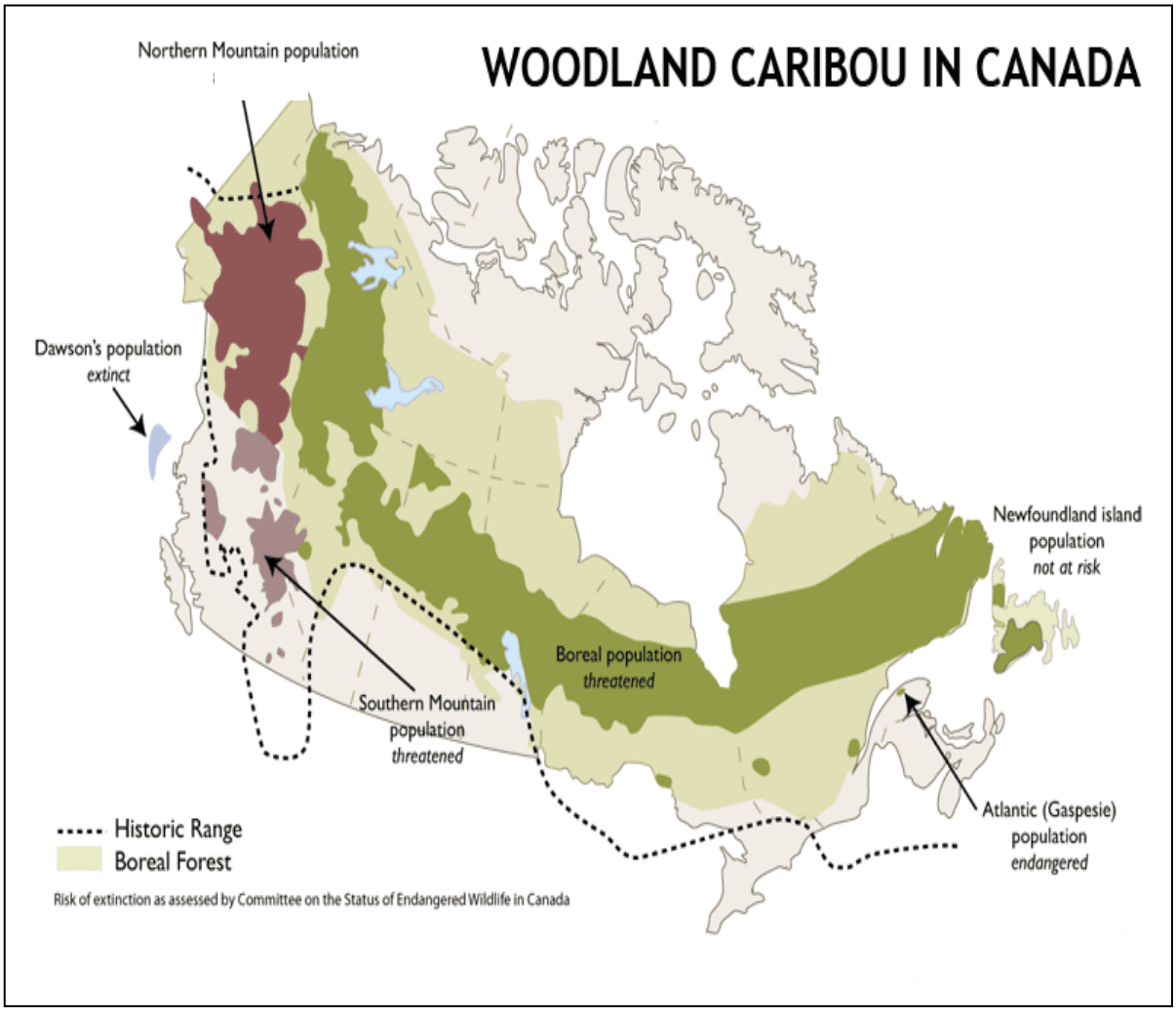


**Figure 1.** Distribution of woodland caribou (*Rangifer tarandus caribou*) across Canada. Figure taken from Thomas and Gray (2002).

The purpose of this document is to provide:

(1) a brief description of the habitat requirements and ecology of boreal caribou,
(2) a review of the factors influencing boreal caribou populations,
(3) a summary of the data (spatial and non-spatial) available for boreal caribou herds in northeastern BC,
(4) a biological rationale for the delineation of Ungulate Winter Range and Wildlife Habitat Areas for boreal caribou in northeastern BC, and
(5) management recommendations for boreal caribou in northeastern BC.

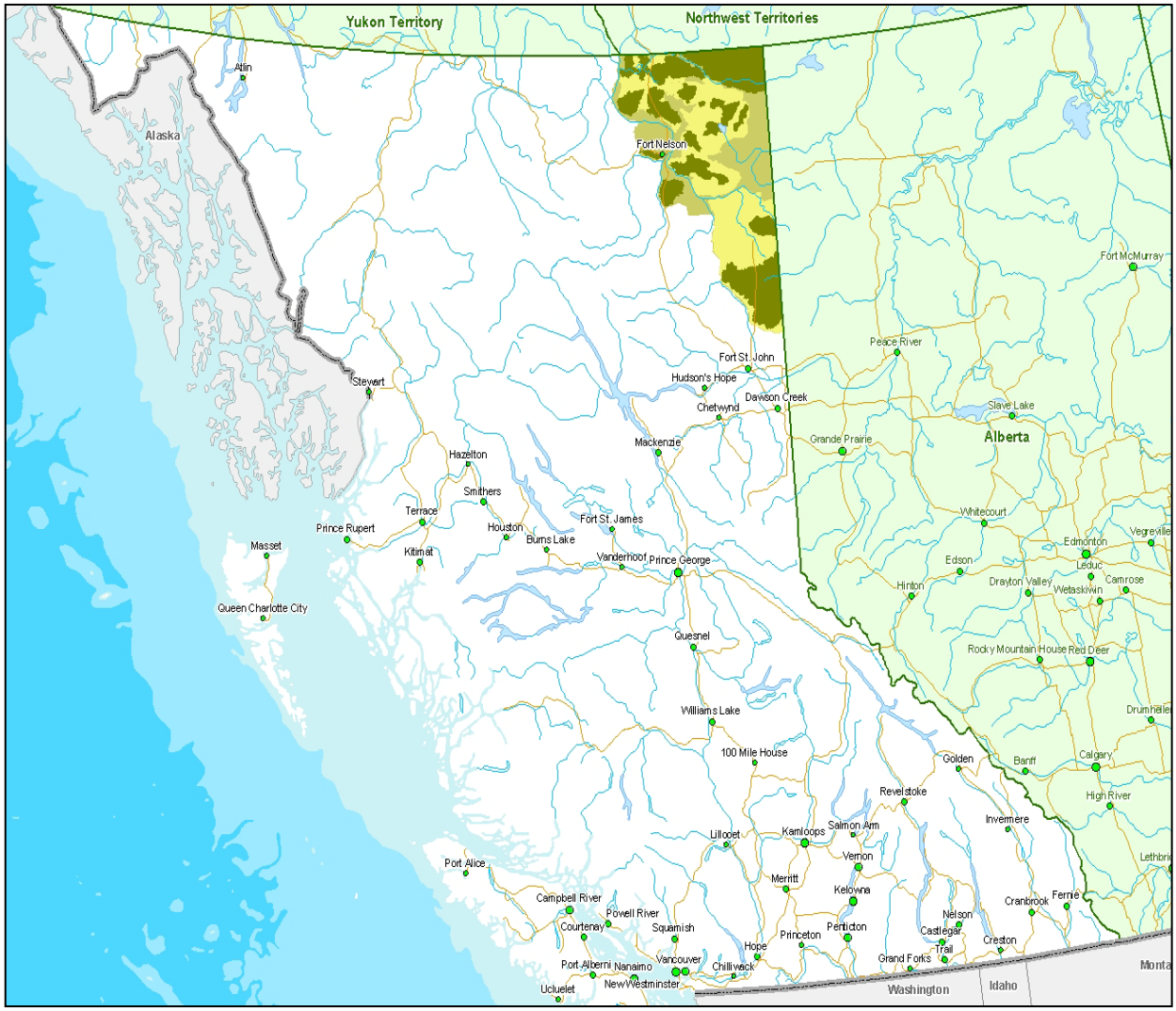


**Figure 2.** Distribution of boreal caribou in British Columbia. The dark green areas represent the core areas.

**Table 1.** Current population estimates for the 6 boreal caribou ranges in northeastern British Columbia. Estimates were taken from BCTAC 2004.

| Range | Estimate | Trend |
|---|---|---|
| Chinchaga | 483 | Suspected declining |
| Snake-Sahtaneh | 365 | Declining |
| Maxhamish | 306[a] | Unknown |
| Calendar | 291 | Unknown |
| Prophet | 54 | Unknown |
| Parker | 13[b] | Unknown |
| **Total in BC** | **1,512** | |

[a] Population estimated at 200 ± 71.6% in 2006 (Rowe 2006)
[b] October 2008 estimate of a minimum of 25 animals (Thiessen 2009)

## ECOLOGY AND HABITAT REQUIREMENTS

Woodland caribou have been designated into 3 ecotypes based on their ecology and habitat requirements (Heard and Vagt 1996). The boreal ecotype is found across Canada, inhabiting habitats associated with the boreal forest, such as peatland complexes, fens, and black-spruce bogs (Bradshaw et al. 1995; Culling et al. 2006). Upland areas across the boreal forest are often dominated by mature timber, such as aspen (*Populus tremuloides*), white spruce (*Picea glauca*), poplar (*Populus balsamifera*) or mixedwood stands. Generally, boreal caribou avoid upland areas, which support higher densities of predators, such as wolves and black bears, and early seral specialists, such as moose, which are the primary target of predators within the boreal forest (James 1999). Boreal caribou, however, may use upland, pine-dominated stands opportunistically when weather conditions are unfavourable, such as during high snow accumulation periods or when the snow surface becomes crusted (Bradshaw et al. 1995; B. Culling, pers. comm.). Boreal caribou also use mature black spruce stands during periods of high snow accumulations (Culling et al. 2006). Movement through habitats during these unfavourable winter conditions can increase the individual's energetic requirements, making caribou more susceptible to predation and decreasing the physical condition of individuals (Bradshaw et al. 1998).

Unlike the mountain and northern ecotypes that inhabit high-elevation mountain habitats, boreal caribou are non-migratory (Thomas and Gray 2002). Boreal caribou use peatland complexes during all seasons, foraging on terrestrial and arboreal lichens such as *Cladina* spp., *Cladonia* spp., *Peltigera* spp., *Stereocaulon* spp. and to a lesser extent, *Bryoria* spp. and *Alectoria* spp. (Klein 1982; Bradshaw et al. 1995; Rowe 2007a). Because of the low nutritional value in lichens, boreal caribou will also feed on plants commonly referred to as "winter-green" plants (Klein 1982). "Winter-green" plants maintain nutrients in the aboveground parts into the winter months, and are often associated with vegetation around lake margins, wetlands, and marsh areas (Klein 1982). Caribou will opportunistically feed on "winter-green" vascular plants, shrubs and sedges, where available, to supplement dietary requirements (Klein 1982; Bradshaw et al. 1995; BCTAC in prep). Vascular plants such as *Equisetum* spp. and *Carex* spp. provide concentrations of protein and phosphorous that is lacking from lichens (Klein 1982), and cannot be obtained by the senesced portions of some vascular plants that remain aboveground during the winter.

A recent study conducted in the Chinchaga range identified use of lease sites and pipelines by boreal caribou. Dietary analysis performed on fecal samples did not suggest a high intake of domestic cultivars by boreal caribou, but rather a high consumption of terrestrial and arboreal lichens (Rowe 2007a). Reasons for the use of disturbed areas by boreal caribou during the winter have not been confirmed. This type of behaviour may be an anti-predator strategy, as wolves will sometimes avoid areas with increased human traffic (Fuller et al. 1992), or selection for high nutrient forage provided by domestic cultivars (Rowe 2007a).

The peatlands and bogs used by boreal caribou naturally provide the forage and spatial segregation required by boreal caribou to survive and avoid predation. As boreal caribou are non-migratory (Stuart-Smith et al. 1997; Culling et al. 2006), these animals rely on large, widespread areas to maintain dispersion during critical times, such as calving, as well as throughout the year (Heard and Vagt 1996; Rettie and Messier 1998; Smith et al. 2000). This spatial and temporal dispersion tactic aids in avoiding predation by wolves, as well as interactions with humans (Smith et al. 2000). Fragmentation of habitats can concentrate caribou into smaller patches, and create greater densities of caribou, which can lead to increased predation pressure and possible declines in populations (Smith et al. 2000).

Adult survival of boreal caribou is relatively high (ranging from 84% to 95%), and not considered a limiting factor for population growth (Stuart-Smith et al., 1997; Rettie and Messier 1998; Culling et al. 2006). Further, boreal caribou also experience high pregnancy and parturition rates (Rettie and Messier 1998; McLoughlin et al. 2003; Culling et al. 2006). Calf survival and recruitment to the breeding population, however, is very low, and is likely the proximate factor in declines of boreal caribou population across their range (Rettie and Messier 1998). Low calf survival can be attributed to predation (Stuart-Smith et al. 1997; Rettie and Messier 1998; McLoughlin et al. 2003; Culling et al. 2006). Calf survival is generally lowest during the first month post-parturition, with the majority of calves lost by approximately the end of June (Stuart-Smith et al. 1997; Rettie and Messier 1998; Culling et al. 2006). In the Snake-Sahtaneh range in northeastern BC, calf survival to one month of age was reported to range from 20-29%, and survival to 10 months of age ranged from 12-14% survival (Culling et al. 2006; Table 2). Bergerud (1996) suggests that the minimum calf recruitment required to maintain

**Table 2.** Calf survival estimates, represented by calf:cow ratios, for fall and late-winter (10 month) recruitment counts conducted in 3 boreal caribou ranges in northeastern BC and estimates for boreal caribou across Alberta and Saskatchewan.

| | Calf:Cow ratio[a] | | | |
|---|---|---|---|---|
| **Range** | **Fall** | **Late Winter** | **Date** | **Source** |
| Chinchaga | | 0.17 | March 2005 | Rowe 2007b |
| Snake-Sahtaneh | 0.12 | | October 2002 | Culling et al. 2006 |
| | | 0.05 | March 2003 | Culling et al. 2006 |
| | | 0.09 | March 2004 | Culling et al. 2006 |
| Maxhamish | 0.31 | | October 2008 | Thiessen 2009 |
| | | 0.10 | March 2006 | Rowe 2006 |
| Saskatchewan | | 0.28 | 1994-1996 | Rettie and Messier 1998 |
| NE Alberta | | 0.18 | 1993-1994 | Stuart-Smith et al. 1997 |
| Alberta | | 0.20 | 1993-2002 | McLoughlin et al. 2003 |
| Threshold | | 0.25 | March | Bergerud 1996 |

[a] Calf:cow ratio = ratio of calves per 100 cows

population stability is 15% calf survival or approximately 25 calves:100 cows. At current levels, the boreal caribou in the Snake-Sahtaneh, Chinchaga, and Maxhamish ranges in northeastern BC are below this threshold, suggesting that the populations are in a state of decline (Table 2).

To avoid predation, calving cows naturally spatially segregate themselves from other individuals, and utilize habitats that are inaccessible or less desirable by predators (i.e., bogs, fens, wetlands, etc; James 1999; Culling et al. 2006). Human disturbances, such as linear corridors, create easier access for predators into critical caribou areas compromising the ability of caribou to successfully disperse and calve (see Table 2; McLoughlin et al. 2003).

## IMPACTS

Boreal caribou use habitats that offer spatial and temporal segregation from factors that may decrease survival, and do so by using the peatlands and bogs of the boreal forest across Canada (Thomas and Gray 2002). Since European settlement, the boreal forest has become more threatened by human encroachment, including industrial activities such as forestry, petroleum exploration, conversion of lands to agriculture, and natural disturbances such as large-scale forest fires. Non-habitat related factors such as hunting, parasites, disease, and extreme winter conditions, can also impact caribou populations (Klein 1982).

### Forestry

Although forestry activities in the range of boreal caribou are generally limited because of the low timber values, impacts associated with logging can have detrimental effects on caribou populations. In northeastern BC, forestry operations are targeting upland areas dominated by white spruce, trembling aspen, or lodgepole pine. While loss of these habitat types does not directly impact boreal caribou, the infrastructure associated with logging and the conversion of mature forests to early seral habitats can indirectly impact caribou in the boreal forest (James 1999).

Forestry activities in the boreal forest generally occur during winter months, when access into cutblocks occurs primarily by winter road. Clearing of access roads and in-block roads creates linear corridors and increases access to areas otherwise unfragmented and generally spatially segregated habitats. Although direct habitat loss due to logging is low, caribou have shown avoidance of new cutblocks up to 11 km (Smith et al. 2000). Further, fragmentation of the landscape through harvesting of cutblocks creates smaller effective habitat patches, and can lead to increased densities of caribou, which is in conflict with the species natural anti-predator strategy of existing at low densities, and remaining dispersed across the landscape (Bergerud et al. 1984; Bergerud 1985; Smith et al. 2000).

Woodland caribou spatially segregate themselves from alternative prey as an anti-predator tactic. Specifically, the boreal ecotype uses dispersion and selects peatland habitats to remain separate from alternate prey species, and to reduce instances of predation (Bergerud et al. 1984; Bergerud 1985). The creation of early seral habitats across a landscape that is largely mature, can result in increased densities of early seral specialists such as moose. Although moose and caribou do not directly compete for habitat and resources, increases in moose density can lead to increased predator densities resulting in increased predation rates on caribou (James 1999).

**Forest Fires**

Within the literature, there has been significant debate around the influence of forest fires on caribou occurring in the boreal forest (Klein 1982; Dunford et al. 2006; Dalerum et al. 2007). Caribou rely on, although not exclusively, lichens for forage, which are a slow-growing species that are associated with old-growth forests (Edmonds and Bloomfield 1984; Joly et al. 2003; Dunford et al. 2006). Therefore, the short-term effect of fire on caribou includes the direct loss of forage, displacement, and habitat loss (Klein 1982). However, some of the long-term impacts of fire on caribou include the increase in young forest stands across the landscape, maintenance of vegetation types and diversity, and a mimicking of natural disturbance in the boreal forest (Klein 1982). Dunford et al. (2006) found that burned sites took, on average, up to 46 years to achieve lichen cover similar to a mature site, and growth of terrestrial lichen *Cladina mitis* was estimated at 4.8 mm per year. Recovery of lichens in the peatlands, however, was significantly faster than in non-peatland forests (Dunford et al. 2006).

Dalerum et al. (2007) report no effects of fire on boreal caribou home range size, fidelity, adult mortality or fecundity in northern Alberta, suggesting that large home ranges likely provide required forage and non-impacted habitats even when substantial portions of the home range has been burned. Because of the fire history in the boreal forest, and the natural relationship of fires and boreal caribou co-existing in the boreal forest, it is often believed that boreal caribou are fire-adapted. According to Klein (1982), boreal caribou are, however, more likely to be fire-influenced than fire-adapted. Although fire is a common natural disturbance in the boreal forest, large-scale forest fires will inevitably destroy lichens required by boreal caribou. In the past, the loss of lichens within caribou range did not have a significant impact on caribou, as animals could move to other areas of the range to access lichens and suitable habitats (Dalerum et al. 2007). However, with increasing industrial development, forest fires pose a significant threat to boreal caribou populations. A large-scale fire in the boreal forest may result in substantial population declines, as caribou densities have increased in remaining suitable habitats, due to habitat loss and fragmentation from industry, and caribou ranges have contracted in response to industrial pressure (Klein 1982).

**Petroleum Exploration**

The most significant threat to boreal caribou habitat and populations is the rapid development of petroleum exploration across the species' range, and the impacts to habitat as a result of the activities associated with the industry (James and Stuart-Smith 2000; Dyer et al. 2001, 2002; Thomas and Gray 2002; McLoughlin et al. 2003; Sorenson et al. 2008). Growth of the petroleum industry results in the creation of multiple linear corridors in the form of seismic lines, roads, and pipelines that severely fragment the landscape and compromise boreal caribou habitat (Nellemann and Cameron 1998). Several studies have suggested that boreal caribou show avoidance of industrial areas; estimating avoidance up to 250 m from linear corridors, roads and facilities (Dyer et al. 2001, 2002; Sorenson et al. 2008). Anecdotal reports, however, suggest that caribou are frequently observed traveling along roads and seismic lines, and foraging in right-of-ways that have been re-vegetated (James and Stuart-Smith 2000; Rowe 2007b; Culling and Culling, pers. comm.). Avoidance of anthropogenic features may only be possible when impacts from industry occur at low enough densities across the landscape to allow caribou to move into adjacent, undisturbed habitat (D. Culling, pers. comm.). As the density of

linear disturbance increases, the ability of caribou to distance themselves from these features decreases (D. Culling, pers. comm.).

The impact of linear corridors on boreal caribou is related to predator access and efficiency. Although caribou will avoid roads for reasons such as traffic, avoidance of crossing a non-natural opening, and human presence, all linear corridors increase predator (primarily wolf) access into caribou habitat that was previously inaccessible (Bergerud et al. 1984; James and Stuart-Smith 2000). Linear corridors also increase predator hunting efficiency by increasing predator access, line of sight, travel speed, search efficiency, and encounter rates (James and Stuart-Smith 2000). In northeastern Alberta, caribou that occupied habitats near linear corridors were at higher risk of predation than caribou that utilized habitats further from corridors (James and Stuart-Smith 2000). In Alaska, the effects of linear corridors on barren-ground caribou have been extensively studied. Nellemann and Cameron (1998) found that caribou densities declined exponentially with increasing road densities, and that caribou avoided habitats with oilfield infrastructures such as roads, pipelines and facilities. An increase in roads from 0 km/km$^2$ to 0.3 km/km$^2$ resulted in a decrease of caribou density by 63%, with complete avoidance of an area when road density increased to greater than 0.3 km/km$^2$ (Nellemann and Cameron 1998). A road density of 0.3 km/km$^2$ is the equivalent of a single road through the middle of a 10 km$^2$ area (Nellemann and Cameron 1998).

Other impacts such as wellsites and facilities also impact caribou through displacement and habitat fragmentation, which increases densities of caribou in suitable areas (Dyer et al. 2001). Specifically, Dyer et al. (2001) found that caribou avoided new wellsites by up to 1 km during calving, and avoided old wellsites up to 500 m during both calving and late winter. An increase in caribou densities makes them more predictable, concentrated, and easier to find for predators (Dyer et al. 2001).

## DATA SUMMARY

Prior to 2000, little research had been conducted on boreal caribou in northeastern British Columbia; however, the Ministry of Environment, Fish and Wildlife Section, Peace Region, had conducted inventories of some of the boreal caribou herds (Table 3). In 2000, an intensive GPS telemetry study was initiated, by Canfor (Slocan Forest Products Ltd.), which involved the collaring of 58 boreal caribou, within the subsequently-defined Snake-Sahtaneh Range, over 4 years (Culling et al. 2006). This study was the first significant research that investigated not only movements of boreal caribou, but conducted extensive habitat selection analyses. Preliminary habitat use data from the Snake-Sahtaneh study was used to delineate boreal caribou ranges for northeastern BC (BCTAC 2004; Culling et al. 2004).

Little information exists for the Calendar Range, the Prophet Range, and the Fortune core area in the Maxhamish Range. In 2008, a GPS collaring program was initiated by Nexen Inc. (Calgary, AB) to investigate boreal caribou habitat use and movements in the Calendar Range, as well as to further understanding of seasonal use of the Tsea Core of the Snake-Sahtaneh Range. Data from this collaring will be available in late winter 2010. In addition, the Ministry of Environment has collared caribou in the Kiwigana and Capot-Blanc cores, as well as in the Parker and Prophet Ranges in February 2008 and February 2009, which will provide more information of the number of animals in these herds, as well as survival and recruitment data.

**Table 3.** Summary of the spatial data available for boreal caribou ranges and associated core areas in northeastern British Columbia.

| Range | Type of Data | Sample Size | Date | Reference |
|---|---|---|---|---|
| *Chinchaga Range* | | | | |
| | GPS/VHF telemetry | 81 | 2002-2009 | Alberta Environment (unpubl. data) |
| | Linear Transect Survey | n/a | 1990 | Backmeyer 1990 |
| Milligan Core | GPS telemetry | 10 | 2004-2005 | Rowe 2007b |
| Etthithun Core | GPS telemetry | 2 | 2004-2005 | Rowe 2007b |
| *Calendar Range* | | | | |
| | Simple Random Sample Block Count | n/a | 2004 | Backmeyer 2004 |
| Calendar | GPS telemetry | 16 | 2008 | Ongoing project – Nexen |
| *Maxhamish Range* | | | | |
| Kiwigana Core | VHF telemetry | 5 | 2008 | Thiessen 2009 |
| | GPS telemetry | 2 | 2009 | Ongoing project – MoE |
| | GPS telemetry | 5 | 2006 | Rowe 2007a |
| | Stratified Random Block Count | n/a | 2006 | Rowe 2006 |
| | Inventory | n/a | 2004 | |
| Capot-Blanc Core | GPS telemetry | 3 | 2006 | Rowe 2007a |
| | Stratified Random Block Count | n/a | 2006 | Rowe 2006 |
| | VHF telemetry | 1 | 2008 | Thiessen 2009 |
| | VHF telemetry | 2 | 2009 | Ongoing project – MoE |
| | GPS telemetry | 1 | 2009 | Ongoing project – MoE |
| *Snake-Sahtaneh Range* | | | | |
| Snake-Sahtaneh | GPS telemetry | 54 | 2000-2004 | Culling et al. 2006 |
| Tsea Core | VHF telemetry | 5 | 2008 | Ongoing project – Nexen |
| *Parker Range* | Inventory | n/a | 2006 | Rowe 2006 |
| | VHF telemetry | 4 | 2008 | Thiessen 2009 |
| | GPS telemetry | 3 | 2009 | Ongoing project – MoE |
| *Prophet Range* | GPS telemetry | 2 | 2009 | Ongoing project – MoE |

## HABITAT PROTECTION

### Species Designation

The boreal ecotype of woodland caribou has been federally listed as *threatened* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2002). According to the Canadian *Species at Risk Act*, recovery strategies must be prepared for endangered and threatened species. These recovery strategies document the species requirements, critical habitat, and research and management needs to prevent extinction of the identified species. The Recovery Strategy for the boreal population (ecotype) of woodland was scheduled to be

completed and posted on the Species at Risk Public Registry by June 2007, but has not yet been completed. This recovery strategy is being lead by Environment Canada.

In British Columbia, boreal caribou are red-listed and considered *threatened* on the provincial Species at Risk list (CDC 2008). In addition, under the *Wildlife Act*, boreal caribou have been included on the Category of Ungulate Species as well as the Category of Species at Risk. These designations provide the basis for applying specific habitat protection mechanisms to populations of boreal caribou in British Columbia.

**Habitat Protection Mechanisms**

Based on the provincial designation of boreal caribou as a Species at Risk and listing on the Category of Ungulate Species, there are two habitat protection mechanisms available for boreal caribou: Ungulate Winter Range (UWR) and Wildlife Habitat Area (WHA). These habitat protection tools are mandated under the *Forest and Range Practices Act* (FRPA) and are therefore only applicable to activities that are legislated under this Act. Any activities associated with forestry and range practices administered under the *Forest and Range Practices Act*, including activities ranging from applying for a license to cut, to harvesting and silviculture, are legally obligated to comply with the management direction (e.g. general wildlife measures) associated with a FRPA mechanism such as a UWR or WHA.

Areas defined as Ungulate Winter Range provide the habitats required by a species during the winter period, and are critical to the survival of animals through this period. Wildlife Habitat Areas provide similar protection for habitats that are used during other critical periods, such as calving and rutting. Ungulate Winter Range and WHAs are managed via General Wildlife Measures, which are legally defined, results-based guidelines that restrict certain activities within the spatial bounds of an approved UWR or WHA. These General Wildlife Measures are based on the species ecology and habitat requirements.

Once approved by the Ministry of Environment's Deputy Minister, all activities included in the *Forest and Range Practices Act*, must comply with these measures within spatially defined boundaries on the landscape. These measures are not currently applicable to oil and gas activities; however, all tenure holders on the land-base that require a licence to cut, administered by the Ministry of Forests and Range, must comply with the direction given by the approved General Wildlife Measures.

**Rationale for Delineation of UWR & WHA Polygons**

The proposed UWR and WHA polygons (Figure 3) for boreal caribou herds in the Fort Nelson area were initially delineated based on a resource selection function (RSF) model developed as part of the Snake-Sahtaneh GPS telemetry study (Culling et al. 2006). The model identified areas predicted to have high suitability for boreal caribou based on fine-scale slope and habitat type. The Snake-Sahtaneh model was tested against existing telemetry data available for other boreal caribou ranges in the Fort Nelson area (Rowe 2007a; Thiessen 2009). Where telemetry data was not available (e.g., Calendar Range), polygons extrapolated from the Snake-Sahtaneh model were retained, as no other information was available to determine the requirement for boundary refinement.

Ungulate Winter Ranges and WHA polygons were refined based on several criteria. First, evidence of seasonal use was determined from an analysis of available radio-telemetry data

and Ministry of Environment inventories (historical and current), in addition to incorporating local anecdotal information (First Nations, trappers, hunters). Second, polygons were analyzed

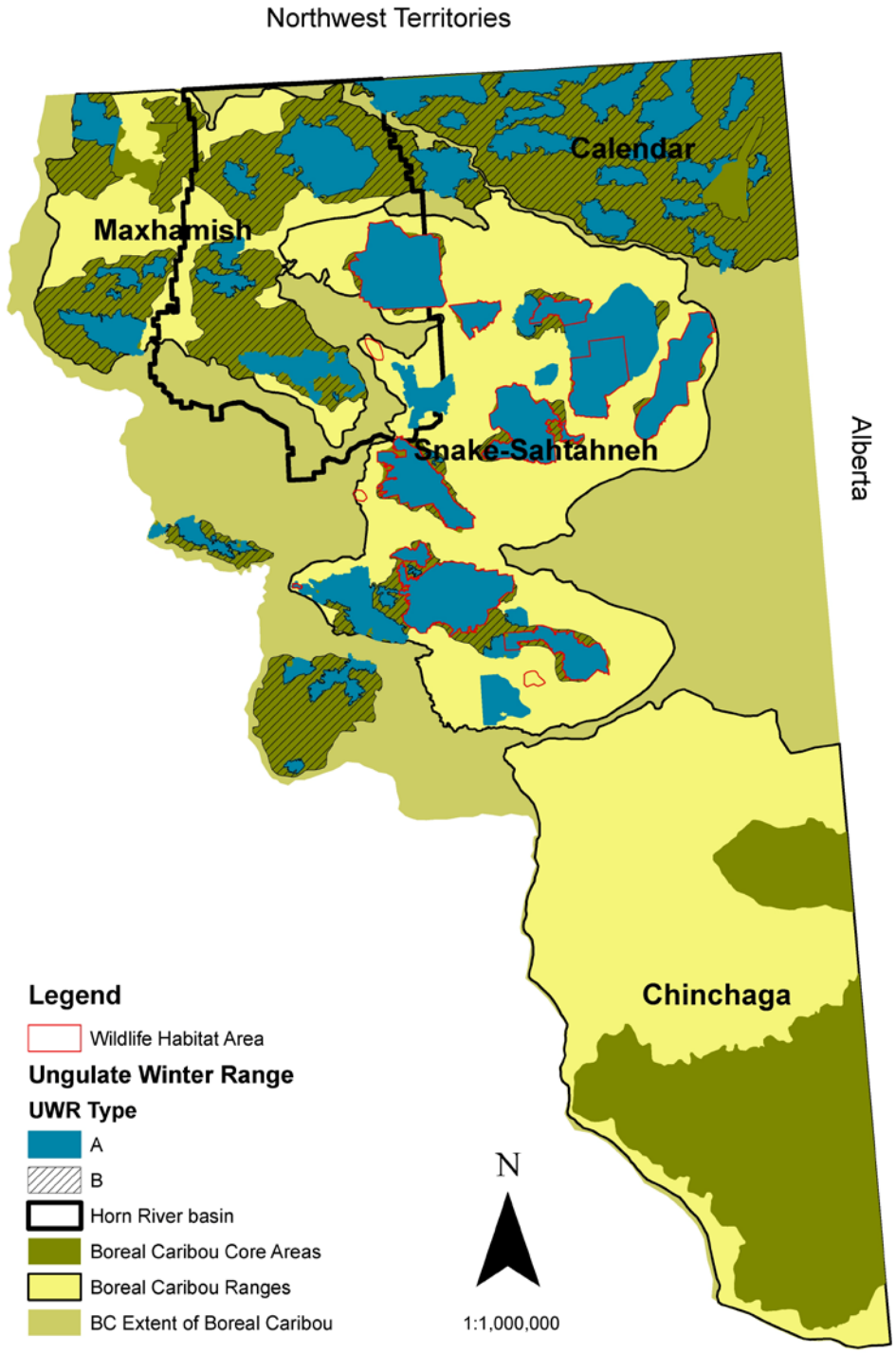


**Figure 3.** Ungulate Winter Range and Wildlife Habitat Area polygons, proposed under the Forest and Range Practices Act, for boreal caribou in the Fort Nelson area.

to ensure habitats contained attributes required by the species, including forest cover type and seral stage. Finally, in order to be in compliance with FRPA, some polygon boundaries were amended to exclude cutblocks classified under Section 196(1) and 196(2) of the *Forest and Range Practices Act*.

The intent of this proposal was to capture all *core* areas as either UWR or WHA for protection under FRPA. However, the current policy, based on Timber Supply Review II, around delineation of UWR and WHA under FRPA, limits the amount of the timber harvesting landbase that can be impacted by the measures associated with a UWR or WHA. In the Fort Nelson Forest District, a maximum of 6,580 ha of forest contributing to the timber harvesting landbase can be impacted by a Wildlife Habitat Area, whereas only 6,666 ha in the Fort Nelson Timber Supply Area can be impacted by an Ungulate Winter Range. The impacts associated with a UWR or WHA cannot exceed these amounts, and thus restricted the delineation of all *core* areas as UWR or WHA.

Areas designated as UWR or WHA polygons included black spruce-leading stands located in flat to low-gradient (less than 0.6%), poorly drained areas (Culling et al. 2006). These areas are generally located within the moist, warm variant of the Boreal White and Black Spruce (BWBSmw2/08) biogeoclimatic zone. This biogeoclimatic zone is characterized by black-spruce bogs, with an abundance of Labrador tea, sphagnum moss, and terrestrial lichens such as *Peltigera* spp (BC MoF 1990). Patches of mature pine- and white spruce-leading stands located in upland areas have also been captured in the UWR or WHA polygons. Although upland habitats are generally avoided by boreal caribou, mature coniferous stands provide important thermal cover and snow interception during extreme weather conditions such as cold temperatures and deep snow pack (B. Culling, pers. comm.). However, Culling et al. (2006) found that boreal caribou in the Snake-Sahtaneh selected for lodgepole pine stands that were generally in low availability across the landscape. This further identifies the importance of certain upland habitats to boreal caribou. These patches of upland habitats have been captured in UWR and WHA polygons to create large, patches of undisturbed habitats, which are required by the widely dispersed nature of boreal caribou utilized to evade predation.

Areas defined as a UWR show consistent use of the area during the winter season (November to April) by boreal caribou, whereas WHA areas include locations during the calving (April 15 to June 30) and rutting periods (September 1 to October 15) or have direct observations of calving activities (Dyer et al. 2002; Culling et al. 2006). Collared individuals from the Snake-Sahtaneh showed high fidelity to calving areas over multiple years (Culling et al. 2006), providing further support for designation of these areas as a WHA.

The Fort Nelson Boreal Caribou UWR/WHA package proposes 100 areas as UWRs (58 as areas of no disturbance [UWR Type A] and 42 as management areas [UWR Type B]), and 15 WHA areas (Figure 3). The proposed UWR areas include: 701,047 ha of areas of no disturbance and 800,088 ha of management areas, with WHA areas totalling 276,335 ha of areas of no disturbance. The total area protected by UWR and WHAs is equivalent to 977,381 ha. These areas are not pristine habitats, as impacts have occurred through portions of the UWR and WHAs. However, designation of these areas will protect boreal caribou from all forestry-related impacts. The current system of applicability to only the forest sector is not sufficient to protect habitat for boreal caribou, and Provincial policies regarding Species at Risk will have to change in order to prevent extirpation of this species. Designation of these areas as UWR and WHA is the initial step of this process.

## IMPORTANCE OF HABITAT PROTECTION

The cause of decline of boreal caribou populations is linked both directly and indirectly to the alteration and fragmentation of habitat across their range (Thomas and Gray 2002; McLoughlin et al. 2003). In a study of cumulative effects on boreal caribou in Alberta, Sorenson et al. (2008) suggested that caribou avoid industrial developments and impacts by a minimum of 250 m, minimizing the amount of *functional* habitat across the species range. Further, Sorenson et al. (2008) found that boreal caribou populations are not sustainable if more than 61% of caribou range is impacted by the industrial footprint. Using this measure of functional habitat and threshold of industrial impacts, a recent analysis of current cumulative impacts was conducted in the boreal caribou core areas in northeastern BC (Figure 4; Table 4; Thiessen 2009). Incorporating industrial impacts such as wellsites, pipelines, exploration roads, seismic, and cutblocks, this analysis suggests that 3 of the 4 boreal caribou ranges (Calendar, Chinchaga and Snake-Sahtaneh) are more than 61% impacted by anthropogenic disturbance, and that all but 3 core areas in northeastern BC have an industrial footprint that exceeds the 61% threshold suggested by Sorenson et al. (2008; Table 4).

**Table 4.** Impact analysis of anthropogenic footprint in boreal caribou core areas in northeastern British Columbia. Areas in red indicate the suggested 61% impact rate is exceeded within the core area (Thiessen 2009).

| Caribou core area | Core Area ($km^2$) | Disturbance Area ($km^2$) | % Impacted |
|---|---|---|---|
| Capot-Blanc | 875 | 453 | 51.8 |
| Kiwigana | 1,301 | 678 | 52.1 |
| Fortune | 2,662 | 1,589 | 59.7 |
| Etsho | 62 | 38 | 61.9 |
| Parker | 224 | 152 | 67.9 |
| Calendar | 4,962 | 3,533 | 71.2 |
| Paradise | 403 | 289 | 71.8 |
| North Kotcho | 748 | 554 | 74.0 |
| Etthithun | 822 | 620 | 75.4 |
| Prophet | 915 | 716 | 78.2 |
| East Kotcho | 318 | 272 | 85.4 |
| Milligan | 4,929 | 4,560 | 92.5 |
| Clarke | 1,381 | 1,292 | 93.5 |
| West Kotcho | 362 | 342 | 94.4 |
| Tsea | 472 | 453 | 96.0 |

Boreal caribou rely on large, non-fragmented tracts of habitat to avoid predation (Cumming et al. 1996); therefore, it is important that assessments of habitat loss on the landscape consider the functional habitat loss associated with disturbances, not just the actual development footprint (Dyer et al. 2001; Sorenson et al. 2008). The analysis conducted by Thiessen (2009) has been supported by research conducted on boreal caribou in Alberta (Dyer et al. 2001; Sorenson et al. 2008), which suggests that caribou are avoiding developments and habitats adjacent to these developments, resulting in a larger estimate of habitat loss due to the developments (Dyer et al. 2001).

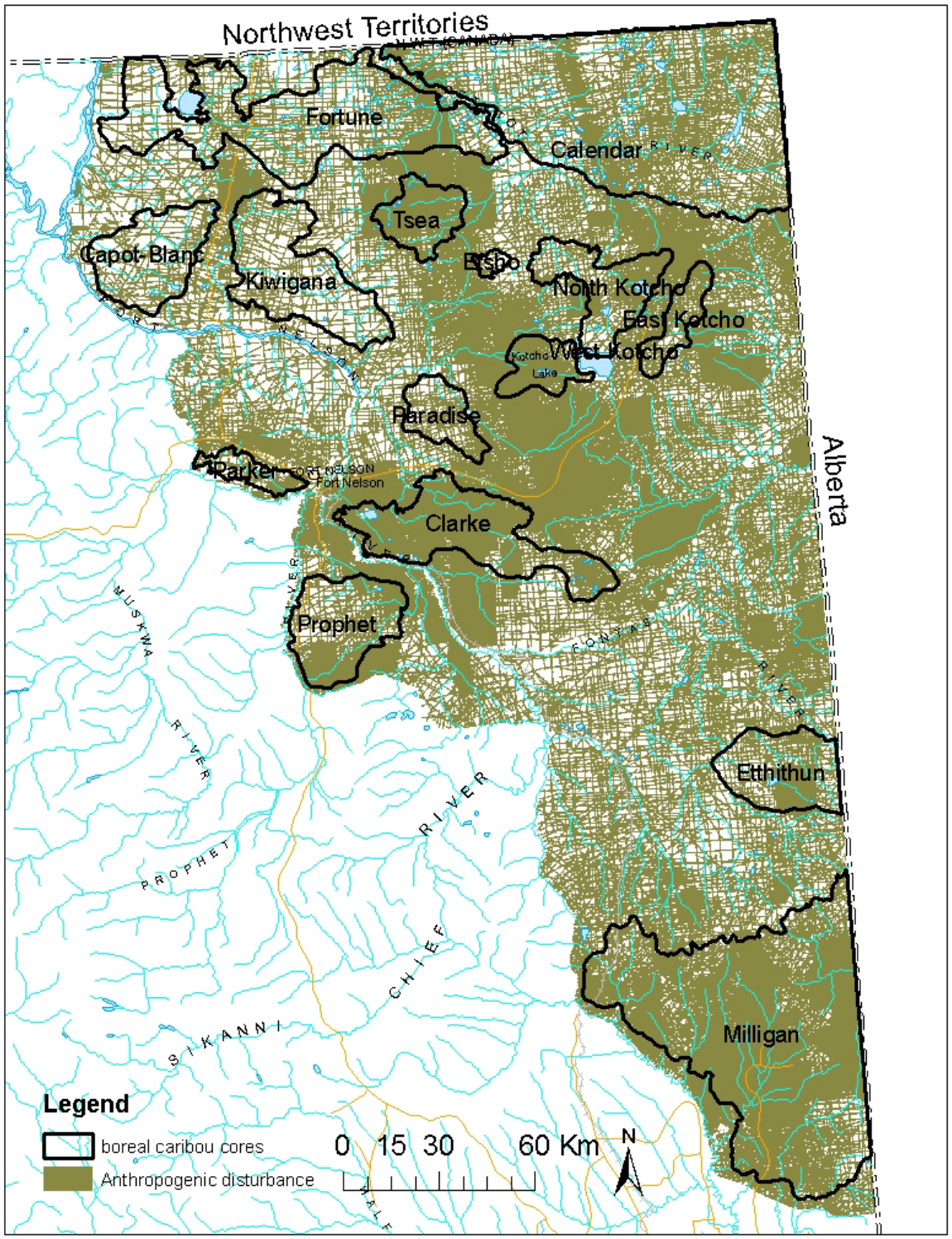


**Figure 4.** Impact analysis showing industrial footprint in boreal caribou core areas, northeastern British Columbia (Thiessen 2009).

Based on the degree of anthropogenic disturbance that has already occurred in the core areas, and suspected population declines based on low calf survival and recruitment rates (<28.9 calves/100 cows; Environment Canada 2008), it is likely that boreal caribou populations in northeastern BC are already in decline and are not currently self-sustaining (Environment Canada 2008). Although caribou are still present in all core areas, calf survival and recruitment estimates are at critical levels and it is unknown how caribou populations will be affected if further fragmentation occurs. Recent oil and gas tenure sales in the Horn River Basin and the Cordova Embayment have the potential to increase habitat fragmentation if developed in a similar fashion as the Barnett Shale in Texas (refer to Canadian Society for Unconventional Gas for comparisons - http://www.csug.ca/). The Barnett Shale gas reserve in Texas produced approximately 1.11 trillion cubic feet of natural gas in 2007, and the reservoir associated with the Horn River Basin and Cordova Embayment in northeastern BC is projected to rival production from the Barnett Shale (http://www.csug.ca/).

Currently, 75% of the boreal caribou range in northeastern BC is already fragmented beyond the 61% threshold, and further fragmentation could have serious implications on the ability of caribou populations to be self-sustaining. Further, the recently released Environment Canada (2008) critical habitat document suggests that caribou ranges with a total anthropogenic and natural disturbance of greater than 59% have a 0.1 probability of persistence. Environment Canada defines 6 local populations in NE British Columbia: (1) AB/BC Chinchaga, (2) BC Maxhamish, (3) BC Calendar, (4) BC Snake Sahtaneh, (5) BC Parker, and (6) BC Prophet (Environment Canada 2008). Five of these 6 local populations have been identified as having Range Not Self-Sustaining, and have relatively high disturbance levels from anthropogenic sources (Environment Canada 2008). Given this assessment, Environment Canada (2008) suggests:

> "Current Range and Improved Conditions: Current range conditions and/or extent would need to be improved to restore the potential to support a self-sustaining population. Further degradation of the range may have serious consequences for local population persistence. For most local populations or units of analysis with weight of evidence supporting Range Not Self-Sustaining (P<0.4), levels of anthropogenic disturbance in conjunction with population trend suggest that recovery efforts are required to restore conditions that support persistence (i.e., a reduction in anthropogenic disturbance and recovery of disturbed habitat is necessary). The nature and magnitude of restoration could be determined through spatial population modeling combined with dynamic landscape simulation." (pg. 66-67).

## MANAGEMENT

### General Wildlife Measures

*Winter Habitats*

The management direction for winter habitats for boreal caribou was written for two types of management regimes: (1) areas of no disturbance, and (2) areas of managed disturbance. Due to policy limitations under the *Forest and Range Practices Act* (FRPA),

impacts to timber harvesting landbase as a result of UWR or WHA designations cannot exceed a set limit for each Forest District or Timber Supply Area (Ministry of Forest and Range 2002). Due to this policy constraint, all areas designated as core areas by Culling et al. (2004) could not be designated as no disturbance areas (UWR Type A) for boreal caribou under the UWR mechanism. Therefore, management areas (UWR Type B) with less restrictive measures were identified to protect habitats that met the habitat criteria, but did not have ample scientific support from telemetry data. The management direction associated with these areas allows for harvesting of large cutblocks, while requiring maintenance of *equivalent sized* or larger leave areas, and restricting construction of all season access roads (Table 5). The purpose of these measures is to attempt to maintain unfragmented areas of suitable boreal caribou habitat, while cutblocks are able to regenerate to a natural state. As more radio-telemetry data becomes available, the intent is to refine UWR Type A polygons for herds where little is known about critical habitat areas (Table 3).

*Calving and Rutting Habitats*

Due to the importance of the calving period, and the low calf survival reported across the boreal caribou's range, calving and rutting habitat areas have been given restrictive management regimes as areas of no disturbance. In addition, a timing restriction has been implemented to have no activity occurring within a calving area between May 1 and June 1, which represents the period in which the majority of parturitions occur. Calving and rutting areas have only been identified for the herds in which year-round telemetry data is available (Figure 3). With on-going GPS telemetry research projects in the Calendar herd, specific calving and rutting data will be available, use of this data will allow for further delineation of calving and rutting habitats.

**Guidelines and Best Management Practices**

As with most Species at Risk, the most important factor for sustaining boreal caribou populations is the maintenance of natural, unfragmented habitat. Given that core areas are currently above the 61% threshold defined by Sorenson et al. (2008) and classified as *not* self-sustaining populations by Environment Canada (2008), boreal caribou core areas in NE BC are recommended to be classified as areas of no further disturbance to maintain existing critical habitats. For areas falling outside of core areas, it is recommended that petroleum exploration activities occurring in boreal caribou ranges be required to follow the *Interim Oil and Gas Guidelines* for Boreal Caribou Ranges in northeastern British Columbia" (Culling et al. 2004) until appropriate legislation is written to provide legal protection of habitats for boreal caribou and other species at risk. These guidelines recommend activities that can minimize impacts on boreal caribou, but should not be substituted for complete habitat protection. Current research from Alberta suggests that the measures such as those outlined in the 2004 *Interim Oil and Gas Guidelines* are likely suitable for maintenance of *declining* boreal caribou populations, but are not sufficient to maintain *self-sustaining* populations, which will result in extirpation of the species overtime (R. Backmeyer, pers. comm.). The creation of linear corridors such as roads and seismic lines is likely the largest threat to boreal caribou habitats. However, the measures outlined in the *Interim Oil and Gas Guidelines* can be taken to reduce the impact of the petroleum industry.

**Table 5.** General wildlife measures (GWMs) for proposed ungulate winter range and wildlife habitat areas for boreal caribou in northeastern British Columbia.

| **FRPA[1] Mechanism** | **Polygons** | **Seasonal Habitat[4]** | **Activity Type** | **Measure** |
|---|---|---|---|---|
| *Ungulate Winter Range* | | | | |
| UWR[2] Type A No Disturbance Area | BCAR-001 to BCAR-058 | Winter | Vehicular Access | No construction of new roads, trails or linear corridors. |
| | | | Forest Harvesting | No forest harvesting. |
| | | | Recreation | No recreation sites or trails. |
| UWR Type B Management Area | BCAR-059 to BCAR-100 | Winter | Vehicular Access | No construction of new permanent, all-weather high-grade roads.<br>Use secondary access routes as low impact roads.<br>Layout and construction of secondary roads will utilize existing linear corridors.<br>Provide adequate visual screening along access corridors.<br>Use coordinated planning to minimize disturbance to caribou. |
| | | | Forest Harvesting | No material adverse disturbance to the productivity of key terrestrial lichen communities.<br>Harvesting of large patches, approximately 100 ha (or larger) openings or block clusters, and at least equivalent size connected leave areas of appropriate forest stand types.<br>Complete harvesting in as short a time frame as practicable. |
| | | | Recreation | No recreation sites or trails. |
| *Wildlife Habitat Area* | | | | |
| WHA[3] No Disturbance Area | 9-074 to 9-088 | Calving & Rutting | Vehicular Access | No construction of new roads, trails or linear corridors. |
| | | | Forest Harvesting | No forest harvesting. |
| | | | Recreation | No recreation sites or trails. |

[1] FRPA – Forest and Range Practices Act
[2] UWR – Ungulate Winter Range
[3] WHA – Wildlife Habitat Area
[4] Seasonal use defined as: Winter (October 16 to April 14), Calving (April 15 to June 30), and Rutting (September 15 to October 15; Culling et al. 2006).

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## APPENDIX I: GENERAL WILDLIFE MEASURE DEFINITIONS

The following definitions are provided to clarify terms used in the proposed General Wildlife Measures outlined above.

Coordinated planning: coordinating access planning, development and deactivation schedules with other users operating within the UWR areas; use of existing linear corridors and shared access to minimize the creation of new access routes.

Key terrestrial lichen communities: list of documented key lichen species utilized by boreal caribou in the muskeg bogs and peatlands of the Boreal White and Black Spruce (BWBSmw2, site series 02, 04, 06, 08, 09) biogeoclimatic zone (Bradshaw et al. 1995, Dunford et al. 2006) includes:

- *Cladina* spp.
- *Stereocaulon* spp.
- *Cetraria* spp.
- *Cladina mitis*
- *Cladina rangiferina*
- *Cladina stellaris*

Linear corridor: any anthropogenic removal of forest cover that results in the creation of linear access routes, including the construction of roads, motor-vehicle trails, seismic lines, transmission lines, pipelines, and secondary roads. Linear corridors result in increased travel corridors and line-of-sight for potential predators and enhances human access into remote areas.

Low-impact roads: low grade/standard roads that have minimal deactivation requirements since their construction involves minimal alteration of the surficial hydrology.

Material adverse: in the context of disturbance or impacts, “material” means that the disturbance must be real, substantive, or significant. “Adverse” means the disturbance must have negative consequences for the affected species.

Primary forest activity: as defined in the Forest Planning and Practices Regulation of the Forest and Range Practices Act, means one or more of the following:

a) timber harvesting;
b) silviculture treatments;
    i. initial primary planting following harvest;
    ii. regeneration survey following planting;
    iii. fill planting (if necessary).
c) road construction, maintenance and deactivation.

Secondary access routes: spur roads from mainlines (excluding in-block roads); may be seasonal, but not all-season roads.