

BRFN Indigenous Knowledge Study of Chinchaga Muskeg Caribou and Pink Mountain Caribou



Final Report

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The recommendations in the report are those of BRFN community members and are not necessarily endorsed by BC OGRIS or AFSAR.



Executive Summary

The Blueberry River First Nations have lived and occupied their traditional territory since time immemorial, and have depended upon the lands and waters in this area for their cultural and spiritual practices and livelihood. Caribou (*Rangifer rangifer tarandus*) are an important part of BRFN's seasonal round—BRFN members rely on caribou meat, hide, and other parts of the animal for specific cultural practices that can only be fulfilled by this species.

Caribou populations across Canada are in decline, and northeastern British Columbia is no exception to this trend. Here, at the crossroads of three woodland caribou ecotypes, a combination of industrial development and increasing predator populations has pushed caribou precariously close to extirpation.

BRFN members no longer hunt caribou in their territory. As this species has declined, so too have other culturally important plants and animals, to the extent that the cultural practices and rights of Blueberry River First Nations people are now severely threatened. To date, British Columbia government efforts to protect caribou while maintaining industrial activity have been largely unsuccessful: recent studies of boreal caribou late winter calf:cow ratios suggest that their numbers continue to decline across all of the delineated ranges in British Columbia (Culling & Culling 2015, Table 4, p. 18).

BRFN are signatories to Treaty 8, and as such their rights to continued access to culturally important species and resources are protected under Canada's constitution. This protection includes the right to hunt preferred species in preferred locations, something that is no longer possible for Blueberry River members with regards to the traditional practice of hunting caribou.

This report provides an initial path forward to recover caribou populations within BRFN territory, grounded in BRFN indigenous knowledge (IK). The IK summarized in this report is based on several sources of data, including earlier studies conducted with BRFN community members on behalf of the BRFN lands department, as well as an eight-day intensive field tour of important areas in BRFN territory with BRFN knowledge holders. The focus of the fieldwork was to describe seasonally important habitat, landscape level habitat needs and migration corridors for both "muskeg caribou" (i.e., boreal caribou living in the Chinchaga Range) and "Pink Mountain caribou" (i.e., northern caribou living in the Pink Mountain Range).

Based on the knowledge shared by BRFN community members, this report identifies the characteristics of spring calving habitat and winter habitat for both ecotypes of caribou. A summary of this long-term knowledge of habitat use is used to develop a draft habitat supply model, which models the availability of suitable winter habitat in the Chinchaga Range. Further work on this approach may provide a useful means of identifying important winter habitat areas for protection within this range. For both muskeg (boreal) and Pink Mountain (northern) caribou, the ecological characteristics of seasonally important habitat and landscape level habitat needs are summarized and used to

develop interim operating guidelines for proposed new industrial development in both ranges.

Throughout this study, BRFN knowledge holders discussed the reasons for declines of caribou and other animals in their traditional territory. From this information, a series of management recommendations have been developed for recovering muskeg and Pink Mountain caribou populations. These recommendations form the basis of BRFN's approach for caribou recovery in their traditional territory.

Summary of Key Findings

Cultural uses of caribou

Caribou were historically important to BRFN as a food source as well as for specific cultural practices. BRFN knowledge holders indicated that, while caribou hunting was common in the past, BRFN members no longer hunt caribou because they are so rare. BRFN members expressed a desire to continue hunting these animals once the populations recover.

Seasonally Important Habitat and Food Sources

For both ecotypes, knowledge holders identified spring calving season and winter (particularly late winter habitat) as the most important habitat types for protection, as caribou are most vulnerable to predation at this time. Fall rutting habitat was noted as important but not as critical in terms of avoiding predation. Avoiding disturbance during summer was noted as important as well; if disturbed, caribou will run further and this will prevent them from developing fat reserves.

For muskeg caribou (Chinchaga Range), knowledge holders identified muskeg, specifically bog, poor fen and treed fen habitat, as important for calving; stands of large spruce/pine trees with ample ground lichen loads were identified as important winter habitat; south facing slopes with early green-up were identified as important in late winter/early spring. For spring, summer and fall, access to water was identified as important both for predator avoidance and to escape insects.

For Pink Mountain caribou (Pink Mountain Range), knowledge holders identified high elevation bog/fen habitat with sedges, horsetails and willow as important for calving, in particular high elevation valleys with accessible ridges or water nearby as predator escape habitat; windswept ridges with exposed lichen were identified as important high elevation winter habitat; stands of large spruce/pine trees with ample ground lichen loads were identified as important low elevation winter habitat. Critically important for this ecotype is maintaining regular migration corridors for seasonal movements and for long distance movements typically observed in the summer.

For all caribou, BRFN knowledge holders identified lichen as the most important food source, particularly ground, but also tree lichens. Lichen is especially important in the winter; in other seasons, caribou will feed more generally from available greens.

Reasons for Population Declines

BRFN members point to a series of impacts on both caribou ecotypes that have led to population declines. The primary reasons for caribou population declines are habitat loss and increased access due to industrial development; increases in wolf populations are also recognized as an important impact on caribou populations. Caribou have also been observed drinking water and licking soil near contaminated well sites: BRFN community members expressed concerns that caribou may become contaminated and more susceptible to disease from licking minerals around well sites.

Specific to the Chinchaga Range, declines in muskeg caribou were attributed to cumulative impacts from industrial development, particularly loss of intact calving habitat and winter foraging areas. This observation is supported by the preliminary results of the IK-based habitat supply model, which shows very little suitable winter forage habitat remaining in the Chinchaga Range (Figure 5a in this report). According to BRFN knowledge holders, the loss of suitable winter forage habitat may increase the susceptibility of caribou to predation, as they lack the energy and fat reserves to outrun wolves. Based on observations from community members, these effects combined with the loss of intact calving habitat and contamination from industrial sites, have resulted in a steeply declining population on a trajectory towards complete loss of the species in this area.

Declines in Pink Mountain caribou (i.e., Pink Mountain Range of the northern caribou ecotype) were attributed to increased access into the area, which has increased predator populations and resulted in low calving success rates. The lack of connectivity for this herd to low elevation winter habitat is also a concern. In general, BRFN knowledge holders felt that the declining population in the Pink Mountain area could be reversed with habitat protection measures and restoration efforts, particularly focused on restoring calving habitat and access to low elevation winter habitat.

BRFN Management Actions for Protecting and Restoring Caribou

The following actions have been identified by BRFN members as important approaches for restoring muskeg caribou populations within the Chinchaga Range:

- **Avoiding contamination of animals:** immediately fence all industrial sites that are attractive to caribou (i.e., man-made licks) and reclaim abandoned industrial sites.
- **Avoiding disturbance to caribou:** institute no-hunting zones (applied to all animals for which there is an open season) for resident and non-resident hunters in some areas of Chinchaga Range, to minimize disturbance to caribou in some parts of the range.
- **Restoring habitat:** develop a restoration plan directed at linear corridors within priority areas, focused on identified calving and winter habitat. This restoration plan must focus on *ecological restoration* as a long-term goal, and include measures to restore lichen loads, particularly in winter habitat.
- **Minimizing predation:** institute a short-term wolf control program within some portions of the Chinchaga Range, focused on areas with high wolf populations and a high density of linear corridors.
- **Protecting calves:** consider maternal penning program for increasing calf survival over the short-term.

- **Avoiding further habitat degradation:** develop BRFN guidelines for industry proposing new works in muskeg caribou habitat.
- **Monitoring results:** secure long-term funding for BRFN monitoring of muskeg caribou populations in the Chinchaga Range.

The following actions have been identified by BRFN members as important approaches for restoring caribou populations within the Pink Mountain Range:

- **Protecting habitat:** immediately protect all identified low elevation and high elevation winter habitat, calving habitat, and movement corridors, using a combination of ungulate winter ranges, wildlife habitat areas, and wildlife features; include specific objectives within these designations to ensure that industry must adhere to strict guidelines for proposed works in these areas.
- **Restoring habitat:** develop a restoration plan directed at restoring linear corridors within priority areas, focused on identified calving, winter habitat and migration corridors. In particular, focus on restoring connectivity between high elevation spring/summer/fall habitat and low elevation winter habitat.
- **Avoiding further habitat degradation:** develop BRFN guidelines for industry proposing new works in Pink Mountain caribou habitat.
- **Monitoring results:** secure long-term funding for BRFN monitoring of Pink Mountain caribou populations.

For both ecotypes, these lists should be considered draft: additional management actions may be added in the coming months.

Due to the urgency associated with improving the existing Interim Operating Procedures for industry working in identified boreal caribou habitat—and the lack of similar guidelines for proposed works in identified northern caribou habitat—BRFN has drafted Interim Operating Guidelines for industry working in these ranges. These draft operating guidelines, which are available from BRFN Lands staff, should be followed for all industry proposing work in BRFN's traditional territory, in all habitat identified as potential caribou habitat for either ecotype. The interim operating guidelines are living documents, and will be updated as needed and as new information becomes available.

BRFN anticipates further efforts in the coming months to address the other priority management actions identified in this report, and to begin the process of halting the ongoing declines of caribou in BRFN's territory.

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1 Introduction

1.1. Overview and Study Goals

Throughout northeastern British Columbia, a burgeoning oil and gas industry has led to extensive industrial development over the past 20 years, particularly north of Fort St. John and east of the Alaska Highway. During this time, several hundred kilometers of pipelines, and more than 16,000 oil and gas wells have been put in place, with commensurate development including seismic lines, roads, compressor stations, gravel pits, and other infrastructure needed to support the industry. Meanwhile, forestry continues at the rate determined by provincial allowable annual cut (AAC) calculations, farmland near the Peace River continues to expand, and preliminary construction for the Site C hydroelectric project is in progress.¹

No community has experienced the impacts from this development more intensely than the Blueberry River First Nations (BRFN), whose traditional territory has been crisscrossed by pipelines, powerlines and roads and lit up by countless gas flares. Where BRFN members used to walk off the reserve to hunt caribou, moose and other culturally important species, they now need to drive several hours to reach reliable sources of wild game that are considered contaminant free. This massive change in practice has occurred over a generation, and is of great concern to BRFN members, particularly as new development continues to get approved on their lands.

As part of efforts to document cumulative effects on culturally important resources to the community, this study was commissioned by BRFN to gather indigenous knowledge (IK) of boreal caribou, northern caribou and moose across BRFN traditional lands. Part of this work was funded through the BC Oil and Gas Research and Innovation Society (BC OGRIS) and the Aboriginal Fund for Species at Risk (AFSAR); both of these funding sources provided support to gather IK on boreal caribou and develop an IK-based habitat supply model for boreal caribou in this range. The AFSAR funding was also directed towards an IK study of northern caribou (Pink Mountain herd).

To fulfill the funding requirements of both BC OGRIS and AFSAR, this report focuses on BRFN IK of boreal caribou within the area delineated by provincial and federal policy makers as the Chinchaga range, and northern caribou within the area delineated as the Pink Mountain Range. Specifically, the report focuses on the following objectives:

- Document BRFN indigenous knowledge of Chinchaga boreal caribou and Pink Mountain northern caribou seasonal habitat associations;
- Document indigenous knowledge surrounding reasons for declines in boreal and northern caribou populations.²

¹ See Macdonald 2016 for a recent analysis of the cumulative landscape disturbance in BRFN's traditional territory

² BRFN members refer to the Chinchaga herd as "muskeg caribou" rather than the provincial/federal designation of "boreal ecotype". For consistency with indigenous knowledge, muskeg caribou is the term used throughout this report for caribou living in this area of BRFN territory.

- Develop a habitat supply model (HSM) characterizing the extent of available suitable habitat for boreal caribou in the Chinchaga Range during winter, based on BRFN IK.
- Develop a series of management recommendations associated with restoring the Chinchaga and Pink Mountain herds.

While current BRFN hunting practices are focused on other ungulate species, primarily moose and elk, BRFN members remain concerned about the precipitous declines of both the “Pink Mountain caribou” and the “muskeg caribou” in their traditional territory. BRFN IK recognizes the differences in appearance, seasonal habitat use, and predator avoidance for these two different ecotypes of caribou. In this study, BRFN hunters confirmed that past hunting practices included hunting of caribou, but that few BRFN members have hunted them in recent years. However, IK of habitat associations and changes in habitat use is still alive and well within the community; this knowledge forms an important component of this report.

1.2. Geographic Area of Focus

The northern caribou (Pink Mountain range) portion of this study focuses on caribou living around the Pink Mountain area, west of the Alaska Highway. The area remains relatively free of industrial development at this time; however, major pipelines are proposed to bisect the area and BRFN members are very concerned about potential impacts to their ongoing cultural use of this area, which, based on BRFN IK, is already impacted by high hunting pressures and predator populations. This area corresponds to BRFN Critical Community Interest Area (CCIA) 1 and parts of CCIA 2, identified in an earlier study with BRFN (Olson et al. 2015); see Section 2 and Figure 1 for the location of CCIA's within BRFN territory.

The boreal caribou portion of this study focuses on caribou in the northeast of BRFN traditional territory, encompassing areas around the Beaton River and Tommy Lakes Road. These areas are identified as being already significantly impacted by development, particularly oil and gas development. This area of interest corresponds to parts of CCIA 1 and 3 (Figure 1).

1.3. Report Structure and Content

The report is structured as follows:

- Section 1 provides an introduction to the report and details study limitations.
- Section 2 provides an overview of BRFN context, including BRFN geographical, historical and current context, and why a BRFN indigenous knowledge baseline on caribou is important. Section 2 contains detailed methods for the study.
- Section 3 describes BRFN indigenous knowledge of boreal caribou and northern caribou, including the importance of caribou, BRFN caribou hunting practices, preferred habitat for boreal and northern caribou (by season; landscape and stand level), and BRFN knowledge of caribou habitat/population/behaviour changes. This

section also includes the methods, key assumptions, and results for BRFN IK-based habitat supply model for boreal caribou.

- Section 4 provides a summary of BRFN knowledge regarding impacts to caribou and other animals within BRFN territory, including habitat impacts, predation pressures, hunting pressures, and timing of impacts.
- Section 5 describes BRFN management recommendations for boreal and northern caribou. It includes a summary of areas of critical importance for protecting or re-establishing BRFN rights to hunt boreal and northern caribou, and recommended BRFN protection measures for this species.

Specific goals for the portion of the study funded through BC OGRIS and AFSAR are documented below.

Table 1: BC OGRIS and AFSAR Study Goals

1. Indigenous knowledge study of caribou and changes to caribou habitat	Sections 3 and 4
2. Development of an IK-based habitat supply model for boreal caribou	Section 3
3. Development of a IK-based management strategy for caribou	Section 5
4. Communication of results to provincial and federal governments	Section 5; presentations to relevant staff members; presentation to REMB (fall 2016)

1.4. Limitations and Use of Information

This report is based on BRFN Indigenous knowledge collected within constraints of scope, budget, and time. Information provided herein is the most current available to BRFN. An important limitation is this report is based on fieldwork with a small group of BRFN knowledge holders, selected by BRFN leadership and staff for their knowledge of caribou habitat associations and important habitat areas. Within the constraints of available time and budget, important areas to visit and document habitat changes were identified, based on areas that have been impacted by industrial development, and areas that are slated for future development. Where possible, this report draws upon existing information from previous traditional use studies (TUS) with BRFN members, including site-specific information from five previous TUS Projects (North Montney Mainline, Merrick Mainline, Prince Rupert Gas Transmission, Coastal GasLink Pipeline, and Shell).³

Few site-specific mapped values (e.g., kill-sites) are presented in this study; those few that are depicted are drawn from previous studies mentioned above. It is critically

³ Together, these studies encompass 208 individual mapping interviews with 120 BRFN members. All mapping interviews were conducted by The Firelight Group with BRFN co-researchers, and used a standard interview protocol with direct-to-digital (D2D) mapping at a scale of 1:50,000 or better.

important to note that the methods used in this study were not intended to map site-specific values but rather to focus on understanding and documenting indigenous knowledge of boreal and northern caribou seasonal habitat use. Any mapped values presented in this report do not reflect all BRFN current use in those areas, and **an absence of data does not signify an absence of use or value**. The limitation is particularly important within the context of caribou hunting, as little caribou hunting has occurred within BRFN territory in the last 20 years.

This report is based on the understandings of the authors at the time of writing and is not intended to be a full reflection of the dynamic and living system of use and knowledge maintained by BRFN elders and members. Information contained herein should not be construed to define, limit, or otherwise constrain the treaty or Aboriginal rights of BRFN or other First Nations or Aboriginal peoples. This report is non-confidential and intended for consideration by the funder within the defined area of interest. However, all data included in this report is the property of the BRFN, and may not be used or reproduced outside the specific funding agreement without the written consent of the BRFN.

Nothing in this report should be construed as to waive, reduce, or otherwise constrain BRFN rights within, or outside of, ongoing government-led processes. Nor should this Report be construed as to define, limit, or otherwise constrain the Aboriginal or Treaty rights of other First Nations or Aboriginal peoples. It should not be relied upon to inform other projects or initiatives without the written consent of the BRFN.

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2 Context and Methods

2.1. BRFN Context and Geographic Location

BRFN traditional territory is located in northeast British Columbia. The primary BRFN Indian Reserve (I.R. No. 205) is located at Blueberry River, approximately 80 km northwest of Fort St. John, BC. A second BRFN Indian Reserve is located at the southern half of Beaton River (I.R. No. 204). BRFN has more than 450 registered members (AANDC 2014), including both Dane-zaa (Beaver) and Cree speakers. Formerly, BRFN was part of Fort St. John Band; however, in 1977 the band was split into the Blueberry River and Doig River First Nations (Ridington and Ridington 2013). After Treaty 8 was imposed in 1898 (AADNC 2010), the Fort St. John Band adhered to the Treaty in 1900, along with other Beaver, Cree, Chipewyan, and Slavey First Nations (Brody 1981).

The Fort St. John Indian Band signed Treaty 8 with the aim of preserving their lands and natural resources from outside interests (Virtual Museum Canada 2007). Treaty commissioners from Canada made BRFN signatories a solemn promise that the Treaty would not lead to any forced interference with their mode of life. BRFN understands their relationship with the Crown in terms of that agreement, that they were promised the ability to practice their traditional mode of life as if they had never entered Treaty.

The Fort St. John Indian Band selected *Gat Tah Kwâ* (Montney), one of the Dane-Zaa traditional gathering places located about 15 miles north of what is now the city of Fort St. John, as the site of its reserve. This was approved in 1914 as I.R. 172. The land selected by the Band for I.R. 172 was within an area known as the Peace River Block, which was part of a series of land conveyances between Canada and BC. In 1947–48, the Department of Indian (DIA) Affairs transferred the Montney Reserve to the Director of the Veterans Land Act for use as farmland for returning war veterans. Three small replacement reserves were established in 1950 (I.R. 204, I.R. 205, and I.R. 206), although Canada failed to reserve the mineral rights on these reserves for the Fort St. John Indian Band's use and benefit. The Beaver and Cree of Fort St. John Indian Band split and moved to two of the reserves (Blueberry River Reserve and the Doig River Reserve) (Treaty 8 FNCAT 2012). A sour gas well leak in 1979 forced the evaluation of the BRFN reserve, and prompted BRFN to move to its current location in 1980.

In 1978 the Fort St. John Indian Band filed an action against Canada for having breached its fiduciary duty, as well as claiming damages over the transfer of the mineral rights in Fort St. John Indian Band territory (ICC 2006). After twenty years of persistent legal action, and following a successful Supreme Court of Canada decision on liability for breach of fiduciary duty, in 1998 the Federal government settled the damages with BRFN and Doig River First Nation for \$147 million for lost oil and gas revenues from the I.R. 172 land.

2.2. Changes to Traditional Territory and Land Use

Much has changed in BRFN territory over the past century. At the time of writing this report, the amount of land that is freely available for BRFN use and occupancy has been reduced to a small fraction of what was previously used, due to modern industrial activities (MacDonald 2016; Lee and Hanneman 2012; Salmo Consulting et al 2003; MSES 2012; Macdonald and Candler 2014). These activities include the use of lands for farming and other private holdings, and disturbance to the landscape and ecology of the area by increasing oil and gas development, mining, hydro development and forestry. A recent study of land use and industrial land changes determined the following major industrial/infrastructure land uses in the Peace Region:

- 16,267 oil and gas well sites;
- 8,517 petroleum and natural gas facilities;
- 358 km² of oil and gas pipeline ROWs;
- 9,781 km² of active oil and gas tenures;
- 5,097 km² of existing and planned logging cut blocks;
- one large hydropower reservoir (Williston), one large proposed reservoir (Site C) and dozens of potential run-of-river hydropower sites; and
- 45,293 km of roads (Lee and Hanneman 2013).

There are many more proposed or planned projects in the near future. To give a very general sense of the scale of activity, over the past five years, referrals have been averaging 607 per year, with approximately 85 per cent coming from the Oil and Gas Commission and the Ministry of Natural Gas Development (personal correspondence, BRFN Lands Office staff, September 5, 2013). In 2014, over 1,200 new permits went through the BRFN lands office (personal correspondence, BRFN Lands Office staff, July 26, 2016). Based on a recent analysis, approximately 73% of the area inside BRFN's traditional territory is within 250 m of an industrial disturbance, and approximately 84% is within 500 m of an industrial disturbance (Macdonald 2016).

Despite these documented cumulative effects, BRFN members continue to actively pursue hunting, trapping, fishing, gathering, and other activities, though they report much lower success rates since the early 2000's. Traditional Use Studies show that BRFN members continue to consume a broad range of animals, including moose, elk, deer, and sheep, among others. Caribou were historically important for BRFN use, but with populations currently dwindling, BRFN members report that they do not harvest this species at this time as they want to give the species the chance to recover. Other culturally important game species also exist in the area (e.g. black and grizzly bear), and smaller game (e.g. grouse, rabbit, goose, beaver) is relied upon as a supplementary resource. Recent TUS studies indicate that this high reliance on country food continues (Bouchard and Kennedy 2011; Gibson and the Firelight Group 2014; Olson and DeRoy 2013). Although focal areas of use have shifted over recent years, the land remains an important resource for subsistence purposes, as well as the foundation of BRFN's way of life, culture, and identity (MacDonald and Candler 2014).

2.3. BRFN Indigenous Knowledge

Dane-zaa have been living in the northeast of BC and northwest of Alberta for millennia, and have amassed a deep understanding of the area over that time. Dane-zaa oral history describes events and people in the area long before the arrival of white explorers. Archaeological evidence from the Charlie Lake caves shows that people occupied the area from at least 10,500 years ago, hunting bison and other game (Ridington and Ridington 2013: 67). The area was rich in wildlife due to the diversity of habitats available. Bison were abundant on the prairie along the Peace River, the muskeg to the north and east supported caribou, moose, elk, deer, beaver and other fur-bearers, and the mountains to the west provided habitat for caribou, sheep, goats, and marmots (whistlers) (MacDonald and Candler 2014). Fish were also abundant in the rivers and lakes (Ridington and Ridington 2013: 68). As a result, habitation of the area has been continuous since this time, as ancestors of the Dane-zaa took advantage of these resources, particularly the vast herds of bison. Dane-zaa ancestors also actively managed the landscape, performing controlled burning around the Peace River to maintain the prairie habitat for the bison herds (Ridington and Ridington 2013: 70).

Dane-zaa ancestors travelled seasonally around the Peace River country from the Rocky Mountains to the Alberta plains (Virtual Museum Canada 2007). This pattern of land use continued until relatively recently – well into the 20th century (Ridington 1980).

Traditionally, Dane-zaa followed the teachings of their ‘dreamers’, who were individuals who had the power to gain knowledge and insight into the future through dreaming. Stories of these dreams and visions remain an important facet of the Dane-zaa culture, and these stories continue to inform the Dane-zaa on ways to maintain balance with one another, as well as with the animals and the land that they depend on (Ridington and Ridington 2013). The knowledge and insight of dreamers is the foundation for BRFN’s protocols for living in balance with the lands and waters around them.

In English, indigenous knowledge (IK), traditional ecological knowledge (TEK) and aboriginal traditional knowledge (ATK) are all similar terms that have to do with the knowledge systems of indigenous communities. TEK is more common in the academic literature, ATK is the term used in policy related to the *Canadian Environmental Assessment Act*, and IK is most common at the international level. Practitioner guidance from the Canadian Environmental Assessment Agency states:

ATK is a body of knowledge built up by a group of people through generations of living in close contact with nature. ATK is cumulative and dynamic. It builds upon the historic experiences of a people and adapts to social, economic, environmental, spiritual and political change... While those involved in environmental assessment will likely be most interested in traditional knowledge about the environment (or, traditional ecological knowledge), it must be understood to form a part of a larger body of knowledge which encompasses knowledge about cultural, environmental, economic, political and spiritual inter-relationships (p. 2).

For this report, BRFN has chosen to emphasize the term indigenous knowledge (IK) because it better recognizes the active and dynamic side of ATK that is able to respond and contribute insight regarding rapidly changing and possible future environments and reclamation based on observation, experience and indigenous analysis.

2.4. Why is a BRFN Indigenous Knowledge Baseline Important?

Indigenous knowledge systems provide an alternate framework of information, hypothesis, understanding, social rules, and relationships that produce critical insight into ecological and cultural relationships, the distribution of resources, environmental, social and cultural conditions and trends over time. The information and perspectives available through a well-conducted indigenous knowledge baseline focus on specific areas and concerns, and are built on a multi-generational foundation of experience that is not typically available to physical science-based researchers (Candler et al., 2013). The indigenous knowledge system must be considered on equal footing with scientific ways of knowing, and deeply respected for the longer-term perspectives it brings.

The importance of IK in understanding impacts to First Nations culture, values, and way of life cannot be overstated. The practice of oral transmission of IK means that each generation shares the knowledge of their parents, their grandparents, and all generations that preceded them. Through the ongoing use of the land, BRFN members continue to practice and gather indigenous knowledge of the health, distribution and ecology of animals that are culturally important. Every observation builds on the observations of generations before, and comes with an astounding depth of place-based knowledge. Ongoing use of the land means that monitoring the abundance and health of populations, and observing changes in habitat use, continues to the present day. While it is sometimes difficult for conventional scientists to accept this knowledge system, in reality, BRFN indigenous knowledge of moose and caribou is likely much more extensive than what is available through formal scientific testing. BRFN knowledge relies on a much longer time period of regular observation and a larger comparative sample of animals over a larger area.

2.5. Summary of Methods

Methods used in this work included existing document review, focus groups, on-territory interviews, habitat supply modelling, and follow-up verification.

Existing document review: Given the breadth of BRFN IK that has already been recorded and mapped in previous Firelight studies, the initial step for this project involved reviewing important caribou IK and mapped areas from these studies. Site-specific caribou data from five earlier TUS Projects (North Montney Mainline, Merrick Mainline, Prince Rupert Gas Transmission, Coastal GasLink Pipeline, and Shell) were gathered and amalgamated onto a territory-wide map specific to this species. For reference, the maps showing BRFN site-specific values and important habitat areas relative to caribou were overlain with caribou herd core areas from the provincial and federal government.

Focus Group: An initial focus group was held with BRFN Chief and Council, staff, and knowledge holders to identify areas of importance for fieldwork conducted for this study. The focus group was held at BRFN's reserve, and included a total of eight knowledge holders. The session was attended by two Firelight ecologists and one Firelight mapping/information management specialist. Based on the focus group, key issues were identified including:

- Areas of focus for the study, including areas that are not currently impacted and areas that have been heavily impacted by industrial development;
- Critical issues to be discussed during interviews with BRFN knowledge holders.

Data Acquisition and Mapping Methods: A field-based approach was used to identify important caribou habitat and to map seasonal habitat associations. This approach was used to cue knowledge holders to discuss seasonal movement patterns, seasonal habitat associations, important site-specific and landscape-level habitat associations, and changes in habitat, populations, and caribou quality over time. Site-based field observation and data collection enabled the collection of a rich, multi-faceted data set touching on seasonal caribou habitat use and impacts to caribou *in situ*.

To facilitate collection of science-based ecological information with indigenous knowledge, Firelight worked with habitat modellers from Wildlife Infometrics to develop a field form in Open Data Kit (ODK)⁴, which was used for each site visit. These field forms included characterizing the ecology of the site, and indicating which species used the area during each season. An example field form is provided in Appendix 1. An interview guide was also developed for conducting focus groups with study participants; the interview guide can be found in Appendix 2. Informed consent was documented for all participants in the study; the declaration of informed consent form can be found in Appendix 3.

On-Territory Field Visits: Based on the review of previous documents and the initial focus group, six days of field visits were held with BRFN knowledge holders. The study included 8 knowledge holders (3 of whom were elders), one BRFN co-researcher, and three Firelight staff members

During each field day, one important hunting area was selected for fieldwork, to which the group travelled via truck and/or ATV. Each day, between 8 – 20 individual sites were visited. At each site, ecological information and IK was recorded. One Firelight staff member was primarily responsible for collecting ecological data, while the two other staff members conducted interviews with knowledge holders. During the field work, information on seasonal use of habitat was gathered, as well as cultural uses, hunting practices, preferred hunting areas, seasonal movements, changes in quality/quantity, and BRFN knowledge of reasons for the observed changes in species numbers and quality. Data were compiled each night and compared to determine key messages from each site.

The following locations were visited (Table 2); road numbers are referenced in relation to the distance north along the Alaska highway from the starting point (mile 0).

Table 2: Summary of Field Work

Day	Location of Field Sites
Day 0 (travel day)	Two sites near Pink Mountain
Day 1	Two Bit Creek to Caribou Flats

⁴ Open Data Kit (ODK) is a free and open-source set of tools, which help organizations author, field, and manage mobile data collection solutions. More information is available here: <https://opendatakit.org/>

Day 2	171 to Trimble Lake area
Day 3	156 road to mountain top
Day 4	Team 1 to 143/Cypress Hills Team 2 to 132 Road, (138 was planned but impassable) and up Pink Mountain.
Day 5	Team 1 to Beatton River/Tommy Lakes Road Team 2 to Gundy Road (120 Road)
Day 6	Focus group to show and verify work so far; travelled to Horse Camp
Day 7	Debrief with team; return to BRFN

In total, 78 sites representing a range of habitat quality for moose and caribou were visited during the on-territory field visits. Ecological data were recorded at 69 of these sites, while IK was recorded at all 78 sites. Each of the 78 sites visited is shown on Figure 2 (labelled as field sites). A brief description of every site visited is provided in Appendix 4.

Data compilation and development of habitat supply model for boreal caribou

Ecological data collected during field visits was compiled, along with IK recorded at each of the sites, into summary data tables that describe BRFN's understanding of seasonal habitat use for boreal and northern caribou. Through collaboration with Wildlife Infometrics, a BRFN IK-based habitat supply model for boreal caribou was developed. The overview table of seasonal habitat associations used to assemble the HSM is provided in Section 3 of this report.

Methods for developing the boreal caribou habitat supply model were adapted directly from McNay *et al.* 2008. Information for model construction was collected using Netica (version 4.16, Norsys Systems Corp., Vancouver, British Columbia), a software shell used for constructing Bayesian Belief Networks (BBNs) and Influence Diagrams. In general, BBNs consist of nodes and linkages, where nodes represent environmental correlates, disturbance factors, and response conditions (see Marcot *et al.* 2006, for descriptions of terms and components of BBNs). All nodes are linked by probabilities. Input nodes (the range and environmental prediction variables) contain marginal ("prior") probabilities of their states; intermediate nodes (e.g., describing attributes of caribou range) contain tables of conditional probabilities; and output nodes (caribou range values) are calculated as posterior probabilities expressed as suitability values from +1.0 (high) to -1.0 (low). Modelling methods generally followed guidelines for creating and updating BBNs presented by Marcot *et al.* (2006). This entailed initially developing simple influence diagrams to depict nodes and linkages, expanding these into initial alpha-level BBN models in which the node states and linkage probabilities were parameterized mostly from indigenous knowledge, expert judgment and initial observations.

ArcGIS 10.0 (ESRI, Redlands, California) and Microsoft Access 2010 (Microsoft Corp., Redmond, Washington) was used to construct and manage case files of environmental correlates taken from 1-ha cells in the project area. The environmental correlates used came primarily from the Earth Observation for Sustainable Development (EOSD) image mapping⁵, BC Vegetation Resources Inventory, digital elevation models, Biogeoclimatic

⁵ See <https://cfs.nrcan.gc.ca/publications?id=20541>

Ecosystem classification, the BC Freshwater Atlas, and the Ducks Unlimited Enhanced Wetland classification datasets. Case files were lists of records (i.e., one record for each unique combination of correlates in the study area) containing columns (i.e., one column for each input node) specifying the existing condition or state of the environmental correlates represented by input nodes. The decision to map results at 1-ha resolution was based on the management problem in question and does not imply accuracy of the input data. Netica in batch mode was used to process the case files before preparing the modelled results in Access for mapping and display in ArcGIS.

Resulting habitat values were classed as high, moderate, low classes using equidistant cutpoints across the range of observed outputs. The area of land (ha) in each class was then summed and stratified by the herd area and by two caribou core areas within the herd area. Locations of radio-collared caribou were obtained and used graphically to visually assess the results of the habitat model. No analytical methods were conducted with the caribou locations although there are a number of methods available to use such data as a more thorough assessment of model results.

Data Verification and Follow-up

A verification session was conducted with two key BRFN knowledge holders, both elders, in March of 2016. These interviews were used to confirm findings from the 2015 fieldwork, discuss how the practice of BRFN's treaty right to hunt caribou has been impacted by industrial development, and discuss priority areas for conservation of caribou habitat. The results of this verification work are incorporated into Section 3, with recommended management options presented in Section 5.

2.6. Ongoing BRFN Studies

BRFN has worked with Firelight researchers to complete a management plan for BRFN territory, focused on priority areas defined by Chief and Council, and BRFN members. These priority areas include Pink Mountain, Sikanni Chief area, Aitken Creek Road, Cypress Creek Road, Cameron River, Beatton River, and Tommy Lakes. The management plan incorporates site-specific and non-site-specific data on BRFN use from five earlier TUS Projects (North Montney Mainline, Merrick Mainline, Prince Rupert Gas Transmission, Coastal GasLink Pipeline and Shell), and includes a total of 208 individual mapping interviews with 120 BRFN members, as well as focus group sessions and on-the-ground mapping.

Where possible, the results from this study have been cross-referenced to the BRFN Management Plan. A detailed review of BRFN history, recent land impacts, and cultural use can be found in the BRFN Management Plan (Olson et al. 2015).

BRFN Critical Community Interest Areas

A key piece of the ongoing development of BRFN's Management Plan has been the identification of Critical Community Interest Areas (CCIAs). In collaboration with Firelight and in consultation with BRFN community members, BRFN lands staff has proposed three CCIAs, as described in Olson et al. 2015. These CCIAs are as follows:

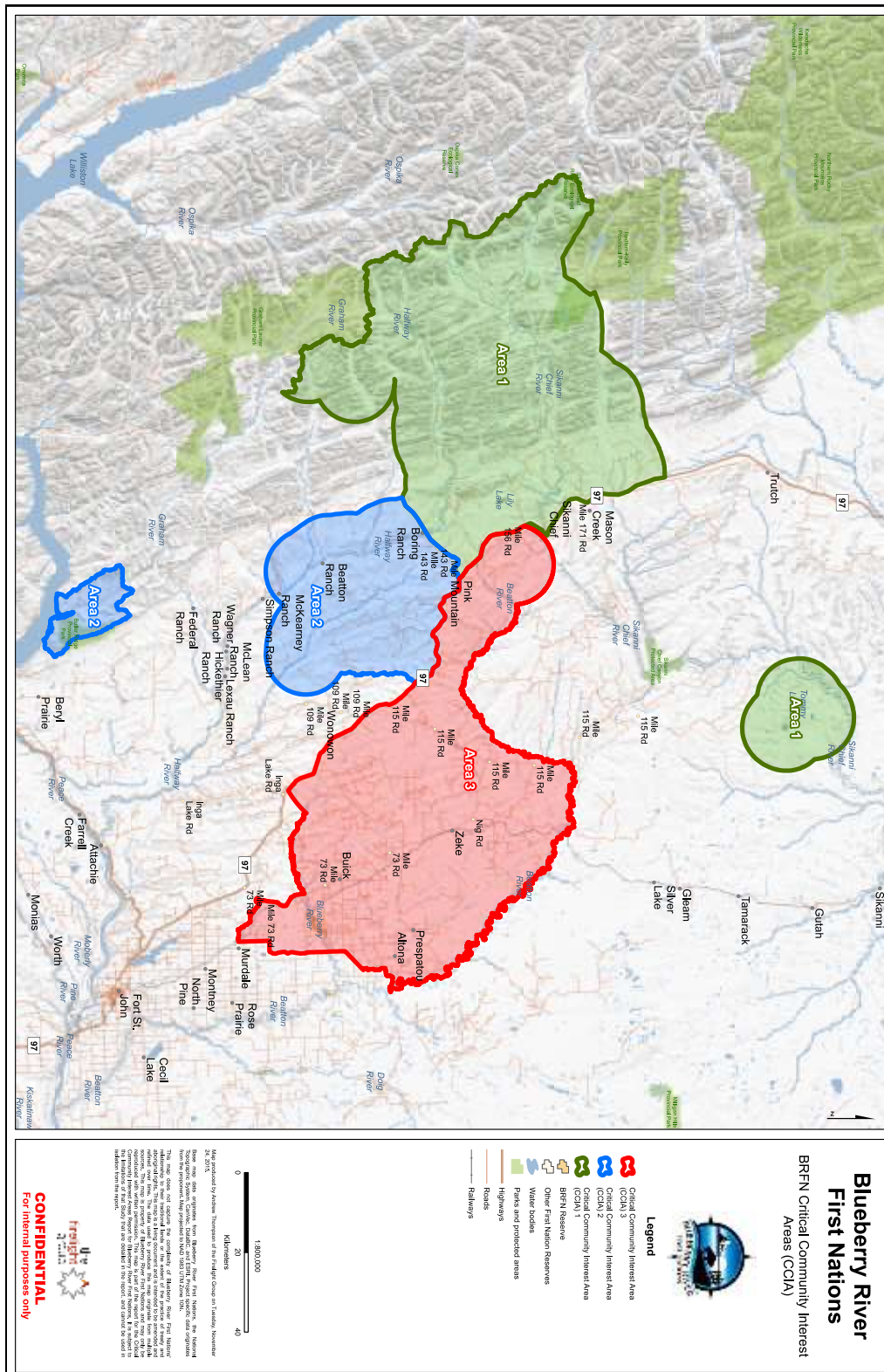
CCIA 1: Sikanni Chief River and Pink Mountain ranges towards the west of Gundy area; area 1 also includes the Tommy Lakes area further to the north east.

CCIA 2: Halfway River and Cameron River towards Cypress Creek area.

CCIA 3: Beatton River and Nig Creek towards Blueberry River area.

These areas (shown in Figure 1) are described in more detail in Olson et al. 2015.

Figure 1: Critical Cultural Interest Areas 1, 2 and 3 within BRFN territory (from Olson et al. 2015).



3 BRFN Indigenous Knowledge of Muskeg and Pink Mountain Caribou

3.1. Caribou kinds and distribution

Woodland caribou (*Rangifer tarandus*) are represented by a number of different ecotypes in British Columbia, including boreal caribou, northern caribou, and southern mountain caribou. Because of widespread declines in all ecotypes of caribou, these ecotypes are all listed under Canada's Species at Risk Act. The boreal and southern mountain caribou ecotypes are listed as "Threatened," while the northern caribou ecotype is listed as "Special Concern." For all ecotypes, the primary identified threats to the population are habitat loss and fragmentation, coupled with predation pressure from increased wolf populations and improved wolf hunting success, which is linked to both increases in other ungulates and increases in linear corridors. A full discussion of the causes of boreal caribou population declines can be found in the Boreal Caribou Recovery Strategy (Environment Canada 2012a). A discussion of impacts to northern caribou can be found in the Management Plan for the Northern Mountain Population of Woodland Caribou in Canada (Environment Canada 2012b).

This report focuses on two ecotypes of woodland caribou (*Rangifer tarandus*): the boreal ecotype, which lives in the muskeg areas to the northeast of BRFN's reserve, and the northern ecotype, which lives in the Pink Mountain area. BRFN knowledge holders distinguish the two ecotypes and report that they used to mix frequently in the lowland areas to the east of Pink Mountain. They refer to the northern mountain ecotype as mountain caribou, and the boreal ecotype as muskeg caribou. These terms are used throughout the remainder of this report to refer to the Pink Mountain herd ("mountain caribou" or "Pink Mountain caribou") and the Chinchaga herd ("muskeg caribou").

Figure 2 shows the current delineation of caribou herds by provincial/federal government within BRFN traditional territory. As part of BC OGRIS' efforts to collect boreal caribou telemetry data, and ongoing revisions to British Columbia's boreal caribou implementation plan, an update to the ranges of boreal caribou herds has been proposed but has not yet been finalized.

3.2. Importance of Caribou to BRFN

Both in the current study and previous studies, knowledge holders have repeatedly reported on declines to caribou in the last five decades.

You'll be lucky if you see a good caribou. Usually you see them by the fifties. Today you will be lucky if you see two in the fall. (B40, 2013)

When I was guiding [at Butler Ridge] way back in '79, to see 200 [caribou] is easy ... Now, you hardly see 20. (B05 07 Oct 13 PRGT)

Well, we wouldn't really go full-fledge hunting caribou, because they weren't around very much, eh? ... most of the time, we would just pass it up because there weren't so many of them, eh? Before, we used to go to Pink Mountain and hunt just big caribou... We'd get about five or six caribou in one hunt. (B44 25 Jun 14 PRGT)

Us right now, when we see caribou, we don't bother with it because there's no caribou, we want caribou to come back, so we all tell each other when we see caribou don't bother with it... this a long time now, maybe 10 years now. (B10, 24 June 15, from researcher notes)

Due to precipitous declines of caribou, BRFN knowledge holders reported little hunting of caribou at present; knowledge holders avoid hunting them due to concerns regarding the sustainability of the herds. Few of the BRFN knowledge holders who participated in fieldwork had hunted muskeg caribou in recent years. Those who had historically hunted muskeg caribou noted that their preferred location for hunting this species was along Tommy Lakes Road, within CCIA 1 and portions of CCIA 3 (see Figure 1).

In terms of specific cultural uses of caribou, BRFN knowledge holders discussed the importance of caribou hide for making drums, specifically mentioned that caribou drums sound different than those made with other animals. BRFN members noted that moose are their staple food (the “main course”) while other animals, including caribou, are hunted and eaten more opportunistically (the “dessert”). Despite this analogy, BRFN knowledge holders are clear that they would like to be able to hunt caribou again in their traditional territory, and that the loss of their ability to hunt this species represents an important infringement of their rights protected under Treaty 8.

BRFN Mapped Caribou-related Sites and Environmental Features.

Figure 2 shows BRFN caribou related sites that have been mapped during previous traditional use studies. The map includes caribou kill sites, identified caribou calving grounds, mineral licks used by caribou, areas where caribou have been sighted, caribou migration corridors, and evidence of caribou. The boundaries of BRFN critical cultural areas are also shown on the map, along with the boundary of BRFN territory and the current range boundaries for the Chinchaga and Pink Mountain ranges. Locations of field sites for this study are also shown on Figure 2.

BRFN mapped data on caribou from previous studies are notably scarce. Part of the reason for the lack of data is that caribou hunting has been severely curtailed for several years. Little site-specific mapping has been done in the Tommy Lakes area (part of CCIA 1), where muskeg caribou have been more extensively hunted in the past, and in the Pink Mountain area. The Pink Mountain range and much of the southern area of the Chinchaga Range falls within an important area of use for BRFN community members.

The lack of mapped caribou sites in this area reflects the lack of project-specific traditional use studies in the area, and does not indicate lack of knowledge of, nor use of, the area. As this project focused on collecting indigenous knowledge of caribou habitat use, no additional mapping was done of site-specific information related to caribou.

BRFN knowledge holders report caribou presence throughout the area visited during fieldwork. Evidence of caribou (including prints) was observed in several west and east of the Alaska Highway, including west of the delineated Chinchaga herd range (Figure 3).

Blueberry River First Nations
Reported BRFN Caribou Kill Sites, Environmental Features, and Select Caribou Herd Locations in relation to Blueberry River First Nations

Legend

- Field Sites
- Caribou Kill Sites (Points)
- Caribou Kill Sites (Polygons)
- Caribou Caching
- Caribou Evidence
- Caribou Habitat
- Caribou Migration Routes
- Caribou Signaling
- Mineral Lode
- Select Caribou Herd Locations for BC
- BRFN Reserve
- Other First Nation Reserves
- BRFN Territory Boundary
- BRFN Critical Areas
- Water bodies
- Parks and protected areas
- Highways
- Roads
- Highways

Map Information:

Map prepared by Andrew Thompson of the Range Group on Thursday April 22, 2010.

Base data was prepared from: Boundary data: First Nations, the National Geographic Database, Statistics Canada, and other. Project location was determined from the provided map coordinates in UTM (WGS 1984) Zone 18N.

The map data did not include the complexity of the terrain. The map is a topographic map and is not intended to be used as a navigation tool. The map is a topographic map and is not intended to be used as a navigation tool. The map is a topographic map and is not intended to be used as a navigation tool.

Scale: 1:50,000

North Arrow: True North

Scale Bar: 0 to 20 Kilometers

Map Labels: Pink Mountain, Chinchaga, Tamarack, Gwam, Silver Lake, Chinchaga Herd, Pink Mountain Herd, Mason Creek, Mile 108 Rd, Mile 109 Rd, Mile 110 Rd, Mile 111 Rd, Mile 112 Rd, Mile 113 Rd, Mile 114 Rd, Mile 115 Rd, Mile 116 Rd, Mile 117 Rd, Mile 118 Rd, Mile 119 Rd, Mile 120 Rd, Mile 121 Rd, Mile 122 Rd, Mile 123 Rd, Mile 124 Rd, Mile 125 Rd, Mile 126 Rd, Mile 127 Rd, Mile 128 Rd, Mile 129 Rd, Mile 130 Rd, Mile 131 Rd, Mile 132 Rd, Mile 133 Rd, Mile 134 Rd, Mile 135 Rd, Mile 136 Rd, Mile 137 Rd, Mile 138 Rd, Mile 139 Rd, Mile 140 Rd, Mile 141 Rd, Mile 142 Rd, Mile 143 Rd, Mile 144 Rd, Mile 145 Rd, Mile 146 Rd, Mile 147 Rd, Mile 148 Rd, Mile 149 Rd, Mile 150 Rd, Mile 151 Rd, Mile 152 Rd, Mile 153 Rd, Mile 154 Rd, Mile 155 Rd, Mile 156 Rd, Mile 157 Rd, Mile 158 Rd, Mile 159 Rd, Mile 160 Rd, Mile 161 Rd, Mile 162 Rd, Mile 163 Rd, Mile 164 Rd, Mile 165 Rd, Mile 166 Rd, Mile 167 Rd, Mile 168 Rd, Mile 169 Rd, Mile 170 Rd, Mile 171 Rd, Mile 172 Rd, Mile 173 Rd, Mile 174 Rd, Mile 175 Rd, 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3.3. Seasonal Preferred Habitat for Muskeg Caribou

BRFN knowledge of seasonal muskeg caribou habitat use and movement corridors is documented in Table 3; this information forms the foundation for the muskeg caribou IK-based habitat supply model described in Section 3.4.

Knowledge holders identified particular seasons and habitat needs as most important for the survival and recovery of muskeg caribou. Based on the site descriptions provided by knowledge holders and ecological data collected on site, these important habitat types are described in some detail below, referencing scientific classification systems wherever possible. This information should be referenced for all future development planning in muskeg caribou habitat.⁶

Characterizing BRFN Important Habitat Areas for Muskeg Caribou

Muskeg Caribou Calving Habitat

Knowledge holders emphasized that muskeg caribou are most vulnerable to predation during the calving season, and that it is critically important that any identified calving habitat should be protected from development. Creating access into these areas greatly increases the predation risk for caribou during this period of time.

Based on the sites visited during fieldwork, important calving areas for muskeg caribou fit the following ecological description:

- Site description: wet, muskeg areas; often with some small trees. Based on ecological classifications conducted during fieldwork, these areas are best characterized as bogs (shrubby/treed, nutrient poor peatlands with ericaceous shrubs and sphagnum species) or poor fens (peatlands with higher mineral availability due to the presence of an active water table; contains higher amounts of non-ericaceous shrubs, sedges, grasses, reeds, and brown mosses).
- Biogeoclimatic Ecosystem Classification (BEC) ecosystem types: The ecosystem type Wb03 Black spruce – Lingonberry – Peat-moss was most often identified as calving habitat, with the “overmature” variation (Wb03.1 Reindeer Lichen variation) also identified as important. Other ecosystem types identified by knowledge holders as important for caribou calving included Wb09 Black spruce – Common horsetail – Peat-moss, a bog / poor swamp site association which is more heavily treed than Wb03, and less frequently Wb06 Tamarack – Water sedge – Fen moss, a bog / poor fen site association with *Larix laricina* (tamarack) and *Picea mariana* (black spruce) in the overstory (Delong et al. 2011).
- Moisture level: according to BRFN knowledge holders, preferred calving areas for muskeg caribou tend to be wetter than moose calving areas; calves are stashed in slightly drier areas / hummocks to avoid detection by predators.

⁶ This information represents the best available and documented BRFN indigenous knowledge at the time of writing this report. However, the details presented here do not represent the full depth and breadth of BRFN knowledge about how caribou use habitat. The information and details presented here may be refined if further information about specific habitat types and seasonal habitat use for caribou becomes available.

- Forest cover: predominantly dwarf / stunted black spruce; in some areas also *Larix laricina* (tamarack)
- Shrub layer: as noted, trees dominate shrub layer; stunted black spruce is the most common species. Low shrubs of *Betula nana* (scrub birch) and *Ledum groenlandicum* may be present; sometimes a willow component. *Equisetum* (horsetail) species are sometimes present.
- Herb layer: typically *Ledum groenlandicum* (Labrador tea), *Rubus chamaemorus* (cloudberry), *Vaccinium vitis-idaea* (lingonberry). Some areas have a higher sedge component.
- Slope: flat, low lying areas
- Elevation: low elevation sites (less than 500 m)
- Age: older, undisturbed bogs are more likely to have high ground lichen cover (*Cladonia* and *Cladina*) due to drying of surface peat.

Muskeg Caribou Winter Habitat

Knowledge holders identified that caribou would use drier areas in the winter, particularly areas with low snow loads and abundant terrestrial and arboreal lichen loads. Terrestrial lichen load was noted as generally more important than arboreal lichen load, with muskeg caribou described as pawing through the snow to undercover lichens. Mature pine and spruce forests (> 60 years old) with low snow cover were identified as most important habitat areas for muskeg caribou in the winter.

Muskeg Caribou Early Spring Habitat

BRFN knowledge holders emphasized the importance of access to early spring food sources for muskeg caribou. Important early spring habitat was predominantly identified as areas within muskeg caribou habitat that would have early spring green-up (i.e., lose snow cover early). This report infers that these areas would occur largely on south-facing slopes and/or areas with lower snowfall (e.g., open forests with good snow interception and high solar insolation).

Seasonally Important Food Sources for Muskeg Caribou

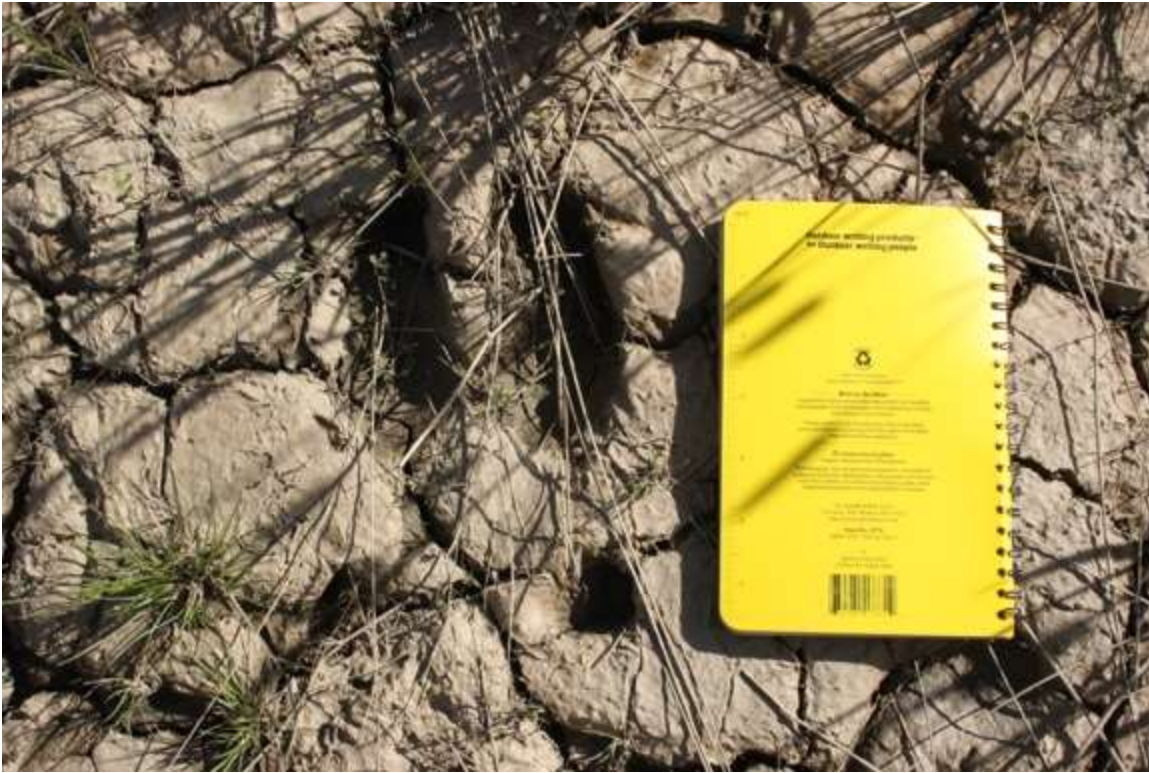
- BRFN knowledge holders identified ground lichens, particularly various *Cladina* and *Cladonia* species, as important for muskeg caribou. However, they noted that caribou would also eat lichen from trees, including *Alectoria* and *Bryoria* species.
- Though lichen were identified as the primary food source for muskeg caribou, throughout fieldwork, knowledge holders pointed out other green plants that they said were regularly eaten by caribou when they were available. These included saskatoon, scrub birch, cottonwood and trembling aspen seedlings, rose, willow, *vaccinium* species, some vetch species, and fireweed. Knowledge holders also stated that caribou would eat berries in the summer.⁷

⁷ This list should not be considered exhaustive but rather is indicative of the wide range of plants that will be eaten by caribou, particularly during spring, summer and fall. The knowledge of BRFN members, representing generations of interactions with caribou, aligns well with a recent study of tame boreal caribou foraging preferences in summer and fall

Table 3: BRFN Knowledge of Stand and Landscape Level Habitat Needs for Muskeg Caribou

Season	Boreal Caribou (BRFN)	Habitat Supply Model Rules
Year-round landscape movement	<p>Caribou travel along habitual routes, to same places seasonally. Disruptions to routes and preferred places (e.g. preferred calving areas) causes confusion, and animals leave the area.</p> <p>Caribou are very sensitive to noise, disturbance, smells.</p> <p>Mature cow makes decisions for the group, and has knowledge of landscape based on experience.</p> <p>For predator avoidance, caribou are slower than wolves but have good endurance and can run for a long time. Knowledge holders noted the following characteristics as being important:</p> <ul style="list-style-type: none"> • Long sight lines (i.e., caribou sees wolves before wolves see caribou) • Proximity to water to escape predators; caribou can sometimes outrun wolves in deadfall forest. Caribou will often head for water when escaping wolves. 	<p>Avoid burns / clearcuts</p> <p>Avoid linear corridors</p> <p>Select for areas near water (except in winter)</p> <p>Select for older forest with high lichen load</p> <p>Assume avoidance of steep slopes (>20%)</p>
Spring/calving season	<p>Male caribou go to snow free areas; seek out new greens / growth.</p> <p>For calving, cows seek sheltered shrub areas surrounded by water (escape terrain), which masks scent to predators. Swampy areas with dry islands in middle makes good calving grounds.</p> <p>As calves get older and can walk further, cows venture further from water</p> <p>Caribou return to same calving grounds each year, and tend to use same routes to get to them.</p>	<p>Males: South facing aspect preferred</p> <p>Females: fens, bogs with hummocks</p>
Summer/fattening season	<p>Cows/calves continue to stay near calving grounds, but venture further up as calves get faster</p> <p>Caribou do not like deciduous forests in summer – they avoid these areas because it is too easy to be seen and there is no good food.</p>	<p>Preferred habitat = rich sites preferred, old growth, areas that are easy to move through with long site lines</p> <p>Females: fens, bogs with hummocks; proximity to upland forests</p>
Fall/rutting season	<p>No specific information on rutting; assuming association with open peatland habitat. Knowledge holders report deciduous stands are used in this season.</p>	<p>Both sexes: open peatland and conifer stands; near water. Deciduous stands also used in this season.</p>
Winter	<p>Mature spruce/ pine; eating lichen from pine/ spruce trees and from ground; avoidance of open water (too easily seen)</p>	<p>Mature pine/ spruce with high lichen load.</p> <p>Drier areas (less snow)</p>

(Denryter, K.A., R.C. Cook, J.G. Cook, and K.L. Parker, in submission. Straight from the caribou's mouth: detailed observations of tame caribou reveal new insights into summer-autumn diets. Submitted to the Canadian Journal of Zoology).

Figure 3: Caribou prints on Tommy Lake Road

3.4. Muskeg Caribou IK-based Habitat Supply Model

Using the habitat associations above and further information from scientific studies of the Chinchaga herd, an IK-based habitat supply model for muskeg caribou was developed by Scott McNay and Viktor Brumovsky from Wildlife Infometrics.

Bayesian Belief Network

A coarse resolution forage layer (node CRF, Figure 4) for the winter season was estimated using the EOSD landcover data. Based on indigenous knowledge, caribou were seen using wetland type habitats⁸ more often than mixedwood forests, for example. Elevation and tree height information was used to form a habitat reduction

⁸ From BRFN knowledge holders' notes: [important food] grows close to bottom of spruce trees in muskeg – important caribou feeding.

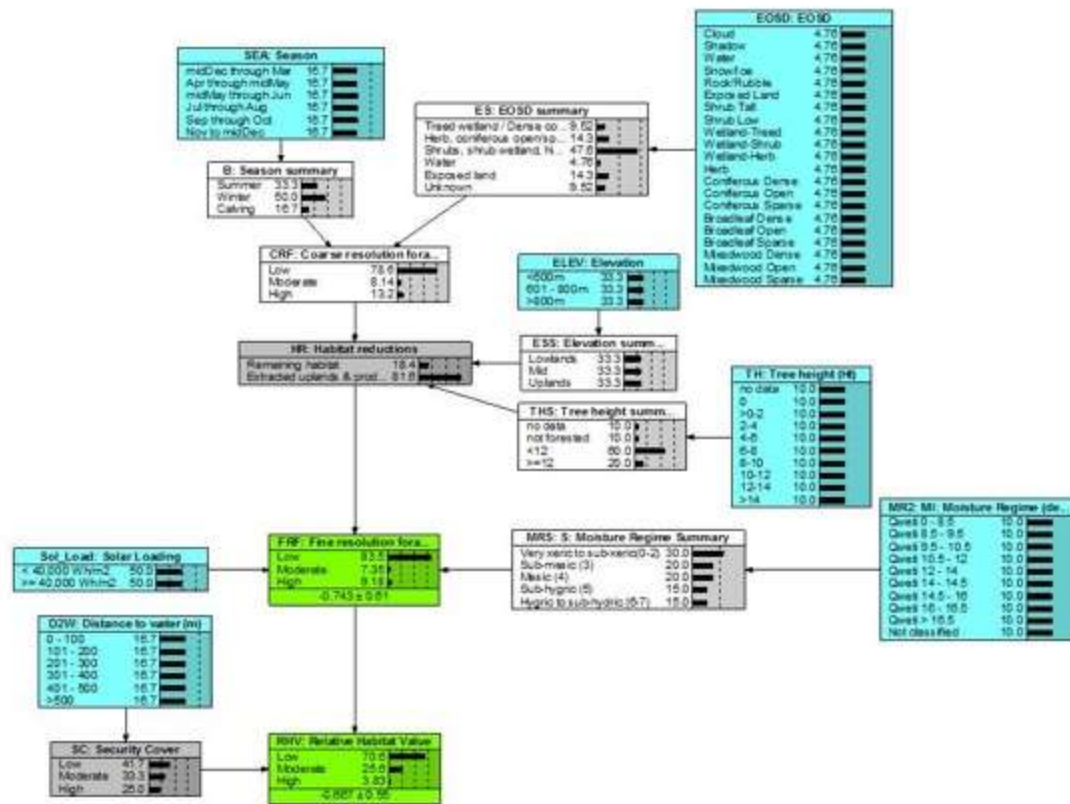


Figure 4: A Bayesian Belief Network representing the influence of environmental conditions (blue nodes) on capability of land to produce boreal caribou forage (green FRF node) and forage in areas that also provide some opportunities for escape from predators (green RHF node).

layer (node HR, Figure 4) because caribou were known not to use highly productive forest sites but rather sites dominated by poor productivity (e.g., black spruce⁹). Finally, a fine resolution forage layer (node FRF, Figure 4) was constructed based on the HR layer, solar loading, and soil moisture regime. Caribou were known to prefer terrestrial lichens as their primary forage in winter and lichens tend to grow best on very dry, nutrient poor sites, that were slightly warmer (i.e., receiving more sun) than otherwise. The FRF node became the first node to be mapped. It represents places where caribou would be able to find forage as long as the site had not been disturbed (i.e., the site is capable of supplying habitat but it may not necessarily be currently suitable if there had been a wildfire or the site was otherwise disturbed by humans as would occur from industrial sources).

Based on BRFN knowledge, caribou often use open water as a way to escape predators¹⁰ and so distance to water modified the value of the FRF node results to create an overall relative habitat value node (node RHV, Figure 4). This became the

⁹ From BRFN knowledge holders' notes on trees identified as important; found mostly on pine and black spruce.

¹⁰ From BRFN knowledge holders' notes: Caribou will often head for water when escaping wolves.

second node to be mapped. It represents places where caribou would be able to find forage and some relative amount of security from predators. These areas might represent the best calving areas during spring for example^{11, 12}.

Habitat Results

There was a large difference between the area of forage (Table 4, top) compared to the amount of area where forage was close to security cover (i.e., open water) (Table 4, bottom). This represents an area of the model in which an adjustment of the conditional probability table would help produce a better reflection of actual caribou use.

Table 4. Estimated habitat area (ha) by capability classes (Low, Moderate, and High) within the Chinchaga caribou herd area, and within caribou core areas, in northeastern British Columbia, based on BRFN IK.

Fine Resolution Forage Node Results				
Capability Class	AOI	Chinchaga Herd	Milligan Core	Etthithun Core
Low	4,620,968.34	1,054,432.85	231,401.10	77,990.92
Moderate	7,978.44	1,658.82	736.00	27.00
High	385,652.86	333,658.40	287,481.44	0.00
TOTAL	5,014,599.64	1,389,750.07	519,618.54	78,017.92
Relative Habitat Value Node Results				
Capability Class	AOI	Chinchaga Herd	Milligan Core	Etthithun Core
Low	4,987,577.70	1,370,999.59	504,203.69	77,812.92
Moderate	22,587.93	14,751.62	11,933.72	205.00
High	4,434.00	3,999.00	3,481.13	0.00
TOTAL	5,014,599.63	1,389,750.21	519,618.54	78,017.92

Maps of the two model node results are provided in Figures 4 (a and b) and 5 (a and b). In both cases, version (a) shows just the mapped results of the model, while version (b) overlays provincial telemetry data on boreal caribou in this range.

In general, most foraging habitat for caribou was predicted to be in the south of the Chinchaga herd range with little to none in the north of the range. This is likely due to the influence of the solar loading node. Use of the range observed from radio-collared caribou shows that there should be a relatively good correlation with the model predictions in the south. Heavy use of some parts of the northern range by radio-collared caribou demonstrates that the model is not as robust as it could be, and that further work should be done to refine how solar inputs influence the weighting of habitat.

As shown in Figure 5, the relative habitat value of some areas in the northern part of the range is increased due to the proximity of water, which according to BRFN knowledge holders provides security from predators.

¹¹ From BRFN knowledge holders' notes: Cow caribou also prefer to calve in areas with water and shrub cover.

¹² From BRFN knowledge holders' notes: For calving, cows seek sheltered shrub areas surrounded by water.

Recommended Follow Up Work

The results presented here are preliminary but demonstrate a promising way to translate indigenous knowledge of First Nations into mapped information of natural resource values; in this case habitat value for boreal caribou. More work needs to be done to refine the model and produce results that better predict fine scale habitat features for boreal caribou, particularly for spring calving habitat.

Specific to BRFN boreal caribou management direction, following refinement of the model, the results of this work could be used to help guide the development of specific management plans for increasing the availability of suitable winter habitat for muskeg caribou in the Chinchaga Range.

Figure 4a: Fine Resolution Forage Potential for Boreal Caribou in Winter Within BRFN Territory, Based on BRFN IK

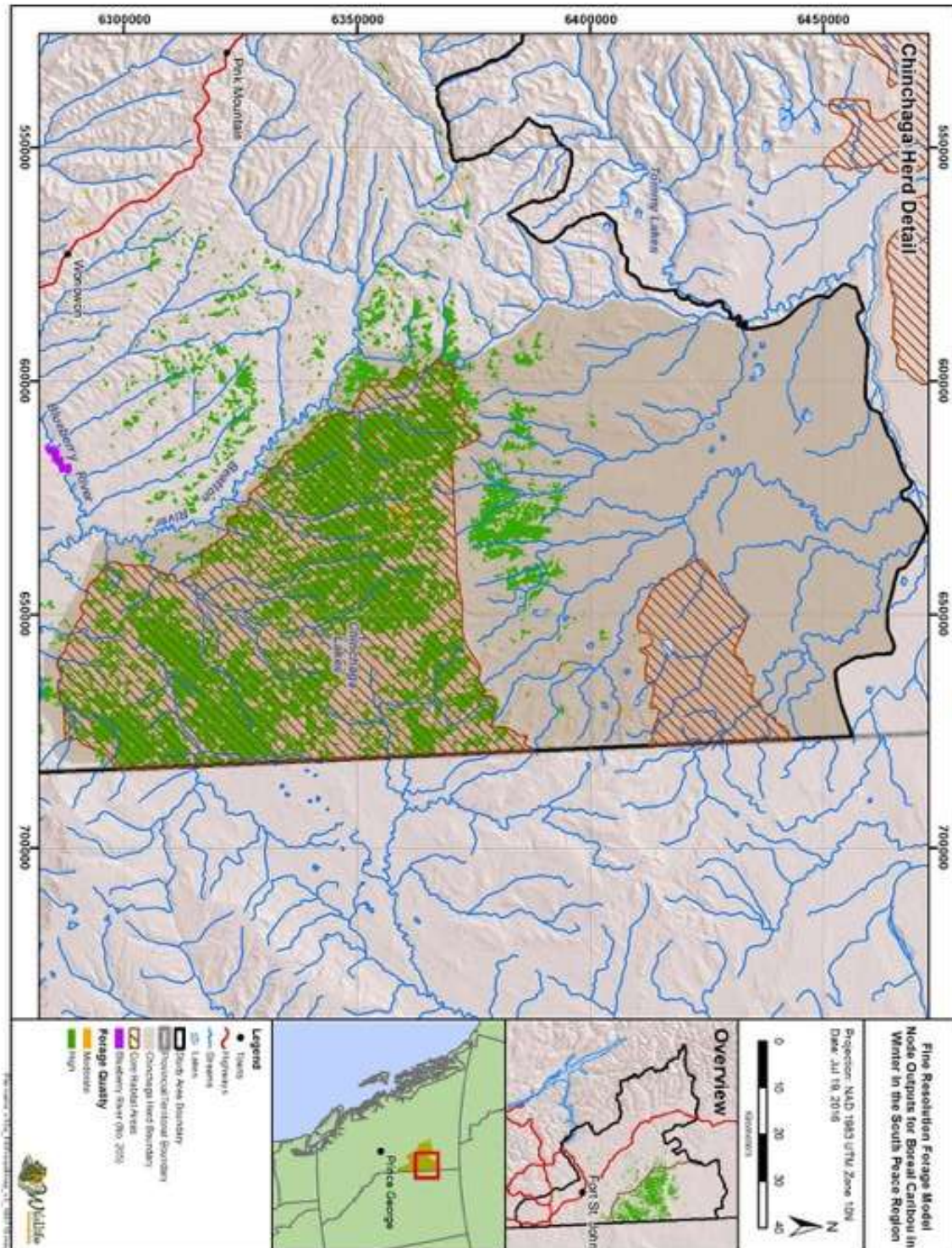


Figure 4b: Fine Resolution Forage Potential for Boreal Caribou in Winter, Based on BRFN IK; includes telemetry data locations

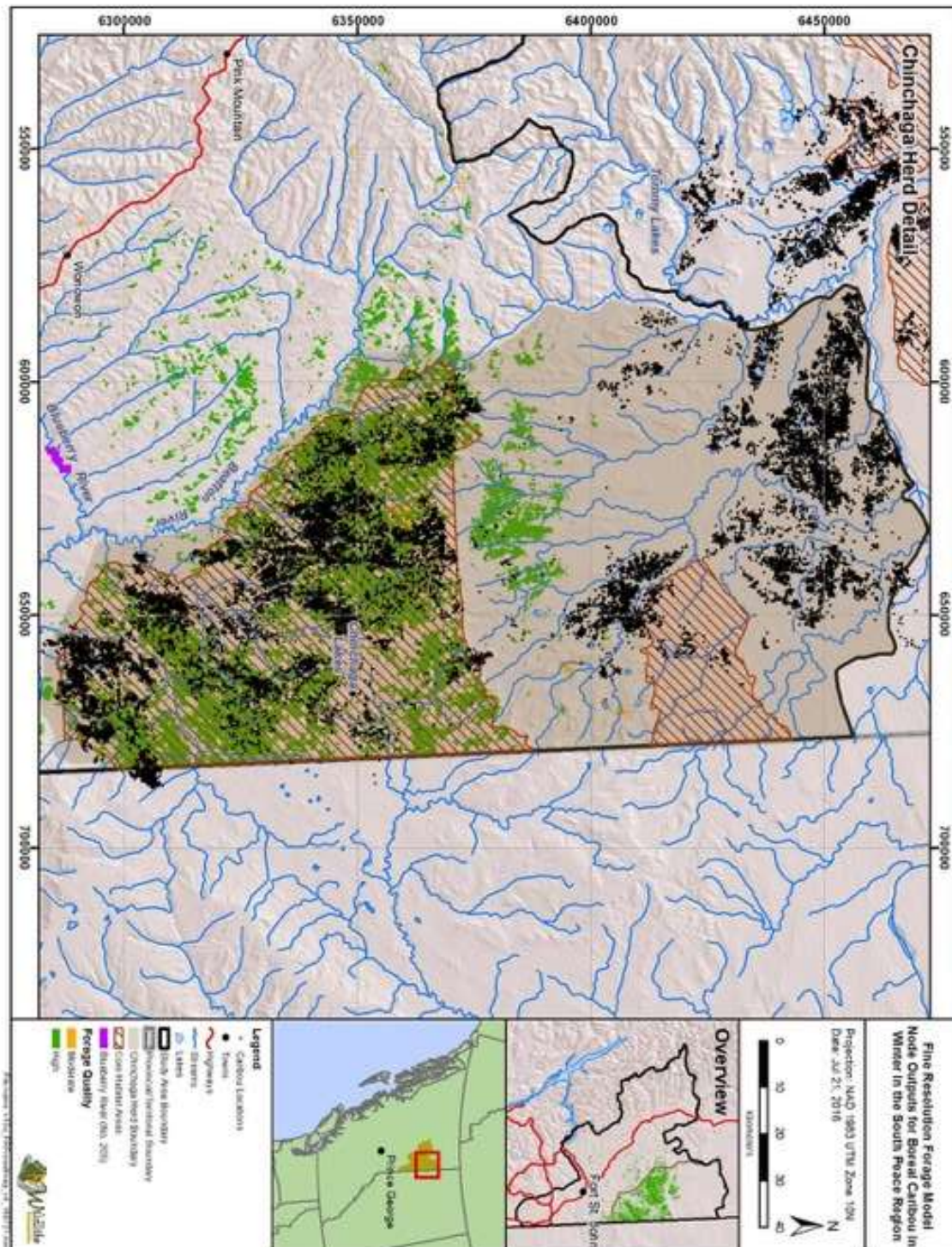


Figure 5a: Suitable Foraging Habitat in Proximity to Security (Water) for Boreal Caribou in BRFN Territory, Based on BRFN IK

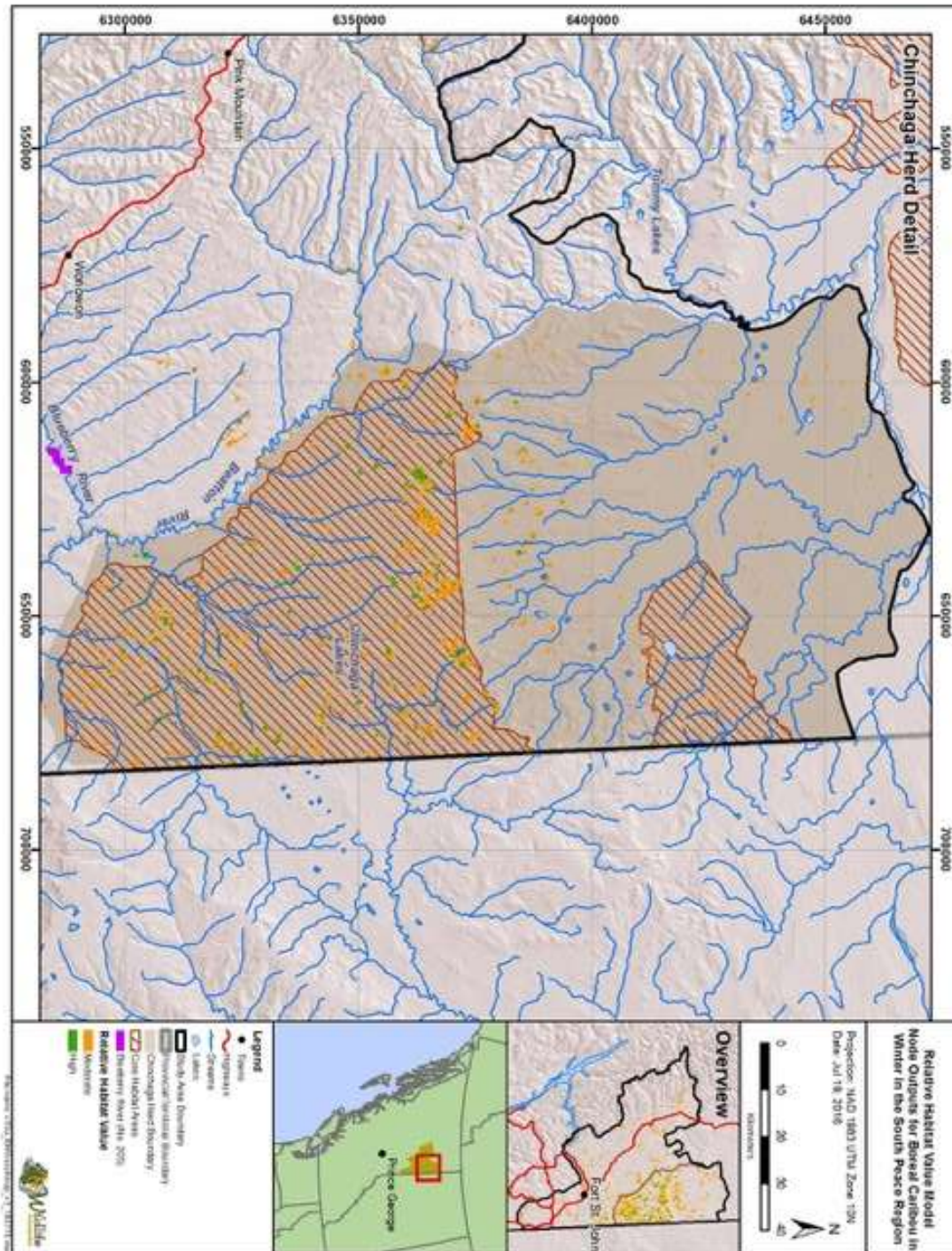
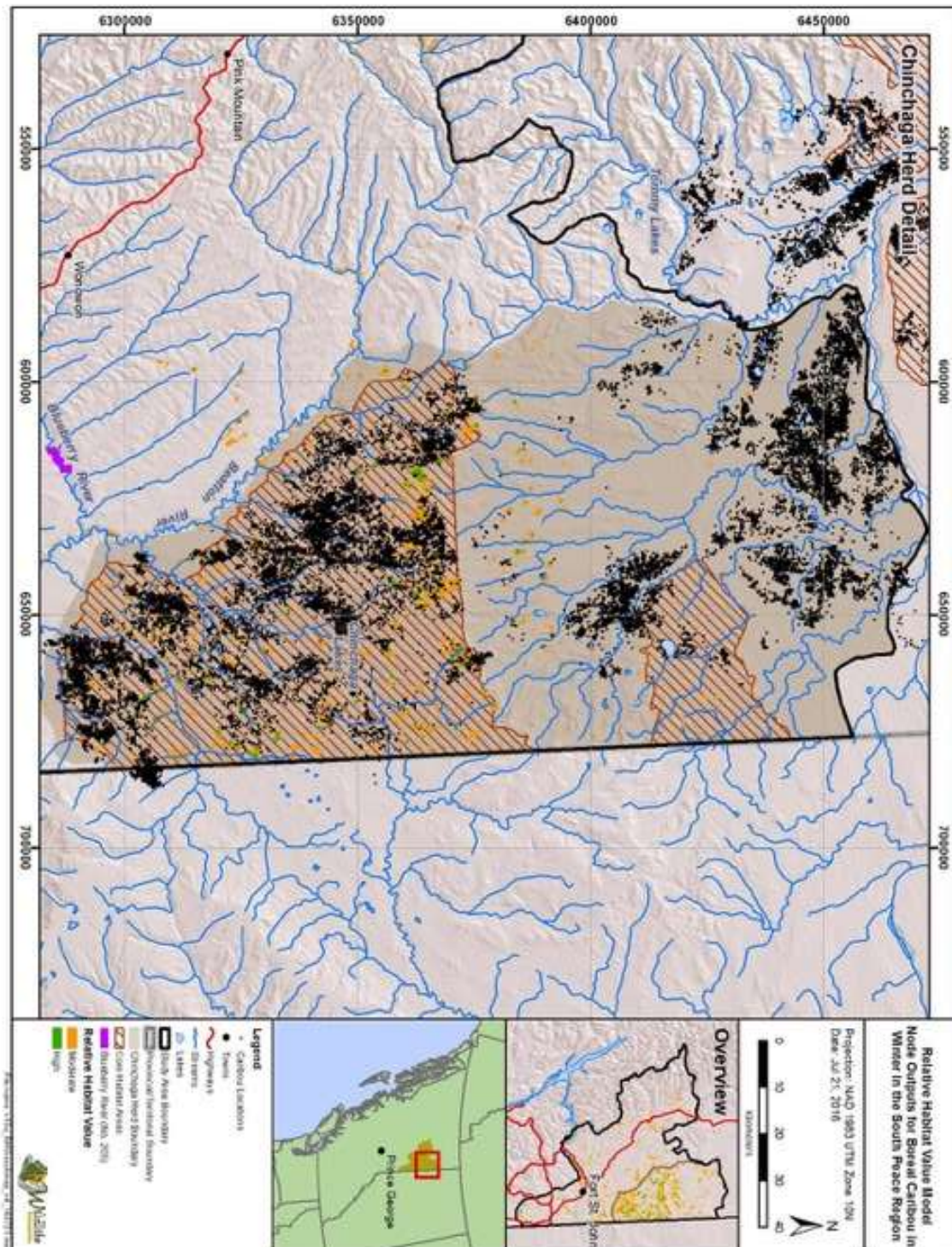


Figure 5b: Suitable Foraging Habitat in Proximity to Security (Water) for Boreal Caribou in BRFN Territory, Based on BRFN IK; includes telemetry data locations



3.5. Seasonal Preferred Habitat for Mountain Caribou

Caribou go across from ridge to ridge, they would go through this site. They would use this game trail. Close to the water, follow for a long way. Wolf will go to a higher spot and watch for them. As soon as they see animal walking, they all phone each other, and make a circle around it. Sit down, like a bunch of bad guys. The only way animals survive is if there's a creek like right here, and if there's a beaver dam, animal jumps in the water, wolf can't go in, animal stays in water, wolf will wait for hours but animal will stay in water and wolf will finally give in. They said, let's go find someone else. That's how they survive. (B10, June 23, 2015, Site 3, from researcher notes)

Information on Pink Mountain caribou seasonal habitat use and seasonal movements is documented below, attributed to specific BRFN knowledge holders by identification number and with examples from specific sites we visited where possible.¹³ Summaries of the information documented on seasonal habitat use and seasonal movements are provided in Table 5.

As with muskeg caribou, knowledge holders identified particular seasons and habitat needs as most important for recovering mountain caribou populations. Based on the site descriptions provided by knowledge holders and ecological data collected on site, these important habitat types are described in some detail below, referencing scientific classification systems wherever possible. **This information should be referenced for all future development planning in mountain caribou habitat.**¹⁴

Characterizing BRFN Important Habitat Areas for Pink Mountain Caribou

Mountain Caribou Calving Habitat

As with muskeg caribou, pink mountain caribou are most vulnerable to predation during the calving season; protection for calving sites was consistently identified as important for ensuring the continued persistence of this species. Caribou have certain locations that they use as calving grounds. Knowledge holders reported that if calving areas are destroyed, female caribou will “calve anywhere”, but they indicate that calving is rarely successful in these cases (B91).

Based on the sites visited during fieldwork, important calving areas for mountain caribou fit the following ecological description:

- Site description: high elevation wet, muskeg areas; often with some trees. Higher portion of *carex* species, horsetails and willows than muskeg caribou calving sites. Areas often surrounded by steep slopes that were identified as important terrain for escaping predators. Caribou cows will stash the calves in willow clumps to avoid predation (B60); long valleys with wetland habitat are considered good escape

¹³Funding was not available for transcription in the 2015 field study. Quotes from June 2015 are noted to be “from field researcher notes” – these have been checked back to the audio to make sure they are accurate quotes. Quotes from earlier studies are verbatim quotes taken from transcriptions of interviews. Notes contained in the text are summaries of information provided by knowledge holders during 2015 fieldwork. Where possible, these comments are attributed to specific knowledge holders using their identification numbers.

¹⁴ This information represents the best available and documented BRFN indigenous knowledge at the time of writing this report. However, the details presented here do not represent the full depth and breadth of BRFN knowledge about how caribou use habitat. The information and details presented here may be refined if further information about specific habitat types and seasonal habitat use for caribou becomes available.

terrain for caribou because sight lines are long and there are water bodies/ponds, so caribou can get into water when predators threaten or climb to inaccessible terrain.

- BEC ecosystem types: In general, the areas BRFN members identified as important calving habitat for mountain caribou were more likely bog/fen habitat or fens. The ecosystem type Wf02 Scrub birch – Water sedge appears to be the most commonly identified ecosystem type.¹⁵
- Moisture level: high; possibly more overlap with moose calving areas at higher elevation.
- Forest cover: predominantly black and white spruce.
- Shrub layer: trees dominate shrub layer; stunted black spruce is the most common species. Low shrubs of *Betula nana* (scrub birch) and various *Salix* species are often present. *Equisetum* (horsetail) species are often present.
- Herb layer: typically higher sedge and grass component. Some moss coverage but generally less than the areas identified as muskeg caribou calving habitat.
- Slope: often within high elevation valley or floodplain between mountain ridges.
- Age: undisturbed areas are preferred. Knowledge holders noted the importance of caribou being able to move quickly to escape terrain to avoid predators.
- Elevation: above 1000 m is typical.

Mountain Caribou Winter Habitat

BRFN knowledge holders noted that mountain caribou have specific habitat needs in the winter. As described in Table 5 below, mountain caribou appear to follow two different strategies in winter: some caribou seek higher elevation, wind swept ridges in the winter, while others migrate to lower elevations and persist largely on arboreal lichens in mature pine / spruce stands. For caribou following the first strategy, knowledge holders identified windswept ridges as most important; knowledge holders confirmed seeing antler sheds at high elevation (B10 and B47). For caribou following the second strategy, mature pine and spruce stands were identified as critical for supporting caribou over the winter.

One knowledge holder suggested that younger caribou are more likely to migrate to lower elevations, while older caribou are more likely to persist on windswept ridges (B11). This observation bears further investigation.

Mountain Caribou Summer Habitat

In the summer, knowledge holders indicated that caribou keep moving from mountain to mountain to avoid bugs. Based on BRFN knowledge, mountain caribou have great endurance and can run a long distance; they use preferred travel routes to move from mountain top to mountain top. Knowledge holders stated that caribou use the same trails to migrate seasonally, each year, to move in and out of the area, and if trails are destroyed, “they seem like they are lost” (B91). High elevation valleys like Caribou Flats (Figure 6) are surrounded by hills in the immediate vicinity that animals would go up in

¹⁵ Note that this BEC ecosystem type is just one of many that was identified as important for Pink Mountain caribou calving.

the summer time to get away from the bugs. Open, windswept areas are important in summer for insect avoidance. In summer and fall, knowledge holders noted that mountain caribou will eat “wet grasses in water” (likely sedges, though the exact species was not confirmed).

Throughout spring, summer and fall, knowledge holders noted that proximity to water is a crucial predator avoidance strategy for caribou, and stated that caribou will swim across water to lose wolves. According to knowledge holders, wolves are faster; caribou have better endurance. Because of these characteristics, caribou need to use water to escape the faster wolves—or they need to see the wolves before the wolves see them.

Mountain Caribou Rutting Habitat

Open, high elevation wetland areas were identified as most important for caribou rutting. However, knowledge holders report that in some known rutting areas, in which herds of more than 80 caribou would have been seen in the past, caribou are no longer observed in fall (B47).

Mountain Caribou Migration Corridors

BRFN members identified specific migration corridors that have been used for generations by mountain caribou during their seasonal migrations from the eastern slopes of the Northern Rockies to low lying over-wintering areas, reportedly travelling as far as 300 – 400 kilometres in herds of 30-40 animals. Knowledge holders noted that caribou use certain trails to migrate; knowing these routes helped them plan fall camping locations.¹⁶ It is during the fall and winter seasons that mountain caribou from the Pink Mountain would have been most likely to encounter and possibly mix with muskeg caribou from the Chinchaga range. All migration routes identified by BRFN knowledge holders during fieldwork for this study have been disrupted by industrial development. While others may exist, it seems clear that development is impeding the ability of mountain caribou to migrate easily to lower elevation over-wintering grounds in some areas.

No specific ecological characteristics were identified for these fall migration corridors. Based on BRFN knowledge, caribou are in the habit of following a particular route, and that if their route is blocked, they appear to be lost. Maintaining and/or restoring identified migration routes are important management priorities for mountain caribou.

Seasonally Important Food Sources for Mountain Caribou

- As with muskeg caribou BRFN knowledge holders identified ground lichens, particularly various *Cladina* and *Cladonia* species, as important for food sources, as well as arboreal lichens (*Alectoria* and *Bryoria* species).
- Similar to muskeg caribou, important seasonal greens identified for mountain caribou included saskatoon, scrub birch, cottonwood and trembling aspen seedlings, rose,

¹⁶ One specific route identified followed a main caribou trail from the higher elevation area shown in Figure 6, through the valley and crossing the Alaska Highway near Mae's Kitchen. From there, caribou travel down the Beaton River to an area near Blueberry Reserve. These caribou reportedly would have historically mixed with other caribou herds during that migration (i.e., muskeg caribou; B91).

willow, *vaccinium* species, some vetch species, fireweed. Horsetails, sedges and grasses were also identified as important food sources for mountain caribou.

Table 5: BRFN Knowledge of Stand and Landscape Level Habitat Needs for Pink Mountain Caribou

Season	Mountain Caribou Behaviour / Preferred Habitat
Year-round landscape movement	<p>B11: Caribou will go back and forth between hills in the distance during winter to here in summer. Estimated distance is 40-50 miles as crow flies.</p> <p>Caribou travel along habitual routes, to same places seasonally. Disruptions to routes and preferred places (e.g, preferred calving areas) causes confusion, and animals leave the area. Caribou are very sensitive to noise, disturbance, smells.</p> <p>Caribou stay up high, and especially in summer, they will travel through lower areas, but usually they move from mountain top to mountain top.</p> <p>Migration is generally east-west, into and out of the foothills. Mature cow makes decisions for the group, and has knowledge of landscape based on experience.</p> <p>For predator avoidance, caribou are slower than wolves but have good endurance and can run for a long time. Knowledge holders noted the following characteristics as being important:</p> <ul style="list-style-type: none"> • Long sight lines • Proximity to water to escape predators; caribou can sometimes outrun wolves in deadfall forest. Caribou will often head for water when escaping wolves.
Spring/calving season	<p>Male caribou go to snow free areas; seek out new greens / growth.</p> <p>For calving, cows seek sheltered shrub areas surrounded by water (escape terrain), which masks scent to predators. Swampy areas with dry islands in middle makes good calving grounds.</p> <p>As calves get older and can walk further, then cows take them up into nearby hills, venture further from water.</p> <p>Caribou eat white lichens ("moss") up mountains. They spend most of their time up high, just passing through lower areas.</p> <p>Caribou return to same calving grounds each year, and tend to use same routes to get to them.</p> <p>B47: small green growths in muskeg; green all year around.¹⁷ Grows close to bottom of spruce trees in muskeg – important caribou feeding</p>
Summer/fattening season	<p>Caribou tend to be in high country, travelling from mountaintop to mountaintop, in summer (B11).</p> <p>Site 8, June 25 noted as good caribou summer habitat on the mountain top. This site is about 1,700 m in elevation. Cover is predominantly dwarf shrubs dominated by dwarf birch; herb layer included lingonberry, lichen, heather. South facing, moderate heat, wind is a dominant feature.</p> <p>Cows/calves continue to stay near calving grounds, but also venture up higher on surrounding hillsides as summer progresses.</p>
Fall/rutting season	<p>Caribou Flats noted as example of preferred rutting ground. Caribou used to gather in this area in large numbers. This site is approximately 1,100 – 1,200 m in elevation and includes a large mineral lick; much use by other ungulates.</p> <p>Knowledge holders noted preferred food during spring/summer/fall in area like Caribou Flats would be grass, particularly the "wet grass in water".¹⁸ Willows would also be eaten.</p>
Late fall/migration	<p>Knowledge holders noted two strategies in this season. Some mountain caribou travel to low elevation in the winter, living in mature spruce or pine and eating lichen from spruce trees and from the ground. Mature spruce trees are important for snow interception and thermal cover. Some knowledge holders suggested mainly young caribou do this, while</p>

¹⁷ Identified as Mare's Tail

¹⁸ These wet grasses in water were likely sedges.

	<p>others noted herds of cows with calves. It is not clear whether mature bull caribou would venture down to lower elevations.</p> <p>Knowledge holders also noted mountain caribou seeking out “lower” high elevation hills, eating lichen from ground—i.e. windswept lower elevation mountaintops with abundant ground lichen. Caribou sheds are frequently seen in these areas. Knowledge holders report more mature caribou seeking higher ground; younger caribou seeking low elevation in winter.</p> <p>B10 noted importance of Sikanni River valley as a main travel corridor for caribou travelling from ridge to ridge. This area is important for all seasons; there is little snow in this area because the ground is warm (i.e., the area is geothermically active).</p>
Winter	<p>High swept ridges; low snow; pawing and eating lichen from ground (B47)</p> <p>Mature spruce; eating lichen from spruce trees (B60)</p> <p>In valleys; similar area to moose. Dig for “grass” – also eat lichen on spruce trees. No caribou up on mountains in winter, except where the wind is, on low mountains (like Pink Mountain) (B11)</p> <p>B47 says caribou would remain at Site 8, June 25th, through winter. As noted above, this site is about 1,700 m in elevation. Cover is predominantly dwarf shrubs dominated by dwarf birch; herb layer included lingonberry, lichen, heather. South facing, moderate heat, wind is a dominant feature.</p>
Late spring	<p>Caribou have been seen in lower elevations on roads in spring (e.g., along 156 Road, at about 7 km), seeking out new vegetation growth.</p>

Figure 6: Caribou Flats – Important mountain caribou habitat for calving, summer survival and rutting, as identified by BRFN members. A large mineral lick in the valley showed evidence of recent use by moose and bison, but no evidence of caribou. BRFN knowledge holders noted that the lack of caribou signs was an important change from previous years.



4 BRFN Summary of Impacts Caribou

4.1. Impacts to BRFN Hunting Practices

BRFN traditional practices revolve around hunting and gathering all of their necessarily life requisites from the land, and actively managing the land to sustain their livelihood. The right to continue to practice this way of life is protected under Treaty 8, and enshrined in Canada's constitution.

Conditions have changed dramatically for BRFN in recent decades. Their community has been heavily impacted by industrial development, to the extent that it is now very difficult for community members to practice their traditional rights. BRFN elders expressed their concerns about the transmission of indigenous knowledge and cultural practices to younger generations, citing the loss of important teaching and camping sites and the scarcity of game as two of the biggest reasons for changes in lifestyles in younger people. One of BRFN's hunters expressed his frustrations in these terms: it is difficult to engage young people in hunting when they go out and travel around for hours without even seeing any animals, let alone having a successful hunt.

According to two BRFN elders interviewed in March of 2016, BRFN families reportedly now get around 25% of the moose and other game than they got a generation before. There are a number of reasons for this decrease, including loss of access, changes in observed quality and associated risk, decreases in the number of animals seen, and changes in lifestyle associated with increasing industrial development.

This section summarizes how hunting practices have changed as a result of declines in moose and caribou, and increases in industrial development, and illustrates direct impacts to BRFN's Treaty protected rights to hunt caribou in their traditional territory.¹⁹

Changes in Access

BRFN community members expressed their concerns and frustrations about being unable to access hunting camps that were used for generations, due to ongoing industrial development and fencing of land for farming. This loss of access continues to spread to areas that were easily accessible as recently as 2-3 years ago.

The bullets below summarize key points made by BRFN knowledge holders about impacts of changes in access, as recorded in field notes for this project:

¹⁹ Funding was not available for transcription in the 2015 field study. Quotes from June 2015 are noted to be "from field researcher notes" – these have been checked back to the audio to make sure they are accurate quotes. Quotes from earlier studies are verbatim quotes taken from transcriptions of interviews. Notes contained in the text are summaries of what we heard from knowledge holders during our 2015 field work. Where possible, this information has been attributed to specific knowledge holders, locations, and audio track recordings. All audio track recordings are the property of BRFN and will be transferred to the community following the completion of this report.

- In the past (pre-1980s), men would hunt, women would stay in camp and tan moose hides. People would be in hunting camps starting at the end of June, when school finished for the year. At that time, they would go up the Blueberry River. BRFN communities are no longer able to do this because there is nowhere to hunt or to camp along the Blueberry River. Land is fenced off due to farmland and there is considerable oil and gas development. BRFN members now have to ask permission to go places in many areas near their reserve.
- BRFN members report a number of areas that are no longer suitable or available for hunting due to oil and gas development, including the Gundy Road (120 Road) and 126 Road areas. BRFN members used to hunt in those areas, as recently as 2005 (B27, B60, B10, B91). BRFN knowledge holders report that these areas now have radio-controlled road access, dangerous traffic, dust, noise, poisonous gas wells and other well heads, clearcuts, contaminated water, soil, vegetation.²⁰
- BRFN knowledge holders emphasized the importance of places where people can camp and hunt with families, in order to teach children and youth culture and practices. Protecting these areas from industrial development is considered as important as protecting habitat, because that ensures the transmission of cultural practices that are respectful of moose and caribou. Various knowledge holders shared memories of hunting camps that are no longer accessible.²¹
- BRFN members expressed concerns that the next generations (their children and grandchildren) will not be able to experience hunting, pack trails, calving grounds, wildlife licks, as all of these important sites are being disturbed and destroyed (B27, June 2015).
- BRFN members can no longer hunt easily: there is nowhere to hunt or camp near Blueberry Reserve or along Blueberry River, where they have always hunted.

Increased Cost of Hunting

As illustrated through summaries from community members below, the cost of hunting has increased now, both because animals are harder to find and people have to drive further to find areas that are not contaminated from industrial development. Loss of access to reliable sources of clean water is also an important impact that increases the cost of hunting.

The bullets below summarize key points made by BRFN knowledge holders about the increased costs of hunting, as recorded in field notes for this project:

- The time required and cost of hunting have increased now, due to development impacts. People can no longer hunt around Blueberry Reserve, because there are not enough animals and those that are there are often diseased. Knowledge holders report finding pus and tumours once animals have been killed and skinned. People have to drive further to hunt now (incurring higher gas costs) and give up more time to cover distance, with fewer animals on the land. Sometimes even after spending

²⁰ Audio files R09_0045-57; June 2015

²¹ Audio files from June 28th 2015.

several days and the cost of gas to drive for hundreds of kilometres, people will go home empty handed (B44, B11, B10, B91).²²

- In the 1975-80s, BRFN hunters would come to a mineral lick and see a lot of use, including many animal tracks and animal beds. Now, animal beds are rarely seen near licks. BRFN hunters need to go further from known habitat sites to hunt. Knowledge holders observe that part of the reason for the decline in animals is increased hunting activity by non-resident hunters working with industry (B04, June 2015).²³
- BRFN knowledge holders are concerned that leaves on vegetation are polluted, even in remaining habitat, and that animal meat is contaminated as well.
- BRFN knowledge holders report observing contamination in water and dropping water levels: muskeg, creeks and lakes are drying up. BRFN knowledge holders noted that they used to drink straight from creeks and muskeg when hunting. Now community members consider the risk of contamination to be high, so they typically bring water with them, which also increases the cost and burden of travel (B27, B60).

Cumulative Effects

With dramatic changes within their traditional territory, BRFN community members are unable to easily hunt for their families; it is increasingly difficult for community members to practice their Treaty-protected right to hunt, while some animals (caribou) are no longer hunted at all.

One knowledge holder reports the following set of impacts to caribou and moose:

- Hills used to have forest, which made for good hunting. Once forests are cleared, wildlife leave the area and head for places with bush. Once mineral licks are clearcut, they dry up and wildlife move. In reference to Site 3 (June 27th), BRFN knowledge holder B04 reports that it is possible to hunt in this area still, but there are fewer animals, fewer tracks, and fewer wildlife. Moose get run over on Alaska Hwy; because of clearcuts and gas wells, animals are on the move and hence get hit.

“As the years go by, the wildlife are getting less and less. Another 5-10 years you won’t see nothing, if they keep on doing this.” B04, June 2015

- BRFN knowledge holders report a self-imposed moratorium on hunting caribou. B10: “Right now if we see caribou we don’t bother them. ‘Cause there’s no caribou. We want caribou to come back.” BRFN members have voluntarily avoided caribou for approximately 10 years.²⁴

²² Audio file R09_0013, June 23 2015

²³ Audio file R09_0053, June 23 2015

²⁴ Audio file R09_0015, June 24 2015

4.2. Important Impacts to Caribou and Other Animals

Predation

BRFN knowledge holders noted that the disturbance to caribou habitat is generally good for predators, especially for wolves. Roads, cutlines and pipeline rights of way allow predators to travel long distances, opening access for increased predation. As described by knowledge holders, clear lines of sight afforded by these linear features also give wolves an advantage over moose and caribou when they are hunting.

But now, I don't know because all the [industrial] activity and everything, right? Even this summer, we noticed that the moose were, like, weren't as plentiful, or harder to get. I don't know if it was because of the wolves and the activity. So, like, there was -- we noticed that right off the bat. Usually, [...] we'd be getting moose like crazy. It took three weeks or whatever before somebody got one moose. (B53, 2014)

I know they [future generations] are not going to have anything, actually. Like, how are they going to go to the land when it's all roads everywhere, and the game can't go places to hide or get [away] from other game like bears and wolves and stuff like that? And what are we going to eat? (B99, 2014)

Habitat loss

BRFN community members noted oil and gas development, logging and uptake of lands for agriculture as important causes of habitat loss for caribou. This has led to decreases in ungulates, especially moose and caribou.

There's also a lot a usage in all these open already, that's their fields, farmer's lands, seismic, well site – you put all that together we are going to have nothing left there already. I mean there's already nothing left there, you know? (B37, 2013)

You hardly see them. You know, everything's getting slowly taken away from us. Even them [the animals], their habitat. You know, when you go hunting in an area where there's a lot of moose and there's pipelines, and seismic, and pump jacks, and frack water, you know, pipelines breaking. Kills everything, right? So you kind of wonder like what's the point. (B15, 2013)

Animals move and then they never go back to the site for a while because they don't trust it... They disrupt their house. If you go [and] put a bulldozer through my house, sure there's no way I'm going to come back right away and say there going to be a house there... So when you take down the trees and animals will leave, see. They don't come back for a while. (B22, 2013)

Even just going up the road here the other day with the kids. They want to go hunting, so OK, we're going to go. So we went, and you see nothing but... cutblocks, like nothing. It's just cutblocks. Like where are the animals supposed to go? So they don't hang around there. (B06, 2013)

Knowledge holders report that as calving grounds and wintering grounds are particularly important, destruction of these areas has larger impacts on ungulates than impacts on other areas.

...They're going -- they're moving somewhere or they're being destroyed... So they got their lack of space, it's disappearing... their wintering grounds, their calving is being taken away from them. And our way of life is taken away from us right in front of us. (B101, 2014)

It [industry] would affect all these animals, animals' areas, the calving areas, lick areas, the feeding areas. It would affect all that. Take that much away from me – wild stuff. We chase them away ... We chase them away farther where they need their feeding areas, and all the areas ... if you go build something, you chase, you would have chased me away if you go build something there. I'll move. I'll move further away from you. That's what they do... (B50, 2013)

Destruction of migration routes was also noted as an important impact to both moose and caribou. Because caribou use specific migration routes, these areas are very vulnerable to destruction. Once their routes are destroyed, they become “confused.” To knowledge holders, this confusion is a critical component of why caribou have become so vulnerable to predation, particularly in the late winter as they lack the fat reserves that they had in previous years.²⁵

BRFN community members noted that clearing of vegetation along pipeline rights-of-way reduces caribou habitat, cuts off spring water sources, and threatens slope stability. They also reported that habitat fragmentation caused by roads, development, noise, and other disturbances confuses animals and interrupts their usual travel corridors, resulting in confused seasonal movement patterns. Based on BRFN knowledge, caribou are particularly susceptible.

But caribou... rare. Within the last two years I've seen two caribou... Like I said, they're migrating, they're a migrating herd. So once their migration routes are messed up, they're messed up. So they're like, 'What do we do?' It's like walking into one of those glass houses, they can't find their way. B78 26-Jun-14 PRGT

BRFN community members (B10, B91, B44, B11) have also observed that water levels are dropping in muskeg, lakes and creeks, likely due to fracking and use of freshwater, as well as logging, clearing for oil and gas development, and climate change. Knowledge holders note that wetlands and lakes have been reduced in size, and muskeg is drying up. This results in impacts to moose habitat, waterfowl and birds, and people.²⁶

BRFN participants also reported that, in some cases, plant regrowth after industrial development limits access and hampers the movements of animals and BRFN hunters.

Yeah. It's -- they affected me and the animals, because when they put pipeline, they don't look after it. Everything grow back so thick, you can't even walk through it. Even the rabbits can't go through. So thick, there. They should look after it, and where the animals could pass by, you can see where they go up, only where they've been -- cattle went through, or when everything goes -- all kind of plants grow back, grow

²⁵ Note that knowledge holders report similar observations of confusion in moose, which leads to increased movement around areas in the summer, which leads to less fat on their bodies when they are going into fall, and increased vulnerability to predation in the late winter.

²⁶ There is extensive audio documenting these observed impacts, including Audio file R09_0013 at Site 8, June 23rd, dried out muskeg where diamond willow has died on June 27th, Gundy Road; on June 24th at Site 3, R09_0015.

thick. It's affected animals like animals go through there, they all walk by like -- big bulls, they don't go through there. They don't go through there. (B11, 2013)

Destruction of important environmental features

BRFN knowledge holders report that both logging and fracking dry up mineral licks, which are critically important for caribou and moose. They also report that compressor stations and other infrastructure have buried mineral licks; several examples of this were seen during fieldwork. Roads, seismic lines and pipelines also traverse and bury freshwater springs and mineral sources (e.g. 156 Road, Site 2, June 25th).²⁷

These mineral licks, these mineral licks been there for thousands and thousands of years, been used by animals. Used by Dane-zaa people, thousands of years. For that development to come through and take that away from our future, I don't know... It isn't going to benefit me... My interest is in being able to harvest, or to harvest off the land. Exercising my treaty rights, that's my interest... It hurts me. It harms me. It harms my health, my potential health. (B34, 2014)

When they make pipeline, even some calving place they destroy all the place... for where wildlife have calf, they are destroying all that place... A lot of good wildlife, places where the oil company want to destroy. Beautiful places. I've seen some places. I don't know who monitors those places. In the -- there was some moose lick that they put a pipeline right through... they should have detoured that thing. Whoever monitored that place, I don't know why they didn't say anything. I mean it's right through. Whoever see the water coming down from a lick... Just down below it. And they made a -- they made a road right there. And now those wildlife -- I walk around that area. I search for tracks. Nothing... they left that place. (B04, 2013)

A lot of these places I see, I'm working in pipelines and seismic -- they go right through licks and they just go right in the middle. They never slow down. (B05, 2013)

Noise decreased habitat suitability

Knowledge holders report that noise from industrial activity and traffic scares animals away. Some get habituated, but others do not. Knowledge holders report that animals are moving west away from development. (B11)

But nowadays, there's so much -- there's so much traffic out there, it doesn't matter where you go. Like, the animals, they constantly move around. (B63, 2014)

Well, like all the noise, of course, all the noise and stuff. Because I think all the game is going to push back. (B99, 2014)

Well, if they're going to have road accesses to the pipeline area, then, yeah, it'll chase away a lot of game. (B113, 2014)

I'm sure there will be a definite impact on the wildlife habitat in that area, right? 'Cause there is going to be... the noise, the traffic, their... Calving areas. (B41, 2013)

Vehicle strikes

²⁷ Audio files R09_0022, R09_0023, June 2015.

Development increases the risk of mortality due to vehicle strikes. For example, moose often get run over on Alaska Hwy, partly because the animals are on the move to get away from noise and their usual places/routes are interrupted or destroyed by clearcuts and gas wells (B04).

When there's lots of activity but you don't see no moose. But, they get run over. ... Yeah, the Alaska Highway, you go through there. You get lucky to never see no carcass on the side of the road. They always get run over. (B07, 2014)

With all the logging trucks and all these people who work out there and, you know, they all ... they run over moose and you always see dead moose on the road and I just can't stand that anymore. (B89, 2014)

Over-hunting

BRFN members report that over-hunting by resident hunters²⁸ is a major cause of declines in moose. Caribou are not hunted at this time; however, they are also impacted indirectly by increased traffic and access into important habitat areas.

BRFN community members report that resident hunters do a lot of damage to the area. These hunters hunt differently from BRFN people. Specifically, knowledge holders mentioned that they will shoot cow moose and leave the calf to starve; they also leave garbage and bait animals (B44, Site 8, June 23rd)²⁹; they often injure animals but do not track them to ensure a kill (B44, Site 2, June 25th).³⁰

BRFN members also note that due to cumulative development impacts, resident hunters have greater access to backcountry areas through roads and seismic cut lines.

At that time, people lived traditional way. Lived off all animals. No one got sick... People lived off moose, deer... See how much change. Before that, there's no highway, there's no pipeline, there's no logging. So when white man hunting around, they can't get nothing, because animals stay in the bush. But today, all the roads, pipeline, seismic line and logging. As soon as white man hunt over there, first 1 hour they drive, they hit pipeline or whatever, they see an animal and they hunt them down. Animals have no chance. No chance to grow. (B10, March 2016)

There are way too many [people and roads] out there. You go around here now. It's just crazy -- the roads that are here. The trap lines and that -- it's all wide open. You can drive around here. Back then, you got a lot of game. Now, there are so many roads. During hunting season, you go around a little bend and there's somebody camping. They don't give anything a chance to stabilize the population. But, the animals that -- the predators are hitting them the same way, from one side and the hunters from one side. How are they going to have a chance? The next thing, it's going to be like urban areas around there. There's going to be nothing. (B51, 2014)

There's going to be a lot of access being opened up, you know, and a lot of virgin ground being opened up. What's going to really bother me is the access -- people

²⁸ Resident hunters are non-Aboriginal hunters who reside in BC.

²⁹ Audio file R09_0013, June 2015.

³⁰ Audio file R09_0022/23, June 2015

getting access into some of these places that weren't accessible before... These last couple years, the hunting was very hard. I've never hunted that hard before, and that's because this access is so easy and over-hunting. There are too many hunters now. So, that's going to affect a lot, and this is going to open up a lot of country to a lot of people. All of them have everything they need. You know, they can jump on their bikes and their side-by-sides, their 4x4s. They've got all the gas they need. (B51, 2014)

But these pipelines they open access too. Like open highways, lot of areas that you can't hunt but pipelines you could. You could have people up and down the road, up that dotted line. I've seen it. (B40, 2013)

BRFN members also note that industrial development brings increasing numbers of seasonal and permanent workers people into the area (B44). These workers often spend extensive time in the bush working on industrial projects, and then return later to these places to hunt.

It's because of the guys that worked there, that went through there. They're bringing people back. They're telling all their friends and all. They're letting their friends and all. Next thing, some of these places are just hunted out. That's what's happened here all over this area. (B51, 2014)

Contamination

BRFN knowledge holders pointed to the risks to wildlife from pipeline spills, and noted that contamination of meat is a serious concern. BRFN members also noted that caribou are vulnerable to contamination at oil and gas sites as they will lick the salt and water that pools around the base of many well sites.

The salt and what chemicals they put in the gas holes. They [industry] don't fence it up. It's bad. And there's no caribou in that country, I used to see them all the time. They're the worst ones, they eat anything. (B07, 4 Nov 2014 Montney)

BRFN members also note that spraying with herbicides for forestry and industrial activities can contaminate animals that eat sprayed plants.

What I see is the danger is that pipeline, they're spraying, that's a big bad thing they did and these... I don't know who they are but when they want to get rid of them little trees or old trees, they sprayed up there. And they all killed our wild chicken in the bush and we don't see them anymore – just very few. (B49, 2013)

BRFN members note that water is contaminated everywhere and as animals drink water this is of great concern. Contamination fears are particularly high around industrial sites, however, where animals drink water and lick minerals.

Even an oil well, I've noticed some day, they got these little ponds at a well site. You'll see all kinds of tracks in there, moose, deer, elk, whatever will go in there and lick it up... They get sick or like they're – I killed a moose one time. There was pus all over the insides. Cut open the liver and everything was just full of pus. It's a result of that, licking up stuff at a well site... more and more really. No matter where we go hunting we run into stuff like that. (B16, 2013)

Because you can see it around his nose and that he's been eating in that flare pit, like one flare pit, and oil and salty, sulfur smell and all that. So that's what they go for, salt, they like salt. (B17, 2013)

4.3. Chronology of Impacts

BRFN knowledge holders identified the timing of impacts and changes to caribou at the locations visited during fieldwork. This information is documented by date and location in Table 6.

Table 6: Chronology of Impacts to Caribou Habitat in BRFN Traditional Territory

Dates	Location	Caribou Population Status
1970s - Forestry and logging active in some areas.	132 Road south of Hwy. Logged in mid-1970s (around 1975). Forest fire burned through slash shortly afterwards (1976?)	Impacted by fire both otherwise good.
	Other areas (Beatton River/Tommy Lakes; 147/Pink Mountain/Caribou flats; 156/Lily Lake; 171/Trimble Lake; Halfway Valley/Horsecamp)	Would easily have seen 100 caribou on top of Pink Mountain. (B11)
1980's – 1990's: Seismic just starting up in 1980s; forestry active. Late 1980's: farming started around Blueberry; farmers had fences	Beatton River/Tommy Lakes	Good.
	147/Pink Mountain/Caribou flats	Good.
	156/Lily Lake	Good.
	171/Trimble Lake	Good.
	Halfway Valley and Horse Camp	Good.
2000's	Beatton River / Tommy Lakes	Declines in caribou started by this time.
	147/Pink Mountain/Caribou flats	Few caribou on top of Pink Mountain
	156/Lily Lake	Fewer animals
	Halfway Valley and Horse Camp	Fewer animals
	171/Trimble Lake	Fewer animals
2015	All areas	Caribou rarely seen

5 BRFN Management Recommendations for Muskeg and Mountain Caribou

5.1. Provincial Management of Boreal and Northern Caribou

Provincial Management of Boreal Caribou

Muskeg caribou habitat protection in British Columbia is informed by the Boreal Caribou Implementation Plan (BCIP, 2011), currently under revision to incorporate new data and information resulting from five years of study funded through the BC Oil and Gas Research and Innovation Society (BC OGRIS).

Boreal Caribou Habitat and Forestry

Forestry activities proposed within boreal caribou habitat are primarily managed through the Forest and Range Practices Act by establishing Ungulate Winter Ranges (UWRs) and through the Identified Wildlife Management Strategy by establishing Wildlife Habitat Areas (WHAs). Forestry companies are required to plan work around timing windows, restricted activities and other objectives established through UWRs and WHAs.

Boreal Caribou Habitat and Oil and Gas Development

Under the Oil and Gas Activities Act, environmental protections for WHAs and UWRs are defined by the Environmental Management and Protection Regulation, and rely on Interim Operating Procedures (IOPs) to prevent a “material adverse effect” to boreal caribou. Based on available guidance, a material adverse effect refers to a change in an environmental value established by the Government’s Environmental Objectives (GEOs) that is both material (i.e., serious, of consequence) and adverse (i.e., injurious, damaging, unfavourable); both conditions must be met for a potential effect to be found inconsistent with the GEOs (BC OGC Environmental Protection and Management Guideline, June 2016, v. 2.3, section 1.2).

Under the EMPR, oil and gas companies are required to follow these GEOs with respect to boreal caribou, as described in Section 6 (only relevant provisions are shown):

a) that operating areas not be located within any of the following:

(i) a wildlife habitat area, unless an operating area will not have a *material adverse effect* on the ability of the wildlife habitat within the wildlife habitat area to provide for the survival, within the wildlife habitat area, of the wildlife species for which the wildlife habitat area was established;

(ii) an ungulate winter range, unless an operating area will not have a *material adverse effect* on the ability of the wildlife habitat within the ungulate winter range to provide for the survival, within the ungulate winter range, of the ungulate species for which the ungulate winter range was established; ...

(b) that oil and gas activities on an operating area outside of a wildlife habitat area be carried out at a time and in a manner that does not result in physical disturbance to high priority wildlife or their habitat, including disturbance during sensitive seasons and critical life-cycle stages; ...

(d) that oil and gas activities not damage or render ineffective a wildlife habitat feature.

Based on BRFN's experience, most companies who have proposed activities within UWRs and WHAs established for boreal caribou in British Columbia have successfully argued that no material adverse effect will occur to boreal caribou, even when levels of disturbance are already well above the acceptable level of risk defined by the Boreal Caribou RS and other key documents. This is because the working definition of "material adverse effect" does not appear to incorporate a consideration of the current context and existing cumulative effects on caribou.

Muskeg Caribou Population Trends in the Chinchaga Range

BC OGRIS has funded numerous projects since 2012 to determine the status of boreal caribou in defined ranges in BC, including the Chinchaga Range. Much effort has gone into collaring caribou and collecting telemetry data. Boreal caribou telemetry data collected by BC OGRIS from 2012 – 2015 are shown in Figures 4b and 5b in this report (Culling & Culling, 2015).

As of 2015, based on tracking 28 collared caribou in the Chinchaga Range:

- 189 caribou were observed in the Chinchaga Range, and 132 caribou in the Milligan Core;
- In 2015, the Chinchaga Range had a calf:cow ratio of 9:100; the Milligan Core had a calf:cow ratio of 6:100. Based 2008 scientific review for the identification of critical habitat for boreal caribou (Environment Canada 2008), this ratio should be at least 28.9 calves/100 cows for the population to be self-sustaining.

In 2009, more than 92% of the Milligan Core was subject to anthropogenic impact (Goddard 2009). This level needs to be decreased to 35%. No reassessment has been done since 2009 of the amount of habitat that is impacted by anthropogenic disturbance in the Milligan Core or the Chinchaga Range as a whole.

In light of the latest data available through BC OGRIS (particularly cow:calf ratios), the provisions in the current IOPs for boreal caribou have not been effective for reversing caribou population declines. Stronger provisions are urgently needed to protect remaining caribou within the Chinchaga Range, and to implement habitat restoration in priority areas.

Provincial Management of Northern Caribou (Pink Mountain Range)

Protection for caribou in the Pink Mountain range is guided by the Management Plan for the Northern Mountain Population of Woodland Caribou (*Rangifer tarandus caribou*) in Canada (Environment Canada 2012b). Until recently, little effort has been placed on

managing habitat for this caribou ecotype in British Columbia. In 2016, MFLNRO proposed new ungulate winter range (U-9-005) and wildlife habitat areas to protect the Pink Mountain herd (and Stone's sheep, *Ovis dalli stonei*, as a secondary species). The proposed UWR encompasses 56,999 ha in the area, while the WHAs cover 107,182 ha in total. The majority of the area designated as potential UWR and WHAs falls within the Muskwa-Kechika Management Area (Arnison 2016).

Pink Mountain Caribou Habitat and Forestry

As with boreal caribou, forestry activities proposed within Pink Mountain caribou habitat are managed primarily through FRPA by establishing UWRs and WHAs.

Pink Mountain Caribou Habitat and Oil and Gas Development

As with boreal caribou, oil and gas activities proposed within Pink Mountain caribou habitat are managed through UWRs and WHAs (under the Oil and Gas Activities Act and the Environmental Protection and Management Regulation).

Northern Caribou Population Trends in the Pink Mountain Range

The most recent published count of the Pink Mountain range was conducted in 2002 (BC MWLAP 2004), and showed a downward trend in caribou populations, likely due to industrial development in the east foothills.³¹ In late winter 2016, MFLNRO conducted an inventory on the herd; that information was not available at the time of writing.

5.2. BRFN Muskeg and Pink Mountain Caribou Restoration Plan

BRFN knowledge holders who participated in this study provided detailed information about causes of caribou declines and important areas for protection and restoration for both muskeg and mountain caribou. Ecological descriptions of important habitat areas for muskeg caribou and mountain caribou are provided in sections 3.3 and 3.5, respectively and are summarized below. Section 3.4 also provides a summary of important winter and spring habitat areas for muskeg caribou, based on the habitat supply model. As this study is based on a small sample of BRFN knowledge holders, it should be noted that additional areas may be identified as important habitat for either species during specific seasons. However, at this time, and based on the knowledge collected to date, BRFN Chief and Council and BRFN Lands Staff have developed guidelines presented in the next two sections for protection and restoration of muskeg caribou and Pink Mountain caribou habitat.

The guidelines are intended to be used by BRFN for the following purposes:

- Working with the provincial government to improve measures for protecting and restoring caribou habitat;

³¹ Industrial development activities in the area includes forestry practices, oil and gas development (including associated well sites, LNG pipelines, pipeline right-of-ways, seismic lines, and resource roads), and wind development.

- Working with industry on referrals, to establish stronger measures for protecting caribou habitat in proposed developments that fall within caribou habitat.³²

The guidelines apply not just within the ranges defined by the provincial and federal governments, but also within areas outside of the defined ranges that are understood and known to be important caribou habitat, based on BRFN knowledge.

³² Due to the dynamic nature of operating guidelines developed by BRFN for industry proposing work within caribou habitat, these guidelines are not included in this report. They are available from the BRFN Lands Staff upon request.

BRFN Muskeg Caribou Management Guidelines

Identification of Important Muskeg Caribou Habitat

Calving Habitat

Based on BRFN knowledge, important calving habitat areas for muskeg caribou include the following habitat type(s):

- The ecosystem type Wb03 Black spruce – Lingonberry – Peat-moss was most often identified as calving habitat, with the “overmature” variation (Wb03.1 Reindeer Lichen variation) also identified as important. Other ecosystem types identified by knowledge holders as important for caribou calving included Wb09 Black spruce – Common horsetail – Peat-moss, a bog / poor swamp site association which is more heavily treed than Wb03, and Wb06 Tamarack – Water sedge – Fen moss, a bog / poor fen site association with *Larix laricina* (tamarack) and *Picea mariana* (black spruce) in the overstory (Delong et al. 2011).
- Moisture level: Based on BRFN knowledge, preferred calving areas for muskeg caribou tend to be wetter than moose calving areas; calves are stashed in slightly drier areas / hummocks to avoid detection by predators.
- Forest cover: predominantly dwarf / stunted black spruce; in some areas also *Larix laricina* (tamarack)
- Shrub layer: as noted, trees dominate shrub layer; stunted black spruce is the most common species. Low shrubs of *Betula nana* (scrub birch) and *Ledum groenlandicum* may be present; sometimes a willow component. *Equisetum* (horsetail) species are sometimes present.
- Herb layer: typically *Ledum groenlandicum* (Labrador tea), *Rubus chamaemorus* (cloudberry), *Vaccinium vitis-idaea* (lingonberry). Some areas have a higher sedge component.
- Slope: flat, low lying areas
- Elevation: low elevation sites (less than 500 m)
- Age: older, undisturbed bogs are more likely to have high ground lichen cover (*Cladonia* and *Cladina*) due to drying of surface peat.

Winter Habitat

BRFN members identified that caribou would use drier areas in the winter, particularly areas with low snow loads and abundant terrestrial and arboreal lichen loads. Terrestrial lichen load was noted as generally more important than arboreal lichen load, with muskeg caribou described as pawing through the snow to undercover lichens. Mature pine and spruce forests (> 60 years old) with low snow cover were identified as most important habitat areas for muskeg caribou in the winter.

Early Spring Habitat

BRFN knowledge holders emphasized the importance of access to early spring food sources for muskeg caribou. Important early spring habitat was predominantly identified as areas within muskeg caribou habitat that would have early spring green-up (i.e., lose snow cover early). This report assumes that these areas would occur largely on south-facing slopes and/or areas with lower snowfall (e.g., old growth forest with good snow interception).

BRFN Management Actions for Protecting and Restoring Muskeg Caribou

The following actions have been identified by BRFN members as important approaches for restoring muskeg caribou populations within the Chinchaga Range and areas outside of the defined range that are known by BRFN members to be important habitat for muskeg caribou:

- Avoiding contamination of animals: immediately fence all industrial sites that are attractive to caribou (i.e., man-made licks) and reclaim abandoned industrial sites using native seeds and plants.
- Avoiding disturbance to caribou: institute no-hunting zones for resident and non-resident hunters in some areas of Chinchaga Range, to minimize disturbance to caribou in some parts of the range.
- Restoring habitat: develop a restoration plan directed at linear corridors within priority areas, focused on identified calving habitat, winter habitat and movement corridors. This restoration plan must focus on ecological restoration as a long-term goal, and include measures to restore lichen loads, particularly in winter habitat.
- Minimizing predation: institute a short-term wolf control program within some portions of the Chinchaga Range, focused on areas with high wolf populations and a high density of linear corridors.
- Protecting calves: consider maternal penning program for increasing calf survival over the short-term.
- Avoiding further habitat degradation: develop BRFN guidelines for industry proposing new works in muskeg caribou habitat.
- Monitoring results: secure long-term funding for BRFN monitoring of muskeg caribou populations in the Chinchaga Range.

This is a draft list of management actions; additional management actions may be added in the coming months. Based on the information gathered through this Project and other studies, interim guidelines for industry proposing new works in muskeg caribou habitat have been developed by BRFN Lands Staff. These are available for industry reference from the BRFN Lands Office.

BRFN Pink Mountain Caribou Management Guidelines

Identification of Important Pink Mountain Caribou Habitat

Calving Habitat

Based on BRFN knowledge, important calving areas for mountain caribou fit the following ecological description:

- High elevation wet, muskeg areas; often with some trees. High occurrence of *Carex* species, horsetails and willows. Areas often surrounded by steep slopes that were identified as important terrain for escaping predators. Caribou cows will stash the calves in willow clumps to avoid predation; long valleys with wetland habitat are considered good escape terrain for caribou because site lines are long and there are water bodies/ponds, so caribou can get into water or climb to inaccessible terrain when predators threaten.
- BEC ecosystem types: In general the areas BRFN members identified as important calving habitat for mountain caribou were bog/fen habitat or fens. The ecosystem type Wf02 Scrub birch – Water sedge appears to be the most commonly identified ecosystem type.
- Moisture level: high.
- Forest cover: predominantly black and white spruce.
- Shrub layer: trees dominate shrub layer; stunted black spruce is the most common species. Low shrubs of *Betula nana* (scrub birch) and various *Salix* species are often present. *Equisetum* (horsetail) species are often present.
- Herb layer: typically higher sedge and grass component. Some moss coverage but generally less than the areas identified as muskeg caribou calving habitat.
- Slope: often within high elevation valley or floodplain between mountain ridges.
- Age: undisturbed areas are preferred. Knowledge holders noted the importance of caribou being able to move quickly to escape terrain to avoid predators.
- Elevation: above 1000 m is typical.

Winter Habitat

BRFN knowledge holders noted that mountain caribou have specific habitat needs in the winter. Mountain caribou appear to follow two different strategies in winter: some caribou seek higher elevation, wind swept ridges, while others migrate to lower elevations and persist largely on arboreal lichens in mature pine / spruce stands. For caribou following the first strategy, knowledge holders identified windswept ridges as most important. For caribou following the second strategy, mature pine and spruce stands (>60 years) were identified as critical for supporting caribou over the winter.

Proximity to Water

Throughout spring, summer and fall, knowledge holders noted that proximity to water is a crucial predator avoidance strategy for caribou.

Rutting Habitat

Open, high elevation wetland areas were identified as most important for caribou rutting.

Migration Corridors

BRFN members noted that during summer, caribou move long distances, usually to avoid insects and predators, along preferred travel routes. In addition, BRFN members identified specific migration corridors that have been used for generations by mountain caribou during their seasonal migrations from the eastern slopes of the Northern Rockies to low lying over-wintering areas, reportedly travelling as far as 300 – 400 kilometres in herds of 30-40 animals. All seasonal migration routes identified by BRFN knowledge holders during fieldwork for this study have been disrupted by industrial development. While others may exist, it is clear that development is impeding the ability of mountain caribou to migrate easily to lower elevation over-wintering grounds in some areas.

No specific ecological characteristics were identified for these fall migration corridors. Based on BRFN knowledge, caribou are in the habit of following a particular route, and if their route is blocked, they appear to be lost. Maintaining and/or restoring identified migration routes are important management priorities for mountain caribou.

BRFN Management Actions for Protecting and Restoring Pink Mountain Caribou

The following actions have been identified by BRFN members as important approaches for restoring caribou populations within the Pink Mountain Range and areas outside of the defined range that are known by BRFN members to be important habitat for Pink Mountain caribou:

- Protecting habitat: immediately protect all identified low elevation and high elevation winter habitat, calving habitat, and movement corridors, using a combination of ungulate winter ranges and wildlife habitat areas.
- Restoring habitat: develop a restoration plan directed at restoring linear corridors within priority areas, focused on identified calving, winter habitat and migration corridors. In particular, focus on restoring connectivity between high elevation spring/summer/fall habitat and low elevation winter habitat.
- Avoiding further habitat degradation: develop BRFN guidelines for industry proposing new works in Pink Mountain caribou habitat.
- Monitoring results: secure long-term funding for BRFN monitoring of Pink Mountain caribou populations.

This is a draft list of management actions; additional management actions may be added in the coming months. Based on the information gathered through this Project and other studies, interim guidelines for industry proposing new works in Pink Mountain caribou habitat have been developed by BRFN Lands Staff. These are available for review from the BRFN Lands Office.

5.3. Summary and Closure

Blueberry River First Nations have lived with and depended upon caribou since time immemorial, and knowledge holders have expressed their desire to continue this relationship for generations into the future. Since industrial development began in this area, BRFN's territory has become increasingly fragmented, habitat has been lost, access routes have been created, and BRFN members have become increasingly concerned about the contamination of lands and waters from industrial development. Concurrently, caribou numbers have plummeted, while many other animals and plants are also suffering and declining because of widespread industrial impacts within BRFN territory.

This document provides a path forward to recover caribou populations within BRFN territory, grounded in BRFN indigenous knowledge. In the coming months, Chief and Council will seek opportunities and partnerships to begin the process of restoring seasonally important caribou habitat and migration corridors for both northern and muskeg caribou.

In the interim, BRFN expects that all newly proposed industrial development within BRFN territory and within the ranges of the Pink Mountain and Chinchaga caribou, will adhere to the interim operating guidelines outlined in this document.

Closure

Please note that this report, and the information contained within it, represents the best available BRFN indigenous knowledge related to caribou at the time of writing. If there are any questions regarding this report and the information contained within it, please contact Norma Pyle, Lands and Resources Manager, Blueberry River First Nation. Box 3009, Buick Creek, British Columbia, V0C 2R0; p. (250) 630-2800

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7 Appendices

7.1. Appendix 1: Ecology Survey Form for BRFN Moose/Caribou Field Work

Ecology Survey # _____

ECOLOGY SURVEY FORM

GENERAL INFORMATION

Survey For : _____
 Location: _____
 Weather: _____ Last rainfall: _____
 Date: _____ Total time On Territory: _____
 Number of sites visited: _____

OTHER DOCUMENTS (Photos, Audio, Video, Notes, Maps, Plots)


Type	Location	Recorded By	Description	Title or File Names	Date Recorded

Survey Team:

Person Name	Person Role(s)	Affiliation

1. SITE SPECIFIC INFORMATION

Site Type:

- | | |
|--|--|
|  Moose Summer habitat |  Caribou Summer habitat |
|  Moose Calving habitat |  Caribou Calving habitat |
|  Moose Fall rutting habitat |  Caribou Fall rutting habitat |
|  Moose Winter habitat |  Caribou Winter habitat |

Site name: _____ Abbreviation: _____

Location Selected By: _____ Rationale: _____

2. LOCATION

Latitude: ____° ____' ____"N Longitude: ____° ____' ____"W Number of Satellites: ____

UTM Zone: ____ Easting: ____ Northing: ____ Error: ____

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Ecology Survey # _____

3. TRADITIONAL KNOWLEDGE

1. Have you seen moose/caribou here? _____
- a. Can you tell me about what you saw?
[How many? Cow/calf? Rutting?]
- b. When was it that you saw this?
[Year? How often person comes? How long been coming for?]
2. Is there a particular timing or season that moose/caribou use this place? Dates/seasonal information:
- a. If winter use, what is the snow load in this area?
- | | | | | |
|------|---|---|---|-----|
| High | | | | Low |
| 1 | 2 | 3 | 4 | 5 |
- b. Quality of site for protection from winter weather:
- | | | | | |
|------|---|---|---|-----|
| High | | | | Low |
| 1 | 2 | 3 | 4 | 5 |
- c. Quality of site for protection from hot summer weather:
- | | | | | |
|------|---|---|---|-----|
| High | | | | Low |
| 1 | 2 | 3 | 4 | 5 |
3. What do moose/caribou eat at this site in winter?
- a. Quality of site for food
- | | | | | |
|------|---|---|---|-----|
| High | | | | Low |
| 1 | 2 | 3 | 4 | 5 |
- b. Top three foods at this site for winter.

- c. Where do moose/caribou drink when they are here?
- d. Quality of site for water:
- | | | | | |
|------|---|---|---|-----|
| High | | | | Low |
| 1 | 2 | 3 | 4 | 5 |
4. What do moose/caribou eat at this site in summer?
- a. Quality of site for food:
- | | | | | |
|------|---|---|---|-----|
| High | | | | Low |
| 1 | 2 | 3 | 4 | 5 |
- b. Top three foods at this site for summer?

- c. Where do moose/caribou drink when they are here?

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Ecology Survey # _____

d. Quality of site for water:

High				Low
1	2	3	4	5

5. How do moose/caribou get away from predators in this area?

a. Quality of site for cover:

High				Low
1	2	3	4	5

6. What other animals live in this area? <list>

7. a. How likely are moose/caribou to be killed on this site? 1-5, where 1 is very likely and 5 is not likely at all.

Very likely					Not likely at all
1	2	3	4	5	

b. What would kill them? 1-5, where 1 is very likely and 5 is not likely at all.

Wolves:	1	2	3	4	5
Bears:	1	2	3	4	5
Non FN Hunting:	1	2	3	4	5
Starvation:	1	2	3	4	5
Disease:	1	2	3	4	5
Accidents:	1	2	3	4	5

8. What are the things in this place that moose/caribou would like or come here for?

9. What important habitat elements are there at this site? E.g., mineral licks, water nearby.

10. What are the things in this place that moose/caribou wouldn't like? Natural site features that might not be good for moose/caribou; other changes that make it less preferred habitat

11. Landscape movements: How would caribou/moose move through this area? _____ Seasons of movement? _____ Where are they travelling to? _____ Direction of travel? _____

12. In your experience, how has this area changed? [Ask **timeframe** for each answer.]**Climate:** E.g., less snow, more snow, changes in species composition for browse, changes in cover _____ Time frame: _____**Vegetation:** e.g. type, coverage, plants, density _____ Time frame: _____**Other:** _____ Time frame: _____13. In your experience, how have the moose/caribou and animals here changed? [Ask **timeframe** for each answer.]**Mortality:** Increased access, more predators, harder to escape predators:**Animal health:** More/less/changes in quality/more ticks/more disease:

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Ecology Survey # _____

14. What do BRFN people need in order to use this place?

16. Habitat rankings

- a. Overall quality of this site for moose winter habitat: 1-5, where 1 is high and 5 is low
- b. Overall quality of this site for moose calving habitat: 1-5, where 1 is high and 5 is low
- c. Overall quality of this site for moose summer habitat: 1-5, where 1 is high and 5 is low
- d. Overall quality of this site for caribou winter habitat: 1-5, where 1 is high and 5 is low
- e. Overall quality of this site for caribou calving habitat: 1-5, where 1 is high and 5 is low
- f. Overall quality of this site for caribou summer habitat: 1-5, where 1 is high and 5 is low

17. Is there anything else about this place, and moose/caribou that you'd like to tell me?

4. ECOLOGY

Defining features (environmental description, landforms, vegetation, drainage): _____

BEC zone/subzone/site series

Forest cover: Deciduous, Mixed, Spruce, Pine, Swamp, Bog, Shrub, OTHER

Main tree species: 1. _____ 2. _____ 3. _____

Main shrub species: 1. _____ 2. _____ 3. _____

Main herb species: 1. _____ 2. _____ 3. _____

ELEVATION Less than 1,200 m, greater than 1,200 m

Age: >70 years; 40-70 yrs; 20-40 years; 5-20 years; <5 years

Disturbance: fire, logging, other _____

Slope: <3%, 3-9%, 9-15%, >15%

Drainage: 0 = dry; 1; 2; 3; 4; 5; 6; 7 = water

Aspect: North, east, south, west

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Ecology Survey # _____

Geomorphology: Flat; Peak; Ridge; Shoulder; Spur; Slope; Hollow; Foot slope; Valley; Pit

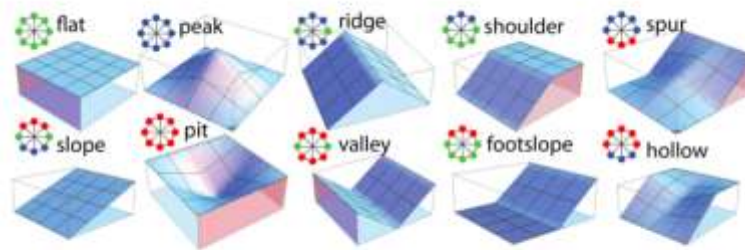


Figure 3: Symbolic 3D morphologies and their corresponding geomorphons (ternary patterns) for the 10 most common landform elements.

Solar input: Hot; Moderate; Cool

Important browse species:

		High				Low
Species name: _____	Load:	1	2	3	4	5
Species name: _____	Load:	1	2	3	4	5
Species name: _____	Load:	1	2	3	4	5
Species name: _____	Load:	1	2	3	4	5
Species name: _____	Load:	1	2	3	4	5

Photos: add multiple photos; add label to photo

Evidence of summer use (e.g., browse, fresh pellets, footprints): _____

Evidence of winter use (e.g., dried pellets; for caribou, lichen clumps overturned): _____

Substrate condition: _____

Photographs (numbers): _____

Audio? ☐ yes ☐ no If yes, reference: _____Filmed interview? ☐ yes ☐ no If yes, reference: _____

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7.2. Appendix 2: BRFN Moose/Caribou Interview Guide

Interview Guide BRFN Moose/Caribou IK Project

Focus Group Introduction

(read with RECORDER ON before every session)

Today is _____, 2015. We are sitting here interviewing experts [and elders] of the Blueberry River First Nation for the **BRFN Moose/Caribou Habitat IK project**. Thank you for coming.

My name is _____ and my co-researchers are _____. We're here at [Pink Mountain]. The knowledge holders here have read and signed the consent forms and we have assigned Interview ID # _____. We are going to be recording this interview on a digital video recorder, digital voice recorder, and with notes [in _____ note book].

Building on information collected in past projects, the BRFN is working to document detailed BRFN knowledge of Moose/Caribou, including habitat and change over time. The information is needed so that the BRFN can better inform protection of Moose/Caribou.

The focus group will take about [3] hours to complete and we might take a break about half way through. There are 3 main sections or types of questions:

- The first section (about 15 minutes) focuses on your knowledge and use of Moose/Caribou.

- The second section (about half an hour) focuses on knowledge on how different Moose/Caribou herds use the land and water.

- The third section (about half an hour), focuses on change over time and pressures affecting Moose/Caribou, including pressure from people, other animals or changes in the environment.

PRE-INTERVIEW CHECK LIST

- ✍ ALWAYS Test your recorders and microphones by listening through headphones.
 - a. Audio recorder
 - b. Video recorder
- ✍ Make sure you have enough note books, pens, and other supplies for the interview.
- ✍ Make sure you have all of the maps you need laid out, or prepared in the GIS with tables ready for data entry.
- ✍ If you are using overlays, make sure you have marked them all with at least 3 anchor points and the map number.
- ✍ Make sure the participating elders or community members are comfortable. Get them a tea or coffee, and talk about the interviews and why we are doing them. Make everyone as relaxed as possible.
- ✍ Review the consent form to the participant and ask them to sign it. Let them know that they don't have to answer any questions that they don't want to.
- ✍ Start the tape and begin the interview.
- ✍ Let them know that we will be reporting back to the community and them.

Some questions are very broad, and others are very detailed. The reason for the detailed questions is so that the BRFN can be in a better position to defend information, if needed, in court or elsewhere.

Finally, if there are things we don't ask about, but you think we should raise in our reports to leadership regarding BRFN knowledge of Moose/Caribou, please let us know.

Mapping Note: Every site should be consistently labelled with a code that indicates site use, site # and source respondent (ex: TX02-M08 where the BRFN member with ID #08 reports the second mapped place where she has camped in a temporary shelter). This should be followed by the date of the event, if possible.

First hand knowledge will be mapped separately from second hand knowledge.

1. Biographical and Background Questions

Background Information

PARTICIPANT INFO (ID numbers)	
<p>If we could start with introductions, it would be great if you could begin by telling me:</p> <p>1 your full name,</p> <p>2 what year you were born,</p> <p>3. If you are a member of the BRFN, and</p> <p>4 where you live around here.</p>	<p>Go around table.</p> <p>Ask for clarification where needed.</p>

2. Dana-zaa or Cree Terms and Caribou/Moose Classification

	Bull	Cow	calf	Indicators?
Moose				
Mountain Caribou				
Boreal Caribou				
Other Categorization				
Caribou/Moose habitat				

Are there other special words that are specific to moose/caribou?

e.g family groups, herds of different sizes, moose/caribou of different colours, different classifications

3. Knowledge of Moose/Caribou and Rights-Based Harvest Estimation

Moose/Caribou USE AND RESPECT

[For all questions, consider 1899 (treaty); 1965 (pre-dev); post 1965 (Current)]

At the time of treaty, how was Moose/Caribou used by BRFN members?

Prompts: food, tools, clothing, ceremonial, sharing, special practices?

Do you use Moose/Caribou now?

If so, what for?

If not, why not?

If you hunt Moose/Caribou, what conditions do you need in order to have a successful Moose/Caribou hunt?

Prompts: Are there things you need to do in order for the hunt to be successful?

Based on your experience, can you estimate how many Moose/Caribou an average BRFN family of five would likely need to harvest each year to satisfy food and cultural needs (including sharing, clothing, ceremonial, or other purposes) assuming they wanted to live entirely based on their rights, as at the time of signing treaty?

About how much Moose/Caribou per year have you been able to access or harvest (hunted or shared from others) for your family in the past five years?

Would you like to have access to more Moose/Caribou?

What are the main barriers to getting more?

How did you learn about Moose/Caribou?

Prompts: Who taught you? When?

Do you know any BRFN stories or oral histories told about Moose/Caribou Are there others you think we should ask about these?

4. Knowledge of Animal use of the land

MOOSE HABITAT

[For all questions, consider 1899 (treaty); 1965 (pre-dev); post 1965 (Current)]

What areas around here are important to moose?

Can you show me on the map?

Why are those places really important to moose?

[Prompt re vegetation, climate, travel, soil, other animals, spirit]

Are there any places that you would say are the most important to them? Why?

Do moose need access to different landscape features at different times of the year?

If so, what do they look for?

In the winter time, where do they shelter? What kind of terrain do they prefer?

In the summer time, where do they shelter? What kind of terrain do they prefer?

What do moose eat?

Prompt: What types of plants are most important to moose?

What plants are most important to them to eat in Winter? Spring? Summer?

What kind of places do those plants grow? (i.e. around spruce, water? Pine trees? leafy trees? Older or younger?)

Are there land forms or other animals or resources that moose depend on?

What things do moose stay away from?

[Prompts: other animals, types of landforms, plants, human activity/development; noise, other]

CARIBOU HABITAT

Ask caribou questions for both mountain-dwelling caribou and lowland dwelling caribou.

What areas around here are important to caribou?

Can you show me on the map?

Why are those places really important to caribou?

[Prompt re vegetation, climate, travel, soil, other animals, spirit]

Are there any places that you would say are the most important to them? Why?

Do caribou need access to different landscape features at different times of the year?

If so, what do they look for?

In the winter time, where do they shelter? What kind of terrain do they prefer?

In the summer time, where do they shelter? What kind of terrain do they prefer?

What do caribou eat?

Prompt: What types of plants are most important to caribou?

What plants are most important to them to eat in Winter? Spring? Summer?

What kind of places do those plants grow? (i.e., around spruce, water? Pine trees? leafy trees? Older or younger?)

Are there land forms or other animals or resources that Caribou depend on?

What things do Caribou stay away from?

[Prompts: other animals, types of landforms, plants, human activity/development; noise, other]

5. Changes over time and pressures affecting Moose/Caribou

[For all questions, consider 1899 (treaty); 1965 (pre-dev); post 1965 (Current)]

Have you noticed a change in number of Moose/Caribou in BRFN territory over time?

Can you describe the changes?

Why are they happening?

Have you seen a change in Moose/Caribou health in your region?

For example, body condition, size, behaviour, parasites, disease (Moose/Caribou) or mortality.

For you, what indicators do you look for to check the health of moose/caribou?

When things are good, how many bulls would you want to see to # of cows (ratio) before hunting season?

How many calves would you want to see later in winter, after hunting?

Have you noticed any change in the survival of calves over time?

For each kind of disturbance, how do moose/caribou generally respond?

Predation,
Disease,
Overharvesting,
Vehicle collisions,
Noise and light disturbance,
Climate change,
Wildfire

What do you think are the biggest pressures or threats to moose/caribou in BRFN territory?

Prompts: (eg: Habitat change: Predation, Disease, Overharvesting, Vehicle collisions, Noise and light disturbance, Climate change, Wildfire)

In your experience how do moose/caribou react to industrial activity or development?

Are reactions different at different times of year?

In your experience, have animals been disturbed by noise or light from aircraft, skidoos, ATVs, or industry? If so where?

Have you observed any changes related to climate change such as changes in snow condition, temperature, or precipitation in your area?

If so, has it affected different moose/caribou groups?

6. Other species' relationship to Moose/Caribou

How do moose and caribou interact with each other?

Prompts: Go to same places? Same or different times? Avoid each other?

Do they eat any of same foods? If so, when?

How do moose/caribou interact with other animals?

Are there more predators (such as wolves, bears, or lynx) in areas where there are moose/caribou?

Has this changed over time?

Is there anything else that you would like to share with us regarding moose or caribou?

My name is _____ and I'm here in the _____ building with _____. We've given him/her TUS ID # _____. We've used __, ____, ____, and _____ maps and a total of _____ tracks on the digital recorder. Notes are recorded in _____ note book.

EXTRAS: MAPPING

[If mapping, read the following out loud on the recording]

We will be mapping digitally using google earth images projected on the wall. Mapping will take place at a scale of 1:50,000 or less. _____ will be doing the mapping using points, lines or polygons, and will be entering the site codes and other data as we go. The study area covers BRFN knowledge of Caribou/Moose throughout BRFN territory.

Mapping Exercise

1. Where have you seen moose/caribou at different times of year? Has there been a change over time? MAP WITH VS
2. Have you ever seen mountain type and boreal type caribou in the same place at the same time? If so, where?
3. Different herds or populations that you are aware of – also, how do you distinguish between them? About how large are the different groups?
4. Any areas that you feel are the most important to protect for BRFN Caribou/Moose hunting?
5. What is the relationship between plains and wood Caribou/Moose?
6. Are there particular corridors that Caribou/Moose regularly use for travel? (map seasonal movement)

7.3. Appendix 3: Declaration of Informed Consent



Victoria office: 201 – 560 Johnson Street, Victoria, BC, V8W 3C6, Tel: (250) 590-9017
 Edmonton office: 10827 131 Street, Edmonton, AB, T5M 1B3
 Vancouver office: Suite 401 - 318 Homer Street, Vancouver, BC, V6B 2V2

Declaration of Informed Consent

BRFN Moose/Caribou IK Project

Declaration of Informed Consent and Permission to use Information

I (name) _____, on this day (complete date) _____,
 give permission for _____ to interview me for the BRFN
 Moose/Caribou IK Project.

I understand that the study is being conducted by the Blueberry River First Nation (BRFN). The purpose of this project is to document Blueberry River people's knowledge and changes over time related to moose and caribou habitat and use in BRFN territory, and to create a habitat supply model based in BRFN knowledge.

By signing below, I give permission to have my words and responses regarding my land use and my past and current traditional ecological knowledge recorded on maps, in notes, and using audio and video recording equipment. I also understand that:

- I am free to not respond to questions that may be asked, and to end the interview at any time that I wish, without penalty.
- The BRFN will maintain intellectual property rights over information and recordings collected through my participation in this interview and may use the information collected, including audio, video, or images, in pursuit of its claims, and for defending and communicating the rights, interests, and titles of its members. This will include, but is not limited to, sharing information for the purposes of environmental assessment.
- BRFN will contact me, or my descendants, before using my information for purposes other than those indicated above.

For more information, please contact Cici Sterritt at 250.630.2802.

If needed, I also give permission to have my name included in reports:

yes no

Signature of participant Witness

 PIN #:

7.4. Appendix 4: BRFN Moose/Caribou Field Site List

Date	Location	Site Code	Description
June 22 2015	Pink Mountain	All-22june15-01	mineral lick no longer used by caribou, north of pink mtn road.
		All-22june15-02	mineral lick north of pink mountain ranch, visited in evening
June 23 2015	Two-bit Creek to Caribou Flats	All-23june15-01	Moose wintering habitat by 2-bit Creek
		All-23june15-02	Bull moose fall habitat
		All-23june15-03	Grizzly dig, rub; cows take calves here for protection from bears and wolves (water masks scent)
		All-23June15-04a	20 m south of tree falling to cross river; medium moose winter habitat.
		All-23june15-04b	GP identifies site as good caribou winter habitat due to high lichen load and forest cover
		All-23june15-05	Caribou flats site 1. Viewed flats from slightly above; noted caribou across the way.
		All-23june15-06a	Caribou flats site 2. Large mineral lick; approximately 1 ha in size. Many tracks noted.
		All-23june15-06b	Caribou and moose fall travel corridor; location between Caribou flats and mineral lick.
		All-23June15-07	Lick noted on outline near 2 bit creek
		All-23june15-08	Lick noted at contaminated former gas well near Halfway River; approx. 12 km from Pink Mountain ranch. Debris left over at site.
June 24 2015	Sikanni River	All-24june15-01	Sikanni airfield
		All-24june15-02	Overlooking Sikanni River; travel corridor noted
		All-24june15-03	Former or still operating gas well in deep valley; very disturbed.
		All-24june15-04a	Along trail; used to be boggy/muskeg but now dried out.
		All-24june15-04b	Cave along trail up big cliff; sacred site
		All-24june15-05	Adjacent to large open bog. Mixed reviews on moose/caribou use during the summer. Game trail nearby (grown over).
		All-24june15-06	End of road – overlooking river, north of Sikanni; valley similar to Caribou flats. Very shrubby.
		All-24june15-07	On return trip; deciduous forest, large stand of trembling aspen and white spruce; little food for caribou or moose.
June 25 2015	156 Road	All-25june15-01	Open cut off 156 road; wet bog surrounded by black spruce bog forest
		All-25june15-02	Mineral lick off 156, bubbling naturally, partially covered by either pipeline or access road. Drier site.
		All-25june15-03	Open cut off 156 road up to Husky gas well
		All-25june15-04	Bridge over creek with beaver dam 10 m downriver, showing two exposed pipes. Along gravel trail.
		All-25june15-05	By exposed moose lick in wet peat bog; could not access lick
		All-25june15-06	Compressor station on mountain.
		All-25june15-07	Shrubby exposed cover on southeast facing shallow slope on top of mountain
		All-25june15-08	Alpine shrub cover on top of mountain facing west / north
June 26 2015	132 Road	JA-26june15-01	Moose lick off 132 road, across small creek. Second moose lick north approx. 40 m.
		JA-26June15-02	Natural spring on side of road; off 132 road at gravel pit.

		JA-26June15-03	Well site off 132 road, down the road from spring. Open grassy habitat, recently disturbed. Two well heads closed down, ,with oil leaking out of one.
		JA-26June15-04	Pink Mountain seismic line, mineral lick. Clearly used for many years as many trails coming to and from in the woods; many tracks noted here.
		JA-26June15-05	Bubbling water on seismic line close to site 04; very similar to previous site.
		JA-26June15-06	Top of Pink Mountain, SE side, low shrub/rock/lichen cover.
		JA-26June15-07	Site along top of Pink Mountain
		JA-26June15-08	Site along top of Pink Mountain
		JA-26June15-09	In saddle of Pink Mountain; site with alpine pine forest and open peat bog.
		JA-25June15-10	Furthest site on top of Pink Mountain. Relatively flat ridge, alpine.
	143 / Cypress Hills	SG-26June15-01	By Halfway River; good fishing site and well used camping site. Fishing for grayling, rainbow, Dolly Varden
		SG-26June15-02	Moose lick; moose tracks visible on road. Moose lick by creek - cut blocks and pipeline around -- pipeline bored under creek. Took photos of pipeline. Calving for caribou higher up near start of the river.
		SG-26June15-03	Moose kill site: fresh kill by grizzly; moose was dragged into forest and buried; to be dug up later.
		SG-26June15-04	Old well site; elk and moose prints -- they have been drinking from this site.
		SG-26June15-05	End of quad trail; lots of moose browse and bear scat. Good habitat for moose. Lots of tracks; lots of willow
		SG-26June15-06	By road side: spruce/pine forest. Game trail may be caribou winter trail.
		SG-26June15-07	Caribou tracks; used to be a major travel corridor for caribou going from Pink Mountain through Royal Camp to Beaton River for wintering.
June 27 2015	Attick Road to Tommy Lakes Road	SA-27June15-01	off attick road, noted that moose and caribou would winter around here. There was good food (willow). They would only pass through this site now as there is a well.
		SA-27June15-02	Moose lick in forest; not as active as it used to be; signs of bull moose browse.
		SA-27June15-03	Well site and borrow pit. Moose lick adjacent to debris from oil and gas. Evidence of browse by moose, moose tracks, older caribou tracks.
		SA-27June15-04	Moose lick off seismic line. Tracks of moose present but no evidence at lick; not much browse noted.
		SA-27June15-05a and b	Lick disturbed by seismic line that went through about 5 years ago. New lick has appeared (site 4) that is not as well used.
		SA-27June15-06	Active well site with flare stack. Could smell gas there; left early as people were feeling dizzy.
		SA-27June15-07	Recently cleared well site just by Sikanni River; used to have moose lick but is now totally cleared and covered up.
		SA-27June15-08	Moose bedding area; black spruce, moose scat present
		SA-27June15-09	Hazardous waste treatment facility on side of the road. Visible raspberry and willows.
		SA-27June15-10	High density pine spruce forest, burned approximately 50 years ago. Picked as representative of poor moose habitat (too dense).

		SA-27June15-11	Open shale pit at intersection of roads. Approximately 9 ha in size.
		SA-27June15-12	Near Beaton River; low lying willow area. Would be good summer and winter habitat. Browse seen on willows; moose scat
		SA-27June15-13	Black and white spruce; trembling aspen; caribou lichen
		SA-27June15-14	Open, now closed well site where caribou seen about five years ago; noted three separate caribou prints. Forested area adjacent was black spruce / lingon berry / lichen.
		SA-27June15-15	Searching for moose lick off 147; not found.
		JG-27June15-01	Site 1: Gundy: Roadside oil spill and massive fenced area. - Pile of dirt cleared beside large, fenced-off area (contaminated materials containment?) <ul style="list-style-type: none"> o At least 10 acres; chain fence with angled barbed wire top - Oil seeping from bottom of dirt pile, running right down hill through open foliage into ground and vegetation o Moose would graze on clover growing beside oil o Strong smell evident; oil sheen; colouring on water and soil o Spill area not within fenced region
	Gundy Road	JG-27June15-02	Pipeline intersection oil spill. Area appeared to have been wetland or muskeg, but had been drained and cleared.
		JG-27June15-03	Gundy: Well head on calving area <ul style="list-style-type: none"> - Well head in middle of good calving area for moose, elk.
		JG-27June15-04	Fracking Bore hole Moose tracks in dust and dirt leading towards the bore hole water. <ul style="list-style-type: none"> - no fence around it - 2-3 acres – estimated
		JG-27June15-05	Clearcut visible from road; whole area cleared and visible used to be good place to hunt (1980s to 2010). Moose and elk visible up until 2013.
		JG-27June15-06	Fracking site where BRFN members reported spill in 2014.
		JG-27June15-07	Water spring on slope with pipeline over top; wide clearcut for pipeline and massive cleared area for well head.
		JG-27June15-08	Large well head clearing with view of Sikanni River / Goat trail
June 28 2015	Halfway River to Horsecamp	All-28June15-01	Site along Halfway River; saw very recent (this morning) caribou and wolf tracks. Evidence that caribou had walked in one direction, then tracks from caribou and wolf going in the same direction (high speed). Caribou may have escaped into adjacent water.
		All-28June15-02	Natural mineral spring on south side of Halfway River. Semi-open aspen/cottonwood forest.
		All-28June15-03	Billy's fishing hole. Open forest – spruce, right next to Halfway River.
		All-28June15-04	Horse camp
		All-28June15-05	Halfway River; falls. Riparian habitat.
		All-28June15-06	Moose lick; heavily used by buffalo in past few years, making it unsuitable for moose. Buffalo excrement makes it unpalatable to moose.
		All-28June15-07	Recent burn; two years old; burned for moose, elk to make new food available
		All-28June15-08	Mineral lick for sheep; naturally occurring iron coming into north side of Halfway River. Sheep often cross river here.