



# Boreal Caribou Protection and Recovery Plan

**Province of British Columbia**

Ministry of Forests, Lands, Natural Resource Operations and Rural Development

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## **Purpose of Document**

This document is being shared to support stakeholder and public engagement on the draft Boreal Caribou Protection and Recovery Plan (BCPRP). It includes an outline of the habitat and population management actions proposed to meet the recovery goal and objectives, as well as information to guide implementation of the proposed management measures.

As part of the engagement process, the Province of British Columbia is seeking feedback on key elements of the draft plan, including the goals & objectives, the proposed habitat and population management actions and the adaptive management model. In addition to the online posting of this document and the accompanying online feedback form and written submissions, opportunities for engagement with stakeholders and communities in Northeast B.C. are scheduled during the engagement period to share information and provide feedback throughout the process.

Feedback gathered during the engagement process will be considered as the draft plan is revised and will be made available to appropriate decision-makers pertaining to boreal caribou recovery management measures for their consideration. Following the engagement period, a “What We Heard” report that summarizing feedback will be shared with stakeholders and posted online.

## Executive Summary

Boreal caribou range across Canada, including Northeast British Columbia (B.C.). These caribou are listed as *Threatened* in Schedule 1 of Canada's *Species at Risk Act* and are red-listed in B.C. Recent population trends from monitoring, as well as First Nations' and local knowledge document a long-term decline in local populations.

The Boreal Caribou Protection and Recovery Plan (BCPRP) outlines a recovery path for four of the five boreal caribou herd ranges within B.C. The BCPRP was co-developed by the Province and Fort Nelson First Nation and through collaboration with the Northern Rockies Regional Municipality.

The BCPRP establishes a management goal to:

- Recover boreal caribou populations across their range to self-sustaining status and to a level capable of supporting an Indigenous sustenance harvest.

In pursuit of this goal, the BCPRP establishes the following management objectives:

- Establish a positive habitat trend within core habitat zones by maintaining condition of the best remaining habitat and improving the condition of currently degraded habitat.
- Stabilize and achieve a positive population trend across all ranges.

Management actions — informed by years of scientific research, Indigenous and local knowledge, and with consideration of socio-economic and cultural values — are proposed for implementation to achieve the plan's objectives and make progress towards the boreal caribou recovery goal. These proposed actions include managing future land-use activities within caribou habitat through protection and conditional development for identified areas of high-value natural resources that are important for building a stable regional economic future. The draft plan provides opportunities for investment in habitat restoration activities to accelerate recovery and it charts a path forward to pursue additional recovery measures through a model of adaptive and collaborative management.

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## Acronyms and Glossary

Adaptive Management	An iterative process whereby the response of caribou populations to management actions is monitored and actions are adjusted based on results of monitoring.
Area of Interest	Areas outside of current provincially delineated range that have been identified by telemetry or indigenous ecological knowledge as an area of potential core habitat.
Anthropogenic Disturbance	A human-caused change in environmental conditions that causes a pronounced change in an ecosystem.
Conditional Development	Regulated development with a focus on mitigating and/or offsetting impacts to caribou and caribou habitat from industrial activities
Core Habitat	Core zones represent the most important habitat within the ranges containing the biophysical attributes required by caribou to carry out life processes necessary for survival and recovery.
Critical Habitat	The habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species under the federal <i>Species at Risk Act</i> .
Identified Wildlife	Species at risk and/or regionally important wildlife designated as requiring special management attention under the <i>Forest and Range Practices Act</i> .
Linear Feature	A linear disturbance such as a road, pipeline, or seismic line.
Matrix Habitat	Habitat possesses low periodic caribou use and is important for connectivity between suitable core habitats. Predator-prey dynamics in these areas have the potential to impact caribou populations both directly and indirectly
PNG	Petroleum and Natural Gas
Polygonal Disturbance	A non-linear disturbance such as a forestry cutblock, wellsite or facility.
Population	A group of caribou occupying a defined area distinguished spatially from areas occupied by other groups of caribou. Population dynamics are driven primarily by local factors affecting birth and mortality rates, rather than immigration or emigration among groups.
Range	A geographic area occupied by a group of individuals that is subjected to the same influences affecting vital population rates over a defined time frame.
Self-sustaining	A local population of boreal caribou that on average demonstrates stable or positive population growth over the short term and is large enough to withstand random events and persist over the long-term without the need for ongoing intensive management intervention (e.g., predator management).
Indigenous Ecological Knowledge	Environmental knowledge that has been gathered by Indigenous peoples who have lived in and observed a particular area for generations.
Treaty Rights	Rights set out in either a historic or modern treaty agreement. Treaties define specific rights, benefits and obligations for the signatories that vary from treaty to treaty. Treaties and treaty rights also vary depending on the time and circumstances in which they were negotiated. These rights are recognized and affirmed by Section 35 of the Constitution Act, 1982.
Ungulate Winter Range	Areas designated under the <i>Forest and Range Practices Act</i> and <i>Oil and Gas Activities Act</i> that contain habitat necessary to meet

Wildlife Habitat Area

the winter habitat requirements of an ungulate species, including caribou.

Areas designated under the *Forest and Range Practices Act* and *Oil and Gas Activities Act* necessary to meet the habitat requirements of an Identified Wildlife species.

# Map of Boreal Caribou Ranges

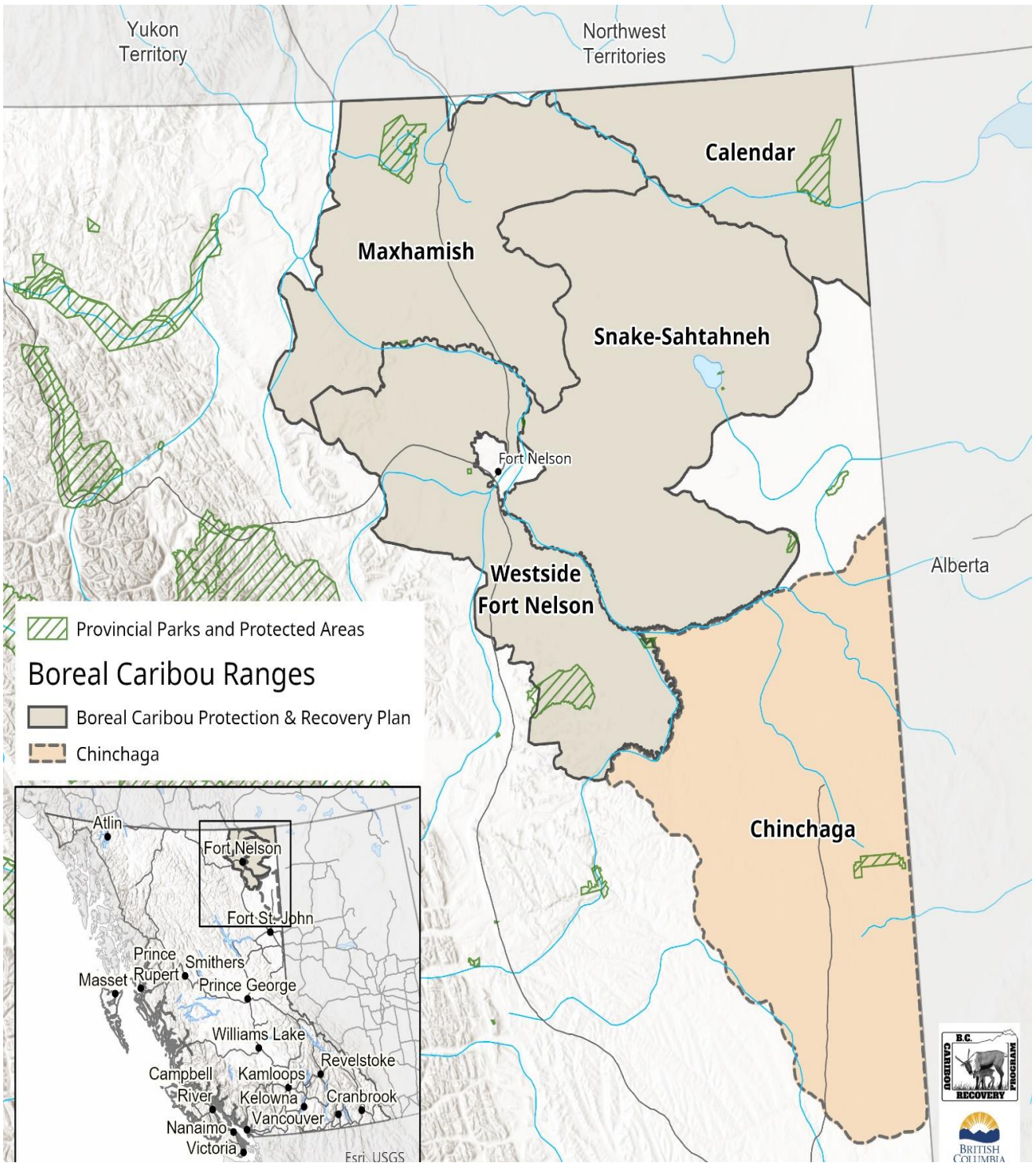


Figure 1: Map of Boreal Caribou Ranges in British Columbia included and excluded from the Boreal Caribou Protection and Recovery Plan



# Introduction

Boreal caribou (*Rangifer tarandus*; woodland caribou) are present in nine provinces and territories in Canada. Many local populations are currently in decline, and these caribou are listed as “threatened” in Schedule 1 of Canada’s *Species at Risk Act* (SARA) and are “red-listed” (i.e., at risk of extirpation, endangered or threatened) in British Columbia (B.C.). Boreal caribou range covers 5% of B.C. and recent population trends from monitoring, as well as Indigenous and local knowledge document a long-term decline in the population (Culling & Cichowski, 2017). Following years of research and regional dialogue on boreal caribou management it was clear that a recovery plan needed to be developed in partnership with Indigenous governments.

The B.C. Government (“the Province”) partnered with Fort Nelson First Nation to co-develop the Boreal Caribou Protection and Recovery Plan (BCPRP) that meets the requirements for recovery of the species and restore the ability of Indigenous peoples to exercise Treaty rights. The parties collaborated with the Northern Rockies Regional Municipality (NRRM) which has a vested interest in conservation outcomes and bring its own unique knowledge and experience to help inform the planning process.

The BCPRP provides direction for caribou recovery for four of the five boreal caribou ranges in B.C.: Calendar, Maxhamish, Snake-Sahtahneh, and Westside Fort Nelson.<sup>1</sup> This plan defines recovery goals and objectives, outlines management actions to achieve goals and objectives, and details an adaptive management framework to inform evaluation and future decisions. The BCPRP will be implemented through a co-management approach between the Province and Fort Nelson First Nation. The implementation will adhere to the goals, objectives and management guidance found within the recovery plan.

## Structure of the Plan

The BCPRP is comprised of two sections. Section 1 outlines the background and context for boreal caribou recovery planning in B.C. Section 2 is the management action portion of the plan that details the management measures available for boreal caribou

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<sup>1</sup> The Chinchaga Herd Plan is being developed with interested Treaty 8 Nations engaged within the Fort St. John Land and Resource Management Plan Update Project.

recovery and the approach for implementing those measures across boreal caribou range. In addition to these two sections there are individual herd plans that describe individual herd status, threats, limiting factors, and management history for each caribou subpopulation. These herd plans align with those produced by the provincial Caribou Recovery Program for caribou populations throughout B.C. and are expected to be appended to the BCPRP, following its approval.

## **Caribou Recovery Planning in British Columbia**

### **Provincial Guidance on Caribou Recovery**

The Province is committed to the long-term success of caribou recovery. It initiated the provincial Caribou Recovery Program (the Program) in 2017 to develop a renewed approach to recovering caribou populations in the Province. The Program has identified eight strategic objectives to guide efforts throughout British Columbia:

1. Reverse the decline of woodland caribou where it is feasible to do so.
2. Achieve a “stable” to “increasing” population of identified woodland caribou herds.
3. Align science and recovery approaches with the federal government’s approaches where appropriate.
4. Incorporate Indigenous values and knowledge into caribou management decisions.
5. Demonstrate reasonable efforts to meet the *Species at Risk Act* (SARA) caribou recovery strategy.
6. Provide increased certainty for the natural resource sector in B.C. regarding caribou management.
7. Ensure that resources are efficiently allocated, coordinated, and prioritized to actions and activities that achieve demonstrable caribou recovery objectives; and
8. Ensure that caribou management actions are open, transparent, and regularly reported.

These strategic objectives have guided the management approach taken in the development of the BCPRP. Those that are particularly relevant to boreal caribou include: providing increased certainty for the natural resource sector; demonstrating

reasonable efforts to meeting the SARA caribou recovery strategy; incorporating Indigenous values and knowledge in caribou recovery activities; and ensuring that caribou management actions are open, transparent, and regularly reported.

## **History of Provincial Boreal Caribou Management**

Boreal caribou have been recognized as a conservation concern by the Province since the early 2000s. An initial *Strategy for the Recovery of Boreal Caribou in British Columbia* was drafted by the Province in 2004, however, it was never approved or implemented on account of government priorities of the day. In 2010, the Province approved the *Implementation Plan for the Ongoing Management of Boreal Caribou (Rangifer tarandus caribou pop. 14) in British Columbia* (BCIP) (BC Ministry of Environment, 2011) with goals to (1) decrease the rate of decline in the Boreal Caribou populations; and (2) significantly reduce the risk of Boreal Caribou extirpation in the Calendar, Chinchaga, Maxhamish and Prophet ranges within 50 years .

Management actions outlined in the BCIP focused on implementing habitat protection measures including Ungulate Winter Ranges (UWR) and Wildlife Habitat Areas (WHA) under the *Forest and Range Practices Act* and the *Oil and Gas Activities Act*. Additionally, Resource Review Areas (RRA) were established under the *Petroleum and Natural Gas Act*, restricting additional oil and gas, mineral, placer, or coal tenures in these areas for a minimum of five years. To oversee implementation of the BCIP, a Research Effectiveness Monitoring Board was established to support research, monitoring, and management of boreal caribou in B.C. (BC OGRIS, 2011).

Developing a recovery plan was identified as a priority by the Province following the release of the federal *Recovery Strategy for the Woodland Caribou (Rangifer tarandus caribou), Boreal population, in Canada* (Boreal Recovery Strategy) (Environment Canada, 2012). In 2016/17, a draft *Boreal Caribou Recovery Implementation Plan* (BCRIP) was developed to replace the existing BCIP. The document outlined additional recovery actions to achieve and maintain a positive habitat trend across boreal caribou range and to stabilize and achieve a positive population trend across boreal caribou range (Ministry of Environment and Ministry of Forests, Lands and Natural Resource Operations, 2017). The BCRIP was met with limited support from regional First Nations

and stakeholders, and the Province initiated a collaborative planning process with Fort Nelson First Nation on a revised plan.

## **Fort Nelson First Nation Guidance on Boreal Caribou Recovery**

Fort Nelson First Nation have lived and stewarded their territory in northeastern British Columbia since time immemorial. Their people are knowledge keepers, building on their ancestors' knowledge and modern science to balance industry and traditional economies in their territory.

FNFN members harvested caribou throughout their territory for countless generations. Historically, boreal caribou provided sustenance, clothing, tools, utensils, snowshoes, and other necessities important to their physical and cultural survival. These practices built strong Indigenous knowledge of caribou, through oral histories passed down through the millennia. Decreasing caribou populations and diminishing habitat have curtailed these practices in recent years. Elders and harvesters say that caribou are increasingly rare in the Liard River basin and that sightings of caribou have declined for many decades. Many of their sightings and experiences with harvesting and using caribou took place when they were children. FNFN's knowledge of boreal caribou declines reflects much greater population losses over a longer timeframe than can be observed from available scientific data (Fort Nelson First Nation and the Liard Basin Monitoring Initiative Team, 2019). FNFN embraces both the right and the responsibility to protect boreal caribou and to ensure that caribou remain on the landscape to support the future health and well-being of the people and the ecosystems with which they are inextricably linked.

### ***Fort Nelson First Nation's Medzih Acton Plan***

In 2017, FNFN released their *Medzih Action Plan* (MAP) for boreal caribou recovery. The MAP defined a goal to recover boreal caribou to self-sustaining levels, across a historic spatial distribution, with resilience to allow for subsistence hunting within 20 years. To achieve this goal, several key actions were defined in the MAP based on the principle that spatially identified and protected habitat is paramount to boreal caribou recovery. This included delineating restoration and habitat protection zones across boreal caribou range, each of which had distinct habitat characteristics and management intent (Fort Nelson First Nation, 2017). The MAP also identified the need to ensure

sustainable industrial development for the long-term stability of FNFN and non-First Nations communities.

## **Federal Guidance on Boreal Caribou Recovery**

The federal government shares the responsibility for the recovery of boreal caribou with provinces and territories, with the federal government's authority coming from the *Species at Risk Act* (SARA). Boreal caribou herds in B.C. are listed in Schedule 1 of SARA as *Threatened*.

As part of its obligations under SARA, ECCC produced the Boreal Recovery Strategy in 2012. This strategy, which was amended in 2020 and outlines management requirements, including critical habitat protection, to achieve self-sustaining status for populations of boreal caribou in Canada. The Boreal Recovery Strategy states that it is unlikely to very unlikely that B.C.'s boreal caribou herds are self-sustaining, and documents that all herd ranges exceed the 35% range disturbance threshold (Environment and Climate Change Canada, 2020). The Boreal Recovery Strategy established the expectation that provinces and territories will develop range plans to outline how the jurisdictions plan to manage range to achieve 65% undisturbed habitat over time. In 2016 ECCC released the *Range Plan Guidance for Woodland Caribou, Boreal Population*, which provides general guidance on the development of range plans and an overview of desired range plan content (Environment and Climate Change Canada, 2016). The BCPRP is intended to align with this guidance and forms part of the Province's response to the Boreal Recovery Strategy.

## **Synopsis of Threats and Limiting Factors to Boreal Caribou**

There are numerous identified threats and limiting factors that may affect caribou populations including habitat alteration from human-caused and natural disturbance, predation, parasites and disease, hunting, and the effects of climate change. These threats act cumulatively to negatively influence caribou populations, which may not be evident when threats are examined individually (Culling & Cichowski, 2017).

Human activities within and adjacent to caribou range are understood to be the primary driver of declining woodland caribou populations across Canada (Environment Canada, 2008). Human activities that pose a threat to caribou include, but are not limited to, forest harvesting, linear features (e.g., seismic lines, roads) development, motorized and non-motorized recreational activity, agriculture, mineral exploration, oil and gas extraction, and mining. Such activities can impact caribou populations through multiple mechanisms including direct habitat loss, displacement from preferred habitats, and alteration of predator-prey dynamics. The figure below provides visual interpretation of the drivers of boreal caribou decline.

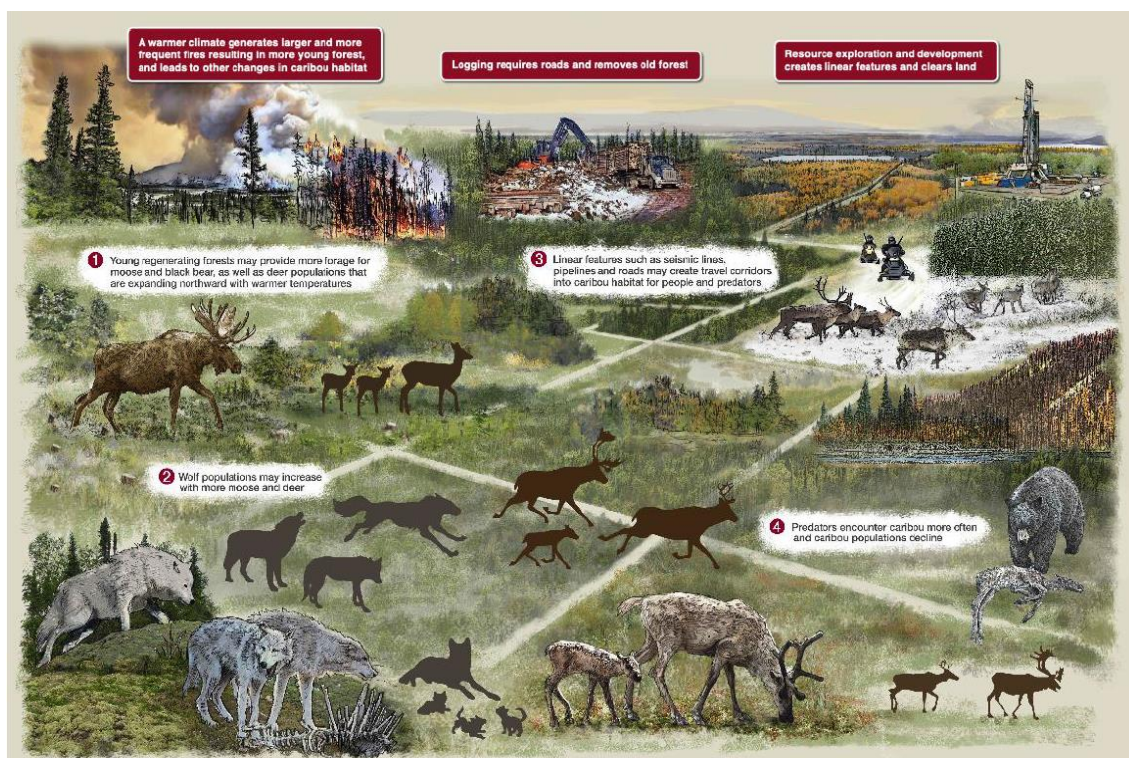


Figure 2: Infographic of the drivers of decline for boreal caribou. Illustration: Soren Heinrich: Alaris Design; with thanks to the Government of Northwest Territories and the B.C. Oil and Gas Research and Innovation Society.

It is generally accepted that increasing rates of predation are the proximate cause of declining woodland caribou populations (McLoughlin, Dzus, Wynes, & Boutin, 2003). For boreal caribou in northeast B.C., wolf predation has been the leading cause of mortality among radio-collared caribou. Other predators of boreal caribou include black bears and wolverine, however, their influence on populations is variable across boreal ranges. Linear features increase predator access and efficiency in caribou habitat and ultimately,

increase predation rates on caribou. Furthermore, the creation of young forests through forest harvesting can increase the abundance and distribution of primary prey species. This leads to increased predator densities and increased predation rates on caribou (Culling & Cichowski, 2017).

While predation has been the documented leading cause of caribou mortality in northeast B.C., pathogens such as viruses, bacteria and parasites have been linked to caribou health, physical condition, and mortality. The British Columbia Boreal Caribou Health Research Program identified that pathogens may have contributed to abnormally high levels of caribou mortality and associated population declines in the past (Bondo, et al., 2019).

## **Implications for Other Values**

### ***Cultural***

Boreal caribou have long been valued as a cultural resource by First Nations in northeast B.C., yet many Nations no longer hunt caribou due to their low numbers. This has implications for the health and well-being of First Nations people. Recovering populations to a place where sustenance hunting can sustainably occur has been identified as a high priority by many of the First Nations that overlap with boreal caribou range (FNFN, 2017; BRFN, 2016; DRFN, 2016). The presence of large intact landscapes have also been identified as being a priority value for the FNFN community (Fort Nelson First Nation and the Liard Basin Monitoring Initiative Team, 2019). Caribou have evolved a life history strategy that is dependent on large landscapes of intact forest-muskeg ecosystems, and population declines are seen as a signal that these ecosystems are no longer healthy. Intact forests and muskegs have inherent and intangible cultural and spiritual values and are important for the continued practice of rights for Indigenous people. Protecting and recovering caribou habitat will also support the many other rights and values that are associated with these ecosystems.

### ***Ecological***

Boreal caribou ranges in B.C. are concentrated around spruce-leading bogs and fens containing abundant lichen, sedge, and moss availability which provides forage opportunity year-round. These peatland complexes are connected by mature conifer-

leading forests with open understories which provide thermal and security cover. Boreal caribou have also been observed using water features such as marshes, lakes, and open water muskeg for seasonal forage opportunity and security purposes, most notably during calving season. Boreal caribou manage predation risk by maintaining low population densities throughout the range and by avoiding areas with high densities of primary prey species (predominantly moose). This translates to avoidance of deciduous and mixed forests in summer and fall, as well as recently disturbed or regenerating areas. Large tracts of contiguous undisturbed habitat are therefore required to accommodate movement in response to changing seasons, predation pressure, and habitat alterations.

Management of boreal caribou habitat revolves around the conservation and maintenance of intact old growth forest and wetland ecosystems. As such, boreal caribou are considered an umbrella species, as maintaining their preferred habitat qualities typically benefits other species selecting the same types of habitats. Boreal caribou range in B.C. overlaps several provincially red-listed species including wood bison (*Bison Bison athabasca*), bay-breasted warblers (*Setophaga castanea*), Nelson's sparrows (*Ammodramus nelsoni*), three species of ray-finned fishes, and two plant species. Additionally, there are six blue-listed species, two blue-listed ecosystems, and one yellow-listed plant in boreal caribou range. Management actions for boreal caribou may positively influence the recovery of these species/ecosystems. Furthermore, the large intact forests and wetland ecosystems required for caribou to recover can also provide extensive ecosystem services including climate change mitigation and biodiversity conservation (Watson, 2018).

### **Socio-economic**

The economy of northeast B.C. is largely driven by industrial development including petroleum and natural gas (PNG) exploration and extraction and forestry. To support planning, a baseline socio-economic assessment was completed which noted that communities in the planning area have disproportionate unemployment and are low in the B.C. regional socio-economic index (Green Analytics and Swifft Creek Consulting, 2018). Forestry activity in the area covered by the BCPRP has declined with no active operations at present, although there have been active investment proponents in recent years. Investment in PNG in the area has largely stalled and there is no near-term



forecasted return for investment within the planning area (Ministry of Energy, Mines and Petroleum Resources, 2018). Natural resource economies are often market driven and subject to boom-and-bust cycles, often leading to major economic swings within resource reliant communities that have associated community impacts.

Planning for the boreal caribou recovery under the BCPRP has been completed with regional representation and consideration of current economic realities. The BCPRP has used an approach to define management goals and objectives for boreal caribou ranges and outlines the trade-offs, risks, and consequences for caribou populations and socio-economic and cultural values associated with achieving these goals. The proposed management actions of the BCPRP maintain access to the valuable natural resources of the region that communities rely upon while providing for increased certainty for industrial proponents and improved likelihood of success in recovery of local caribou populations.

# **Boreal Caribou Protection and Recovery Plan: Management Actions**

The Boreal Caribou Protection and Recovery Plan (BCPRP) provides management direction for caribou recovery for four of the five boreal herd ranges in B.C.: Calendar, Maxhamish, Snake-Sahtahneh and Westside Fort Nelson. The BCPRP integrates western science with Indigenous and local knowledge in a unique approach to defining recovery goals and objectives and the identification of supporting habitat and wildlife management actions deemed necessary to recover boreal caribou. Section 2 of the BCPRP describes the management strategy for boreal caribou including the recovery goal and objectives, habitat management and population management actions and adaptive management framework.

## **Boreal Caribou Recovery Goal and Management Objectives**

The goal of the BCPRP is to:

- *Recover boreal caribou populations across their range to self-sustaining status and to a level capable of supporting an Indigenous sustenance harvest.*

The aim is to achieve this goal within a 40-year time frame. In pursuit of this goal the BCPRP establishes the following management objectives:

- *Establish a positive habitat trend within core habitat zones by maintaining condition of the best remaining habitat and improving the condition of currently degraded habitat.*
- *Stabilize and achieve a positive population trend across all ranges.*

## **Managing Areas to Achieve Positive Habitat Trend**

Boreal caribou habitat in B.C. is highly fragmented with all herd ranges currently exceeding the disturbance threshold identified within the federal recovery strategy<sup>2</sup>. To recover boreal caribou populations, areas within all the ranges must be protected, both

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<sup>2</sup> See Appendix: Disturbance for provincial disturbance assessment.

to prevent further disturbance and so investments in restoration can be effective over the long-term in recovering the large, intact areas of habitat which is essential to achieving the BCPRP recovery goal.

In identifying areas for habitat protection and recovery, a scenario planning approach was undertaken. This supports a transparent decision-making process through demonstrating potential socio-economic and cultural impacts associated with the various scenarios alongside associated risk of achieving the overarching BCPRP goal. Multiple scenarios were developed to address boreal caribou recovery in B.C. representing a range in likelihood of achieving the self-sustaining caribou populations over the long-term. Appendix 1 summarizes the planning framework and methodology employed to develop the scenarios.

The BCPRP proposes a scenario for implementation that maintains access to required natural resources for local communities while providing for positive long-term outlook for boreal caribou. Outlined in the following subsections is the approach to managing the land base within caribou ranges to achieve the habitat objectives and support achievement of the recovery goal over the long-term.

## **Core Habitat Zones and Areas of Interest**

Core habitat zones are the foundation for the habitat management strategy within the BCPRP. Core habitat zones incorporate both scientific information (habitat suitability, telemetry data from radio collared boreal caribou) and Indigenous knowledge of caribou distribution and habitat use. Core zones represent the most important habitat within the ranges containing the biophysical attributes required by caribou to carry out life processes necessary for survival and recovery. Areas outside of core zones and within caribou range are classified as matrix habitat. Matrix habitat possesses low periodic caribou use and is important for connectivity between suitable core habitats. Predator-prey dynamics in these areas have the potential to significantly impact caribou populations both directly and indirectly.

Through the planning process, two Areas of Interest (AOIs) were identified based on Indigenous knowledge, local observations, and telemetry data: the Hay River / Shekilie AOI and the Muskwa-Westside Connection AOI. These areas were previously not

considered in provincial management of boreal caribou habitat. More information about caribou use and movement is necessary to fully understand how caribou are using these areas and the linkages between northern mountain and boreal caribou interactions. Until more information is available, habitat management in these AOIs will mirror that of core habitat zones but no management actions are proposed in the areas surrounding the AOIs.

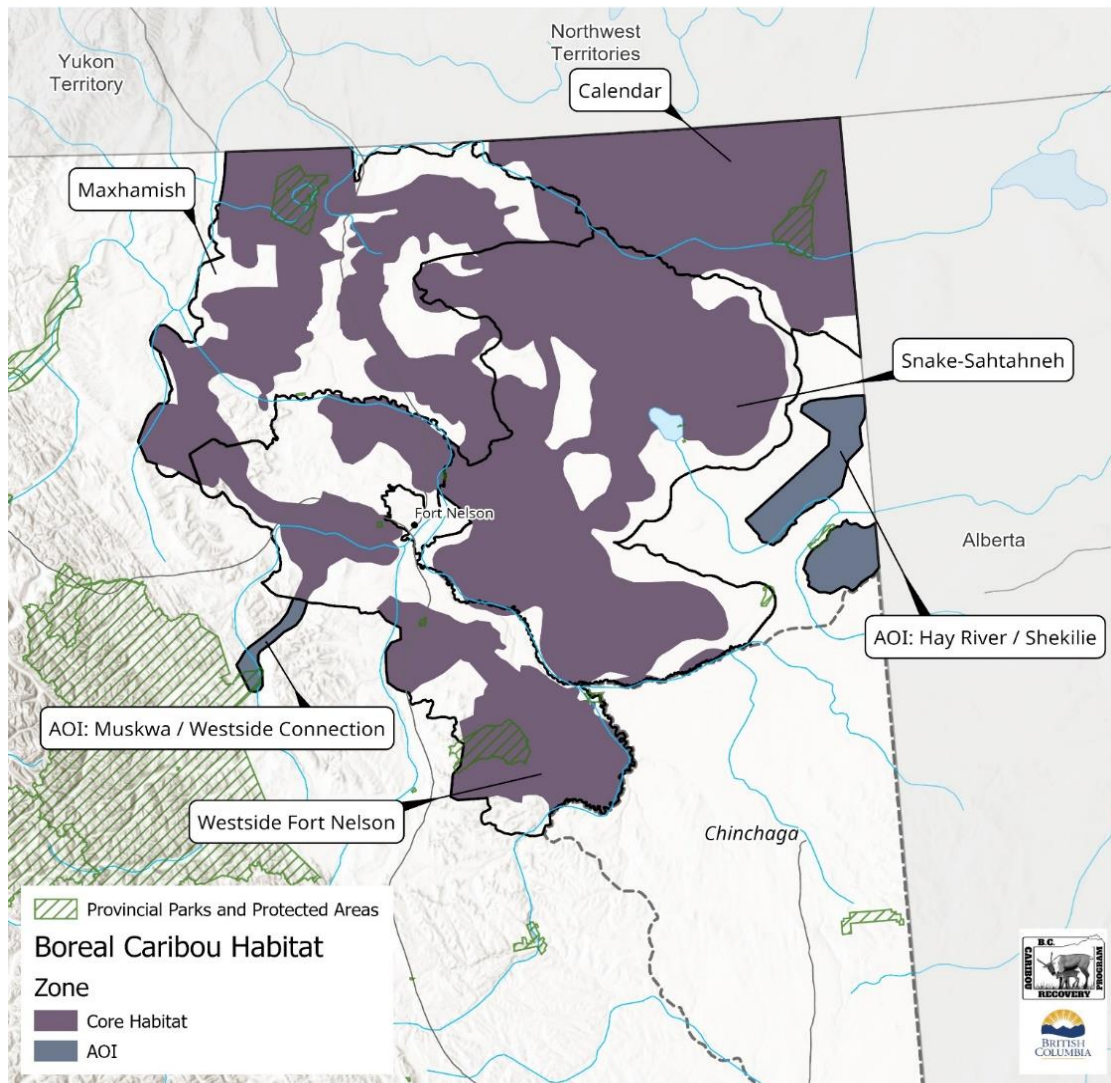


Figure 3: Map of Boreal Caribou Ranges, Core Habitat Zones and Areas of Interest

	Calendar	Maxhamish	Snake-Sahtahneh	Westside Fort Nelson
Core Area (ha)	525,388	661,580	1,045,995	516,970
Matrix (ha)	33,237	350,408	294,421	320,177
Range Total (ha)	558,625	1,011,989	1,340,416	837,147

## Habitat Management Types

The BCPRP establishes four habitat management types that will apply across caribou range (Table 1). They guide future activities within range to meet established objectives and make progress towards the recovery goal. The spatial application of management types considers habitat type, condition and natural resource values including PNG deposits and associated tenures, forest merchantability, and area-based tenures. The table below summarizes the intent and measures associated with each Management Type. Figure 4 presents a visual map of the spatial application of the management types.

Type	Management Intent	Management Measures
1	<ul style="list-style-type: none"> <li>• Full habitat protection across all industries</li> <li>• Top restoration priority</li> </ul>	<ul style="list-style-type: none"> <li>• No new subsurface and surface tenure disposition</li> <li>• No new surface disturbance</li> <li>• Reclamation and restoration of legacy disturbance permitted through appropriate regulatory mechanisms</li> </ul>
2	<ul style="list-style-type: none"> <li>• Full protection from forest harvest</li> <li>• Conditional petroleum and natural gas development</li> <li>• Secondary restoration priority</li> </ul>	<ul style="list-style-type: none"> <li>• No new subsurface and surface tenure disposition</li> <li>• No new surface disturbance</li> <li>• Maintain access to petroleum and natural gas resources within existing industrial footprint</li> </ul>
3	<ul style="list-style-type: none"> <li>• Conditional forest harvest</li> <li>• Conditional petroleum and natural gas development</li> <li>• Lowest restoration priority</li> </ul>	<ul style="list-style-type: none"> <li>• No new subsurface and surface tenure disposition</li> <li>• Petroleum and natural gas activities will be subject to updated Planning and Operational Measures</li> <li>• Forest harvest will be subject to updated General Wildlife Measures (GWMs).</li> </ul>
4	<ul style="list-style-type: none"> <li>• Conditional forest harvest</li> <li>• Conditional petroleum and natural gas development</li> </ul>	<ul style="list-style-type: none"> <li>• Petroleum and natural gas activities will be subject to updated Planning and Operational Measures</li> <li>• Forest harvest will be subject to GWMs.</li> </ul>

Table 1: BCPRP Management Types, Intents and Measures

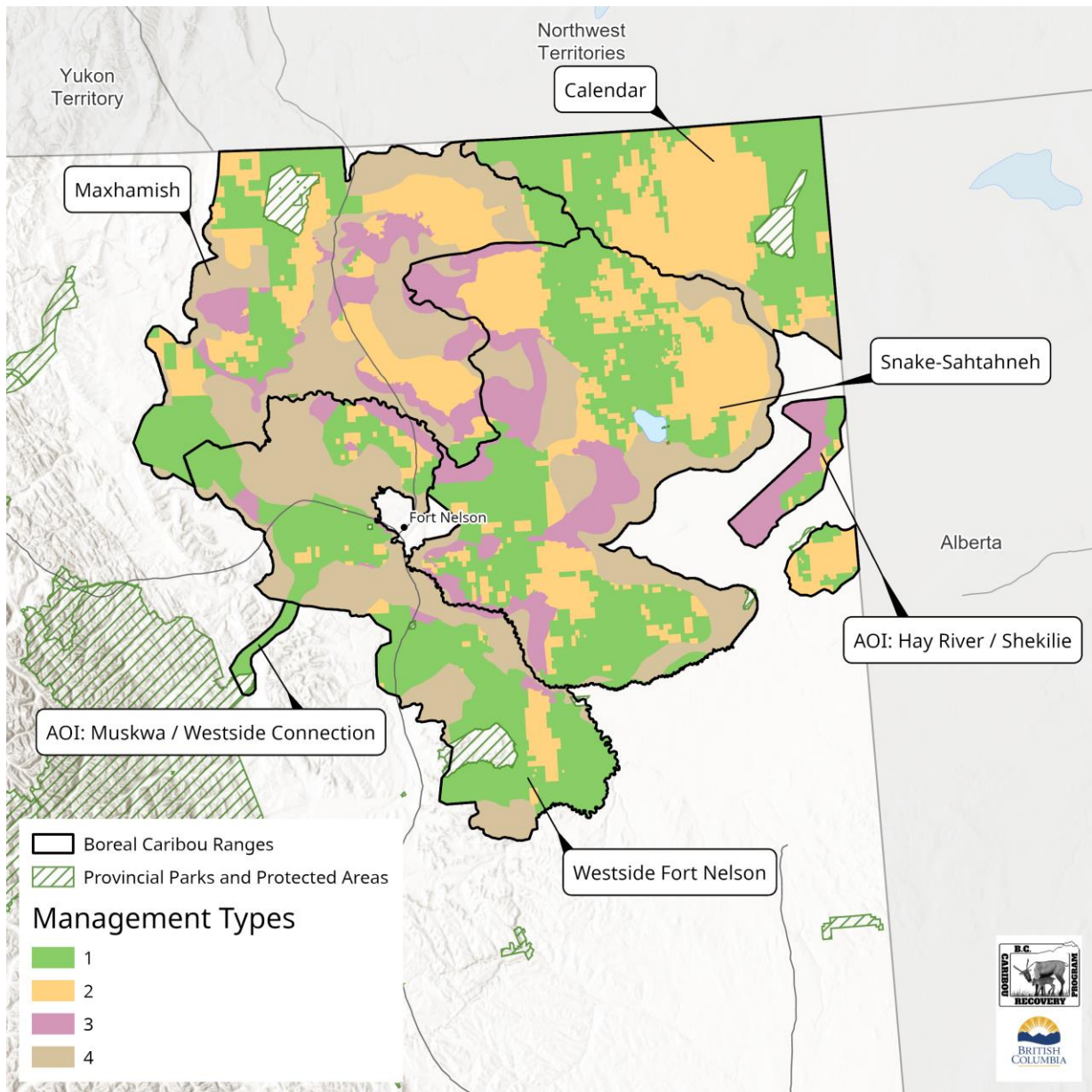


Figure 4: Boreal Caribou Protection and Recovery Plan Habitat Management Types

## Habitat Management Tools for Positive Habitat Trend

### Habitat Protection

Habitat protection refers to the application of existing legislative and policy tools to restrict future tenures and industrial activities that result in habitat disturbance. Habitat protection allows habitat recovery to occur through natural regeneration and ensures habitat restoration can be effective over the long term. The table below outlines the management measures, protection tools and enabling legislation or policy which may be used. Through implementation the aim is to explore the range of tools available and use the strongest possible mechanisms to achieve the desired management intent of each Management Type.

Management Measure	Habitat Conservation Tool	Enabling Legislation or Policy
No new surface disturbance	Wildlife Habitat Area and Ungulate Winter Range	Forest and Range Practices Act (s. 149) Government Action Regulation (s. 9-12) Oil and Gas Activities Act (s. 104) Environmental Protection and Management Regulation (s. 30-31)
	Wildlife Management Area	Wildlife Act (s. 4-6)
	Designate crown land for conservation of natural or heritage resources	Land Act (s.17)
	Order Respecting the Environment and Land Use	Environment and Land Use Act (s. 7)
No new subsurface and surface tenure dispositions	Resource Review Area	Provincial Policy, Petroleum and Natural Gas Act
	Withdrawal from Disposition	Petroleum and Natural Gas Act (s. 72)
	Conditional Withdrawal	Land Act (s. 17)
Maintain access to resource within existing industrial footprint.	Prescribed permit requirements	Oil and Gas Activities Act (s. 25) Environmental Protection and Management Regulation (s. 6)
All PNG activities will be subject to updated Planning and Operational Measures	Prescribed Permit Requirements	Oil and Gas Activities Act (s. 25) Environmental Protection and Management Regulation (s. 6)
Forest harvest will be subject to caribou General Wildlife Measures (GWMs) and spatial harvest planning	Wildlife Habitat Area and Ungulate Winter Range	Forest and Range Practices Act (s. 149) Government Action Regulation (s. 9-12)

Updated industrial guidance such as Planning and Operational Measures and General Wildlife Measures prescribed in the tables above are subject to the required regulatory consultation with industrial stakeholders and the appropriate regulators. Updated guidance will focus on mitigating and/or offsetting impacts to caribou and caribou habitat from industrial activities in line with the intent of the respective management type. The updated guidance is expected to focus on:

- reducing industrial disturbance footprint through access management;
- aggregating disturbances where possible to maximize contiguous intact caribou habitat;
- spatial and temporal caribou avoidance measures; and
- developing ecologically and culturally appropriate offsetting measures that can be adopted and enforced to ensure that new development within core management zones is offset.

## **Habitat Restoration**

Habitat protection is a crucial first step in slowing habitat degradation trends and allowing for natural habitat regeneration over the long term. However, the timeline for natural regeneration can be very long within boreal caribou habitat, and certain disturbance types may never recover without intervention. Habitat restoration is a key tool to reduce current disturbance and accelerate habitat regeneration within caribou range.

Fort Nelson First Nation has been implementing caribou habitat restoration programs within their traditional territory since 2017, and there have been a number of caribou habitat restoration projects carried out throughout B.C. and other jurisdictions by provincial agencies, First Nations, and industrial partners that are contributing to a growing knowledge base for future implementation (BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, 2021).

Habitat restoration efforts can be funded through federal, provincial, or First Nations initiatives, or triggered by industry regulations. Given the extent of disturbance across the area covered by the BCPRP and the costs associated with restoring these features, actively restoring all disturbance features is not feasible. As such, guidance will be



created that identifies priority areas for restoration investment to align efforts across initiatives.

Priority areas will be delineated utilizing the following high-level criteria, which were developed as part of a series of workshops on habitat restoration which included government agencies, First Nations, and industrial stakeholders:

- restoration efforts should focus on creating and expanding intact habitat areas;
- priority areas should focus on currently occupied caribou habitat and critical habitat features;
- restoration efforts should be focused in areas with little to no risk of future disturbance (i.e., Management Type 1+2); and
- restoration investment should be as efficient as possible and focus on areas where there is maximum return of intact habitat per hectare restored ( Golder Associate Ltd., 2019).

As restoration priority criteria are reliant on protection status and industrial management measures, the final guidance will be completed as part of BCPRP implementation. Additional considerations, such as restoration sequencing and access management, will be included to the extent possible in planning documents, but will also require site-level knowledge and project engagement which is best developed on a project-by-project basis.

## **Habitat Offsetting**

Habitat offsetting is a tool used to mitigate the impacts of habitat loss, by replacing habitat that is impacted by a project or activity. Offsetting is the final stage in a mitigation hierarchy, whereby predicted impacts of a development must first be avoided, followed by minimization, and on-site restoration, before the remaining impacts are offset. Offsetting may include habitat and/or ecosystem enhancement, off-site restoration, creation or, in some cases, habitat protection and preservation both within and outside of the development area (B.C. Ministry of Environment, 2014). The focus of the BCPRP is the long-term protection and restoration of caribou habitat. In areas of core management zones where conditional development is permitted, ecologically and culturally appropriate offsetting measures will be established through implementation to align with the BCPRP habitat objective.

## **Wildfire Management**

Wildfire is a common natural disturbance across boreal caribou ranges. Given the current state of boreal caribou habitat within B.C., large wildfires within caribou habitat could have a major impact on caribou distribution and demographics. Mapped caribou habitat and protection information will be provided to the B.C. Wildfire Service on an annual basis to be incorporated into regional wildfire response plans as a valued component. Caribou values will also be included in Wildfire Risk Reduction plans that overlap identified habitat.

## **Wildlife Population Management Tools**

The recovery of habitat to a state that supports stable self-sustaining populations of boreal caribou may take decades to achieve. In the interim, wildlife management measures may be required to avoid further declines of boreal caribou. Within the BCPRP, the only measure under consideration is predator management. Maternal penning, predator exclosure, primary-prey management, conservation breeding, and supplementary feeding which are being implemented in other caribou ranges in Canada, are not being considered for this area at this time. The need for additional population management tools will be continually assessed as part of the adaptive management evaluation over the life of the BCPRP.

## **Predator Management**

Predator management consists of reducing predator populations where predation is a limiting factor for caribou populations. Wolves are a primary predator of caribou and are the leading cause of boreal caribou mortality within northeastern B.C. Wolf reduction has been shown to be an effective tool to halt or reverse declining caribou populations over a short-term period (Farnell, 2009; Hervieux et al 2014; Bridger 2019; Serrouya et al. 2019). In northeast B.C., wolf reduction has been implemented to support caribou recovery within the central mountain group, the Graham and Pink Mountain northern mountain ranges and the Chinchaga boreal range more recently. Early results of these programs have demonstrated an increasing population trend, decreased adult female mortality and increased calf recruitment (FLNRORD, 2019).

It is important to acknowledge that wolf control measures are costly and require sustained effort over time. Wolf populations have been observed to rebound quickly once removal efforts are stopped (Farnell, 2009), suggesting that these efforts only work if they are continued until other impacts to caribou are reduced. Furthermore, high numbers of wolves need to be removed to see a meaningful increase in caribou calf survival (FLNRORD, 2019). The intensive nature of these efforts means that wolf control should only be enacted where populations are at high risk, with the preferred approach being recovery of habitat to reduce the predation risk.

In 2021, the B.C. Caribou Recovery Program established an interim aerial wolf reduction procedure to guide decisions, monitoring and reporting associated with direct reduction of wolf populations for the purpose of caribou recovery (Province of British Columbia, 2021). The provincial procedure establishes a target density of <3 wolves/1,000km<sup>2</sup> within identified caribou herd boundaries, as well as a decision path on whether a herd should be considered for predator management based on a series of factors. This builds on previous guidance to support decisions for predator management (FLNRORD, 2019).

As part of the BCPRP implementation, each herd will be assessed against established criteria and a decision will be made on whether predator reduction is an appropriate tool to stabilize the herd. Should predator reduction be implemented in the BCPRP area, it will align with Fort Nelson First Nation guidance on culturally appropriate predator management. Associated impacts on other species will be monitored and potential effects may result in management of those species and outcomes.

## **Adaptive Management and Evaluation**

Adaptive management acknowledges the uncertainty inherent in the outcomes of implementing strategies. Investments in boreal caribou research, monitoring and management in B.C. from 2011-2018 have resulted in a vastly improved understanding of boreal caribou populations in B.C. (B.C. Boreal Caribou Research and Effectiveness Monitoring Board, 2018). However, as remaining knowledge gaps are addressed, the BCPRP must have the flexibility to adapt to new information and will therefore be implemented within an adaptive management framework.

Adaptive management refers to an iterative process whereby the response of caribou populations to management actions is monitored and actions are adjusted based on results of monitoring. Adaptive management is critical to allow managers to adjust given the uncertainty around the effectiveness of some management actions. The BCPRP proposes an adaptive management cycle for caribou recovery which includes annual monitoring requirements and will be implemented every five years at a minimum, with additional review as required to ensure that changes in management are supported by the best available information at the time.

## **Performance Indicators**

The BCPRP will be evaluated using the adaptive management framework outlined in Figure 5. Performance indicators have been identified to help track progress towards BCPRP objectives.

### ***Habitat Trend***

The long-term habitat goal for BCPRP caribou herds is to reduce overall disturbance to a level that supports self-sustaining caribou populations. While habitat protections provide for the natural regeneration of disturbance in core habitat areas and safeguard investments for further restoration efforts it is recognized that habitat protection does not immediately equate to intact habitat. Given the long time-lag for natural recovery of disturbances, progress towards the disturbance targets will need to be measured consistently to gauge the need for active restoration or further measures.

Habitat disturbance across boreal caribou range will be measured on a yearly basis to assess whether a positive habitat trend is being achieved. Habitat disturbance trend will be evaluated against current disturbance and long-term (40 years) habitat recovery targets (Figure 5). Monitoring will aim to be consistent with current methodologies while incorporating emerging techniques and technologies to render the process as efficient and accurate as possible. Disturbance metrics will be reported out by herd range as well as cumulatively across all B.C. boreal herd ranges.

In addition to overall disturbance figures, the density of linear features will also be measured and reported. Given that linear features are the primary disturbance across the BCPRP area, total disturbance values will be strongly correlated, such that reduction

in linear feature densities will result in lower total disturbance. The linear feature target density within core management zones is <1km/km<sup>2</sup>.

The BCPRP is based on the key principle of habitat protection as a means of preventing further habitat degradation, which is why protection is focused on the most intact habitat. Although it is anticipated that disturbances within restrictive management types will naturally regenerate, active restoration efforts will be required in core management areas to ensure habitat targets are achieved over the long-term. To guide habitat restoration investments, restoration priority areas will be identified in the implementation phase.

The point at which a disturbance is sufficiently recovered to be considered undisturbed habitat is a crucial factor for monitoring habitat trend. Polygonal disturbance in the form of wildfires and cutblocks can be considered undisturbed when the disturbance reaches the age of 40 years (Environment Canada , 2011). However, timelines are not as clear for linear features, such as seismic lines and roads, where the natural recovery of vegetation varies based on site-specific limiting factors. As part of BCPRP implementation, the characteristics that determine undisturbed habitat will be defined and incorporated into the monitoring program. These characteristics and criteria will be refined over the course of the effectiveness monitoring program and be responsive to site-specific observations.

Herd Range	Percent (%) Habitat Undisturbed	
Subpopulation	2020	Long term (40 years)
Calendar	6%	>65%
Snake-Sahtahneh	4%	>62%
Westside Fort Nelson	13%	>57%
Maxhamish	12%	>52%
BCPRP Area	9%	>63%

*Figure 5: Current Buffered Cumulative Disturbance of BCPRP Caribou Range Areas and Long-Term Targets. Disturbance methodology outlined in Disturbance Appendix. Long-term targets are the percent of the range that is restricted from further human disturbance based on scenario presented within the BCPRP.*

### ***Caribou Population Trend***

The primary performance indicator for the effectiveness of the BCPRP is boreal caribou population trend. Population “lambda” has been used as an effective and efficient measure for estimating caribou population trends within B.C. and across Canada.

Population lambda ( $\lambda$ ) refers to the rate of population growth estimated from adult female and calf survival. Lambda indicates whether a population is stable ( $\lambda = 0.99 - 1.01$ ), increasing ( $\lambda > 1.01$ ) or decreasing ( $\lambda < 0.99$ ). To achieve BCPRP's goal of self-sustaining boreal caribou populations that can support an indigenous sustenance harvest, lambda would have to be stable or increasing in all ranges over the short-term (five years), medium-term ( $\leq 20$  years) and long-term ( $\geq 50$  years; Table 7). To measure success in achieving population objectives and the BCPRP recovery goal, lambda will be estimated every five years and assessed in relation to short and long-term targets.

Caribou Subpopulation	Mean Annual Lambda (2014-2021) <sup>1</sup>	Cumulative Lambda (2014-2021) <sup>2</sup>	Short-term Target <sup>3</sup>	Long-term Target <sup>3</sup>
Calendar	0.971	0.711	$\lambda \geq 1.01$ (increasing)	$\lambda = 0.99 - 1.01$ (stable)
Snake-Sahtahneh	0.996	0.941	$\lambda \geq 1.01$ (increasing)	$\lambda = 0.99 - 1.01$ (stable)
Westside Fort Nelson	0.937	0.546	$\lambda \geq 1.01$ (increasing)	$\lambda = 0.99 - 1.01$ (stable)
Maxhamish	0.987	0.865	$\lambda \geq 1.01$ (increasing)	$\lambda = 0.99 - 1.01$ (stable)
<sup>1</sup> Average annual population growth rate from 2014-2021. Expressing lambda as an average over time reduces the volatility of the observed rates year to year. <sup>2</sup> Cumulative Lambda measures the overall population growth rate between 2014-2021, based on the annual population growth rates compounded year over year. <sup>3</sup> Lambda will be estimated every five years and must average to a stable or increasing level over each of the time periods to meet the target.				

Figure 6: Current (2014-2021) population growth rates (lambda) and short-term ( $\leq 20$  years) and long-term ( $\geq 50$  years) growth rate targets for boreal caribou ranges in B.C.

The Province has maintained GPS collars and performed annual surveys within all boreal caribou ranges since 2014, with the population trend results summarized in Figure 7 below. Annual growth rates have been highly variable, but the overall trend has shown a decline in the population. The monitoring plan is designed to decrease the volatility and uncertainty in monitoring by expanding the number of collars maintained in each herd, and by summarizing data over five-year periods. Monitoring efforts prior to 2014 were less frequent and relied on minimum population counts and estimates. As such, it is difficult to estimate historic boreal caribou population numbers within the BCPRP area. However, indigenous knowledge, local observations, and previous monitoring data all indicate that caribou populations have significantly declined from historic levels, particularly over the last several decades.

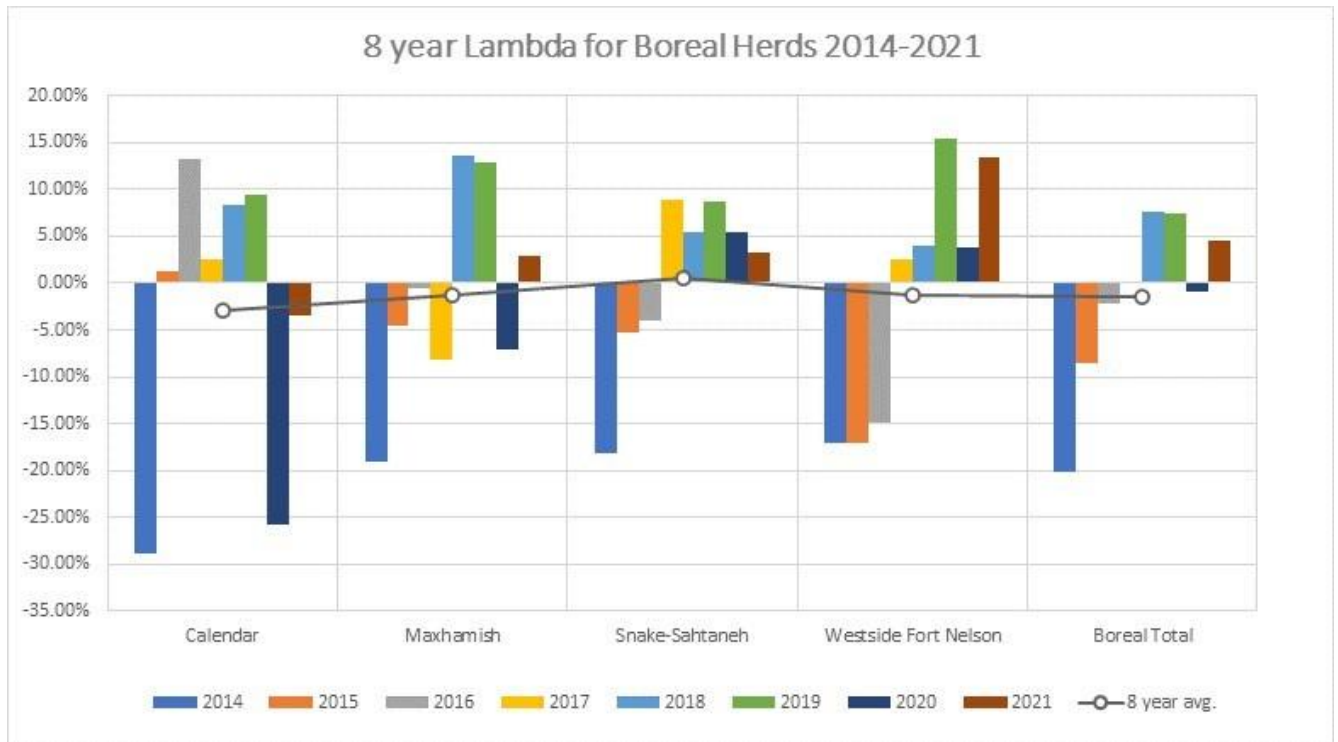


Figure 7: Estimated Annual Population Growth Rates (Lambda) for each herd range in the BCPRP area (2014-2021).

Caribou demographic information is currently measured as part of the provincial monitoring program, which includes GPS collaring of female caribou in each range and annual aerial surveys. To ensure that sufficient data are gathered to monitor BCPRP effectiveness, the monitoring program will continue and expand to meet the following targets:

- Maintain GPS collars on 30 caribou per range annually and ongoing monitoring of caribou health metrics and mortalities; and
- Annual surveys of each range to monitor cow:calf ratios.

It is recognized that over the lifespan of the BCPRP, new monitoring techniques may emerge which can more efficiently deliver demographic information or may provide additional data. Where adaptations are required to the monitoring program, the necessary data will continue to be collected in a manner that provides accurate short- and long-term population trend monitoring.

## Summary of BCPRP Implementation and Effectiveness Monitoring

Ongoing implementation and effectiveness monitoring is an important component of adaptive management. Proposed measures will take years to fully implement, and there is substantial engagement, program and capacity development required to do so. To track progress on implementing proposed measures, an implementation monitoring program will be adopted which measures progress towards the management intentions of the BCPRP.

<b>Implementation Monitoring</b>			
<b>Objective</b>	<b>Factor</b>	<b>Target</b>	<b>Frequency</b>
Habitat Trend	Amount of area protected.	Implementation of legislation, regulation and policy in accordance with the management intents	Yearly
	Up to date industry guidance	Creation and adoption of industry guidance matching the management intents	Yearly
	Habitat restoration planning	Approved restoration framework and tactical restoration plans.	Yearly
	Habitat restoration funding	Establishment of funding system for restoration, or coordination across appropriate funding programs	Yearly
Caribou Population Trend	Establishment of monitoring program	Confirmation of multi-year monitoring program which meets the data needs of the adaptive management plan	Yearly

*Table 2: Factors to inform BCPRP Implementation Monitoring*

Additionally, monitoring the effectiveness of implementation measures is important to understand progress on achieving established objectives and long-term goals. Every five years or when deemed necessary, an effectiveness review of caribou recovery measures will take place using metrics described below and will re-evaluate management actions as described in Figure 5. Additional management measures may be implemented based on the results of evaluation. Should additional measures be implemented, the effectiveness monitoring plan will be updated to reflect the new factors and targets.



<b>Effectiveness Monitoring</b>				
Objective	Factor	Target	Frequency	Method
Habitat Trend	% habitat undisturbed	Increasing undisturbed habitat across caribou range within 40 years	Yearly	Provincial tracking system in combination with remote sensing or field visit verification
	Linear feature density	Decreasing within core management zones within each range to <1 km/km <sup>2</sup> within 40 years	Yearly	Provincial tracking system in combination with remote sensing or field visit verification
	Habitat restoration effectiveness	Restored areas on trajectory to contribute to intact caribou habitat.	Yearly	Provincial tracking system in combination with remote sensing or field visit verification
Caribou population trend	Population lambda	Increasing to stable over time	Five Years	Calculated from mortality and cow: calf ratios
	Caribou mortality rates / causes	Mortality is lower than recruitment Identification of limiting factors	Yearly	Telemetry data (30 collars / herd range) and analysis
	Cow: calf ratios	100:28 (indicates stable or increasing population)	Yearly	Annual flights in late winter
	Body condition	Healthy caribou Identification of limiting factors (i.e., nutrition, disease)	Yearly	Sampling conducted during caribou capture and collaring. Investigations into mortality causes. Observations during annual flights in late winter

Table 3: Factors to inform BCPRP Effectiveness Monitoring

## Next Steps: Implementation and Research

The BCPRP will be implemented in a co-management approach between the B.C. government and Fort Nelson First Nation. The implementation will adhere to the goals, objectives and management guidance found within the recovery document and be coordinated with any future land-use planning processes.

## Implementation Priorities

Once the BCPRP is finalized and approved implementation of habitat and population management measures will proceed. Implementation steps have been identified throughout this document. The remainder of this section summarizes the key

implementation steps. The roles, responsibilities and timelines of implementation will be informed through the development of the co-management approach and appended to the BCPRP post-engagement.

### ***Habitat Protection***

The top implementation priority is the establishment of habitat protections consistent with the BCPRP management types. While legislative and policy mechanisms have been identified to achieve management intents, the Province will not be limited by the mechanisms listed within this document. Multiple protection measures may be overlaid to ensure consistency across industries where necessary.

### ***Updated Industrial Guidance***

Industry-specific guidance will need to be updated or created to align with the intentions and measures of the conditional development management types. This document identifies General Wildlife Measures (forestry) and Planning and Operational Measures (PNG) as the appropriate guidance tools, though other tools may be adopted based on industry engagement.

### ***Habitat Restoration***

To maximize habitat gains and return on restoration investment, priority restoration guidance will be developed, which will aim to identify the highest priority areas for restoration investment. In addition, the tactical restoration plans will be developed for priority areas to inform restoration proponents. Coordinating and tracking restoration activities and establishing consistent standards will be required. Where appropriate, systems and guidance under development at a provincial scale will be reflected in future guidance specific to boreal caribou.

### ***Predator Management***

Each herd subject to the BCPRP will be assessed to determine if predator management measures are required to immediately stabilize the herd. If wolf removal is recommended for any BCPRP herds, an operational plan will be developed, which includes securing the appropriate approvals and funding to begin the program.

### ***Monitoring and Adaptive Management***

This document outlines key factors to be considered for ongoing caribou and habitat

monitoring which will feed into an adaptive management plan. Any factors not adequately captured by the current ongoing monitoring program will be identified, and operational plans created to address the data gaps. This will include securement of funding, coordination between jurisdictions, and having all necessary approvals in place.

## **Ongoing Research**

The success of management actions identified in the BCPRP relies on the assumption that protecting and restoring habitat will lead to stable and increasing caribou populations over time. It is recognized that caribou population demographics are the result of a complex web of factors and ongoing research is essential to inform adaptive management. It is imperative that research goes beyond the monitoring plan outlined in this document. At the time this plan was drafted, the following high-level areas were identified as research priorities:

- extent of natural regeneration of habitat disturbance
- climate change and boreal caribou ecology
- predator-prey relationships in boreal landscapes
- caribou health as it relates to ecosystem productivity; and
- identifying fine-scale habitat features and movement corridors.

The above priorities are not a comprehensive list of potential research avenues. Research programs should be coordinated between the provincial and federal governments, interested First Nations, industrial stakeholders, and academia to maximize available data and funding opportunities.

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## **Appendix: Technical Methodology Summary**

Technical planning for the Boreal Caribou Protection and Recovery Plan (BCPRP) was completed by the Boreal Caribou Technical Team (BCTT), comprised of representatives from the Ministry of Forests, Lands, Natural Resource Operations, and Rural Development (MFLNRORD) and Fort Nelson First Nation (The Firelight Group and Veridian Ecological Consulting). Planning was informed by the Fort Nelson Caribou Steering Committee (FNCSC) which is comprised of representatives from Fort Nelson First Nation, Northern Rockies Regional Municipality, MFLNRORD and the Ministry of Energy Mines and Low Carbon Innovation

The spatial planning scope of the BCPRP is limited to four boreal caribou ranges which primarily overlap with the Fort Nelson Natural Resource District: Calendar, Maxhamish, Snake-Sahtaneh and Westside Fort Nelson. The Chinchaga range was excluded as a modernized land-use planning initiative was committed to within the Peace Natural Resource District and the Fort St. John Timber Supply Area which encompasses the Chinchaga range.

### **Delineation of Core Caribou Habitat and Ranges**

The BCTT delineated revised core caribou habitat and ranges as the first phase of the planning process. Core habitat zones incorporate both scientific information (habitat suitability mapping and telemetry data from radio-collared boreal caribou) and Indigenous knowledge of caribou distribution and habitat use. Core zones represent the most important habitat within caribou ranges containing the biophysical attributes required by caribou to carry out life processes necessary for survival and recovery. Areas outside of core zones and within caribou range are classified provincially as matrix habitat. Matrix habitat possesses low to no known periodic caribou use and is important for connectivity between suitable core habitats. These areas support primary prey and associated predators that have the potential to affect local caribou populations both directly and indirectly. Spatial analysis to map core habitat zones were performed utilizing ArcMap 10.6.1, ArcGISPro and R version 3.5.1.

The first step in delineating core habitat was the development of a caribou use layer. The caribou use layer was developed using four different datasets:

- Telemetry data from British Columbia (Mar 2011– Apr 2018)
- Telemetry data from Alberta (Mar 2007- Jun 2018)
- Local observation data gathered by Fort Nelson First Nation (Jul 2014 Mar 2016)
- Indigenous Knowledge from members of Fort Nelson First Nation.

B.C. telemetry data from all five boreal caribou herds were used by Caslys Consulting to develop visual maps representing relative use Kernel Density Estimates (KDE) by herd at the request of the MFLNRORD. This analysis was based on walk lines for each boreal herd and used an average bandwidth/search radius derived from daily movement rates. The latter was calculated for each herd and each year using the *kernelUD* function in the *adeHabitatHR* package in R. Density rasters were then generated using the Kernel Density Tool in ArcGIS at cell size of 200m to ensure movement corridors were captured and processing time was minimized. Density rasters were reclassified to five values representing frequency of caribou use based on quantiles (4:highest use; 3:high use; 2:medium use; 1:low use; 0:no known use). Herd rasters were merged into a single raster and where herds overlapped, the maximum value was selected. While this output provided a good understanding of relative use by collared female caribou, it did not

provide a full picture of caribou-use.

To ensure a more holistic picture of caribou use, the BCTT then compared the KDE output with local observation data, FNFN Indigenous Knowledge, and Alberta collar location data to ensure all areas were captured in the final caribou use layer. Three Areas of Interest (AOIs) were identified based on Indigenous knowledge, local observations, and telemetry data: the Hay River AOI, the Shekilie AOI and the Muskwa-Fort Nelson AOI. For these AOIs, caribou use scores were assigned to each of the newly developed polygons based on the strength of evidence of caribou use in

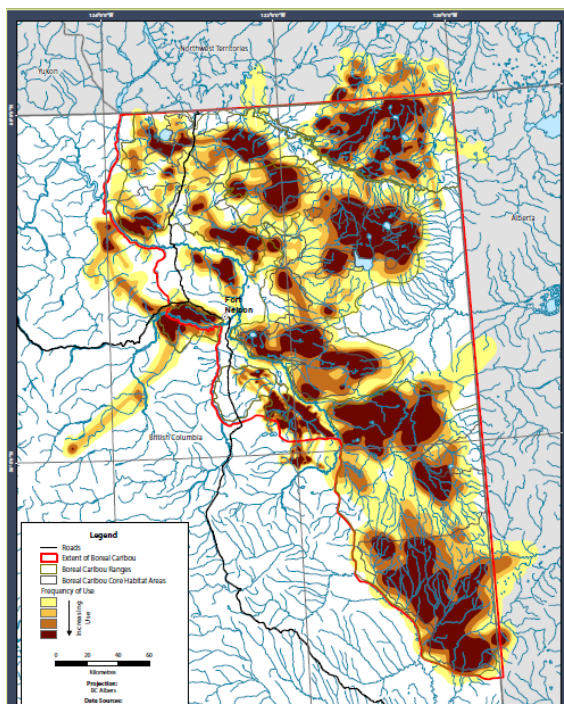


Figure 8: Boreal Caribou Relative-Use by Herd Kernel Density Output



that area. The Shekilie and Muskwa/Westside Fort Nelson polygons were scored as “medium use” based on local observation data and supporting TEK. The Hay River polygon was scored as “high use” based on Alberta telemetry data. To generate a final caribou use layer, newly developed polygons were converted to raster using the “Feature to Raster” tool and combined with the KDE layer using the “Mosaic to New Raster” tool. The final caribou use layer was converted to point format from raster using the “Raster to Point” tool. Areas identified for core delineation included all Very High, High, and Medium Caribou Use.

As a next step, the technical team assessed the Caribou Relative-Use KDE layer against Ducks Unlimited Enhanced Wetland Classification Data converted into boreal caribou habitat rating map developed by Arsenault (2014) and modified by FNFN to reflect their knowledge of B.C. boreal caribou use<sup>3</sup>. The Ducks Unlimited habitat suitability layer was converted from a raster to vector format. The habitat suitability layer was then intersected with the 1 km<sup>2</sup> fishnet grid using the “Intersect” tool. The “Select Layer by Attribute” tool and was used to identify cells that had >50% +3 and +2 habitat rankings (Treed Bog, Shrubby Bog, Treed Rich Fen, Treed Poor Fen, Tamarack Swamp, Conifer Swamp). The technical team utilized the layer to identify and delineate high-value habitat areas adjacent to known caribou use areas for inclusion into core habitat.

Following identification of core habitat, range boundaries were adjusted to better reflect current boreal caribou habitat use and were expanded to include all core habitat and were bounded against other ranges along major river systems or were clipped to provincial jurisdictional boundaries.

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<sup>3</sup> See Appendix 1: Medzih Action Plan. Link:  
[http://www.fortnelsonfirstnation.org/uploads/1/4/6/8/14681966/2017-sept-29\\_fnfn\\_medzih\\_action\\_plan\\_final\\_medres.pdf](http://www.fortnelsonfirstnation.org/uploads/1/4/6/8/14681966/2017-sept-29_fnfn_medzih_action_plan_final_medres.pdf)

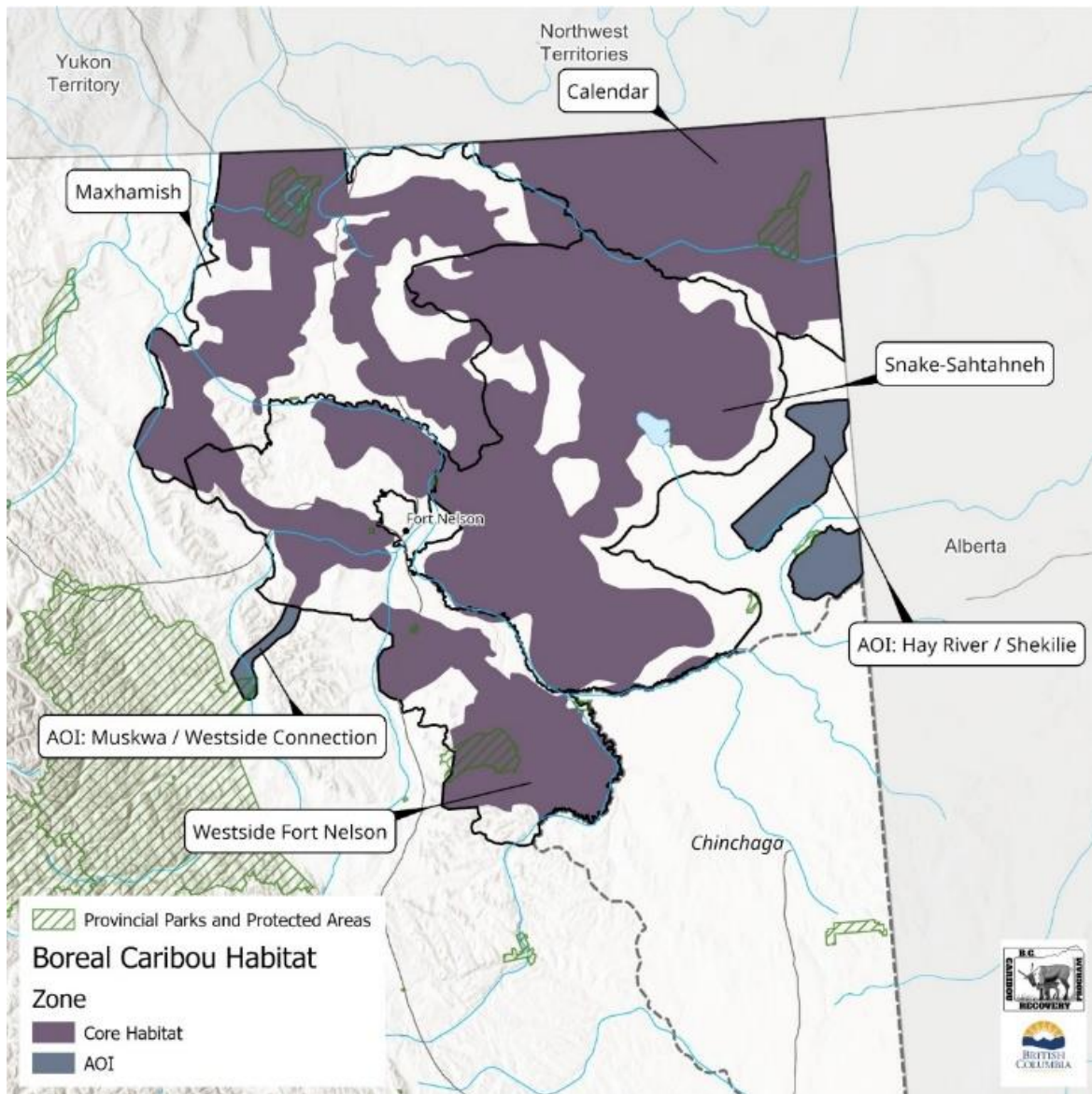


Figure 9: BCPRP Boreal Caribou Ranges, Core Habitat, and Areas of Interest

The next step after delineating core habitat was to understand the habitat condition of core habitat areas to inform management planning. The BCTT utilizing disturbance mapping developed for the Northeast Regional Strategic Environmental Assessment, a trusted information source by the parties<sup>4</sup>. The BCTT related density of disturbance to relative intactness using a ranking system that mimicked the ranking system for caribou

<sup>4</sup> Link to RSEA Dataset: <https://catalogue.data.gov.bc.ca/dataset/regional-strategic-environmental-assessment-disturbance-layer-northeast-bc>

use (Table 4); increasing levels of disturbance corresponded to decreasing relative intactness.

**Table 4.** Ranking system for caribou use and disturbance layers used in the analysis to develop management zones in boreal caribou range in British Columbia.

	Ranking of Habitat Intactness	Linear Feature Disturbance (km/km <sup>2</sup> ) <sup>1</sup>	Areal Disturbance (% of cell)
4	Very High (VH)	0 – 1	0
3	High (H)	1 - 2	0 – 5
2	Medium (M)	2 – 3	5 – 15
1	Low (L)	3 – 4	15 - 35
0	Very Low (VL)	>4	35+

The linear features layer included roads, railways, and seismic, transmission, and power lines (Figure 11). The density of linear features (km/km<sup>2</sup>) was calculated on a 1 x 1 km basis. The polygonal disturbance layer included cutblocks, well sites, infrastructure, and agriculture (Table 5) and was also developed as a 1 x 1 km grid. The linear feature and polygonal disturbance layers were combined into one disturbance layer. The lowest rank (i.e., the lowest relative intactness) of the two layers was assumed for each output cell.

Disturbance Type	Source Layer in RSEA Dataset
<b>Linear</b>	
Roads, railways, trails, and seismic cutlines	AnthroDisturbances_Linear_C_Merge
Power lines and transmission lines	IN_POW_B_Dissolve_Type
Pipelines	IN_OG_B_ATTRIBUTES
<b>Polygonal</b>	
Cutblocks	IN_FOR_B_ATTRIBUTES
Oil and gas facilities and wellsites	IN_OG_B_ATTRIBUTES
Agricultural land use areas	IN_AGRI_B_Dissolve
Mining activity	IN_MINE_B_Dissolve
All communities (includes airports and rural residential areas)	COMM_B_ATTRIBUTES
All compiled recreation facilities, such as camps or lodges	REC_B_Dissolve

*Figure 10: Linear and Polygonal Disturbances within the RSEA Dataset*

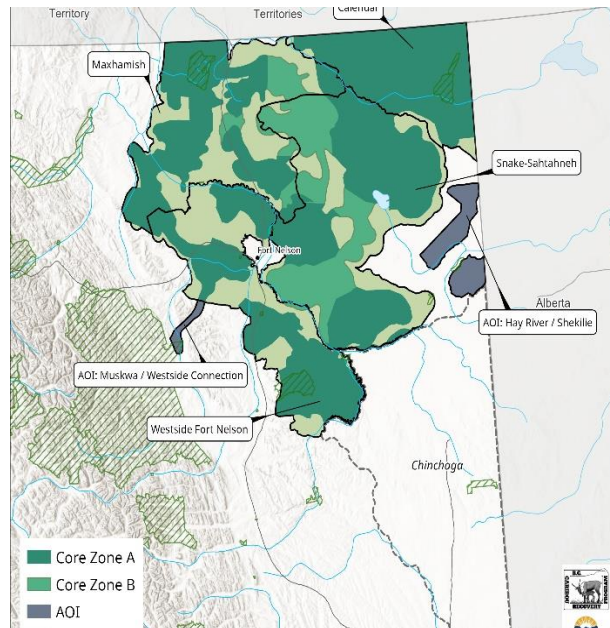
After developing the relative intactness layer, caribou use, and disturbance data were combined to develop a habitat class dataset. This dataset provided a visual reference of caribou use and habitat condition based on disturbance and could be used to inform priority areas for habitat protection. The “Join Data” tool was used to join the caribou use data to the disturbance data. The attributes describing the relative intactness and caribou use were concatenated using the “Calculate Field” tool. For example, a ‘Very Low’ intactness ranking combined with ‘Very High’ caribou use ranking would be classified as ‘VeryLowVeryHigh’. We then grouped the concatenated values (e.g., ‘VeryLowVeryHigh’) into 6 habitat classes (Table 6). Class 1 and 2 had the highest

conservation value i.e., the most intact and used habitat. While Class 3 areas had relatively high caribou use but were less intact. Class 4 and 5 areas have low to very low caribou use and are not intact. Lastly, Class 6 areas possessed high quality habitat and were relative more intact but had low caribou use.

Caribou Use	Intactness				
	VH	H	M	L	VL
Very High (VH)	1	1	2	3	3
High (H)	1	1	2	3	3
Medium (M)	2	2	3	3	3
Low (Low)	6	6*	4	4	4
VL (Very Low)	6*	6*	5	5	5

**Table 6.** Boreal caribou habitat classes based relative habitat use and intactness.

\* Areas of high-habitat suitability



Three categories of habitat were identified to be utilized for planning purposes:

- Core Habitat Zone A: Habitat Classes 1,2, and 6.
- Core Habitat Zone B: Habitat Classes 3.
- Matrix Habitat Zone C: Habitat Classes 4 and 5.

Range /Area of Interest	Core: Zone A (km <sup>2</sup> )	Core: Zone B (km <sup>2</sup> )	Total Core: (km <sup>2</sup> )	Matrix (Km <sup>2</sup> )	Range: (km <sup>2</sup> )
Calendar	5247	0	5247	339	5586
Maxhamish	5837	974	6811	3309	10,120
Snake-Sahtahneh	6493	3827	10,320	3084	13,404
Westside Fort Nelson	5570	47	5617	2754	8,371
AOI: Hay River / Shekilie	1238	0	-	-	-
AOI: Muskwa / Westside Connection	189	0	-	-	-

**Table 7.** Total area and percent of boreal caribou range covered by Core Habitat and Matrix Management Zones

## **Planning Framework**

Aligning with the provincial mandate for boreal caribou – to stabilize and achieve self-sustaining populations in all boreal caribou herds and to maintain a positive habitat trend across boreal caribou ranges in B.C. – the parties identified an overarching recovery goal: **to recover boreal caribou populations across their range to self-sustaining status and to a level capable of supporting an Indigenous sustenance harvest.**

A scenario planning approach was undertaken by the BCTT to support a transparent decision-making process through demonstrating potential socio-economic and cultural implications associated with the various scenarios and the risk to achieving the overarching BCPRP goal. Four initial scenarios were developed to address boreal caribou recovery in B.C. that represents a range in likelihood of achieving the self-sustaining caribou populations over time (Table 8).

Scenario	Intent	Likelihood of Achieving Goal for Each Herd Range			
		Calendar	Maxhamish	Snake-Sahtahneh	Westside Fort Nelson
1	65% undisturbed habitat target met or exceeded in all herd ranges	VH	H	H	H
2	65% undisturbed habitat target met in all herd ranges.	VH	H	H	H
3	65% average undisturbed habitat target across all herd ranges, with some ranges >65% undisturbed and others <65% undisturbed.	VH	M	H	M
4	<65% average across all herd ranges. Most herds <65% undisturbed.	VH	L	H	L

**Table 8:** Likelihood of achieving self-sustaining boreal caribou herds in British Columbia under the scenarios considered by the BCPRP. The BCTT evaluated each scenario using a 50-year time frame as a reasonable length of time to allow existing disturbances in protected areas of the range to recover. The evaluation follows the approach presented in ECCC 2019, Table E-1, which identified the following categories to describe the likelihood of achieving a self-sustaining population based on percent undisturbed habitat: Very high:  $\geq 90\%$ ; High  $< 90$  to  $\geq 60\%$ ; Moderate  $< 60$  to  $\geq 40\%$ ; Low  $< 40$  to  $\geq 10\%$ ; Very low:  $< 10\%$ . For each scenario, the BCTT assumed that the percentage of the range falling into restrictive management types (1 and 2) is a reasonable proxy for the level of disturbance in 50 years.

Scenario intents were drafted prior to the initiation of subsequent petroleum and natural gas (PNG) and forestry analyses to provide benchmark guidance on the scale of habitat protections that are required at a range and landscape scale for the various likelihoods of achieving the recovery goal. In the absence of herd-specific information on the relationship between disturbance levels and caribou population dynamics, guidance from the federal *Recovery Strategy for the Woodland Caribou, Boreal population, in Canada* (ECCC 2012) was used: maintaining 65% undisturbed habitat in a range will lead to a moderate 60% chance of a self-sustaining boreal caribou population. The BCTT used it as benchmark guidance with the understanding that protection would not necessarily equate to 65% undisturbed in the immediate future but with the understanding that protecting habitat secures large contiguous areas of the land base to allow for natural regeneration of disturbance and safeguards investments in restoration, such that the 65% undisturbed target is more likely to be met over time

## **Petroleum and Natural Gas Activity Analysis**

The objective of this analysis was to spatialize the tenure and activity status and categorize the landscape based on the probability of meaningfully protecting habitat and the likelihood of future development. The BC Oil and Gas Commission (OGC) significantly contributed to this analysis and provided tenure and activity status data for the PNG industry.

The BCTT worked with OGC staff to categorize the different tenure types (unconventional or conventional) and activities (abandoned, active, or potential wells) based on the probability of protecting these areas and the likelihood of future development (Table 8). Unconventional tenure refers to tenure to access gas extracted from relatively impermeable, source shale, whereas conventional tenure refers to tenure to access discrete pools/accumulations of gas. While the presence of either form of tenure decreases the ability to protect habitat, unconventional tenure is more likely to be developed than conventional tenure in northeastern BC. The influence of wells in caribou habitat is dependent on the status of the well. For example, active wells are more likely to have associated PNG activity than abandoned wells.

**Table 8.** Categorization of PNG tenure and activity data based on probability of protection and likelihood of development.

PNG Category	Probability of Protection	Likelihood of Development	Tenure Type		Well Status		
			Conventional	Unconventional	Abandoned	Active	Potential
1	High	Low					
2	High	Low			X		
3	Medium	Medium	X		X		
4	Low	High	X	X	X	X	X

First, Categories 3 and 4 were spatially defined. This was done by classifying active and potential wells and unconventional tenure as Category 4. Minimum bounding polygons were drawn around active and potential wells in conventional tenure and these regions were also classified as Category 4. Areas with conventional tenure located outside of Category 4 areas were classified as Category 3. These Category 3 areas represent areas with conventional tenure that contain abandoned wells or no wells at all.

Next, Categories 1 and 2 were defined. Abandoned wells in areas without tenure were buffered by 1.5 km, dissolved and a unique ID was calculated for the dissolved features. The unique ID was joined back to a layer containing abandoned wells in areas without tenure. Minimum bounding polygons were created for these abandoned wells, and areas overlapping the bounding polygons were classified as Category 2. Remaining regions that did not contain tenure and did not contain wells were classified as Category 1.

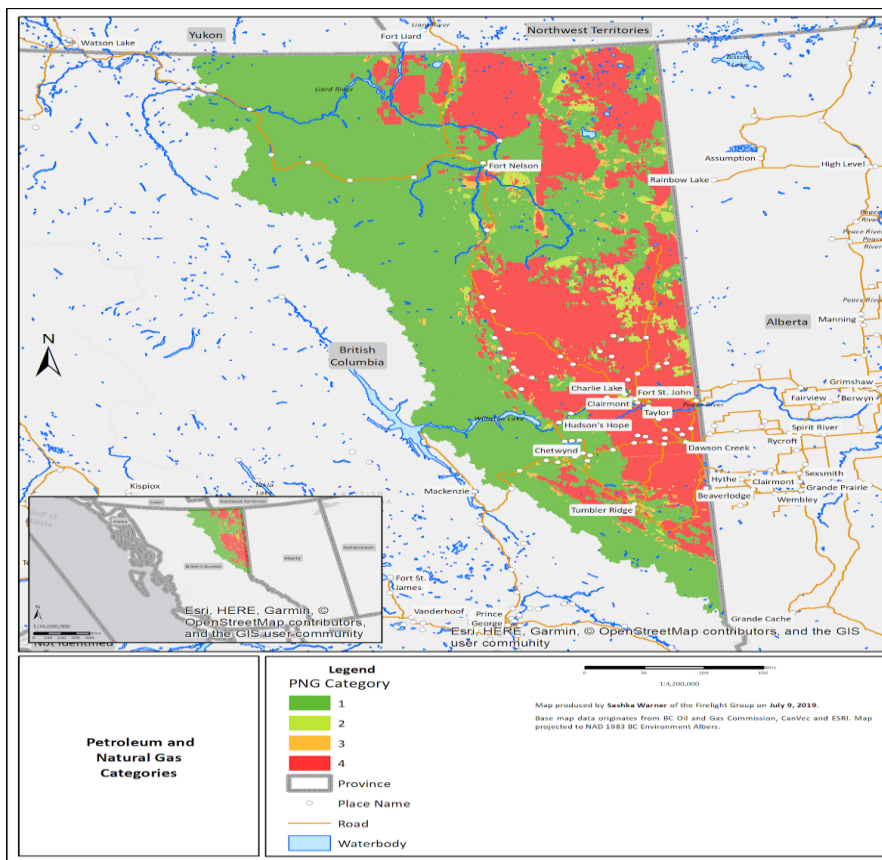


Figure 11: Petroleum and Natural Gas Categories expressing Probability of Protection across Northeast BC.

## **Forestry Analysis**

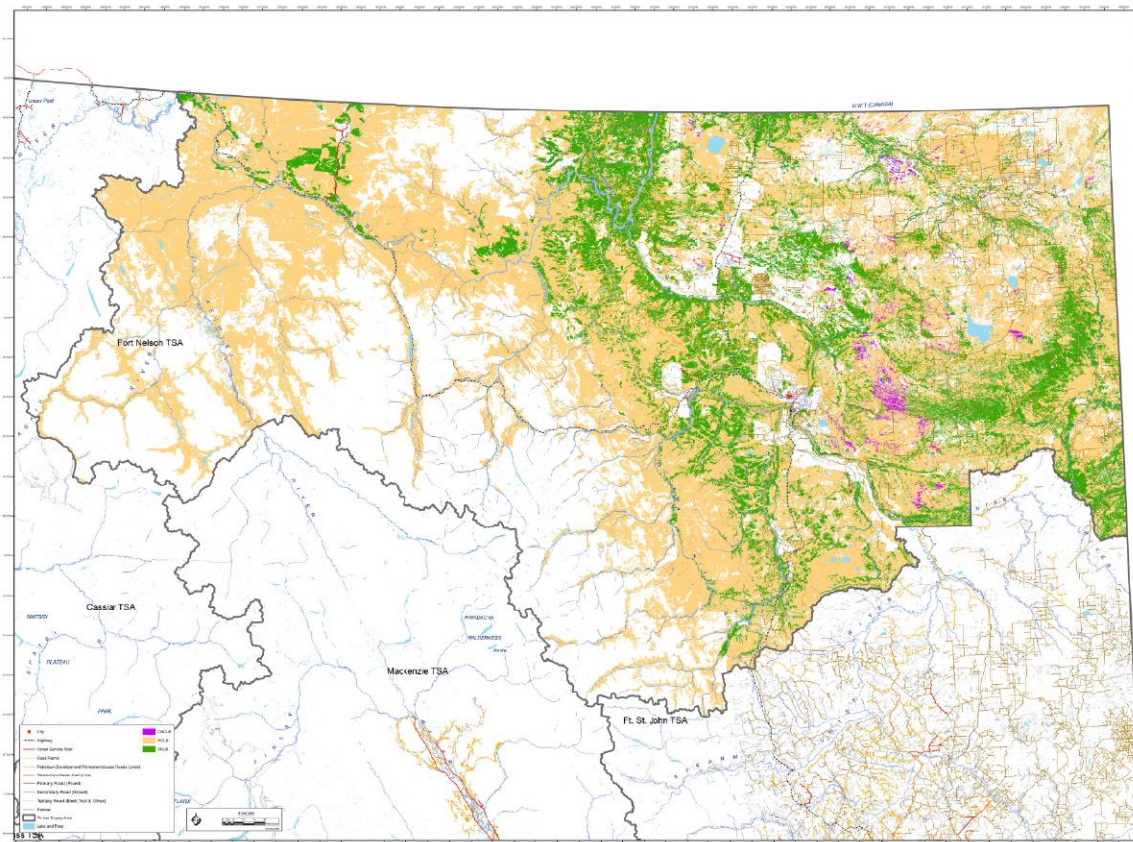
The objective of this analysis was to develop a spatial forestry layer that could be utilized to understand potential pressures from forestry, develop a scale of probability of protection and inform potential impacts associated with habitat protection. The Timber Harvesting Land Base (THLB), the portion of the Crown Forest Land Base was used as a metric for this assessment. The BCTT worked with Industrial Forestry Service to



develop a THLB layer classified by site index (SI) into three categories of merchantable timber: non-merchantable, low-volume merchantable, high-volume merchantable (Table 9). It was assumed that the probability of protection would be lowest in areas with high volumes of merchantable timber and highest in areas with non-merchantable timber or no THLB.

**Table 9.** Probability of protection of core caribou habitat based on no, low, and high volume THLB.

Timber Harvesting Land Base			Probability of Protection
Non-Merch (SI < 10 or Visual Quality Objective = Retention)	Low-Volume Merch (SI 10-17)	High-Volume Merch (SI > 17)	
		X	Low
	X		Medium
X			High



*Figure 12: Timber Harvesting Land base of the Fort Nelson Timber Supply Area*

## **Management Type Development and Scenario Building**

The PNG and forestry analysis provided a better understanding of the likelihood of development and the potential for protection within boreal caribou habitat. The results of these analyses were used to spatially define caribou habitat management types. Five management types with different management intents were developed for forestry and PNG (Figure 13).

Management Type	Management Intent: Forestry	Management Intent: Petroleum and Natural Gas
1	Full protection	Full protection
2	Full protection	Full Protection with variances for reclamation.
3	Full protection	Maintain Access; Conditional Development
4	Conditional forest harvest	Maintain Access; Conditional Development
5	Conditional forest harvest	Maintain Access; Conditional Development

*Figure 13: Proposed caribou habitat management types and their associated protections from forestry and petroleum and natural gas development.*

Types 1 to 4 overlap with core caribou habitat zones A and B, while Type 5 overlaps matrix management zone.<sup>5</sup> Guided by the Planning Framework the BCTT developed four conservation scenarios. The primary difference between the scenarios is the extent of conversion of Management Types 1,2,3 to Type 4. Areas identified for conversion were informed primarily from a forestry perspective with merchantability and access infrastructure, current regulation (WHAs and UWRs), caribou use and habitat class, and ecological considerations including habitat contiguity and landscape connectivity. Core and Area of Interest habitat areas identified for conversion are reflected in Management Type 4 within the various scenarios in Figure 6.

The initial scenarios illustrated potential trade-offs associated with caribou recovery and implications for natural resource access. It further provided an opportunity to identify highly merchantable stands within caribou range that contribute to a targeted economic fibre supply required to support regional investment in forestry operations.

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<sup>5</sup> After review of original management types and measures that could support achieving management intent, Management Type 1 & 2 were combined and re-classed as Management Type 1 within external facing BCPRP document. While maintaining intents, Management Type 3 was reclassified as Management Type 2 and Management Type 4 reclassified as Management Type 3 and Management Type 5 reclassified as Management Type 4.



Figure 14: Initial draft BCPRP Management Scenarios: Top Left (Management Scenario 1); Top Right (Management Scenario 2); Bottom Left (Management Scenario 3); Bottom Right (Management Scenario 4).



Range Area	Calendar	Maxhamish	Snake-Sahtahneh	Westside Fort Nelson	AOI: Hay River/ Shekile	AOI: Muskwa/West side Connection
<b>Scenario 1</b>						
Type 1	254,105	263,055	454,549	447,407	59,237	15,401
Type 2	11,333	6,256	85,173	10,259	5,464	-
Type 3	239,565	418,491	506,202	66,639	58,973	-
Type 4	-	-	-	-	-	-
Type 5	33,237	296,522	292,874	285,447	-	-
Park/Protected Area	20,384	27,665	1,617	27,395	117	3,451
<b>Scenario 2</b>						
Type 1	254,105	249,111	451,002	447,407	59,237	15,401
Type 2	11,333	6,631	84,169	10,259	5,464	-
Type 3	239,565	381,797	392,966	66,639	58,973	-
Type 4	-	-	117,788	-	-	-
Type 5	33,237	346,786	292,874	285,447	-	-
Park/Protected Area	20,384	27,665	1,617	27,395	117	3,451
<b>Scenario 3</b>						
Type 1	254,105	247,457	451,013	406,549	59,237	15,401
Type 2	11,333	6,126	84,169	9,414	5,464	-
Type 3	239,565	326,977	373,101	57,142	58,973	-
Type 4	-	53,504	137,642	17,371	-	-
Type 5	33,237	350,260	292,874	319,276	-	-
Park/Protected Area	20,384	27,665	1,617	27,395	117	3,451
<b>Scenario 4</b>						
Type 1	254,105	142,546	451,013	204,114	-	-
Type 2	11,333	5,121	84,169	5,965	-	-
Type 3	239,565	262,190	373,090	50,025	-	-
Type 4	-	224,208	137,653	230,373	123,674	15,401
Type 5	33,237	350,260	292,874	319,276	-	-
Park/Protected Area	20,384	27,665	1,617	27,395	117	3,451

## **Values Assessment and Scenario Refinement**

Under guidance by the FNCSC and to inform discussion on the range of implications of scenarios for other values and potential refinements to scenarios, assessments were completed on multiple identified values. Performance measures were identified for: caribou recovery likelihood of self-sustainability, impacts to forest-profile, access to PNG resource, other ecological considerations including implications for moose, furbearer and habitat resilience, non-indigenous trapping, recreation, implementation costs, local employment and FNFN cultural values.

After review of the performance measures, the FNCSC tasked the BCTT with revising existing Scenario Three to increase protections in Maxhamish and Westside Fort Nelson

range boundaries as well as the Hay River and Shekilie AOIs, while minimizing impacts to highly merchantable forest profile and improving alignment with FNFN cultural values. Through its Land Stewardship Plan, FNFN identified spatial cultural values to inform this task.

The BCTT revised Scenario 3 spatial linework to develop a revised scenario that optimized overlap of cultural values with Management Types 1 and 2 and identified additional areas of the THLB and area-based forest tenures from Management Type 1 & 2 for conversion to Management Type 3.

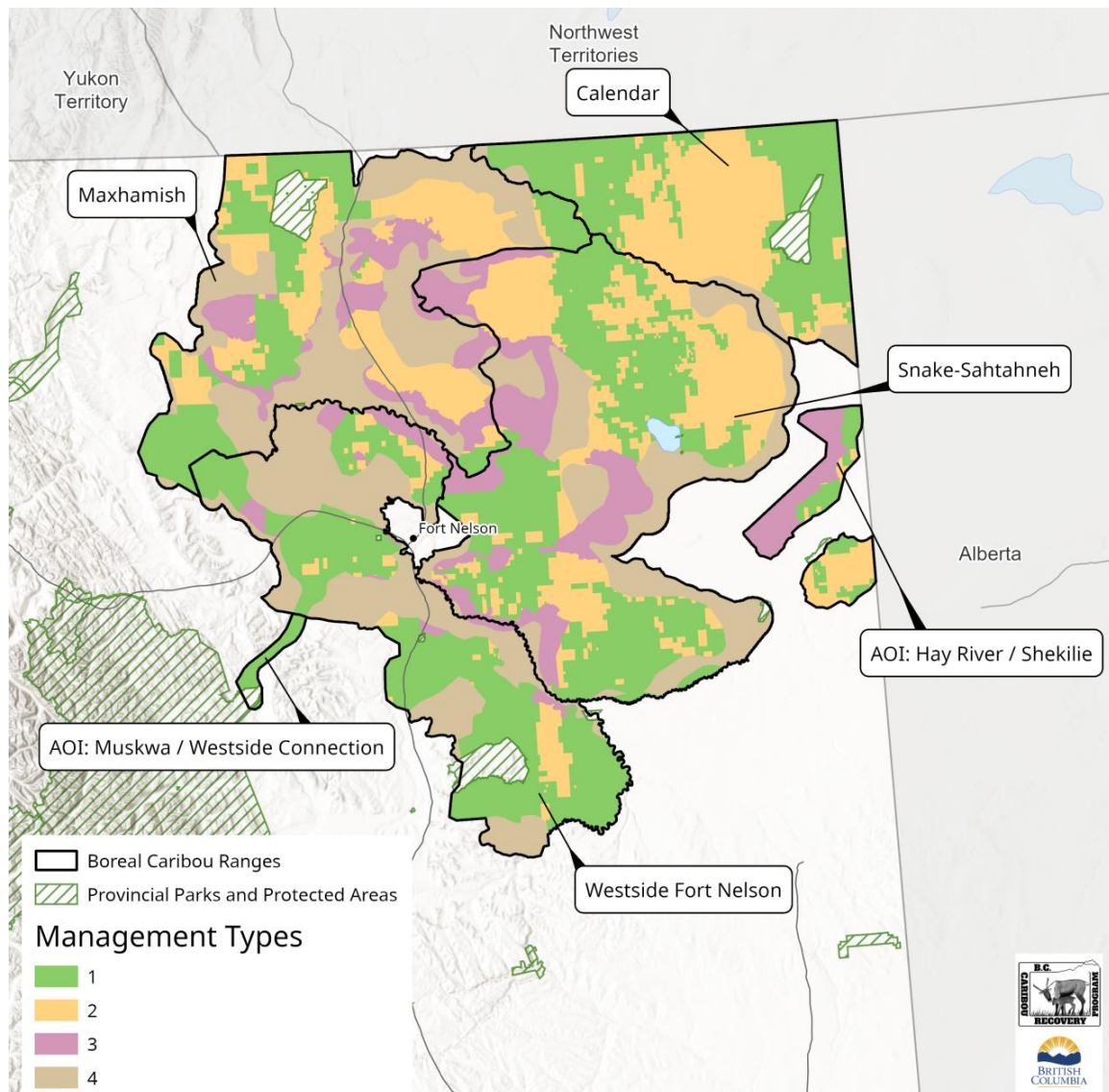


Figure 15: BCPRP Revised Scenario 3.

## Appendix: Range Disturbance Summary

Outlined below are current disturbance levels of boreal caribou ranges estimated by the B.C. Government using a geographical information systems approach. Disturbance information was collated from the B.C. Geographic Warehouse and is up to date to December 2021. The source-data information is consistent with the disturbance data from the Regional Strategic Environmental Assessment. Amounts differ from Environment and Climate Change Canada's (ECCC) 2011 disturbance analysis which used remote sensing satellite imagery. When calculating cumulative disturbance, all disturbance sources (and buffers where applicable) are flattened and amalgamated to ensure that overlapping disturbances are not double counted. As such, each individual disturbance type cannot be added up to equal the cumulative disturbance based on this table alone.

There are unresolved issues relating to accuracy with both methods of disturbance assessment. The reported disturbance does not reflect potential regeneration of linear feature disturbances, and as such likely represents an overestimate of potential disturbance. Disturbance buffers of 500m are included in disturbance assessments to account for behavioural responses of caribou to disturbance and provide for a representation of the zone of influence of a disturbance feature, consistent with ECCC analyses. BC Government estimates are reported as non-buffered and buffered.

	Herd Name	Calendar		Maxhamish		Snake-Sahtaneh		Westside Fort Nelson	
	Habitat	Herd boundary		Herd boundary		Herd boundary		Herd boundary	
	Area (ha)	558,625		1,011,989		1,345,052		832,511	
Habitat disturbances (500m buffer)	Agriculture	0.0%	(0.0%)	0.0%	(0.0%)	0.0%	(0.0%)	0.0%	(0.2%)
	Airstrip	0.0%	(0.1%)	0.0%	(0.0%)	0.0%	(0.5%)	0.0%	(0.0%)
	Mine	0.0%	(0.0%)	0.0%	(0.7%)	0.0%	(0.4%)	0.0%	(0.4%)
	Pipeline	0.1%	(3.7%)	0.1%	(4.2%)	0.1%	(9.2%)	0.1%	(3.1%)
	Rail	0.0%	(0.0%)	0.0%	(0.0%)	0.0%	(0.7%)	0.0%	(0.0%)
	Road	3.8%	(59.1%)	3.2%	(49.8%)	4.0%	(61%)	3.2%	(48.9%)
	Seismic	1.7%	(91.4%)	1.2%	(82.2%)	2.8%	(94.9%)	1.4%	(78.5%)
	Transmission Line	0.0%	(0.0%)	0.0%	(0.0%)	0.1%	(1.1%)	0.0%	(0.3%)
	Urban	0.0%	(0.4%)	0.0%	(1.6%)	0.0%	(1.6%)	0.0%	(0.5%)
	Well	0.1%	(5.5%)	0.0%	(0.9%)	0.0%	(0.8%)	0.0%	(0.2%)
	Cutblocks 1980-2020	0.0%	(0.0%)	2.4%	(11.1%)	0.6%	(3.5%)	3.3%	(16.8%)
	Wildfires 1981-2021 (no buffer)	16.1%	(16.1%)	1.3%	(1.3%)	4.0%	(4.0%)	2.7%	(2.7%)
	Cumulative Total 1981-2021 (500m buffer)	20.6%	(95.3%)	7.6%	(88%)	10.9%	(96.2%)	9.9%	(87.3%)

## **Appendix: Forestry and Petroleum Natural Gas Implication Summary**

Outlined below is an assessment of implications associated with proposed conservation measures of the BCPRP for the forestry and petroleum and natural gas sectors. As noted in the BCPRP there are tangible and intangible co-benefits associated with proposed conservation measures including investments in habitat restoration, maintaining biodiversity, climate change mitigation, intact landscapes, restoring ability to exercise treaty rights, ecosystem health and the cultural linkages. These measures are not articulated in this summary but are recognized by the parties as important considerations for decision-makers.

### **Forestry**

The Fort Nelson Timber Supply Area (TSA) is the second largest in British Columbia covering an area of almost 9.9 million hectares. The forests in this area consist mainly of old and mature stands of spruce, pine, aspen, cottonwood, and birch. Aspen is the most common species within the Timber Harvesting Land Base (THLB) both in area and by volume.<sup>6</sup> The current Allowable Annual Cut (AAC) for the TSA is 2,582,250 cubic metres (m<sup>3</sup>) with an additional 217,650 m<sup>3</sup> available for harvest through the Fort Nelson Community Forest for a combined total AAC of 2,800,000 m<sup>3</sup>. Forestry and wood products manufacturing have historically been an important part of the economy of the Northern Rockies Regional Municipality (NRRM). Forest harvesting peaked around 2002, when nearly 1,500,000 m<sup>3</sup> were harvested. The closure of local processing facilities in 2008 resulted in a rapid decline in forestry activity, with negligible levels of harvesting occurring in the region since. Revitalizing the forestry sector in the region and building the skilled labour force is a shared interest of the Province, Fort Nelson First Nation and the NRRM.

To support an understanding of the socio-economic implications of the draft BCPRP for a future forestry sector, an assessment of potential impacts was completed by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development's

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<sup>6</sup>[https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/fort\\_nelson\\_tsa\\_discussion\\_paper\\_2018.pdf](https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/fort_nelson_tsa_discussion_paper_2018.pdf)

Forest Analysis Inventory Branch and the Economics and Trade Branch. Given current negligible harvesting levels, potential impacts on the forest sector need to be understood from the perspective of opportunity cost or foregone benefit of implementing the BCPRP, as there are no realized impacts on existing industrial operations or employment. The table below summarizes the maximum potential estimated opportunity cost impacts associated with the current proposed measures of the BCPRP.

	Volume Available for Harvest (m <sup>3</sup> )	Potential Employment	Potential Tax Revenue (\$)	Potential Crown Stumpage (\$)	Potential GDP (\$)
Current Available Volume	2800000	1333	19,263,351	19,483,476	220,016,784
BCPRP Adjusted Volume	2394099	1140	16,470,198	17,894,176	188,114,724
Opportunity Cost Impact	489497	233	3,368,408	2,243,243	38,472,344

The estimates assume that the full AAC is harvested annually. Given that the full AAC volume is unrealized and under-committed it is assumed that negative impacts would be reduced. Further, the assessment utilizes impact coefficients for the Northern Interior and it is recognized that forestry activity in the Northeast Region does not conform to forestry activity of other northern areas and estimated impacts, particularly employment, are on the high side.

### **Petroleum and Natural Gas**

Petroleum and natural gas (PNG) resource exploration, development and production in BC primarily occurs within the Western Canadian Sedimentary Basin (WCSB), which covers 14 million hectares of northeast B.C. Within the WCSB, PNG resources occur in conventional and unconventional plays. The most significant unconventional play trends in northeastern BC are the Montney play (tight gas/liquids/oil potential) in the central WCSB and the Liard, Horn River and Cordova Basins (shale gas potential) in the northern WCSB. Conventional plays were the main focus of PNG exploration and development activity for the past several decades but following the recent discoveries of large unconventional plays in BC, the primary focus of new PNG development activity has shifted to the extensive unconventional plays in the Montney play. The four herd ranges of the BCPRP (Maxhamish, Snake-Sahtahneh, Calendar and Westside Fort



Nelson) overlap one or more of the Liard, Horn River and Cordova Basins within the northern WCSB.<sup>7</sup>

The BCPRP maintains access to all existing tenured PNG resources. In recent years, owing to a lack of industry interest in further development within the northern WCSB, tenure has been reverting back to the Crown. Comparison of herd range PNG resource potential based solely on quantitative economic estimates is not advisable. There are uncertainties with the estimated economic values and there is not necessarily a direct correlation between the magnitude of the economic value estimates and the likelihood of future PNG resource development. The BCPRP maintains conditional access to existing tenured PNG resources. The table below provides an estimate of the proportion of reach range or Area of Interest tenured and the estimated potential resource volumes (conventional and non-conventional) within tenured and untenured locations.

Herd Range	Range Area (Ha)	Tenured Range Area	Untenured Range Area	Estimated Potential PNG Resource Volumes (Tcf)		
				Tenured Locations	Untenured Locations	Total
Calendar	558,625	33%	67%	4	5	9
Maxhamish	1,011,989	40%	60%	42	72	114
Snake-Sahtahneh	1,340,416	37%	63%	14	16	30
Westside Fort Nelson	837,147	10%	90%	3	32	35
AOI: Hay River / Shekilie	123,791	41%	59%	0.1	0.1	0.2
AOI: Muskwa / Westside Connection	18,852	0%	100%	-	0.03	0.0

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<sup>7</sup> Petroleum and Natural Gas Resource Assessment for Caribou Herd Ranges in Northeastern BC. 2018. Ministry of Energy, Mines and Petroleum Resources – Oil and Gas Division – Tenure and Geoscience Branch