

Current Condition Report for Grizzly Bear in the Cariboo Region | 2019 Analysis

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Companion Documents

- Interim Assessment Protocol for Grizzly Bear in British Columbia – Standards for Assessing the Condition of Grizzly Bear Populations and Habitat under British Columbia’s Cumulative Effects Framework. Version 1.2 (October 2020). Prepared by the Provincial Grizzly Bear Technical Working Group – Ministry of Environment and Climate Change Strategy and Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 45 pp.
<https://www2.gov.bc.ca/assets/download/B2D0CE24E5524AC6B4910E759BF65A97>
- Cumulative Effects Framework Interim Policy for the Natural Resource Sector (October 2016). 32 pp. <https://www2.gov.bc.ca/assets/download/9342A9C980A7440C9E5A15EA591912D4>
- Grizzly Bear Value Summary (April 2016) – Draft for Discussion. Prepared by the Ministry of Environment and Ministry of Forests, Lands and Natural Resource Operations. 16 pp.
<https://www2.gov.bc.ca/assets/download/23A5372CF84444A7887B841A4B33E9CF>
- Cumulative Effects Interpretation and Management Guidance (IMG) Key – Grizzly Bear Value: Cariboo Region. (November 2024). Prepared by the Ministry of Water, Land and Resource Stewardship.

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TABLE OF CONTENTS

List of Figures	2
List of Tables	3
Executive Summary	4
List of Acronyms	6
Glossary	7
1 Introduction	8
2 Grizzly Bear Overview	9
2.1 Habitat and Diet.....	9
2.2 Distribution and Management in the Cariboo Region.....	11
2.3 Potential Threats to Grizzly Bears	12
2.4 Grizzly Bear Objectives and Legal Protection	15
2.4.1 Provincial Broad Objectives and Plans.....	15
2.4.2 Regional Objectives AND Plans.....	15
2.4.3 Provincial Legislation – Tools for Grizzly Bear Protection	15
3 Indicators and Methodology	17
3.1 Methodology and Data.....	17
3.2 Assessment Units.....	17
3.3 Indicators	17
3.4 Interpreting Flagged Units on the Landbase.....	19
4 Assessment Results by Indicator	20
4.1 Population Rank	21
4.2 Number of Bears (BEAR DENSITY)	23
4.3 Mortality Rate	26
4.4 Road Density	29
4.5 Core Security Areas	32
4.6 Front Country	35
4.7 Hunter Day Density	38
4.8 Poor Forage Potential (BEC Mid-Seral Dense Conifer)	41
4.9 Quality Food	44
4.10 Habitat Protection	48

5 Conclusion and Next Steps	52
5.1 Main Observations	52
5.2 Further Analysis and Investigation	54
5.3 Recommended Next Steps	55
6 References	58
7 Appendices.....	60
Appendix 1 – Grizzly Bear Objectives and Legal Protection.....	60
Appendix 2 – Conceptual Model	63
Appendix 3 – Data	64

List of Figures

Figure 2.1 Habitat capability map for the Cariboo Region (2020).....	10
Figure 2.2 Map of the Cariboo Natural Resource Region depicting GBPUs, WMUs, parks and protected areas and major roads.	11
Figure 4.1 Population Rank – Cariboo Region.....	22
Figure 4.2 Bear Density – Cariboo Region	25
Figure 4.3 Female Grizzly Bear Mortality – Cariboo Region.....	28
Figure 4.4 Road Density – Cariboo Region.....	31
Figure 4.5 Core Security Areas – Cariboo Region	34
Figure 4.6 Front Country – Cariboo Region	37
Figure 4.7 Hunter Day Density – Cariboo Region	40
Figure 4.8 Poor Forage Potential (BEC Mid-Seral Dense Conifer) – Cariboo Region	43
Figure 4.9 Quality Food (Salmon and BEI Capability) – Cariboo Region	46
Figure 4.10 Quality Food Sub-Indicators – Cariboo Region.....	47
Figure 4.11 Habitat Protection – Cariboo Region.....	50
Figure 4.12 WHA and EBM Presence – Cariboo Region	51

List of Tables

Table 3.1 Overview of Grizzly Bear Assessment Indicators.....	18
Table 3.2 Colour scale used in assessment maps for representing indicator condition in relation to benchmarks	19
Table 4.1 GBPU Summary Table	24
Table 4.2 Number of Bears Indicator Relevance and Precision Ranking	25
Table 4.3 Mortality Rate Indicator Relevance and Precision Ranking.....	27
Table 4.4 Road Density Indicator Relevance and Precision Ranking.....	30
Table 4.5 Core Security Areas Indicator Relevance and Precision Ranking.....	33
Table 4.6 Front Country Indicator Relevance and Precision Ranking	36
Table 4.7 Hunter Day Density Indicator Relevance and Precision Ranking.....	39
Table 4.8 Poor Forage Potential Indicator Relevance and Precision Ranking	42
Table 4.9 Poor Forage Potential Indicator Relevance and Precision Ranking	45
Table 4.10 Habitat Protection Indicator Relevance and Precision Ranking.....	49

EXECUTIVE SUMMARY

This current condition assessment for Grizzly Bear in the Cariboo Natural Resource Region (the Cariboo Region) is carried out under British Columbia's Cumulative Effects Framework (CEF) and follows the methods set out in the Interim Assessment Protocol for Grizzly Bear in British Columbia (2020). Using data from 2019, 10 indicators are used to describe and assess the status of grizzly bears and habitat relative to the provincial government's broad objectives for grizzly bears.

Risks to grizzly bears are assessed and reported at two scales: large Grizzly Bear Population Units (GBPUs) and smaller Landscape Units (LUs). Populations are managed within the former, while habitat objectives are managed within the latter.

This assessment provides insights to where cumulative effects on grizzly bears are occurring and where management attention may be needed in the Cariboo Region. Cumulative effects that are observed in the region are largely the result of human activities on the landbase, resulting in negative human-bear interactions and habitat displacement (either through direct alteration of habitat or resulting avoidance of habitat). Natural disturbance from mountain pine beetle infestation and forest fires have also contributed to cumulative effects in the region that may also impact grizzly bears.

The area with the highest potential impacts to grizzly bears is the area surrounding the extirpated area that runs through the center of the Cariboo Region. Due to human presence and activities, the likelihood of lethal human-bear encounters is higher (as shown in the flagged areas for the mortality rate, front country, road density, and hunter day density indicators). Impacts are driven by human activity in communities, including forestry, rural and agriculture activities, and expansion into the backcountry. Even though natural food sources such as salmon and vegetation are found within the region, non-natural food sources including garbage, agriculture crops, fruit trees and livestock are also present and make management complex in this area.

Grizzly bear habitat is largely protected by parks and wildlife habitat areas (WHAs) in the Cariboo Region. Although these protected areas exist, they are disconnected across the region, making it more difficult for grizzly bears to travel between these areas. Notably, the Quesnel Lake North and South Chilcotin GBPUs have the highest percentage of overall habitat protection in the region due to protection measures such as provincial parks (Bowron Park, Cariboo Mountains Park, Ts'il?os Park, Big Creek Park, Churn Creek Protected Area) and WHAs. These areas also have high habitat capability as the landscape and food resources are present to support grizzly bears and low human presence. Management attention should be focused on maintaining and enhancing these areas with high habitat protection, habitat capability, and quality food sources, while also enhancing connectivity between these areas to ensure habitat requirements are met and to maintain appropriate core security.

Resource specialists and decision-makers should consider mitigation measures when reviewing proposed land use activities in the Cariboo Region to reduce incremental loss of grizzly bear habitat and mortality pressure on grizzly bears. The grizzly bear cumulative effects interpretation and management guidance (IMG) key can be used by decision-makers and support staff to guide recommendations based on this report. From the results of this assessment, mitigation measures could include:

- Establishing protected areas (park and protected areas, WHAs, Wildlife Management Areas [WMAs] and Specified Areas [SAs]) in locations where grizzly bear habitat capability is high to maintain habitat protection, quality food sources, and core security and conduct further grizzly bear habitat mapping to identify or refine areas in which to focus additional conservation efforts;
- Improving connectivity between protected areas and/or areas with high habitat protection and capability using habitat mapping;
- Expanding bear conflict planning and public education to reduce mortality and restore access to secure quality food and habitat and to improve proactive non-natural attractant management;
- Deactivating and/or restricting access on roads and corridors (permanent or seasonal) in high priority grizzly bear habitat;
- Adjusting forest planning practices and access management in priority grizzly bear habitat to conserve or enhance the long-term availability of seasonal foraging habitats (e.g., berry production) and to maintain core security;
- Adjust range planning and practices to minimize conflicts between livestock and grizzly bears, particularly so that bears cannot access dead livestock and grain;
- Adjust best practices for other major industrial projects to mitigate project impacts to grizzly bear populations and habitat in areas that are shown to have high risk to grizzly bears or are located in highly capable habitat; and,
- Conducting further research on climate change throughout the Cariboo Region to see how grizzly bears may respond to changes in food (e.g., salmon and berries) and habitat over time

LIST OF ACRONYMS

B.C.	British Columbia
BEC	Biogeoclimatic Ecosystem Classification
BEI	Broad Ecosystem Inventory
CCLUP	Cariboo-Chilcotin Land Use Plan
CEF	Cumulative Effects Framework
CID	Compulsory Inspection Database
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EBM	Ecosystem Based Management
FOR	Ministry of Forests
FRPA	<i>Forest and Range Practices Act</i>
GBPU	Grizzly Bear Population Unit
IMG Key	Interpretation and Management Guidance Key
LEH	Limited Entry Hunt
LU	Landscape Unit
LUO	Land Use Order
MOECCS	Ministry of Environment and Climate Change Strategy
PEM	Predictive Ecosystem Mapping
SA	Specified Area
SARA	<i>Species at Risk Act</i>
TEM	Terrestrial Ecosystem Mapping
VRI	Vegetation Resources Inventory
WLRS	Ministry of Water, Land and Resource Stewardship
WHA	Wildlife Habitat Area
WMA	Wildlife Management Area
WMU	Wildlife Management Unit

GLOSSARY

Benchmarks	Reference points that support interpretation of the condition of an indicator or component. Benchmarks are based on scientific understanding of a system and may or may not be defined in policy or legislation. For the purpose of the CEF, benchmarks are identified to support assessment and reporting in relation to broad objectives (CEF Interim Policy, 2016).
Cumulative effects	Under the Provincial Cumulative Effects Framework, cumulative effects are defined as changes to environmental, social, and economic values caused by the combined effect of past, present, and potential future human activities and natural processes.
Grizzly Bear Population Units (GBPUs)	Grizzly bears exist as a set of interconnected populations, which can be divided into sub-populations based on bear ecology using grizzly bear population units. Grizzly bear population units delineate individual bear populations for conservation and management. In total, there are 55 GBPUs in B.C.
Landscape Units (LUs)	Landscape units are areas of land and water used for long-term planning of resource management activities, with an initial priority for biodiversity conservation. They are important in creating objectives and strategies for landscape-level biodiversity and for managing other forest resources.
Precision	Precision is defined as the level of confidence associated with the data inputs used in each indicator. Precision ranking (i.e., High vs. Moderate vs. Low) indicates the level of confidence in the indicator output/results derived from the input within the region.
Relevance	Relevance is defined as the level of importance of each indicator within the region (i.e., all indicators do not necessarily have the same level of relevance throughout the province).
Utility	Utility is defined as ability to effectively manage the value in response to the indicator result. Strategic, tactical, and/or operational management actions may be taken.
Wildlife Management Units (WMUs)	Delineated administrative regions for wild game management. The Province of B.C. is divided into nine administrative regions, having a total of 225 WMUs.

1 INTRODUCTION

The Province of British Columbia (B.C.) is committed to sustainable resource management. As resource demands grow, we must be able to measure the effects of natural resource activities, large and small, on the values important to the people of British Columbia. To meet this need, the Province of B.C. (the Province) established a Cumulative Effects Framework (CEF) in 2014 to guide the assessment of cumulative effects¹ across natural resource sectors and support the integration of assessment results in natural resource decision-making.

As part of the CEF, the Province carried out a provincial assessment of the current condition of several resource values of importance to British Columbians, using indicators for each value that illustrate the cumulative effects of natural resource activities on these identified values.

This report provides an overview of the current condition of grizzly bear populations within the Cariboo Natural Resource Region (the Cariboo Region) as of 2019. This assessment uses a methodology that examines the status of grizzly bear populations, the capacity of grizzly bear habitat to provide adequate food and shelter, and the risks associated with human presence in grizzly bear habitat.

In particular, this report includes:

- An overview of grizzly bear ecology and habitat requirements, threats to habitat and survival, and government objectives and legal protection tools for the species;
- An overview of indicators and methods used to assess the current condition of grizzly bears within the Cariboo Region, including any limitations of the assessment;
- Results and regional interpretation for each indicator, including assessment maps, and links to further data;
- A summary of the results and key contributing factors influencing the results; and,
- A summary of opportunities to enhance grizzly bear populations and habitat within the Cariboo Region.



The results generated from this report are based on a strategic-level provincial assessment and are intended to inform various resource management decisions that influence the conservation and management of grizzly bear populations and habitat in the Cariboo Region. This report should be used in conjunction with the Cariboo Region grizzly bear cumulative effects interpretation and management guidance (IMG) key aimed to further assisting management decisions as one line of evidence.

Overall, this report aims to support and inform collaborative discussions on cumulative effects between government decision-makers, First Nations, natural resource industries, and community stakeholders to ensure that cumulative effects are identified, considered, and managed appropriately.

¹ Under the Cumulative Effects Framework, cumulative effects are defined as changes to environmental, social, and economic values caused by the combined effect of past, present and potential future human activities and natural processes.

2 GRIZZLY BEAR OVERVIEW

In B.C., grizzly bears have a significant ecological, economic, and cultural importance. Ecologically, they are an umbrella species that reflect the overall health of the ecosystems they inhabit since they rely on relatively large and varied home ranges. Many First Nations in B.C. also include grizzly bears in their cultural and spiritual traditions, histories, and philosophies and ecotourism and bear viewing are also important to the local economy.

Grizzly bears are identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a species of “special concern” in Canada, given their sensitivity to human activities and disturbance (COSEWIC, 2012). Grizzly bears are also identified as a species of Special Concern (Schedule 1) of the *Species at Risk Act* (SARA) (Government of Canada, 2011). Under B.C.’s Conservation Framework, grizzly bears are identified as a high priority for conservation (BC MELP, 1995a & BC MELP 1995b).

The following sections provide a general overview of grizzly bears in the Cariboo Region, including a description of their habitat requirements, dietary preferences, and distribution. The potential threats to grizzly bear populations and habitat in the Cariboo Region are also described below along with provincial and regional management objectives that are in place for the species.

2.1 HABITAT AND DIET

Grizzly bears require large, connected areas to meet their life requisites. Large-scale connectivity of habitat is very important for grizzly bear populations, with their home range sizes being proportionate to the quality, quantity, and distribution of food.

Grizzly bears favour habitats such as grasslands and shrublands that are integrated with forests, as well as subalpine meadows, avalanche chutes and forests, alpine areas, flood plains, and riparian areas—all of which are utilized at different times throughout the year. Recently disturbed areas, like burns and harvested areas, are important for foraging (Munro et al., 2006; Nielsen et al., 2008; Souliere et al., 2020). However, the benefit of post-harvest areas is lost if road densities are not managed to minimize associated human-caused mortality (Nielsen et al., 2008).

As a grizzly bear’s habitat use varies with the seasons, so does a grizzly bear’s diet. Forbs, grasses, sedges, and other green vegetation is consumed in spring and early summer, whereas berries, roots and salmonids are consumed in late summer and fall. Berries, in particular, play a key role in hyperphagia, the period when bears must store enough fat reserves for hibernation, and in the case of females, production of cubs. Terrestrial protein sources such as ants, ground squirrels, and ungulates are consumed throughout the year. Consumption of ungulates varies spatially and temporally with availability, and ungulates form a more substantial portion of the diet in areas where they are abundant (Mowat and Heard, 2006).

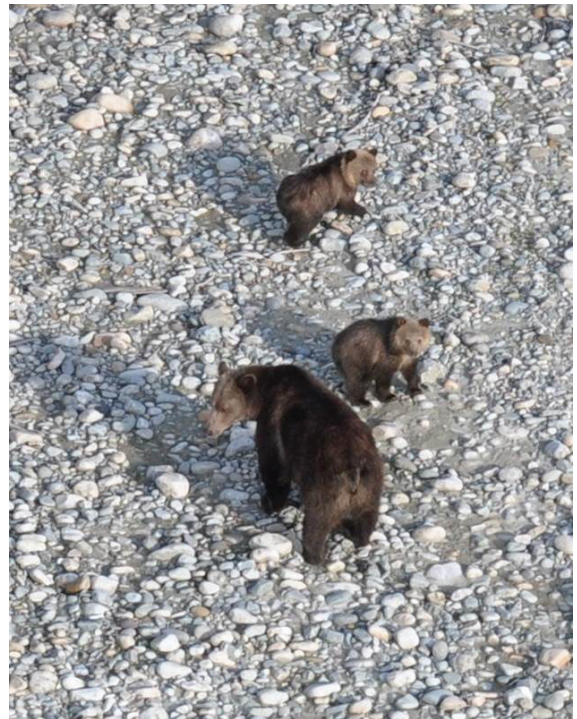


Photo: Pat Dielman

In the interior, including the Cariboo, kokanee appear to be an important protein source (Mowat and Heard, 2006). Consumption of salmon is largely limited to coastal populations, but salmon are important for bears at Quesnel Lake and Wells Gray Park (Mowat and Heard, 2006).

Grizzly bear habitat capability mapping is based on 1:250,000 scale Broad Ecosystem Inventory (BEI) mapping. As defined by Hamilton and Austin (2004), "habitat capability is the inherent, idealized ability for the land to support a specific density of grizzly bears. Different ecological units are ranked by capability density based on their relative habitat productivity independent of the current structural stage of forested habitats or proximate human influence."

As illustrated in Figure 2.1, the majority of the Cariboo Region has low to moderate grizzly bear capability, with higher capability habitats occurring in the east and the southwest. These areas may be associated with salmon spawning area where grizzly bears will congregate in the fall to consume high-protein salmon sources before hibernation.

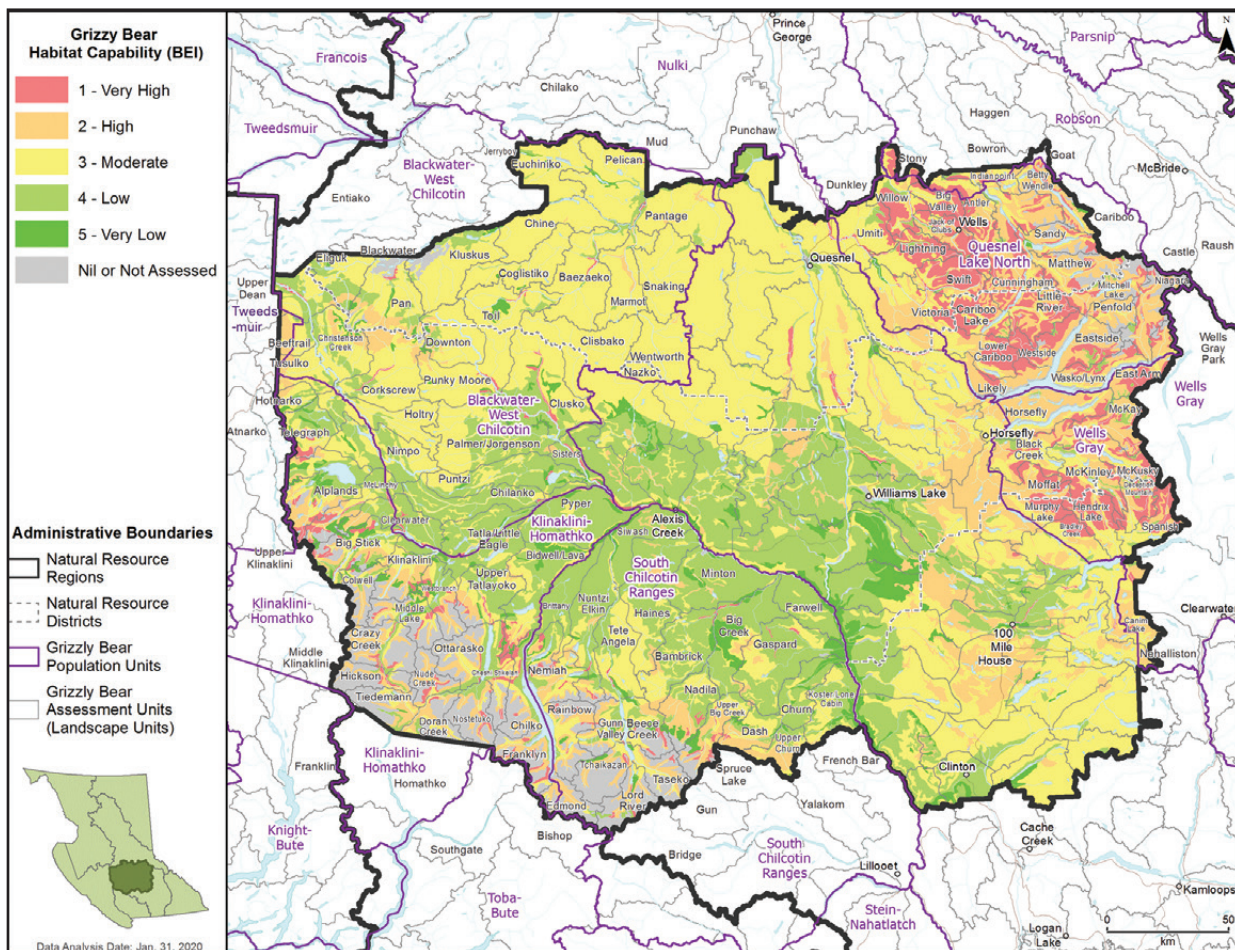


Figure 2.1 Habitat capability map for the Cariboo Region (2020).

2.2 DISTRIBUTION AND MANAGEMENT IN THE CARIBOO REGION

In the Cariboo Region, grizzly bears are considered to be extirpated² throughout the centre of the region, stretching from the Thompson-Okanagan Natural Resource Region in the south and into the Omineca Natural Resource Region to the north. This is due to historical habitat loss associated with human settlement and establishment of agricultural areas.

There are five grizzly bear population units³ (GBPUs) located in the Cariboo Region (Figure 2.1). All of these GBPUs overlap adjacent Natural Resource Regions including South Coast, Omineca, Thompson-Okanagan, and Skeena.

As GBPUs and Landscape Units (LUs) within the Cariboo Region overlap with neighbouring Natural Resource Regions, this report only provides information for the following GBPUs that largely fall within (>50% area) and are directly managed by the Cariboo Region: Blackwater-West Chilcotin, Klinaklini-Homathko, South Chilcotin Ranges, Wells Gray, and Quesnel Lake North.

Please refer to the current condition reports for the neighbouring regions for further information via the Provincial Cumulative Effects Framework website.

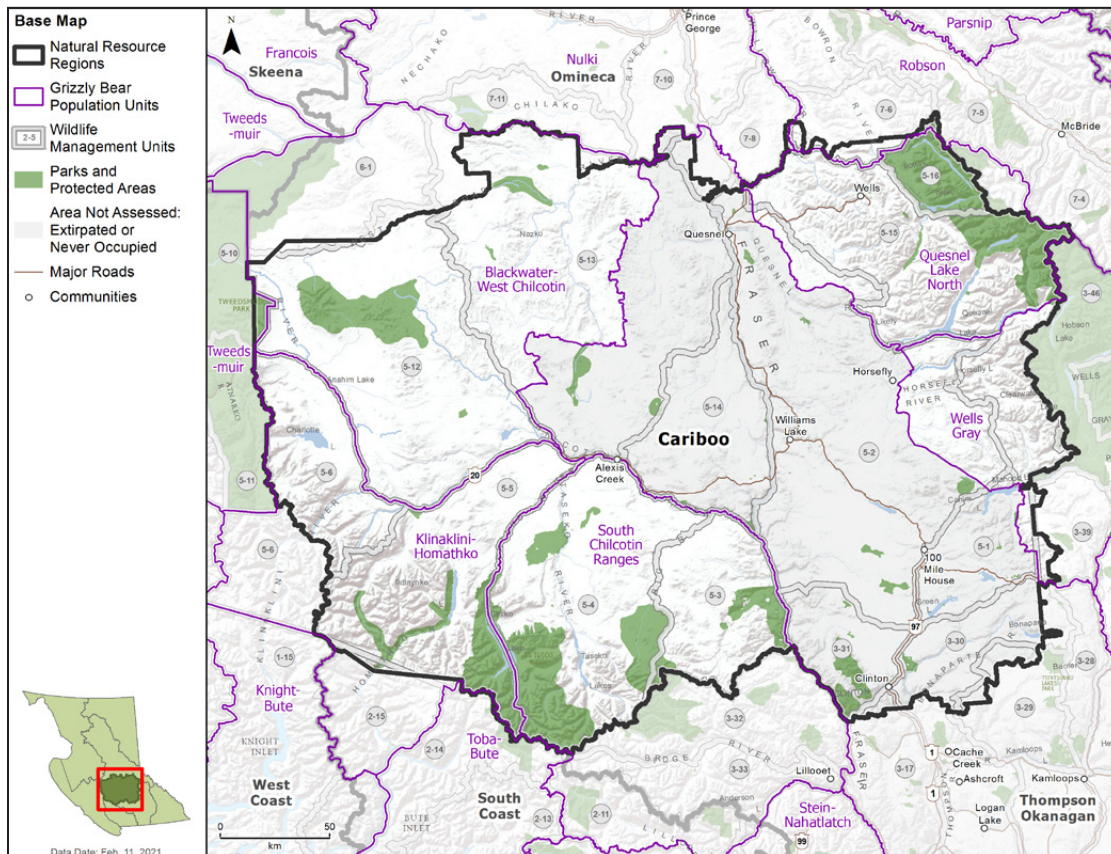


Figure 2.2 Map of the Cariboo Natural Resource Region depicting GBPUs, WMUs, parks and protected areas and major roads. The extirpated area (light grey) divides the Cariboo Region in the centre.

² Extirpated means there is no evidence of resident reproductive females. Extirpation does not preclude ephemeral movements of grizzly bears from adjacent population units that could be characterized as forays by resident adults or sub-adult dispersals (Apps, 2013). Numerous anecdotal sightings of grizzly bears in this area support this theory.

³ GBPUs are delineated based on similar behavioural ecotypes and sub-populations of bears; they generally follow ecological boundaries and transitions (e.g., heights of land) that are not necessarily barriers to movement.

2.3 POTENTIAL THREATS TO GRIZZLY BEARS

Past, present, and future human activities and natural disturbances have the potential to impact grizzly bear populations and habitat. Cumulative effects from various sources may contribute to habitat loss, alteration, fragmentation, and population decline over time.

Overall, grizzly bears are highly mobile omnivores with large spatial requirements and are found throughout much of the Cariboo Region apart from areas of extirpation around the larger community centers. Threats to grizzly bears within the Cariboo Region may include impacts from industrial activities, road development, human presence, access management issues, as well as climate change. These threats are discussed in detail below.

Industrial Activities

The Cariboo Region is largely forestry-dominated, with impacts from harvesting and associated road building and increased human access. Agriculture and ranching have increased human-bear conflicts that have resulted in bear deaths. Mining and mineral exploration activities are present in areas around the region and may also have increased human-bear conflicts. Collisions with trains are also a source of bear mortalities (van der Grift 1999); railways can attract bears through enhanced vegetation (Pollock et al. 2017), spilled grain (Gangadharan et al. 2017; Murray et al. 2017), and carcasses from train collisions (Murray et al. 2017).

Road Development

Roads and corridors associated with the development of industrial activities and human settlement also affect grizzly bear populations and habitat in positive and negative ways. Areas with high road density are avoided by grizzly bears as it leads to habitat loss and fragmentation and increased chance of direct mortality. Most grizzly bear mortality from human encounters occurs within 500 metres of a road. Additionally, grizzly bears may be displaced from their preferred habitats near and along roadways due to noise and human presence and activity.⁴

However, areas with low road density are more favourable for grizzly bears and can attract them due to roadside seeding, linear movement corridors, and increased prey availability. Grizzly bears use linear corridors for foraging, digging, berry feeding, bedding and travel which increases the chance of encountering humans, human activity, and the non-natural attractants therein (Bourbonnais et al., 2013). This can include urban and rural communities, industrial camps and worksites, hunting camps for species other than grizzly bear, and their associated access roads.

Moreover, the development of roads also allows easier human access into grizzly bear habitat, which in turn increases the risk of human-bear conflicts and mortality risk.



⁴ Although Government tracks human-caused grizzly bear deaths, the other impacts of humans (e.g., industrial activity, traffic, noise) on bears (such as habitat displacement) are not well known and an important research priority.

Human Presence and Access Management

Quesnel, Williams Lake and 100 Mile House are the main communities with human settlement in the Cariboo Region. As of 2016, their combined population was just over 22,000 people.⁵ The majority of people are settled in the communities of Quesnel and Williams Lake and surrounding areas.

Grizzly bears are attracted to non-natural food sources and attractants including livestock, livestock feed, grain crops, roadkill, landfills, urban waste, and fruit trees. These food sources and attractants are present in urban or rural areas in the region, which may contribute to increased likelihood of human-bear encounters and bear mortality.

Human-bear encounters may also increase if humans expand into or are able to access remote areas for forestry activities, mining and mineral exploration activities, and recreational purposes (hunting, fishing, eco-tourism), leading to human-bear conflicts, habitat loss, fragmentation, displacement, and and/or behavioural changes to bears.



Climate Change

The climate in the Cariboo Region has changed over the past century and is expected to continue to change. Historical trends indicate that the average temperature in the Cariboo Region has been increasing, with over 1°C of warming occurring during the 20th century. Climate models have projected that warming will continue to occur throughout the 21st century, with summer months warming more than other seasons by 1.9°C (1.3 to 2.8°C) by the 2050s and 3.1°C (1.9 to 4.9°C) by the 2080s (Pacific Climate Impacts Consortium, n.d.). Additionally, spring snowfall is expected to decrease, leading to drier summer months. This increases the risk for lower water flow and increased temperatures in rivers, lakes, and streams.

In the forest-grassland ecotones of the Cariboo, the historical fire regime was characterized by both frequent, low severity (stand-maintaining) fires and widespread fires of moderate to high burn-severities (stand-replacing fires) (Harvey et al., 2017). The former were associated with wetter, cooler conditions in the year of and preceding the fire, while the latter were associated with periods of dry, warm years (Harvey et al., 2017). Fire suppression over the past 120 years has greatly reduced the frequency of fires, resulting in increased stand densities (Harvey et al., 2017). Climate change will result in increased temperatures, leading to increased frequency, duration, and area of drought, forest insects, and fire (Turner, 2010). Climate change in combination with artificially high stand densities



⁵ Statistics Canada – 2016 Census Data (Census Subdivision/Municipality population numbers were used to calculate total population) <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E>

is expected to result in increased frequency of high-severity fires, where the canopy burns and mature forests are replaced by early seral stages (Harvey et al., 2017).

Climate change will likely have both positive and negative effects on grizzly bears in the Cariboo Region. On the positive side, warmer temperatures and less spring snowfall will bring about earlier spring conditions and a longer growing season, which may favour summer vegetation grizzly bears rely on. Increased frequency of fires will increase available forage, because post-fire, early seral stands are more productive for graminoids, forbs, ants, roots, and berries (McLellan and Hovey, 1995), and have higher ungulate densities (Fisher and Wilkinson, 2005).

However, the broader effects of climate change on wildlife species ranges; predator-prey relationships, and food supply are largely uncertain, and could negatively affect grizzly bears. For example, the Cariboo Region is expected to experience more extreme weather, such as increased flooding in riparian areas, late-season drought, and higher stream temperatures, all of which could negatively impact vegetation and salmon productivity. Additionally, droughts that are induced by climate change may cause berry or seed crop failures across the region and may lead to grizzly bears increasing their mobility to search for food, potentially resulting in increased human-bear conflict and risk of bear mortality.

Furthermore, the far eastern and western portions of the region contain large swaths of mountainous terrain where elevational shifts of ecological processes (i.e., vegetation communities) could be significant. However, it is unknown if this would have a significant impact or be a benefit for grizzly bears inhabiting this area.

Grizzly bears face challenges as habitat generalists but even more as salmon specialists. The projected declines in salmon with climate change pose a significant threat to grizzly bears. Warmer temperatures, less spring snowfall, and longer growing season may positively affect spring-summer vegetation food sources; however, increases in late-season drought may negatively impact fall vegetation production. Distribution and fruiting time of huckleberries (*Vaccinium membranaceum*) is expected to shift in British Columbia with changes in climate (Prevéy et al., 2020). Climate-induced insect infestations have also recently led to large-scale salvage logging in the region which has increased road density, displaced bear habitat, and increased the potential for human-bear conflicts.

For more information on the anticipated effects of climate change on ecosystems in the Cariboo Region, see *Adapting Natural Resource Management to Climate Change in the Cariboo Region: Considerations for Practitioners and Government Staff* (BC MFLNRO, 2016) and *Climate Change Vulnerability of B.C.'s Fish and Wildlife: First Approximation* (Daust and Price, 2016).



2.4 GRIZZLY BEAR OBJECTIVES AND LEGAL PROTECTION

In B.C. and in the Cariboo Region, the management and conservation of grizzly bears is governed by a number of provincial and regional strategies, legislation, land use plans, and management plans.

A brief description of important strategies, plans, and legislation that apply provincially and for the Cariboo Region are listed below. For more detailed information, refer to **Appendix 1**.

2.4.1 Provincial Broad Objectives and Plans

- **Provincial Grizzly Bear Conservation Strategy (BC MELP, 1995b):** Has an overarching objective to “maintain in perpetuity the diversity and abundance of grizzly bears and the ecosystems upon which they depend.”
- **Conservation Ranking of Grizzly Bear Population Units (2019):**
 - ensure grizzly bear populations are sustainable, including managing for genetic and demographic linkage;
 - continue to manage lands and resources for the provision of sustainable grizzly bear viewing opportunities; and,
 - where appropriate, restore the productivity, connectivity, abundance, and distribution of grizzly bears and their habitats.

2.4.2 Regional Objectives AND Plans

- **Cariboo Chilcotin Land Use Plan (CCLUP),⁶** the higher-level land use plan guiding resource management activities in the Cariboo Natural Resource Region. The CCLUP Grizzly Bear Habitat legal objective calls for:
 - retaining security cover adjacent to critical grizzly bear foraging habitats within moderate to very high grizzly bear habitat capability units, and
 - conducting silvicultural treatments on cut blocks within moderate to very high grizzly bear habitat capability units to retain as much natural berry production as practicable.



Photo: Pat Dielman

2.4.3 Provincial Legislation – Tools for Grizzly Bear Protection

Legally enforceable measures for the management and conservation of grizzly bears and their habitat may be available under existing legislation. A brief description of potential legal mechanisms is provided below (for more detailed information, please refer to **Appendix 1**):

- **Forest and Range Practices Act (FRPA) Government Actions Regulation:** under section 9, the minister responsible for the *Wildlife Act* by order may establish an area as a WHA if satisfied that

⁶ For more information on the Cariboo-Chilcotin Land Use Plan, visit <https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/cariboo/cariboochilcotin-rlup>

the area is necessary to meet the habitat requirements of a category of species at risk or regionally important wildlife.⁷ There are multiple established grizzly bear WHAs in the Cariboo Region.

- **Wildlife Act:** the hunting of grizzly bears is regulated under the *Wildlife Act*; in December 2017, the provincial government closed the licensed grizzly bear hunt. Furthermore, under section 109 of the Act, the minister may make regulations that prohibit or restrict public access to designated areas of the province for the purposes of wildlife management, and for the temporary closure or imposition of restrictions on vehicular access to a highway or road for the purpose of protecting wildlife.⁸ Additionally, under section 4(2) an area of land can be designated as a Wildlife Management Area (WMA) for the benefit of significant fish and wildlife species or their habitat.
- **Environmental Assessment Act:** the environmental review and certification of major projects (e.g., mines, pipelines, hydropower generation) can set legally binding conditions that required proponents to mitigate the impacts of the project on grizzly bears.
- **Land Act:** Under section 16, the minister may temporarily withdraw Crown land from disposition under the Act for any purpose the minister considers advisable in the public interest and may impose any terms and conditions the minister considers necessary or advisable on the use of the land temporarily withdrawn. Under section 17, the minister may designate a portion of Crown land for a particular use or for the conservation of natural or heritage resources and may impose any terms and conditions the minister considers necessary or advisable on the use of the land designated (Wildlife Habitat Management Areas). These designations have a maximum term of thirty years, and terms over ten years must be reviewed every ten years. Additionally, under section 66, the uses of Crown land in a designated area may be prohibited by the Lieutenant Governor in Council. Under section 93.4, the Minister may establish objectives by order for the use and management of Crown resource, Crown land or private land that is subject to a tree farm licence, woodlot licence or community forest agreement. An example of this is the grizzly bear objectives in the Land Act Order for the CCLUP area.
- **Tsilhqot'in Title:** In 2014, the Supreme Court of Canada granted Aboriginal title to the Tsilhqot'in Nation for an area of the South Chilcotin within the Cariboo Region (located within the Klinaklini-Homathko and South Chilcotin GBPU). The Tsilhqot'in Nation can manage these title lands under Tsilhqot'in laws and governance. In September 2015, the Nation announced that the title area is closed to hunting for non-Tsilhqot'in persons. Since 2021, access to the Chilko River within the Tsilhqot'in Title Area was closed jointly by the Tsilhqot'in Nation, Xenigwet'in First Nation, and the Province of BC during the salmon-spawning season to reduce human-grizzly bear interactions.

The CEF assessment is part of a suite of tools that can be used for grizzly bear management, extending from conservation assessment to operational management and monitoring. These include the federal and provincial status of the Western Grizzly Bear population, the provincial ranking of conservation concern, and the province's upcoming Grizzly Bear Management Plan (in development). The conservation assessments provide a scientific evaluation of the state of grizzly bears, whereas the CEF assessment describes indicators that are more tightly coupled with resource management objectives and practices to address risks to bears. The province's Grizzly Bear Management Plan (in development) will enable further regional actions for managing factors that impact grizzly bears.

⁷ WHAs may only be established in cases when the establishment does not unduly impact provincial timber supply and does not have a material adverse impact on delivered wood costs.

⁸ The approval of the minister responsible for the highway or road is required for the temporary closure or for the imposition of restrictions on vehicular access.

3 INDICATORS AND METHODOLOGY

3.1 METHODOLOGY AND DATA

This current condition report is consistent with the methodology and assessment procedures outlined in the Interim Assessment Protocol for Grizzly Bear in British Columbia (the Protocol) (BC MFLNRORD & BC MOECCS, 2020). The Protocol provides a foundation for a consistent approach to assessing the status of grizzly bears in B.C. and provides a clear link to management actions. The conceptual model (**Appendix 2**) provides an overview of the functions, processes and indicators that affect grizzly bears, based on the current scientific understanding of grizzly bear ecology.

In this report, the current condition of grizzly bear populations within the Cariboo Region is assessed using data up until 2019. A variety of data sources are used in this assessment and are disclosed in the Protocol and its relevant appendices.

3.2 ASSESSMENT UNITS

Risks to grizzly bears are assessed and reported at two scales: large Grizzly Bear Population Units (GBPUs) and smaller Landscape Units (LUs). Population objectives are set and managed within the former, while habitat objectives are delivered through land-use planning within the latter. These units may overlap with other land and resource use planning polygons, including other FLNRORD Natural Resource Regions, Wildlife Management Units (WMU) for which game management objectives and hunting regulations are set, as well as parks and protected areas for which habitat protection objectives are set.

In this report, the results for all the indicators are extrapolated and reported at the much smaller LU scale⁹ to inform resource management planning and decision-making at strategic, tactical, and operational scales. The Population Rank indicator is the only indicator reported at the GBPU scale.

3.3 INDICATORS

Ten indicators from the Protocol are used to describe and assess the status of grizzly bear populations and habitat relative to the provincial government's broad objectives. These indicators individually and (in some cases) collectively describe the status of grizzly bear populations and habitat relative to the provincial government's broad objectives for grizzly bears.

Table 3.1 provides a brief description of the population and habitat indicators that were used in this assessment. **Appendix 2** provides a conceptual model that illustrates how the indicators work together to influence the functions and processes that support grizzly bear populations and habitat.

In Section 4, the approach to assessing each indicator is explained in more detail to help reviewers of this report interpret the results

⁹ LUs more closely approximate the size of one to several adult female home ranges.

Table 3.1 Overview of Grizzly Bear Assessment Indicators

Indicator	Description	Spatial Scale
Population Indicators		
Population Rank	The conservation status of each GBPU in B.C.	GBPU
Number of Bears	The estimated number of bears per 1000 km ² within each GBPU	LU
Mortality Rate	The percent female mortality of the estimated total GBPU grizzly bear population compared against mortality reference points	LU
Road Density	The total length of roads (and pipeline corridors, transmission line rights-of-way, and rail lines) divided by total LU area (km/km ²)	LU
Core Security Area	Patches of secure grizzly bear habitat (with minimal likelihood of human use) greater than 10 km ² within a LU	LU
Front Country	Urban and rural landscapes (including rural roads up to 2 hours travel time from cities) that have relatively high human density as well as grizzly bear attractants (e.g., livestock, grain crops, fruit trees, human food, garbage)	LU
Hunter Day Density	The number days per year that hunters occupy WMUs	LU
Habitat Indicators		
Poor Forage Potential (BEC Mid-Seral Dense Conifer)	The amount of mid-seral dense conifer forest (by BEC zone) within each LU, to represent areas of grizzly bear habitat that are sub-optimal forage production	LU
Quality Food	The (Broad Ecosystem Inventory (BEI) capability of ecosystems to produce vegetation grizzly bears forage for (e.g., forbs, grasses, sedges, berries), including salmon biomass and other protein sources (e.g., ground squirrels, ungulates).	LU
Habitat Protection	The amount of high capability grizzly bear habitat within a LU that is protected in conservation areas and WHAs	LU

For more insights into the grizzly bear assessment methodology, indicators, and data sources, refer to the Interim Assessment Protocol for Grizzly Bear in British Columbia (2020).

3.4 INTERPRETING FLAGGED UNITS ON THE LANDBASE


This assessment uses flags to highlight areas where the condition of an indicator has exceeded a benchmark.¹⁰ Indicators that exceed benchmarks are “flagged” and expected to represent higher risks to grizzly bear populations. **These flags are provided for information only and do not necessarily equate to areas of actual adverse impacts to grizzly bear populations or habitat within a region, GBPU, or LU.**

Benchmarks are based on our scientific understanding of a system and may be based on empirical evidence or expert opinion. In either case, flagged areas highlight areas that require further investigation and validation by regional specialists and decision makers to determine the current condition for grizzly bears and what potential mitigation or management responses may be required.

The current condition of each indicator is interpreted with reference to benchmarks (where applicable) by assessment unit. The results of the indicator assessment are reported on a gradient colour scale (Table 3.2) that reflects increasing potential effects to the value and indicates the benchmark value, where applicable.

Table 3.2 Colour scale used in assessment maps for representing indicator condition in relation to benchmarks. Some indicators use several benchmarks to communicate increasing effects to effects to grizzly bears.

Gradient Scale	Indicator Condition
	Above Benchmark 4
	Above Benchmark 3
	Above Benchmark 2
	Above Benchmark 1
	Below Benchmark
	Not Assessed: Extirpated or Never Occupied



Increasing potential effects to grizzly bears

¹⁰ Benchmarks are defined as reference points that support interpretation of the condition of an indicator or component. Benchmarks are based on our current scientific understanding of a system and may or may not be defined in policy or legislation. For the purpose of the CEF, benchmarks are identified to support assessment and reporting in relation to broad objectives (Province of BC, 2016). Benchmarks are described for each indicator in Section 4.

4 ASSESSMENT RESULTS BY INDICATOR

This section provides a high-level overview and key to interpreting the assessment results. The results for all 10 indicators are presented along with maps and are followed by regional commentaries. The regional commentary provided for each indicator describes and elaborates upon the maps. These sections interpret the meaning of the results, identify relevant contributing or causal factors, provide supporting numerical data where it is useful, and discuss limitations (if any).

Reviewers are also encouraged to explore the results further within their areas of interest using provincial data sources outlined in **Appendix 3**.

While the Protocol was developed by provincial subject matter experts in the Ministry of Water, Land and Resource Stewardship (WLRS), Ministry of Forests (FOR), and the Ministry of Environment and Climate Change Strategy (MOECCS),¹¹ the following assessment results and recommendations were developed by provincial and Cariboo regional staff from WLRS and FOR.

As iterated above, this is a broad, landscape-level assessment that “flags” areas where management attention may be warranted. Recommendations are provided in this report that suggest further analysis or investigation could be undertaken at the regional level to better understand the condition of grizzly bears and their habitat. This may be needed where:

- Proposed projects and activities are being considered in flagged areas; in these cases, decision makers are encouraged to discuss the proposed work with regional subject matter experts to better understand the potential cumulative impact of the new work on the existing landscape and discuss potential mitigation options.
- Strategic-level actions or planning activities are being considered to address impacts to grizzly bears and their habitats; in these cases, further analysis and investigation may provide additional information needed to inform management actions.

¹¹ Provincial subject matter experts have expertise in cumulative effects assessment and grizzly bear biology.

4.1 POPULATION RANK

Indicator Description:

Assigns a conservation management concern rank for each GBPU in B.C. using the NatureServe ranking methodology (Master et al., 2012) and calculator.¹² Each GBPU is ranked to reflect the GBPU's population size and population trend (if available), genetic and demographic isolation, as well as threats to bears and their habitats (M1 to M5;¹³ ranked highest to lowest conservation rank in terms of risk). See Morgan et al., 2012 for full details.

Management Context

Decisions related to population recovery planning.

Benchmark:

- Very Low (M5) and Low (M4) conservation concern (not flagged)
- Moderate (M3), High (M2), and Extreme (M1) conservation concern (flagged)

Interpretation Key:

- High risk LUs (M1, M2, and M3) are flagged; management considerations are recommended when reviewing land-based decisions in these areas.

Regional Commentary:

Three of the five GBPUs in the Cariboo Region are flagged for management attention. The Blackwater-West Chilcotin, South Chilcotin Ranges and Quesnel Lake North GBPUs are classified with the M3 (Moderate Concern) conservation classification, indicating that grizzly bear populations are at a higher risk. These LUs are likely flagged due to habitat loss and/or displacement due to human activities and human presence.

The Klinaklini-Homathko and Wells Grey GBPUs are classified with the M4 (Low Concern) conservation classification, indicating that grizzly bear populations are at a lower risk and are therefore not flagged for management attention at this time.

Grizzly bear populations are considered extirpated¹⁴ throughout the center of the Cariboo Region, largely due to human presence in this area. While grizzly bears may be extirpated, this does not preclude ephemeral movements of grizzly bears from adjacent GBPUs and LUs into this extirpated area. Source-sink dynamics may also be present in the Cariboo Region. Female grizzly bears may be able to successfully reproduce in sink habitats (M1, M2, M3 and the extirpated area of the region) but bear persistence may be reliant on bears travelling from less disturbed (M4, M5) or wilderness areas in the region or from other neighbouring Natural Resource Regions (Lamb et al, 2020).

All of the GBPUs within the Cariboo Region overlap the administrative boundaries of other Natural Resource Regions (Figure 4.1). As grizzly bears traverse these administrative boundaries, the management of grizzly bear populations and habitat is a cross-regional undertaking and must be coordinated in areas where grizzly bear populations are flagged or are at a higher risk.

¹² NatureServe Conservation Rank Calculator <https://www.natureserve.org/conservation-tools/conservation-rank-calculator>

¹³ Categories M4 and M5 replace the previous 'Viable' category and M1-M3 are analogous to the previous 'Threatened' category, where M1 requires the most urgent conservation management focus

¹⁴ Extirpated means there is no evidence of resident reproductive females.

4.2 NUMBER OF BEARS (BEAR DENSITY)

Indicator Description:

This indicator reports the estimated number of bears per 1000 km² from a regression model that extrapolates field-based population estimates to unsurveyed areas based on factors that drive grizzly bear population size including human intrusion and forage availability (Mowat et al., 2013). Bear densities are generated for GBPUs and LUs using the same regression model. Model-generated bear density estimates may have been revised based on local knowledge. This indicator is assessed at the LU level.

Management Context

Decisions related to population recovery planning, estimating historic range occupancy, estimating current population density, establishing licensed hunting allocations (when hunts were open), and conservation management.

Benchmark:

- >10 bears per 1,000 km² (not flagged)
- <10 bears per 1,000 km² (flagged)¹⁵

Interpretation Key:

- Bear densities >10 bears per 1,000 km² are lower risk.
- Bear densities < 10 bears per 1,000 km² are higher risk and are flagged; management considerations are recommended when reviewing land-based decisions in these areas.

Regional Commentary:

In the Cariboo Region, the Quesnel Lake North, Wells Gray, and the western portion of the Klinaklini-Homathko GBPUs have the highest bear density of 10-30 bears per 1000 km² and are, therefore, considered as low risk. However, these areas should be monitored as they may be acting as source to nearby sinks for population growth and/or decline (i.e., grizzly bears produced in these GBPUs and LUs may be dispersing to other areas of high mortality risk).

Most of the LUs in the Blackwater-West Chilcotin GBPU are flagged for management attention with bear densities below 10 bears per 1000 km², with the exception of three LUs (Upper Dean, Beeftrail and Tusulko), which are predicted to have 10-30 bears per 1000 km².

Clusters of flagged LUs within the South Chilcotin Ranges and Wells Gray GBPUs are also flagged for management attention with bear densities below 10 bears per 1000 km². The LUs are notably adjacent to the extirpated area in the center of the region that has a large human population and presence. This cluster of LUs and their lower bear densities is likely associated with habitat displacement, which is the result of the combined effect of the proximity to agricultural and urban areas, road density and human presence in the region. While the lack of habitat may deter grizzly bears from inhabiting these areas, grizzly bears may frequent these areas in search for food and forage and may successfully coexist with humans (e.g., nocturnality), increasing the chance of human-bear conflicts resulting in bear mortality.

¹⁵ Benchmarks were derived from the IUCN calculator (Morgan et al., 2020)

Substantial mountain pine beetle salvage logging has occurred in recent years in some LUs (ex. Moffat, Murphy Lake, and across the Blackwater-West Chilcotin GBPU) potentially negatively affecting bear densities because of increased road densities. Other indicator results presented in this report including core security, front country, and road density show strong relationships to this indicator (Figure 4.5, 4.6).

Reference to the habitat capability map provided in Figure 2.1 helps to provide additional context for the indicator of bear density. While low bear densities are flagged throughout the Cariboo Region, the capability of those areas to support bears should also be considered. Poor quality areas are capable of supporting fewer bears (Nielsen et al., 2008) and home range sizes are larger in poor quality habitats (McCloughlin et al., 2000; Dahle & Swenson, 2003), leading to lower densities. This is seen in the Cariboo Region where higher bear densities coincide with higher capability habitats in the east while lower densities are present throughout the Chilcotin areas west of the Fraser River where habitats are defined as moderate and low.

Table 4.1 GBPU Summary Table

GBPU	Conservation Status	Estimated Population ¹⁶	Grizzly Bear Density (# bears/1000 km ²)	Total GBPU Area (km ²)*	GPBU Area Within Cariboo Region (km ²)*	% GBPU within Cariboo Region
Blackwater-West Chilcotin^{^x°}	M3 (Moderate Concern)	53	2.4	22,231	17,223	77.5
Klinaklini-Homathko^x	M4 (Low Concern)	251	20.3	12,358	9,314	75.4
Quesnel Lake North[^]	M3 (Moderate Concern)	187	21.5	8,681	8,239	94.9
South Chilcotin Ranges⁺⁺	M3 (Moderate Concern)	222	11.7	19,022	11,355	59.7
Wells Gray⁺⁺	M4 (Low Concern)	345	24.8	13,888	4,404	31.7

* Area calculations exclude rock, water and ice which grizzly bears do not use.

+ Overlap with South Coast Natural Resource Region

x Overlap with West Coast Natural Resource Region

^ Overlap with Omineca Natural Resource Region

† Overlap with Thompson-Okanagan Natural Resource Region

° Overlap with Skeena Natural Resource Region

¹⁶ The GBPU estimated population numbers contained in Table 4.2 are from the British Columbia Grizzly Bear Population Estimate for 2018 report completed by FLNRORD in 2020.

Table 4.2 Number of Bears Indicator Relevance and Precision Ranking

Indicator Quality	Ranking	Rationale
Relevance	High	Bear density as predicted by relative human activity and forage abundance is a moderately relevant indicator for population status. Density is unable to provide information on conservation risk, unless information about carry capacity is known, and this is currently lacking in the Cariboo Region.
Precision	Low	Model-derived population estimates that are used to inform this ranking are uncertain in the Cariboo region. Improved population data (e.g. expanding population surveys) would increase the precision of this indicator.
Utility	Low	Limited data availability limits practical management response to those few areas with high quality data.

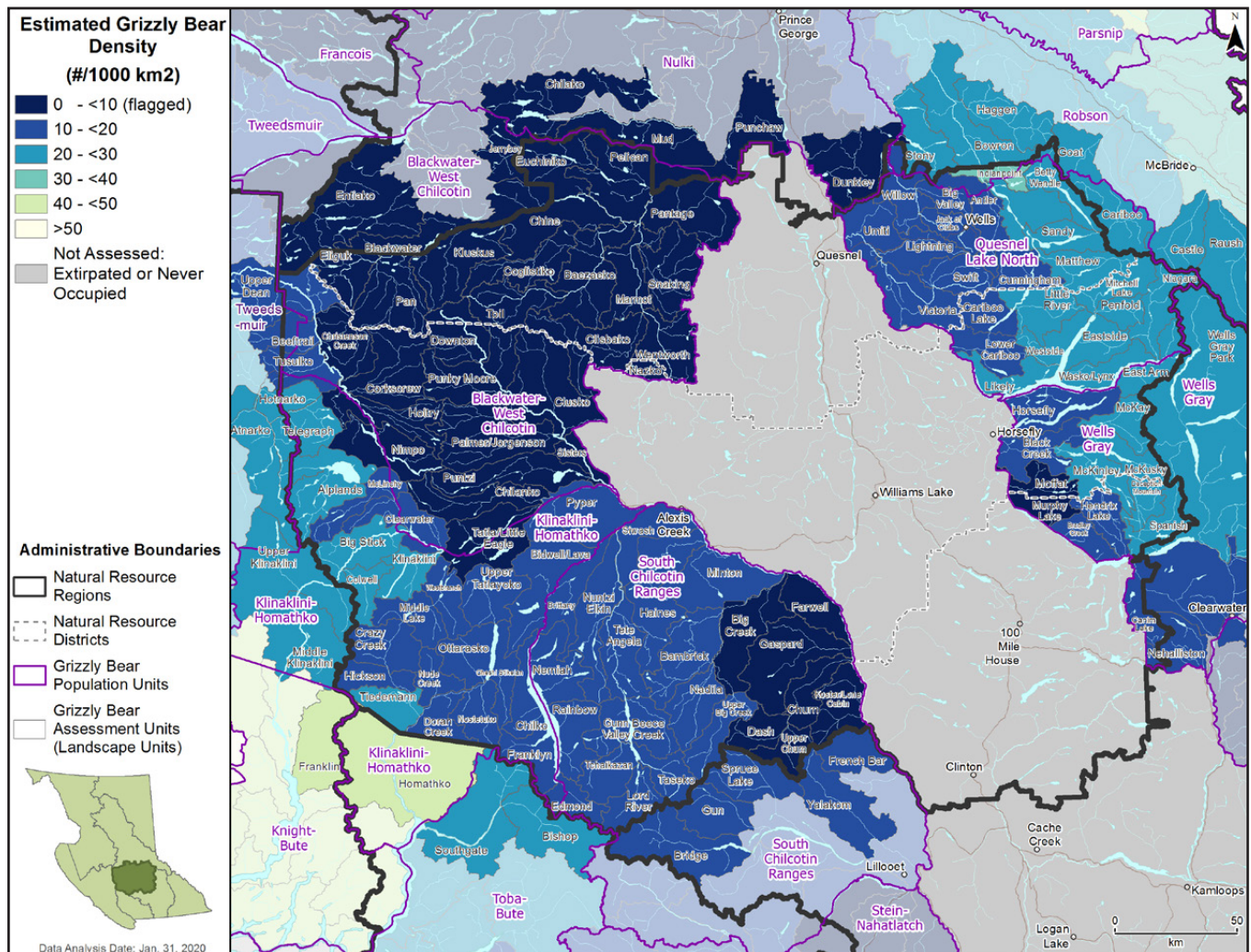


Figure 4.2 Bear Density – Cariboo Region

4.3 MORTALITY RATE

Indicator Description:

This indicator reports the percent female mortality of the estimated total GBPU grizzly bear population compared against mortality reference points,¹⁷ averaged over 2008 to 2017. Population estimates are derived from the 2018 Grizzly bear population estimates for BC, mortality is derived from the Compulsory Inspection Database [CID]), and provincial estimates for unreported mortality.¹⁸ Results are then scaled down to the LU level, where LUs are assigned a pass or fail depending on overlap (<10%) with a failed mortality polygon.

Management Context

Any relevant land use decision that could impact mortality for grizzly bears, including access, regulating licensed hunters, education, presence of conservation officers, etc.

Benchmark:

- 0 to 1.33% = Negligible Risk
- 1.34 to 2.1% = Moderate-Low Risk
- 2.11 to 3.34% = Moderate Risk
- Above 3.34% = High Risk

Interpretation Key:

- Female mortality >1.33% is flagged as a potential risk to grizzly bears

Regional Commentary:

Humans are the main cause of grizzly bear mortality. This includes mortality from human-bear conflicts, poaching, collisions with vehicles, trains and hunting (prior to 2017).¹⁹ In the CID, reported mortalities fall into the following categories: hunting, animal control (to address human-bear conflicts), illegal hunting, trapping, pick-ups (grizzly bears found dead, with cause of death unspecified), road kills, and rail kills.

From 2008-2017, the CID-reported 185 grizzly bear deaths within the Cariboo Region: 126 (68%) were the result of hunting, 43 (23%) the result of animal control, 11 (6%) the result of illegal hunting, 4 the result of trapping (2%), and 1 (<1%) the result of roadkill.

Indicator results for mortality rate suggest annual bear mortality exceeded regional limits in a contiguous grouping of LUs within the Quesnel Lake North, Wells Grey, Blackwater West-Chilcotin, and northern portions of the Klinaklini Homathko GBPUs. These LUs are flagged for management attention. The grouping of LUs in the Quesnel Lake North and Wells Grey GBPUs align within WMU 5-15, and the majority of grizzly mortality reported in the CID within this WMU was a result of hunting activity prior to 2017. The grouping of LUs within the Blackwater West-Chilcotin and northern portion of the Klinaklini-Homathko overlap with WMU 5-12, and the majority of grizzly bear mortality reported in CID within this WMU was a result of animal control prior to 2017.

¹⁷ B.C. uses 4-6% as the range of mortality for interpreting population risk (1.33% to 2% female), with the higher values associated with units verified to have higher recruitment rates.

¹⁸ Mortality limits for each Fish & Wildlife region are established using the B.C. Government's Grizzly Bear Harvest Management Procedure (BC MWLAP, 2004a). Mortality limits include known mortalities plus an estimate of unknown human-caused mortalities.

¹⁹ In December 2017, the B.C. Government announced a provincial ban on grizzly bear hunting (other than hunting by First Nations for food, social and ceremonial purposes). This decision will affect future management of grizzly bear populations given that hunting has traditionally accounted for the majority of the mortality in the province.

After the grizzly hunt ban, from 2018-2019,²⁰ the CID reported 25 grizzly bear deaths within the Cariboo Region: 23 (92%) were the result of animal control and 2 (8%) were the result of roadkill. There were no reports of grizzly bear mortality due to hunting or illegal hunting during this time range, suggesting that the provincial ban on grizzly bear hunting may be working to enhance the management of grizzly bears. Further investigation is required to conclude if positive effects from the provincial ban are observed and are effective in the Cariboo Region.

However, the increase in animal control mortality following the grizzly hunting ban suggests that as hunting-caused grizzly bear mortality rates drop, grizzly bear mortality due to human-bear conflicts may rise in areas occupied by farmers, ranchers, wildlife hunters, and recreationists, especially if humans continue to expand into the backcountry, reducing grizzly bear habitat and causing displacement. Increasing education on attractant management and human-grizzly conflict mitigation may help mitigate this risk.

Based on the assessment results and regional knowledge, regional experts suggest that this indicator has moderate relevance, low precision and low utility. Rationales for these rankings are described in Table 4.4 below.

Table 4.3 *Mortality Rate Indicator Relevance and Precision Ranking*

Indicator Quality	Ranking	Rationale
Relevance	Moderate	A highly relevant indicator for population viability as populations are driven by presence of reproductive females. The CID is a good database to monitor and report grizzly bear mortality and provides relevant information for this assessment. With the closure of the licensed hunt, this indicator is only relevant where human-bear conflicts occur. If the hunt re-opens, then it may increase in relevance.
Precision	Low	Mortality rates are calculated based on population estimates which carry uncertainty. There is also high uncertainty in our estimates of unlicensed harvest data.
Utility	Low	The different types of mortality included in this indicator (e.g. harvest, unlicensed harvest, human conflict, roadkill, etc.) require different management actions. For this indicator to be more useful these sources of mortality would need to be separated out.

²⁰ At the time of writing this report, the CID had recorded data up to the end of 2019.

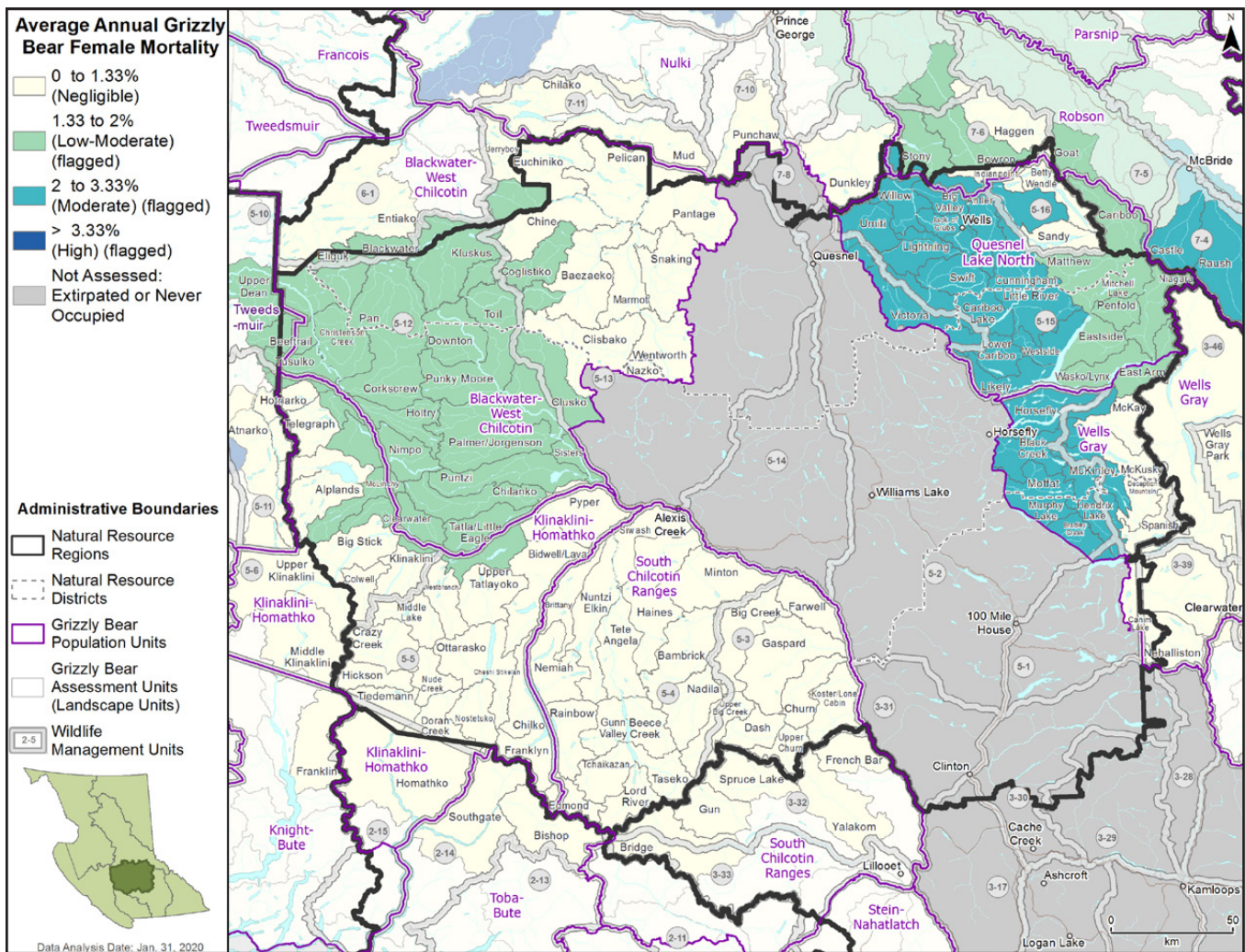


Figure 4.3 Female Grizzly Bear Mortality – Cariboo Region

4.4 ROAD DENSITY

Indicator Description:

This indicator reports total length of open roads²¹ (as well as pipeline corridors, transmission line rights-of-way, and rail lines) divided by total LU area (km/km²). Most grizzly bear mortalities occur within 500 metres of a road or other corridor, and are the result of human-bear conflicts, illegal hunting or collisions with vehicles and trains.²² Furthermore, as road density increases, displacement from key habitats near roads increases, leading to habitat loss, fragmentation, potential loss of access to key food sources, and ultimately decline of grizzly bear populations.

Management Context

- Managing human access (road densities, road deactivation/restoration and road closures);
- Managing attractants such as hydro and pipeline right-of-ways, garbage dumps, camp management, access to salmon, licensed hunter regulation; and,
- Minimizing bear mortality from negative encounters with humans.

Benchmark:

- Road Density >0
- Class 0= 0 km/km² (Roadless)
- Class 1= 0.01-0.3 km/km² (Low)
- Class 2= 0.31-0.6 km/km² (Moderate)
- Class 3= 0.61-0.75 km/km² (High)
- Class 4, 5, 6 & 7= >0.75 km/km² (Very High)²³

Interpretation Key:

- Classes 0, 1 and 2 pose a low risk to grizzly bears and are not flagged
- Classes 3, 4, 5, 6 and 7 pose a high risk to grizzly bears and are flagged for management attention²⁴

Regional Commentary:

For most regional assessments in B.C., risks to grizzly bear populations and habitat correlate more with road density than any other indicator. Areas with high road density are generally avoided by grizzly bears as road development contributes to habitat loss and fragmentation, population isolation, and population decline over time. Areas with low road density are more favourable for grizzly bears. Attraction due to roadside seeding, the creation of linear movement corridors, and increased prey availability can have positive effects where human interaction is low. Despite low road densities, conflicts may still occur between bears and humans and often result in bear mortality. Most grizzly bear mortality from human encounters occurs within 500 metres of a road.

The main road networks in the Cariboo Region include Highway 97, Highway 20, Highway 24 and Highway 26. Highway 97 runs through the extirpated area from 100 Mile House to Quesnel, then north to Prince George. Highway 20 provides access from Williams Lake to the West Blackwater-West Chilcotin, Klinaklini-Homathko, and South Chilcotin Ranges GBPU. Highway 24 connects Highway 97 south of 100 Mile House, east to Little Fort mainly through the extirpated area for grizzly bears. Likely Road leaves the community of 150 Mile House just south of Williams Lake and splits off to the

²¹ Using the CE Consolidated roads layer, available from the BC Data Catalogue. Note that this indicator does not include roads that are permanently deactivated or closed to access.

²² For more information on the science informing this indicator, please refer to the Interim Assessment Protocol for Grizzly Bear in British Columbia, V1.2 (BC MFLNRORD & BC MOECCS, 2020).

²³ Road densities above 0.75 km/km² were associated with modeled population decline in an Alberta population (Boulanger and Stenhouse, 2014). Similarly, a transborder US-BC study found sub-populations increased in areas where road density averaged 0.39 km/km² and decreased where density averaged 0.9 km/km². Several studies have recommended landscape scale thresholds of 0.6 km/km² (e.g., Mace et al. 1996) and planning processes in B.C., Alberta and the US have used these recommendations.

²⁴ Classes 3 through 7 have been further split into 4 sub-classes to provide more detailed information on road density to facilitate in communicating risk within sensitive high risk LUs.

communities of Likely and Horsefly and into the Quesnel Lake North and Wells Grey GBPU. Highway 26 leaves Quesnel east towards the community of Wells and into the Quesnel Lake North GBPU. In the north, additional roads (Blackwater Road and Nazko Road) leave the city of Quesnel into the Blackwater-West Chilcotin GBPU.

The highest road densities occur in the Quesnel Lake North, Blackwater West Chilcotin, and Wells Gray GBPU and are flagged for management attention. Multiple LUs within these GBPU have road densities that are very high risk to grizzly bears (greater than 2.50 km/km²- Class 7). Additionally, multiple LUs adjacent to the extirpated area within all GBPU are also flagged for management attention as road densities are also high (0.61 – 2.50 km/km² [Class 3 –6]) and pose a risk to grizzly bears in the region.

Many of these units that are flagged for management attention are less than 100 km from major centers such as Quesnel and Williams Lake and border the extirpated area. These higher road densities reflect cumulative effects from increased forest harvesting activities as many of the roads are built to access timber resources within shorter haul times to the mills. As the availability of timber declines closer to major centers and with large-scale mountain pine beetle salvage harvesting, high risk road densities (greater than 0.61 km/km²) are observed throughout a number of LUs.

Additionally, resource roads that are open seasonally or that generally have fewer vehicles, may attract grizzly bears because of food availability (road-side vegetation or carrion), security from dominant bears, and as travel routes, leading to potential grizzly bear mortality from human-bear interactions.

Within and adjacent to the Cariboo Region, areas with no roads or very low road density are closely correlated with areas of core security (Figure 4.5). This is not surprising as low road density (and viable forage habitat) directly correlates with high bear density.

Based on the assessment results and regional knowledge, regional experts suggest that this indicator has high relevance, low precision and high utility. Rationales for these rankings are described in Table 4.5 below.

Table 4.4 Road Density Indicator Relevance and Precision Ranking

Indicator Quality	Ranking	Rationale
Relevance	High	There has been significant research linking road density to grizzly bear population trends which makes the road density indicator highly relevant and this anecdotally appears to hold true in the Cariboo Region.
Precision	Low	After 2019, the Cariboo Region created a consolidated roads layer which has higher certainty associated with it than the provincial layer. This assessment used the provincial layer. If managers refer to the regional layer, there is high precision associated with it.
Utility	High	Road density and grizzly bear trends are linked and important. Identifying areas with high road densities can allow for management actions including road de-activation, restoration or access management.

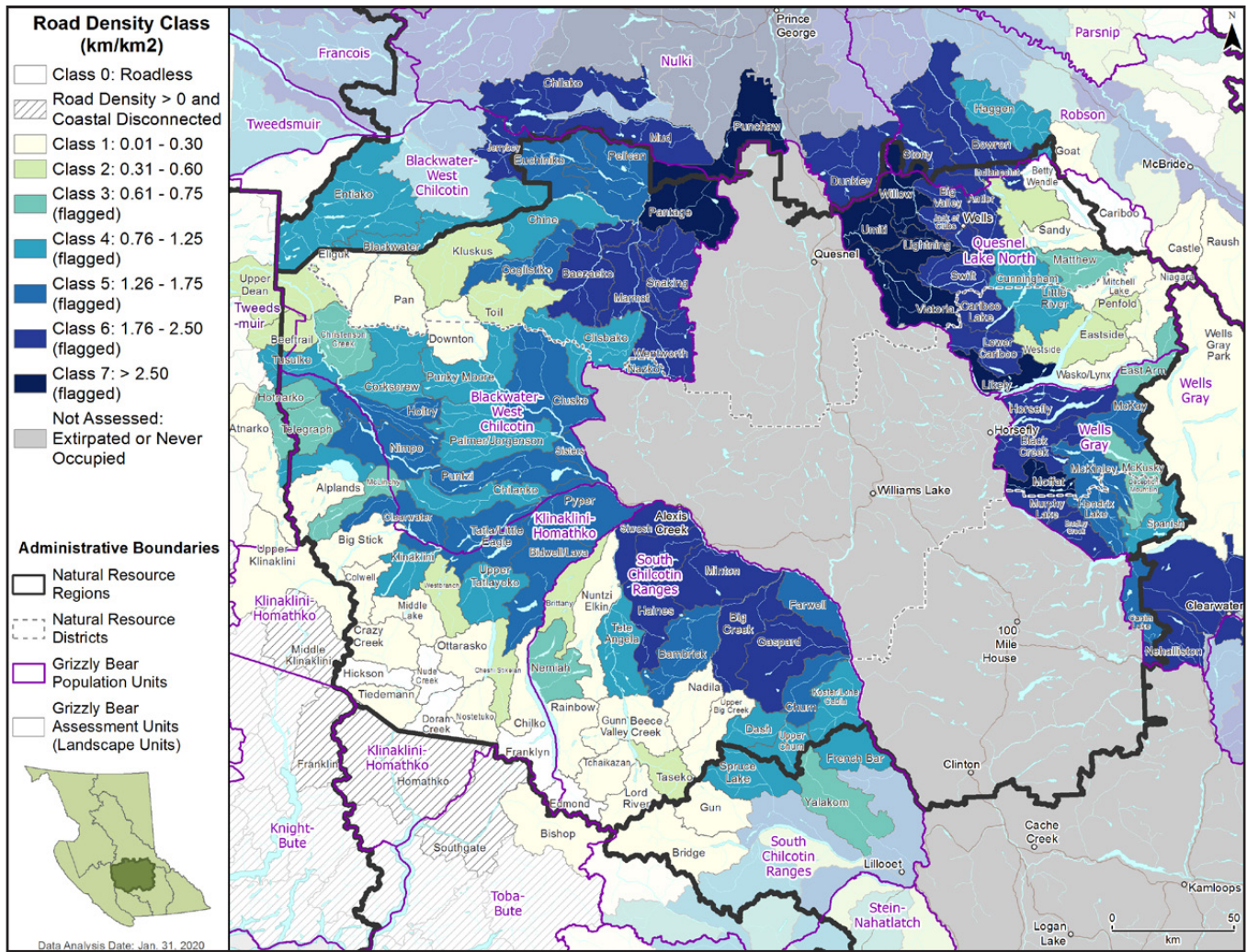


Figure 4.4 Road Density – Cariboo Region

4.5 CORE SECURITY AREAS

Indicator Description:

This indicator reports the prevalence of core security areas, which are patches of habitat greater than 10 km² within an LU with minimal likelihood of human use. These areas are large enough to accommodate a female grizzly bear's daily foraging requirements in areas with an absence of roads, settlement areas, recreation areas, industrial areas. To adequately buffer grizzly bears from humans, these core security areas must be 500 metres or more from human infrastructure and activity.²⁵

Management Context

Managing human access (reducing road network, minimizing new road, restoration of old road and motorized vehicle restrictions), managing attractants (e.g., hydro line right of ways and pipeline corridors, garbage dumps, camp management, access to salmon, licenced hunter regulation for managing ungulate kills (i.e., removing carcasses to avoid negative bear encounters), etc.), minimizing bear mortality resulting from negative encounters with humans, and hunter education and regulations.

Benchmark:

- ≥ 60% capable core²⁶ (not flagged)²⁷
- < 60% capable core (flagged)

Interpretation Key:

- LUs with more than 60% of the area in core security areas pose a low risk to grizzly bears.
- LUs with less than 60% of the area in core security areas pose a higher risk to grizzly bears and are flagged for management attention.

Regional Commentary:

Overall, there is a lack of core security areas in portions of all GBPUs in the Cariboo Region (Figure 4.5).

Multiple LUs within the eastern portions of the Blackwater West-Chilcotin, Klinaklini Homathko and South Chilcotin Ranges GBPUs and western portions of the Quesnel Lake North and Wells Grey GBPUs exhibit low levels of core security are flagged for management attention. All of these LUs border the extirpated area in the center of the Cariboo Region.

Flags within these areas are not surprising given that core security areas must be 500 metres or further from human infrastructure and activity. The areas with core security deficits directly correlate with cumulative effects from human presence and human activities, including but not limited to forestry, mining and mineral exploration, transportation, agriculture and ranching, recreation, and human settlements.

Furthermore, road development also contributes to core security deficit as it fragments grizzly bear habitat below the appropriate size to maintain life requisites for grizzly bears. The results of this indicator strongly correlate with the results of the road density (Figure 4.4) and front country (Figure 4.6) indicators. As industrial roads and corridors are the primary means for range use holders, guide-outfitters, hunters, trappers, and recreation enthusiasts to access the backcountry, this indicator

²⁵ 500-meter buffers on select human disturbance are excluded from Secure Core: mining & extraction, oil & gas, utility ROWs, agricultural, urban, urban mixed, recreation (see Appendix II tab 'meta Disturbance') or Appendix III of the Interim Assessment Protocol for Grizzly Bear in British Columbia (BC MFLNRORD & BC MOECCS, 2020).

²⁶ Capable core is defined as areas without rock, ice, and lakes that grizzly bears do not use and are away from human presence and activities.

²⁷ Science and policy from other jurisdictions recommend that secure habitat constitute 68-84% of an average female home range for long-term stability (Gilbert et al., 2004). The Yellowstone and Northern Continental Divide Ecosystem conservation plans apply the objective of no less than 60% core security in any one bear management unit to support recovery of grizzly bear populations.

should be monitored closely in the future as expansion occurs into the backcountry. Upon further research in the Cariboo Region, mitigation and management measures may be considered to ensure that areas of core security and available forage are protected to maintain grizzly bear populations and habitat in the future.

It is important to note that some of the LUs flagged within the Cariboo Region are located in areas with lower natural capable habitat for grizzly bear. For example, the cluster of LUs within the South Chilcotin Ranges GBPU (Farwell, Gaspard, Minton, etc.) are in Interior Douglas Fir (IDF) and Bunchgrass zones which are not favoured by grizzly bears, so they are less likely to utilize this habitat in general.

Overall, core security areas for grizzly bears in the Cariboo Region are best represented in the southwestern portion of the South Chilcotin Ranges and Klinaklini-Homathko GBPU, the northwest portion of the Blackwater-West Chilcotin GBPU, the eastern portions of the Quesnel Lake North and Wells Grey GBPU.

Several large provincial parks in the South Chilcotin (Nunsti, Ts'il'os, Big Creek), Klinaklini-Homathko (Ts'il'os, Homathko River – Tatlayoko Protected Area), Blackwater-West Chilcotin (Itcha-Ilgachuz), and Quesnel Lake North GBPU (Bowron Lake and Cariboo Mountains) provide secure core habitat for grizzly bear as well as other values including food sources and connectivity. Further research in these areas should be conducted to identify, maintain or improve connectivity within and to these areas for grizzly bears.

Based on the assessment results and regional knowledge, regional experts suggest that this indicator has high relevance, moderate precision and high utility. Rationales for these rankings are described in Table 4.6 below.

Table 4.5 Core Security Areas Indicator Relevance and Precision Ranking

Indicator Quality	Ranking	Rationale
Relevance	High	A highly relevant indicator for population viability.
Precision	Moderate	The Provincial road inventory that drives the core security indicator has low confidence within the Cariboo region. Since this assessment was completed, the Cariboo Region created a consolidated roads layer which has higher certainty associated with it than the provincial layer and can be used in future versions.
Utility	High	Managing for the last remaining undisturbed core areas is important to grizzly bears in the Cariboo.

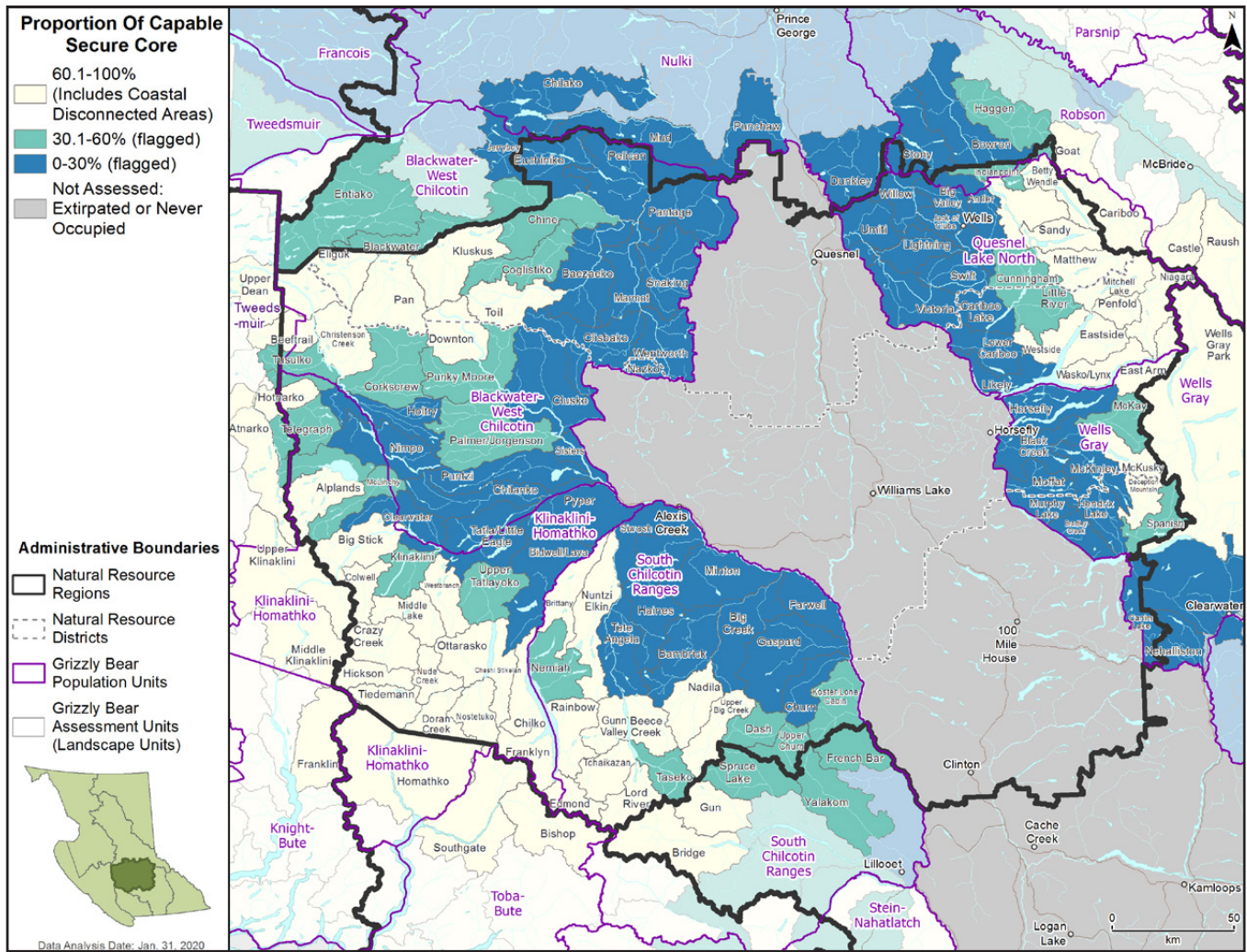


Figure 4.5 Core Security Areas – Cariboo Region

4.6 FRONT COUNTRY

Indicator Description:

This indicator reports the proportion of each LU that is considered front country. The front country is defined by urban and rural landscapes include both relatively high human density and access, and grizzly bear attractants in the form of livestock, livestock carcasses, livestock feed, fruit trees, human food/garbage and grain. This indicator includes areas of human settlement (including communities and agricultural areas) as well as high-use rural roads (roads up to two hours travel time from cities).

Management Context

Front country decisions related to managing attractants (hydro lines, pipeline right of ways, dumps, camp management, access to salmon, hunter regulation for managing ungulate kills, etc.), education for private land, managing human access, managing livestock attractant and areas.

Backcountry decisions related to managing attractants, major project permits, reducing human-bear encounters and mortality.

Benchmark:

- ≤ 20% Front country (not flagged)
- > 20% Front country (flagged)²⁸

Interpretation Key:

- LUs with less than 20% of the area in front country are low risk to grizzly bears.
- LUs with more than 20% of the area in front country are higher risk to grizzly bears and are flagged for management attention.

Regional Commentary:

Overall, there is a substantial amount of front country present in portions of all GBPU's due to human presence and activities throughout the Cariboo Region (Figure 4.6). Multiple LUs are flagged within each GBPU, the majority of which are located adjacent to the extirpated area in the center of the region.

The results for this indicator largely relate to the road density indicator (Figure 4.4) and core security indicator (Figure 4.5), as similar LUs are flagged as high-risk, particularly around highways (Highway 20, 26 and 97) and major roads that provide access throughout the region for forestry, mining and mineral exploration, agriculture and ranching, recreation, and human settlements.

Rural and agricultural development in the Cariboo Region has been established for many years. These rural and agricultural areas where grizzly bear attractants (e.g., livestock, livestock feed, fruit trees, human garbage/grain crops) are present may increase the risk of grizzly bear mortality due to human-bear conflicts. These conflicts may occur seasonally when grizzly bears are in search of food in the spring, summer and fall months. Attractant management in and around these LUs should be considered in the future.

Despite these areas where front country is flagged, the Cariboo Region has areas that still remain remote (i.e., not flagged for management attention at this time) with limited roads, as the distance from human settlement and activities increases. This includes multiple LUs in the western portions of Blackwater West-Chilcotin, southern portion of the Klinaklini-Homathko, southern portion of the South Chilcotin Ranges GBPU's and a few LUs in the eastern portions of the Quesnel Lake North and Wells Grey GBPU's.

²⁸ Benchmarks were derived from expert opinion (Tony Hamilton and other provincial grizzly bear experts).

However, access to these areas has been increasing in recent decades as a result of the mountain pine beetle epidemic and related salvage harvesting. In addition, the 2017 and 2018 wildfires have resulted in disturbance and access into areas previously with limited disturbance. Recovery efforts are underway to address some of the access created from firefighting efforts.

Furthermore, these remote areas are used recreationally for various activities such as hunting, fishing, camping, and hiking, which further increase human access and the likelihood of human-bear encounters.

Regional experts suggest that monitoring of these areas that are remote and currently not flagged for management attention should be conducted in the future. This will allow for experts to determine if additional areas are being impacted from cumulative effects and will allow for appropriate mitigation or management measures to be put in place where they are warranted.

Based on the assessment results and regional knowledge, regional experts suggest that this indicator has low relevance, moderate precision and low utility. Rationales for these rankings are described in Table 4.7 below.

Table 4.6 *Front Country Indicator Relevance and Precision Ranking*

Indicator Quality	Ranking	Rationale
Relevance	Low	The majority of the front country is made up of roads, not direct settlements. However, there are key areas near human activity where it is extremely important to track front country expansion such that this metric is spatially relevant in those locations.
Precision	Moderate	Although this layer captures areas where humans have settled, it does not capture areas where human frequently recreate and can have negative impacts on grizzly bears (e.g. Bowron Provincial Park).
Utility	Low	This indicator has low utility because the threshold was expert-based and the actual relationship to bears has not been tested. Also, this indicator is largely driven by human settlement, most of which are permanent including the roads associated with the settlement.

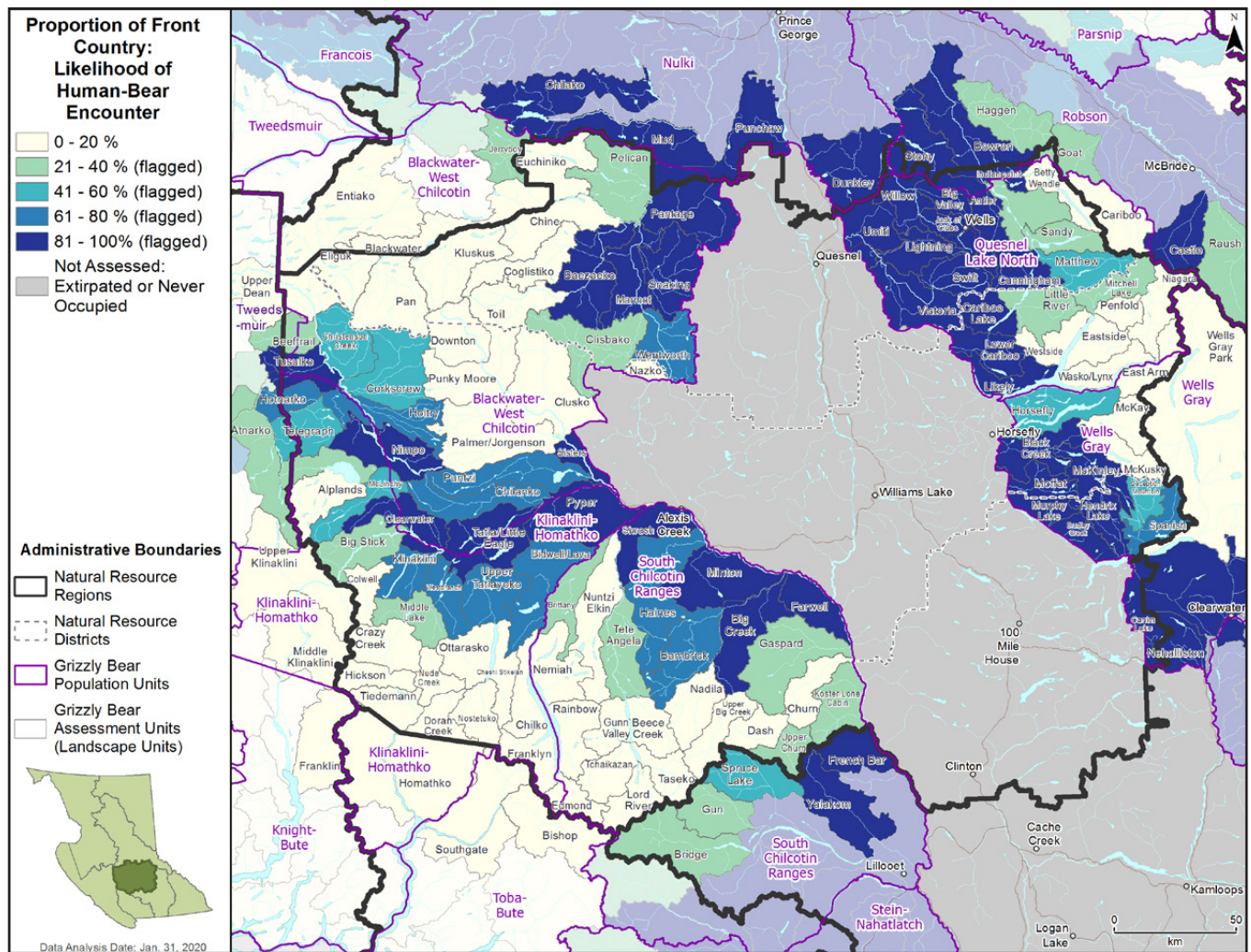


Figure 4.6 Front Country – Cariboo Region

4.7 HUNTER DAY DENSITY

Indicator Description:

This indicator reports average annual hunter day density, which is the number of days over a 5-year period (2013-2017) per year for the occupied portion of the WMU.²⁹ This density is extrapolated to the LU level (days/km²). Hunter density can influence the amount of bear mortality due to the potential for lethal encounters with grizzly bears.³⁰ Hunters targeting ungulates or other wildlife may encounter a grizzly bear or have a grizzly bear approach their kill, resulting in a grizzly bear mortality. LU average hunter day density is divided into statistical quartiles for the current assessment – quartiles are not equal.

Management Context

Minimizing bear mortality resulting from negative encounters with hunters.

Benchmark:

- LU average hunter day density is divided into statistical quartiles for the current assessment; quartiles are not static
- Low = Quartiles 1 & 2 (0-0.65 hunter days/km²) (not flagged)
- Moderate = Quartile 3 (0.651-1.87 hunter days/km²) (not flagged)
- High = Quartile 4 (>1.871 hunter days/km²) (flagged)

Interpretation Key:

- Average annual hunter days of 0-0.65/km² are low risk to grizzly bears
- Average annual hunter days of 0.651-1.87/km² are moderate risk to grizzly bears.
- Average annual hunter days greater than 1.871/km² are high risk to grizzly bears and are flagged for management attention.

Regional Commentary:

Hunter day density is flagged for management attention in a series of LUs located in the western portion of the Quesnel Lake North and Wells Gray GBPU and in the southern portion of the South Chilcotin Ranges GBPU (WMU 5-3). The groupings of flagged LUs in the Quesnel Lake North and Wells Gray GBPU are disconnected, but are both located within WMU 5-2 and WMU 5-15 boundaries. The LU that is flagged within the South Chilcotin Ranges GBPU is located within WMU 5-3 and is adjacent to several flagged LUs within the Thompson Okanagan Region.

Areas where hunter day density is flagged as moderate or high risk are largely located in areas surrounding the extirpated area in the centre of the region where there is a higher human presence, which may indicate areas where lethal human-bear encounters are more likely to occur. The high hunter day density associated with areas close to the larger communities are likely as a result of easier and quicker access to hunting areas. The hunters accessing these areas are likely day hunters (rather than multi-day hunters who travel to remote areas for longer periods to hunt) that are actively hunting mule deer, moose, or black bears.

²⁹ Note that this indicator reflects activity of **all hunters**, not just grizzly bear hunters, because it captures the direct mortality risk to grizzly bears caused by people on the landscape with firearms who may kill a bear in a conflict situation or incidental to hunting other species.

³⁰ The effect of ungulate hunters on grizzly bear mortality has been documented (Haroldson et al., 2004).

Additionally, hunters that are hunting in more remote areas (i.e., further from the extirpated area) for other species where grizzly bears are present may increase the risk of human-bear encounters. Open hunting³¹ and/or limited entry hunt (LEH)³² for big horn sheep, mule deer, white-tailed deer, black bear, wolves, moose, caribou, coyote, bobcat, lynx and multiple bird species such as snow geese, ptarmigan and sharp-tailed grouse occurs throughout the Cariboo Region.

Based on the assessment results and regional knowledge, regional experts suggest that this indicator has moderate relevance, moderate precision and low utility. Rationales for these rankings are described in Table 4.8 below.

Table 4.7 Hunter Day Density Indicator Relevance and Precision Ranking

Indicator Quality	Ranking	Rationale
Relevance	Moderate	The risk of bear mortality increases as the number of hunters on the landscape increases through conflicts with hunters and their harvested ungulates or intended mortality when the licensed grizzly bear hunt was open. This indicator is a good measure of relative mortality risk from conflict encounters.
Precision	Moderate	The hunter day metric is calculated from the Hunter Sample Survey, which is relatively accurate in generating estimates of hunter harvest and effort. However, unlicensed harvest estimates are missing decreasing the precision of this indicator.
Utility	Low	Managers are unlikely to restrict the harvest of other species harvest based on a risk to grizzly bears. However, a finer-scale analysis could be beneficial to show regional variation in hunting pressure based on access, which can inform mitigation measures such as access restrictions, road rehabilitation, etc., to reduce hunting pressure in key areas. For these reasons, this indicator should be closely monitored.

³¹ Region 5 Hunting and Trapping Synopsis (2016-2018) <https://www2.gov.bc.ca/assets/gov/sports-recreation-arts-and-culture/outdoor-recreation/fishing-and-hunting/hunting/regulations/2016-2018/hunting-trapping-synopsis-2016-2018-region5.pdf>

³² LEH Zone Maps for Region 5: Cariboo <https://www2.gov.bc.ca/gov/content/sports-culture/recreation/fishing-hunting/hunting/limited-entry-hunting/leh-zone-maps/region-5-cariboo?keyword=region&keyword=5&keyword=hunting>

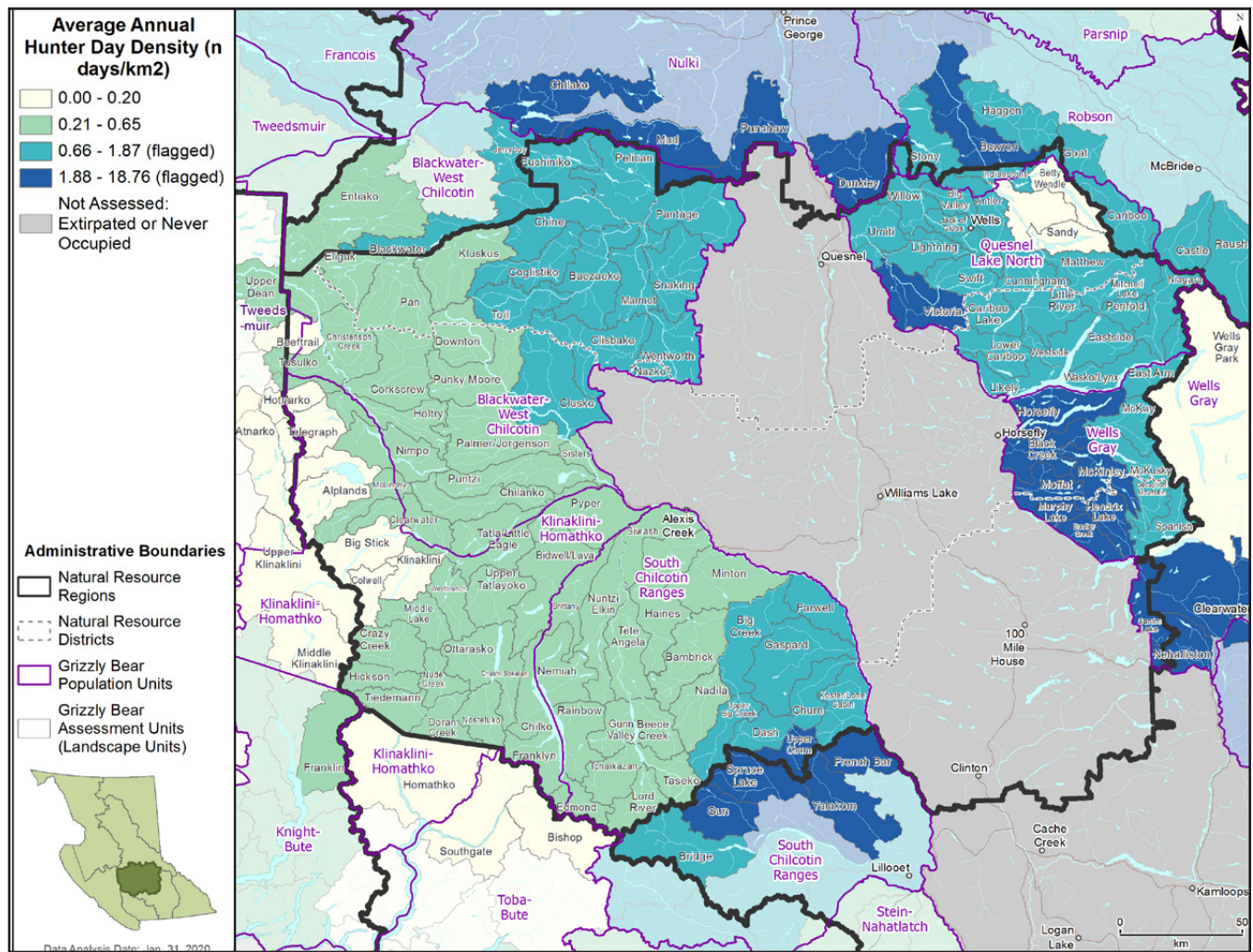


Figure 4.7 Hunter Day Density – Cariboo Region

4.8 POOR FORAGE POTENTIAL (BEC MID-SERAL DENSE CONIFER)

Indicator Description:

This indicator reports the amount of mid-seral³³ dense conifer forest within each LU; mid-seral forests represent areas that are **sub-optimal** for forage production potential for grizzly bears. Open canopy forests support greater berry production, which is an important food source for grizzly bears. Ultimately, this indicator flags potential seral stage imbalances at the landscape level that could be rectified (through management responses) to create more optimal conditions for grizzly bear forage production.

Management Context

- Managing forage supply (e.g., timber Supply Review, silviculture, etc.)
- Meeting specific mid-seral objectives in some timber supply areas

Benchmark:

- Low Risk = Mid-Seral Dense Conifer \leq 30% in High or Moderate BEC zones (or Low sensitivity BEC Zone) in a LU³⁴
- High Risk = Mid-Seral Dense Conifer $>$ 30% for select BEC Zones in a LU
- Insufficient Data = VRI gap \geq 10% of BEC Zone in LU³⁵

Interpretation Key:

- LUs with less than or equal to 30% of area in mid-seral dense conifer are low risk to grizzly bears
- LUs with more than 30% of area in mid-seral dense conifer are high risk to grizzly bears and are flagged for management attention

Regional Commentary:

Optimal forage supply for grizzly bears is associated with open-canopy, mixed forests, alpine meadows, avalanche slopes, and regenerating burns that yield high berry density. Sub-optimal forage supply is characterized by areas with mid-seral dense conifer present, which creates an undesirable habitat for grizzly bears.

Mid-seral dense conifer forests are found throughout the Cariboo Region. The Quesnel Lake North and Wells Gray GBPUs are dominated by Interior Cedar-Hemlock (ICH), Engelmann Spruce-Subalpine Fir (ESSF), and Sub-Boreal Spruce (SBS) BEC zones. The Blackwater-West Chilcotin GBPU is dominated by Sub-boreal Pine-Spruce (SBPS) and Montane Spruce (MS) BEC zones. The Klinaklini-Homathko and South Chilcotin Ranges GBPUs are dominated by ESSF, Interior Douglas Fir (IDF), MS and SBPS BEC zones.

LUs flagged for management attention are scattered across the region, with small clusters occurring in each of the GBPUs. The majority of the flagged areas occur along major rivers in the Cariboo Region, including the Chilko River (Bidwell/Lava and Brittany LUs in the South Chilcotin Ranges and Klinaklini-Homathko GBPUs) and Horsefly River (Black Creek and McKusky LUs in the Wells Grey GBPU), and around some larger lakes such as Quesnel Lake (Wasko/Lynx LU in the Quesnel Lake North GBPU) and Eliguk Lake/Blackwater River headwaters (Eliguk LU in the Blackwater-West Chilcotin GBPU).

³³ Mid-seral dense conifer forests are typically 40 to 100 years old depending on the ecosystem (BC MF & BC MELP, 1995).

³⁴ Landscapes with $>$ 30% mid-seral dense coniferous forests should be evaluated for a shortage of forage and included in assessments of suitability, particularly in more sensitive ecological zones.

³⁵ Benchmarks were derived from expert opinion (Tony Hamilton and other provincial grizzly bear experts).

In these flagged areas, forage production may be sub-optimal or may have been impacted from historical forestry practices and historic wildfires. While these areas may not be optimal for foraging, these areas are known to have large salmon biomass that support grizzly bears (section 4.9). Additionally, in the Cariboo Region, many dense mid-seral conifer stands within these flagged LUs occur within mid-19th century wildfire areas (1920s-1970s). Prior to the mid-1990s the projected ages of stands within wildfire areas were not consistently updated within regionally held forest cover data sets,³⁶ therefore the VRI data may under-report mid-seral age classes in these historic fire areas and stands within these mapped wildfire boundaries may be significantly younger than indicated in the VRI.

Overall, regional experts recommend that these areas be evaluated further through local grizzly bear food, habitat use, and selection studies to validate results for this indicator. While the CCLUP requires that licensees conduct silviculture treatments on cutblocks to retain as much existing natural berry production as practicable, monitoring to determine the effectiveness of this practice has not been carried out. Stocking standard variations reducing target densities by 1/3 to maintain and enhance grizzly bear forage and security cover have also been introduced.³⁷

Should further evaluation of the flagged areas identify a need for further management action to enhance grizzly bear forage habitat, guidance documents and research related to alternative silviculture and stocking regimes in other parts of the province should be referenced.^{38 39}

Based on the assessment results and regional knowledge, regional experts suggest that this indicator has moderate relevance, low precision and low utility. Rationales for these rankings are described in Table 4.9 below.

Table 4.8 Poor Forage Potential Indicator Relevance and Precision Ranking

Indicator Quality	Ranking	Rationale
Relevance	Moderate	This indicator is moderately relevant as its related to seasonally important food sources (e.g., spring vegetation and berries). Forage constraints are a real concern for grizzly bears especially in areas with relatively homogeneous forest ages resulting from forestry activity.
Precision	Low	There is uncertainty as to whether mid-seral accurately tracks forage constraints across the landscape resulting in low precision for this indicator.
Utility	Low	Given the uncertainty associated with this layer, it would be better for managers to focus their efforts on protecting good grizzly bears areas (e.g. core secure areas) than focusing on potential poor forage sites.

³⁶ Marc Rousseau, VRI Update Team Lead, BC Ministry of Forests, pers. comm, October 2020. The update of forest cover data was not centralized in BC until the mid-1990s; prior to this wildfires may or may not have triggered a stand age update in regionally managed forest cover maps.

³⁷ Silviculture Guidelines and Practices for Maintaining or Recruiting Key Habitat Objectives, Manning, Cooper and Associates, February 2004. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/land-based-investment/forests-for-tomorrow/mca_silvbmp.pdf

³⁸ Extension Note #54 – Grizzly Bear Habitat in Managed Forests: Silviculture Treatments to meet Habitat and Timber Objectives. Ministry of Forests. April 2001. <https://www.for.gov.bc.ca/hfd/pubs/Docs/En/En54.pdf>

³⁹ Using Silviculture to Maintain and Enhance Grizzly Bear Habitat in Six Variants of the Prince George Forest Region. P. Beaudry and Associates Ltd. March 2001. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/land-based-investment/forests-for-tomorrow/grizzly_bear_forage.pdf

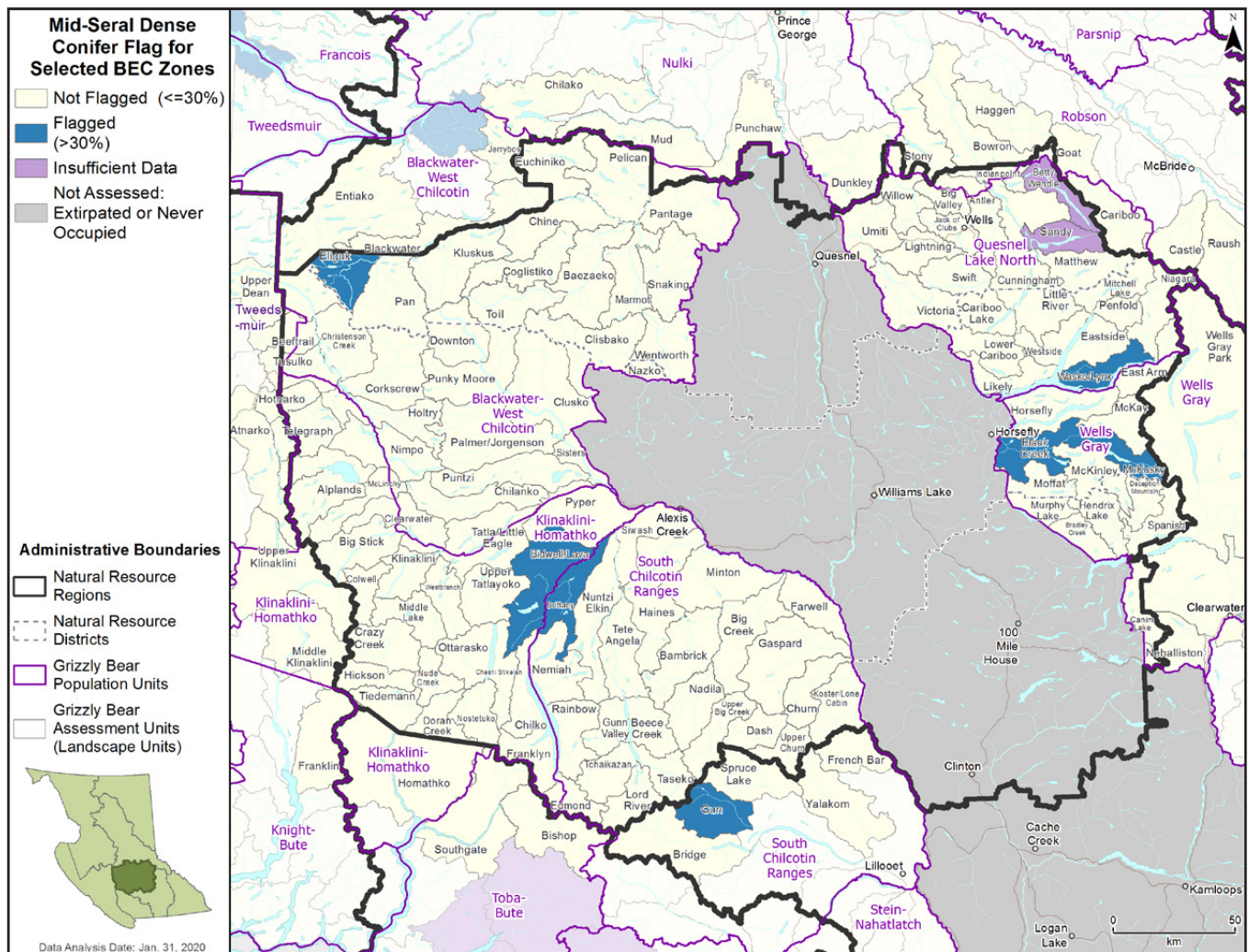


Figure 4.8 Poor Forage Potential (BEC Mid-Seral Dense Conifer) – Cariboo Region

4.9 QUALITY FOOD

Indicator Description:

This indicator assesses the amount of quality food sources available to grizzly bears. Quality food is defined as >50% of the LU having high or very high habitat capability (BEI) and/or any unit with >10,000kg salmon biomass.⁴⁰

Management Context

Conservation management.

Benchmark:

- Yes – high salmon or high capability
- No – not high salmon or high capability⁴¹

Interpretation Key:

- Quality forage plants are considered present if >50% of the LU is classified as high or very high capability BEI (Classes 2 and 1 respectively).
- Salmon is considered present if >10,000 kg is available at all time periods (sum of salmon kg by LU).
- Where LUs have benchmark levels of both types of quality food (>10,000 kg salmon and high or very high BEI capability for >50% of the LU), they are indicated on the results map (Figure 4.10) by a combination of solid green shading with a blue crosshatch overlay.

Regional Commentary:

In the Cariboo Region, quality food sources (including salmon and vegetation) are concentrated in the eastern portion of the region, particularly within the Quesnel Lake North and Wells Grey GBPUs (Figure 4.9 and 4.10). A cluster of LUs adjacent to the Chilko River in the Klinaklini-Homathko and South Chilcotin Ranges GBPUs are an area with high salmon biomass (Figure 4.9 and 4.10).

Biomass/Vegetation

Vegetation productivity on the west side of the region is limited (Figure 4.10). The eastern portions of the Cariboo Region have areas of high and very high BEI capability particularly in the Quesnel Lake North and Wells Gray GBPUs.

The remaining areas in the Klinaklini-Homathko, South Chilcotin Ranges and the Blackwater-West Chilcotin GBPUs are classified as moderate or low BEI capability for grizzly bears. In these areas, bears will rely on other protein sources such as carrion, small mammals, and ungulates as well as vegetation sources.

Salmon

The presence of salmon is notably high in the Quesnel Lake North and Wells Grey GBPUs due to the presence of the Horsefly River and Quesnel River, which support large salmon runs and are surrounded by mountainous terrain (Figure 4.10).

Additionally, the presence of salmon is also high in a portion of the South Chilcotin Ranges and Klinaklini-Homathko GBPUs, along the Chilko River (Brittany and Bidwell/Lava LUs), which has the third largest salmon run in the province. Grizzly bears are known to travel to and congregate along the Chilko River in the late summer and fall to feed on returning salmon—a critical source of protein for bears going into winter hibernation.

Salmon productivity is most notable in Chilko River, which has the third largest salmon run in the province. Given the prevalence of front country along most of the other rivers in the region, it is likely that the Chilko River is the only highly productive salmon-bearing river that actively sustains

⁴⁰ Salmon availability averaged annually using Fisheries and Oceans Canada NuSEDS data (Fisheries and Oceans Canada, 2014).

⁴¹ Benchmarks were derived from expert opinion (Tony Hamilton and other provincial grizzly bear experts).

grizzly bear populations within the Cariboo Region. However, a study of stable isotopes to describe grizzly diet across North America showed the highest consumption of salmon in non-coastal areas to be at Quesnel Lake and Wells Gray Park (Mowat and Heard 2006).

Impact of Climate Change on Quality Food Resources

Salmon populations within the province have experienced declining returns as a result of climate change, ocean conditions, and harvesting activities in recent years. Changes in the availability in salmon resources could result in potential negative effects to grizzly bear populations within the Cariboo Region.

Climate change may also cause spatial and elevational shifts of vegetation, particularly in the eastern, mountainous portion of the region (Quesnel Lake North and Wells Gray GBPU) that may also have subsequent potential negative impacts on grizzly bears.

However, it is predicted that results of climate change such as wildfires like those experienced in the Cariboo Region in 2017 may result in a period of time of increased forage opportunities for grizzly bear as early seral areas provide vegetation and berry species used by grizzly bears.

Despite these predictions, the true effects of climate change and how it may impact grizzly bears are not fully known. Development of a historic range of variation (HRV) model for the Cariboo Region is currently underway and may be a useful tool for modelling future changes in forage distribution due to climate change and anthropogenic disturbance.

Based on the assessment results and regional knowledge, regional experts suggest that this indicator has high relevance, low precision and high utility. Rationales for these rankings are described in Table 4.10 below.

Table 4.9 Poor Forage Potential Indicator Relevance and Precision Ranking

Indicator Quality	Ranking	Rationale
Relevance	High	The relevance is high as the importance of forage plants and salmon for grizzly bears has been well studied.
Precision	Low	Vegetation: The use of BEI capability reflects the forage potential across the landscape but does not illustrate current state of forage availability thus creating a good deal of uncertainty on actual forage availability. Salmon: There are some uncertainties and data gaps with the salmon escapement data that is used.
Utility	High	Vegetation: the utility is high as ecosystems will likely change at a slow rate in the future. Managing food sources can be addressed as required to reduce mid-seral footprints and enhance forage productivity. Salmon: the utility is high as salmon stocks can be studied and areas can be flagged based on historical numbers of salmon. However, it is difficult to predict future salmon runs.

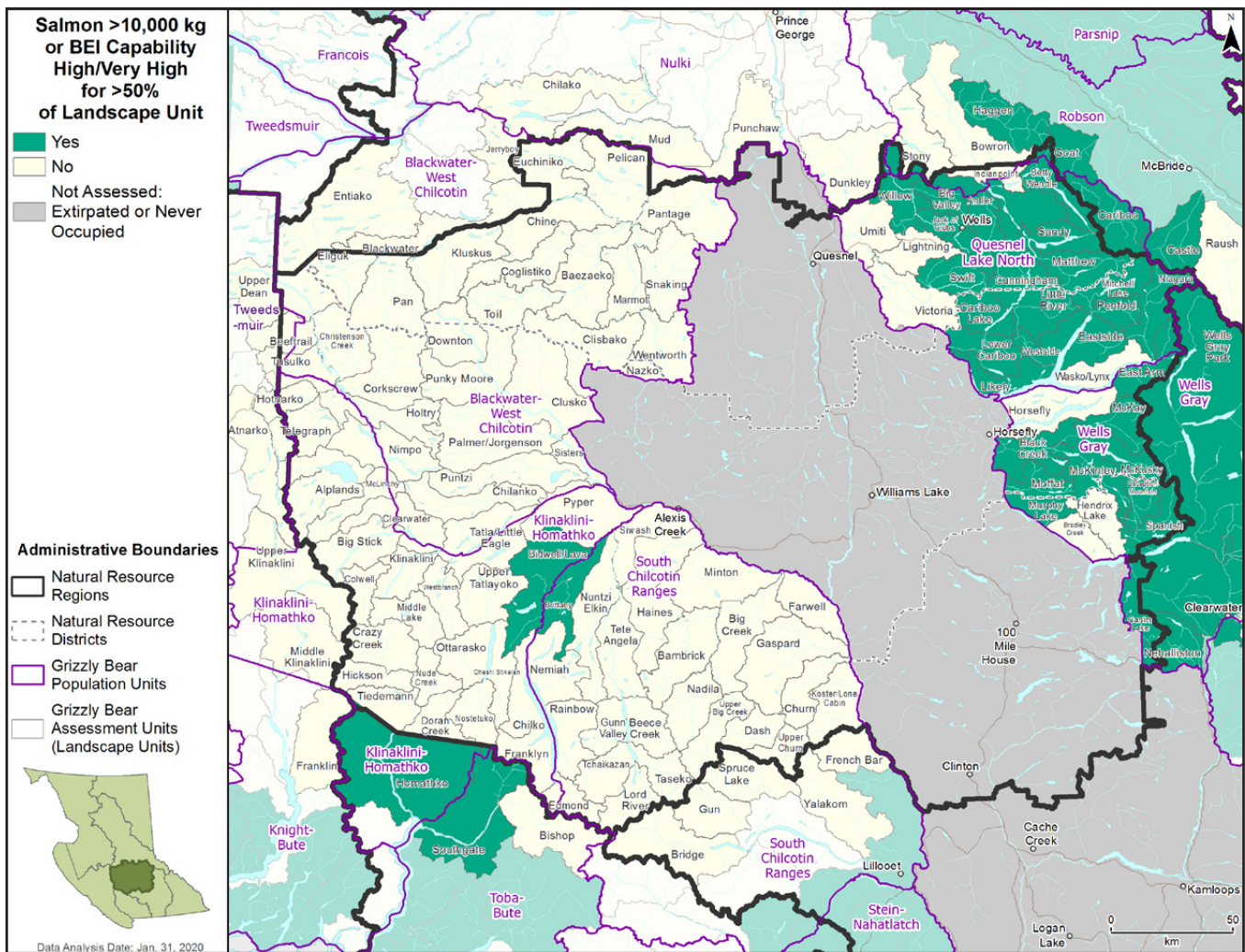


Figure 4.9 Quality Food (Salmon and BEI Capability) – Cariboo Region

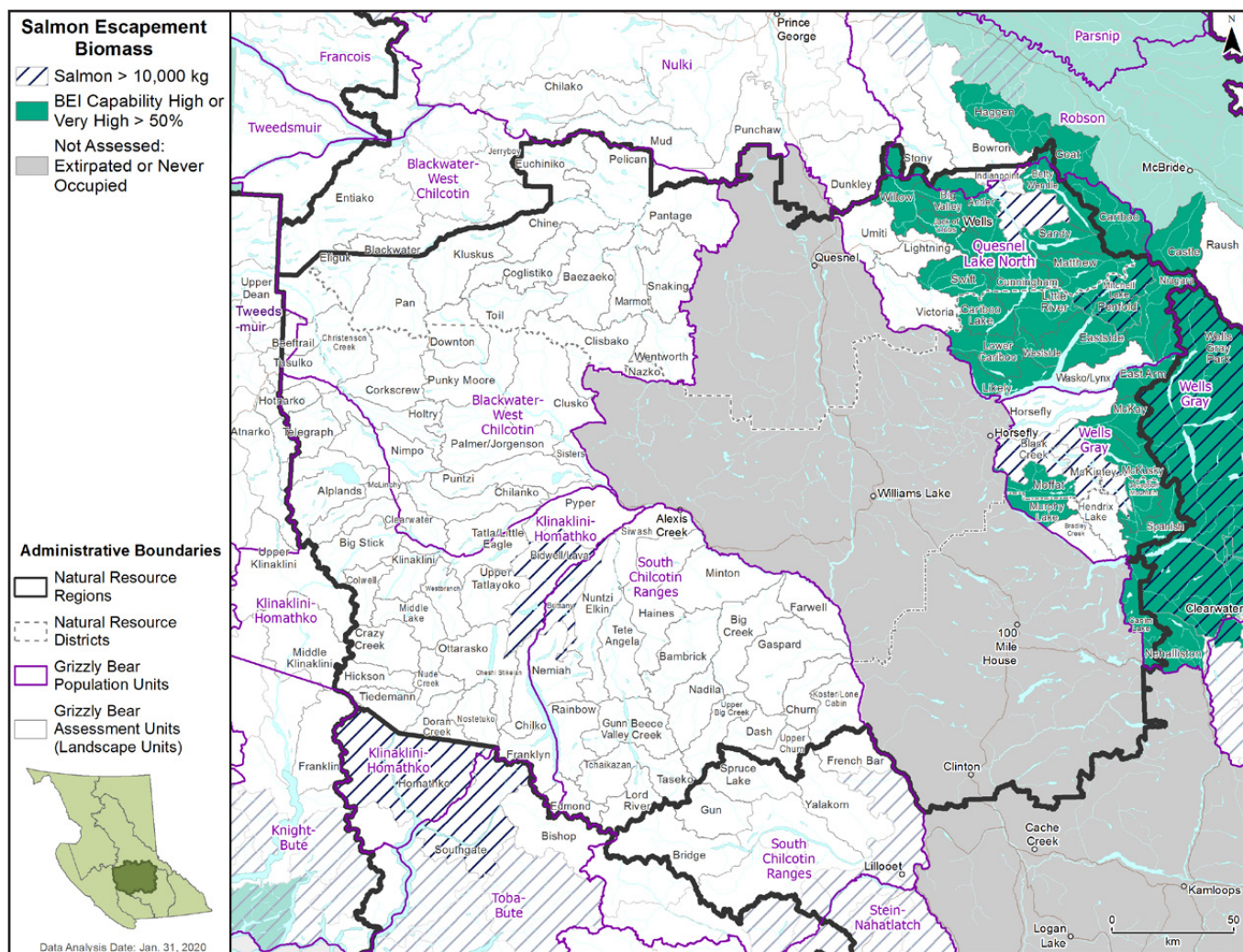


Figure 4.10 Quality Food Sub-Indicators – Cariboo Region

4.10 HABITAT PROTECTION

Indicator Description:

Habitat protection has two indicators:

- Indicator 1: Percent of total area of very high and high grizzly bear habitat capability (BEI or ecosystem-based management (EBM)) in a LU captured within conservation areas and other designations.⁴²
- Indicator 2: Presence/absence of Grizzly Wildlife Habitat Areas (WHA)/Specified Areas or Coastal EBM areas within an LU.

Management Context

Conservation management⁴³

Benchmark:

- Indicator 1:
 - Low Risk= >60% protected
 - Moderate Risk= 30-60% protected
 - High Risk= <30% protected
- Indicator 2:
 - Yes: LU contains $\geq 0.05\%$ WHA/EBM areas (present)
 - No: WHA/EBM areas absent or $< 0.05\%$ (absent)⁴⁴

Interpretation Key:

- Indicator 1:
 - LUs with >60% of very high and high capability habitat protected are low risk to grizzly bears.
 - LUs with 30 to 60% of very high and high capability habitat protected are moderate risk to grizzly bears.
 - LUs with < 30% of very high and high capability habitat protected are high risk to grizzly bears.
- Indicator 2:
 - If $> 0.05\%$ of the LU comprises grizzly bear WHAs, WHAs are considered present.
 - If $< 0.05\%$ of the LU comprises grizzly bear WHAs, WHAs are considered absent.

Regional Commentary:

LUs that have 60% or more of their high-capability grizzly bear habitat protected in parks and WHAs are found in small, disconnected portions throughout the Cariboo Region.

Many provincial parks exist within these GBPU, including Bowron Lake Provincial Park and Cariboo Mountains Provincial Park in the Quesnel Lake North GBPU, Ts'il'os Provincial Park and Big Creek Provincial Park in the South Chilcotin Ranges GBPU, and Nazko Lake Provincial Park and Itcha Ilgachuz Provincial Park in the Blackwater-West Chilcotin GBPU. Administrative boundaries do not situate Wells Grey Provincial Park entirely within the Wells Gray GBPU in the Cariboo Region; however, it is immediately adjacent to the east of the boundary. Since the habitat is connected, it has contributed to the success and viability of grizzly bears in the Wells Grey GBPU.

Similar to previous indicators, flagged areas exist along the boundary of the extirpated area and in areas with human disturbance (i.e., forestry, agricultural practices, high human presence) or natural disturbance (i.e., mountain pine beetle, forest fires).

There are seven grizzly bear WHAs established in the Cariboo Region (WHA 5-037 to WHA 5-043)⁴⁵ that are within the Quesnel Lake North GBPU. However, under the Order⁴⁶ for these WHAs, it is noted

⁴² As referenced in the Grizzly Bear Protocol – Appendix 2 Data Dictionary (BC MFLNRORD & BC MOECCS, 2020).

⁴³ WHAs/SA only address forestry and range threats and not other threats – e.g., recreation, residential, some transportation.

⁴⁴ Benchmarks were derived from expert opinion (Tony Hamilton and other provincial grizzly bear experts).

⁴⁵ Ministry of Environment. Approved Wildlife Habitat Areas. <http://www.env.gov.bc.ca/wld/frpa/iwms/wha.html>

⁴⁶ Ministry of Environment. Wildlife Habitat Area #5-037 to 5-403 Grizzly Bear– Central Cariboo Forest District. http://www.env.gov.bc.ca/wld/documents/wha/URAR_5-037to043_CentalCariboo.pdf

that a main operational road may be constructed through two of the WHAs (5-037 and 5-038) to allow access to otherwise isolated timber. These two WHAs exist north of the east arm of Quesnel Lake where roads remain extremely limited.

The Cariboo Chilcotin Land Use Plan, Land Use Order and associated Orders also provide some legal protections, associated with no harvest and modified harvest restrictions for Caribou, community areas of special concern, critical fish habitat, mule deer winter range, etc. Regional experts note that these are not incorporated into this indicator and should be assessed in addition to these results to determine if any additional legal protection may exist for grizzly bear across the region.

Additionally, as the BEI is set at a 1:250,000 scale, regional experts suggest that a finer-scale metric such as Terrestrial Ecosystem Mapping (TEM) or Predictive Ecosystem Mapping (PEM) (at 1:20,000 or 1:50,000 scales) can provide more precise information and should be used in future assessments. Several TEM projects have been completed within the Cariboo Region,⁴⁷ and the entire Cariboo Region has PEM coverage.⁴⁸

Based on the assessment results and regional knowledge, regional experts suggest that this indicator currently has moderate relevance, low precision and low utility. Rationales for these rankings are described in Table 4.11 below.

Table 4.10 *Habitat Protection Indicator Relevance and Precision Ranking*

Indicator Quality	Ranking	Rationale
Relevance	Moderate	Maintaining high quality forage in protected habitats is important in maintaining long-term viability of grizzly bear populations. However, BEI capability rather than a suitability indicator reduces the importance of this indicator. Considerable amounts of grizzly bear forage are usually available outside protected areas as well but in a less-than-predictable state (e.g., not protected from timber harvest).
Precision	Low	The use of BEI capability reflects the forage potential but does not illustrate current state of forage availability in protected areas thus creating a good deal of uncertainty on actual forage availability.
Utility	Low	Current indicator resolution is too coarse to guide clear effective management response for the Cariboo region. Need to be able to identify where there is quality habitat with little management/protection.

⁴⁷ Province of BC. Terrestrial Ecosystem Data and Information. <https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/ecosystems/search-ecosystem-info>

⁴⁸ Cariboo PEM Final Report 2008. https://www.env.gov.bc.ca/esd/distdata/ecosystems/wis/pem/warehouse/region_5_Cariboo/Cariboo_ftp_final_5512/pem_5512_rpt.pdf

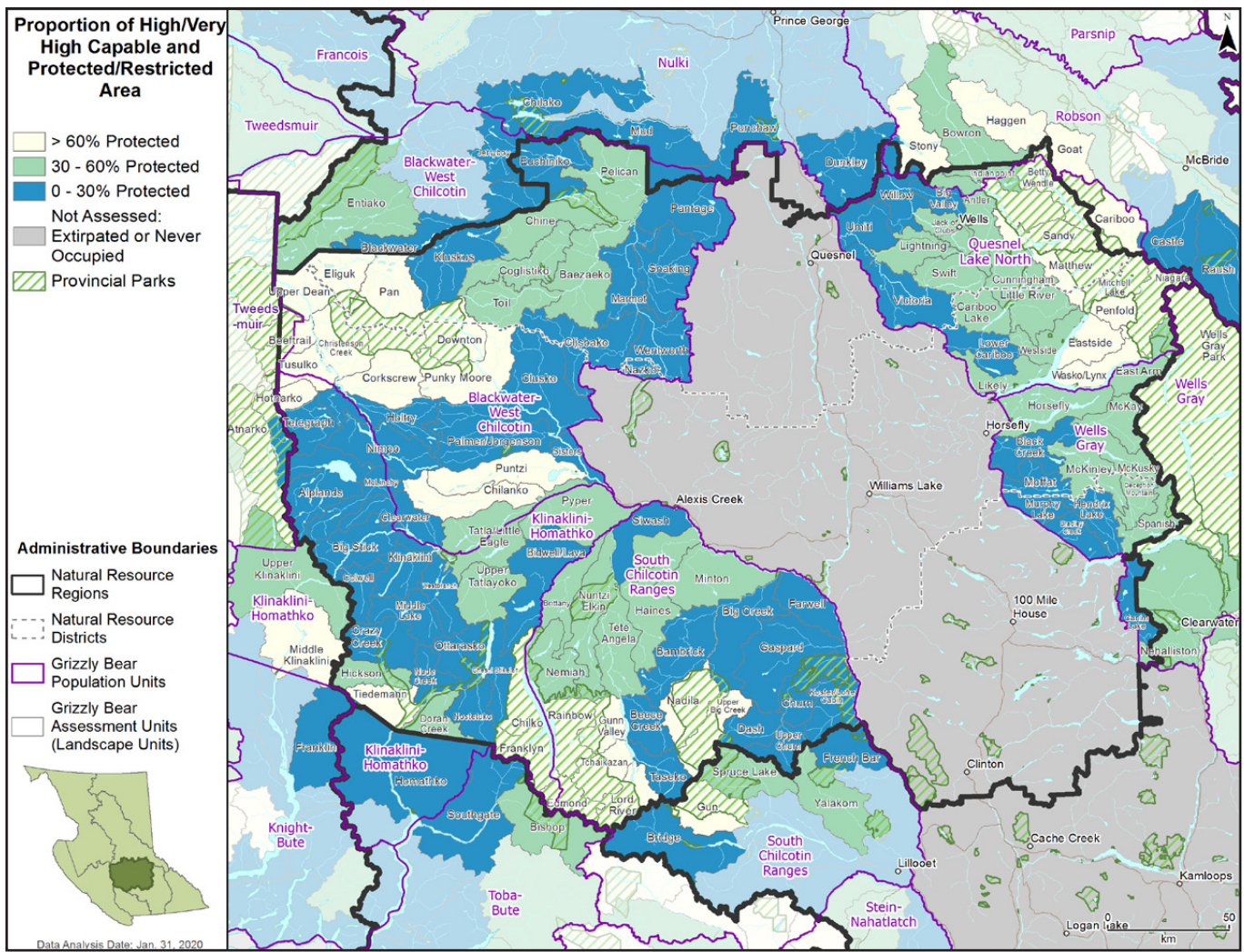


Figure 4.11 Habitat Protection – Cariboo Region

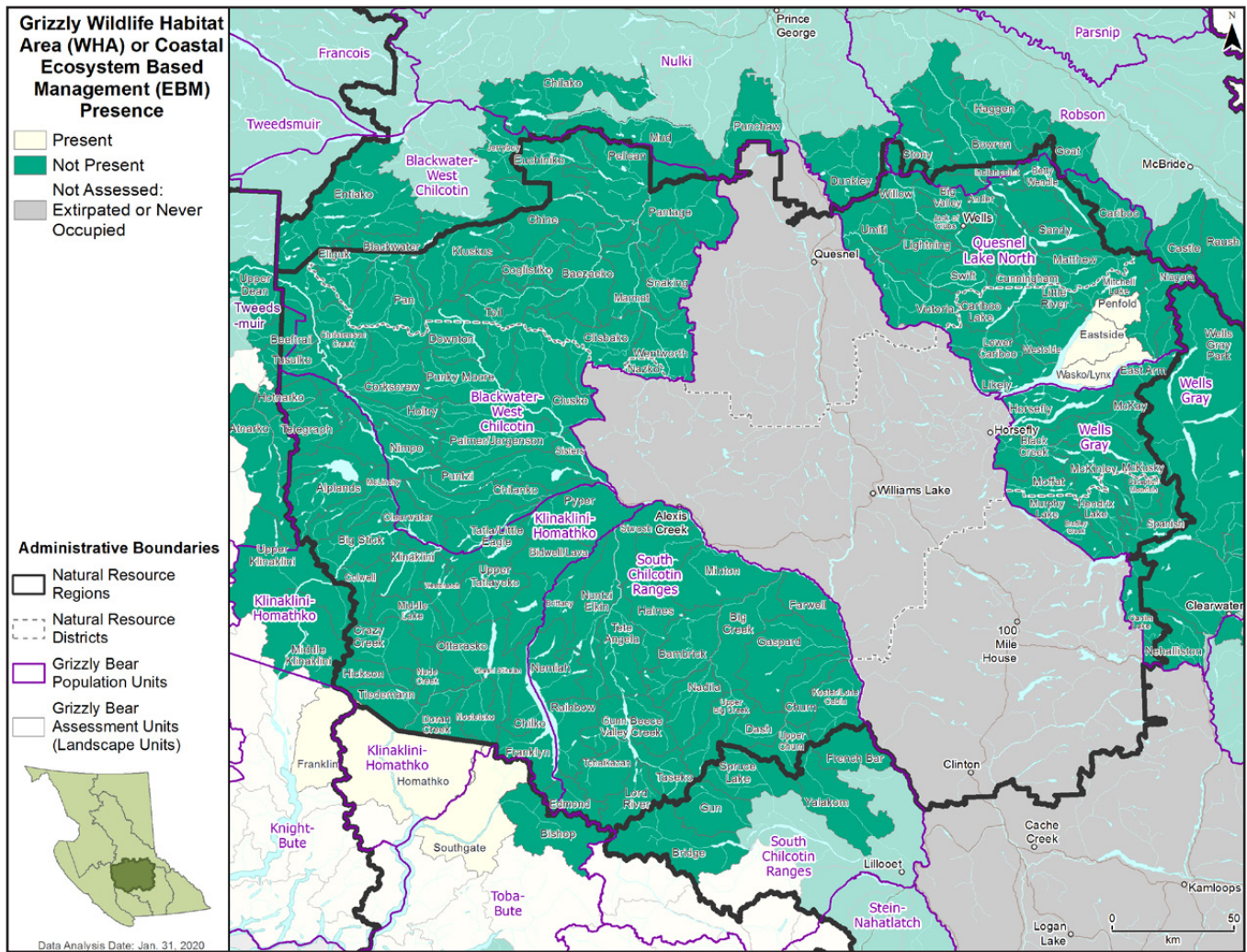


Figure 4.12 WHA and EBM Presence – Cariboo Region

5 CONCLUSION AND NEXT STEPS

Grizzly bears are susceptible to the cumulative impacts on their populations and habitat from extensive land use activities and disturbances. Within the Cariboo Region, various historic, present, and future anthropogenic activities and natural disturbances have the potential to impact grizzly bears.

This section discusses the results of this assessment, outlines how to improve assessments in the future, as well as next steps to manage grizzly bear populations and habitat within the Cariboo Region.

5.1 MAIN OBSERVATIONS

Grizzly Bear Conservation Concern Rank and Density

The **population rank** for grizzly bears varies across the Cariboo Region. The Blackwater-West Chilcotin, South Chilcotin Ranges and Quesnel Lake North GBPUs are classified with the M3 (Moderate Concern) conservation classification and are flagged for management attention. The Klinaklini-Homathko and Wells Grey GBPUs are classified with the M4 (Low Concern) and are not flagged at this time.

GBPU population estimates vary in relation to estimated **bear density** and GBPU area. Bear density is flagged for management attention in the majority of the Blackwater West Chilcotin GBPU and small portions of the Wells Grey and South Chilcotin Ranges GBPUs.

Human Presence and Activities

From this assessment, it appears that the main risk to grizzly bears is disturbance from anthropogenic activities and human-bear conflicts that result in grizzly bear mortality. It is important to acknowledge that the Cariboo Region has low human density outside of towns such as Williams Lake, Quesnel and 100 Mile House, however the landbase has been impacted by human activities in the region including mineral exploration and development, pipeline and transmission line development, urban development, forestry activities, range and agricultural use, recreational use, and associated road development. Humans are also continuing to expand into backcountry areas for recreational purposes or other development projects, which may further impact grizzly bears in the future.

The extent of expansion and human presence is apparent in the Cariboo Region as the **front country** indicator is flagged for most of the region, indicating a potential threat to grizzly bear populations and habitat. **Road density** is also flagged in many LUs throughout the region due to the extent of human presence and anthropogenic activities which may lead to population effects (i.e., lower grizzly bear **populations** and **densities** due to **mortality** resulting from human-bear conflict) and habitat effects such as habitat fragmentation. The assessment results also show a general deficit of **core security areas**. This is in part due to human presence which has fragmented grizzly bear habitat, but also in part due to naturally low areas of habitat capability (i.e., drier ecosystems and presence of **mid-seral dense conifer**).

Hunter day density is also flagged for management attention, mainly within the Quesnel Lake North, Wells Grey (WMU 5-2 and WMU 5-15) and southern tip of the South Chilcotin Ranges GBPU (WMU 5-3). These areas are in proximity to human settlement but accessible areas popular with game hunters that are hunting species other than grizzly bears. Again, grizzly bear populations may be impacted from these activities as the presence of game hunters increases the likelihood of human-bear conflicts.

Habitat Quality and Protection

While **poor forage potential** has only been flagged for a small amount of LUs in the region, the Cariboo Region supports low to moderate habitat quality for grizzly bears overall.

In terms of **habitat protection**, high-capability grizzly bear habitat is found in small areas throughout the region, mainly through provincial parks and WHAs. Parks including Bowron Lake Provincial Park, Cariboo Mountains Provincial Park (Quesnel Lake North GBPU), Ts'il'os Provincial Park, Big Creek Provincial Park (South Chilcotin Ranges GBPU), Nazko Lake Provincial Park, and Itcha Ilgachuz Provincial Park (Blackwater-West Chilcotin GBPU) help to conserve high-capability grizzly bear habitat. The majority of these areas are disconnected from each other, meaning that grizzly bears are isolated to specific areas within the region.

The Cariboo Region also supports low habitat capability for grizzly bears. Areas with the highest **habitat capability** are isolated to the eastern portions of the region within the Quesnel Lake North and Wells Grey GBPU. The remainder of the region has low to moderate habitat capability.

Quality Food Sources

Quality food sources (including salmon and vegetation) are concentrated in the eastern portion of the region, particularly within the Quesnel Lake North and Wells Grey GBPU. A cluster of LUs adjacent to the Chilko River in the Klinaklini-Homathko and South Chilcotin Ranges GBPU are an area with high salmon biomass. There are numerous salmon-bearing rivers throughout the region, however salmon availability is variable, and may be further impacted by climate change into the future.

5.2 FURTHER ANALYSIS AND INVESTIGATION

As this initial assessment is at a broad scale, further research, analysis, and refinement at the regional level could improve the quality and applicability of some indicators. However, information provided in this current condition report alongside the grizzly bear cumulative effects (IMG) key should be used by land managers in the interim to assess the potential cumulative impacts of further developments on the landbase.

Further investigation into the indicators, improvements to future assessments, and additional research that could be undertaken to improve the assessment of grizzly bears in the Cariboo Region includes:

- **Bear Density:** The bear density indicator provides an initial population estimate; however, it may not be the best methodology to determine where sources and sinks for grizzly bear populations are occurring. Population should be measured in a more direct way (see Lamb et al 2020).
- **Road Density:** Improve road dataset to further identify different types of roads, including their uses, and the temporal scale of use to more accurately reflect road density metrics and the potential threat to grizzly bears. Additionally, separate pipeline corridors, transmission line rights-of-way, and rail lines from the roads data layer as these linear features have different effects on grizzly bear. Future assessments should make use of the Cariboo consolidated roads layer that was produced after this assessment was run.
- **Poor Forage Potential (BEC Mid-Seral Conifer):** Incorporate more temporal variation to this indicator to include a signal for decision makers of potential upcoming mid-seral foraging constraints. Include the actual spatial arrangement of flagged LUs to provide decision makers a finer scale for consideration in their decisions.
- **Quality Food:** Include kokanee in future assessments as they are a substantial part of grizzly bears diets in the Cariboo Region.
- **Habitat Protection:** Include key CCLUP legal objectives that indirectly protect grizzly bear habitat such as Community Areas of Special Concern which contribute over 400,000 ha of no-harvest protections mainly within the Klinaklini-Homathko GBPU.
- Create a Human Influence Index, which is directly related to bear density, mortality risk, and other metrics (see Lamb et al 2020).

5.3 RECOMMENDED NEXT STEPS

Overall, the results of this assessment are intended to inform strategic and tactical decision making and may be used to provide relevant context for operational decision making within certain areas within the Cariboo Region. These assessment results should also be considered in the context of First Nations' interests, unique LU characteristics, competing resource values, climate change and other important contextual information before determining which type of management response is warranted, if any.

Reducing Risk to Populations and Habitat

Resource managers should consider the following actions to reduce risks to grizzly bear populations and habitat:

- Incorporate grizzly bear population objectives for GBPU from the Provincial Grizzly Bear Management Plan
- Deactivate and/or restrict access on roads (permanent or seasonal) in high priority grizzly bear habitat, especially in areas where roads and associated human activity are impacting the ability of grizzly bears to travel across their range (i.e., to connect and enhance core security areas);
- In the longer term, establish grizzly bear WHAs or WMAs in locations where habitat capability is high and populations are threatened, and ensure that these areas are connected;
- Adjust forest planning and practices and access management in priority grizzly bear habitat to conserve grizzly bear habitat and to enhance seasonal foraging habitats (e.g., berry production);
- Adjust range planning and practices to minimize conflicts between livestock and grizzly bears, particularly so that bears cannot access dead livestock and grain;
- Continue education on proper management of attractants (e.g., managing dead livestock appropriately, bear-proof disposal of roadkill)
- Adjust best practices for other major industrial projects (such as mining and energy projects) to mitigate project impacts to grizzly bear populations and habitat in areas that are shown to have high risk to grizzly bears or are located in highly capable habitat; and,
- Follow a suite of provincial best management practices and guidelines as well as best available information when making decisions regarding future conservation and management of grizzly bear populations and habitat in the Cariboo Region and adjacent regions.

Validation and Ground-Truthing

As this is a Tier 1 (GIS-based) assessment, validation of assessment results could be conducted within flagged LUs to verify/ground truth results to determine the amount of risk exists and what type of management responses could be taken to reduce risks.

Research, Inventory and Monitoring

In recent years, management attention has been focused within the Cariboo Region related to grizzly bear populations and habitat. Research, inventory, and monitoring efforts have recently been completed or are underway throughout the region, led by scientific experts, local First Nations groups, and/or the Province. Some of these projects include studying grizzly bear habitat selection, habitat suitability, habitat management, population density and distribution, and seasonal population dynamics, among others. Of note, the Tsilhqot'in Nation has been leading a grizzly bear radio-collaring project in the Chilko River area since 2021 to better understand grizzly bear seasonal movements and survival. They also initiated a DNA study along the Chilko River in 2022 to assess seasonal population dynamics in this important grizzly bear forage area. Additionally, the province installed a camera trap grid along the Chilko River corridor in 2021 to help estimate population density and distribution in the area. This project is being conducted in partnership with the University of British Columbia Okanagan, the Tsilhqot'in Nation and Xenigwet'in First Nation. Additionally, a grizzly bear DNA project was started for the Quesnel Lake North Population Unit in 2023 to improve understanding of grizzly bear density and seasonal habitat-use, particularly around highly productive salmon bearing river systems that are within or connected to protected areas. Grizzly bear DNA is being collected by non-invasive hair snags and the work is being led by the Southern Dakelh Nation Alliance and Lhtako Dene Nation. Two years of hair snag grids have been completed in the Quesnel Highlands, Quesnel Lake north arm, and Mitchell River in Cariboo Mountains Provincial Park. The study will provide critical information to help manage landscape activities and understand their impacts on grizzly bear and salmon relationships in these ecologically important and sensitive areas in central-east British Columbia. This project is supported by BC Parks, Environment and Climate Change Canada, and BC Ministry of Water, Land and Resource Stewardship.

As such, resource managers should consider conducting or continuing ongoing research, inventory (especially in smaller and/or more isolated GBPUs), and monitoring efforts to refine understanding of grizzly bear populations, density, habitat use, diet, and threats, especially in LUs flagged as high risk to grizzly bears due to insufficient core security area, high hunter and road densities, and inadequate quality habitat protected.

Additionally, resource managers should also consider continuing to conduct cumulative effects assessments within the region. These assessments are GIS-based and provide an approximation of the status of values across a spatial area based on the effects of multiple activities on the landbase. For grizzly bears, these assessments can inform if population and habitat effects or risks are present, and over time, temporal trends of values across the landscape can be compared. The results of these assessments can inform where additional research, inventory and monitoring is required, and can inform resource management practices, including land use planning.

Government Decisions and Plans

The provincial government is working to develop a provincial grizzly bear management plan that will provide guidance for establishing and implementing habitat and population objectives and targets for each GBPU in the province (based on the IUCN-NatureServe GBPU conservation and management status rankings).

Additionally, work underway to modernize land use plans will be instrumental in providing additional management actions and considerations for land use decision makers.

These plans are supported by regional experts as it will be instrumental in informing the Cariboo Region and adjacent regions' actions to address grizzly bear populations and habitat in the future.

Coordination with Neighbouring Regions

Notably, an opportunity exists for the Cariboo Region to work with the Thompson-Okanagan Region to facilitate a coordinated approach in managing grizzly bear populations and habitat within the Wells Grey GBPU.⁴⁹ Wells Grey Provincial Park and the surrounding area that supports both populations, habitat, and food sources for grizzly bears is split between these two regions. As grizzly bears are able to traverse park and administrative boundaries, this particular area should be jointly managed and monitored over time.

Coordinated management is also warranted with the South Coast, West Coast, Omineca, and Skeena regions where GBPU and LUs overlap to manage grizzly bear populations and habitat.

Assessment of Future Trends

Future environmental and industrial trends will be important to consider when determining next steps for managing grizzly bear populations and habitat in the assessed GBPUs, including but not limited to:

- **Logging and wildfires** – will create more closed-canopy conifer forests in future, which are not suitable grizzly bear habitat; roads associated with harvest and wildfire rehabilitation activities must be managed.
- **Urban and agricultural areas, natural resource industries (especially energy), and backcountry recreation** – anticipated growth of these areas and industries in the region will further diminish viable grizzly bear habitat and increase human-bear conflict, especially in already imperilled and vulnerable GBPUs in proximity to major southern interior centers; and,
- **Climate change** – the effects of climate change on grizzly bears is uncertain, but the combined effects of industrial and urban expansion and climate change will likely increase grizzly bear mobility (in search of food) and consequent potential for human-bear conflicts.

Supporting Future Current Condition Assessments

Continuing to monitor the current condition of grizzly bears in the Cariboo Region is also recommended. As human activities continue and may potentially expand in the region in the future, it is imperative that cumulative effects are monitored over time to determine if and how they are impacting grizzly bear populations and habitat.

Re-running this analysis every three to five years will allow for the ability to measure the spatial and temporal impacts from human activities in the region, from which mitigation measures can be applied and monitored for effectiveness in areas that are a high risk for grizzly bears. This timeframe for re-assessment should also consider the projections of human population, progression of increased mid-seral due to forest harvesting post-beetle epidemic, development and activities within the region and should be adjusted accordingly if activities are predicted to increase substantially in the near future or are expected to be gradual over a longer term.

⁴⁹ Caribou management is also ongoing in the Wells Grey and Itcha-Ilgachuz area. Conversations on how to manage both species in this area must also be coordinated between the Cariboo and TOK Regions.

6 REFERENCES

- BC MELP (British Columbia Ministry of Environment, Lands and Parks) 1995a. Conservation of Grizzly Bears in British Columbia Background Report. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/grizzly-bears/grizzly_background_report.pdf
- BC MELP (British Columbia Ministry of Environment, Lands and Parks) 1995b. A Future for the Grizzly: British Columbia Grizzly Bear Conservation Strategy. <https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/grizzly-bears/futureforgrizzly1995.pdf>
- BC MFLNRO (British Columbia Ministry of Forests, Lands and Natural Resource Operations). 2020. British Columbia Grizzly Bear Population Estimate for 2018. Accessed from https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/grizzly-bears/grizzly_bear_pop_est_report_2018_final.pdf
- BC MFLNRO (British Columbia Ministry of Forests, Lands, and Natural Resource Operations). 2016. Adapting Natural Resource Management to Climate Change in the Thompson-Okanagan Region: Considerations for practitioners and Government staff <https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/regional-extension-notes/toen160222.pdf>
- BC MOECC & MFLNRORD (Ministry of Environment and Climate Change Strategy and Ministry of Forests, Lands, Natural Resource Operations and Rural Development). 2020. Interim Assessment Protocol for Grizzly Bear in British Columbia – Standards for Assessing the Condition of Grizzly Bear Populations and Habitat under British Columbia’s Cumulative Effects Framework. Version 1.2. Prepared by the Provincial Grizzly Bear Technical Working Group – Ministry of Environment and Climate Change Strategy and Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 45 pp. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/protocols/cef_grizzly_bear_protocol_oct2020_final.pdf
- Bourbonnais ML, Nelson TA, Cattet MRL, Darimont CT, Stenhouse GB 2013. Spatial Analysis of Factors Influencing Long Term Stress in the Grizzly Bear (*Ursus arctos*) Population of Alberta, Canada. *PLoS ONE* 8(12): e83768. <https://doi.org/10.1371/journal.pone.0083768>
- COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012. COSEWIC Assessment and Status Report on the Grizzly Bear (*Ursus arctos*) in Canada. Ottawa, ON. xiv + 84 pp. https://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_ours_grizz_bear_1012_e.pdf
- Dahle B & Swenson JE. 2003. Home ranges in adult Scandinavian brown bears (*Ursus arctos*): effect of mass, sex, reproductive category, population density and habitat type. *J Zool.* 260(4):329. <https://doi.org/10.1017/S0952836903003753>
- Daust, D & Price K. 2016. Climate Change Vulnerability of BC’s Fish and Wildlife: First Approximation. Accessed Aug 15, 2018 from <https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/adaptation/climate20change20vulnerability20of20bcs20fish20and20wildlife20final20june6.pdf>
- Fisher JT & Wilkinson L. 2005. The response of mammals to forest fire and timber harvest in the North American boreal forest. *Mammal Rev.* 35(1):51–81. <https://doi.org/10.1111/j.1365-2907.2005.00053.x>
- Gangadharan A, Pollock S, Gilhooly P, Friesen A, Dorsey B & St. Clair CC. 2017. Grain spilled from moving trains create a substantial wildlife attractant in protected areas. *Animal Conservation.* 20(5):391–400. <https://doi.org/10.1111/acv.12336>
- Gilbert B, Craighead L, Horejsi B, Paquet P, & McCrory, W. 2004. Scientific Criteria for Evaluation and Establishment of Grizzly Bear Management Areas in British Columbia. Panel of Independent Scientists, Victoria, B.C. 16pp. <https://www.jstor.org/stable/3873239>
- Government of Canada. 2011. Species Profile: Grizzly Bear Western Population. Species at Risk Public Registry. https://wildlifesppecies.canada.ca/species-risk-registry/species/speciesDetails_e.cfm?sid=1195
- Hamilton AN & Austin MA. 2004. Estimating Grizzly Bear (*Ursus arctos*) Population Size in British Columbia Using an Expert-Based Approach. Ministry of Water, Land and Air Protection. Victoria, B.C. 38 pp. http://www.env.gov.bc.ca/wld/documents/gb_est_pop_size.pdf
- van der Grift EA. 1999. Mammals and railroads: impacts and management implications. *Lutra.* 42:77–98.
- Haroldson MA, Schwartz CC, Cherry S, & Moody DS. 2004. Possible effects of elk harvest on fall distribution of grizzly bears in the Greater Yellowstone Ecosystem. *The Journal of Wildlife Management* 68(1): 129-137. [https://doi.org/10.2193/0022-541X\(2004\)068\[0129:PEOEH0\]2.0.CO;2](https://doi.org/10.2193/0022-541X(2004)068[0129:PEOEH0]2.0.CO;2)
- Harvey JE, Smith DJ & Veblen TT. 2017. Mixed-severity fire history at a forest–grassland ecotone in west central British Columbia, Canada. *Ecological Applications.* 27(6):1746–1760. <https://doi.org/10.1002/eap.1563>
- Lamb CT, Ford, AT, McLellan, BN, Proctor, MF, Mowat, G, Ciarniello, L, ... & Boutin, S. 2020. The ecology of human–carnivore coexistence. *Proceedings of the National Academy of Sciences*, 117(30), 17876–17883. <https://doi.org/10.1073/pnas.1922097117>

6 References

- Master LL, Faber-Langendoen D, Bittman R, Hammerson GA, Heidel B, Ramsay L, Snow K, Teucher A, & Tomaino A. 2012. NatureServe Conservation Status Assessments: Factors for Evaluating Species and Ecosystem Risk. NatureServe, Arlington, VA. https://www.natureserve.org/sites/default/files/publications/files/natureserveconservationstatusfactors_apr12_1.pdf
- McLellan BN & Hovey FW. 1995. The diet of grizzly bears in the Flathead River drainage of southeastern British Columbia. *Can J Zool.* 73(4):704–712. <https://doi.org/10.1139/z95-082>
- McCloughlin PD, Ferguson SH & Messier F. 2000. Intraspecific Variation in Home Range Overlap with Habitat Quality: A Comparison among Brown Bear Populations. *Evolutionary Ecology.* 14(1):39–60. <https://doi.org/10.1023/A:1011019031766>
- Mowat G & Heard D. 2006. Major components of grizzly bear diet across North America. *Can J Zool.* 84:473–489. <https://doi.org/10.1139/z06-016>
- Mowat G, Heard DC, & Schwarz CJ. 2013. Predicting Grizzly Bear Density in Western North America. *PLoS ONE* 8(12): e82757. <https://doi.org/10.1371/journal.pone.0082757>
- Munro RHM, Nielsen SE, Price MH, Stenhouse GB & Boyce MS. 2006. Seasonal and Diel Patterns of Grizzly Bear Diet and Activity in West-Central Alberta. *J Mammal.* 87(6):1112–1121. <https://doi.org/10.1644/05-MAMM-A-410R3.1>
- Murray MH, Fassina S, Iii JBH, Whittington J & Clair CCS. 2017. Seasonal and individual variation in the use of rail-associated food attractants by grizzly bears (*Ursus arctos*) in a national park. *PLoS ONE.* 12(5):e0175658. <https://doi.org/10.1371/journal.pone.0175658>
- Nielsen SE, Stenhouse GB, & Beyer HL, Huettmann F & Boyce MS. 2008. Can natural disturbance-based forestry rescue a declining population of grizzly bears? *Biological Conservation.* 141(9):2193–2207. <https://doi.org/10.1016/j.biocon.2008.06.020>
- Pollock SZ, Nielsen SE, & Clair CCS. 2017. A railway increases the abundance and accelerates the phenology of bear-attracting plants in a forested, mountain park. *Ecosphere.* 8(10):e01985. <https://doi.org/10.1002/ecs2.1985>
- Prevéy JS, Parker LE, Harrington CA, Lamb CT, & Proctor MF. 2020. Climate change shifts in habitat suitability and phenology of huckleberry (*Vaccinium membranaceum*). *Agricultural and Forest Meteorology.* 280:107803. <https://doi.org/10.1016/j.agrformet.2019.107803>
- Province of British Columbia. 2016. Cumulative Effects Framework Interim Policy for the Natural Resource Sector. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/cef-interimpolicy-oct_14_-2_2016_signed.pdf
- Province of British Columbia. 2013. Compulsory Inspection Database. <https://www2.gov.bc.ca/gov/content/sports-culture/recreation/fishing-hunting/hunting/compulsory-inspection>
- Province of British Columbia. 1995. Biodiversity Guidebook. Victoria, British Columbia, Canada. <https://www.for.gov.bc.ca/hfd/library/documents/bib19715.pdf>
- Province of British Columbia. 1995. Cariboo-Chilcotin Resource Land Use Plan. Accessed Aug 15, 2018, from <https://www2.gov.bc.ca/gov/content?id=761AAFE2EA0C43B6A14F77FAB50B4F2F>
- Provincial Grizzly Bear Technical Working Group. 2015. Cumulative Effects Grizzly Bear Knowledge Summary – draft (June 30, 2015). 38 pp.
- Souliere CM, Coogan SCP, Stenhouse GB & Nielsen SE. 2020. Harvested forests as a surrogate to wildfires in relation to grizzly bear food-supply in west-central Alberta. *Forest Ecology and Management.* 456:117685. <https://doi.org/10.1016/j.foreco.2019.117685>
- Turner MG. 2010. Disturbance and landscape dynamics in a changing world. *Ecology.* 91(10):2833–2849. <https://doi.org/10.1890/10-0097.1>

7 APPENDICES

APPENDIX 1 – GRIZZLY BEAR OBJECTIVES AND LEGAL PROTECTION

In B.C. and the Cariboo Region, management and conservation of grizzly bears is governed by a number of provincial and regional strategies, legislation, land use plans, and management plans. A detailed description of the plans, strategies and legislation that are important for grizzly bears is provided below.

Provincial Strategies and Management Plans

The Provincial Grizzly Bear Conservation Strategy (BC MELP, 1995b) establishes government’s overarching objective for grizzly bears – to “maintain in perpetuity the diversity and abundance of grizzly bears and the ecosystems on which they depend throughout B.C. for future generations.” A provincial grizzly bear management plan is currently under development.

In October 2017, the B.C. Auditor General released An Independent Audit of Grizzly Bear Management, which highlights the need for Government action to identify and secure key grizzly bear habitats, and to mitigate the impacts of human activities that degrade this habitat. The government of B.C. committed to implementing the Auditor General’s recommendations by creating a provincial grizzly bear stewardship framework that will set clear policy objectives for managing and conserving grizzly bears across the province. In turn, this plan will inform the Cariboo Region’s actions to sustain grizzly bear populations and habitat.

Licensed Grizzly Bear Hunt Closure

In December 2017, the B.C. Government announced a provincial closure on licensed grizzly bear hunting (other than harvests by First Nations for food, social and ceremonial purposes). Historically, hunting of grizzly bears was strictly regulated under the provincial *Wildlife Act*.

Since 2001, grizzly bear hunting has not been permitted in threatened GBPU or in GBPU with low bear population densities (i.e., the number of bears per 1,000 km²).⁵⁰ Where hunting has been permitted, it has been managed through limited entry hunts and quotas issued to guide outfitters.

Legislation

Forest and Range Practices Act (FRPA)

Under FRPA grizzly bears are “identified wildlife” (a species that is vulnerable to the effects of forest and range practices). This means that government may establish legally enforceable wildlife habitat areas and general wildlife measures (forest and range practices)⁵¹ for grizzly bears in areas of high conservation priority.

⁵⁰ As per British Columbia’s Grizzly Bear Population Estimate- 2018 (MFLNRORD 2020).

⁵¹ Note that general wildlife measures do not apply to mining, oil and gas exploration, production, and development under the following acts: *Mineral Tenure Act, Coal Act, Mines Act, Petroleum and Natural Gas Act, Pipeline Act, or Geothermal Resources Act*.

For grizzly bear habitat that is not already protected in parks, WHAs or SAs, section 7(1) of the Forest Planning and Practices Regulation identifies the objectives set for wildlife for the purpose of Forest Stewardship Planning under FRPA, while section 9(2) of the Woodlot License Planning and Practices Regulation identifies the objectives set for wildlife for the purpose of Woodlot License Planning under FRPA. Grizzly Bear Accounts and Measures provide additional provincial policy guidance to inform forest and range planning and practices that aim to mitigate impacts to the habitat.

Wildlife Act

In December 2017, the B.C. Government closed the licensed grizzly bear hunt. Up until this time, hunting of grizzly bears was highly regulated under the provincial *Wildlife Act*. Where hunting was allowed, it was managed through LEHs and quotas.

In addition to enabling the regulation of hunting, the *Wildlife Act* (section 109) also enables government to regulate public access to the backcountry (e.g., road closures, motor vehicle restrictions) for the purpose of protecting or managing wildlife.⁵²

Environmental Assessment Act

Major industrial projects – such as mines, pipelines, and hydropower generation projects – can be a threat to grizzly bears if they are located within grizzly bear habitat, require new roads and corridors, or involve human camps and activity. As such, an important legal tool for protecting grizzly bears is the environmental review and certification of major projects under the *Environmental Assessment Act*. If a major project is deemed to impact grizzly bears, approval of the project will likely be subject to legally binding conditions that specify actions to mitigate the impacts of the project on grizzly bears.

There are few major industrial projects are located within or adjacent to the Cariboo Region including existing Mt. Polley and Gibraltar Gold/Copper Mine and various placer and gold mine operations being proposed or underway. Many of these projects are located in grizzly bear habitat and therefore have enforceable conditions that require avoiding high-value grizzly bear habitat, minimizing and/or remediating new roads or trails, and, educating project works to reduce bear attractants, manage human food and waste, and avoid human-bear conflicts.

Other Legislation

The *Land Act* (section 66), the *Forest and Range Practices Act* (sections 22.2 and 58), and the *Motor Vehicle (All Terrain) Act* (section 7) also enable the provincial government to restrict land uses, recreation uses, road access, or use of all-terrain vehicles in the backcountry, all of which may assist in managing human access to bear habitat.

Land Use Plans

Land use plans in the Cariboo Region establish resource management objectives and strategies for maintaining grizzly bear habitat and protecting bear populations on Crown lands.

The Cariboo Chilcotin Land Use Plan (CCLUP) (1994) establishes resource management objectives, some legal and some non-legal, as well as strategies for maintaining grizzly bear habitat and protecting bear populations within the GBPUs discussed in this report.

⁵² In addition to the *Wildlife Act*, the *Land Act* (section 66), the *Forest and Range Practices Act* (sections 22.2 and 58), and the *Motor Vehicle (All Terrain) Act* (section 7) enable Government to restrict land uses, recreation uses, road access, or use of all terrain vehicles in the backcountry, all of which may assist in managing human access to bear habitat.

The management objectives and strategies for grizzly bears in this plan are not all legally-binding but are intended to guide regulatory agencies and tenured resource users in oversight, planning, and delivery of industrial and recreation activities on Crown lands.

Objectives for grizzly bear include both broad objectives and specific objectives. Broad objectives are over-arching descriptions of desired conditions that often lack clear definitions and metrics, while specific objectives that have metrics directly associated with them.

Based on a review of existing direction for the management of grizzly bears the following broad objectives are considered for viable GBPU:

- At the population scale, ensure grizzly bear populations are sustainable, including managing for genetic and demographic linkage;
- Continue to manage lands and resources for the provision of sustainable grizzly bear hunting and viewing opportunities as informed by research, inventory and monitoring; and
- At the landscape scale, sustain and where appropriate, restore the productivity, connectivity, abundance and distribution of grizzly bears and their habitats.

It is recognized that there are additional objectives for grizzly bears at various scales, and that these are supplemental to the objectives stated above and can be considered in cumulative effects assessments at regional levels.

In the Cariboo Region, specific objectives for grizzly bear are set out in the CCLUP, the Land Use Order (LUO)⁵³ and under several WHAs through the Government Actions Regulation (GAR).

In the CCLUP Appendix 3, the objective for grizzly bear is the following provision for 31 of the 37 CCLUP sub-units, and the same provision without specifying “grizzly bear” but specifying “species at risk” for the remaining six CCLUP sub-units: *“To manage for **grizzly bear**, moose, furbearer, **species at risk**, and other sensitive habitats within the areas identified as riparian buffers, recreation areas, caribou habitat and lakeshore management zones and throughout the polygon under the biodiversity conservation strategy.”*

Objectives 33 and 34 of the LUO provide additional, detailed objectives for grizzly bear. These are:

- **33** *Apart from existing Wildlife Habitat Areas, retain security cover adjacent to critical grizzly bear foraging habitats which include salmon and trout spawning reaches or shoals, and herb-dominated avalanche track and run-out zones on southerly and westerly aspects, in very high, high and moderate capability grizzly bear units shown on Map 12 and defined by the spatial dataset, Cariboo-Chilcotin Grizzly Bear Capability.*
- **34** *In very high, high and moderate capability grizzly bear units shown on map 12 and defined by the spatial dataset, Cariboo-Chilcotin Grizzly Bear Capability, conduct silviculture treatments on cutblocks to retain as much existing natural berry production as practicable.*

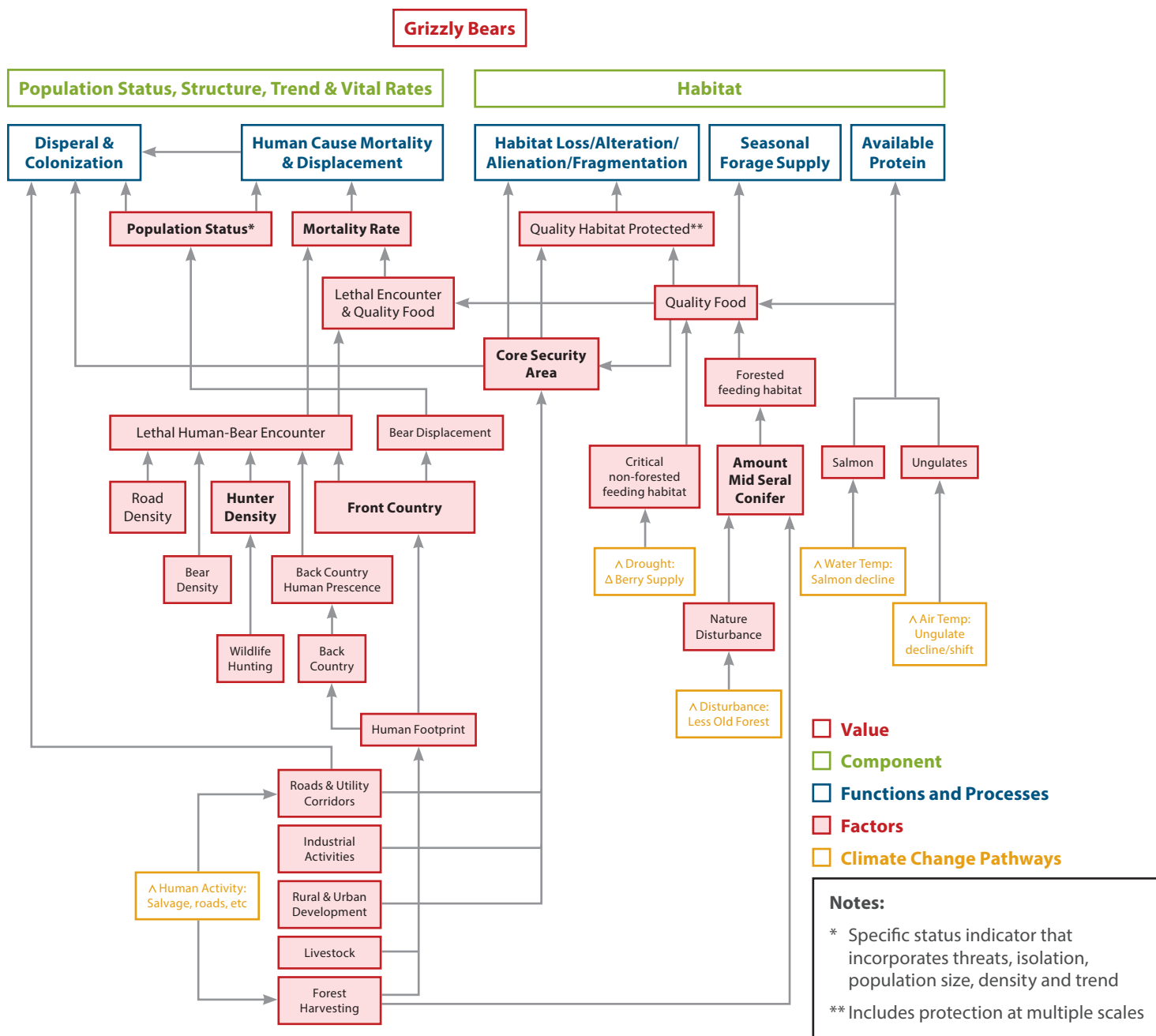
Additionally, in 2007, seven Wildlife Habitat Areas were established under the GAR for grizzly bear in three LUs in the Quesnel Lake North GBPU. These orders and associated supporting information are available at http://www.env.gov.bc.ca/cgi-bin/apps/faw/wharesult.cgi?search=wlap_region&wlap=Cariboo.

⁵³ https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/cariboo-region/cariboochilcotin-rlup/order_cariboo_chilcotin_luo_lupa.pdf

APPENDIX 2 – CONCEPTUAL MODEL

This diagram illustrates how the indicators (a sub-set of the factors shown in the diagram)⁵⁴ influence the functions and processes that support grizzly bear populations and habitat in B.C.

Also shown are the factors considered to assess the risks from threats to grizzly bears and the pathways of effect resulting from climate change. However, those effects have not yet been spatially assessed but will be considered more explicitly in future versions of the protocol.



⁵⁴ The bolded factors (population status, mortality rate, hunter density, front country, core security area, and amount mid seral conifer) are core indicators, meaning they are the primary indicators used to assess potential risks to grizzly bears. Supplementary indicators were also assessed to provide important context information to support decision-making; the supplementary indicators are bear density, road density, quality food, lethal encounter potential and quality food, and quality habitat protected.

APPENDIX 3 – DATA

Please see Appendix II of the Interim Assessment Protocol for Grizzly Bears in British Columbia and the British Columbia Data Catalogue for the dataset and metadata used in this assessment.

Please visit the provincial Cumulative Effects Framework website for more information and to view reports for other regions across British Columbia.



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