Current Condition Report for Grizzly Bear in the Thompson Okanagan 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/BB796F2DAAAB4220942E4587DEE20C7B

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

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EXECUTIVE SUMMARY

This current condition assessment for grizzly bear in the Thompson Okanagan Region was created under B.C.'s Cumulative Effects Framework (CEF) and follows the methods set out in the Interim Assessment Protocol for Grizzly Bear in British Columbia. Using data from 2019, 10 indicators are used to describe and assess the status of grizzly bears and their 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 small Landscape Units (LUs). Populations are managed within the former, while habitat objectives are managed within the latter.

At the LU level, three indicators – front country, road density, and core habitat security – were frequently flagged for management attention and drove overall rankings when rolled up at the GBPU level. Together, these indicators highlight high human activity across the region, which increases mortality risk for bears through human-bear encounters and habitat displacement (either through habitat loss or avoidance).

This report highlights that all GBPUs in the Thompson Okanagan Region are of management concern except the Wells Gray GBPU. The GBPUs in order of conservation ranking are: North Cascades and Stein-Nahatlatch; followed by Columbia-Shuswap, Central Monashee, and Kettle-Granby; then South Chilcotin; and finally, Wells Gray. Every highlighted GBPU requires management attention when making decisions that influence grizzly bears and/or their habitat in these GBPUs.

Trends and mechanisms for risk to grizzly bear are variable across the Thompson Okanagan Region. The highest risk areas for grizzly bears centre around the extirpated area in the middle of the region and follow major travel corridors. Highways 99, 5 and 1 are major corridors with high human use that inhibit movement of grizzly bears between population units. The highest road densities occur around those major travel corridors and in and around human settlements (i.e., in the Central Monashee, Columbia-Shuswap, Kettle-Granby, North Cascades GBPUs as well as the southern portion of the Wells Gray GBPU).

On the east side of the region, human-bear conflicts are expected to increase as bear distribution expands into areas grizzly bears have been absent from for decades. On the west side of the region, increased recreation is expected to be the driving cause of increased human-bear conflict.

Core secure habitat is low across most of Thompson Okanagan Region, which also increases risk of human-bear interactions. Areas of low road density, high core security habitat and low front country habitat are correlated with parks and protected areas across the region.

When reviewing proposed land use activities in the Thompson Okanagan Region, resource specialists and decision-makers should consider mitigation measures to reduce grizzly bear mortality and loss of grizzly bear habitat. The indicators in this report highlight where the spatial constraints on grizzly bear habitat are highest in the region. Suggested mitigation measures include:

- Urgent management action to address road density and core habitat security, especially in LUs that are flagged for deficit of these items. We strongly recommend the deactivation and/or restriction of access on roads and corridors in high-priority grizzly bear habitat, particularly where forage capability is high but core security areas do not exist;

- Establish grizzly bear Wildlife Habitat Areas (WHAs) in locations where grizzly bear habitat capability is high but populations are pressured by the combined effects of high road density, high hunter day density, and low core security areas;
- Adjust forest planning practices in priority grizzly bear habitat to conserve or enhance the long-term availability of seasonal foraging habitats (e.g., berry production); and,
- Mitigate human-bear conflict with bear-smart community initiatives (e.g., WildSafeBC, Bear Hazard Assessments).

LIST OF ACRONYMS

B.C.	British Columbia
BEC	Biogeoclimatic Ecosystem Classification
BEI	Broad Ecosystem Inventory
CEF	Cumulative Effects Framework
CID	Compulsory Inspection Database
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
FLNRORD	Ministry of Forests, Lands, Natural Resource Operations and Rural Development
FRPA	*Forest and Range Practices Act*
GBPU	Grizzly Bear Population Unit
IUCN	International Union for Conservation of Nature
LEH	Limited Entry Hunt
LU	Landscape Unit
MOECCS	Ministry of Environment and Climate Change Strategy
SA	Specified Area
WHA	Wildlife Habitat 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 Cumulative Effects Framework (CEF), benchmarks are identified to support assessment and reporting in relation to broad objectives (CEF Interim Policy, 2016).

Cumulative Effects: Under the Provincial CEF, 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 (GBPUs) delineate individual bear populations for conservation and management. In total, there are 55 GBPUs in B.C.

Landscape Units (LUs): Landscape units (LUs) are areas of land and water used for long-term planning of resource management activities, with an initial priority for biodiversity conservation. LUs are important in creating objectives and strategies for landscape-level biodiversity and for managing other forest resources.

Wildlife Management Units (WMUs): Delineated administrative regions for wild game management. The province of B.C. is divided into 9 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 B.C. 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 effects[1] across natural resource sectors and to support the integration of assessment results into natural resource decision-making.

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

This report provides an overview of the current condition of grizzly bear (*Ursus arctos*) populations within the Thompson Okanagan Natural Resource Region (Thompson Okanagan Region) as of 2019. Separate reports look at the current condition of grizzly bear populations in the other Natural Resource Regions of the province (see section 2.2).

The methodology of this assessment was targeted to address broad provincial objectives for grizzly bear (see section 2.4) and examines: 1) the status of grizzly bear populations, 2) the capacity of grizzly bear habitat to provide adequate food and shelter, and 3) the risks associated with human presence in grizzly bear habitat.

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 the indicators and methods used to assess the current condition of grizzly bears within the Thompson Okanagan Region, including limitations of the assessment;
- Results and regional interpretation for each indicator, including 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 Thompson Okanagan Region.

The results in 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 Thompson Okanagan Region.

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 (Province of B.C., 2016).

2 GRIZZLY BEAR OVERVIEW

In B.C., grizzly bears have significant ecological, cultural, and economic importance. Ecologically, they are an umbrella species that reflect the overall health of the ecosystems they inhabit. Culturally, many First Nations in B.C. include grizzly bears in their cultural and spiritual traditions, histories, and philosophies. Economically, ecotourism and bear viewing are important to the provincial economy (though opportunities are limited in the Thompson Okanagan Region).

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) in the federal *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, 1995).

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

2.1 HABITAT & DIET

Grizzly bears require large and connected areas to meet their life requisites. Large-scale habitat connectivity is very important for grizzly bear populations, and their home range sizes are proportionate to the quality, quantity, and distribution of food (BC MWLAP, 2004b).

Grizzly bears favour habitats such as open cutblocks that are integrated with forests, subalpine meadows, south facing avalanche chutes and forests, alpine areas, flood plains, recent burns, and riparian areas – all of which are utilized at different times throughout the year (Apps et al., 2007; Ramcharita 2000; Serrouya et al., 2011). Recent disturbances from wildfire or timber harvest often provide important foraging areas (Munro et al., 2006; Souliere et al., 2020) if road density thresholds are not exceeded (Nielsen et al., 2008).

Grizzly habitat use and diet varies seasonally. Forbs, grasses, sedges, and other green vegetation are consumed in spring and early summer, whereas berries, roots, whitebark pine *(Pinus albicaulis*) seeds, and salmonids are consumed in late summer and fall.

In most areas of the B.C. Interior, fish protein is not readily available, and berries (e.g., *Vaccinium membranaceum, Shepherdia canadensis*) are the most important food source in late summer and fall (McLellan & Hovey, 1995; Mowat & Heard, 2006). Terrestrial protein sources such as ants, ground squirrels, and ungulates are consumed throughout the year. Additional species-specific information on grizzly bears can be found in **Appendix 1**.

2.2 DISTRIBUTION & MANAGEMENT IN THE THOMPSON OKANAGAN REGION

In the Thompson Okanagan Region, grizzly bears are considered to be extirpated[2] throughout the centre of the region, stretching north from the United States border to the Cariboo Region (Figure 2.1). This is due to historic habitat loss associated with human settlement and establishment of agricultural areas.

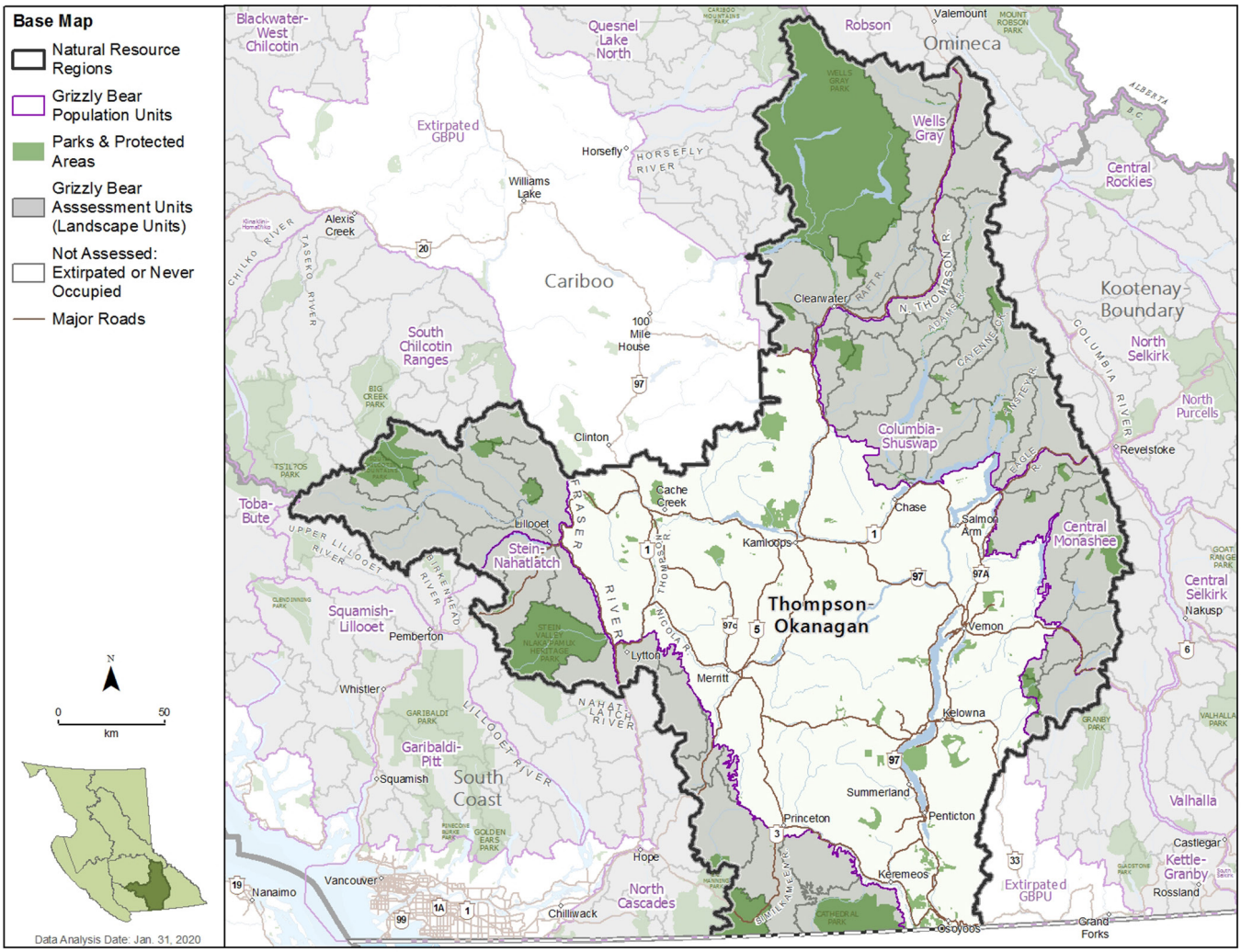

Figure 2.1 *Grizzly bear population units and assessment units in the Thompson Okanagan Natural Resource Region.*

[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).

This report provides information for the following GBPUs that largely fall within (>50% in area) and are directly managed by the Thompson Okanagan Region: Central Monashee, Columbia-Shuswap, Kettle-Granby, North Cascades, South Chilcotin Ranges, Stein-Nahatlatch, and Wells Gray. These GBPUs significantly overlap adjacent FLNRORD Natural Resource Regions including Cariboo, South Coast, Omineca, and Kootenay-Boundary.

Please refer to the current condition reports for neighbouring Natural Resource Regions for further assessment information via the Provincial Cumulative Effects Framework website.

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. Potential threats to grizzly bears in the Thompson Okanagan Region include the pervasiveness of front country, industrial activities, road development, human presence, and climate change.

Front Country

In the Thompson Okanagan Region, the largest threat to grizzly bears is pervasive front country. Front country includes urban and rural settlements, agricultural lands, industrial development, recreational areas, and associated roads.

The encroachment of front country into viable grizzly bear habitat has, over time, led to loss, alteration, and fragmentation of grizzly bear habitat. In these modified environments, human-bear conflicts increase, resulting in grizzly bear mortality. Bears are often attracted to these environments, which can lead to ecological traps and even declining populations. The historical expansion of human settlement and conversion of forests for agriculture in the central part of the region led to the loss of local grizzly bear populations in the area currently considered as extirpated.

Human-bear conflicts usually lead to bear mortality, which is an important concern in three of the seven GBPUs in the region – South Chilcotin Ranges, Stein-Nahatlatch, and Kettle-Granby – where 24% to 75% of bear deaths are due to “problem bears”. In the front country, grizzly bears are attracted to livestock, crops, orchards, garbage, and other attractants.

The Thompson Okanagan Region is characterized by a relatively high human population density, with many agricultural communities unaccustomed to grizzly bears, and grizzly bears are expanding their range in the northern and eastern sections of the region. It is expected that human/agricultural conflicts with grizzly bears will continue to increase as bears recolonize parts of the Thompson Okanagan Region where they have been absent for decades. These conflicts will be most pronounced adjacent to the Kettle-Granby, Central Monashee, and Columbia-Shuswap GBPUs as bears disperse into the area where they are currently considered extirpated.

Industrial Development

In the backcountry, industrial development (primarily forestry, ranching, and mining, but also energy projects) and recreation are extensive in most parts of the Thompson Okanagan Region. These activities – including the roads and corridors created to enable human access to the backcountry – pose a significant threat to grizzly bears as they may lead to habitat loss, fragmentation, displacement, and increased risk of mortality.

In the backcountry, grizzly bears are drawn to hunter kills and human camps (especially garbage), all of which increase their risk of being killed due to human conflicts.

Road Development & Access Management

Roads and corridors associated with industrial development and human settlement affect grizzly bear populations and habitat. Road development results in direct habitat loss and fragmentation, as well as displacement from preferred habitats near and along roadways due to human presence and activity.[3]

The primary risk from roads is increased mortality, as they allow people and bears to get into closer proximity. Roads and other linear corridors (e.g., pipelines and transmission lines) connect previously disconnected watersheds, and those that remain open after deactivation are used by guide outfitters, hunters, trappers, and other recreationists to access the backcountry. Grizzly bears also use linear corridors for foraging and travel, which increases the risk of human-bear conflicts that may result in mortality (Boulanger and Stenhouse, 2014).

Climate Change

Climate change may create both positive and negative environmental conditions for grizzly bears. See the following section for a description of the potential effects of climate change on grizzly bears in the Thompson Okanagan Region.

[3] Although the Government of B.C. 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 are an important research priority.

Potential Effects of Climate Change on Grizzly Bears in the Thompson Okanagan Region

The climate in the Thompson Okanagan Region has changed over the past century and is expected to continue to change (BC MFLNRO, 2016). Projections suggest that by the end of this century, the region may warm, on average, an additional 1.6°C to 4.4°C. Summer temperatures are projected to increase the most; more heat waves are expected, particularly at low elevations. Precipitation is projected to decrease in summer and to increase in other seasons. Spring snowfall is projected to decrease, resulting in reduced snowpack. Warmer temperatures and less spring snowfall will result in a longer growing season.

Climate envelopes, climatic conditions associated with currently mapped biogeoclimatic zones, are expected to shift upslope and northward across the province (BC MFLNRO, 2016). Projections suggest that climate envelopes for current biogeoclimatic zones in the Thompson Okanagan Region may shift 85-250 m upward in elevation and up to 175 km northward by mid-century. Ecosystems may undergo regime shifts, for example, conversion of forests to shrubs or grassland ecosystems. The increased prevalence of natural disturbance will vary by climatic sub-region, elevation, and forest type. Hotter and drier summers, along with increased tree mortality due to drought and pests, will increase fire hazard. More frequent, severe, and extensive wildfires are projected.

Grizzly bears are highly adaptable omnivores with a diverse foraging strategy (MacHutchon, 2021); predicting the multiple trophic effects of climate change on bears is complicated (BC MFLNRORD, in prep.). This species' ability to move long distances across various habitat types to track seasonally available forage may buffer against some of the anticipated effects of climate change (Ciarniello, 2018). Nevertheless, climate change will influence availability of important seasonal food sources (Ciarniello, 2018). Lack of high-quality foods during the fat deposition period in late summer and fall may impair body condition prior to hibernation (Mowat & Heard, 2006). Adult females with low body fat have lower reproduction rates; those with very low (≤20%) body fat may not give birth at all (Robbins et al., 2012).

Climate change is expected to alter the spatial and temporal availability of fleshy fruits, a critical high-energy food source in late summer and fall. Where available, black huckleberry (*Vaccinium membranaceum*) is the primary species consumed by grizzly bears across the province; fruiting species of secondary importance in the Thompson Okanagan Region include saskatoon berry

(*Amelanchier alnifolia*), oval-leaved blueberry (*Vaccinium ovalifolium*), dwarf blueberry (*Vaccinium caespitosum*), grouseberry (*Vaccinium scoparium*), blue-leaved huckleberry (*Vaccinium deliciosum*), thimbleberry (*Rubus parviflorus*), and soapberry/soopolallie/buffaloberry (*Shepherdia canadensis*) (Ciarniello, 2018; MacHutchon, 2021). Black huckleberry distribution in the Thompson Okanagan Region is projected to contract at lower elevations, while expanding northward and into higher elevations where soil conditions are suitable (Prevéy et al., 2020). Berry supply may be variable, decreasing in areas affected by drought, yet increasing in areas disturbed by fire (Prevéy et al., 2020). Warmer winter and spring temperatures are expected to advance the timing of flowering and fruit production, potentially affecting berry quality and quantity (Laskin et al., 2019; Prevéy et al., 2020). Earlier flowering may increase risk of frost damage and/or asynchronization with pollinators, resulting in berry crop failures (Prevéy et al., 2020). Earlier ripening may widen the gap between berry availability and hibernation, negatively affecting female body condition and reproduction (Laskin et al., 2019).

Climate change is projected to decrease the supply of whitebark pine (*Pinus albicaulis*) seeds, a high-quality food source preferentially consumed by grizzly bears where available (Ciarniello, 2018). Whitebark pine has already declined across its range in western North America due to the combined effects of white pine blister rust, mountain pine beetle, and fire suppression; climate change will further amplify the decline of this sub-alpine tree species (COSEWIC, 2010; Keane et al., 2017). Bioclimate envelope models for British Columbia project that 73% of the current habitat of whitebark pine will be lost by 2085 (Hamann and Wang, 2006). Such a significant decline will impact Thompson Okanagan grizzly bears, particularly bears in the Stein-Nahatlatch and South Chilcotin Ranges GBPUs, through the loss of a critical food source and by increasing the probability of human-bear conflicts as bears seek alternate foods at lower elevations (Ciarniello, 2018; Iredale, 2016).

Spatiotemporal availability of other seasonal plant foods is also projected to change. Herbaceous vegetation (i.e., forbs, grasses, sedges) will be available earlier in spring and later into the fall/winter because of a longer growing season, thereby extending the foraging period (Ciarniello, 2018). Summer moisture deficit, however, may constrain vegetation productivity, particularly in drier Thompson Okanagan sub-regions (BC MFLNRO, 2016). Supply of plant roots in high-elevation habitats, an important food source before and after herbaceous vegetation is available (Coogan et al., 2012), may decline due to woody encroachment of alpine/sub-alpine meadows (Roberts et al., 2014). Other high-value foraging habitats may become limited. For example, avalanche chutes may become less common due to reduced snowpack (Butler, 2012). Upslope migration of forage plant species, particularly berry-producing shrubs, may improve habitat quality at higher elevations, offsetting some of these losses (Roberts et al., 2014).

Climate change is expected to affect abundance and distribution of salmon and terrestrial prey species. Salmon, an important food source for some Thompson Okanagan grizzly bears, such as those in the Wells Gray and South Chilcotin Ranges GPBUs (Mowat & Heard, 2006; Mueller & Boulanger, 2013), are projected to decline (Grant et al., 2019). Climate change is projected to favour generalist species such as elk and deer (Price & Daust, 2016); how this will affect Thompson Okanagan grizzly bears is unknown given that grizzly bears are opportunistic predators and not all individuals consume meat (Mowat & Heard, 2006).

The projected decline of salmon, loss of whitebark pine, and northward/upslope shift in huckleberry distribution is concerning for grizzly bears in the Thompson Okanagan Region. Although grizzly bears have the capacity to adapt to alternative food sources under a changing climate, resiliency of grizzly bear populations will depend on secure access to critical food sources (Ciarniello, 2018). Individuals can adapt their foraging behaviour to co-exist with humans; however human-caused mortality, either directly through human-bear conflicts or indirectly through habitat loss, will likely continue to threaten grizzly bear populations (Lamb et al., 2020). Warmer spring temperatures, reduced snowpack, and a longer growing season are expected to shorten the hibernation period, which may negatively affect cub body condition and survival, as well as increase the probability of human-bear conflicts (Pigeon et al., 2016). Land use will likely expand and/or shift with the changing climate, contributing to further habitat loss (Price & Daust, 2016).

Persistence of grizzly bears in human-dominated landscapes will continue to be a challenge (Lamb et al., 2020). Motorized access management, key to minimizing human-caused mortality, will be most effective when applied across smaller areas to optimize the protection of high-quality habitats to benefit female distribution, survival, reproduction, and density across a broad area (Proctor et al., 2019). Re-establishing and/or enhancing inter-population movement will also be critical to ensuring the persistence of grizzly bears (Proctor et al., 2012), particularly for the small and totally isolated North Cascades and Stein-Nahatlatch GPBUs in the Thompson Okanagan Region (Environmental Reporting BC, 2020; McLellan et al., 2021; NCGBRT, 2004).

2.4 GRIZZLY BEAR MANAGEMENT, OBJECTIVES, AND GUIDANCE

In B.C. and in the Thompson Okanagan Region, the management and conservation of grizzly bears is governed by several provincial and regional strategies, legislation, land use plans, and management plans. Legislation and any legal orders related to these documents are legally enforceable, and the non-legal direction is also important as it outlines important management and conservation objectives.

A brief description of strategies, plans, and legislation that apply provincially and in the Thompson Okanagan Region are listed below. For more detailed information, please refer to **Appendix 1** (section on legal objectives) and **Appendix 4**.

Provincial Broad Objectives & Plans

- **Provincial Grizzly Bear Conservation Strategy**: overall objective to "maintain in perpetuity the diversity and abundance of grizzly bears and the ecosystems upon which they depend" (BC MELP, 1995).
- **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.

Regional Objectives & Plans

- **Land and Resource Management Plans**[4] for the Thompson Okanagan Region call for:
  - managing grizzly bear habitat, including maintaining or enhancing forage availability sources, cover, and connectivity;
  - minimizing negative interactions associated with access;
  - maintaining forest attributes suitable for high capability grizzly bear habitat;
  - minimizing new roads and deactivating/restricting access on existing roads;
  - minimizing negative human-bear interactions through public education; and,
  - minimizing negative interactions associated with commercial tourism and recreation developments, while maintaining economic opportunities.

[4] For more information on the Land and Resource Management Plans in the Thompson Okanagan Region, visit https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/thompson-okanagan.

Legal 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 the area is necessary to meet the habitat requirements of a category of species at risk or regionally important wildlife.[5]
- ***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.[6]
- ***Environmental Assessment Act***: the environmental review and certification of major projects (e.g., mines, pipelines, hydropower generation) can set legally binding conditions that 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.

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.

[5] 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 (DWCs).

[6] 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 & DATA

This current condition report follows the methodology outlined in the Interim Assessment Protocol for Grizzly Bear in British Columbia, Version 1.2 (the Protocol) (BC MFLNRORD & BC MOECCS, 2020). The Protocol provides an initial 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 assessment model (**Appendix 2**) provides an overview of the functions, processes, and indicators that affect grizzly bears, which are based on the current scientific understanding of grizzly bear ecology.

In this report, the current condition of grizzly bear populations within the Thompson Okanagan Region is assessed using data from 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 at two spatial scales: large Grizzly Bear Population Units (GBPUs) and small Landscape Units (LUs). GBPU boundaries identify similar behavioural ecotypes and sub-populations of grizzly bears for the purposes of management and conservation. LUs are a spatially defined area of land and/or water used for long-term planning of resource management activities.[7] GBPUs and LUs may overlap with other land and resource use planning polygons, including other FLNRORD Natural Resource Regions, Wildlife Management Units (WMUs), as well as parks and protected areas for which habitat protection objectives are set.

In this report, the results for each indicator (except Population Rank) are reported at the LU scale 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 are used to describe and assess the status of grizzly bear populations and habitat relative to the provincial government's broad objectives (see section 2.4) for grizzly bears.

Table 3.1 below 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.

The approach to assessing each indicator is detailed in Section 4.

[7] 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 number of bears per 1,000 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, 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 an 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		
Mid-Seral Dense Conifer (Poor Forage Potential)*	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 BEI capability of ecosystems to produce grizzly bear forage (e.g., forbs, grasses, sedges, berries, whitebark pine) plus salmon biomass.	LU
Habitat Protection+	The amount of high-capability grizzly bear habitat within an LU that is protected in conservation areas and wildlife habitat areas	LU

Note: * Core indicators = the primary flags for identifying potential sources of risk to grizzly bears.
+ Supplemental indicators = intended to provide more detail and contextual information to aid in informing decisions.

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.

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.[8] Indicators that exceed benchmarks are "flagged" and expected to represent higher risks to grizzly bear populations (Table 3.1). **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 3.1) that reflects increasing potential effects to the value and indicates the benchmark value, where applicable.

Table 3.1 *Colour scale used in assessment maps for representing indicator condition in relation to benchmarks. Some indicators use several benchmarks to communicate increasing 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

[8] 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 B.C., 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 regional commentaries.

The regional commentaries interpret the meaning of the results, identify relevant contributing or causal factors, provide supporting numerical data where appropriate, and discuss limitations of the assessment. Recommendations may include further analysis or investigation that could be undertaken at the regional level to better understand the condition of grizzly bears and their habitat.

To facilitate comparison of assessment results across LUs and indicators, **Appendix 3** includes a comprehensive list of flagged/not flagged results by LU that highlight where there are higher risks to grizzly bears that may warrant further investigation by resource managers and decision-makers.

Appendix 4 provides additional insight into the current condition of grizzly bears in each GBPU, as well as the conservation and management actions in place or proposed in each GBPU that aim to mitigate threats to grizzly bear habitat and populations.

Reviewers are also encouraged to explore the results further within their areas of interest using provincial data sources outlined in **Appendix 4** and through the Thompson Okanagan Region's online, interactive dashboard and web mapping tool (when available).

4.1 POPULATION RANK – CORE

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.[9] 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,[10] ranked highest to lowest conservation rank in terms of risk, see Morgan et al., 2019 for full details).

Interpretation Key

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

Benchmark

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

Management Context

Decisions related to population recovery planning.

Regional Commentary:

Conservation Concern Rankings

The majority of the GBPUs in the Thompson Okanagan Region are flagged for management attention. The Stein-Nahatlatch and the North Cascades GBPUs are classified with the M1 (Extreme Concern) conservation classification. These GBPUs are adjacent to the Garibaldi-Pitt GBPU in the South Coast region; the only other GBPU in the province that is also classified with the M1 (Extreme Concern) conservation classification. These GBPUs are flagged because they are isolated, with few bears, a decreasing population trend, significant natural resource or urban development, and high presence of humans through recreation or settlement.

The Columbia-Shuswap, Central Monashee, and Kettle-Granby GBPUs are classified as High conservation concern (M2). These GBPUs are flagged because they are moderately to highly isolated and face numerous threats due to natural resource development and recreation. The South Chilcotin Ranges GBPU is classified as Moderate conservation concern (M3) because it is somewhat isolated and faces threats from natural resource development and recreation; this GBPU has also shown an increasing population trend in recent years. See **Appendix 4** and Morgan et al., 2019 for more details.

The only GBPU that is not flagged is Wells Gray, which is classified as Low conservation concern (M4).

As mentioned in Section 2.2, certain GBPUs within the Thompson Okanagan Region overlap the administrative boundaries of other Natural Resource Regions (Figure 2.1; Table 4.1). 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.

[9] For additional information on the NatureServe Conservation Rank Calculator, visit https://www.natureserve.org/conservation-tools/conservation-rank-calculator.

[10] 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.

Additionally, grizzly bear populations are considered extirpated throughout the centre of the Thompson Okanagan 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.

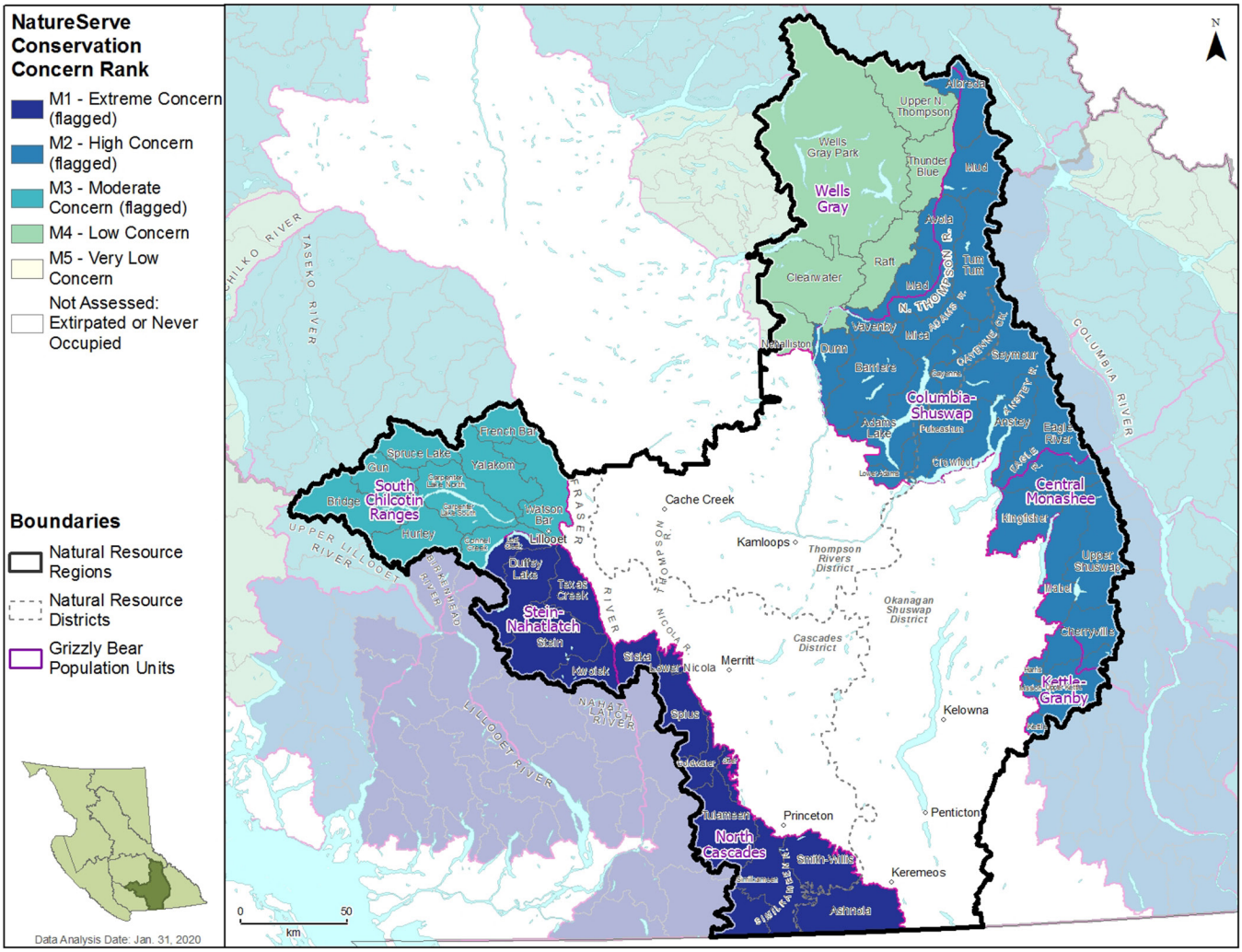

Figure 4.1 *Conservation ranking of grizzly bear population units that overlap the Thompson Okanagan Natural Resource Region. Conservation ranking was completed using NatureServe methodology.*

4.2 NUMBER OF BEARS – SUPPLEMENTAL

Indicator Description

This indicator reports the estimated number of bears per 1,000 km^2 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.

Interpretation Key

- Bear densities >10 bears per 1,000 km^2 are lower risk.
- Bear densities < 10 bears per 1,000 km^2 are higher risk and are flagged; management considerations are recommended when reviewing land-based decisions in these areas.

Benchmark

- >10 bears per 1,000 km^2 (not flagged)
- <10 bears per 1,000 km^2 (flagged)[11]

Management Context

Decisions related to population recovery planning, estimating historic range occupancy, estimating current population density, establishing licensed hunting allocations (prior to the December 2017 closure), and conservation management.

Regional Commentary:

Bear densities within the Thompson Okanagan Region are variable. Bear densities are highest along the northern border of the Wells Gray and Columbia-Shuswap GBPUs, as well as within the Central Monashee GBPU, where the average grizzly bear density is greater than 20 bears/1,000 km^2, well above the 10 bears/1,000 km^2 benchmark. Overall, these portions of the GBPUs are lower risk for grizzly bears.

All of the Stein-Nahatlatch, North Cascades, and the southwest portion of the Columbia-Shuswap GBPU (comprising five LUs in the Shuswap Highlands surrounding Adams Lake) are flagged for management attention as grizzly bear densities are estimated to be less than 10 bears/1,000 km^2. This flag is consistent with the Population Rank indicator as grizzly bears have been affected by habitat loss and displacement due to human activities and human presence in these areas.

Population Estimates

Population estimates assume a uniform bear density across GBPUs. However, this assumption is not always valid due to localized variation in seasonal forage distribution, human activity, and interactions with other bears. As such, Table 4.1 should be utilized for relative density estimates between GBPUs.

GBPUs in the Thompson Okanagan Region have population estimates[12] ranging from 6 to 345 bears (Table 4.1) (BC MFLNRORD, 2020). The North Cascades GBPU has the lowest population estimate at 6 bears, while the Wells Gray GBPU has the highest population estimate at 345 bears.

[11] Benchmarks were derived from the IUCN calculator (Morgan et al., 2019).

[12] Population estimates were developed in 2018 using a regression model and field-based population inventory data where available (BC MFLNRORD, 2020).

Table 4.1 *Summary of population estimates for each Grizzly Bear Population Unit that overlaps the Thompson Okanagan Natural Resource Region.*

GBPU	NatureServe Conservation Concern Rank	Estimated Population	Total GBPU Area (km²)*	Bear Density (bears/ 1,000 km²)	GPBU Area Within TOK Region (km²)*	% GPBU Area Within TOK Region
Central Monashee	M2 (High Concern)	147	6,258	23.5	3,816	61%^
Columbia-Shuswap	M2 (High Concern)	318	12,643	25.2	10,250	81%^
Kettle-Granby	M2 (High Concern)	87	6,556	13.3	1,146	17%^
North Cascades	M1 (Extreme Concern)	6	9,763	0.6	5,636	58%+
South Chilcotin Ranges	M3 (Moderate Concern)	222	19,022	11.7	5,784	30%+
Stein-Nahatlatch	M1 (Extreme Concern)	22	7,482	2.9	3,114	42%+
Wells Gray	M4 (Low Concern)	345	13,888	24.8	9,479	68%x

Note: * Area calculations exclude rock, water, and ice which grizzly bears do not use.
^ Overlap with Kootenay Boundary Natural Resource Region
+ Overlap with South Coast Natural Resource Region
x Overlap with Cariboo Natural Resource Region

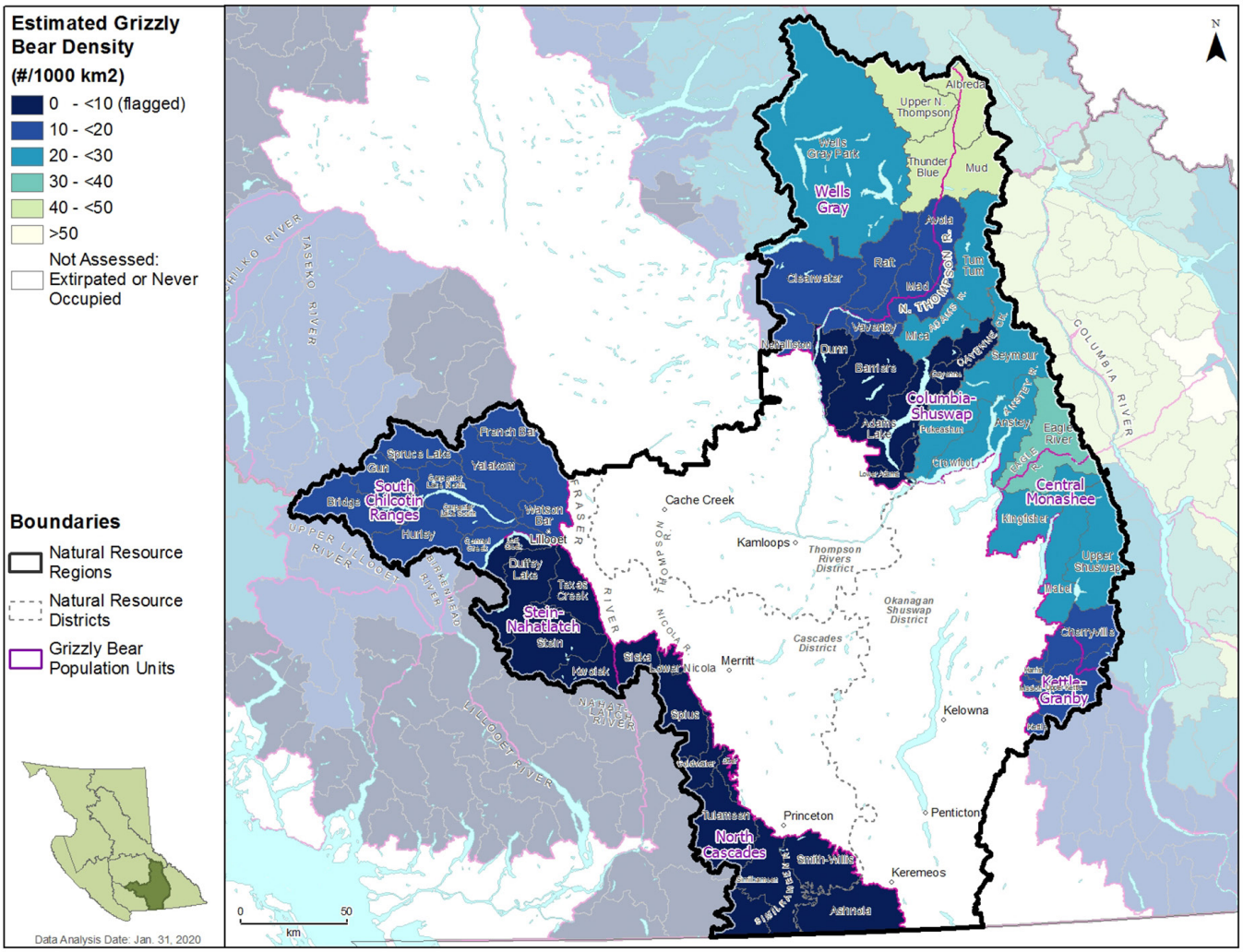

Figure 4.2 *Estimated grizzly bear density by landscape unit in the Thompson Okanagan Natural Resource as of 2018. Landscape units that are 'flagged' are under a provincial mortality benchmark that is expected to highlight increased risk to grizzly bears.*

4.3 MORTALITY RATE – CORE

Indicator Description

This indicator reports the percent female mortality of the estimated total GBPU grizzly bear population compared against mortality reference points,[13] averaged over 2008 to 2017. Population estimates are derived from the 2018 grizzly bear population estimates for B.C. Mortality is derived from the Compulsory Inspection Database [CID]), and provincial estimates for unreported mortality.[14] 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.

Interpretation Key

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

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

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.

Regional Commentary:

Humans are the main cause of adult grizzly bear mortality, including human-bear conflicts, illegal kills, and collisions with vehicles and trains. In the CID, mortalities are reported in six categories: hunting, animal control (to address human-bear conflicts), illegal kills, pick-ups (grizzly bears found dead, with cause of death unspecified), road kills, and rail kills.

There are nine contiguous moderate and high risk LUs within Columbia-Shuswap, Central Monashee and Kettle-Granby GBPUs (Figure 4.3). This area extends from the Eagle River LU north of Highway 1 to the Eagle LU south of Highway 6, and is situated along the west side of the Columbia River and Upper and Lower Arrow Lakes.

Mortality statistics indicate that instances of mortality in the Columbia-Shuswap and Central Monashee GBPUs are mostly associated with hunting in previous years, whereas animal control (to address human-bear conflicts) and illegal kills are likely reasons for excessive mortality in Kettle-Granby GBPU. Trends in reported mortality causes for each GBPU are summarized in **Appendix 4**.

Hunting of grizzly bears has not been permitted in the North Cascades GBPU since the mid-1970s, in Kettle-Granby GBPU since 1995, in the Stein-Nahatlatch GPBU since 2000, and in portions of the South Chilcotin Ranges GBPU[15] since 2000. Grizzly bear hunting has been prohibited in all other GBPUs since December 2017.[16]

[13] B.C. uses 4% to 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.

[14] 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.

[15] Grizzly bear hunting was permitted after 2000 for Region 5, including the Chilcotin Wildlife Management Unit 5-05 zone A (Homathko River) and Chilcotin Wildlife Management Unit 5-06. Season dates were from April 1 to June 10.

[16] 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) to conserve grizzly bear populations threatened by habitat loss and fragmentation as well as by direct human-caused bear mortality.

Implications of the provincial ban on grizzly bear hunting in 2017 are not yet known. However, the ban is not expected to have a significant impact on grizzly bear recovery in threatened GPBUs in the Thompson Okanagan Region, as hunting was already excluded in these areas.

It is important to note that the data used for this indicator are from the CID, and therefore represent a minimum estimate of female mortality. Not all natural mortality or mortality from unlicensed or illegal kills are captured in the CID, however provincial estimates are used to capture this in the assessment. For example, according to the CID data (Figure 4.3), the Stein-Nahatlatch GBPU has a low rate of female mortality of 0%–1.33% between 2008 and 2017. In contrast, during a collaring project between 2005 and 2018, Lamb et al. (2020) estimated adult female survival in the same GBPU to be 0.87 (or roughly 13% mortality rate).

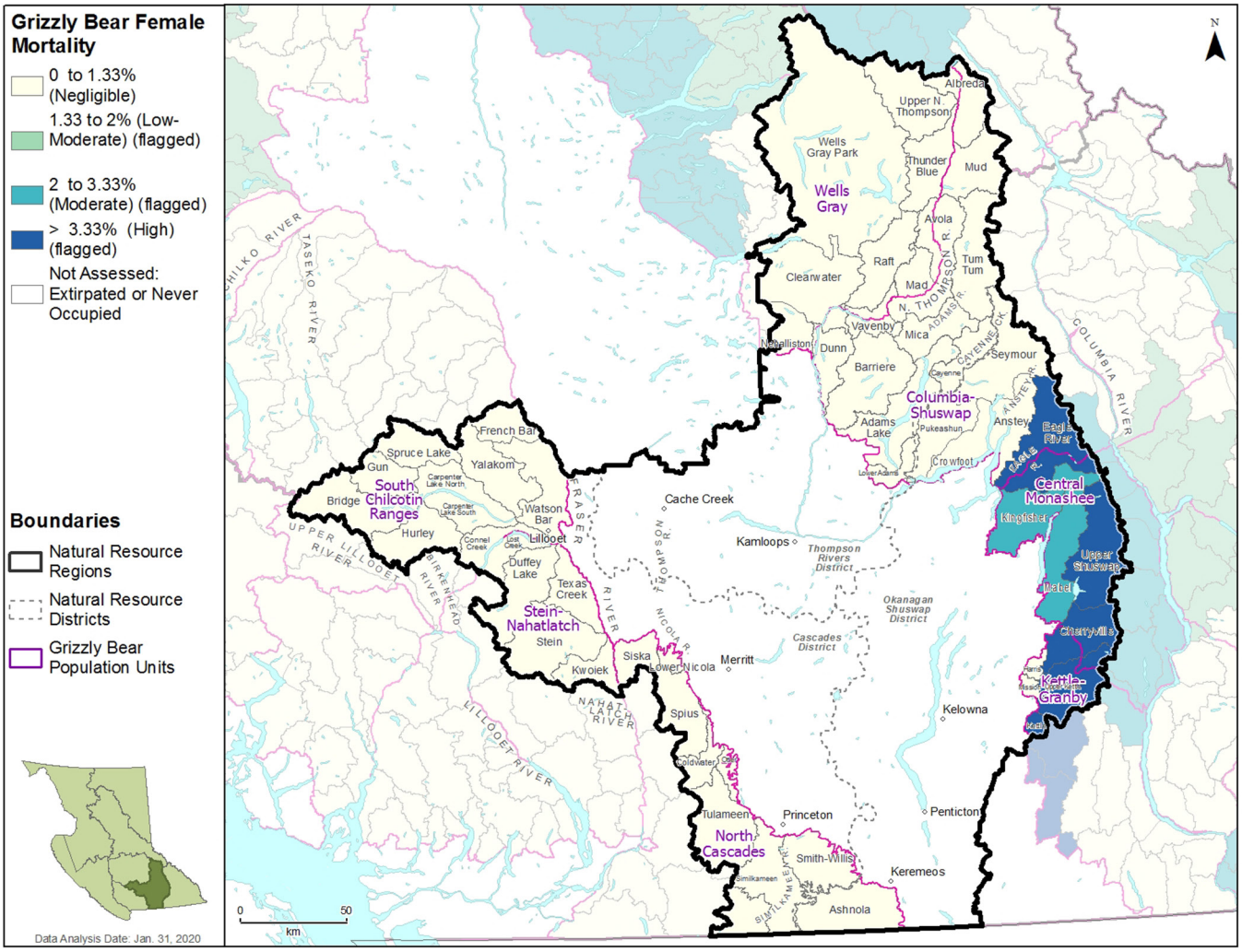

Figure 4.3 *Average annual female grizzly bear mortality rate by landscape unit in the Thompson Okanagan Natural Resource Region between 2008 and 2017. Mortality rates are as recorded in the Compulsory Inspection Database and updated to include provincial estimates for unreported mortality. Landscape units that are 'flagged' are above a provincial mortality benchmark that is expected to increase risk to grizzly bears.*

4.4 ROAD DENSITY – SUPPLEMENTAL

Indicator Description

This indicator reports total length of open roads[17] (as well as pipeline corridors, transmission line rights-of-way, and rail lines) divided by total LU area (km/km^2). Most grizzly bear mortalities occur within 500 metres of a road or other corridor, and are the result of human-bear conflicts, illegal kills, or collisions with vehicles and trains.[18] 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.

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 attention.[19]

Benchmark

- Road Density >0
- Class 0= 0 km/km^2 (Roadless)
- Class 1= 0.01-0.3 km/km^2 (Low)
- Class 2= 0.31-0.6 km/km^2 (Moderate)
- Class 3= 0.61-0.75 km/km^2 (High)
- Class 4, 5, 6 & 7= >0.75 km/km^2 (Very High)[20]

Management Context

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

Regional Commentary:

Multiple studies have found that most known grizzly bear deaths occur within 500 metres of a road or other corridor (Wakkinen & Kasworn, 1997; McLellan, 2015; Benn, 1998; Benn & Herrero, 2002; Boulanger & Stenhouse, 2014). Additionally, areas with high road density are avoided by grizzly bears. Overall, high road densities lead to habitat loss, fragmentation, population isolation, and an increased risk of human-caused mortality. Roads and traffic can alter bear behaviour in complex ways that vary by bear sex and dominance, and some demographic groups may experience higher road-related mortality risk than others (Boulanger & Stenhouse, 2014). For instance, grizzly bear cubs may not avoid roads, leading to increased and unsustainable mortality rates for the population. Resource selection function models for grizzly bears within southwestern British Columbia indicate that bears selected against resource roads (McLellan 2020; Iredale 2016). Areas with low road density are more favourable for grizzly bears, and the few roads present can attract bears due to roadside seeding, linear movement corridors, and increased prey availability (e.g., carrion).

The highest road densities occur in the Central Monashee, Columbia-Shuswap, Kettle-Granby, North Cascades GBPUs (Figure 4.4) as well as the southern portion of the Wells Gray GBPU. LUs that are flagged as >0.75 km/km^2 correlate directly to major highways in the region, including Highway 5, and

[17] 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.

[18] 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).

[19] 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.

[20] Road densities above 0.75 km/km^2 were associated with modeled population decline in an Alberta population (Boulanger and Stenhouse, 2014). Similarly, a transborder U.S.–B.C. study found sub-populations increased in areas where road density averaged 0.39km/km^2 and decreased where density averaged 0.9km/km^2. Several studies have recommended landscape scale thresholds of 0.6 km/km^2 (e.g., Mace et al., 1996) and planning processes in B.C., Alberta, and the U.S. have used these recommendations.

human settlements around towns. Road density ratings also vary substantially in the LUs within the South Chilcotin Ranges and Stein-Nahatlatch GBPUs from low (Class 1) to very high (Class 5). Although not considered in this assessment, access closures across the region mitigate some of the effects of high road density on grizzly bear populations (see **Appendix 4** for detailed closure information).

Although some LUs are not flagged for management attention at this time, these road networks are long-term disturbances that may see variable use by season and have the potential to negatively affect grizzly bears now and in the future. Improved inventory and classification of roads into hierarchical categories of human use (e.g., primary and tertiary/rugged) may improve our ability to assess risks resource roads pose to grizzly bears. This could be attained through remote sensing such as LiDAR.

Low road density ratings are generally associated with parks and protected areas (e.g., Wells Gray Park and E.C. Manning Park). Within and adjacent to the Thompson Okanagan Region, areas with no roads or very low road density are closely correlated with areas of core security (section 4.5); low road density (and viable forage habitat) directly correlates with high bear density.

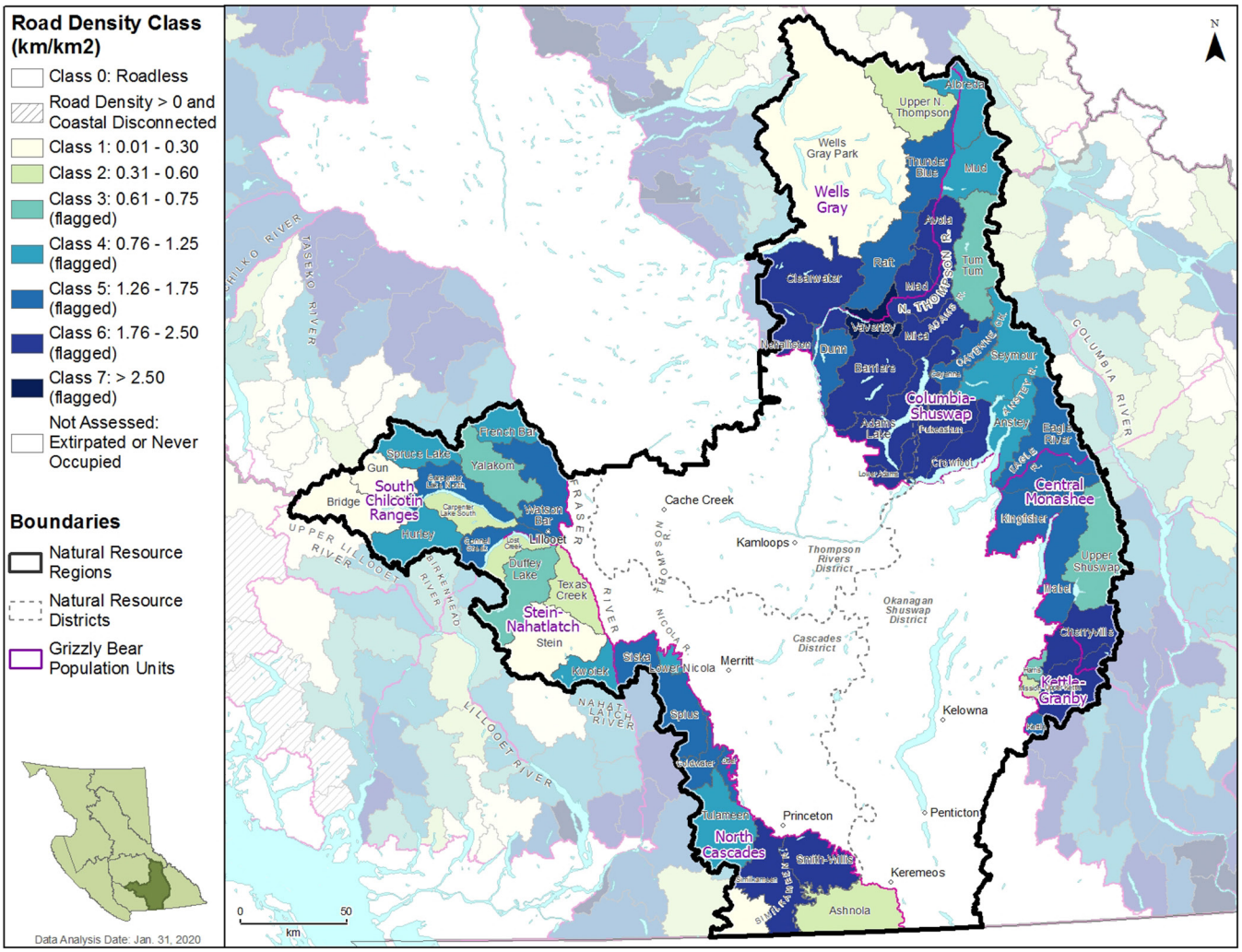

Figure 4.4 *Average road density by landscape unit in the Thompson Okanagan Natural Resource Region in 2018. Landscape units that are 'flagged' are above a road density benchmark and expected to increase risk to grizzly bears.*

4.5 CORE SECURITY AREAS – SUPPLEMENTAL

Indicator Description

This indicator reports the prevalence of core security areas, which are patches of habitat greater than 10 km^2 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 and/or industrial areas. To adequately buffer grizzly bears from humans, these core security areas must be 500 metres or more from human infrastructure and activity.[21]

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.

Benchmark

- ≥ 60% capable core[22] (not flagged)[23]
- < 60% capable core (flagged)

Management Context

Managing human access, managing attractants (e.g., hydro line rights-of-way and pipeline corridors, garbage dumps, camp management, access to salmon, licensed hunter regulation for managing ungulate kills such as removing carcasses to avoid negative bear encounters, etc.), minimizing bear mortality resulting from negative encounters with humans, and hunter education and regulations.

Regional Commentary:

Core security areas for grizzly bears are best represented in groupings of LUs that have high habitat capability and are protected, mountainous, or have minimal road access. In contrast, LUs with a deficit of core security have low habitat capability and/or habitat that is rendered ineffective because it is occupied by humans.

All assessed GBPUs in the Thompson Okanagan Region have areas with low core security for grizzly bears. Areas of core security are largely associated with parks in the Thompson Okanagan Region.

On the west side of the region, there are areas of sufficient core security habitat in Gun and Bridge LUs in the South Chilcotin Ranges GBPU; these are part of a cluster of LUs with sufficient core security habitat that extends into the Cariboo Natural Resource Region. Core security in this area are supported by several large provincial parks, including Nuntzi, Ts'ylos, Big Creek, South Chilcotin Mountains, and Upper Lillooet. Core security areas are also abundant in a cluster of LUs east of the Lillooet River along the northwest portion of Stein-Nahatlatch GBPU, extending east through Stein and Texas Creek LUs, which includes Mehatl Creek and Stein Valley Parks. Sufficient core security habitat in the North Cascades GBPU is limited to three LUs covering Skagit Valley, E.C. Manning, and Cathedral Provincial Parks. Outside of the Gun and Bridge River areas, the rest of the South Chilcotin Ranges GBPUs have a deficit of core secure habitat, and the Duffey Lake corridor and Kwoiek watershed within the Stein-Nahatlatch GBPU are notable for low amount of core secure habitat.

[21] 500-metre buffers on select human disturbance are excluded from core security areas: mining & extraction, oil & gas, utility rights-of-way, 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).

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

[23] 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.

On the east side of the region, core security habitat is abundant within and adjacent to Wells Gray Provincial Park, as well as along the eastern portion of the Central Monashee GBPU where the Upper Shuswap LU has sufficient core security habitat. This is adjacent to a cluster of LUs with sufficient core security habitat in the Kootenay-Boundary Region along the west side of the Columbia River in the Monashee Mountains. This series of LUs with sufficient core security habitat may facilitate connectivity and easy access to habitat and food sources between the Thompson Okanagan and Kootenay-Boundary Regions.

The majority of the Columbia-Shuswap and the Kettle-Granby GBPUs also have a deep deficit of core security (0%–30%). These results correlate with the road density indicator (section 4.4).

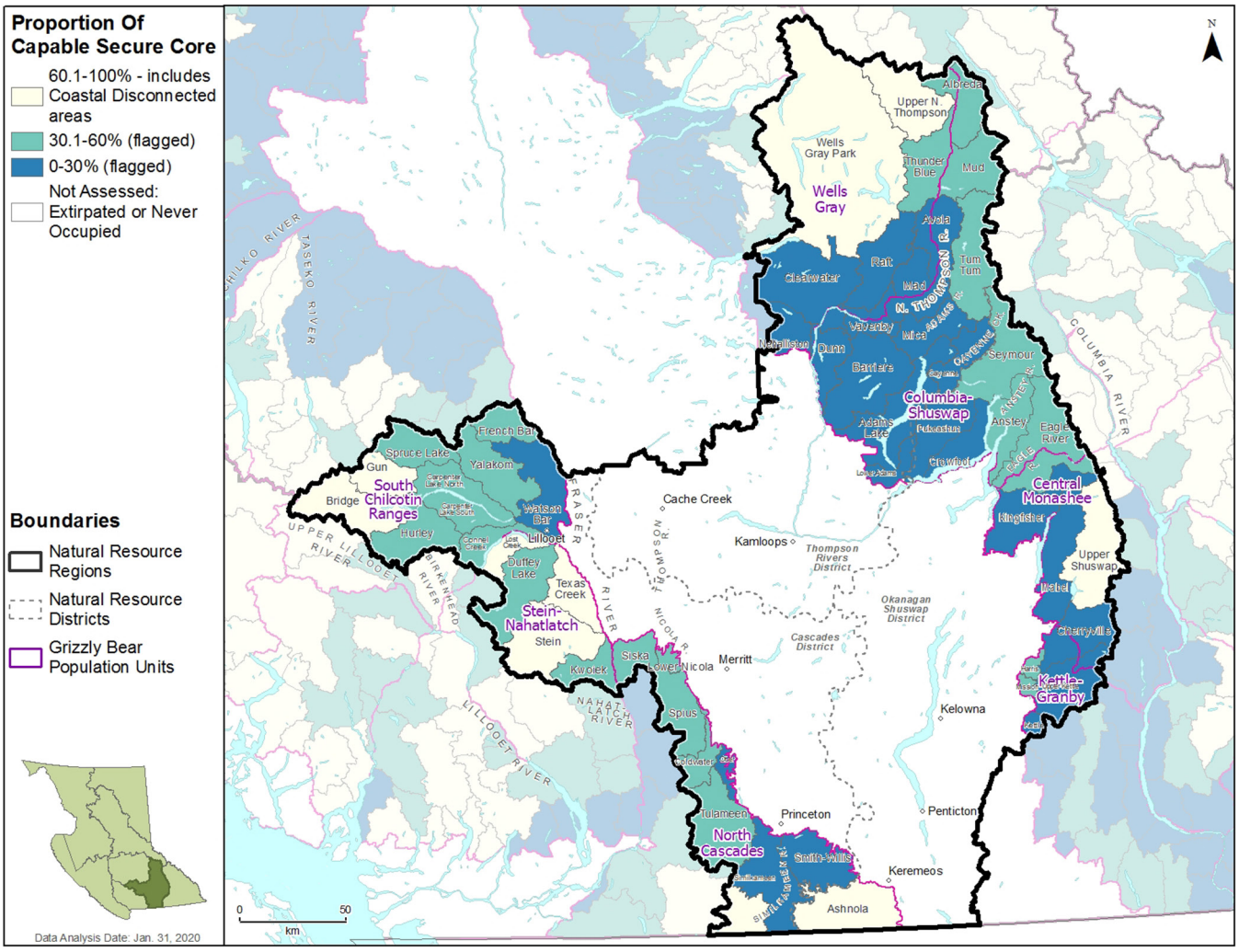

Figure 4.5 *Average percent capable core secure habitat for grizzly bears by landscape unit in the Thompson Okanagan Region in 2018. Capable core secure habitat is defined as patches of habitat greater than 10 km^2 with minimal likelihood of human use. Landscape units that are 'flagged' are below a benchmark and expected to increase risk to grizzly bears.*

4.6 FRONT COUNTRY – CORE

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 with 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).

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.

Benchmark

- ≤ 20% Front country (not flagged)
- > 20% Front country (flagged)[24]

Management Context

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

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

Regional Commentary:

Front country is an important zone of interface between humans and grizzly bears. These areas have relatively high human density and use, and contain attractants for grizzly bears (e.g., livestock, livestock carcasses and feed, grain crops, fruit trees, and human food and garbage). The likelihood of human-bear encounters, conflicts, and consequent risk of bear mortality in the front country is high.

Front country areas (Figure 4.6) correlate closely with areas of core security deficit (Figure 4.5). Almost all LUs within the seven GBPUs overlapping the Thompson Okanagan Region have a high risk of human-bear encounters as front country is abundant within these GBPUs; therefore, they are flagged for management attention. The only area where abundance of front country does not pose a hazard to grizzly bears is the Wells Gray LU that comprises Wells Gray Provincial Park.

The southern interior of B.C. is an area of high human density and use relative to other parts of the province; this is largely due to the presence of major communities, agriculture and ranching, recreation, and natural resource industries. Over the last several decades, human conversion of backcountry into front country has displaced and fragmented grizzly bear habitat, which has led to the extirpation or threatened status of grizzly bear populations throughout most of the region.

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

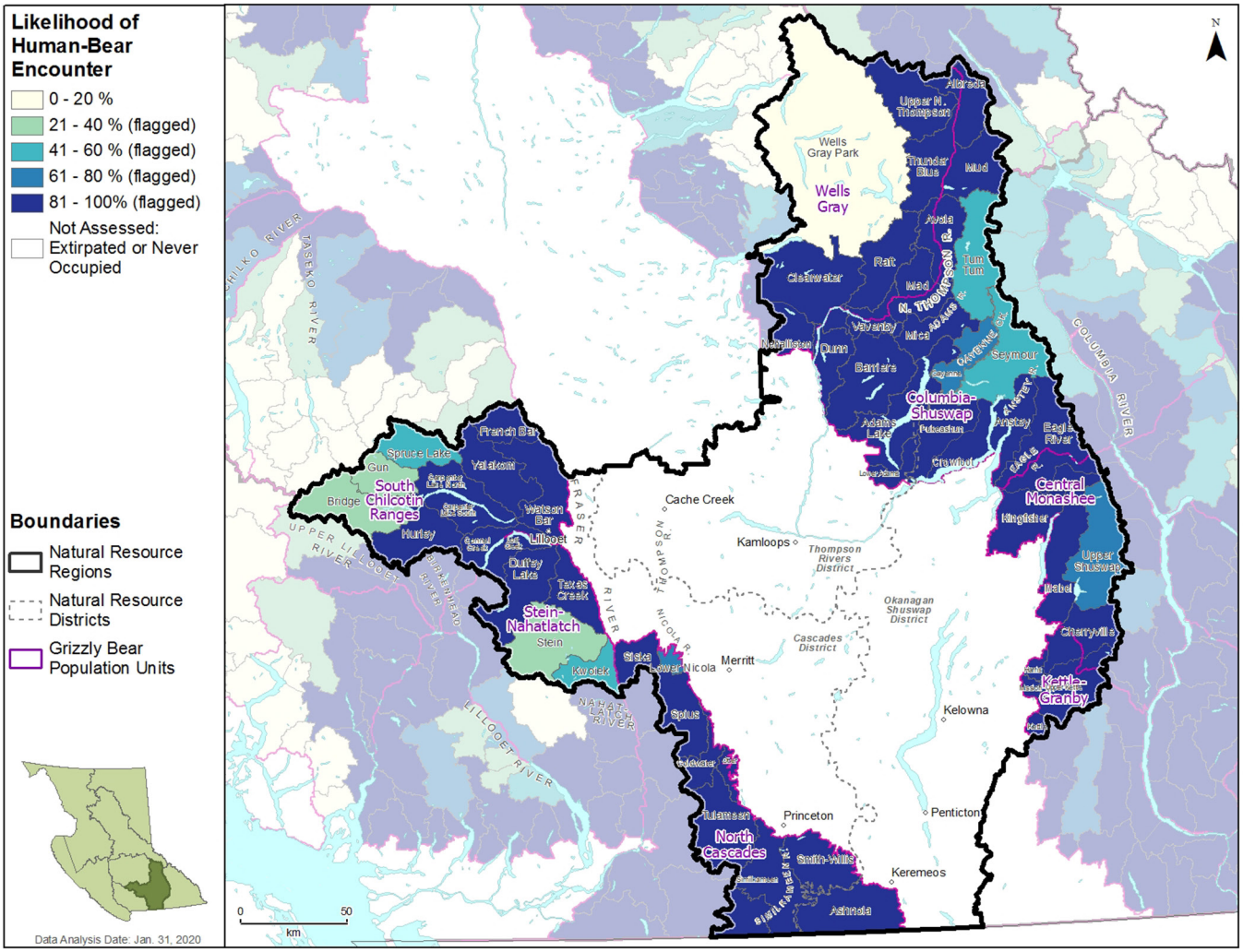

Figure 4.6 *Average proportion of front country habitat by landscape unit in the Thompson Okanagan Region in 2018. Front country habitat is defined by urban and rural landscapes with relatively high human density and access, and grizzly bear attractants in the form of livestock, livestock carcasses, livestock feed, fruit trees, human food/garbage, and grain. Landscape units that are 'flagged' are above a benchmark and expected to increase risk to grizzly bears through negative encounters with humans.*

4.7 HUNTER DAY DENSITY – CORE

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.[25] This density is extrapolated to the LU level (days/km^2). Hunter density can influence the amount of bear mortality due to the potential for lethal encounters with grizzly bears.[26] 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.

Interpretation Key

- Average annual hunter days of 0-0.65/km^2 are low risk to grizzly bears.
- Average annual hunter days of 0.651-1.87/km^2 are moderate risk to grizzly bears.
- Average annual hunter days greater than 1.871/km^2 are high risk to grizzly bears and are flagged for management attention.

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/km^2) (not flagged)
- Moderate = Quartile 3 (0.651-1.87 hunter days/km^2) (not flagged)
- High = Quartile 4 (>1.871 hunter days/km^2) (flagged)

Management Context

Minimizing bear mortality resulting from negative encounters with hunters.

Regional Commentary:

Hunter day density is included as an indicator in this report because of the potential for negative interactions between licensed hunters and grizzly bears leading to higher mortality rates. Although these types of grizzly bear mortalities do occur every year, they are unlikely to be common enough to have population-level impacts in most GBPUs. Critically endangered GBPUs like Stein-Nahatlatch may be an exception, where there are only a small number of breeding females adding cubs to the population. In such cases, events that result in the removal of even one female could have population-level effects.

Hunter day density varies throughout the Thompson Okanagan Region. It is limited in three isolated areas due to poor access or hunting restrictions in provincial parks: the west edge of Stein-Nahatlatch GBPU (east of the Lillooet River in Lizzie and Rogers LUs), E.C. Manning Park (Similkameen LU) at the south end of North Cascades GBPU, and Wells Gray Park in the north of Wells Gray GBPU.

High hunter day density areas are associated with proximity to human settlement and agriculture areas or are remote but accessible areas popular with big game hunters. Flagged portions of South Chilcotin Ranges, North Cascades, Wells Gray, Columbia-Shuswap, Central Monashee, and Kettle-Granby GBPUs are popular for hunting a variety of wildlife, primarily mule deer but also white-tailed deer, elk, moose, mountain goats, bighorn sheep, black bears, and cougars.

[25] 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.

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

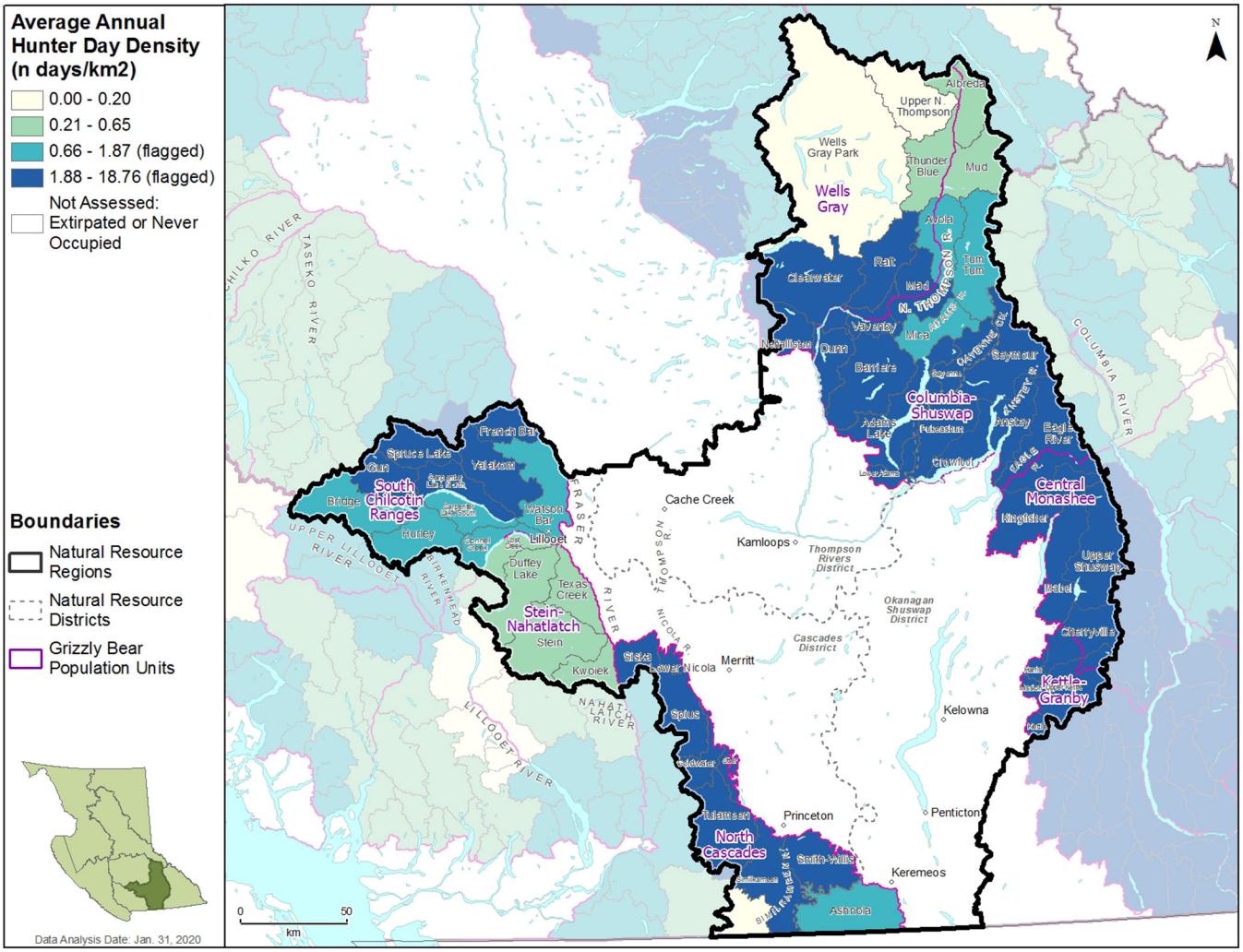

Figure 4.7 *Average annual hunter day density (number of hunter days per square kilometre) by landscape unit in the Thompson Okanagan Natural Resource Region from 2013-2017. Landscape units that are 'flagged' are above a benchmark that is expected to increase risk to grizzly bears through negative encounters with humans.*

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

Indicator Description

This indicator reports the amount of mid-seral[27] 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.

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.

Benchmark

- Low Risk = Mid-Seral Dense Conifer ≤ 30% in High or Moderate BEC zones (or Low sensitivity BEC Zone) in a LU[28]
- High Risk = Mid-Seral Dense Conifer > 30% for select BEC Zones in a LU
- Insufficient Data = VRI gap ≥ 10% of BEC Zone in LU[29]

Management Context

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

Regional Commentary:

Optimal forage supply for grizzly bears is associated with mature, open-canopy, mixed forests, alpine meadows, avalanche slopes, and high-elevation 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.

Forest seral stage is likely to support berry growth in the Thompson Okanagan Region. The entirety of the Kettle-Granby, North Cascades, and Stein-Nahatlatch GBPUs are characterized as low risk to grizzly bears as they contain less than 30% mid-seral dense conifer, which may support adequate forage potential for grizzly bears. Additionally, the majority of the LUs within the South Chilcotin Ranges, Wells Gray, Columbia-Shuswap, and Central Monashee GBPUs are also characterized as low risk to grizzly bears as they contain less than 30% mid-seral dense conifer.

Particular LUs within the South Chilcotin Ranges, Wells Gray, Columbia-Shuswap, and Central Monashee GBPUs are flagged for management attention as greater than 30% mid-seral dense conifer is present. These include:

- One LU in South Chilcotin Ranges GBPU: Gun
- A group of six LUs in lower Wells Gray and upper Columbia-Shuswap GBPUs: Raft, Mad, Lower Adams, Tum Tum, Mica, and Cayenne
- One LU in the Central Monashee GBPU: Upper Shuswap

While mid-seral conifer forests are currently limited in the Thompson Okanagan Region (and favourable habitat is currently present for grizzly bears), closed-canopy forests will likely increase

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

[28] 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.

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

over time in areas where formerly logged or burned forests are regrowing and where habitat is being managed for mountain caribou recovery. Future iterations of this analysis should conduct future scenarios analyses to identify where potential upcoming foraging constraints may occur in the future (e.g., the amount of current early seral forest that will turn into mid-seral).

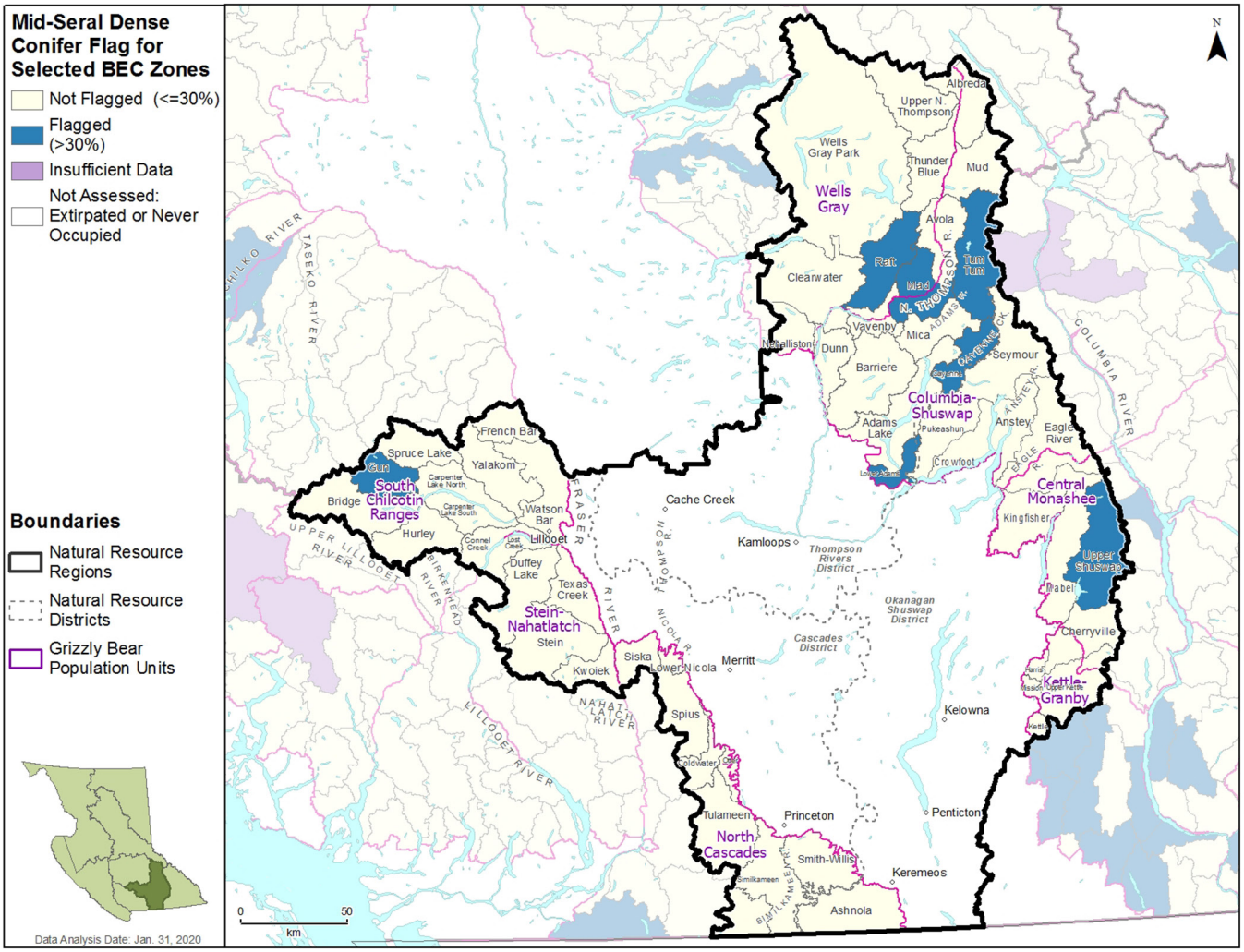

Figure 4.8 *Percentage of mid-seral dense conifer forest by landscape unit in the Thompson Okanagan Natural Resource Region in 2018. Landscape units that are 'flagged' are above a benchmark and are expected to have sub-optimal forage production potential for grizzly bears.*

4.9 QUALITY FOOD – SUPPLEMENTAL

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 >10,000 kg salmon biomass.[30]

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 cross-hatch overlay.

Benchmark

- Yes – high salmon or high capability
- No – not high salmon or high capability[31]

Management Context

Conservation management.

Regional Commentary:

In the Thompson Okanagan Region, quality food is associated with the productivity of both salmon (biomass) and vegetation (high or very high capability BEI). Figure 4.9 indicates that quality food (whether it is salmon or biomass) is present in many areas of the Thompson Okanagan Region, notably in the Wells Gray GBPU.

Biomass/Vegetation

Vegetation productivity on the west side of the region is limited except for the Similkameen and Coldwater LUs in the North Cascades GBPU (Figure 4.9). On the east side of the region, vegetation productivity is high in most LUs. Key food sources include berries (huckleberry, buffaloberry, and saskatoon berry) and whitebark pine seeds.

In areas of high bear density that have insufficient salmon or vegetation productivity (such as adjacent to the upper Columbia River), grizzly bears may rely more on terrestrial protein food sources (such as ants, carrion, ground squirrels, other small mammals, and ungulates). Areas of the South Chilcotin and Stein-Nahatlatch rely heavily on whitebark pine as they do not fall into areas of high capability for other fall food sources such as huckleberry (Figure 4.9). Whitebark pine is an endangered species under SARA due to threats from white pine blister rust, mountain pine beetle, fire exclusion, and climate change. Therefore, future changes in food supply in this GBPU are of concern.

Appendix 4 summarizes research completed and underway to better understand grizzly bear diet in South Chilcotin Ranges and Stein-Nahatlatch GBPUs.

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

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

Salmon

Historically, many watersheds in the Thompson Okanagan Region have been home to highly productive salmon populations (Figure 4.10). Recently, however, many of these watersheds have experienced variable or dwindling returns.

Along the east side of the region, in the North Thompson, South Thompson, and Shuswap watersheds, salmon productivity has generally been on a declining trend. Currently, there are a series of LUs in the Wells Gray, Columbia-Shuswap and a small portion of the Central Monashee GBPUs that have sufficient salmon biomass that may support grizzly bears. These areas include the Adams River, Eagle River, and portions of the North Thompson River.

Within the western portion of the region, several mid-Fraser watersheds, including the Seton and Bridge Rivers, maintain salmon populations that are above the quality food threshold. However, these salmon runs are variable and have been impacted by hydropower activities in the watershed. Despite being protected with the Stein Valley Nlaka'pamux Heritage Park, the Stein River does not consistently achieve the quality food threshold.

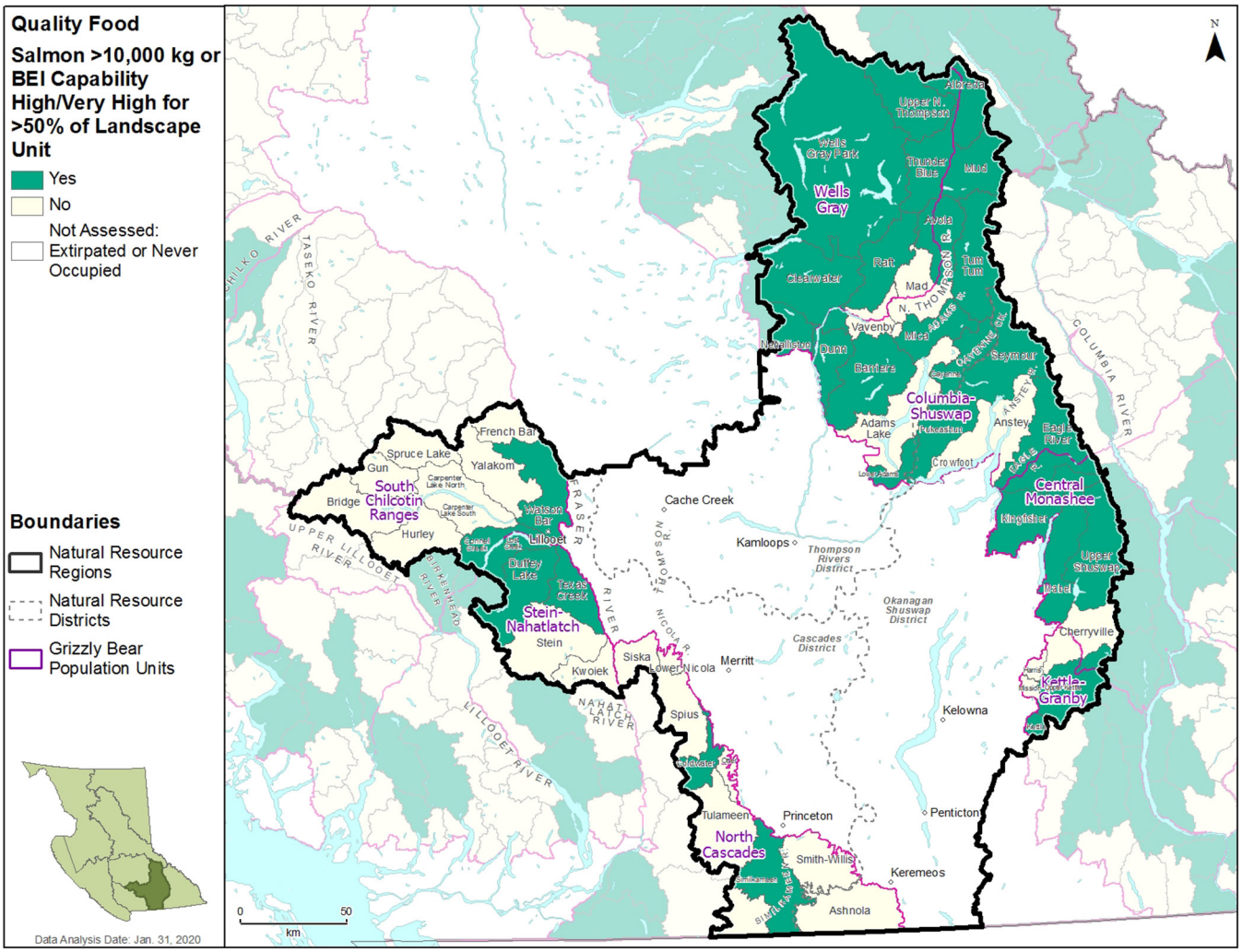

Figure 4.9 *Presence of quality food by landscape unit in the Thompson Okanagan Natural Resource Region in 2018. Quality food is defined by >50% high or very high habitat capability and/or >10,000 kg salmon biomass. Landscape units that are 'flagged' are expected to have low food availability for grizzly bears.*

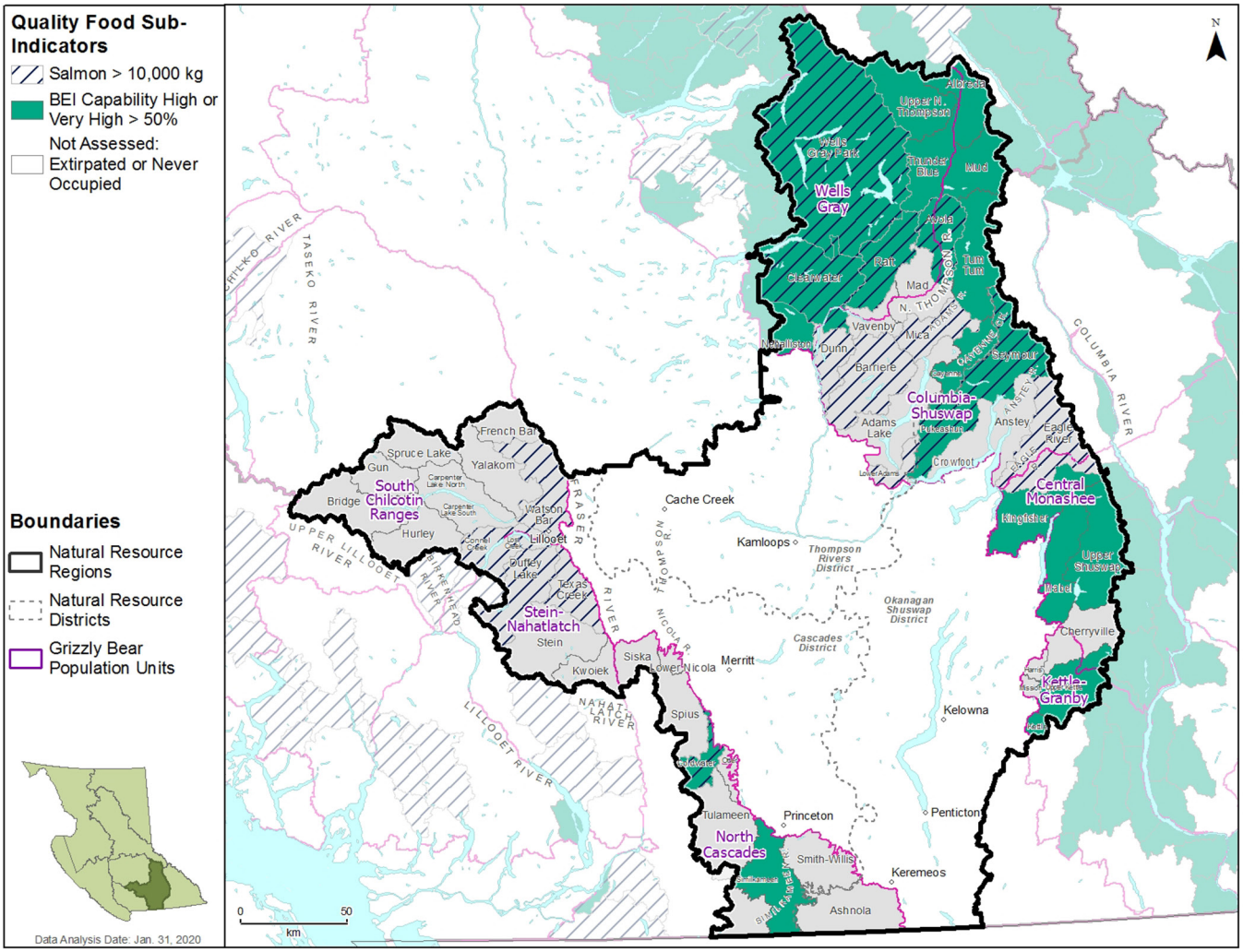

Figure 4.10 *Presence of quality food by sub-indicator by landscape unit in the Thompson Okanagan Natural Resource Region in 2018. Quality food sub-indicators are 1) >50% high or very high habitat capability and 2) >10,000 kg salmon biomass.*

4.10 HABITAT PROTECTION – SUPPLEMENTAL

Indicator Description

Habitat protection has two indicators:

- Indicator 1: Percent of total area of very high and high grizzly beat habitat capability (BEI or EBM) in a LU captured within conservation areas and other designations.[32]
- Indicator 2: Presence/absence of Grizzly Wildlife Habitat Areas (WHA)/Specified Areas (SA) or Coastal Ecosystem Based Management (EBM) areas within an LU.

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.

Benchmark

- Indicator 1:
  - Low Risk= >60% protected[33]
  - Moderate Risk= 30-60% protected (flagged)
  - High Risk= <30% protected (flagged)
- Indicator 2:
  - Yes: LU contains >= 0.05% WHA/EBM areas (present)
  - No: WHA/EBM areas absent or < 0.05% (absent)[33]

Management Context

Conservation management.[34]

Regional Commentary:

The Thompson Okanagan Region has dedicated 924,416 hectares of the landbase for grizzly bear habitat management and protection through the establishment of WHAs and an SA. LUs that have 60% or more of their high-capability grizzly bear habitat protected in parks, WHAs and the SA are found throughout the Thompson Okanagan Region.

On the west side of the region and in the Wells Gray GBPU, large provincial parks act to conserve high-capability grizzly bear habitat. However, in the Columbia-Shuswap, Central Monashee, and Kettle-Granby, GBPUs are primarily covered by the establishment of an SA.

Other than the large SA on the east side of the region, multiple small WHAs are established in most LUs in North Cascades GBPU (that are not already in park land) and in the upper half of Kettle-Granby GBPU. WHAs in these GBPUs are specified for grizzly bear except for the Wells Gray GBPU, which has WHAs for mountain caribou (in McKay and McKusky LUs) that happen to overlap high-capability grizzly bear habitat.

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

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

[34] WHAs/SA only address forestry and range threats and not other threats, e.g., recreation, residential, some transportation.

Almost half of the LUs on the west side of the region (South Chilcotin Ranges, Stein-Nahatlatch, and North Cascades) are considered a high risk to grizzly bears because 30% or less of their high-capability habitat is protected.[35]

Appendix 4 provides more detail on the specific conservation measures in place or proposed for each GBPU, as well as a brief summary of research projects aimed at helping to identify candidate areas for future conservation in threatened GBPUs.

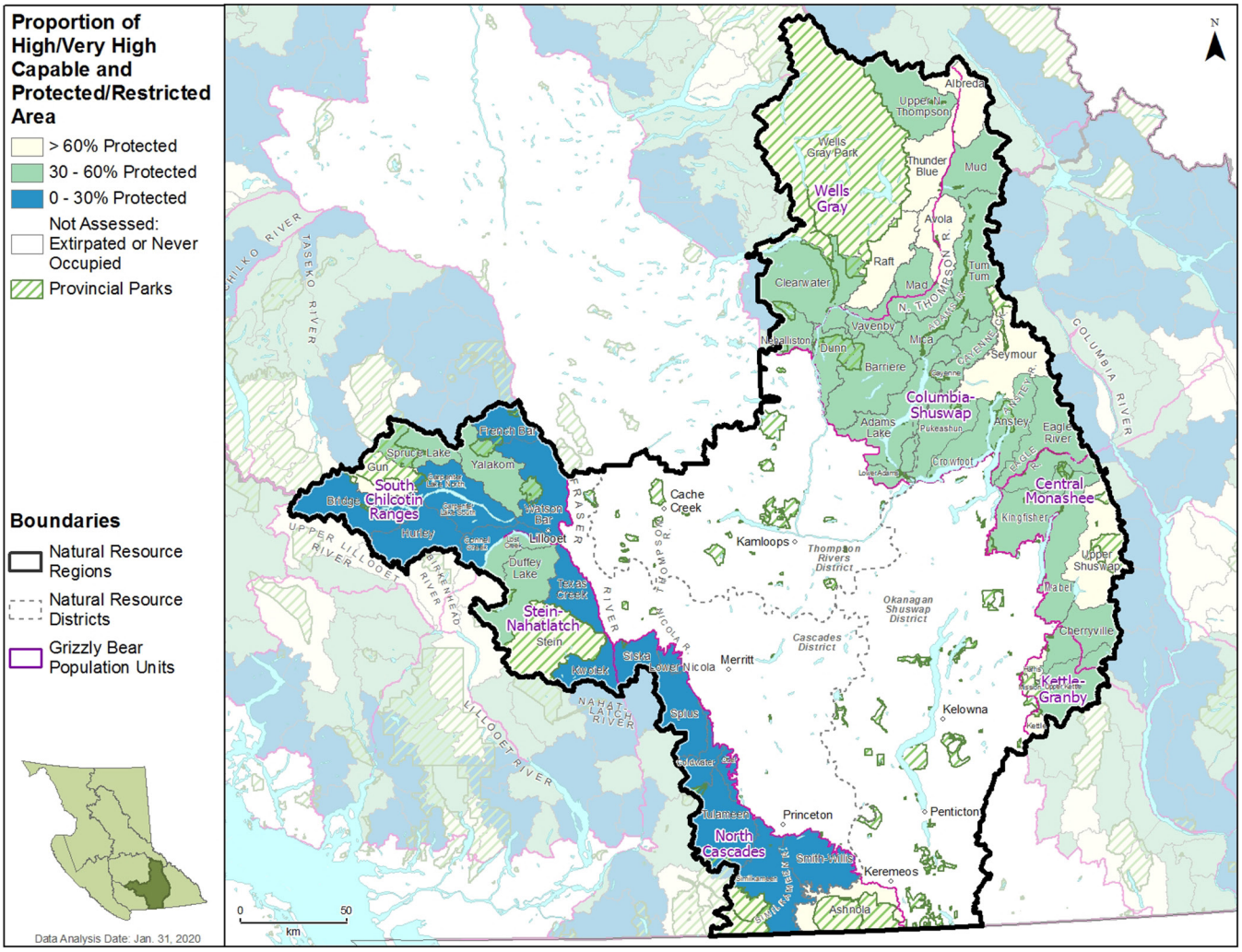

Figure 4.11 *Average proportion of high or very high capability grizzly habitat that is protected by parks or other landscape designations in the Thompson Okanagan Region as of 2018.*

[35] Note that an SA (439,000 hectares) within which general wildlife measures apply was approved for the Lillooet TSA (which overlaps the southern portion of South Chilcotin Ranges and northern portion of Stein-Nahatlatch GBPUs). This SA was approved in 2021 after the analysis for this report was completed.

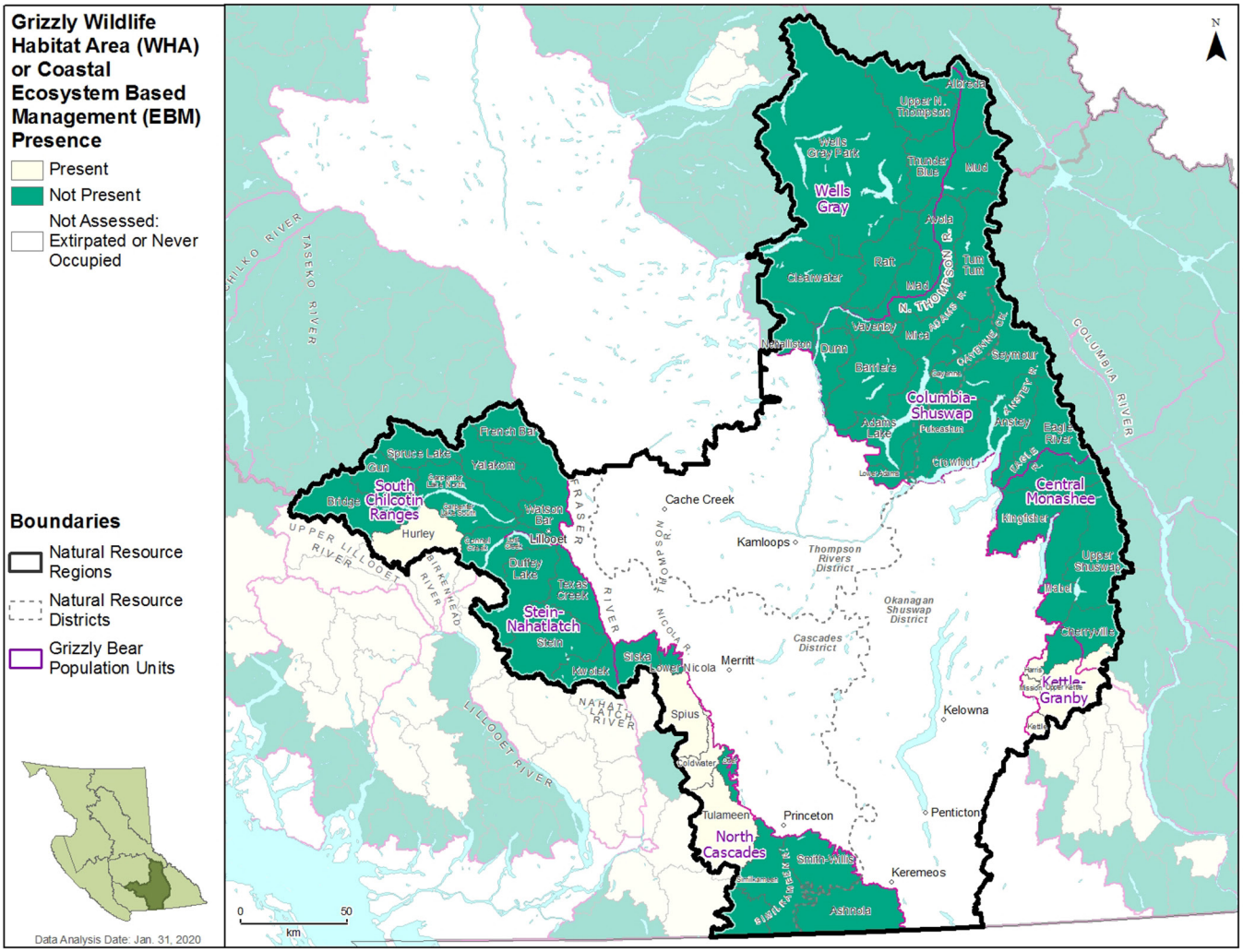

Figure 4.12 *Landscape units containing wildlife habitat areas or specified areas designated for grizzly bear in the Thompson Okanagan Natural Resource Region in 2018. Absence of these designations is expected to increase risk to grizzly bears.*

5 CONCLUSION AND NEXT STEPS

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

This section discusses the results of this assessment and provides next steps to improve grizzly bear populations and habitat within the region as well as suggestions from regional experts for further investigation or additional research that could be undertaken related to the assessment indicators and improvements to future assessments.

5.1 MAIN OBSERVATIONS

Human Presence and Activities

From this assessment, the main risk to grizzly bears is disturbance from anthropogenic activities. The Thompson Okanagan Region has relatively high human density and use relative to other parts of the province, and over the last several decades, humans have expanded into backcountry areas and have transformed them into front country areas. This shift has occurred due to multiple activities,[36] including mine exploration and development, pipeline and transmission line development, urban development, forestry activities, agricultural use, recreational use, and associated road development. This region also has a large extirpated area that divides grizzly bear populations, due to both human presence and a natural lack of suitable habitat for grizzly bears.

The extent of expansion and human presence is apparent in the Thompson Okanagan 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 displacement or **mortality** due to human-bear conflict) and habitat effects such as habitat fragmentation.

The assessment results also show 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 mid-seral dense conifer as seen in much of the Kettle-Granby GBPU).

Hunter day density is also moderate to high throughout the Thompson Okanagan Region, and therefore many areas are flagged for management attention. These areas are in proximity to human settlement and agriculture areas or are remote but accessible areas popular with big game hunters who are hunting species other than grizzly bears. The presence of hunters increases the likelihood of human-bear conflicts. This is a concern for critically endangered GBPUs with low bear

[36] Appendix 4 provides a list of activities that have occurred in the past, present, and future in each GBPU in the Thompson Okanagan Region.

populations where stochastic events that result in the removal of even one female could have population-level effects. However, in more stable population units, these types of grizzly bear mortalities are unlikely to be frequent enough to have population-level impacts.

Habitat Protection

High-capability grizzly bear **habitat** is protected in areas throughout the region, mainly through provincial parks, WHAs, and an SA. Wells Gray Provincial Park (located in the Wells Gray GBPU) helps to conserve high-capability grizzly bear habitat where an SA mitigates habitat impacts from forestry and range activities in the Columbia-Shuswap, Central Monashee, and Kettle-Granby GBPUs.

Established WHAs in the North Cascades and Kettle-Granby GBPUs are specified for grizzly bear as well. The Wells Gray GBPU also contains WHAs for mountain caribou (in McKay and McKusky LUs) that overlap high-capability grizzly bear habitat. Note that an SA (439,000 hectares) within which general wildlife measures apply was approved for the Lillooet TSA (which overlaps the southern portion of South Chilcotin Ranges and northern portion of Stein-Nahatlatch GBPUs). This SA is absent from this analysis as it was approved in 2021 after the analysis for this report was completed.

In general, the Thompson Okanagan Region supports moderate- to high-quality habitat for grizzly bears. Only a few LUs have been flagged for **mid-seral dense conifer** (>30%) and are limited to a few LUs within the South Chilcotin Ranges, Wells Gray, Columbia-Shuswap, and Central Monashee GBPUs. This is likely a result of lower resource use in these areas and natural disturbance regimes.

Quality Food Sources

Overall, the Thompson Okanagan Region generally has relatively good **quality food** sources for grizzly bears, including salmon and vegetation. There are multiple salmon-bearing rivers throughout the region, however, salmon productivity is variable, with some rivers' populations trending upwards and others trending downwards. Currently, sufficient salmon biomass can be found within a series of LUs in the Wells Gray, Columbia-Shuswap and a small portion of the Central Monashee GBPUs in the eastern portion of the region. In the western portion of the region, sufficient salmon biomass is found in a contiguous set of LUs in the South Chilcotin and Stein-Nahatlatch GBPUs.

Vegetation production is high in parts of all GBPUs on the eastern side of the region, with some notable exceptions adjacent to Horsefly Lake, Mahood Lake, Adams Lake, Shuswap Lake, the upper Columbia River, and along the western border of Kettle-Granby GBPU. Key food sources include berries (huckleberry, buffaloberry, and saskatoon berry) and whitebark pine seeds. Vegetation productivity on the west side of the region is limited except for areas in the Similkameen and Coldwater LUs in the North Cascades GBPU owing to wetter coast transition areas with abundant spring vegetation, huckleberry, and whitebark pine.

While food sources and habitat for grizzly bear currently exist in the Thompson Okanagan Region, climate change might impact these aspects in the future. Climate change is likely to lead to decline of salmon (Grant et al., 2019), loss of whitebark pine (Keane et al., 2017), and northward/upslope shift in huckleberry distribution (Prevéy et al., 2020). Changes in some food sources may cause bears to move into human areas in search for food and may result in human-bear conflicts (Ciarniello, 2018; Iredale, 2016).

5.2 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 Thompson Okanagan 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

Based on analysis of research, inventory, and monitoring outcomes, resource managers should consider the following actions to reduce risks to grizzly bear populations and habitat:

- Establish population objectives for GBPUs for the Thompson Okanagan Region (that are consistent with the Provincial Grizzly Bear Stewardship Framework);
- Establish grizzly bear WHAs in locations where grizzly bear habitat capability is high but populations are ranked as extreme to high conservation concern by the combined effects of high road density and low core security areas;
- Deactivate and/or restrict access on roads in high-priority grizzly bear habitat, especially in areas where roads and associated human activity are flagged for impacting the ability of grizzly bears to travel across their range (i.e., to connect and enhance core security areas);
- Adjust forest planning and practices in priority grizzly bear habitat with a view to conserving or enhancing seasonal foraging habitats (e.g., berry production) and screening core security areas;
- Adjust range planning and practices to minimize conflicts between livestock and grizzly bears (e.g., limited salt placement, alternative water developments, drift fencing, herding, and alternative grazing periods);
- Adjust best practices for other major industrial projects (such as mining and energy projects) to mitigate project impacts to grizzly bear populations and habitat;
- 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 Thompson Okanagan Region and adjacent regions (**Appendix 4**);
- Improve resource road classification and inventory using remote sensing LiDAR to refine and prioritize road deactivation projects for the benefit of grizzly bears; and,
- Work towards mitigating human-bear conflict with bear-smart communities initiatives (e.g., WildSafeBC, Bear Hazard Assessments).

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 that exists and what type of management responses could be taken to reduce risks. Appendix 3 provides further details on the indicators that are flagged for each LU in the Thompson Okanagan Region. Flagged indicators indicate that there is a potential higher risk to grizzly bears within the LU. These areas may warrant further analysis to determine if management attention is needed to mitigate risks to bear populations and habitat.

Research, Inventory, and Monitoring

Research, inventory, and monitoring efforts have recently been completed or are underway throughout the region. These projects include studying grizzly bear habitat selection, habitat suitability, habitat management, population density and distribution, among others. A list of projects that are underway within the Thompson Okanagan Region and adjacent southern interior regions is provided in **Appendix 4**.

Resource managers should consider conducting or continuing ongoing research, inventory, 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. Refer to **Appendix 4** for more information.

Additionally, resource managers should also consider repeating this assessment or a similar cumulative effects assessment on a regular basis 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 are 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 stewardship framework 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).

At a population unit scale, plans are being drafted for the North Cascades and Stein-Nahatlatch population units, which will provide GBPU-specific management actions and considerations for land use decision-makers.

Additionally, work is underway to modernize land use planning, which may provide an opportunity to add management actions and considerations for land use decision-makers.

Coordination with Neighbouring Regions

An opportunity exists for the Kootenay-Boundary region to facilitate coordinated industrial access management planning in the northeast portion of Kettle-Granby GBPU where extensive research, a Forest Practices Board investigation, and the Chief Forester have all recommended efforts to recover imperilled grizzly bear populations by reducing road density in areas of suitable grizzly bear habitat.

Coordinated management is also warranted with the South Coast and Cariboo Regions where GBPUs and LUs overlap.

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:

- **Past logging and large wildfires** – These will create more closed-canopy conifer forests in future, which are not suitable grizzly bear habitat.
- **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, especially in already imperilled and vulnerable GBPUs in proximity to major southern interior centres.
- **Climate change** – The effects of climate change on grizzly bears are 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

Continued monitoring of the current condition of grizzly bears in the Thompson Okanagan Region is recommended. As human activities continue and potentially expand in the region, it is imperative that cumulative effects are monitored over time to determine if and how they are impacting grizzly bear populations and habitat.

Rerunning this analysis every three to five years will likely capture 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 reassessment should also consider the projections of human population, 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.

Additional Indicators to Explore

Aside from the indicators assessed in this report, another indicator worth exploring in future cumulative effects assessments for southern interior GBPUs is grizzly bear habitat displacement associated with backcountry recreation.

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7 APPENDICES

APPENDIX 1 – GRIZZLY BEAR OBJECTIVES & LEGAL PROTECTION

In B.C. and the Thompson Okanagan Region, management and conservation of grizzly bears is governed by a number of provincial and regional strategies, legislation, land use plans, and management plans. The plans, strategies, and legislation that are important for grizzly bears are described below.

Provincial Strategies and Management Plans

The Provincial Grizzly Bear Conservation Strategy (1995) establishes the Province of B.C.'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 stewardship framework 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 Thompson Okanagan 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 ban on licensed grizzly bear hunting (other than hunting 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 was not permitted in threatened GBPUs or in GBPUs with low bear population densities (i.e., the number of bears per 1,000 km^2).[37] Where hunting was permitted, it was 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 government may establish legally enforceable WHAs and wildlife measures for grizzly bears in areas of high conservation priority. Grizzly Bear Accounts and Measures provide provincial policy guidance to inform forest and range planning and practices within grizzly bear habitat. FRPA also enables restrictions or prohibitions on recreation (section 58).

[37] As per British Columbia Grizzly Bear Population Estimate for 2018 (BC MFLNRORD, 2020).

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 limited entry hunts (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.[38]

Environmental Assessment Act

Major industrial projects – such as mines, pipelines, and hydropower generation projects – can threaten adjacent grizzly bears populations. As such, an important legal tool for protecting grizzly bear populations and habitat in the Thompson Okanagan Region is the environmental review and certification of major projects under the *Environmental Assessment Act*.

Major industrial projects are located within or adjacent to the Thompson Okanagan Region in grizzly bear habitat include: **Prosperity Gold-Copper Mine** and **Jaime Creek Hydroelectric Project** (in South Chilcotin Ranges GBPU), **Kwoiek Creek Hydroelectric Project** (in Stein-Nahatlatch/North Cascades GBPU), and **Trans Mountain Pipeline Expansion** (in Wells Gray, Columbia-Shuswap, and North Cascades GBPUs).

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.

If a major project is deemed to impact grizzly bears, approval of the project may be subject to legally binding conditions. These conditions specify that there must be a plan of actions to mitigate the impacts of the project to grizzly bear populations and habitat.

Other Legislation

***The Land Act* (sections, 17, 16, and 66), FRPA (sections 22.2 and 58)**, and the ***Motor Vehicle Act* (All Terrain) (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.

Plans

Land use plans in the Thompson Okanagan Region establish resource management objectives and strategies for maintaining grizzly bear habitat and protecting bear populations on Crown lands. The objectives and strategies for grizzly bears in these plans are not legally binding but are intended to guide the operational planning and practices of tenured resource users on Crown lands. The Cariboo Chilcotin Land Use Plan (1994), the Sea to Sky Land and Resource Management Plan (2008), the Okanagan Shuswap Land and Resource Management Plan (2001), and the Kootenay Boundary Land Use Plan (2001), establish 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. In addition, a Recovery Plan for Grizzly Bears in the North

[38] In addition to the *Wildlife Act*, the *Land Act* (section 66), the *Forest and Range Practices Act* (sections 22.2 and 58), the *Motor Vehicle (All Terrain) Act* (section 7) enables 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.

Cascades of British Columbia (2004) includes objectives for recovering the grizzly bear population in the North Cascades GBPU; however this plan was not endorsed by the B.C. government. Proposed plans are currently being drafted for the North Cascades and Stein-Nahatlatch population units, which would provide GBPU-specific management actions and considerations for land use decision-makers. Collaborative management actions have been implemented in the interim in Stein-Nahatlatch.

The management objectives and strategies for grizzly bears in these plans 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. Table A1 provides a brief synthesis of grizzly bear objectives and strategies that apply to the GBPUs discussed in this report.

Table A0.1 *List of existing British Columbia government objectives that apply in the Thompson Okanagan Natural Resource Region that support grizzly bear habitat and populations.*

Objectives	Strategies
Grizzly Bear Habitat	
Provide habitat of sufficient quantity and quality to support viable grizzly bear populations Prevent population fragmentation and maintain genetic diversity Increase grizzly bear populations in threatened GBPUs	• Identify, map, and protect critical grizzly bear habitat in wildlife habitat areas • Incorporate priority grizzly bear habitats into connectivity and migration corridors • Maintain forest attributes suitable for high capability grizzly bear habitat (e.g., coarse woody debris, berry producing sites, riparian areas, areas adjacent to avalanche chutes)
Grizzly Bear Populations	
Minimize human-caused grizzly bear mortality and displacement from critical habitats	• Maintain screening, security, and thermal cover adjacent to critical habitats • Minimize new roads and manage existing access through deactivation or access restrictions in critical grizzly bear habitat • Locate and/or plan commercial tourism and recreation developments to avoid critical grizzly bear habitat or to minimize human-bear conflicts • Minimize negative livestock-bear interactions through rancher education and range planning and practices • Minimize negative human-bear interactions through public education • Increase public knowledge of, and support for, recovery of grizzly bear populations in threatened GBPUs
Grizzly Bear Habitat and Populations	
Government oversight	• Facilitate inter-agency cooperation and management of grizzly bear populations and habitat

A full list of the land and resource management plans in the Thompson Okanagan Region can be found here: https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/thompson-okanagan.

Additional Resources

In addition to the references noted in previous sections, the following strategies, management guidelines, and best available information are worth considering when making decisions regarding future management and conservation of grizzly bear populations and habitat in the Thompson Okanagan Region.

- BC MELP (B.C. Ministry of Environment, Lands and Parks). 1995. Conservation of Grizzly Bears in British Columbia. Background Report. 70 pp.
- BC MWLAP (British Columbia Ministry of Water, Land and Air Protection). 2004. Grizzly Bear *(Ursus arctos)*. Identified Wildlife Management Strategy – Accounts and Measures for Managing Identified Wildlife (Grizzly Bear) (v. 2004).

B.C. Government plans:

- British Columbia Conservation Officer Service, 2001, Be a Bear Smart Community (and other Bear Smart Resources and Publications)
- BC MOE (British Columbia Ministry of Environment), 2006. Wildlife Guidelines for Backcountry Tourism/Commercial Recreation in British Columbia
- BC MFLNRO (British Columbia Ministry of Forests, Lands, Natural Resource Operations), 2014. A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (Interim Guidance)
- Boyce, Derocher, Garshelis, 2016. Scientific Review of Grizzly Bear Harvest Management System in British Columbia
- B.C. Government, 2016. Climate Change Vulnerability of B.C.'s Fish and Wildlife: First Approximation

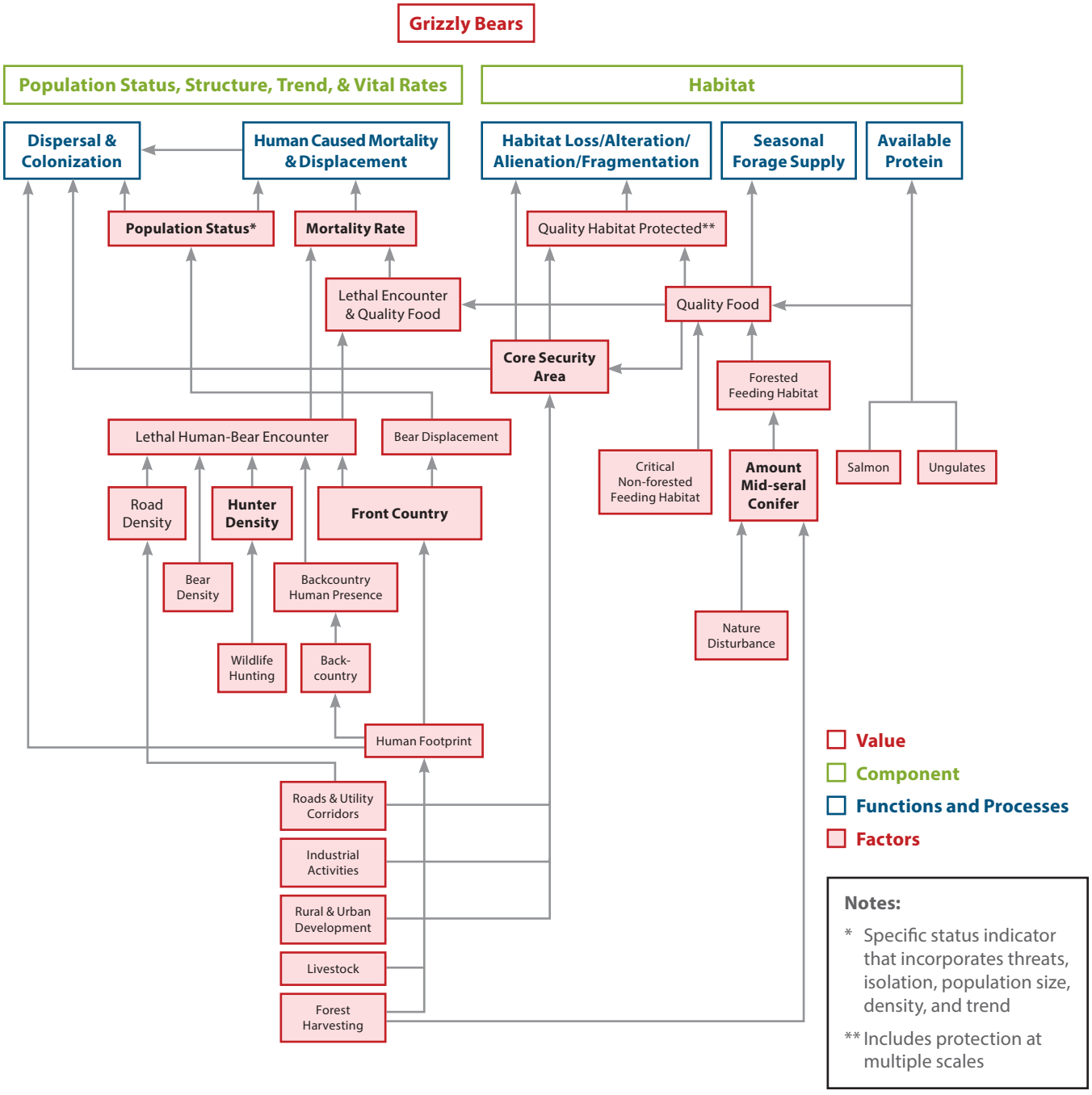
The following reports provide additional information or insights into the current condition of grizzly bears:

BC MFLNRO (British Columbia Ministry of Forests, Lands, Natural Resource Operations), 2014. Guidelines for Industrial Activity in Bear Country: For the mineral exploration, placer mining, and oil and gas industries

- Stenhouse et al., 2013. Grizzly bears and pipelines: response to unique linear features. This report summarizes research on the use of pipeline rights-of-way by grizzly bears in Alberta.
- Boulanger and Stenhouse, 2014. The impact of roads on the demography of grizzly bears in Alberta. This report summarizes research on how road density affects grizzly bear population demographics and includes threshold road densities that may be used to manage population stability and recovery.
- B.C. Auditor General, 2017. An Independent Audit of Grizzly Bear Management

APPENDIX 2 – CONCEPTUAL MODEL FOR ASSESSING GRIZZLY BEARS

This diagram illustrates how the indicators (which are a sub-set of the factors shown in the diagram)[39] influence the functions and processes that support grizzly bear populations and habitat in B.C.



[39] 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 – LANDSCAPE UNIT RISK RATINGS

Indicator	Key to Interpreting Risk Rating
Flag = assessment results indicate a higher risk to grizzly bears and are flagged for management attention	
Population Rank	Flag = High risk LUs (M1, M2, and M3)
Bear Density	Flag = bear densities in LU are less than 10 bears per 1,000 km^2
Female Mortality Rate	Flag = annual mortality rate in LU exceeds regionally specified mortality limits
Road Density	Flag = road densities in LU are greater than 0.61 km/km^2
Core Security Area	Flag = less than 60% of LU is in core security areas
Front Country	Flag = greater than 20% of LU is in front country
Hunter Day Density	Flag = average annual hunter days in LU exceed 1.508812/km^2
BEC Mid-Seral Dense Conifer	Flag = greater than 30% of LU is in mid-seral conifer forest
Quality Food	Flag = quality food is not present in LU (less than 50% of LU is in high/very high capability BEI and/or the LU's salmon biomass is less than 10,000 kg)
Quality Habitat Protected	Flag = less than 30% of LU's very high or high capability habitat is protected

GBPU/ Landscape Unit	Population Rank	Bear Density	Mortality Rate	Road Density	Core Security Area	Front Country	Hunter Day Density	Poor Forage Potential	Quality Food	Quality Habitat Protected	Quality Habitat Protected – Protected Areas
South Chilcotin Ranges											
Bridge	Flag					Flag					Flag
Carpenter Lake North	Flag			Flag	Flag	Flag	Flag				Flag
Carpenter Lake South	Flag				Flag	Flag					Flag
Connel Creek	Flag			Flag	Flag	Flag			Flag		Flag
French Bar	Flag			Flag	Flag	Flag	Flag				Flag
Gun	Flag					Flag	Flag	Flag			
Hurley	Flag			Flag	Flag	Flag				Flag	Flag
Watson Bar	Flag			Flag	Flag	Flag			Flag		Flag
Yalakom	Flag				Flag	Flag	Flag				
Spruce Lake	Flag			Flag	Flag	Flag	Flag				
Stein-Nahatlatch											
Duffey Lake	Flag	Flag			Flag	Flag			Flag		
Kwoiek	Flag	Flag		Flag	Flag	Flag					Flag
Lost Creek	Flag	Flag				Flag			Flag		
Texas Creek	Flag	Flag				Flag			Flag		Flag
Stein	Flag	Flag				Flag					
North Cascades											
Ashnola	Flag	Flag				Flag					
Coldwater	Flag	Flag		Flag	Flag	Flag	Flag		Flag	Flag	Flag

GBPU/ Landscape Unit	Population Rank	Bear Density	Mortality Rate	Road Density	Core Security Area	Front Country	Hunter Day Density	Poor Forage Potential	Quality Food	Quality Habitat Protected	Quality Habitat Protected – Protected Areas
Lower Nicola	Flag	Flag		Flag	Flag	Flag	Flag				Flag
Otter	Flag	Flag		Flag	Flag	Flag	Flag				Flag
Siska	Flag	Flag		Flag	Flag	Flag	Flag				Flag
Smith-Willis	Flag	Flag		Flag	Flag	Flag	Flag				Flag
Spius	Flag	Flag		Flag	Flag	Flag	Flag			Flag	Flag
Tulameen	Flag	Flag		Flag	Flag	Flag	Flag			Flag	Flag
Similkameen (1830)	Flag	Flag		Flag	Flag	Flag	Flag		Flag		Flag
Similkameen (1144)	Flag	Flag				Flag					
Wells Gray											
Upper N. Thompson						Flag			Flag		
Raft				Flag	Flag	Flag	Flag	Flag	Flag		
Clearwater				Flag	Flag	Flag	Flag		Flag		
Mad	Flag			Flag	Flag	Flag	Flag	Flag			
Nehalliston				Flag	Flag	Flag	Flag		Flag		
Thunder Blue				Flag	Flag	Flag			Flag		
Wells Gray Park									Flag		
Columbia-Shuswap											
Anstey	Flag			Flag	Flag	Flag	Flag				
Crowfoot	Flag			Flag	Flag	Flag	Flag				
Eagle River	Flag		Flag	Flag	Flag	Flag	Flag		Flag		
Pukeashun	Flag			Flag	Flag	Flag	Flag		Flag		
Albreda	Flag			Flag	Flag	Flag			Flag		
Mud	Flag			Flag	Flag	Flag			Flag		
Tum Tum	Flag				Flag	Flag		Flag	Flag		
Avola	Flag			Flag	Flag	Flag			Flag		
Vavenby	Flag			Flag	Flag	Flag	Flag				
Mica	Flag			Flag	Flag	Flag			Flag		
Barriere	Flag	Flag		Flag	Flag	Flag	Flag		Flag		
Dunn	Flag	Flag		Flag	Flag	Flag	Flag		Flag		
Adams Lake	Flag	Flag		Flag	Flag	Flag	Flag				
Seymour									Flag	Flag	
Cayenne	Flag	Flag		Flag	Flag	Flag	Flag	Flag	Flag		
Lower Adams	Flag	Flag		Flag	Flag	Flag	Flag	Flag	Flag		

GBPU/ Landscape Unit	Population Rank	Bear Density	Mortality Rate	Road Density	Core Security Area	Front Country	Hunter Day Density	Poor Forage Potential	Quality Food	Quality Habitat Protected	Quality Habitat Protected – Protected Areas
Central Monashee											
Kingfisher	Flag		Flag	Flag	Flag	Flag	Flag		Flag		
Mabel	Flag		Flag	Flag	Flag	Flag	Flag		Flag		
Cherryville	Flag		Flag	Flag	Flag	Flag	Flag				
Upper Shuswap	Flag		Flag			Flag	Flag	Flag	Flag		
Kettle-Granby											
Harris	Flag				Flag	Flag	Flag			Flag	
Mission	Flag				Flag	Flag	Flag			Flag	
Upper Kettle	Flag		Flag	Flag	Flag	Flag	Flag		Flag	Flag	

APPENDIX 4 – GBPU BACKGROUNDER

See compendium document, GBPU Backgrounder.

APPENDIX 5 – DATA

Please see Appendix II of the Interim Assessment Protocol for Grizzly Bears in British Columbia and the British Columbia Data Catologue 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.

BRITISH COLUMBIA
Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Ministry of Environment and Climate Change Strategy
CEF Cumulative Effects Framework