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

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

Ministry of Environment and Climate Change Strategy

BRITISH COLUMBIA

CEF Cumulative Effects Framework

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EXECUTIVE SUMMARY

This current condition assessment for Grizzly Bear in the West Coast Region is carried out under BC'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 habitat relative to the provincial government's broad objectives for grizzly bears.

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

This assessment provides insights to where management attention may be needed in the West Coast Region. This may be due in part to human activities and increased interaction with grizzly bears and habitat displacement (either through direct alteration of habitat or resulting avoidance of habitat). Within the West Coast Region, the Tweedsmuir GBPU is of highest concern based on this assessment, and as such, require management attention when making decisions that influence grizzly bears and/or their habitat in these GBPUs.

The area with the highest potential impacts to grizzly bears is the area surrounding the community of Bella Coola, and the Highway 20 corridor. Due to human presence and activities, the likelihood of lethal human-bear encounters are higher (as shown in the flagged areas for the mortality rate, front country, road density, and hunter day density indicators). Impacts are driven by human activity in communities, including rural and agriculture activities and an increase in eco-tourism activities that are bringing more humans to the backcountry. The combination of natural (salmon, vegetation and berries) and non-natural (garbage, agriculture crops, fruit trees and livestock) food sources that are present also make management complex in this area.

The potential for low forage for grizzly bears (forests in a mid-seral stage with closed canopy and little opportunity for berry production) is not flagged in the region. However, additional measures should be taken to incorporate more temporal variation to this indicator to include a signal for decision-makers of potential upcoming foraging constraints (i.e. the amount of current early seral forest that will turn into mid-seral).

Roughly 45 of the 77 LUs managed by the West Coast Region are at moderate to high risk by having <60% of their high and very high-quality grizzly habitat in protection or restriction. However, the establishment of the Great Bear Rainforest and associated Land Use Order (LUO) (2016), Wildlife Habitat Areas, parks and protected areas, and other conservation tools offer protection for grizzly bear habitat. GBPUs in the West Coast Region that have a high degree of protection include the Kitlope-Fjordland, Tweedsmuir and Kwatna-Owikeno GBPUs, whereas southern GBPUs including the Knight-Bute and Kingcome-Wakeman are flagged for management attention.

Overall, management attention should focus on LUs that have high-quality food resources (either salmon or high and very high-quality habitat) that are connected to ensure that grizzly bear food and habitat requirements are met and to maintain appropriate core security.

Resource specialists and decision-makers should consider mitigation measures when reviewing proposed land use activities in the West Coast Region to reduce incremental loss of grizzly bear habitat and mortality pressure to grizzly bears. The indicators in this report highlight where the spatial constraints on grizzly bear habitat are highest in the region. Mitigation measures could include:

- Establishing grizzly bear 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;

- Integrate salmon data, core security, and front country assessment outcomes into current grizzly bear habitat mapping to identify or refine areas in which to focus additional conservation efforts in areas that provide sufficient food and protection for grizzly bears;

- Deactivating and/or restricting access on roads and corridors in high priority grizzly bear habitat, particularly where forage capability is high, but core security areas do not exist;

- Adjusting 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 to maintain core security;

- Adjust range planning and practices and farming practices in the Bella Coola Valley to minimize conflicts between livestock and grizzly bears (e.g. limited salt placement, alternative water developments, drift fencing, herding, and alternative grazing periods, electric fencing, moving livestock closer to homes during calving);

- Expand and focus on bear conflict planning in the Bella Coola corridor to reduce mortality and restore access to secure quality food and habitat and to improve proactive non-natural attractant management the Bella Coola corridor;

- Adjust best practices for development projects or human activities to mitigate project impacts to grizzly bear populations and habitat; and,

- Expand studies on climate change throughout the West Coast Region to see how grizzly bears may respond to changes in food (e.g. salmon and berries) and habitat over time.

LIST OF ACRONYMS

B.C.	British Columbia
BEC	Biogeoclimatic Ecosystem Classification
BEI	Broad Ecosystem Inventory
CEF	Cumulative Effects Framework
CID	Compulsory Inspection Database
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EBM	Ecosystem Based Management
FLNRORD	Ministry of Forests, Lands, Natural Resource Operations and Rural Development
FRPA	*Forest and Range Practices Act*
GBPU	Grizzly Bear Population Unit
GBR	Great Bear Rainforest
IPP	Independent Power Project
LEH	Limited Entry Hunt
LU	Landscape Unit
LUO	Land Use Order
LUP	Land Use Plan
MOE	Ministry of Environment and Climate Change
OGMA	Old Growth Management Area
ROR	Run-of-River
TEM	Terrestrial Ecosystem Mapping
UWR	Ungulate Winter Range
VQO	Visual Quality Objective
WHA	Wildlife Habitat Area
WMA	Wildlife Management Area
WMU	Wildlife Management Unit

GLOSSARY

Benchmarks

Reference points that support interpretation of the condition of an indicator or component. Benchmarks are based on scientific understanding of a system and may or may not be defined in policy or legislation. For the purpose of the CEF, benchmarks are identified to support assessment and reporting in relation to broad objectives (CEF Interim Policy, 2016).

Cumulative effects

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

Grizzly Bear Population Units (GBPUs)

Grizzly bears exist as a set of interconnected populations, which can be divided into sub-populations based on bear ecology using grizzly bear population units. Grizzly bear population units delineate individual bear populations for conservation and management. In total, there are 55 GBPUs in B.C.

Landscape Unit

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

Precision

Precision is defined as the level of confidence associated with the data inputs used in each indicator. Precision ranking (i.e. High vs. Moderate vs. Low) indicates the level of confidence in the indicator output/results derived from the input within the region.

Relevance

Relevance is defined as the level of importance of each indicator within the region (i.e. all indicators do not necessarily have the same level of relevance throughout the province).

Utility

Utility is defined as ability to effectively manage the value in response to the indicator result. Strategic, tactical, and/or operational management actions may be taken.

Remote Coastally Disconnected/ Unconnected Areas/ Remote Coastal Override

Remote Coastally Disconnected/Unconnected areas are landscape units (LUs) with barge, ferry, or air as their primary access. Because of this remoteness, any roads in these LUs contribute less to the risk of potential bear mortality, as measured by road density, core security, and the potential for human encounter (front/back country status) indicators.

Wildlife Management Units (WMUs)

Delineated administrative regions for wild game management. The Province of B.C. is divided into nine administrative regions, having a total of 225 WMUs.

1 INTRODUCTION

The Province of British Columbia (B.C.) is committed to sustainable resource management. As resource demands grow, we must be able to measure the effects of natural resource activities, large and small, on the values important to the people of BC. To meet this need, British Columbia Provincial Government (the Province) established a Cumulative Effects Framework (CEF) in 2014 to guide the assessment of cumulative effects[1] across natural resource sectors and support the integration of assessment results in natural resource decision-making.

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

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

This report includes:

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

The results generated from this report are based on a strategic-level provincial assessment and are intended to inform various resource management decisions that influence the conservation and management of grizzly bear populations and habitat in the West Coast Region.

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

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

2 GRIZZLY BEAR OVERVIEW

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

Grizzly bears are identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a species of "special concern" in Canada,[2] given their sensitivity to human activities and disturbance. Grizzly bears are also identified as a species of Special Concern (Schedule 1) of the *Species at Risk Act* (SARA).[3] Under B.C.'s Conservation Framework,[4] grizzly bears are identified as a high priority for conservation.

The following sections provide a general overview of grizzly bears in the West Coast Region, including a description of their habitat requirements, dietary preferences, and distribution. The potential threats to grizzly bear populations and habitat in the West Coast Region are also described below along with provincial and regional management objectives that are in place for the species.[5]

2.1   Habitat & Diet

Grizzly bears require large, connected areas to meet their life requisites. Large-scale connectivity of habitat is very important for grizzly bear populations, with their home range sizes being proportionate to the quality, quantity and distribution of food. For coastal B.C., the average minimum single year home range size is 137 km^2 for males, and 52 km^2 for females.[6]

Grizzly bears favour a variety of habitats over different seasons for forage, cover, and hibernation purposes. Alpine areas (ridgetops, talus slopes, avalanche chutes); subalpine meadows and forests; and grasslands, shrublands, creek/river bottoms, fluvial/alluvial floodplains, wetlands, marine foreshore areas, and riparian areas in montane and foothill ecosystems are all habitats that are important for grizzly bears.

In addition to suitable feeding areas, grizzlies require forest cover for thermal regulation, security, and resting. Grizzly den sites vary from alpine/subalpine talus slopes, shrubfields and krummholz[7] areas to various timbered subalpine and lowland areas. Mountain valley bottoms (riparian habitats) and ridgetops serve as travel corridors. Corridors connect different habitat units, preventing isolation and enabling bears to travel to key food sources.

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[2] COSEWIC assessment and status report on the Grizzly Bear Ursus arctos in Canada. Committee on the Status of Endangered Wildlife in Canada. https://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_ours_grizz_bear_1012_e.pdf

[3] Government of Canada. Species Profile- Grizzly Bear. https://wildlife-species.canada.ca/species-risk-registry/species/speciesDetails_e.cfm?sid=1195

[4] Province of BC. Conservation Framework. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/species-ecosystems-at-risk/setting-priorities/conservation-action-tools

[5] See section 5.4 for additional resources on grizzly bear biology, local research, and management strategies.

[6] See Gyug et al, 2004. Grizzly bear (Ursus arctos). Accounts and measures for managing identified wildlife – Accounts Ver. 2004.

[7] Krummholz are areas of stunted windblown trees growing near the tree line on mountains.

As a grizzly bear's habitat use varies with the seasons, so does a grizzly bear's diet. Forbs, grasses, sedges and other herbaceous vegetation is consumed in spring and early summer. During these seasons, grizzly bears exploit moist fens and riparian areas produce high densities of prime summer vegetation. In the late summer and fall, berries and roots are an important additional component of their diet.

Human-disturbed sites, like roadways, tend to support early succession vegetation, which is favoured by grizzly bears. Other important feeding areas include recently logged areas where early seral plant communities are abundant.

Ants, ground squirrels, and spawning salmonids are also consumed by grizzly bears when available. Predation on ungulates is not a foraging strategy employed by all grizzly bears; however, some grizzly bears will opportunistically predate on ungulates, especially those in poor condition. For grizzly bears in the West Coast Region, ungulates are not a primary food source, rather grizzly bears exploit salmon and marine invertebrates as part of their diet.

2.2   Distribution & Management in the West Coast Region

Grizzly bears are found throughout the West Coast Region, apart from Haida Gwaii and Vancouver Island. Grizzly bears are occasionally found on Vancouver Island when they swim from the mainland to Vancouver Island.

Wildlife Management Units (WMUs) are delineated administrative regions for wild game management. There are 225 WMUs in B.C. of which 11 are in the West Coast Region (Table 2.1).

B.C.'s 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 (GBPUs).[8] In total, there are 55 GBPUs in B.C. that delineate individual bear populations for conservation and management. In northern and coastal areas, GBPU boundaries are delineated by natural and ecological boundaries or transition areas (e.g. heights of land) as there are few actual barriers to grizzly bear movement.

There are six GBPUs located in the West Coast Region (Figure 2.1). All of these GBPUs significantly overlap adjacent Cariboo, South Coast and Skeena Natural Resource Regions. Landscape Units (LUs) are spatially identified areas of land and/or water used for the long-term planning of resource management activities. LUs are used to create objectives and strategies to maintain biodiversity and manage other forest resources including wildlife habitat and timber harvesting. There are 77 LUs primarily managed by the West Coast Region (Table 2.1).

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[8] GBPUs are delineated based on similar behavioural ecotypes and sub-populations of bears; they generally follow ecological boundaries and transitions (e.g. heights of land) that are not necessarily barriers to movement.
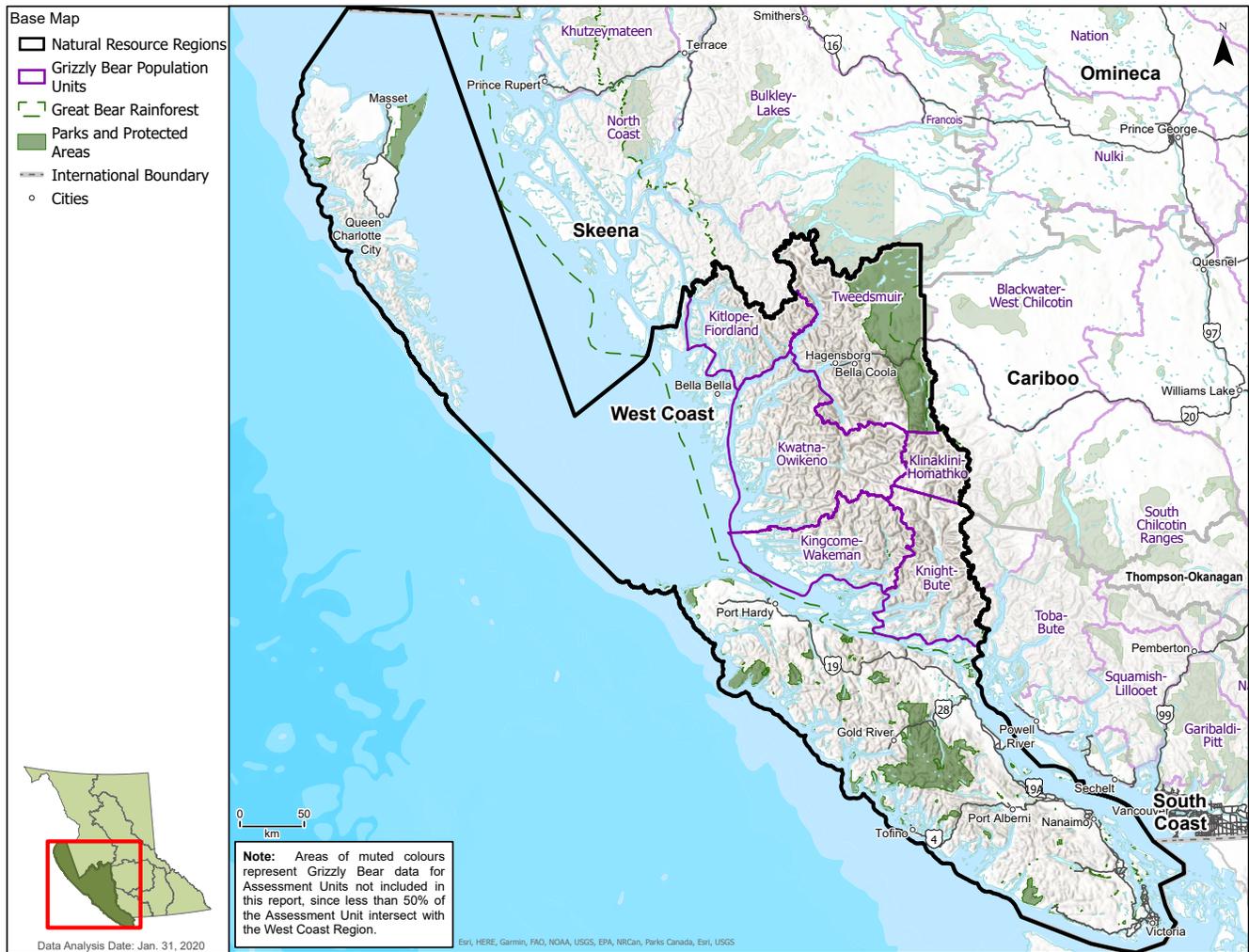
Figure 2.1 *Map of the West Coast Region*

This report only provides information on the six GBPUs outlined in Table 2.1 and only for the LUs that are more than 50% within the West Coast Region. Please refer to the current condition reports for the neighbouring regions for further information via the Provincial Cumulative Effects Framework website.

Table 2.1 *GBPUs, WMUs, and LUs Managed by the Region*

GBPU	WMUs in Region	Number of LUs
Kitlope-Fiordland	5-9, 6-3	9
Tweedsmuir	5-8, 5-9, 5-10	19
Kwatna-Owikeno	5-7, 5-8	21
Kingcome-Wakeman	1-14	12
Knight-Bute	1-15, 2-15	14
Klinaklini-Homathko	5-6	2

2.3   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. Threats to grizzly bears in the West Coast Region include:

Industrial Activities

Industrial development on the mainland West Coast Region is limited in comparison to elsewhere in the province. Forestry is present throughout but only 15% of the GBR land base is now available for sustainable forestry. Agriculture is present around the Bella Coola corridor. Industrial footprints of these activities vary in size and may operate on different temporal scales (e.g. year-round or seasonally). Depending on the location of these activities, they may contribute to habitat loss and/or fragmentation and displacement of grizzly bears from project areas.

Additionally, independent Run-of-River (ROR) hydropower projects have been proposed along the mainland coast of the West Coast Region which may impact grizzly bears. While an individual ROR may not impact grizzly bears, multiple cumulative RORs on the landbase may do so. The ability of bears to travel across their range may be impacted, and industrial activity and road networks will increase and potentially increase access to the backcountry throughout the project development stages.

Road Development

Roads and corridors associated with the development of industrial activities and human settlement also affect grizzly bear populations and habitat in positive and negative ways. Areas with high road density are avoided by grizzly bears as it leads to habitat loss and fragmentation and increased chance of direct mortality. Most grizzly bear mortality from human encounters occurs within 500 metres of a road. Additionally, grizzly bears may be displaced from their preferred habitats near and along roadways due to noise and human presence and activity.[9]

However, areas with low road density are more favourable for grizzly bears and can attract them due to roadside seeding, linear movement corridors, and increased prey availability. Grizzly bears use linear corridors for foraging, digging, berry feeding, bedding and travel which increases the chance of encountering humans, human activity and the non-natural attractants therein.[10] This can include urban and rural communities, industrial camps and worksites, hunting camps for species other than grizzly bear, and their associated access roads.

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

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

[10] See Stenhouse et al, 2013. Grizzly bears and pipelines: response to unique linear features.

Human Presence & Access Management

Bella Coola, Bella Bella, Hagensborg, Firvale, Stuie, Denny Island, Ocean Falls and Rivers Inlet are the main communities with human settlement in the West Coast Region. As of 2016, their combined population was less than 4,000 people.[11] The majority of people are settled in the communities of Bella Bella, Bella Coola and Hagensborg in the Bella Coola Valley.

Grizzly bears are attracted to livestock, livestock feed, and grain crops in the Bella Coola Valley and throughout the Bella Coola corridor as non-natural food sources and other attractants such as roadkill, landfills, urban waste, and fruit trees in other remote communities such as Kingcome Village. If these activities are present in urban or rural areas, this may contribute to increased likelihood of human-bear encounters.

Human-bear encounters may also increase if humans expand into or are able to access remote areas for recreational purposes, leading to habitat loss, fragmentation, displacement, and potentially mortality.

Guide-outfitters, trappers and outdoor enthusiasts may also contribute to the cumulative pressures to grizzly bears. This may occur through the use of river boats, helicopters, and drones that are used by recreationists, leading to permanent or temporal displacement of grizzly bears.[12]

Grizzly bear viewing is a popular ecotourism activity that is increasing in the West Coast Region. Humans are accessing more remote areas to view grizzly bears, which can impede bear access to seasonally important foods and increase chance for human-bear conflict.

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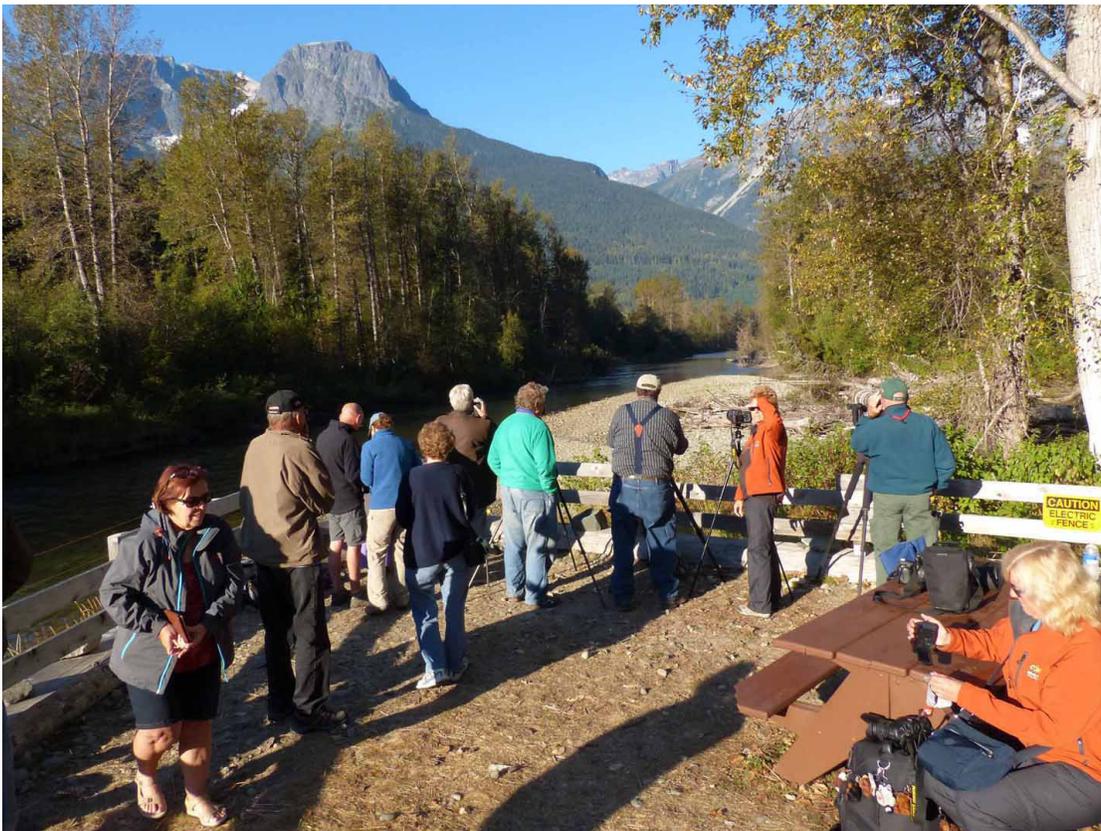
[11] Statistics Canada - 2016 Census https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E

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

Climate Change

The coastal climate has changed over the past century and is expected to continue to change. Averaged across the coast, over 1°C of warming has occurred during the 20th century. Projections suggest the West Coast Region may warm, on average, an additional 1.2 to 3.5°C by the end of this century[13].

Precipitation trends are more complex, varying across the region and from year to year. Current winter precipitation ranges from over 1,000 mm on the outer coast to less than half that amount in rain-shadow areas. Over the entire region, annual precipitation has increased over the past century, although winter precipitation decreased from 1951–2009. Projected changes in precipitation are relatively modest compared to historical variability, with about a 10% decrease in summer and a 10% increase in other seasons by the end of this century. Snowfall is projected to decrease considerably in both winter and spring.

Climate change will likely have both positive and negative effects on West Coast Region grizzly bears. On the positive side, warmer temperatures and less spring snowfall will bring about earlier spring conditions and a longer growing season, which may favour summer vegetation grizzly bears rely on.

However, the negative impacts of warmer weather are a concern for coastal bear protein availability with concerns surrounding the future availability Pacific salmon stocks with the increase in water temperature expected to occur. Increases in late-season drought may also negatively impact fall vegetation production or alter the timing of peak food availability (e.g. berries arriving during salmon spawning season). Flooding and an increase in fire regimes may negatively impact vegetation production and availability.

Additionally, under a changing climate, human land uses and species habitat ranges will likely expand and/or shift, increasing the potential for human-bear conflicts.

For more information on the anticipated effects of climate change on ecosystems, see Adapting Natural Resource Management to Climate Change in the West & South Coast Regions: Considerations for Practitioners and Government staff (2016) and Climate Change Vulnerability of BC's Fish and Wildlife: First Approximation (2016).

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[13] Adapting Natural Resource Management to Climate Change in the West & South Coast Natural Resource Regions: Considerations for Practitioners and Government staff (2016) https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/regional-extension-notes/coasten160222.pdf

2.4   Grizzly Bear Objectives and Legal Protection

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

The mainland portion of the West Coast Region occupied by grizzly bears is situated entirely within the Great Bear Rainforest (GBR) forest management area as designated under the *Great Bear Rainforest (Forest Management) Act* (2016).[14] Within the GBR, ecosystem-based management is delivered through land use objectives set by the Great Bear Rainforest Land Use Order (GBRLUO 2016) in combination with other measures from legislation such as the *Forest and Range Practices Act* (FRPA).

The GBR will conserve 85 percent of the forest and 70 percent of the old growth over time, leaving 15 percent of the area available for sustainable forestry. Ecosystem-based management planning to support GBR land use objectives integrates and expands on grizzly bear habitat objectives and strategies previously set by the Central Coast Land and Resource Management Plan (CCLRMP 2004). Measures to address ecosystem-based management of grizzly bear habitat in the GBR include the designation of protected conservancies for former CCLRM Grizzly Bear Management Areas, specific GBR land use objectives for grizzly bear habitat, grizzly habitats captured within mandated GBR Landscape Reserve Designs and Riparian Reserve and Riparian Management Zones, and the complementary use of other strategic and operational land use planning tools such as FRPA grizzly bear Wildlife Habitat Areas.

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

- **Provincial Grizzly Bear Conservation Strategy**[15] – "maintain in perpetuity the diversity and abundance of grizzly bears and the ecosystems upon which they depend"

- **Great Bear Rainforest Land Use Order**[16] sets objectives for spatially identified grizzly bear habitat:

  - maintain critical grizzly bear habitat in functional condition across the GBR within all West Coast Region GBPUs (100% Class 1)

  - maintain 50% of sensitive grizzly bear habitat in functional condition in the Central and North Coast portion of the GBR, including the Kitlope-Fjordland, Tweedsmuir and Kwatna-Owikeno GBPUs in the West Coast Region (50% Class 2)

  - protection of grizzly bear dens across the GBR within all West Coast Region GBPUs.

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[14] *Great Bear Rainforest Management Act* https://www.leg.bc.ca/parliamentary-business/legislation-debates-proceedings/40th-parliament/5th-session/bills/third-reading/gov02-3

[15] Ministry of Environment, Land and Parks. 1995. A Future for the Grizzly - British Columbia Grizzly Bear Conservation Strategy. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/grizzly-bears/futureforgrizzly1995.pdf

[16] Province of BC. Great Bear Rainforest Order. https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/west-coast/great-bear-rainforest/great-bear-rainforest-legal-direction-agreements

- **Landscape Reserve Designs (LRDs)** mandated by the GBR Land Use Order for all Landscape Units, developed within the First Nation-Provincial government to government framework to inform and provide guidance for more detailed resource development, consider among other things:

  – protecting critical grizzly bear habitat

  – integrating priority grizzly bear habitats into connectivity corridors

  – 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

  – maintaining economic opportunities such as bear viewing while minimizing impacts to bears

- ***Forest and Range Practices Act***:[17] grizzly bear accounts and measures for protecting or managing for grizzly bear habitat in Wildlife Habitat Areas (WHAs) using General Wildlife Measures (GWMs); there are a multiple established grizzly bear WHAs in the West Coast Region

- ***Wildlife Act***: establishment of Wildlife Management Areas (WMAs); hunting regulations for grizzly bears prior to 2017 and all other hunted species in the West Coast Region; restriction of public access to backcountry

- ***Environmental Assessment Act***: environmental review and certification of major projects (e.g. mines, pipelines, hydropower generation) can set conditions that require proponents to mitigate industrial impacts to grizzly bears.

- ***Land Act***: Section 16 removal from disposition of important grizzly bear habitat from the land base from development.

- ***Parks Act***: conservancies have been established over LRMP-recommended GBMAs, and conservancies, ecological reserves and Class A parks in the West Coast Region protect grizzly bear habitat.

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[17] See Gyug et al, 2004. Grizzly bear (Ursus arctos). Accounts and measures for managing identified wildlife – Accounts Ver. 2004.

3 INDICATORS AND METHODOLOGY

3.1 Methodology

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

In this report, the current condition of grizzly bear populations within the West Coast 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 and reported at two scales: large Grizzly Bear Population Units (GBPUs) and smaller Landscape Units (LUs). Population objectives are set and managed within the former, while habitat objectives are delivered through land-use planning within the latter. These units may overlap with other land and resource use planning polygons, including other FLNR Regions, Wildlife Management Units (WMU) for which game management objectives and hunting regulations are set, as well as parks and protected areas for which habitat protection objectives are set.

In this report, the results for all the indicators are extrapolated and reported at the much smaller LU scale[18] 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 Province's broad objectives. These indictors individually and in some cases collectively describe the status of grizzly bear populations and habitat relative to the provincial government's broad objectives for grizzly bears.

Table 3.1 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.

In Section 4, the approach to assessing each indicator is explained in more detail to help readers interpret the results. Additionally, an assessment of the value of the results (level of precision, utility and relevance) for informing management responses is provided for each indicator, along with a regional perspective on potential next steps to strengthen the information needed to support management responses.

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[18] 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
Population Indicators	
Population Rank*	The conservation status of each GBPU in B.C.
Number of Bears (Bear Density)[+]	The estimated number of bears per 1000 km^2 within each GBPU
Mortality Rate*	The percent female mortality of the estimated total GBPU grizzly bear population compared against mortality reference points
Road Density[+]	The total length of roads (and pipeline corridors, transmission line rights-of-way, and rail lines) divided by total LU area (km/km^2)
Core Security Area*	Patches of secure grizzly bear habitat (with minimal likelihood of human use) greater than 10 km^2
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)
Hunter Day Density[+]	The number of days per year that all hunters (i.e. excludes grizzly bear hunters after 2017 when the licensed hunt was closed) occupy WMUs
Habitat Indicators	
Poor Forage Potential (Mid-Seral Dense Conifer)*	The amount of mid-seral dense conifer forest (by BEC zone) within each LU, to represent areas of grizzly bear habitat that have sub-optimal forage production
Quality Food*	The Broad Ecosystem Inventory (BEI) capability of ecosystems to produce vegetation grizzly bears forage for (e.g. forbs, grasses, sedges, berries), and high salmon biomass.
Habitat Protection[+]	The amount of high capability grizzly bear habitat within a LU that is protected in conservation areas and wildlife habitat areas

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.[19] Benchmarks are based on our scientific understanding of a system and may be based on empirical evidence or expert opinion. Where available, West Coast Region data was incorporated into provincial risk assessment and benchmark development.

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.

Flagged areas simply highlight areas that require further investigation by regional specialists and decision-makers to determine the current condition for grizzly bears and what potential mitigation or management responses may be required.

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

Table 3.2 Colour Scale for Interpreting Effects to Grizzly Bears

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

Increasing potential effects to grizzly bears

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[19] Benchmarks are defined as reference points that support interpretation of the condition of an indicator or component. Benchmarks are based on our scientific understanding of a system and may or may not be defined in policy or legislation. For the purpose of the CEF, benchmarks are identified to support assessment and reporting in relation to broad objectives (CEF Interim Policy, 2016).

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

Each map provides an initial overview of the assessment results, and **Appendix 3** provides detailed assessment results of LUs that are flagged/not flagged that highlight where there are higher risks to grizzly bears that warrant further investigation.

Reviewers are also encouraged to explore the results further within their areas of interest using provincial data sources outlined in **Appendix 4** and through available online, interactive dashboard and web mapping tools.

While the Protocol was developed by provincial subject matter experts in FLNRORD and the Ministry of Environment and Climate Change (MOE),[20] the following assessment results and recommendations were developed by provincial and West Coast Regional staff from FLNRORD. This is a broad, landscape-level assessment that "flags" areas where management attention may be warranted. Recommendations are provided in this report for further analysis or investigation that could be undertaken at the regional level to better understand the condition of grizzly bears and their habitat; this may be needed where:

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

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[20] Provincial subject matter experts have expertise in cumulative effects assessment and grizzly bear biology.

4.1   Population Rank – Core

Indicator Description

Assigns a conservation management concern rank for each GBPU in B.C. using the NatureServe ranking methodology[20] and calculator.[21] Each GBPU is ranked to reflect the GBPU's population size and trend, genetic and demographic isolation, as well as threats to bears and their habitats (M1 to M5;[22] ranked highest to lowest conservation rank in terms of risk). [23] Landscape Units ≥50% within a GBPU are assigned the rank for that GBPU.

Interpretation Key

- High risk LUs (M1, M2, and M3) are flagged; 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 Rankings

The Kitlope-Fiordland, Knight-Bute, Kwatna-Owikeno, Kingcome-Wakeman and Klinaklini-Homathko GBPUs are all classified as Low (M4) conservation concern, indicating that grizzly bear populations are at a lower risk in these respective GBPUs.

The majority of the LUs within the Tweedsmuir GBPU are classified as Very Low Concern (M5); the remainder are classified as Low (M4) conservation concern except some (4) that overlap Blackwater-West Chilcotin GBPU are classified as Moderate (M3) conservation concern meaning they are at higher risk.

These four flagged LUs in the Tweedsmuir GBPU are partially contained within the administrative boundary of the West Coast Natural Resource Region, however, the majority of the LU area falls within the administrative boundaries of either the Skeena or Cariboo Natural Resource Regions.

Only two of the six GBPU's are completely contained within the West Coast Region: Kingcome-Wakeman and Kwatna-Owikeno. The remaining four GBPUs (Tweedsmuir, Kitlope-Fiordland, Knight-Bute and Klinaklini-Homathko) span two or more Natural Resource Regions (Table 4.1). As grizzly bears are able to traverse these administrative boundaries, the management of grizzly bear populations and habitat is a cross-regional undertaking and must be coordinated in areas where grizzly bear populations are flagged or are at a higher risk.

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[21] NatureServe Conservation Status Assessments: Factors for Evaluating Species and Ecosystem Risk. 2012. https://www.natureserve.org/sites/default/files/publications/files/natureserveconservationstatusfactors_apr12_1.pdf

[22] NatureServe Conservation Rank Calculator. https://www.natureserve.org/conservation-tools/conservation-rank-calculator

[23] 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.

[24] NatureServe. 2015. NatureServe Element Occurrence Viability Calculator Version 1. NatureServe, Arlington, VA.

Indicator Quality	Ranking	Rationale
Relevance	High	A highly relevant indicator for population status and health.
Precision	Low	Model-derived population estimates are uncertain in West Coast Region. Population inventory should be expanded, improved, and updated to help fill the data gap generated by limited field-based population estimates on the coast to inform the coastal population estimate regression model. Regional DNA studies can be used to help fill this gap.
Utility	Low	The utility is low for this indicator due to lack of population estimate data and therefore, does not support a meaningful management response for the region.
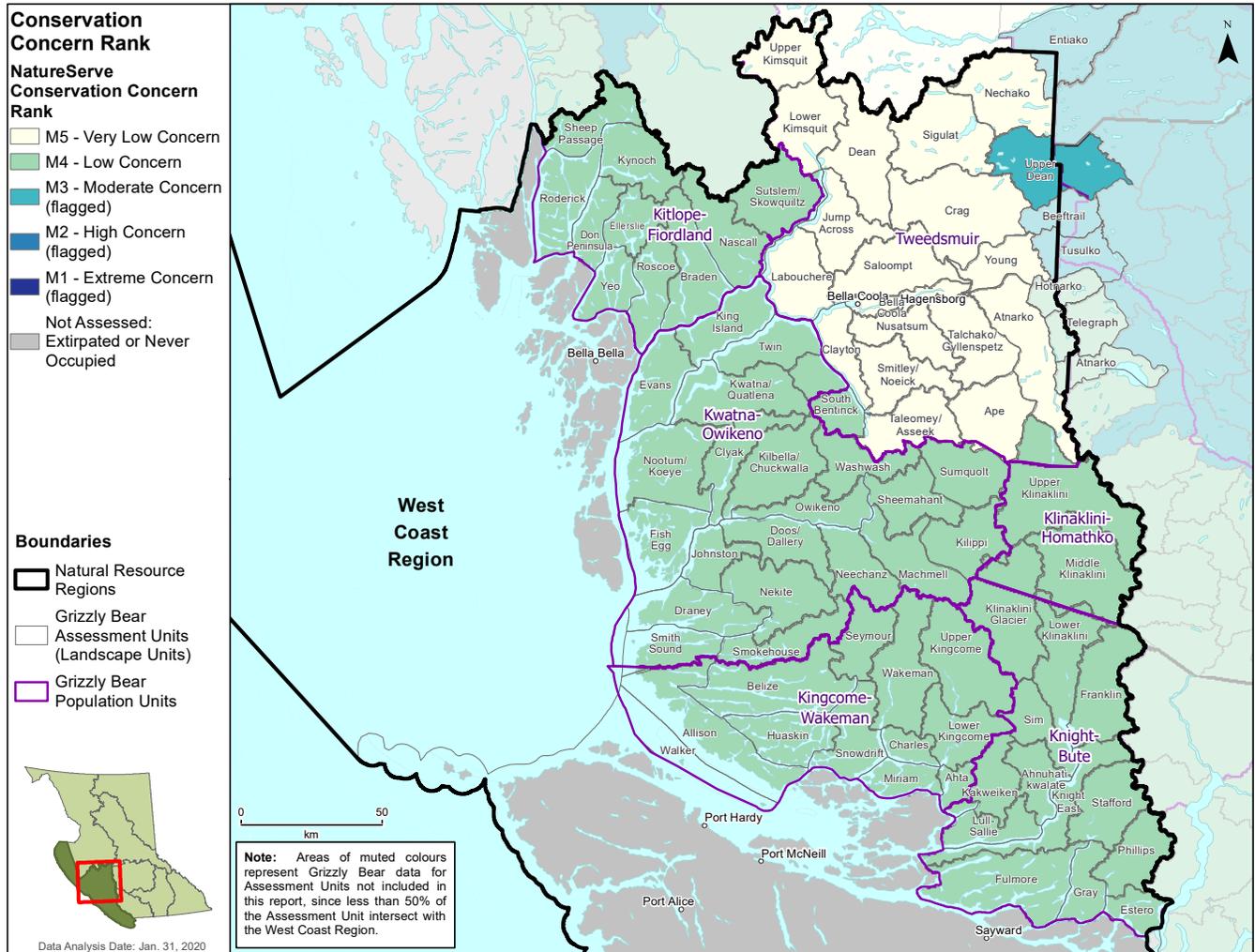
Figure 4.1 *Grizzly Bear Conservation Status – West Coast Region*

4.2   Number of Bears (Bear Density) – Supplemental

Indicator Description

This indicator reports the estimated density of bears (number of bears per 1000 km^2) from a regression model that extrapolates field-based population estimates to unsurveyed areas based on factors known to driver population size including human intrusion and forage availability.[24] 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. The indicator is assessed at the LU level.

Interpretation Key

- Bear densities >10 bears per 1000 km^2 are lower risk.
- Bear densities < 10 bears per 1000 km^2 are higher risk and are flagged; management considerations are recommended when reviewing land-based decisions in these areas.

Benchmark

- >10 bears per 1000 km^2 (not flagged)
- <10 bears per 1000 km^2 (flagged)

Management Context

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

Regional Commentary:

Estimated bear densities within the West Coast Region are variable (Figure 4.2) but are predicted to exceed >10 bears/1000 km^2 indicating that they are all considered as lower risk.

Bear densities are highest throughout the Knight-Bute, in the eastern portions of the Kingcome-Wakeman, and the Kwatna-Owikeno GBPUs (Table 4.1). These high bear densities are due in part to low human presence as well as high-quality grizzly bear habitat and food sources found in these areas.

The Bella Coola LU remains unique within the West Coast Region and among GBPUs. This unique travel corridor with abundant natural and non-natural food sources produces elevated bear numbers in close proximity to human settled front country. These relatively high numbers of bears in close proximity to people often results in direct bear mortality as a result of human-bear conflict resolution.

It is important to note that grizzly bears are not evenly distributed across the landscape and that population estimates may not be representative of where grizzly bears are on the landbase throughout the year. This is due to the seasonal presence of food sources (e.g. salmon availability at certain times of year) as well as habitat availability.

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[25] See Mowat et al, 2013. Predicting Grizzly Bear Density in Western North America.

Table 4.1 Population Unit Summary Table

GBPU	Conservation Status	Estimated Population	Grizzly Bear Density (# bears/ 1000 km²)	Total GBPU Area (km²)*	GBPU Area within WCR (km²)*	% GBPU in West Coast Region
Kitlope-Fiordlandˣ	Low Concern (M4)	214	23.1	11,186	5,089	45.5
Tweedsmuirˣˆ	Very Low (M5)	368	22.1	19,366	12,885	66.5
Knight-Bute+	Low Concern (M4)	250	46.6	7,283	6,830	93.4
Kwatna-Owikeno	Low Concern (M4)	229	24.8	12,138	12,138	100.0
Kingcome-Wakeman	Low Concern (M4)	199	41.0	6,863	6,863	100.0
Klinaklini-Homathkoˆ+	Low Concern (M4)	251	20.3	14,853	2,318	15.6

* Area calculations exclude rock, water and ice which grizzly bears do not use.
⁺ Overlap with South Coast Natural Resource Region
ˣ Overlap with Skeena Natural Resource Region
ˆ Overlap with Cariboo Natural Resource Region

Assessing Grizzly Bear Density in the West Coast Region

The regression model used to estimate bear density in coastal ecosystems relies on several indicators, including salmon, a high source of protein that makes up a large portion of a grizzly bear's diet, and precipitation, which is the main indicator of plant productivity (the capability of ecosystems to produce vegetation grizzly bears rely on).

While the model used for this assessment is robust, additional data can improve these results for the West Coast Region. For instance, field-based population inventories and monitoring may be necessary to provide validated estimates to support appropriate management (mitigation) responses to the indicator results in this report (Section 5.2).

Indicator Quality	Ranking	Rationale
Relevance	High	A highly relevant indicator for population health.
Precision	Low	Model-derived population estimates are uncertain in West Coast Region. Population inventory should be expanded, improved, and updated to help fill the data gap generated by limited field-based population estimates on the coast to inform the coastal population estimate regression model. Regional DNA studies can be used to help fill this gap.
Utility	Low	Limited data availability limits practical management response to those few areas with high quality data.

Estimated Grizzly Bear Density

(#/1000 km2)
- >50
- 40 - <50
- 30 - <40
- 20 - <30
- 10 - <20
- 0 - <10 (flagged)
- Not Assessed: Extirpated or Never Occupied

Boundaries
- Natural Resource Regions
- Grizzly Bear Assessment Units (Landscape Units)
- Grizzly Bear Population Units

Data Analysis Date: Jan. 31, 2020

Note: Areas of muted colours represent Grizzly Bear data for Assessment Units not included in this report, since less than 50% of the Assessment Unit intersect with the West Coast Region.

Figure 4.2 Grizzly Bear Density – West Coast Region

4.3 Mortality Rate – Core

Indicator Description

This indicator reports the annual percent female mortality of the estimated total GBPU grizzly bear population compared against mortality reference points,[26] averaged over 2008 to 2017. Estimates are derived from provincial population estimates, data from the Compulsory Inspection Database [CID]), and provincial estimates of un-reported mortality.[27] Results are extrapolated to the LU level, where LUs are flagged if they overlap by more than <10% with a flagged mortality polygon.

Interpretation Key

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

Benchmark

- 0 to 1.33% = Negligible Risk – below 4% total mortality
- 1.33 to 2% = Moderate-Low Risk – below the 6% total mortality
- 2 to 3.33% = Moderate Risk – above 6% but below possible maximum
- Above 3.33% = High Risk – above absolute maximum of 10% total

Management Context

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

Regional Commentary:

Humans are the main cause of grizzly bear mortality. This includes mortality from human-bear conflicts, illegal poaching, collisions with vehicles, trains and (prior to 2017) hunting.[28] In the CID, reported mortalities fall into six categories: hunting, animal control (to address human-bear conflicts), illegal hunting, pick-ups (grizzly bears found dead, with cause of death unspecified), road kills, and rail kills. From 2008-2017, the CID-reported 219 grizzly bear deaths within the West Coast Region:[29] 70% were the result of hunting, 26% the result of animal control, 2% the result of illegal hunting, 1% unspecified (pick-ups), and <1% the result of roadkill.

Prior to the cessation of licensed grizzly bear hunting, annual female mortality only exceeded the Negligible Risk benchmark within the Tweedsmuir GBPU. In the Bella Coola LU and adjacent LUs, female mortality flagged as high due to conflict kills in the Bella Coola valley (Figure 4.3). The Upper Dean LU also flagged with low to moderate mortality rates.

The overall low level of grizzly bear mortality found throughout the West Coast Region largely reflects the lack of human access due to the complex terrain found within the Coast Mountain Range and the absence of high-use road networks in this remote region (Figure 4.4).

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[26] B.C. uses 4-6% as the range of total mortality for interpreting population risk (1.33 to 2% female).

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

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

[29] WMUs identified within the CID do not overlap the West Coast Region GBPUs identically. Region 1 (Vancouver Island) and Region 5 (Cariboo) also contribute to the GBPUs found within the West Coast Region.

Indicator Quality	Ranking	Rationale
Relevance	Moderate	A highly relevant indicator for population viability as populations are driven by presence of reproductive females. The CID is a good database to monitor and report grizzly bear mortality and provides relevant information for this assessment. With the closure of the licensed hunt, this indicator is only relevant where human-bear conflicts occur. If the hunt re-opens, then it may increase in relevance.
Precision	Low	Based on current data, known mortality rates are well tracked through the CID and through other provincial monitoring programs (e.g. Fish and Wildlife). With the closure of the licensed hunt, this indicator will likely become more precise where human-bear conflicts occur. Unreported mortality is often related to human-bear conflict scenarios and with the relatively high level of human-bear conflicts in certain areas of West Coast Region (e.g. Bella Coola, Highway 20 corridor), the likelihood of unreported female grizzly bear kills is high. Illegal hunting is also a large factor that contributes to grizzly bear mortality in the region. Without information on this mortality rate, the precision of this indicator is reduced.
Utility	High	Known mortality is tracked well through the CID, which provides good information for this assessment. Additionally, provincial monitoring programs (i.e. Fish and Wildlife) effectively integrates mortality into population modelling and uses outputs to help address current bear management issues such as human-bear conflict areas and bear viewing impacts.
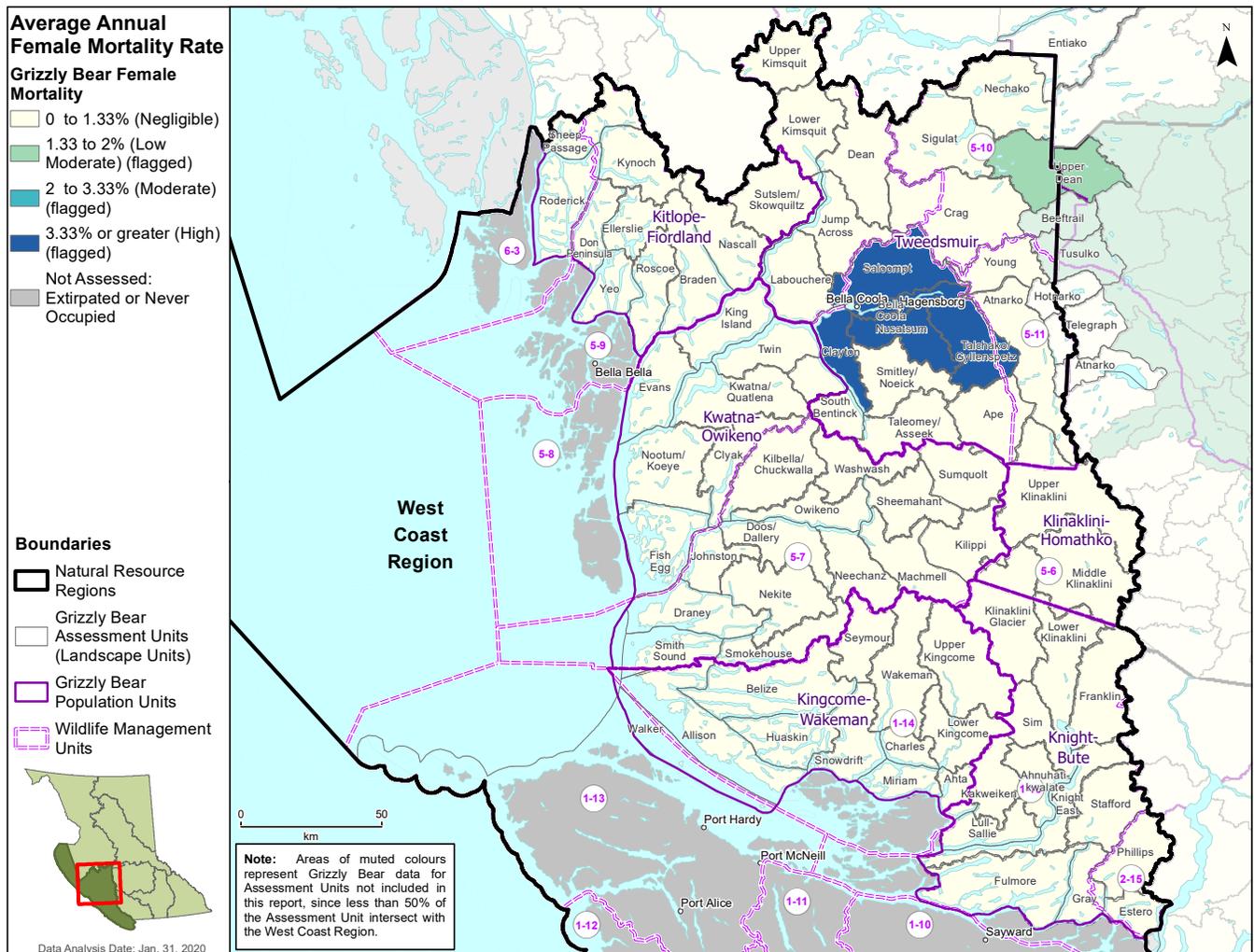
Figure 4.3 *Average Annual Female Mortality Rate – West Coast Region*

4.4   Road Density – Supplemental

Indicator Description

This indicator reports total length of open roads[30] (as well as pipeline corridors, transmission line rights-of-way, and rail lines) divided by total LU area (km/km^2). Most grizzly bear deaths occur within 500 metres of a road or other corridor, and are the result of human-bear conflicts, poaching, or collisions with vehicles and trains. 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 to decline of grizzly bear populations.

Interpretation Key

- Remote, isolated, coastal road systems pose a low risk to grizzly bears and are not flagged.
- Classes 0, 1, and 2 pose a lower 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[31]

Benchmark

- Class 0= 0 km/km^2 (Roadless)
- Road Density > 0 and Coastally Disconnected (i.e. not connected or unconnected to other road systems)
- 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, and 7= >0.75 km/km^2 (Very High)

Management Context

- Managing human access (road densities and road closures)
- Managing attractants such as hydro and pipeline right-of-ways, dumps, camp management, angled salmon, hunter regulation
- Minimizing bear mortality from negative encounters with humans

Regional Commentary:

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

Due to limited access to the coast from the interior, and the unconnected nature of roads in the West Coast Region, the relationship between bears and road density is not as strong as other regions in the province. The majority of LU's in the West Coast Region are not flagged for management attention based on road density as the majority of the road networks within the region are remote, isolated and unconnected, and have very limited access (Figure 4.4).

The main road network within the region is located within the Tweedsmuir GBPU where Highway 20 connects Bella Coola to the interior of the province, along with adjacent roads primarily for forestry activity. As such, the LU containing the community of Bella Coola and a portion of Highway 20 is flagged for management attention. The Young and Atnarko LUs connect Highway 20 to the interior of the province. However, they are not flagged for management attention as the terrain is steep and rugged, and Highway 20 is the only main road in those LUs.

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[30] Note that this indicator does not include roads that are permanently deactivated or closed to access.

[31] 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.

Although the majority of the roads within the West Coast Region are unconnected, roads are also found within multiple LUs in the Kwatna-Owikeno (Allison, Huaskin, and Snowdrift), Kingome-Wakeman (Nootum/Koeye) and Knight-Bute GBPUs (Fulmore and Grey) where logging activities and forestry roads occur. Although these are not widely accessible to the public, a temporal disturbance still exists as logging activities are present.

Indicator Quality	Ranking	Rationale
Relevance	Low	There are very few accessible roads and connected road networks on the coast, therefore there is a low relevance indicator for the West Coast Region.
Precision	Moderate	Road and settlement datasets are derived from multiple provincial data layers enhancing the precision of this indicator. All roads, regardless of ease of travel, are considered to have the same disturbance potential on bears.
Utility	Moderate	Due to the unconnected nature of the roads in the West Coast Region, there is a low utility. However, where potential areas of conflicts exist, road access can be adjusted as needed.
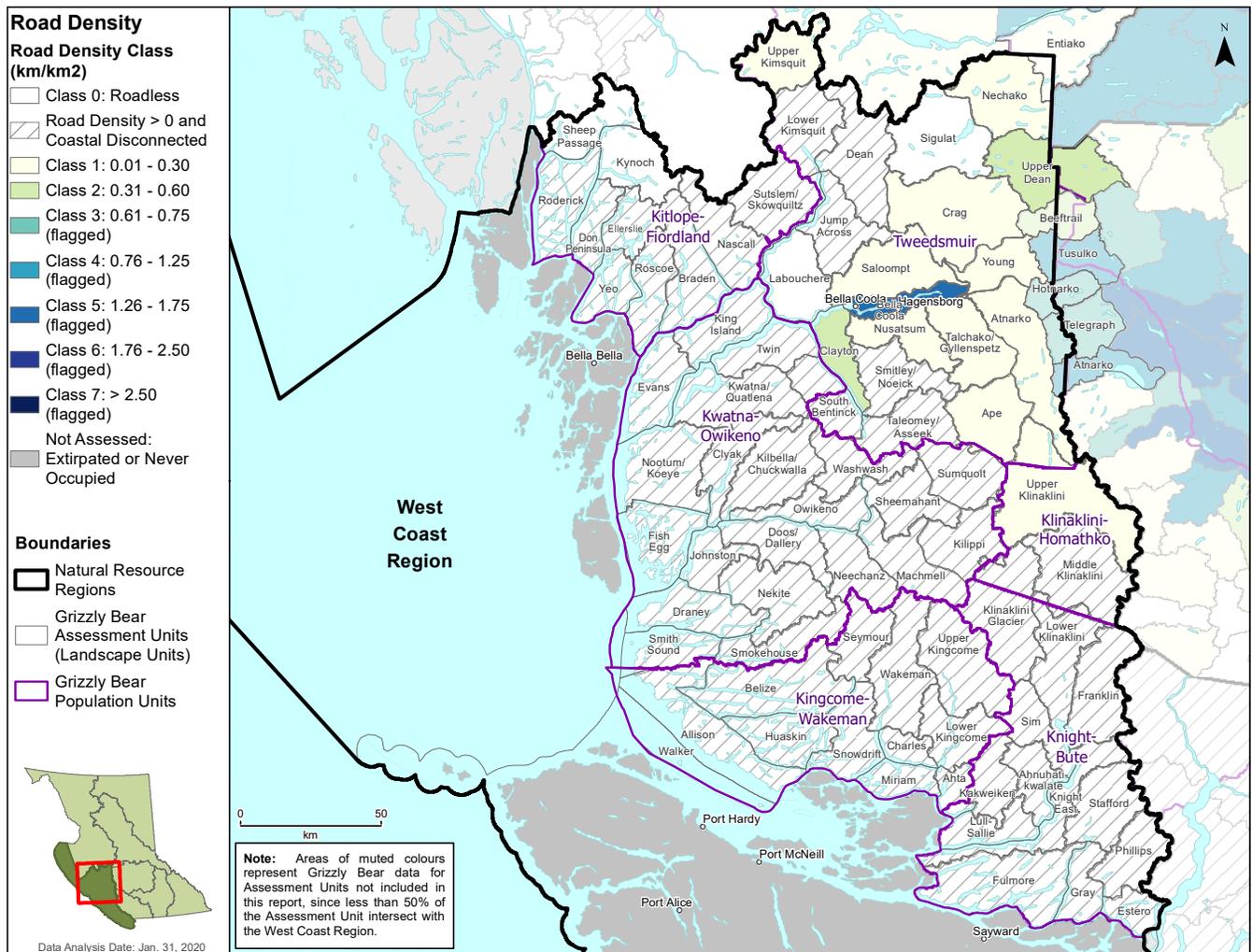
Figure 4.4 Road Density – West Coast Region

4.5   Core Security Areas – Core

Indicator Description

This indicator reports the prevalence of core security areas, which are patches of habitat greater than 10 km^2 within a LU with minimal likelihood of human use. These areas are large enough to accommodate a female grizzly bear's daily foraging requirements in areas unlikely to have human activity (e.g. absence of roads, settlement areas, recreation areas, industrial areas). To adequately buffer grizzly bears from humans, these core security areas must be 500 metres or more from human infrastructure and activity.[32]

Interpretation Key

- LUs with more than 60% of the area in core security areas pose a lower 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% of LU in core condition[33] (not flagged)
- < 60% of LU in core condition (flagged)

Management Context

Managing human access, managing attractants (such as hydro line ROWs and pipeline corridors, dumps, camp management, angled salmon), hunter regulation for managing ungulate kills, etc.), minimizing bear mortality resulting from negative encounters with humans through hunter education, public education, and regulations.

Regional Commentary:

All GBPUs have core security area available for grizzly bears, and most LUs have >60% of their area serving as core security areas. Connectivity of core security is not considered an issue within this region given generally low levels of human settlement and linear development (e.g. roads, pipelines, ROWs).

Only the Bella Coola LU within the Tweedsmuir GBPU is flagged for this indicator (Figure 4.5). The Bella Coola LU contains the major transportation corridors within the region (e.g. Bella Coola and Highway 20 corridor) along with adjacent spur roads primarily for forestry activity. The Young and Atnarko LUs are not flagged for management attention at this time as Highway 20 is the only main road in these LUs and are within Tweedsmuir Park.

Given that core security areas must be 500 metres or farther from human infrastructure and activity, and there are few roads throughout the West Coast Region, there is an abundance of core security area. GBPUs in the West Coast Region do not encompass the typical infrastructure that occurs in other regions of the province as there is a low concentration of urban areas, agriculture areas, industrial roads, infrastructure associated with oil and gas exploration, pipelines, hydro power generation, utilities, mines, and limited forestry. Where roads exist, they are primarily used by resource-based industrial users, and not by everyday commuters, therefore reducing the temporal disturbance along these corridors compared to roads more frequently travelled by the general public, minimizing both the amount and timing of disturbance.

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[32] 500m buffers on select human disturbance are excluded from Secure Core: mining & extraction, oil & gas, utility ROWs, agricultural, urban, urban mixed, recreation (see Appendix II tab 'meta Disturbance') or Appendix III of the Interim Assessment Protocol for Grizzly Bear in British Columbia, 2020).

[33] Core condition includes is areas without rock, ice and lakes that grizzly bears do not use and are away from human presence and activities.

While the West Coast Region supports a significant amount of core security for grizzly bears at this time, this indicator should be monitored closely into the future if human activities (e.g. hydropower generation projects, forestry activities) increase within the region. Temporal activities and human access should be monitored as well, particularly in the spring and fall when grizzly bears are accessing feeding sites along rivers and waterways in coastal GBPUs. Threats to grizzly bears may increase during these times of the year as illegal poaching in these remote, backcountry areas may increase mortality at these sites. Moreover, future developments and human activity should be avoided in core security areas with available forage.

Additional recommendations to improve this indicator in the future are provided in section 5.2.

Indicator Quality	Ranking	Rationale
Relevance	High	A highly relevant indicator for population viability.
Precision	Moderate	Road and settlement datasets are derived from multiple provincial data layers enhancing the precision of this indicator. All roads, regardless of ease of travel, are considered to have the same disturbance potential on bears.
Utility	Moderate-Low	Since there are few remote and disconnected roads in the West Coast Region, this indicator has moderate-low utility, apart from the Bella Coola corridor (Highway 20) where it has high utility. If road networks expand in the future, then the utility of this indicator would increase.
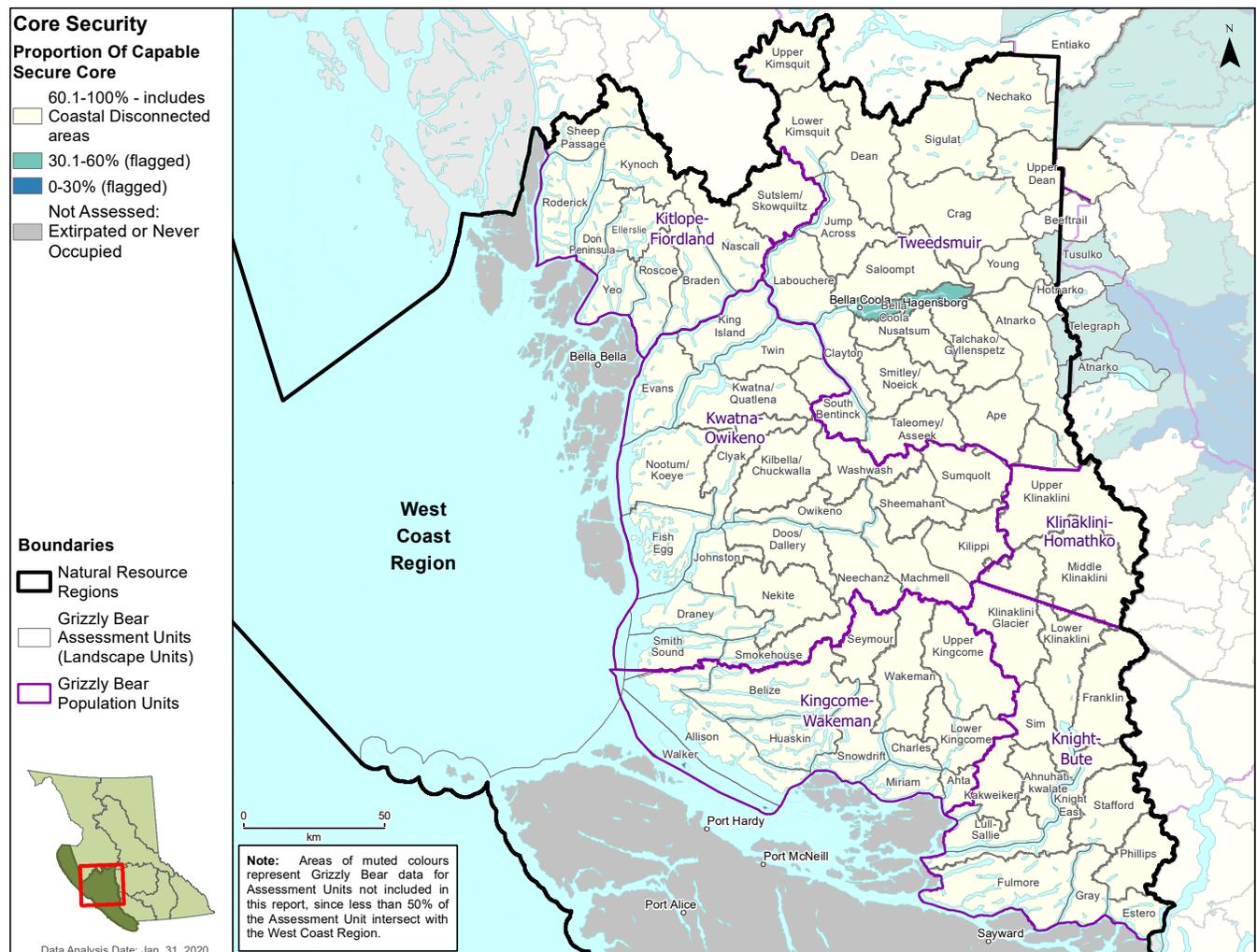
Figure 4.5 *Core Security Area for Grizzly Bears – West Coast Region*

4.6   Front Country – Supplemental

Indicator Description

This indicator reports the proportion of each LU that is considered front country.

Front country is defined as urban and rural landscapes that may include both relatively high human density and access, and grizzly bear attractants in the form of livestock, livestock carcasses, livestock feed, fruit trees, human food/garbage and grain. This indicator includes areas of human settlement (including communities and agricultural areas) as well as high use rural roads (roads up to 2 hours travel time from cities).

Interpretation Key

- LUs with less than 20% of the area in front country are lower 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	Management Context
- ≤ 20%[34] Front country (not flagged) - > 20% Front country (flagged)	- Front country decisions related to: managing attractants (hydro lines, pipeline right of ways, dumps, camp management, angled salmon, hunter regulation for managing ungulate kills, etc.), education for private land, managing human access, managing livestock attractant and areas. - Back country decisions related to: managing attractants, major project permits, reducing human-bear encounters/mortality.

Regional Commentary:

There is very little front country present in the West Coast Region compared to other areas of the province due to its remoteness and inaccessibility to the interior overland. However, where front country exists, there is a potential for increased human-bear conflicts due to human presence and activities. The only GBPU that contains both a deficit in core security (Figure 4.4) and a higher proportion of front country is the Tweedsmuir GBPU, where multiple LUs are flagged along the Highway 20 corridor and around the community of Bella Coola.

The Bella Coola corridor is a unique feature in the West Coast Region. There is one highway (Highway 20) in and out of the area to support the small communities of Bella Coola and Hagensborg (~2,300 people). Development including rural and agriculture activities in the corridor is extensive and has been established for many years. The combination of natural (salmon, vegetation and berries) and non-natural (garbage, agriculture crops, fruit trees and livestock) food sources make this a complex management area. Human-bear conflicts may also be increased by the continued expansion of the bear-viewing industry that brings thousands of tourists into the valley annually that would otherwise not visit the area. Human-bear conflicts are high throughout the spring, summer and fall. Environmental factors influence salmon returns to the area, such as drought, flood, fires, and ocean temperatures. Years with low salmon returns result in increased human-bear conflict due to availability of alternate natural food sources and non-natural attractants in the corridor.[35] The potential for bear mortality may increase as the bear-viewing industry, associated tourism and overall human population expands.

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[34] Currently, there is no scientific data linking the total proportion of front country in a LU to key grizzly population parameters like population trend, survival rates and reproductive rates; ≤ 20% of a LU in front country condition is conservatively assumed to confer low risk to bear populations.

[35] Artelle et al. (2016) identified that for grizzly bear populations that feed on spawning salmon (Oncorhynchus spp.), the annual number of bears/km2 killed due to conflicts with humans increased by an average of 20% (6–32% [95% CI]) for each 50% decrease in annual salmon biomass.

Overall, the assessment outcomes indicate that the majority of the West Coast Region has a low potential for human-bear encounters in remote areas outside of Bella Coola and the Highway 20 corridor. Additionally, the remote coastal override was applied to the use of roads in the derivation of this indicator to reflect the challenges of accessing roads disconnected with the interior of BC.

Indicator Quality	Ranking	Rationale
Relevance	Low	There is little front country present in the West Coast Region making the relevance of this indicator low. However, there are key areas near human activity where it is extremely important to track front country expansion such that this metric is spatially relevant in those locations.
Precision	High	Road and settlement datasets are derived from multiple provincial data layers enhancing the precision of this indicator. It also generally aligns with human-bear conflict activity on the landbase.
Utility	High	This indicator has high utility as it flags the areas where human-bear encounters may occur and can be monitored as appropriate.
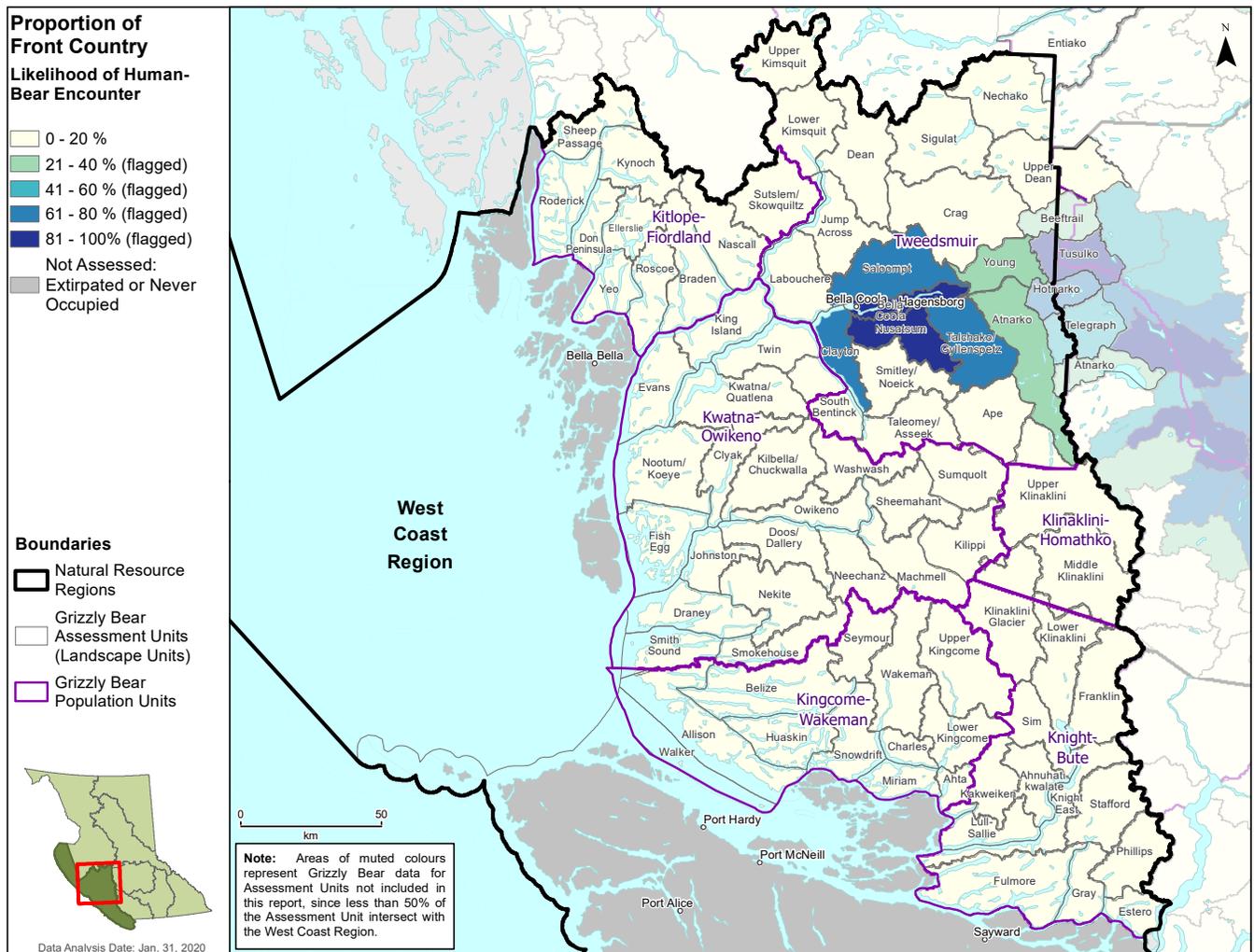
Figure 4.6 *Front Country – West Coast Region*

4.7   Hunter Day Density – Supplemental

Indicator Description

This indicator reports average annual hunter day density, which is the number of days over a 5-year period (2013-2017)[35] per year for the management unit (MU).[36] This density is extrapolated to the LU level (days/km^2). 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 lower risk to grizzly bears
- Average annual hunter days of 0.66 – 1.87/km^2 are moderate risk to grizzly bears.
- Average annual hunter days greater than 1.87/km^2 are higher risk to grizzly bears and are flagged for management attention.

Benchmark

- Lower = Quartile 1 (0 – 0.2 hunter days/km^2) (not flagged)
- Lower+ = Quartile 2 (0.21 – 0. 65 hunter days/km^2) (not flagged)
- Moderate = Quartile 3 (0.65 – 1.87 hunter days/km^2) (not flagged)
- Higher = Quartile 4 (>1.87 hunter days/km^2) (flagged)

Management Context

Minimizing bear mortality resulting from negative encounters with hunters.

Regional Commentary:

Hunter day density is extremely low throughout the West Coast Region from 2013 to 2017. No GBPUs have been flagged for management attention, and no LUs exceed the low risk level of 0.65 days/km^2 (Figure 4.7). Thirteen LUs throughout the Tweedsmuir, Klinaklini-Homathko, and Knight-Bute GBPUs have a moderate risk associated with hunter day density between 0.21-0.65 days/km^2 but do exceed the threshold for management attention.

No LUs are flagged as a risk in this indicator. Hunter day densities are inflated by 13% on average because this indicator used hunter data from when the licensed grizzly bear hunt was occurring. In the West Coast Region, grizzly bear hunters contributed a substantial amount to overall hunter effort and this contribution varied by WMU between 0 and 31%. As such, risk to grizzly bears from hunters on the landscape is over-estimated now that the licensed grizzly bear hunt is closed.

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[36] As per the Interim Assessment Protocol for Grizzly Bears in B.C. (2020) https://www2.gov.bc.ca/gov/content?id=36E762B74B5E43E28DB32BEDBD39EEFC

[37] 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.

Regional Assessment	Ranking	Rationale
Relevance	Low	Human-bear conflict with hunters can result in bears being killed such that this indicator is a good measure of relative mortality risk from conflict encounters, also possibly poaching.
Precision	Moderate	Hunter sample questionnaires are used to estimate harvest in the area and big game harvest statistics show how many hunters were present in the area at a time. However, these are only estimates, and statistical inferences are challenging for areas with small numbers of respondents, and may not accurately reflect realities on the landbase.
Utility	Low	Given current harvest limits imposed for hunted species and limited access, we do not expect an increase in hunters over time and therefore no increasing risk to grizzly bears from conflicts with hunters. If access increases, it may result in more hunters on the landbase and the utility of this indicator will increase. For this reason, this indicator should be closely monitored. Overall, human-bear encounters do not occur often in the West Coast Region and the probability of this encounter is generally low due to the remoteness of the Region.
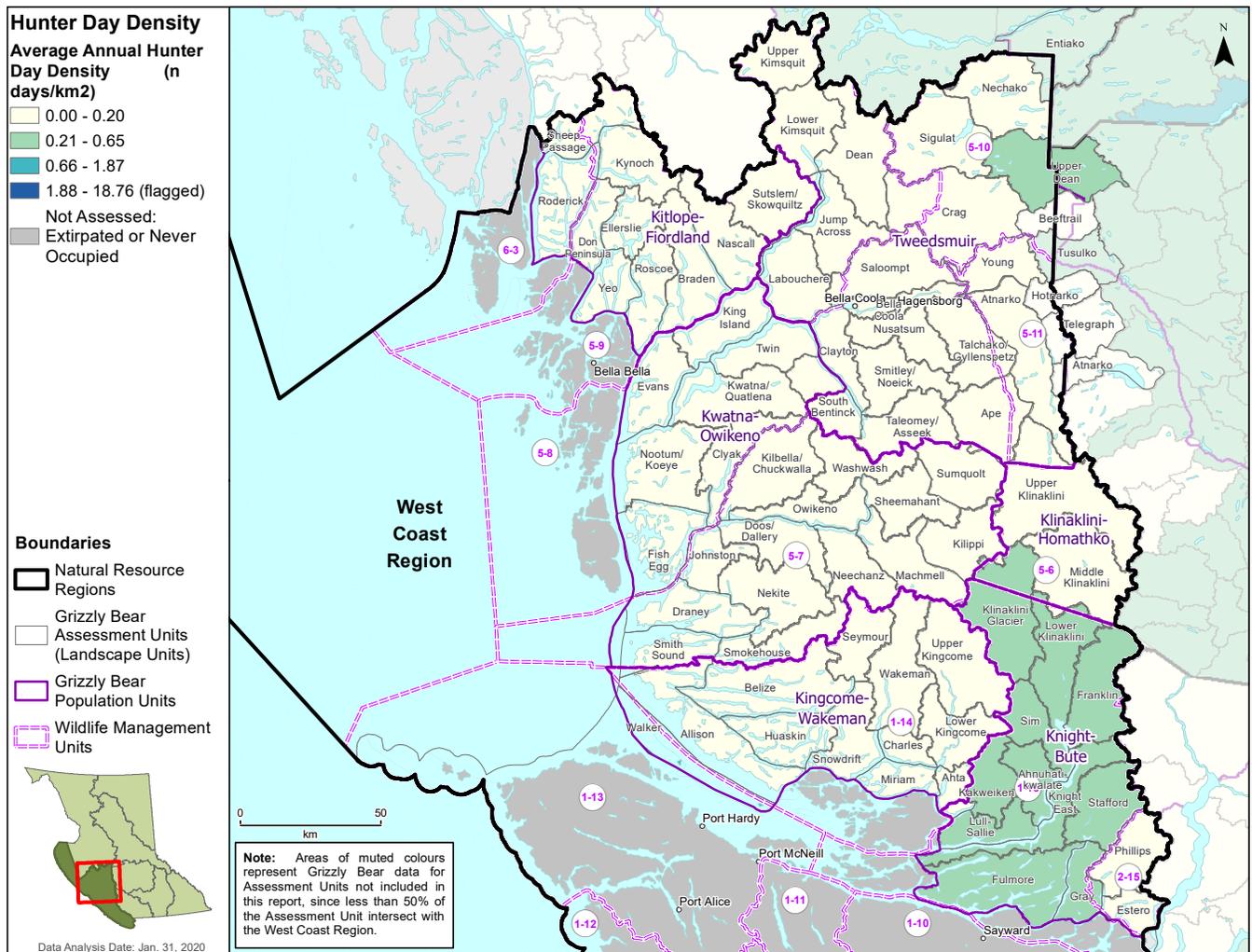
Figure 4.7 *Hunter Day Density – West Coast Region*

4.8   Poor Forage Potential (BEC Mid-Seral Dense Conifer) – Core

Indicator Description

This indicator reports the amount of mid-seral[37] dense conifer forest (by BEC zone) within each LU to represent areas that are **sub-optimal** for forage production 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

- Biogeoclimatic Ecosystem Classification (BEC) Zones are distinguished as either High, Moderate, or Low sensitivity:
  - High: CWH, ICH, ESSF, SBS
  - Moderate: MS, MH, IDF
  - Low: (all other BEC Zones)
- LUs with less than or equal to 30% of area in mid-seral dense conifer are lower 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

- Lower Risk= Mid-Seral Dense Conifer ≤ 30% in High or Moderate BEC zones (or Low sensitivity BEC Zone) in a LU
- Higher Risk= Mid-Seral Dense Conifer > 30% in High or Moderate BEC zones in a LU
- Insufficient Data= VRI gap ≥ 10% of BEC Zone in LU

Management Context

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

Regional Commentary:

Relevant BEC Zones in the West Coast Region are: **Coastal Western Hemlock (CWH)**, **Engelmann Spruce Sub-alpine Fir (ESSF)**, **Mountain Hemlock (MH)** and **Interior Douglas Fir (IDF)**. The age-class for mid-seral forest varies by BEC zone and is taken from the Biodiversity Guidebook (1995): 40-80 years for CWH and 40-100 years for ESSF, MH and IDF.

In the West Coast Region, optimal forage supply for grizzly bears is associated with old and mature, open-canopy forests on relatively rich sites with openings for berry growth and other understory forage, as well as alpine meadows, avalanche tracts, and productive berry habitats including high-elevation shrub ecosystems, regenerating early seral clear cuts, and regenerating burns. Grizzly bears use high elevation habitats primarily for denning and early summer feeding and spend the rest of their time in the low elevation CWH.

Mid-seral conifer forests have dense, closed canopies which are suboptimal for forage production and are generally undesirable for grizzly bears. Additionally, grizzly bears in the West Coast Region generally avoid hypermaritime forests as vegetation food sources are low, though the hypermaritime offers rich protein sources such as clams, crabs and other invertebrates in non-forested habitats such as beaches and estuaries.

No GBPUs within the West Coast Region are flagged for management consideration based on mid-seral constraints as all LUs contain less than 30% mid-seral forests (see Figure 4.8).

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[38] Mid-seral dense conifer forests are typically 40 to 100 years old depending on the ecosystem (Biodiversity Guidebook, 1995).

Regional Assessment	Ranking	Rationale
Relevance	Moderate	This indicator is relevant since it's related to seasonally important food sources (e.g. spring vegetation and berries).
Precision	Low	There are uncertainties that exist with the ages used to represent excluded forage. Ground-truthing is recommended to improve the precision of this indicator.
Utility	Low	Due to the relatively low amount of forestry activity in associated LUs, this indicator has limited utility for the West Coast Region.
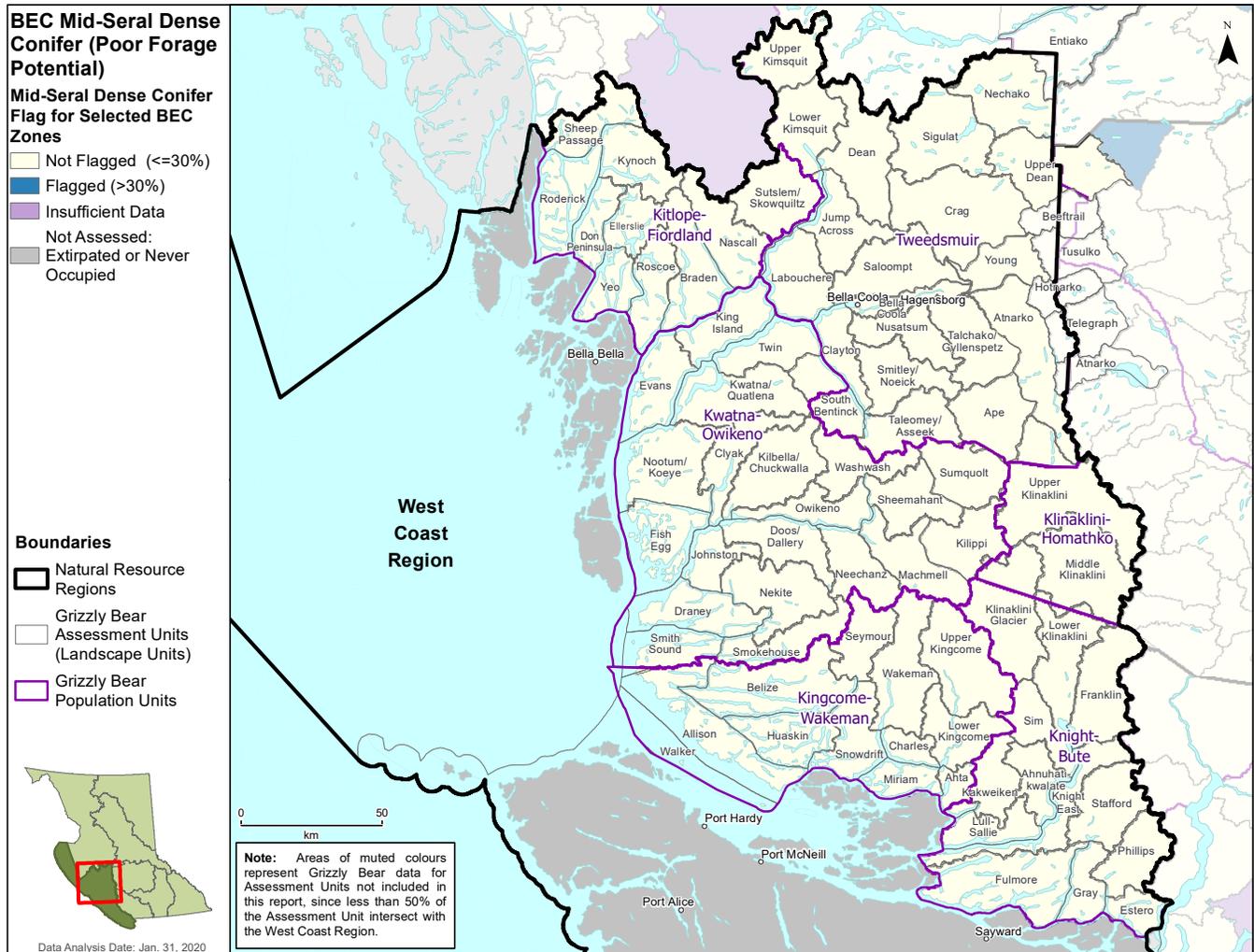
Figure 4.8 *BEC Mid-Seral Dense Conifer – West Coast Region*

4.9   Quality Food – Core

Indicator Description

This indicator assesses the amount of quality food sources available to grizzly bears. Quality food is defined by >50%[38] of LU is high or very high habitat quality ecosystems (BEI and EBM)[39] and/or any unit with >10,000kg high salmon biomass.

Interpretation Key

• Quality food is considered present if:
   – >50% of the LU is classified as high or very high quality habitat indicating presence of quality forage plants or
   – >10,000 kg of salmon is available at all time periods[40] (sum of salmon kg by LU).

Benchmark

• Yes - High salmon or >50% of LU in high or very high habitat quality
• No - Not high salmon or >50% of LU in high or very high habitat quality

Management Context

Conservation management and access to high quality food resources.

Regional Commentary:

In coastal B.C., a grizzly bears' spring diet includes early green vegetation, including skunk cabbage, at low elevations. In the summer months, grizzly bears follow receding snow up avalanche chutes and return to lower slopes for summer berries[42] and salmon runs, after which they focus on spawning salmon until late fall and vegetation until denning. Grizzly bears will travel long distances to reach salmon resources during the mid-summer and fall months, including the Bella Coola/Atnarko River area of West Coast Region. As such, large portions of grizzly bears in a GBPU may be supported by spatially constrained salmon resources which requires habitat connectivity to reach these spawning areas.

Grizzly bear productivity on the coast increases with the availability of salmon and terrain ruggedness and decreases with canopy closure. Although grizzly bears consume ungulates opportunistically through predation and scavenging, ungulates are not considered a major food source for grizzly bears in the West Coast Region. Instead, coastal grizzly bears favour marine protein sources such as spawning salmon in accessible streams, clams, crabs and other marine invertebrates found in estuaries, and along the marine shoreline/intertidal zones in the West Coast Region.

High quality food sources are found in various LUs within the Kitlope-Fiordland, Tweedsmuir, Kwatna-Owikeno, Kingcome-Wakeman, and Knight-Bute GBPUs (Figure 4.9) and quality food is driven primarily by abundance of salmon resources (Figure 4.10). Many LUs within these areas also have intertidal areas to sustain grizzly bears in the seasonal absence of salmon resources.

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[39] Currently, there is no scientific data linking quality food to LU's with >50% high or very high habitat quality ecosystems; >50% benchmark is conservatively assumed to confer low risk to bear populations

[40] Grizzly bear habitat suitability mapping was completed by the Ecosystem-based Management Working Group as part of the planning initiative for the Great Bear Rainforest Land Use Order (2016). See MacHutchon and Hamilton in Horn (2009) for a grizzly bear habitat mapping summary https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/westcoast-region/great-bear-rainforest/ei02c_report_4_habitat_mapping_summary.pdf

[41] Salmon availability averaged annually using 2014 Fisheries and Oceans Canada NuSEDS data https://open.canada.ca/en/suggested-datasets/new-salmon-escapement-database-nuseds

[42] Information on berry distribution and abundance is intended to be used in the future, as information becomes available.

The complicated mountainous terrain creates a diverse array of ecosystems from high quality alpine ecosystems and riparian forests to productive temperate rainforests. High and very high habitat capability ecosystems are distributed throughout the maritime and sub-maritime portions of the region, but do not exceed the 50% by LU threshold in most LUs as a result of the complex terrain in each LU.

To the east of the Coast Mountain Range, the terrain is less mountainous, and ecosystems tend to have simpler vegetation characteristics and/or a lower vegetation production potential. This results in reduced habitat capability for grizzly bears in the eastern portion of West Coast Region compared to coastal areas.

The West Coast Region is also well known for high salmon production, a food source that is highly significant to a grizzly bear's diet. Figure 4.10 illustrates that there is high salmon escapement (>10,000 kg) within various LUs within the Kitlope-Fiordland, Kwatna-Owikeno, Kingcome-Wakeman, Knight-Bute GBPU and western portion of the Tweedsmuir GBPU. These areas are all connected to coastal areas, major watercourses and/or the Pacific Ocean, and have suitable habitat for large amounts of spawning salmon. These areas have appropriate water quantity and gradients to support salmon, however, salmon biomass had been declining in recent years and this further threatens grizzly bear populations in the West Coast Region.

The only GBPU without any high salmon biomass LUs is the Klinaklini-Homathko GBPU, which is not connected to coastal areas; habitat quality for all its LUs is based on habitat capability only. Additionally, the most of the Tweedsmuir GBPU does not support large amounts of salmon biomass as this area is mountainous and does not support appropriate salmon habitat.

As salmon are significantly important to grizzly bears in the West Coast Region, regional experts consider this to be a "core" indicator, as opposed to a "supplemental" indicator as identified in the Interim Assessment Protocol for Grizzly Bears in British Columbia (2020). Any negative changes to salmon biomass, availability, and habitat connectivity required to travel to spawning streams will have large implications to grizzly bears within this region. Therefore, additional research, inventory, and monitoring of salmon biomass and identifying and travel corridors that connect grizzly bear habitat is recommended.

Climate change impacts such as increased water temperatures and changes to precipitation patterns also have the potential to alter food quality and habitat capability, including the availability of salmon and seasonal key forage plants. As such, regional experts also suggest climate change modelling research be conducted in the region as it relates to grizzly bear food and habitat quality and supply.

Further analysis and investigation into this indicator could include:

- Improve and standardize the resolution of ecosystem and air photo mapping used to model Class 1 and 2 habitat suitability for the GBR and improve the level of field verification. The Grizzly Bear Habitat layer is an amalgamation of multiple projects, some of which used Terrestrial Ecosystem Mapping (TEM) which may over-estimate the amount of quality habitat, and some of which had little or no field verification.

- Refine the definition of quality foods through diet analysis (isotope) of existing grizzly bear hair samples and relate the indicator thresholds to the prevalence of those foods in bear diets. This step may also provide some insight into a minimum amount of salmon that must be available to be considered a key food source (e.g. is the 10,000kg cut-off appropriate?).

- Improve the salmon data layer to include an adjustment for salmon availability that reflects stream features influencing bears' ability to access spawning salmon (i.e. high amounts of spawning salmon might be present in a stream but if the stream is too deep to be fishable by bears, those salmon are not truly available to bears). A more detailed review with regional experts to resolve discrepancies in the data is warranted prior to any resource management decisions being made in the West Coast Region.

- Identify streams that are highly utilized by grizzly bears to access salmon and conduct salmon monitoring to improve salmon population data. This will aim to fill data gaps as the Department of Fisheries and Oceans does not monitor salmon in all streams in the West Coast Region.

- Re-run the analysis every 5 years to incorporate the effect of continued declines in salmon availability.

Regional Assessment	Ranking	Rationale
Relevance	High	**Vegetation:** the relevance is high as the importance of forage plants for grizzly bears has been well studied and the GBR habitat mapping is spatially comprehensive. **Salmon:** Relevance is high for salmon escapement data that is used in the assessment.
Precision	Moderate	**Vegetation:** Food quality data and models are sound, based on best available science. The habitat mapping layer is seamless though comprised of numerous mapping projects of varying quality. Underlying ecosystem mapping and levels of field verification are highly variable across the region. **Salmon:** there are some uncertainties and data gaps with the salmon escapement data that is used.
Utility	High	**Vegetation:** the utility is high as ecosystems will likely change at a slow rate in the future. Managing food sources can be addressed as required to reduce mid-seral footprints and enhance forage productivity. **Salmon:** the utility is high as salmon stocks can be studied and areas can be flagged based on historical numbers of salmon. However, it is difficult to predict future salmon runs.
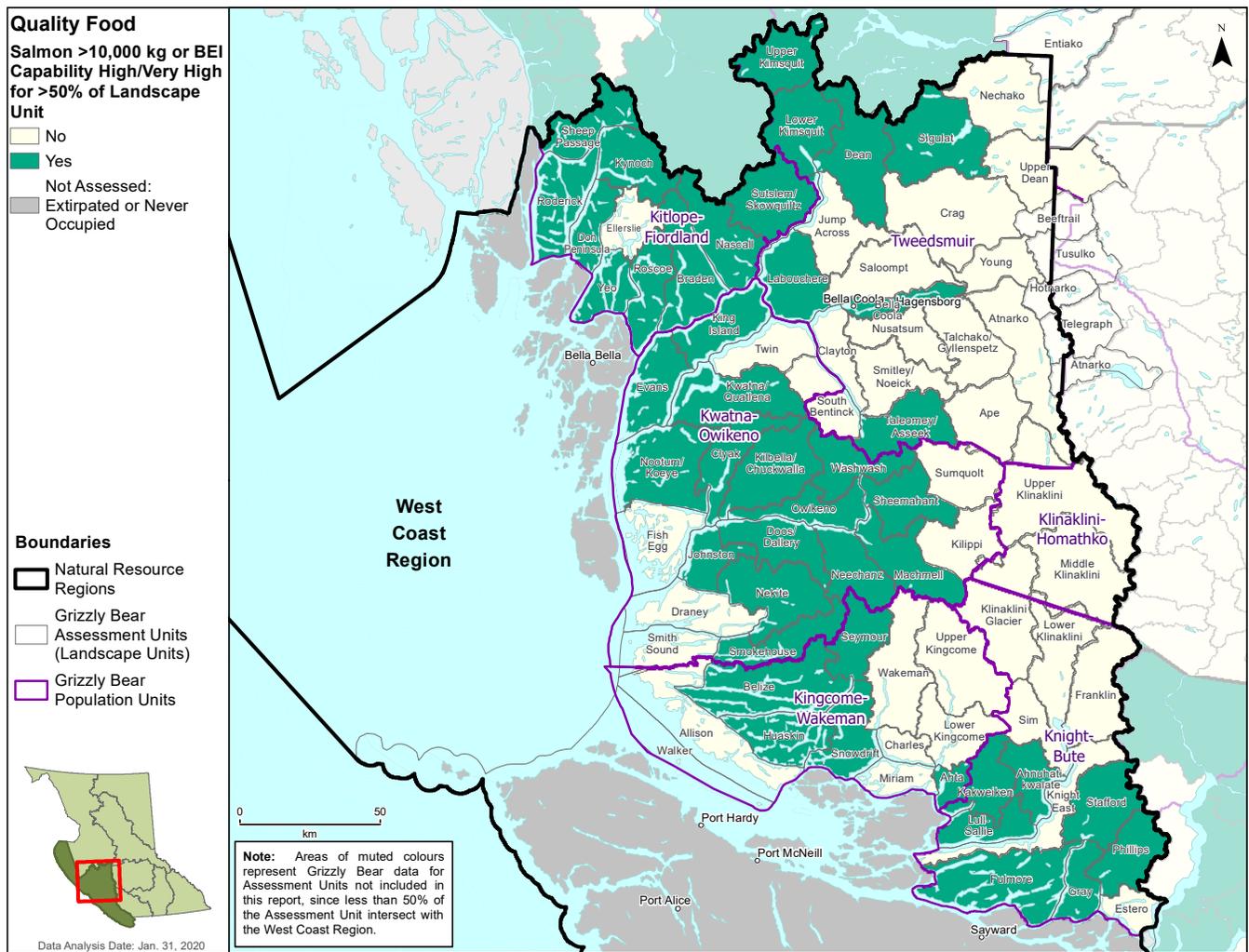
Figure 4.9 *Quality Food – West Coast Region*
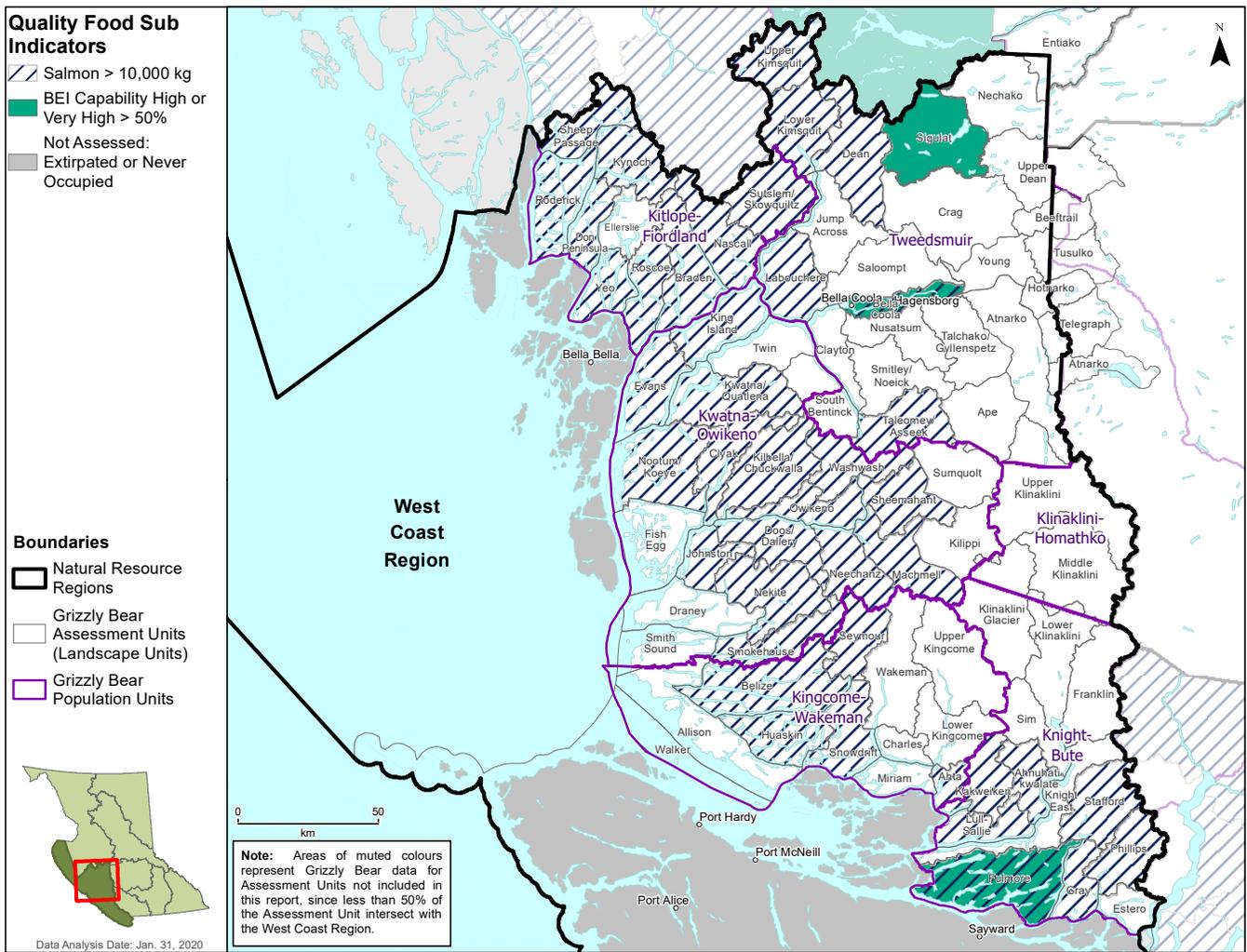
Figure 4.10 *Salmon Escapement Biomass – West Coast Region*

4.10 Habitat Protection – Supplemental

Indicator Description

Habitat protection has two indicators:
- Indicator 1: Percent of total area of very high and high grizzly bear habitat quality in a LU captured within conservation areas and other designations (protected/restricted areas).[42]
- Indicator 2: Presence/absence of areas for which grizzly bear habitat objectives are set, including grizzly bear Wildlife Habitat Areas (WHAs)/Specified Areas and/or Great Bear Rainforest Land Use Order Class 1 and 2 grizzly bear habitats.

Interpretation Key

- Indicator 1:
  - LUs with >60% of very high and high-quality habitat protected are low risk to grizzly bears.
  - LUs with 30 to 60% of very high and high-quality habitat protected are moderate risk to grizzly bears.
  - LUs with < 30% of very high and high-quality habitat protected are high risk to grizzly bears and are flagged for management attention.
- Indicator 2:
  - If > 0.05% of the LU is comprised of grizzly bear WHAs or GBR Class 1 and 2 habitats, considered present.
  - If <0.05% of the LU is comprised of grizzly bear WHAs or GBR Class 1 and 2 habitats, considered absent.

Benchmark

- Indicator 1:
  - Low Risk= >60%[43] protected
  - Moderate Risk= 30-60% protected
  - High Risk= <30% protected (flagged)
- Indicator 2:
  - Yes: LU contains >= 0.05% WHA/GBR Class 1 & 2 (present)
  - No: WHA/GBR Class 1&2 areas absent or < 0.05% of LU (absent)

Management Context

Conservation management

Regional Commentary:

Almost all of the mainland portion of the West Coast Region falls within the Great Bear Rainforest (GBR) forest management area. The eastern edge of the Tweedsmuir GBPU lies outside of the GBR but is protected within Tweedsmuir Provincial Park. High and very high-quality grizzly bear habitat is protected or conserved throughout the GBR and West Coast Region in a system of parks and conservancies, wildlife management areas (WMAs), old growth management areas (OGMAs), Wildlife Habitat Areas (WHAs), and other specified or otherwise designated areas.

Historically, as land use planning for the Great Bear Rainforest evolved, the level of land protection rose. The Khutze and the Ahnuhati Grizzly Bear Management Areas recommended by the Central Coast LRMP (2004) were established as Conservancies under the *Parks Act*.

Only 15% of the GBR land base is available for sustainable forestry, and that 15% is subject to an ecosystem-based management regime which protects and conserves a broad range of values for ecological integrity and human well-being. The GBR Land Use Order (LUO) (2016) sets specific

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[43] Now includes all EBM Class 1 and 2 as capable habitat. Weighted Area of Protected/Restricted area per LU. High restricted area (e.g. Parks, Conservancy, OGMAs, WHAs, WMA, conservation lands, etc.) are considered 100% protected, while 'Medium' (e.g. UWR, VQO partial retain) are considered 50% protected.

[44] Currently, there is no scientific data linking LU's with >60% high or very high habitat in protection. >60% benchmark is conservatively assumed to confer lower risk to bear populations

objectives for spatially mapped high and very high quality grizzly bear habitat,[45] but all LUs in the plan area are subject to a suite of other terrestrial and aquatic ecological objectives which support and conserve grizzly bear habitats and populations, including objectives for High Value Fish Habitat, Important Fisheries Watersheds, Upland Streams, and required Landscape Reserve Designs which address issues of connectivity across the GBR.

The GBR LUO sets objectives for the maintenance of functional condition in 100% of Class 1 very high quality (critical) habitats across the plan area including all GBPUs in the West Coast Region, and 50% of Class 2 high quality (sensitive) habitats in the Central and North Coast Area which includes the Kitlope-Fjordland, Tweedsmuir and Kwatna-Owikeno GBPUs. The LUO also sets an objective for protection of grizzly bear dens across the GBR, including all GBPUs in the West Coast Region.

There are 336 WHAs established and distributed throughout the West Coast Region specifically for grizzly bears. WHAs may overlap with GBR Class 1 and 2 habitats and contain high quality habitat as defined by the FRPA Identified Wildlife Strategy (2004). WHAs have General Wildlife Measures in place to protect and/or conserve high quality grizzly bear habitat. In the West Coast Region, the quality habitats protected in WHAs focus on protecting seasonally important food sources in avalanche chutes and key riparian areas.

The majority of LUs in the Tweedsmuir and Kitlope-Fjordland GBPUs have >60% of their high and very high-quality habitat in protection. The proportion of high and very high quality habitat in protection/restriction declines further south in the region reflecting the range of strategic land use planning agreements and plans that have gone into the current design of the GBR as well as the historic distribution of provincial parks and the timber harvesting land base (Figure 4.11).

However, the distribution of high and very high-quality habitat in the West Coast Region, constrained by rugged topography to the east and the hypermaritime to the west, must be considered when interpreting results for this indicator. The indicator is expressed as a proportion of the total amount of high and very high-quality habitat in an LU. If a LU has very little mapped habitat, all of which falls within protection, the entire LU scores as low risk for this indicator though there is very little high-quality habitat protected (e.g. Allison LU in the Kingcome-Wakeman GBPU or the Middle Klinaklini LU in the Klinaklini-Homathko GBPU). Conversely, if a LU has very little mapped habitat and all of it sits outside of protection, the entire LU scores as high risk for the indicator though there is very little habitat at risk (e.g. Fish Egg LU in the Kwatna-Owikeno GBPU or Klinaklint Glacier LU in the Knight-Bute GBPU). Those LUs with a relatively high amount of quality habitat which are high or moderate risk warrant closer management attention (e.g. the Kilbella/Chuckwalla LU (moderate risk) in the Kwatna-Owikeno or the Stafford LU (high risk) in the Knight-Bute GBPU).

Roughly 45 of the 77 LUs primarily managed by the West Coast Region are at moderate to high risk by having <60% of their high and very high-quality grizzly habitat in protection or restriction. However, ecosystem-based management in the GBR is has a range of tools at its disposal. Of interest is knowing if, for the LUs with a low to moderate proportion of high quality grizzly habitats and resources in protection/restriction (and so high to moderate risk), the principles of ecosystem-based management have adequately compensated for this apparent protection deficit with conservation tools and objectives such as WHAs and LUO objectives for grizzly habitat.

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[45] Class 1 very high quality (critical) and Class 2 high quality (sensitive) grizzly bear habitats are mapped in Schedule D of the Great Bear Rainforest Land Use Order. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/westcoast-region/great-bear-rainforest/gbr_schedule_d_grizzly_bear_habitat.pdf

Unfortunately, Indicator 2 does not allow us to assess this potential offset nor the identification of true high risk LUs (i.e. high risk for both indicators). Almost every LU in the West Coast Region has at least one designated polygon (WHA or Class 1 or 2 grizzly habitat) with objectives set for grizzly bears and so passes the extremely low benchmark set provincially. Those few LUs that do not have anything, most likely have little to no mapped quality grizzly bear habitat nor salmon escapement (Figure 4.10) or have a high proportion of protection (Figure 4.11).

Management attention should be paid to those LUs that have high-quality food resources (either salmon or high and very high quality habitat) but little in the way of either protected/restricted area or objectives set for grizzly bear (e.g. the Yep LU in the Kitlope-Fjordland GBPU), where the LU risk can then be evaluated in the context of the dominant LU risk for the entire GBPU.

It is also important to remember that in the West Coast Region, outside of parks and protected areas and designated areas with grizzly objectives, all LU's will have GBR Landscape Reserve Designs and be guided by ecosystem-based management principles and land use objectives for a range of related values.

The level of habitat protection afforded high quality grizzly bear habitats and resources is an important indication of risk to grizzly populations. However, the interconnected strategic framework of ecosystem-based management for the GBR has resulted in most if not all of the mapped high-quality grizzly habitat coming under some form of protection or conservation management. Linking the spatial distribution of critical salmon resources to spatial protection and conservation management areas is also important. While the relevance of habitat protection in the West Coast Region is high, the utility of the specific indicators 1 and 2 are low.

Regional Assessment	Ranking	Rationale
Relevance	High	It is important to assess how much good quality grizzly bear habitat and quality food resources are protected or conserved.
Precision	High	The precision is as good as the contributing data layers used in indicator calculation. Though the resolution and verification of Class 1 and 2 grizzly habitats could be improved, the mapping seamless and based on the best available models of habitat suitability and capability.
Utility	Low	Current indicator resolution is too coarse to guide clear effective management response for the West Coast region. Need to be able to identify where there is quality habitat with little management/protection.
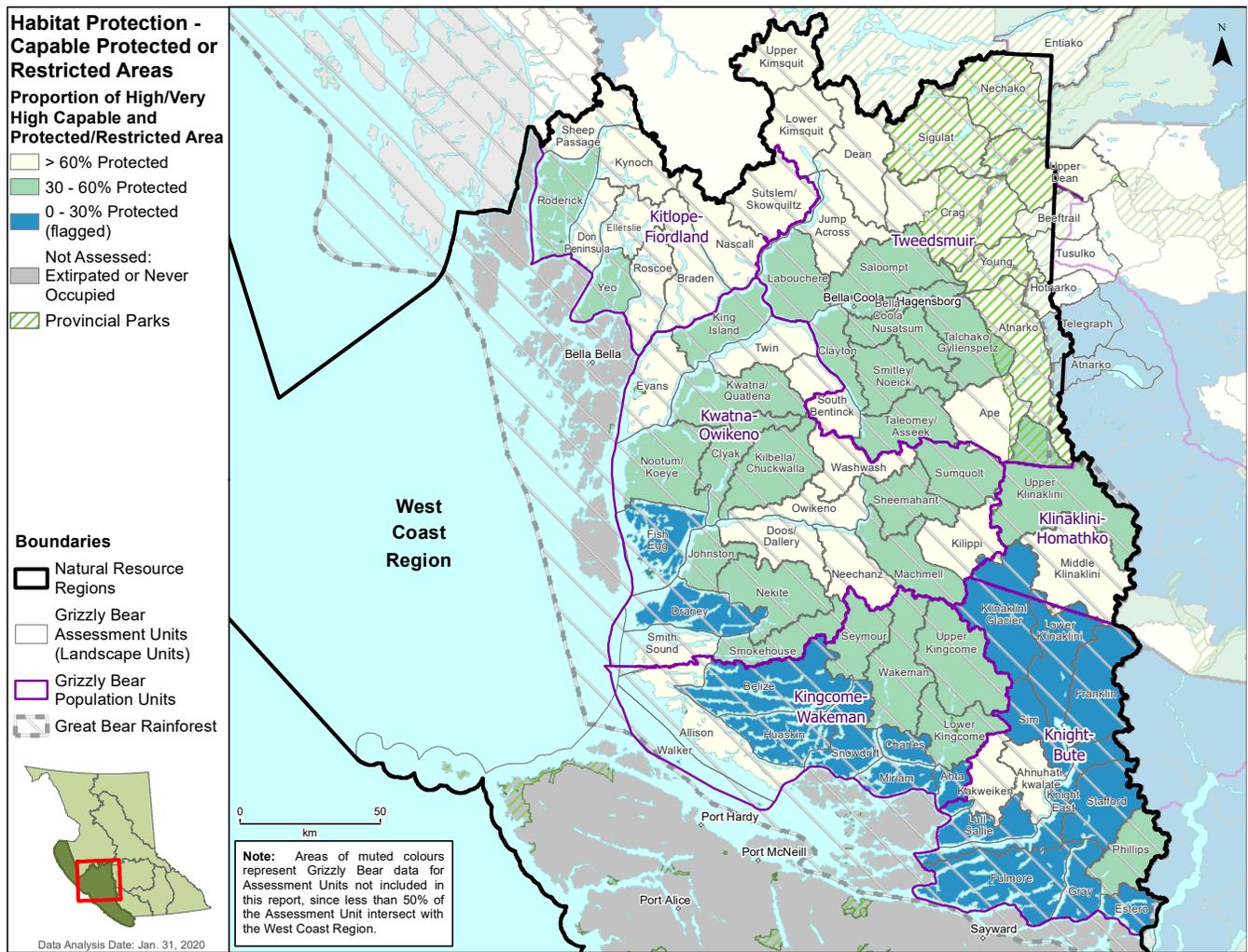
Figure 4.11 *Quality Habitat Protected – West Coast Region*
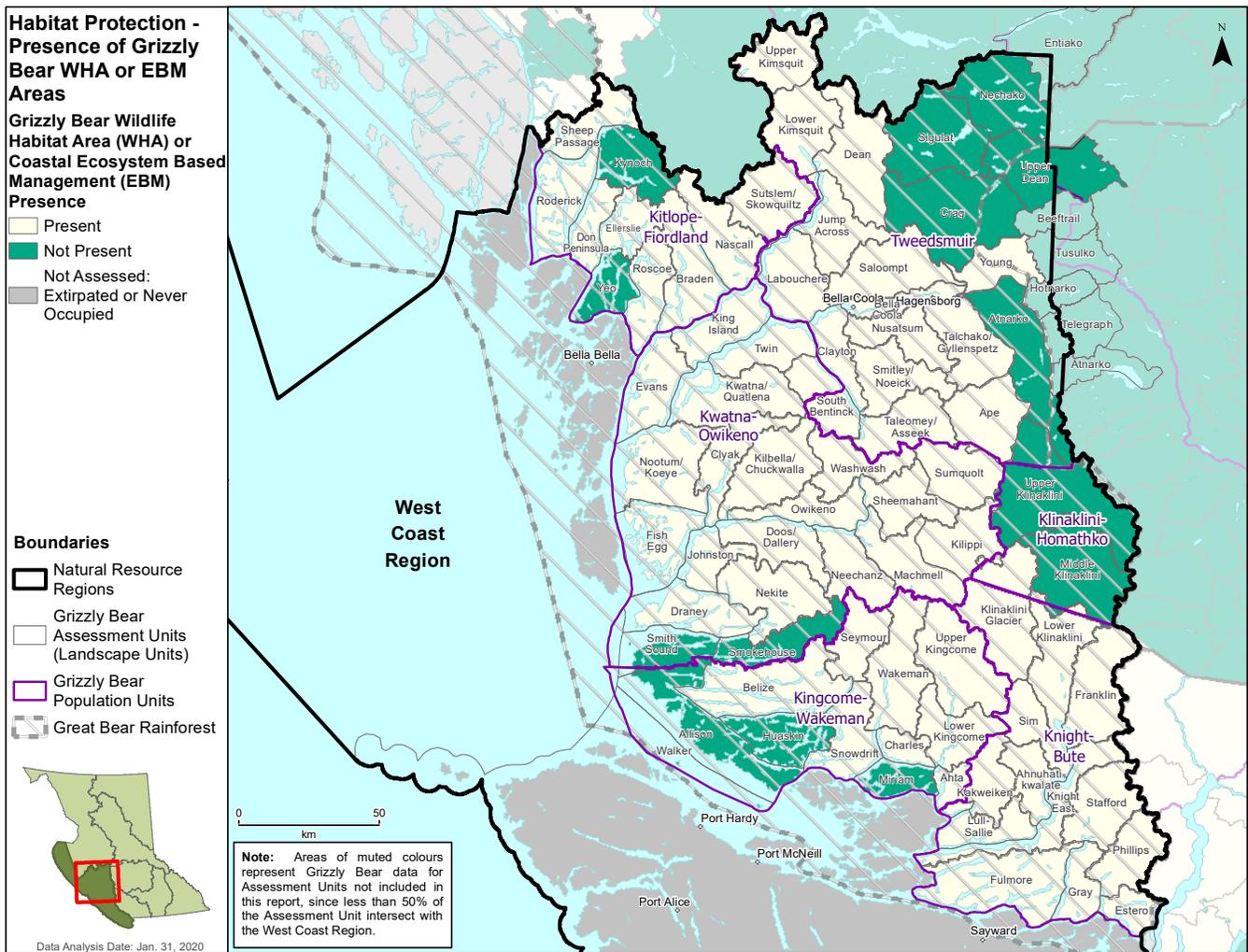
Figure 4.12 *Presence of WHA and GBR Class 1 and 2 Habitat – West Coast Region*
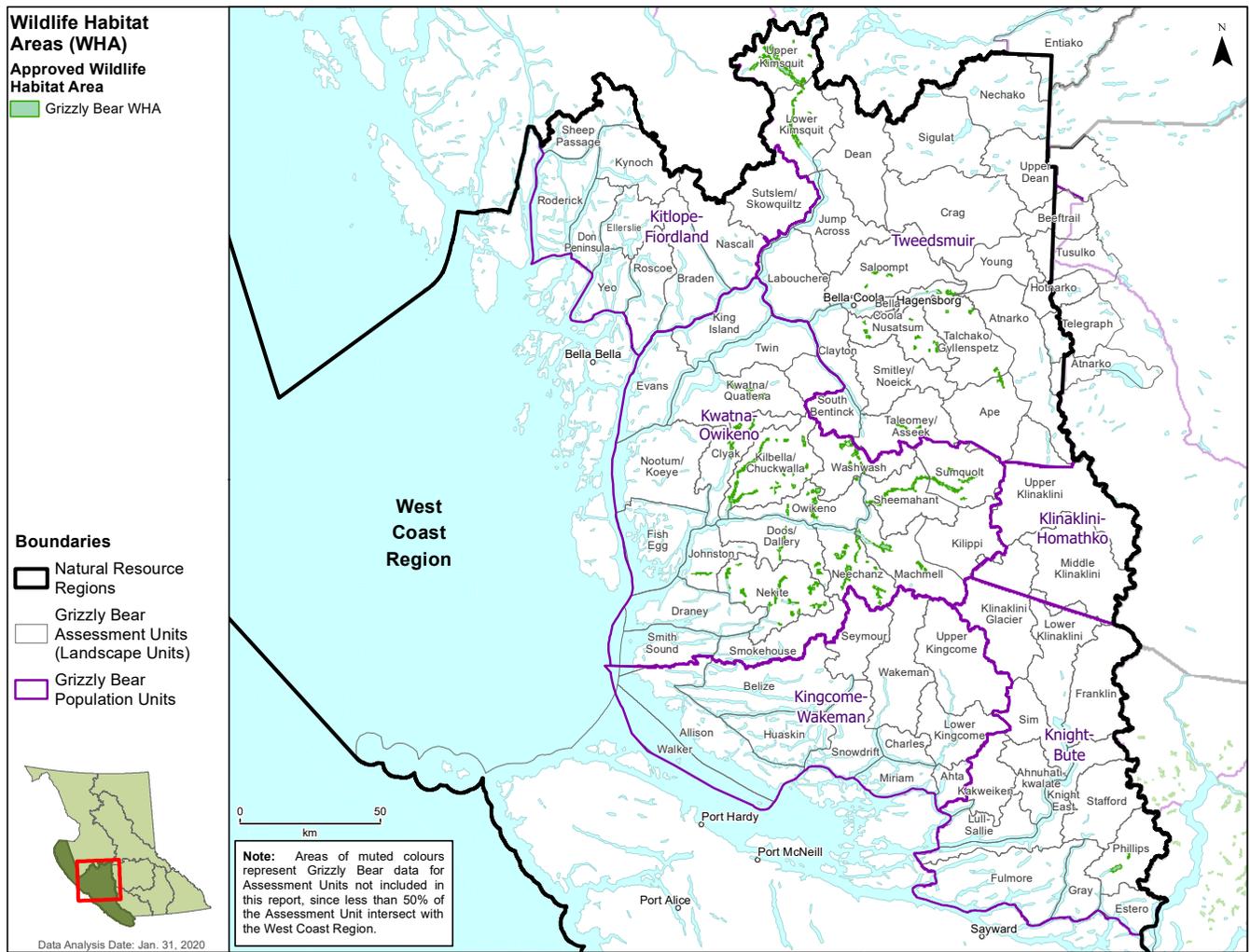
Figure 4.13 *Wildlife Habitat Areas -- West Coast Region*
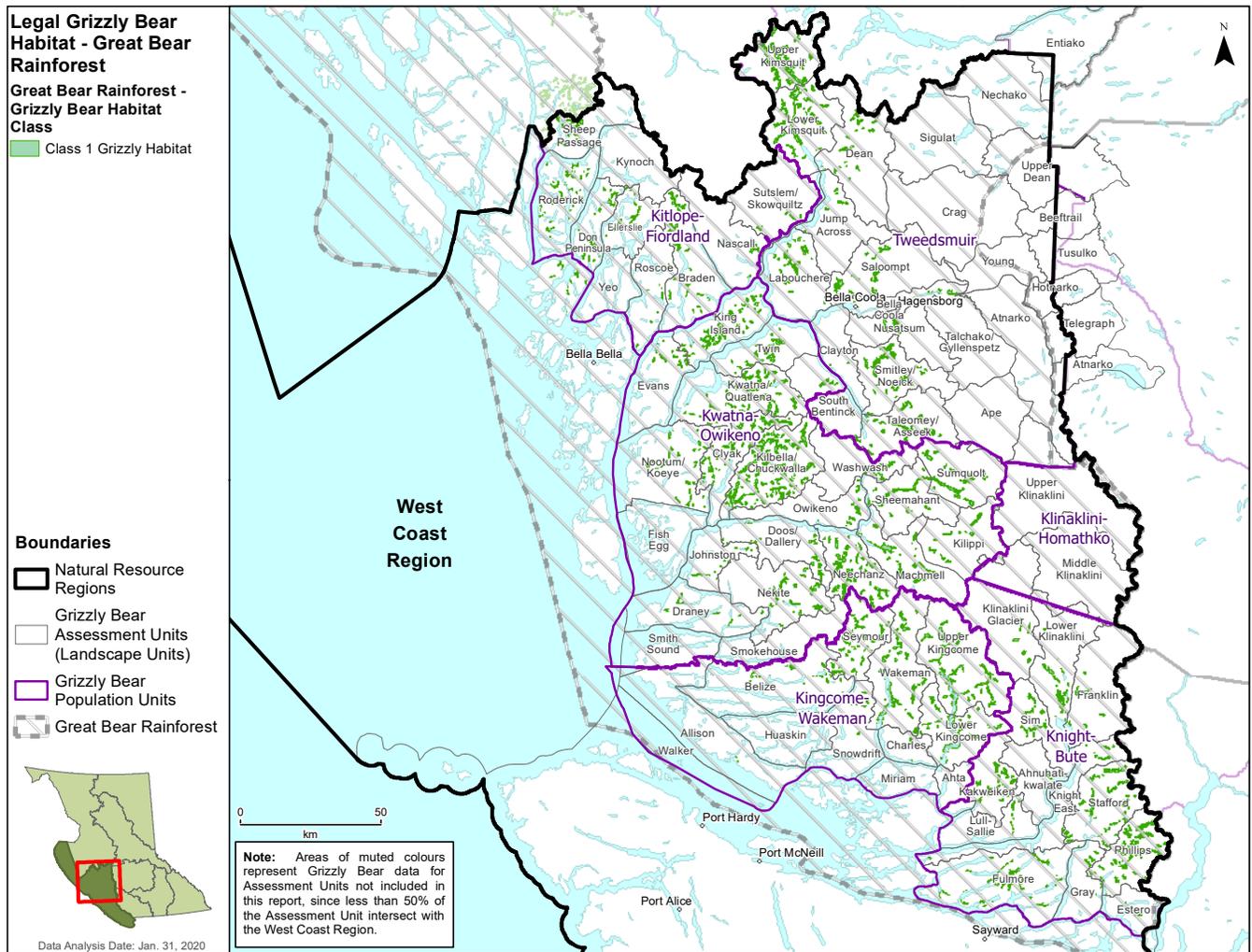
Figure 4.14 *Class 1 Habitat in the Great Bear Rainforest*

5 CONCLUSION & NEXT STEPS

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

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

5.1 Main Observations

Grizzly Bear Conservation Concern Rank and Density

The majority of the GBPUs in the West Coast Region are ranked as a Low (M4) or Very Low (M5) conservation concern, indicating that grizzly bear **populations** are at a low risk.

GBPU population estimates vary in relation to estimated **bear density** and GBPU area. All GBPUs are not of management concern based on the estimated bear density in this assessment.

Human Presence and Activities

Due to low human populations, limited assess, and limited agriculture, mining, oil and gas activities in the West Coast Region, human activities and presence do not currently pose a major threat to grizzly bears in much of the region. There may be localized threats due to human activities including illegal poaching, agriculture, forestry and grizzly bear viewing that may threaten grizzly bear populations in the future.

The extent of human presence and expansion is apparent in certain areas of the region, notably around Bella Coola and through the Highway 20 corridor where the **front country** indicator is flagged. **Mortality** is also flagged near Bella Coola and along the Highway 20 corridor where humans and bears are most likely to interact often resulting in bear mortality due to conflicts with people. Additionally, **road density** is flagged along this corridor. These results also correlate with **core security** in the West Coast Region; for example, the availability of core security is low in the LU near Bella Coola and the Highway 20 corridor resulting from relatively high road densities.

Hunter day density is low throughout the region and thus the risk to grizzly bears from hunters entering into conflict with bears while hunting is low due to limited human presence, activities and access in the region.

Habitat Quality & Protection

In general, the West Coast Region supports moderate to high quality habitat for grizzly bears. No LUs have been flagged with >30% **poor forage potential** forests in the entire West Coast Region, indicating that habitat within the region is generally suitable for grizzly bears.

Various grizzly bear habitat protection measures are in place throughout the West Coast Region in the form of provincial parks and protected areas (including Tweedsmuir South Provincial Park and Homathko River-Tatlayoko Protected Area), wildlife management areas, old growth management areas, and WHAs. The majority of **habitat protection** (>60% protected) is located in the Tweedsmuir and Kitlope-Fiordland GBPUs. Notably, the Great Bear Rainforest Order has habitat protection measures in place for grizzly bears, where 100% of Class 1 habitat must be maintained and 50% of Class 2 habitat must also be maintained within the spatial boundaries of the Order as noted in Schedule D, and there are over 300 WHAs in the region.

Quality Food Sources

Overall, the West Coast Region has relatively moderate **quality food** sources for grizzly bears. The main food sources for bears in the region include salmon and vegetation. There are numerous salmon-bearing rivers throughout the region, however salmon availability is variable and quantities are much lower than historic amounts, and may be further impacted by climate change into the future.

While food sources for grizzly bear currently exist in the West Coast Region, it is possible that climate change may impact these aspects in the future. Shifts in temporal and spatial availability of vegetation (including berries), changing precipitation patterns (i.e. drought and flood events), forest fires, and increased stream temperatures may drive bears to shift movement patterns to find food and this may increase the frequency of human-bear conflicts. While the effects of climate change on grizzly bears may be positive or negative, the full extent of these impacts are not fully known.

5.2   Further Analysis & Investigation

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

Further investigation into the indicators, improvements to future assessments, and additional research that could be undertaken at the regional level includes:

- **Number of Bears:** Conduct field-based trend or population inventories to improve data to develop appropriate mitigation measures and/or monitor the efficacy of mitigation measures implemented from incremental increases in human activity in at-risk areas.

- **Mortality Rate:** Create an additional class for examining mortality rate that highlights where hunt opportunities were reduced to remain within sustainable levels. This will provide an extra layer of information for decision makers to note where mortality levels were close to being exceeded. This work is a low priority unless the grizzly bear hunt reopens.

- **Road Density:** Weight roads by different levels of accessibility to improve the utility of this indicator.

- **Core Security:** Assess whether these core security areas provide high quality food improving their functionality. Habitat change or industrial use should be avoided in areas with both key forage and core security. Assess where non-core security areas overlap key forage availability to focus restoration/road reclamation efforts to increase the amount of availability of core security habitats with good quality forage. Restoration efforts should focus on areas with key forage but no secure core. Research to improve the benchmark for this indicator is recommended.

- **Front Country:** Minor adjustments to a few roads in the spatial layer are required to improve the accuracy of this indicator. Research to improve the benchmark for this indicator is recommended.

- **Poor Forage Potential (BEC Mid-Seral Conifer):** Incorporate more temporal variation to this indicator to include a signal for decision makers of potential upcoming mid-seral foraging constraints. Include the actual spatial arrangement of flagged LUs to provide decision makers a finer scale for consideration in their decisions.

- **Quality Food:** Integrate salmon availability and habitat suitability into grizzly bear habitat models. Refine the definition of quality foods through diet analysis (isotope) of existing grizzly bear hair samples and relate the indicator thresholds to the prevalence of those foods in bear diets. Improve the salmon data layer to include an adjustment for salmon availability that reflects stream features that influence bears' ability to utilize spawning salmon. Identify streams that are highly utilized by grizzly bears to access salmon and conduct salmon monitoring to improve salmon population data. This will aim to fill data gaps as the Department of Fisheries and Oceans does not monitor salmon in all streams in the West Coast Region. Re-run the analysis every 5 years to incorporate the effect of continued declines in salmon population and/or availability.

- **Habitat Protection:** Explore this indicator further to better identify West Coast Region LUs with insufficient spatially explicit conservation of high quality habitats and resources. Update with any additional habitat designations or conservation measures for grizzly habitat enacted since the original CE assessment, such as outcomes of Landscape Reserve Designs. Improve the quality of the grizzly habitat mapping through improved resolution of source coverages and field verification. Update habitat models if required once diet research to determine important regional foods is complete.

5.3   Recommended Next Steps

Overall, the results of this assessment are intended to inform strategic and tactical decision making and may be used to provide relevant context for operational decision making within certain areas of the West Coast Region. These assessment results should also be considered in the context of First Nations' interests, Government to Government obligations within the GBR, unique LU characteristics, competing resource values, climate change and other important contextual information before determining which type of management response is warranted, if any. In most cases further assessment at a finer resolution is required to address the indicator flags from this strategic level assessment.

Reducing Risk to Populations and Habitat

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

- Consider grizzly bear population objectives for GBPUs from the Provincial Grizzly Bear Management Plan (currently under development) in decision-making;

- Establish grizzly bear wildlife habitat areas and other grizzly bear habitat protection measures in locations where grizzly bear habitat and food quality is high but populations are at risk from the combined effects of high road density, low core security areas and minimal protection or conservation effort;

- Deactivate, rehabilitate and/or restrict access on roads in high quality grizzly bear habitat, especially in areas in the Tweedsmuir GPBU where roads and associated human activity may impact the ability of grizzly bears to travel across their range (i.e. to connect and enhance core security areas);

- Integrate salmon, core security, and front country assessment outcomes into current grizzly bear habitat mapping to identify or refine areas in which to focus additional conservation efforts.

- Adjust forest planning and practices in high quality grizzly bear habitat with a view to conserving or enhancing seasonal foraging habitats (e.g. berry production) and maintaining core security areas;

- Adjust range planning and practices and farming practices in the Bella Coola Valley to minimize conflicts between livestock and grizzly bears (e.g. limited salt placement, alternative water developments, drift fencing, herding, and alternative grazing periods, electric fencing, moving livestock closer to homes during calving);

- Expand and focus on bear conflict planning in the Bella Coola corridor to reduce mortality and restore access to secure quality food and habitat.

- Improve proactive non-natural attractant management in places like the Bella Coola corridor where grizzly bear mortality risk is high and core security is low;

- Adjust best practices for industrial projects (such as forestry and energy projects) to mitigate project impacts to grizzly bear populations and habitat; and,

- Follow a suite of provincial best management practices and guidelines as well as best available information when making decisions regarding future conservation and management of grizzly bear populations and habitat in the West Coast Region and adjacent regions.

Validation and Ground-Truthing

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

Research, Inventory and Monitoring

Grizzly bear research in the West Coast Region that investigates population size, dynamics and habitat requirements is limited. Although the provincial model for estimating grizzly bear densities identifies a lack of population estimates on the coast to improve model output, from the perspective of indicators in this CE protocol, developing field-based population estimates is unlikely to greatly improve the precision of this density indicator since the populations densities are even anecdotally known to exceed the risk threshold of 10 bears/1000km^2. Research into changing habitat quality and distribution, spatial habitat use, and diet composition, over time, in light of the Great Bear Rainforest initiative, potential increases in human activity/novel industrial activity such as hydropower, climate impacts, and continued declines in salmon returns is highly warranted to improve multiple indicators and better inform decision makers.

There is no scientific data used to support the 60% threshold for the Core Security indicator nor the 20% threshold used in the front country indicator. Research to develop these scientific thresholds would assess the response of grizzly bear population trends, survival rates and reproductive rates to proportions and distributions of secure and insecure habitats. Provincial benchmarks for all indicators should be regionally calibrated through research.

There is current research occurring into the effects of bear viewing activities on bears foraging for spawning salmon and estuarine invertebrates including a current PhD research project from UVic. Results of viewing research may help improve management and best practices for viewing to improve reduce human-bear conflicts and maintain bears' access to these seasonally important food sources.

For grizzly bears, these assessments can inform if population and habitat effects or risks are present, and over time, temporal trends of values across the landscape can be compared. The results of these assessments can inform where additional research, inventory and monitoring is required, and can inform resource management practices, including land use planning.

Government Decisions and Plans

The Province is working with First Nations and stakeholders to develop a provincial grizzly bear management plan that will provide guidance on ways to ensure that grizzly bear in BC are sustainably managed and do not become legally threatened.[46] The plan should provide guidance for establishing and implementing habitat and population objectives for GBPUs with priority given to GBPUs identified as having higher conservation concerns based on the IUCN-NatureServe rankings or where high priority GBPUs are identified by First Nations or stakeholders.

The Great Bear Rainforest Land Use Order sets objectives for grizzly bear habitat as does Wildlife Habitat Area Orders under FRPA. Grizzly bear habitat and population values are incorporated into Landscape Reserve Designs (LRD). LRD development and implementation occurs within the First Nation-Provincial G2G governance framework established by the applicable agreements and reconciliation protocols, in collaboration with relevant forest licencees.[47] LUO objectives and values are/will be addressed at a LU scale in strategic LRDs which will provide guidance to industrial operations. The results of this strategic coarse scale cumulative assessment will inform and support the development and refinement of LRDs.

The above planning efforts are supported by regional experts as it will be instrumental in informing the West Coast Region and adjacent regions' actions to address grizzly bear populations and habitat in the future.

Coordination with Neighbouring Regions

Notably, an opportunity exists for the West Coast Region to work with the Cariboo Region, Skeena Region and BC Parks to facilitate a coordinated approach in managing grizzly bear populations and habitat within the Tweedsmuir GBPU. As grizzly bears are able to traverse park and administrative boundaries, this particular area should be jointly managed and monitored over time.

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

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[46] Threatened as defined by COSEWIC and SARA.

[47] Landscape reserve policy framework for the Great Bear Rainforest. 2016. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/westcoast-region/great-bear-rainforest/gbr_framework_landscape_reserve_design_great_bear_rainforest.pdf

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 -** 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; and,

- **Climate change -** the effects of climate change on grizzly bears is uncertain, but the combined effects of industrial and urban expansion and climate change will likely increase grizzly bear mobility (in search of food) and subsequent potential for human-bear conflicts. Grizzly bear food sources such as berries and salmon should also be monitored.

Regional habitat supply and forecast modelling should be undertaken to assess these future trends.

Supporting Future Current Condition Assessments

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

Re-running this analysis every three to five years will likely be able to measure the spatial and temporal impacts from human activities in the region, from which mitigation measures can be applied and monitored for effectiveness in areas that are a high risk for grizzly bears. This timeframe for re-assessment should also consider the projections of human population, 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 is grizzly bear habitat displacement associated with **backcountry recreation**. Developing a metric around bear viewing activities (e.g. tracking person days spatially) as bear viewing can constrain bears' ability to forage and increases potential for conflicts resulting in bear mortality.

5.4   Additional Resources

The following strategies, management guidelines, and best available information should be considered when making decisions regarding future management and conservation of grizzly bear populations and habitat in the West Coast Region:

Government Plans, Guidance and Resources

- B.C. Government, 2001, Be a Bear Smart Community (and other Bear Smart Resources and Publications).

- B.C. Government, 2006, Wildlife Guidelines for Backcountry Tourism/Commercial Recreation in British Columbia.

- Yukon Government, 2008, Guidelines for Industrial Activity in Bear Country: For the mineral exploration, placer mining, and oil and gas industries.

- B.C. Government, 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.

- B.C. Government, 2016, Great Bear Rainforest Land Use Order

The following reports provide additional information or insights into the current condition of grizzly bears in the province and on the coast:

- B.C. Government, 2012, Grizzly bear population status in B.C..

- Nielsen et al, 2013. Population recovery targets for grizzly bears in Alberta: A biologically-based bottom-up approach to estimating carrying capacity to inform recovery. This report summarizes research on the use of pipeline rights-of-way by grizzly bears in Alberta.

- B.C. Auditor General, 2017, An Independent Audit of Grizzly Bear Management.

- Bunnell, F.L., Hamilton, A.N. 1983. Forage digestibility and fitness in grizzly bears. Int. Conf. Bear Res. and Manage. 5:179-185.

- FLNRO. 2013. Central and North Coast Order April 2013 consolidated version for communication only. Accessed Dec 15, 2015: https://www.for.gov.B.C.ca/tasb/slrp/lrmp/nanaimo/cencoast/docs/2013/cnc/Central-and-North-Coast-Order-Consolidated-Version-2013.pdf

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- MacHutchon, G. and T. Hamilton. 2009. 5.0 Grizzly bear (Ursus arctos). *In* Horn, H.L., P. Arcese, K. Brunt, A. Burger, H. Davis, F. Doyle, K. Dunsworth, P. Friele, S. Gordon, Hamilton, G. MacHutchon, T. Mahon, E. McClaren, V. Michelfelder, B. Pollard, G. Sutherland, S. Taylor, L. Waterhouse. 2009. Part 3: Knowledge Base for Focal Species and their Habitats in Coastal B.C. Report 3 of the EBM Working Group Focal Species Project. Integrated Land Management Bureau, Nanaimo, B.C.

- MacHutchon, G. and T. Hamilton. 2009. 4.0 Grizzly Bear. *In* Horn, H. 2009. Part 4: Summary of Habitat Mapping to Support EBM Implementation. Report 4 of the EBM Working Group Focal Species Project. Integrated Land Management Bureau, Nanaimo, B.C.

- Mowat, G., D.C. Heard and C.J. Schwarz. 2013. Predicting grizzly bear density in western North America. PLoS ONE 8(12): e82757. doi:10.1371/journal.pone.0082757

- Austin, M.A. and C. Wrenshall. 2004. An analysis of reported grizzly bear (Ursus arctos) mortality data for British Columbia from 1978-2003. BC Ministry of Water, Land and Air Protection. Technical report.

First Nations and Grizzly Bear Management

Below is a list of resources that outline peer-reviewed literature on grizzly bear management from First Nations and First Nations partnerships.

- Clark, D., Artelle, K.A., Darimont, C.T., Housty, W., Tallio, C., Neasloss, D., Schmidt, A., Wiget, A., and Turner, N. 2021. Grizzly and polar bears as non-consumptive cultural keystone species: Prospects for reconciliation through conservation. FACETS 6(1): 379- 393.

- Artelle, K.A., Stephenson, J., Bragg, C., Housty, W.G., Housty, J.A., Kawharu, M., Turner, N.J. 2018. Values-Led Management: the guidance of place-based values in environmental relationships of the past, present, and future. Ecology and Society.

- Housty, W.G., A. Noson, G.W. Scoville, J. Boulanger, C.T. Darimont, and C.E. Filardi. 2014. Grizzly bear monitoring by the Heiltsuk people as a scientific crucible for First Nations conservation practice. Ecology and Society 19 (2): 70.

- Service, C.N., Adams, M.S., Bateman, A.W., Artelle, K.A., Reimchen, T.E., Paquet, P.C., and Darimont, C.T. 2018. Species diversity predicts salmon consumption by terrestrial wildlife. Journal of Animal Ecology 88, 392– 404.

- Adams, M., Service, C., Bateman, A., Bourbonnais, M., Artelle, K., Nelson, T., Paquet, P., Levi, T., and Darimont, C. 2017. Intrapopulation diversity in isotopic niche over landscapes: Spatial patterns inform conservation of bear-salmon systems. Ecosphere 8(6):e01843. 10.1002/ecs2.1843.

- Service, C.N., M.S. Adams, K.A. Artelle, P.C. Paquet, L.V. Grant and C.T. Darimont. 2014. Indigenous knowledge and science unite to reveal spatial and temporal dimensions of distributional shift in wildlife of conservation concern.

- Bryan, H.M., C.T. Darimont, P.C. Paquet, K.E. Wynne-Edwards and J.E. Smits. 2014. Stress and reproductive hormones reflect inter-specific social and nutritional conditions mediated by resource availability in a bear-salmon system. Conservation Physiology 2 (1).

- Bryan, H.M., C.T. Darimont, P.C. Paquet, K.E. Wynne-Edwards and J.E. Smits. 2013. Stress and reproductive hormones in grizzly bears reflect nutritional benefits and social consequences of a salmon niche. PLOS ONE 8(11): e80537.

- Artelle, K.A., Anderson, S.C., Reynolds, J.D., Cooper, A.B., Paquet, P.C., and Darimont, C.T. 2016. Ecology of conflict: marine food supply affects human-wildlife interactions on land. Scientific Reports 6: 25936.

- Artelle, K.A., S.C. Anderson, A.B. Cooper, P.C. Paquet, J.D. Reynolds, C.T. Darimont. 2013. Confronting uncertainty in wildlife management: performance of grizzly bear management in British Columbia, Canada. PLOS ONE 8(11): e78041.

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BC MFLNRORD (British Columbia Ministry of Forests, Lands, and Natural Resource Operations and Rural Development). 2020. British Columbia Grizzly Bear Population Estimate for 2018. 7 pp. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/grizzly-bears/grizzly_bear_pop_est_report_2018_final.pdf

BC MFLNRO (British Columbia Ministry of Forests, Lands and Natural Resource Operations). 2016. Grizzly Bear Value Summary–Draft for Discussion. 16 pp.

BC MOECC & MFLNRORD (Ministry of Environment and Climate Change Strategy and Ministry of Forests, Lands, Natural Resource Operations and Rural Development). 2020. Interim Assessment Protocol for Grizzly Bear in British Columbia – Standards for Assessing the Condition of Grizzly Bear Populations and Habitat under British Columbia's Cumulative Effects Framework. Version 1.2. Prepared by the Provincial Grizzly Bear Technical Working Group – Ministry of Environment and Climate Change Strategy and Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 45 pp. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/protocols/cef_grizzly_bear_protocol_oct2020_final.pdf

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Appendix 1 – Grizzly Bear Objectives and Legal Protection

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

Provincial Strategies and Management Plans

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

In October 2017, the B.C. Auditor General released An Independent Audit of Grizzly Bear Management, which highlights the need for Government action to identify and secure key grizzly bear habitats, and to mitigate the impacts of human activities that degrade this habitat. The government of B.C. committed to implementing the Auditor General's recommendations. One action will be to create a provincial grizzly bear management plan that will set clear policy objectives for managing and conserving grizzly bears across the province. In turn, this plan will inform the West Coast Region's actions to sustain grizzly bear populations and habitat. The December 2017 decision to close the licensed grizzly bear hunt across the province may further assist the West Coast Region in sustaining grizzly bear populations despite the grizzly bear harvest being relatively low.

Licensed Grizzly Bear Hunt Closure

In December 2017, the B.C. Government announced a provincial closure on licensed grizzly bear hunting (does not apply to harvests by First Nations for food, social and ceremonial purposes). Historically, hunting of grizzly bears was strictly regulated under the provincial *Wildlife Act*.

Since 2001, grizzly bear hunting was not permitted in threatened GBPUs or in GBPUs with low bear population densities.[48] Where hunting was permitted, it was managed through limited entry hunts and quotas issued to guide outfitters.

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[48] As per British Columbia Grizzly Bear Population Estimate for 2012, FLNRO, April 2012.

Legislation

Forest and Range Practices Act

Under the *Forest and Range Practices Act* (FRPA), grizzly bears are "identified wildlife" (a species that is vulnerable to the effects of forest and range practices). This means that government may establish legally enforceable wildlife habitat areas and general wildlife measures (forest and range practices)[49] for grizzly bears in areas of high conservation priority.

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

Wildlife Act

In December 2017, the B.C. Government closed the licensed grizzly bear hunt. Up until this time, hunting of grizzly bears was highly regulated under the provincial *Wildlife Act*. Where hunting was allowed, it was managed through 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.[50]

Environmental Assessment Act

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

There are very few major projects in the West Coast Region that are large enough to trigger an environmental assessment. However, multiple smaller projects including IPPs are found throughout the region that may possibly lead to cumulative effects on grizzly bears.

Other Legislation

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

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

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

Land Use Plans

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

Land use plans in the West Coast 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. They generally call for:

- identifying, mapping and protecting critical grizzly bear habitat in wildlife habitat areas;

- incorporating priority grizzly bear habitats into connectivity and migration corridors;

- maintaining forest attributes suitable for high capability grizzly bear habitat;

- minimizing new roads and managing existing access through deactivation or access restrictions in critical grizzly bear habitat;

- minimizing negative human-bear interactions through public education (e.g. how to avoid attracting bears to human areas, and how to behave during a bear encounter); and,

- maintaining economic opportunities associated with hunting and commercial bear viewing.

Appendix 2 – Conceptual Model for Assessing Grizzly Bears

This diagram illustrates how the indicators (a sub-set of the factors shown in the diagram)[51] influence the functions and processes that support grizzly bear populations and habitat in B.C.

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

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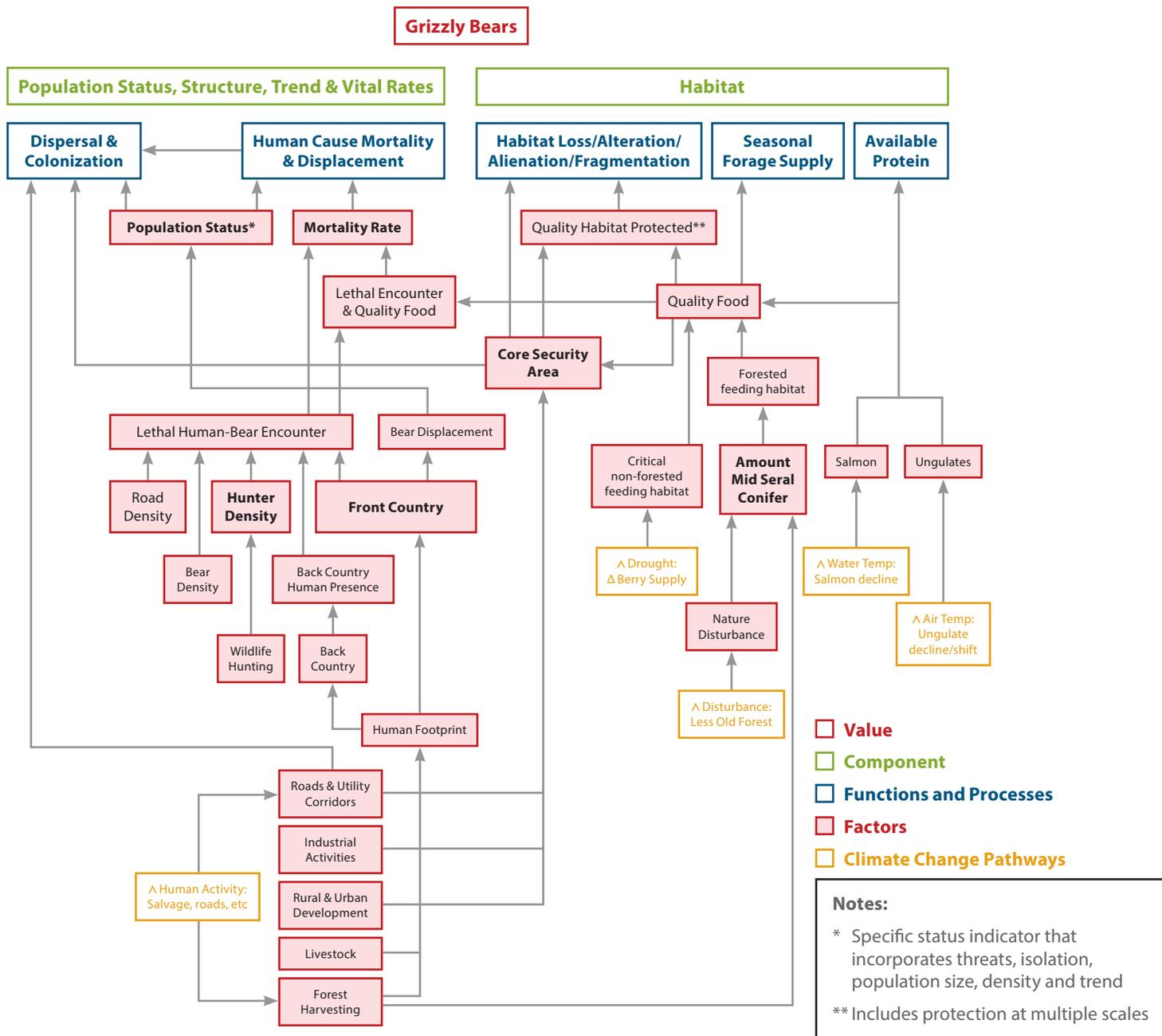
[51] The **bolded** factors (population status, mortality rate, hunter density, front country, core security area, and amount mid seral conifer) are *core indicators*, meaning they are the *primary* indicators used to assess potential risks to grizzly bears. *Supplementary indicators* were also assessed 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 – Indicator Tables

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 1000 km²
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/km²
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/km²
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	Female Mortality Rate	Road Density	Core Security Area	Front Country	Hunter Day Density	BEC Mid-Seral Dense Conifer	Quality Food	Quality Habitat Protected-WHA/EBM	Quality Habitat Protected - Protected Areas
Kingcome-Wakeman											
Charles									Flagged		Flagged
Huaskin										Flagged	Flagged
Lower Kingcome									Flagged		
Miriam									Flagged	Flagged	Flagged
Snowdrift											Flagged
Upper Kingcome									Flagged		
Wakeman									Flagged		
Seymour											
Belize											
Allison									Flagged	Flagged	
Ahta											Flagged
Walker					Flagged				Flagged	Flagged	Flagged
Kitlope-Fiordland											
Braden											
Don Peninsula											
Ellerslie									Flagged		
Nascall											
Roderick											
Sheep Passage											
Sutslem/Skowquiltz											

GBPU/ Landscape Unit	Population Rank	Bear Density	Female Mortality Rate	Road Density	Core Security Area	Front Country	Hunter Day Density	BEC Mid-Seral Dense Conifer	Quality Food	Quality Habitat Protected- WHA/EBM	Quality Habitat Protected - Protected Areas
Yeo										Flagged	
Kynoch										Flagged	
Roscoe											
Klinaklini-Homathko											
Middle Klinaklini									Flagged	Flagged	
Upper Klinaklini									Flagged	Flagged	
Knight-Bute											
Ahnuhati-kwalate											
Estero									Flagged		Flagged
Franklin									Flagged		Flagged
Fulmore											Flagged
Gray											Flagged
Kakweiken											
Klinaklini Glacier									Flagged		Flagged
Knight East									Flagged		Flagged
Lower Klinaklini									Flagged		Flagged
Lull-Sallie											Flagged
Phillips											
Sim									Flagged		Flagged
Stafford											Flagged
Kwatna-Owikeno											
Clyak											
Doos/Dallery											
Draney									Flagged		Flagged
Evans											
Fish Egg									Flagged		Flagged
Kilbella/Chuckwalla											
Kilippi									Flagged		
King Island											
Kwatna/Quatlena											
Machmell											
Neechanz											
Nekite											
Nootum/Koeye											
Owikeno											
Sheemahant											
Smith Sound									Flagged	Flagged	

GBPU/ Landscape Unit	Population Rank	Bear Density	Female Mortality Rate	Road Density	Core Security Area	Front Country	Hunter Day Density	BEC Mid-Seral Dense Conifer	Quality Food	Quality Habitat Protected- WHA/EBM	Quality Habitat Protected - Protected Areas
Smokehouse										Flagged	
Sumquolt									Flagged		
Twin									Flagged		
Washwash											
Johnston											
Tweedsmuir											
Ape									Flagged		
Bella Coola			Flagged	Flagged	Flagged	Flagged					
Clayton			Flagged			Flagged			Flagged		
Crag									Flagged	Flagged	
Dean											
Jump Across									Flagged		
Labouchere											
Lower Kimsquit											
Nusatsum			Flagged			Flagged			Flagged		
Saloompt			Flagged			Flagged			Flagged		
Smitley/Noeick									Flagged		
Talchako/Gyllenspetz			Flagged			Flagged			Flagged		
Taleomey/Asseek											
Upper Kimsquit											
Upper Dean	Flagged		Flagged						Flagged	Flagged	
Atnarko						Flagged			Flagged	Flagged	
Young						Flagged			Flagged		
Sigulat										Flagged	
South Bentick									Flagged		
Nechako									Flagged	Flagged	

Appendix 4 – Data

Please see the following link to access this Dataset and metadata from British Columbia's Data Catalogue.

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