

Skeena Sustainability Assessment Forum's State of Value Report for Grizzly Bear

Skeena ESI Area



Prepared by

Skeena Sustainability Assessment Forum (SSAF) of the Skeena Environmental Stewardship Initiative (ESI)



Document Version Control Table

Date	Version	Author(s)	Description of Changes
March 29, 2019	1	LS	Interpretation of figures and provision of commentary using other CCR templates.
March 29, 2019	1	TT	Reviewed what Liz put together. Made updates. Emailed Rob for the attribute table for the Skeena (the data to use for the commentary sections and appendices)
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December 6, 2021	6.1	SSAF	Correction to Table 10, page 71. 0.6 is flagged as high for road density.
February 1, 2022	6.1	SSAF	Correction to indicator 4.6, page 42. 1.87 is flagged as high for hunter day density.

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Acknowledgements

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Skeena ESI Values

Values are things that the people care about. Values are seen as important by the people, government of British Columbia, and First Nations for maintaining the integrity and well-being of the communities, economies, and ecological systems within the province. Skeena First Nations and the British Columbia provincial government have collaboratively identified five values of critical importance that provide the foundation of the Skeena ESI. These values have been assessed to reflect the state of the values.

The Skeena Region is delivering on the Cumulative Effects Framework through the Skeena ESI. A Current Condition report reflects provincial policy on natural resource reporting through Cumulative Effects. This product is a Current Condition report, however, through ESI it has been collaboratively decided between the Provincial and First Nation partners to title ESI Products as “State of the Value” to reflect the nature of the five chosen values.

The five values of Skeena ESI are ¹:



Figure 1 Illustrative Summary of the Skeena ESI Five Values

¹ Illustrative Summary created by Colleen Stevenson from Four Directions Management Services. *ESI Community Engagement Workshops Summary Report*. Four Directions Management Services. August 30, 2017.

Executive Summary

The following overview provides a high-level summary of the current condition of grizzly bear populations and habitat within the Skeena Environmental Stewardship Initiative (ESI) boundary, based on analysis of 10 indicators. The area contains large portions of the Babine, Bulkley-Lakes, Cranberry, Francois, Tweedsmuir and Upper Skeena-Nass Grizzly Bear Population Units (GBPUs) (Figure A4-1).

Conservation Status

- Tweedsmuir (M5) and Upper Skeena-Nass (M5) are classified as very low conservation concern;
- The Cranberry (M4) is low;
- The Babine (M3) and Bulkley-Lakes (M3) are medium; and
- The Francois (M2) GBPU is of high conservation concern.

Bear Density

- Grizzly bear densities (bears per 1000 km²) for GBPUs are low in the eastern central area of the Skeena ESI. Densities greatly increase to the north, and along the western and southern extent of the SSAF project area.
- Field-based bear density inventories in representative ecosystems have been completed in the southern part of the Cranberry GBPU. However, inventories are lacking in the other GBPUs. Inventories are needed to validate this indicator and to support management responses.

Bear Mortality

- Humans are the main cause of bear mortality through hunting (mistaken identity kills), animal control (defense of life, livestock, or property), illegal hunting, road kills, rail kills, and trapping.
- grizzly bear mortality exceeds limits - human caused mortality greater than 4% - in 7 Wildlife Management Units (WMU) in the Babine, Bulkley-Lakes, Cranberry and Tweedsmuir GBPUs, with excessive mortality occurring in the Babine and Bulkley-Lakes GBPUs.

Core Security

- Secure core areas (10 km² of continuous suitable grizzly bear habitat buffered from human activity) mainly occur in the northern and southern extents of the SSAF project area.
- Bulkley-Lakes, Francois, and Babine GBPUs contain significant core security deficit. This deficit roughly follows the major roadways in the region.

Front Country

- Front country areas (interface between humans and bears in urban/rural areas that contain grizzly bear attractants, such as livestock, grains, crops, fruit trees) do not correlate with areas of core security deficit (as noted above) as expected.
- Areas that have low probabilities of human-bear encounters are found in the northern and southern GBPUs and this encounter probability significantly increases in the central GBPUs. Some Landscape Units (LU) with higher likelihood of human-bear encounters are those along the western edge of the Upper Skeena-Nass and across the southern section of the Tweedsmuir GBPU. These high encounter trends appear to follow the major highways across the region.

Hunter Day Density

- Hunter day density² (the number of days per year of hunters of all wildlife species) is highest across the central portion of the Skeena ESI, with the highest density along the eastern boundary of the Francois GBPU.

Road Density

- Risks to grizzly bear populations and habitat correlate more with road density than any other indicator because roads facilitate human-bear interactions and bears avoid roads when possible. Roads also cause habitat loss, fragmentation, and population isolation/decline.
- Roadless or low road density areas are generally located in the northern and southern areas of the SSAF (Upper Skeena-Nass and Tweedsmuir); a few low road density LUs are found in the southern portion of the Bulkley-Lakes GBPU, and in the northern portions of the Cranberry and Babine GBPUs.
- Areas of high road density are concentrated across the central SSAF (Francois, Bulkley-Lakes, and southern LUs of Cranberry and Babine GBPUs).

BEC Mid-Seral Dense Conifer

- LUs flagged for management attention that contain more than 30% mid-seral dense conifer (considered sub-optimal forage supply) are few in the Skeena ESI. LUs flagged for management attention that have more than 30% of their forested land-base dominated by closed-canopy conifer-dominated stands (40 to 100 years old for most SSAF Biogeoclimatic units) may highlight a seasonal forage deficit at the home range scale. The dark understories of such post-logging or post-fire stands have very few grizzly food plants, including extremely important berry species. The majority of these LUs are found in Francois GBPU, with a few scattered in Babine and Tweedsmuir GBPUs.
- There are a few large LUs within the Cranberry and Bulkley-Lakes GBPUs that do not have sufficient data and as such could not be assessed.

Quality Food

- Less than half of the LUs in the SSAF are assessed as having high or very high-quality food and are distributed in the less mountainous LUs in the central and western part of the SSAF.
- Four of the GBPUs in this region meet the overall quality food requirement for salmon (>10,000 kg of salmon is available across time (sum of salmon kg by LU)) and vegetation productivity (total weighted area of broad ecosystem inventory [BEI] rated high or very high for habitat capability).
- Another appropriate indicator of habitat capability for grizzly bears is the availability of terrestrial protein (primarily ungulates), which is not included in this assessment at this time.

Quality Habitat Protected

- The largest area of protected high-capability grizzly bear habitat is in the Tweedsmuir GBPU within the boundaries of Tweedsmuir Provincial Park. Other areas of high to moderate-capability grizzly habitat correlate with areas designated as Provincial Parks.
- In contrast, almost all other GBPUs have large areas with minimal to no legal conservation of grizzly bear habitat (protected = parks, wildlife management areas, Old Growth Management Areas (OGMA), Wildlife Habitat Areas (WHA), etc.).

² In December 2017, the B.C. Government announced a provincial ban on grizzly bear hunting (other than hunting by First Nations for food, social and ceremonial purposes).

- There are few grizzly bear WHAs in the Skeena ESI area.

Table of Contents

Executive Summary.....	6
Table of Contents.....	9
List of Tables and Figures.....	11
List of Acronyms.....	13
1 Introduction	14
1.1 Report Purpose	18
1.2 Report Context and Content.....	18
2 Grizzly Bear Overview	21
2.1 Species Status	21
2.2 Species Information	21
2.3 Threats to Grizzly Bears	21
2.4 Grizzly Bear Objectives and Legal Protection	21
2.5 Cultural Relevance of Grizzly Bear to the SSAF Nations	22
2.6 Babine GBPU Narrative	24
2.7 Cranberry GBPU Narrative	24
2.8 Bulkley-Lakes GBPU Narrative	24
2.9 Francois GBPU Narrative.....	24
2.10 Tweedsmuir GBPU Narrative	25
2.11 Upper Skeena-Nass GBPU Narrative.....	25
3 Overview of Indicators.....	26
4 Assessment Results for each Indicator	27
4.1 Conservation Rank	27
4.2 Bear Density	31
4.3 Core Security Areas.....	33
4.4 Mortality Rate	35

This modified methodology is consistent with the Ministry of Environment and Climate Change’s 2015 Guidance for Threats Assessments for Species and Ecosystems at Risk (ENV 2015), and NatureServe’s Conservation Status Assessments at the species level. The approach is also aligned with COSEWIC, IUCN, NatureServe and species-level threats analyses used in provincial and national recovery planning processes.....

4.2 Bear Density	31
4.3 Core Security Areas.....	33
4.4 Mortality Rate	35

4.5	Front Country	38
4.6	Hunter Day Density	41
4.7	Road Density	43
4.8	BEC Mid-Seral Dense Conifer	46
4.9	Quality Food	48
4.10	Quality Habitat Protected	50
5	Interpretation and Key Drivers of Results	53
5.1	Summary of Assessment Results	53
5.2	Skeena ESI Commentary	54
6	Monitoring	55
6.1	Summary of Existing Monitoring Efforts	55
6.2	Other Initiatives to Inform Monitoring	56
6.3	Tier 1 and Tier 2 Assessment and Monitoring	59
7	Potential Next Steps	61
	Appendix 1—Grizzly Bear Backgrounder	62
	Appendix 2—Conceptual Model for Assessing Grizzly Bears	67
	Appendix 3—Indicator Tables	68
	Appendix 4—Gitanyow Huwilp Recognition and Reconciliation Agreement	75
	Appendix 5—Skeena Region Objectives Related to Grizzly Bears	81
	Appendix 6—Skeena Sustainability Assessment Forum (SSAF) Nations within the Skeena Environmental Stewardship Initiative (ESI)	84
8	Literature Cited	92

List of Tables and Figures

Figure 1 Illustrative Summary of the Skeena ESI Five Values	4
Figure 2 Skeena ESI Study Area.....	17
Table 3.1 Grizzly Bear Indicators.....	26
Table 4.1. Population Unit Summary Table by GBPU	29
Figure 5.1 Grizzly Bear Conservation Rank, M1, M2 and M3 GBPUs require more conservation management attention – Skeena ESI East Area.....	30
Figure 5.2 Grizzly Bear Density by GBPU/WMU/LEH - Skeena ESI	32
Figure 5.3 Core Security Area for Grizzly Bears, areas with >60% core are lower risk - Skeena ESI.....	34
Figure 5.4 Grizzly Bear Mortality Rate, low, medium and high units require more management attention - Skeena ESI	37
Figure 5.5 Front Country areas with >20% front country are at greater risk to negative human-bear conflicts - Skeena ESI.....	40
Figure 5.6 Hunter Day Density WMUs with >1.87 hunter days/km ² are at risk - Skeena ESI.....	42
Figure 5.7 Road Density, densities greater than 0.6km/km ² increase risk to grizzly bears – Skeena ESI ..	45
Figure 5.8 Mid-Seral Dense Conifer, areas with >30% mid seral could constrain forage supply – Skeena ESI.....	47
Figure 5.9 Quality Food, coloured units have quality grizzly bear food– Skeena ESI	49
Figure 5.10 Quality Habitat Protected – Skeena ESI	52
Figure 11 Conceptual diagram of the relationship between Tier 1 assessment and Tier 2 monitoring. ...	59
Figure A6-1. Environmental Stewardship Initiative (ESI) Skeena Sustainability Assessment Forum (SSAF) Boundary within the Grizzly Bear Population Units (GBPUs)	85
Figure A6-2. Gitanyow Wilp boundaries within the Cranberry GBPU of the Skeena Environmental Stewardship Initiative (ESI)	86
Figure A6-3. Gitxsan Wilp boundaries within the GBPUs of the Skeena Environmental Stewardship Initiative (ESI)	87
Figure A6-4. Gitxsan Watersheds within GBPUs of the Skeena Environmental Stewardship Initiative (ESI)	88
Figure A6-5. Lake Babine Sub-Watershed boundaries within the Babine and Francois GBPUs of the Skeena Environmental Stewardship Initiative (ESI)	89
Figure A6-6. Wet’suwet’en Yikh boundaries within the Babine, Bulkley-Lakes, Francois, and Tweedsmuir GBPUs of the Skeena Environmental Stewardship Initiative (ESI).....	90

Figure A6-7. Gitwangak Watershed boundaries within the Cranberry and Bulkley-Lakes GBPU of the Skeena Environmental Stewardship Initiative (ESI) 91

List of Acronyms

B.C.	British Columbia	ISP	Indigenous Stewardship Project
BEC	Biogeoclimatic Ecosystem Classification	IUCN	International Union of Conservation of Nature
BEI	Broad Ecosystem Inventory	LEH	Limited Entry Hunt
CE	Cumulative Effects	LNG	Liquefied Natural Gas
CEF	Cumulative Effects Framework	LU	Landscape Unit
CID	Compulsory Inspection Database	LUO	Land Use Order
CWH	Coastal Western Hemlock	LUP	Land Use Plan
CO	Conservation Officer	MRVA	Multiple Resource Value Assessment
COSEWIC	Committee on the Status of Endangered Wildlife in Canada	OGMA	Old Growth Management Area
ESI	Environmental Stewardship Initiative	PEM	Predictive Ecosystem Mapping
FRPA	<i>Forest and Range Practices Act</i>	SBS	Sub-Boreal Spruce
GBPU	Grizzly Bear Population Unit	SSAF	Skeena Sustainability Assessment
GWG	Governance Working Group	TEM	Terrestrial Ecosystem Mapping
ICH	Interior Coastal Hemlock	WHA	Wildlife Habitat Area
		WMU	Wildlife Management Unit

1 Introduction

The Environmental Stewardship Initiative (ESI) is a true collaboration between the Province and First Nations in the northern areas of the Province. The collaborative approach, that has been developed through ESI, incorporates western science and Indigenous knowledge and is working towards shared principles in land management. ESI is intended to facilitate collaboration and trust between the parties in an effort to enhance environmental sustainability, and to address First Nation's long-standing concerns with stewardship of the land and cumulative effects in their traditional territories. The goals of the ESI are to collaboratively establish positive environmental stewardship legacies across the north by investing in four key areas:

- 1) ecosystem assessment and monitoring;
- 2) ecosystem restoration and enhancement;
- 3) ecosystem research and knowledge exchange; and
- 4) stewardship education and training.

The Province and First Nations have developed and are implementing four Regional Stewardship Forums; Skeena, Omineca, North East, and North Coast. These forums identify and develop projects according to priorities in each area. A fifth working group – the Governance Working Group (GWG) – is responsible for ESI governance principles, decision-making, and a long-term operating structure.

The Skeena Sustainability and Assessment Forum (SSAF) – has a mandate to generate trusted data, co-develop a monitoring and assessment framework, and use the results to inform natural resource management in the Skeena ESI area. The SSAF objectives are to:

- 1) Design and implement projects that are aligned with the objectives of the ESI;
- 2) Generate trusted, relevant, accessible information regarding the condition of values to inform the management and stewardship of natural resources;
- 3) Inform and be informed by Indigenous Stewardship Projects (ISP);
- 4) Use the results of the SSAF to inform future Provincial and Skeena First Nations' natural resource decisions;
- 5) Build capacity for Skeena First Nations to lead in natural resource initiatives;
- 6) Build capacity for Skeena First Nations to participate in natural resource initiatives (Skeena Sustainability Assessment Forum 2017).

SSAF is composed of the Province and ten member Nations: Lake Babine Nation, Office of the Wet'suwet'en, Gitxsan Nation, Gitanyow Nation, Wet'suwet'en First Nation, Witset (Morisetown), Nee-Tahi-Buhn, Skin Tyee, Hagwilget Village, and Gitwangak. The SSAF is comprised of a Project Team and a Science and Technical Committee (STC) with representation from the participating Nations and the Ministries of Environment and Climate Change Strategy (ENV) and Forests, Lands, and Natural Resource Operations and Rural Development (FLNRORD). The SSAF is also responsible for delivering Indigenous Stewardship Projects (ISPs) that directly support the objectives and elements of the SSAF.

The five environmental values selected by the SSAF Project Team are: Grizzly Bear, Wetlands, Fish and Fish Habitat, Moose, and Medicinal Plants. As outlined in the recent audit by British Columbia's Auditor General (OAG 2017), grizzly bears have almost universal cultural, ecological and economic regard and their conservation and management is frequently controversial. Under phases 1 and 2 of the SSAF work

plan, SSAF member Nations conducted First Nations community workshops and a conference to engage community members about local knowledge related to the SSAF values. Following these workshops, Four Dimensions Management Services provided an overview of what First Nation community members believe constitutes healthy habitats for grizzly bears, impacts and pressures, cultural uses, and protection opportunities (included below in Section 2.5).

An extract of the results from the Provincial Grizzly Bear Cumulative Effects Protocol (ENV and FLNRO 2020) was done to inform this assessment, under the direction of the STC and the Provincial Grizzly Bear Cumulative Effects (CE) protocol author and STC member Don Morgan. An initial draft of this summary was provided by Tania Trip of Madrone Environmental Services. The STC subsequently contracted protocol co-author, A.N (Tony) Hamilton to review and provide comments on the initial report and recommend revisions based on STC suggestions. He also included results of supplementary data analyses and additional maps.

The results reported here are complementary to the other SSAF grizzly bear projects in the Skeena Region (Apps 2017, Apps 2019 and Apps and Koch 2019). There are four monitoring goals outlined by Apps in 2017 including: 1) absolute population size and density; 2) population trend and demography; 3) occurrence and distribution relative to influential factors; and 4) population connectivity and fragmentation. The SSAF is using the recommendations from its completed population monitoring projects, and the CE assessment results presented here to help identify further projects to “efficiently fill knowledge gaps about grizzly bear populations across the Skeena ESI Area” (Apps 2017). Initial recommendations for subpopulation and habitat monitoring priorities are included in this document.

One of the challenges in assigning priorities for further ESI grizzly bear assessment and monitoring arises due to the lack of a Provincial set of cohesive Grizzly Bear Population Unit (GBPU) specific objectives for grizzly bear populations and habitats. A key recommendation from the grizzly bear Audit is to “create and implement a grizzly bear management plan that includes clear goals and targets”. The Province is currently developing a Grizzly Bear Management Plan that will enable the establishment of GBPU management direction. The assessment and monitoring work done under the SSAF will support the setting of Skeena ESI GBPU goals and targets under the Provincial plan. Specifically, consensus on GBPU-specific objectives for grizzly bears and their habitat will enable: 1) clear direction to land and resource decision makers regarding appropriate trade-offs among economic and environmental values; 2) simpler assignment of priorities for research, monitoring or direct management intervention; and 3) assignment of local accountability for delivering specific grizzly bear outcomes, such as determining and mapping occupancy, protecting seasonally important habitats, or managing motorized access to reduce mortality risk. Objectives may include: 1) population recovery and habitat restoration; 2) maintenance of existing distribution and abundance; 3), population and habitat linkage across known fractures; 4) habitat protection where appropriate; 5) localized, targeted mortality risk reduction; or 6) bear use in commercial and recreational viewing situations. Effectiveness monitoring can then be implemented to determine bear population trend and habitat supply in response to management as progress towards meeting objectives is periodically assessed.

The current condition analyses provided here will assist setting GBPU objectives in the Provincial Grizzly Bear Management Plan by providing locally vetted monitoring priorities based on an in-depth review of available information on subpopulations and habitats. Together, the objectives, the current condition overview, and the initial monitoring priorities would provide a strong basis for modernized land use

planning undertaken by the Province and First Nations should it be initiated in the Skeena ESI area³. In addition, the approved Coastal Gaslink Liquefied Natural Gas (LNG) pipeline overlaps four of the participating Skeena ESI First Nation traditional territories. This report will help inform how the forthcoming LNG Grizzly Bear Mitigation Plan is implemented.

³ [https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/modernizing-land use-planning](https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/modernizing-land-use-planning)

1.1 Report Purpose

The primary purpose of this report is to provide an overview of the current condition of grizzly bears and their habitat in the Skeena ESI area. It also provides recommendations for future Skeena ESI expenditures on grizzly bear and grizzly bear habitat monitoring, building on work already conducted (Apps 2019, Apps and Koch 2019). Thirdly, the report, plus further investigation and analysis of the results by the Skeena ESI, is intended to help inform the array of resource management decisions that impact the conservation and management of grizzly bear populations and habitat in the Skeena ESI, including but not limited to: research, inventory, and monitoring; occupancy verification; land use including habitat protection and access management planning; forest and range planning and practices; major project reviews and conditions; permit authorizations; hunting and access regulations; grizzly bear recovery planning; public education; and, compliance and enforcement. This report will inform initial collaborative discussions among First Nations, Government, natural resource industries, and community stakeholders.

1.2 Report Context and Content

Indigenous Knowledge:

The SSAF is incorporating Indigenous knowledge into the assessments through Indigenous Stewardship Projects (ISP) and Indigenous participation and leadership in the Science and Technical Committee.

This SSAF report differs from Provincial MRVA or CEF reports in several notable ways. Most importantly, the protocols and indicators driving this assessment were collaboratively modified or developed, reviewed, and agreed-upon by SSAF members. Secondly, this report is an example of enhancements made to the Provincial CEF assessments through incorporation of a regional, local as well as Indigenous knowledge. Thirdly, throughout this report, the SSAF has included SSAF-specific perspectives on each of the indicators, including a specific section on the cultural relevance of grizzly bear (see section 2.5 below).

This report provides a current condition report on the grizzly bears population units that have a majority overlap with the Skeena ESI area. The report uses an assessment methodology that examines grizzly bear populations and habitat using 10 indicators of current conditions. The assessment is based on 2015 and 2019 data and methodology as outlined in version 1.2 of the Provincial Grizzly bear CE Assessment Protocol (ENV and FLNRO 2020). The focal area of this current condition report is the Skeena ESI area; specifically, the boundaries of the Skeena ESI First Nations, and the GBPU's that significantly intersect their traditional territories (see

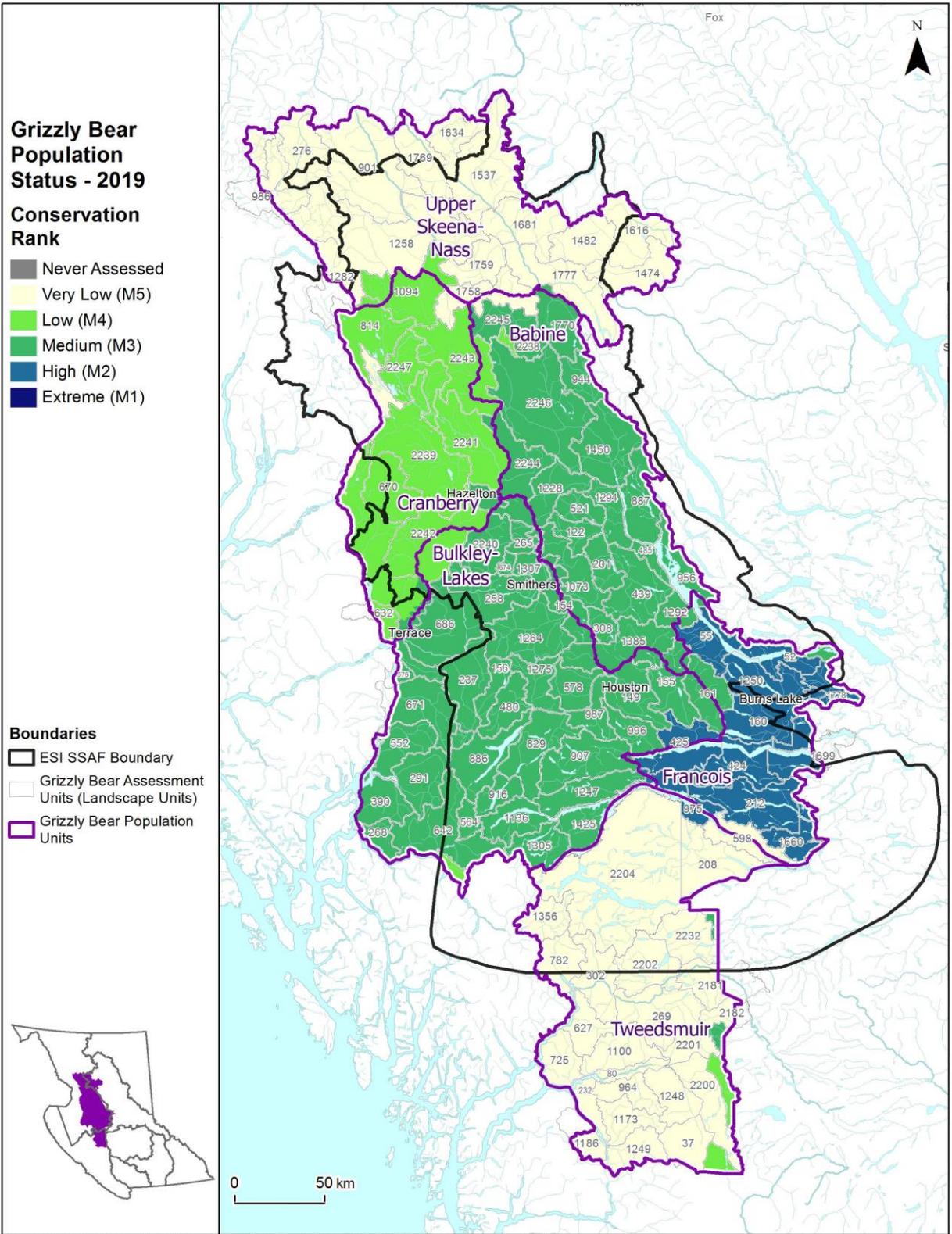


Figure 5.1 and Appendix 4).

As described by Apps (2019): “Grizzly bear population sampling, survey, and monitoring is carried out to address the following management issues: (1) regulation of legal population harvest, (2) bear-human conflict and resulting human-caused mortality, (3) broad-scale fragmentation of habitat and populations leading to decreased population resilience and range contraction, and (4) the degradation of quality habitat and its effectiveness in supporting a healthy and productive local population”.

Priorities for monitoring outlined in this report may reflect conservation risk irrespective of which of the management issues have been identified. For example the M2 Status assignment of the Francois GBPU, resulting from a combination of a number of factors, including a small increasingly isolated population which, very high open road densities, lack of core secure habitat, abundance of front country and lack of any grizzly bear Wildlife Habitat Areas (WHAs) suggest a priority be put on occupancy determination and genetic isolation building on the work undertaken by the Skeena and Omineca Regions in 2016 and 2017 (Bill Jex and Shelley Marshall pers. comm.).

Alternatively, monitoring priorities may be assigned to lower-risk grizzly bear subpopulations and habitats to support proactive, preventative management designed to prevent population decline and range contraction. For example, initial monitoring in the Cranberry GBPU and Gitanyow Territory (Apps and Koch 2019) enables an assessment of fracture across Highway 37 south from Cranberry Junction and provides a strong 2019 baseline for establishing population trend. Choice of monitoring priorities should therefore reflect both local current conditions and conservation and management objectives to ensure that focus is not only put on restoration and recovery wherever appropriate, but also on maintenance of grizzly bears and their habitats in currently healthy landscapes.

This report includes:

- an overview of grizzly bear ecology, habitat requirements, threats to its habitat and survival, First Nation 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 in the Skeena ESI, including limitations of the assessment;
- results for each indicator, including descriptive maps, interpretation of those maps, and links to further detailed maps and data;
- a summary of the results and key contributing factors influencing the results;
- a summary of other information on the current condition of grizzly bears in the Skeena; and
- a summary of opportunities to enhance grizzly bear populations and habitat in the Skeena based on the results outlined in this report.

2 Grizzly Bear Overview

2.1 Species Status

- **COSEWIC status:** Species of Special Concern
- **Species at Risk Act status:** Special Concern
- **B.C. Conservation Framework:** High priority for conservation

Conservation Rank (Morgan et. al. 2019):

- The Tweedsmuir and Upper Skeena-Nass are classified as M5;
- The Cranberry is classified as M4;
- The Babine and Bulkley-Lakes are classified as M3; and
- The Francois GBPU is classed as M2.

2.2 Species Information

- **General:** highly mobile omnivores with large spatial requirements; spatial requirements vary depending on distribution and availability of forage resources.
- **Habitat:** grasslands and shrublands integrated with forests, subalpine meadows and forests, and alpine areas, flood plains and riparian areas, rivers, streams and lakes.
- **Diet:** forbs, grasses, sedges and other green vegetation in spring and early summer; berries, fruit and roots in late summer and fall; animal matter (ants, ground squirrels, ungulates, other bears, and salmon where available) throughout the year but especially in spring and fall.
- **Natural travel corridors:** mountain valley bottoms, ridgetops, and riparian corridors.

2.3 Threats to Grizzly Bears

- **Industry:** mining, forestry, agriculture, and linear development corridor (transportation, oil and gas, and hydro) contribute to habitat loss/alteration/alienation/fragmentation and increased access to bear habitat.
- **Humans:** human-bear conflicts are threats to bear populations through direct mortality and indirectly through displacement from and loss of preferred habitats, including areas used for human settlement and recreation.
- **Climate change:** warmer temperatures, less spring snowfall, and longer growing season may positively affect spring-summer food sources; however, increases in late-season drought may negatively impact fall vegetation production; human-bear conflicts will likely increase as land uses and habitat ranges expand or shift. Further, declines in salmon stocks triggered by changing ocean conditions may lead to increases in human-bear conflict and decreased body condition.

2.4 Grizzly Bear Objectives and Legal Protection

- **Provincial Grizzly Bear Conservation Strategy (MOE 1995)** – “maintain in perpetuity the diversity and abundance of grizzly bears and the ecosystems upon which they depend”
- **Forest and Range Practices Act:** (policy) grizzly bear accounts and measures; there are a few established grizzly bear WHAs in the Skeena ESI (Les et. al. 2004).

- **Land and resource management plans** (policies) for the Skeena ESI call for:
 - protecting critical grizzly bear habitat in WHAs
 - 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: bear viewing
- **Wildlife Act:** hunting regulations; restriction of public access to backcountry (*Land Act*, *FRPA*, and *[All-Terrain] Motor Vehicle Act* also enable access restrictions)
- **Environmental Assessment Act:** environmental review and certification of major projects (e.g., mines, pipelines, hydropower generation) can set conditions linked to mitigation planning, effectiveness monitoring, pre/during/post construction assessment, and compliance monitoring, although most projects do not require the collection of population data nor is there a before-after effects assessment required.
- **Gitanyow Huwilp Recognition and Reconciliation Agreement:** includes management direction for grizzly bears with an objective to provide adequate habitat to ensure a healthy population of grizzly bears (Appendix 4).
- **Skeena Region Legal Orders, Regulations, Policy, and Land Use Plans:** several provincial level objectives apply to the Skeena ESI values, many of these reference protections of either grizzly bear habitat or grizzly bear populations (Appendix 5).

2.5 Cultural Relevance of Grizzly Bear to the SSAF Nations

The following has been directly extracted from the summary of ESI Community Workshops (Four Directions Management Services 2017):

Healthy Habitats

Grizzly bears are healthy when they are on the territory eating roots and berries and not eating garbage. Their health is expressed when their fur is nice (no patches missing), their coats are thick and shiny, and they are large and plump. Grizzly bears need to have the access and ability to move throughout their large territories. Healthy habitats need to have roots for them to eat at the edge of a river and plenty of fish and beaver available for them to eat. When grizzly bears are in the area, they will be controlling beaver populations which helps sustain an overall healthy habitat as well. We know they are thriving in healthy habitats when we aren't encountering them because that would mean that they have ample habitat to roam, there is a balance in the ecosystem, cubs are being born, and the species are robust and healthy.

Impacts/Pressures

Impacts on grizzly bear populations include trophy hunting, poaching and overhunting in general. The loss of habitat and the fragmentation of their territory, human habitation and encroachment into their territory, and urban and industry development is also impacting the grizzly bear species. Development such as road corridors and railways, logging/clear cutting, and mining are causing further pressures on

grizzly bear environments. Their environments are also being impacted by hiking trails and access into the grizzly bear territory, campers leaving behind food and garbage, overpopulation and less natural food sources being available because of low fish returns, pollution, and climate change.

Cultural Uses

There has always been a deep respect for grizzly bears; they are sacred animals. Traditionally they hold a very important spiritual significance in our teachings and we would use their grease, fat, and claws. We would never hunt grizzly bear for food and know to never go to the wild celery area because that is where grizzly bears give birth. It is considered taboo to talk about or mock them because they know what you are saying if you talk about them. Grizzly bears were also used in storytelling, but the stories are not killing them because when ancestors tried to kill and cook the grizzly it turned into a cloud of mosquitos and that is where mosquitos came from. Grizzly bears hold a spiritual significance for teaching younger generations and as such, deep respect is shown to them.

Protection Opportunities

To help protect the grizzly bears, we should be monitoring their populations and territories. We should also be working to stop all trophy hunting, sport hunts, and the use of their body parts (Since the time of the ESI Community Workshop there has been a moratorium on grizzly bear hunting). Protection of their environment is also critical, and this can include reducing clear cuts, human encroachment and littering, and protecting their food sources by enhancing our fisheries management practices. Education and awareness are also important protection measures to take to ensure grizzly bear population preservation. This includes ensuring people don't leave garbage around to make sure that bears aren't attracted to communities by food and garbage. Greater awareness through enhanced communication about where grizzly bears are, animal rehabilitation and relocation centers would also help protect them.

The SSAF would like to recognize that Gitanyow are technical subject matter experts and have administered contracts and led field programs for grizzly bears from 2017-2018. Grizzly Bears are of high traditional, spiritual, and cultural importance to every Nation in the SAFF. In addition to the above synthesis, a representative from the Gitanyow First Nation has submitted the following narrative regarding grizzly bears:

The grizzly bear (liki'inswx) is a highly regarded animal for the Gitanyow, with cultural and spiritual significance dating back thousands of years. There are adawaak (oral history) which speak of the relationship between humans and grizzly bears, and several of the totem poles in Gitanyow have grizzly ayuuks (crests) depicted on them. Grizzly meat is sometimes eaten, but not necessarily a staple of traditional diet. The fur and claws are used in shamanic regalia primarily. Today, Gitanyow continues to support a ban on trophy hunting of any animal, including the previous trophy or sport hunting of grizzlies around the Kitwancool Lake area and the Hanna Tintina area primarily. Grizzly bear habitat is protected in the Gitanyow Lax'yip Land Use Plan, as both habitat complexes and specified areas and also through Forest Ecosystem Networks to protect travel corridors.

2.6 Babine GBPU Narrative

The Babine GBPU, until recently (2017), was open for resident and non-resident hunting. All types of human-caused mortality are tracked to ensure mortalities do not exceed established maximum allowable limits. Babine River Corridor Provincial Park and Babine Mountain Provincial Park provide some habitat protection for grizzly bears in the Babine GBPU. Development of Wildlife Habitat Areas (Grizzly Drop and Klaytahnkut) specifically for grizzly bears is currently underway. During peak salmon runs, the Babine River is a major attractant with adjacent populations of bears travelling through key mountain passes, such as the Kotsine. The Babine GBPU has been identified as a priority unit for monitoring, and evaluating population, distribution and connectivity. Due to high mortality and human presence the Babine is ranked as M3 of medium conservation concern.

2.7 Cranberry GBPU Narrative

The Cranberry GBPU was, until recently, open for resident and non-resident hunting. All types of human-caused mortality are tracked to ensure mortalities do not exceed established maximum allowable limits although the remoteness of the GBPU render enforcement very difficult. The Cranberry GBPU has been identified as a priority unit for monitoring, and evaluating population, distribution and connectivity and a population monitoring project was initiated in 2018. The construction of BC Hydro's Northwest Transmission Line through the GBPU was a significant development in the last decade and until the hunt closure, became known as a popular hunting spot for grizzly and black bear that were attracted by early seral vegetation emergence in the spring. The mountainous portions of the GBPU remain a stronghold of core habitat due to limited industrial development and access. The Cranberry is ranked as a M4, low conservation management concern.

2.8 Bulkley-Lakes GBPU Narrative

The Bulkley-Lakes GBPU ranks in the middle of the NatureServe scale (M3) and is considered a medium management concern with many factors contributing to its rank. The Bulkley- Lakes GBPU was, until recently, open to resident and non-resident grizzly bear hunting except for one area. Resident hunter effort was historically spatially separated into 6 Limited Entry Hunt zones with no hunting in WMU 6-03a. Movement of grizzly bear from the west into the GBPU is expected to be low as the North Coast GBPU is classed as somewhat isolated. Proximity to human activities (communities, highways) increase probability of non-hunt grizzly bear mortalities and contribute to the unit's isolation. The Bulkley-Lakes GBPU has been identified as a priority unit for monitoring, and evaluating population, distribution, and connectivity.

2.9 Francois GBPU Narrative

The Francois GBPU has been closed to hunting since 2010 due to an apparent prior overage in the allowable annual human-caused mortality limit, a reduced modelled population estimate in 2011 and the fact that no female harvest has occurred since 1999; these all led to the closure of the licensed harvest. Human-bear conflicts continue to be reported to conservation officers (e.g., a sow with 2 cubs at a local abattoir in 2013 near Bickle Lake), but the level of unreported human caused mortality is likely under-estimated in the model. Confounding the situation is the ecological and geographic distance to the nearest grizzly bear inventory. The model-based estimate of 58 bears (as reflected in the 2020

Provincial population estimate) has been accepted but is below historic habitat-based estimates and local anecdotal information.

Highway 16 and a long-established agricultural and human settlement zone bisect the unit and North/South population linkage is a potential concern. Current and recent high levels of logging activity in the northern half is creating additional large areas and amounts of early seral, removing some of the last remaining forested linkages; this will further add to concerns around female permeability and home-range establishment and illegal kills. While bears are quite capable of swimming across Oosta Lake (also Francois & Babine Lakes), historic movement permeability has been affected by the reservoir. Human-conflict kills associated with cattle farming in the Southern half of the GBPU further compound movement and colonization potential. The Francois GBPU has been identified as a priority unit for monitoring, and evaluating population, distribution and connectivity and is ranked as M2 high conservation management concern.

2.10 Tweedsmuir GBPU Narrative

The Tweedsmuir is ranked as M5, very low management concern. Although a large stable population, there are issues related to the public recreational viewing in the Atnarko. However, there is an on-going monitoring program improving understanding.

2.11 Upper Skeena-Nass GBPU Narrative

The Upper Skeena-Nass is ranked as M5, very low management concern. This population unit is considered to have a stable population and is well connected to adjacent areas. Due to lack of population information the Upper Skeena-Nass GBPU has been identified as a priority unit for evaluating population, distribution and connectivity.

3 Overview of Indicators

The current condition of grizzly bears in the Skeena ESI area was assessed in 2015 and 2019 using ten indicators⁴. Some of the indicators used 2019 available data, as follows: population status, bear density, and female mortality. The remaining indicators used 2015 available data. The indicators individually and (in some cases) collectively describe the status of grizzly bear populations and habitat relative to broad objectives for grizzly bears (described above).

Table 3.1 Grizzly Bear Indicators

Indicator	Description
Population Indicators	
Population Status	The conservation status of each GBPU as determined through BC's Grizzly Bear status assessment (Morgan et. al. 2019).
Bear Density	The estimated number of bears per 1000 km ² within each GBPU.
Mortality Rate	Percent female mortality over past 10 years
Core Security Area	Patches of secure grizzly bear habitat (that is, areas with minimal likelihood of human use) greater than 10 km ² within a landscape unit (LU).
Front Country	Urban and rural landscapes (including areas accessible by rural roads within 2 hours travel time from cities) that have relatively high human density and/or non-natural as well as grizzly bear attractants (e.g., livestock, grain crops, fruit trees, human food, garbage).
Hunter Day Density	The number days per year that wildlife hunters occupy Wildlife Management Units (WMUs).
Road Density	The total length of roads (including pipeline corridors, transmission line rights-of-way, and rail lines) divided by total LU area (km/km ²).
Habitat Indicators	
BEC Mid-Seral Dense Conifer	The amount of BEC mid-seral dense conifer forest within each LU, to represent areas of sub-optimal forage production.
Quality Food	The capability of ecosystems to produce vegetation that is foraged by grizzly bears (e.g., forbs, grasses, sedges, berries), measured as high and very high capability areas within the broad ecosystem inventory (BEI).
Quality habitat protected	The amount of high capability grizzly bear habitat within a LU that is protected in conservation areas and wildlife habitat areas.

See Appendix 2 for a conceptual model that illustrates how the indicators work together to influence the functions and processes that support grizzly bear populations and habitat. In the next section, the approach to assessing each indicator is explained in more detail to help reviewers of this report interpret the results. For more insights into the grizzly bear assessment methodology and data sources, refer to the [Interim Assessment Protocol for Grizzly Bear in British Columbia, version 1.2](#) (October 2020).

⁴ The core indicators are the primary flags for identifying potential sources of risk to grizzly bears. The supplemental indicators and indices are intended to provide more detail and contextual information for informing decisions.

4 Assessment Results for each Indicator

Assessment results for each indicator are presented with maps, a brief description of the indicator, a key to interpreting the results, and description that elaborates upon the results with a discussion of: what the results mean; relevant contributing or causal factors; supporting numerical data where it is useful; limitations, if any, in the utility of the results; and, any other relevant local information (such as complementary research, inventory, monitoring, or cumulative effects analyses) that would help clarify the current condition of grizzly bears relative to the indicator.

Important Note

It is important to emphasize that units (primarily landscape units (LUs)) flagged as higher risk to grizzly bears do not necessarily equate to areas of actual adverse impacts to grizzly bear populations or habitat. Higher risk and flagged LUs are intended to point regional specialists and First Nation and Provincial leaders to areas that may warrant further investigation and analysis prior to determining whether or what management (mitigation) response is

Although data for the indicators was gathered at multiple scales - primarily the GBPU and WMU⁵ scales – all of the indicators except population status (which reports at the GBPU scale) extrapolate and report results at the much smaller LU⁶ scale to inform resource management planning and decision-making at strategic, tactical and operational scales. Due to vast numbers of LUs within the assessment, the description for each indicator typically discusses results at the GBPU level.

4.1 Conservation Rank

Indicator Description: BC is part of NatureServe’s western hemisphere-wide network of non-profit conservation programs. NatureServe is dedicated to providing scientific and technical support, and information for species status assessment. Species and ecosystems are assessed using standard criteria including threats (NatureServe 2012). The threats are based on International Union of Conservation of Nature (IUCN) classification (IUCN 2020). The values obtained for criteria such as population size, long and short-term trend, genetic isolation and threats are entered into the ‘Element Rank Calculator’⁷ that was developed by NatureServe to provide a standardized ranking method (NatureServe 2012). NatureServe modified the NatureServe Element Rank Calculator under the guidance of internationally recognized BC based grizzly bear biologists Dr. Bruce McLellan and Dr. Michael Proctor to be used to enable the assignment of conservation concern rank to the Province’s GBPUs.

The Province has applied the modified NatureServe ranking methodology and calculator to assign a conservation management concern rank for each of the Province’s GBPUs^{Error! Bookmark not defined.}. Each GBPU is assigned a rank that reflect the G

⁵ For bear density and mortality indicators, data was also gathered by Limited Entry Hunt (LEH) zone within WMUs.

⁶ LUs more closely approximate the size of one to several adult female home ranges.

BPU's population size and trend, genetic and demographic isolation, as well as threats to bears and their habitats (M1 to M5; ranked highest to lowest conservation concern). In general terms, 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.

This modified methodology is consistent with the Ministry of Environment and Climate Change's 2015 Guidance for Threats Assessments for Species and Ecosystems at Risk (ENV 2015), and NatureServe's Conservation Status Assessments at the species level. The approach is also aligned with COSEWIC, IUCN, NatureServe and species-level threats analyses used in provincial and national recovery planning processes.

The NatureServe assessment considers a set of IUCN threats; specifically: 1) Residential & Commercial Development; 2) Agriculture & Aquaculture; 3) Energy Production & Mining; 4) Transportation & Service Corridors; 5) Biological Resource Use; 6) Human Intrusions & Disturbance; and 11) Climate Change. Indicators from the CE protocol (human caused mortality, hunter density, and road density) provide inputs to the Province's NatureServe assessment ranking of GBPUs, specifically road density (threat 4), bear mortality, mid seral forest condition and hunter density (threat 5), and front country (threat 6). The CEF protocol habitat protection indicators reflect the effects of threats 1 and 2 but are considered differently than in the NatureServe assessment.

The conservation concern ranking is a high-level summary of overall threats, genetic isolation, trend and population size; whereas the CE protocol provides other specific indicators to make direct linkages to grizzly bear management objectives, practices and actions the conservation concern ranking provides an effective 'roll up' of the conservation condition of a GBPU. However, it does not provide the direct management linkages that are part of the CE protocol.

- Interpretation Key:**
- Each GBPU is identified as very low, low, medium, high, or extreme.
 - Medium, high and extreme GBPUs are flagged for management attention.
- Assessment Results**
- Refer to Table 5.1 and Figure 5.1

Description:

- Tweedsmuir and Upper Skeena-Nass are classified as very low conservation concern (M5);
- The Cranberry is low(M4);
- The Babine and Bulkley-Lakes are medium (M3); and
- The Francois GBPU is of high conservation concern (M2) requiring the significant management effort to ensure its long-term sustainability.

Table 4.1. Population Unit Summary Table by GBPU

GBPU	# of LUs included	Status	Estimated Population	Estimated Bear Density (bears/1,000km²)	Total GBPU Area (km²)
Babine	19	M3 - Medium	313	23	13,743
Bulkley-Lakes	34	M3 - Medium	439	20	22,244
Cranberry	9	M4 - Low	352	31	11,481
Francois	8	M2 - High	58	7	7,778
Tweedsmuir	3	M5 – Very Low	368	22	16,661
Upper Skeena-Nass	5	M5 – Very Low	755	47	16,083

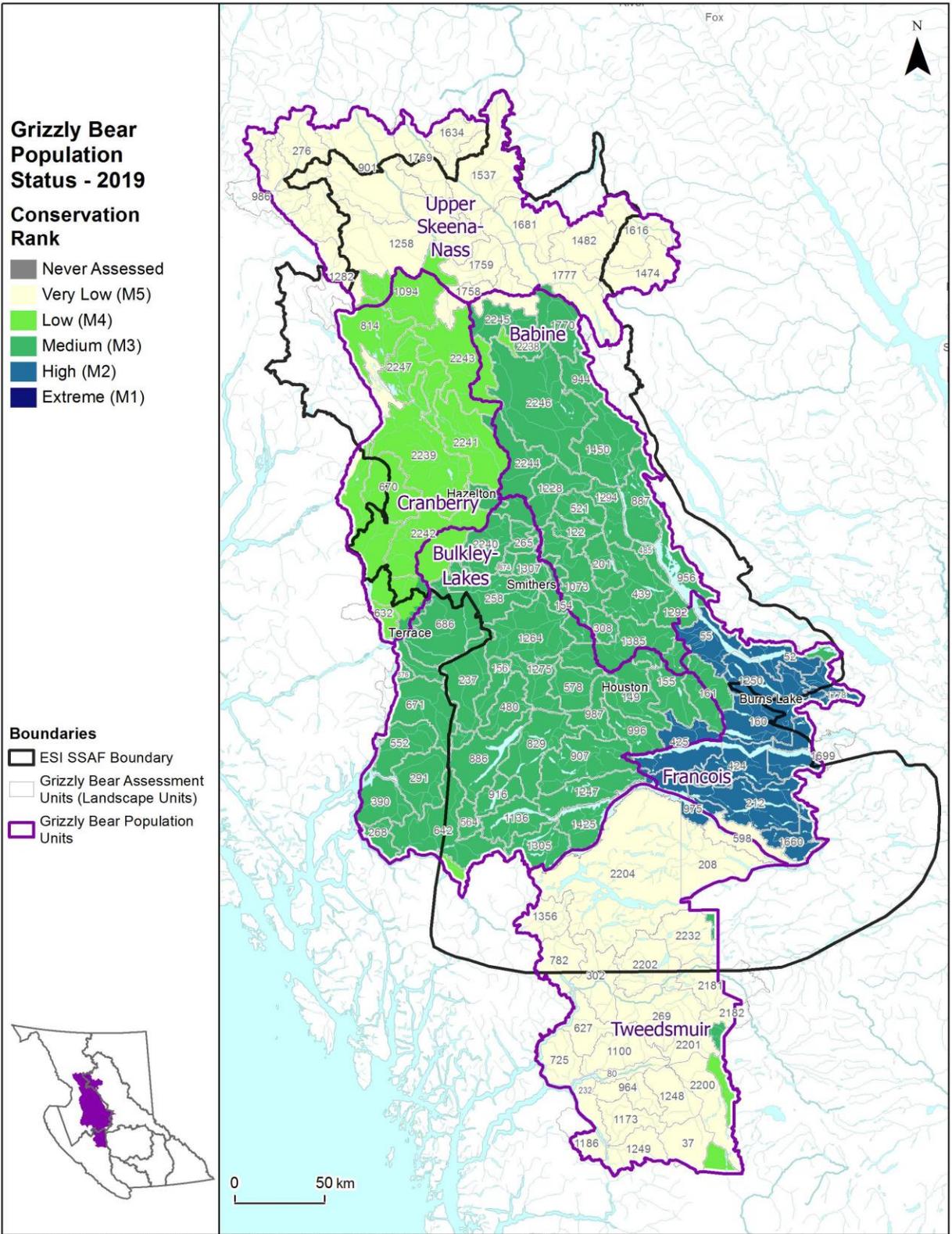


Figure 5.1 Grizzly Bear Conservation Rank, M1, M2 and M3 GBUs require more conservation management attention – Skeena ESI East Area

4.2 Bear Density

Indicator Description:	This indicator reports the number of bears per 1000 km ² from field-based population estimates based on a regression model (Mowat et. al. 2013). Bear densities are generated for GBPU/WMU/LEH. Model-generated bear density estimates may be revised based on local knowledge.
Interpretation: Key:	<ul style="list-style-type: none">• Bear densities greater than 10 bears per 1000 km² are lower risk.• Bear densities less than 10 bears per 1000 km² are higher risk and are flagged; management considerations are recommended when reviewing land-based decisions in these areas.
Assessment Results:	<ul style="list-style-type: none">• See Figure 5.2

Description:

Bear density estimates for the ESI GBPUs range from a low of 7 bears per 1000 km² to as high as 47 bears per 1000 km². At the LU scale, grizzly bear densities range from a low of 3.38 to a high of 48.29 bears per 1000 km². Population estimates per GBPU range from a low in the Francois GBPU of 58 grizzly bears to a high of 755 in the Upper Skeena-Nass GBPU (Table 5.1).

Based on the regression model results, bear densities within the Skeena ESI are variable, but follow a trend of decreasing bear density in the central east, and increasing densities to the north, south and west. Francois GBPU and southeastern Bulkley-Lakes have been flagged for exceptionally low bear density (<10 bears per 1000 km²). Directly north and south of the exceptionally low-density area, bear density increases to 10-<20 bears per 1000 km² in the Bulkley-Lakes, Babine, and Tweedsmuir GBPUs. The highest bear density LUs in this region do not exceed 40-<50 bears per 1000 km² and are found contiguously in the Upper Skeena-Nass, scattered along the western extent of Bulkley-Lakes and Tweedsmuir GBPUs.

At the GBPU scale, 5 of the 6 have predicted bear densities of >10 bears per 1000 km² (Table 5.1). At the LU scale, 14 of 78 (18%) are flagged based on grizzly bear estimated population densities of less than 10 bears per 1000 km². The LUs with bear densities of 10-20 bears per 1000 km² that are flagged for management attention include LUs within the Francois, Bulkley-Lakes, Babine, and Tweedsmuir GBPUs.

The regression model used to estimate bear density relies on several indicators, including precipitation, which is the main indicator of plant productivity (the capability of ecosystems to produce vegetation grizzly bears rely on). Due to the uncertainty associated with grizzly bear population and density estimates for the Skeena ESI, field-based population inventories would be necessary in representative ecosystems across the region to provide validated estimates that support appropriate management (mitigation) responses to the indicator results in this report. It is recommended that representative ecosystems across the region that are considered a high priority be sampled.

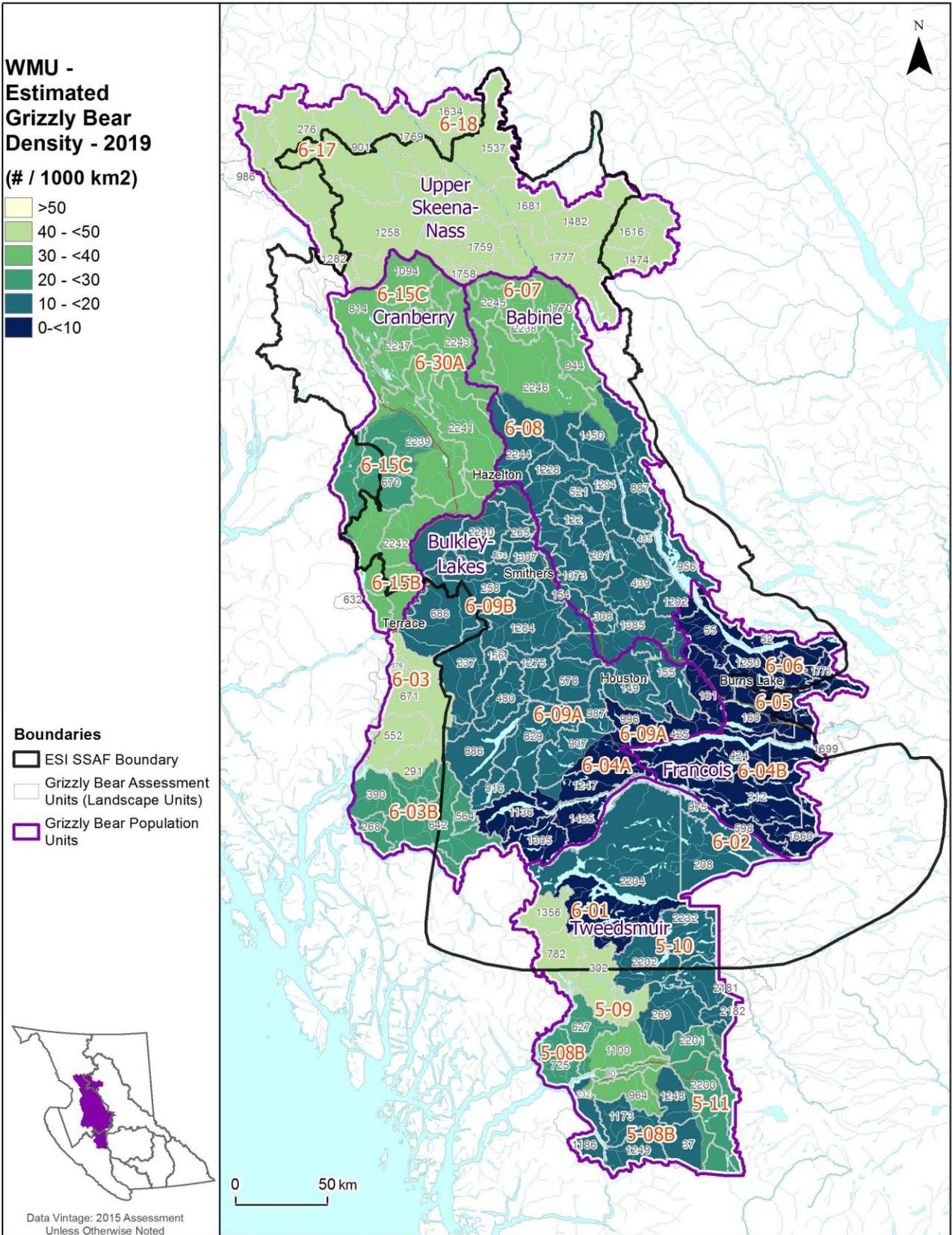


Figure 5.2 Grizzly Bear Density by GBP/WMU/LEH - Skeena ESI

4.3 Core Security Areas

Indicator Description:	This indicator reports the prevalence of capable core security areas, which are patches of habitat greater than 10 km ² with minimal likelihood of human use (as defined by distance to access) and are composed of capable habitat. Where capable habitat is defined by an interpretation of Broad Ecosystem Inventory (BEI) units which have been rated for grizzly bear habitat capability across the province and are divided into six classes (very high-1, high-2, moderate-3, low-4, very low-5, nil-6) ¹ with classes 1-5 defined as capable. These areas are large enough to accommodate a female grizzly bear's daily foraging requirements in areas unlikely to have human activity (e.g., roads, settlement areas, recreation areas, industrial areas). To adequately buffer grizzly bears from humans, these areas must be 500 metres or more from human infrastructure and activity.
Interpretation Key:	<ul style="list-style-type: none">• LUs with more than 60% of the area in core security areas pose a low risk to grizzly bears.• LUs with less than 60% of the area in core security areas pose a higher risk to grizzly bears and are flagged for management attention.
Assessment Results:	<ul style="list-style-type: none">• See Figure 5.4

Description:

Connectivity of core security is indicated as occurring across the northern Upper Skeena-Nass GBPU which connects to contiguous core security in the northern extents of the Cranberry and Babine GBPUs (refer to figure 5.4). The southern Tweedsmuir GPBU also has high connectivity of core security and continues into the southern and central LUs of Bulkley-Lakes GPBU and into the south of Cranberry GBPU portion of the region. As with other indicators, there is a deficit of core security habitat along the central eastern part of the region. The ratio of core security area (viable habitat) to non-core security area (human-occupied areas, including roads) within each GBPU is summarized in Appendix 3.

Given that core security areas must be 500 metres or farther from human infrastructure and activity, it is not surprising that Upper Skeena-Nass and Tweedsmuir contain significant abundance of core security, and Francois contains a deficit. The areas that contain abundant core habitat connectivity occur largely in mountainous regions or within protected Provincial Parks. The Francois GBPU encompasses urban and agricultural areas, and high concentrations of industrial roads, corridors, and infrastructure associated with utilities, forestry, and an LNG pipeline under construction. As noted in the Grizzly Bear Overview (and Appendix 1), industrial roads (and permanent corridors) are the primary means for guide-outfitters, hunters, trappers, and recreation enthusiasts to access the backcountry.

The ratio of core security area (viable habitat) to non-core security area (human-occupied areas, including roads) within each GBPU is described in Appendix 3 - Table 3. Mortality risks are higher in subpopulations with lower ratios of core security to remaining occupied habitats.

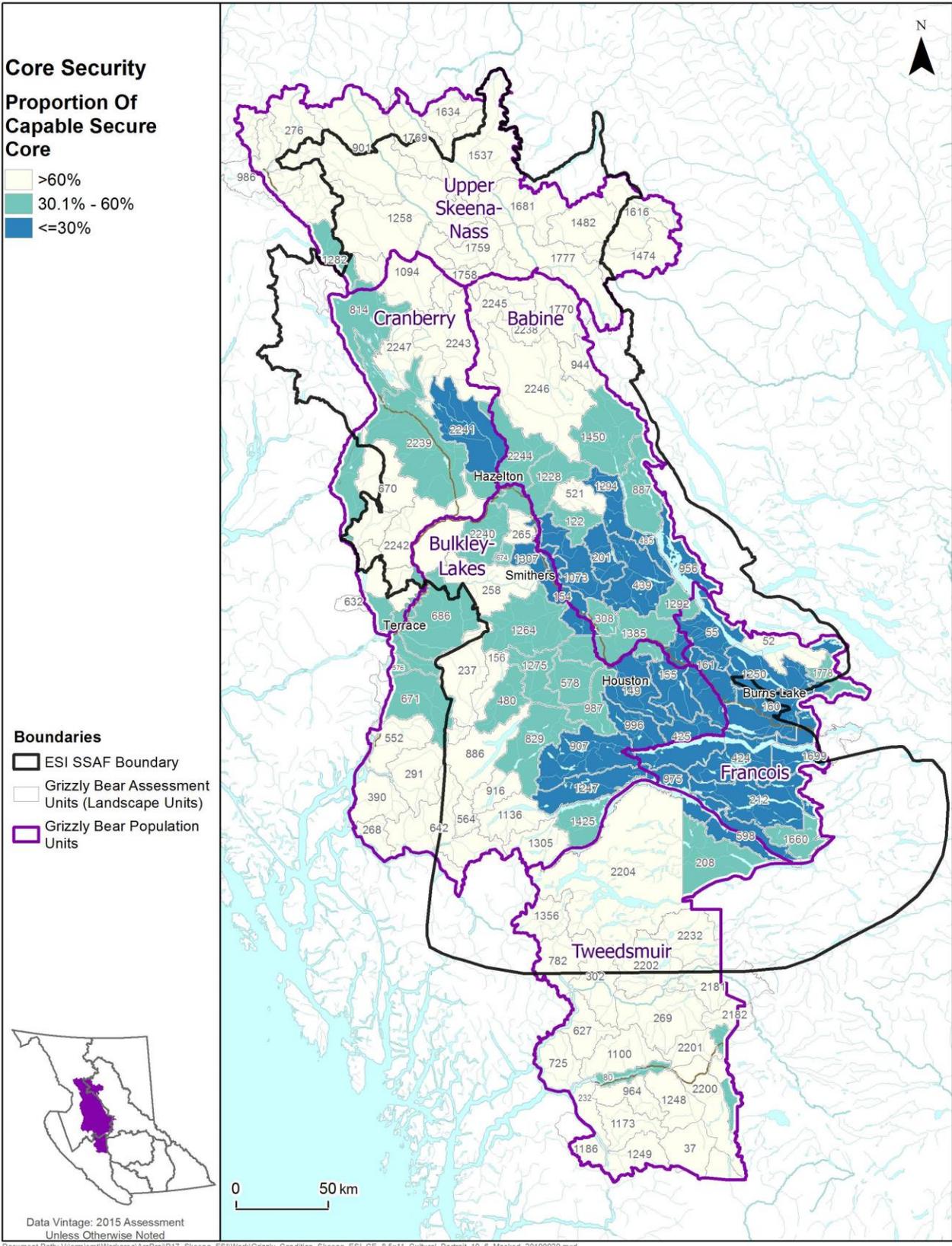


Figure 5.3 Core Security Area for Grizzly Bears, areas with >60% core are lower risk - Skeena ESI

4.4 Mortality Rate

Indicator Description: Humans are the main cause of grizzly bear mortality, and the majority of human-caused mortality occurs near human occupied areas or roads (Proctor et. al. 2018). Bears die at a disproportionate rate when they are close to active roads and people who use the roads are armed. Mortality may occur from mistaken identity kill, human-bear conflict (self-defence kill, management control kills, landowner defence-of-life and property), illegal reported harvest, or vehicle collisions.

This indicator reports human-caused bear mortalities per GBPU (as reported in the [Compulsory Inspection Database \[CID\]](#)) compared to area-specific mortality limits⁸. Mortality limits may vary but are capped at 6% of a grizzly bear population within a WMU⁹. Further, the Grizzly Bear Harvest Management Procedure (under the *Wildlife Act*) sets the limit of no more than 30% of this mortality being female bears (averaged over a five-year allocation period) (MOE 2007).

BC uses 4-6% as the range of mortality for interpreting population risk (1.33 to 2% female), with the higher values associated with units verified to have higher recruitment rates. Research indicates that human caused mortality can be as high as 10% (3.33 % female) and still be sustainable in some places.

Interpretation Key:

- Results for each WMU are extrapolated to LU.
- A LU is flagged for management attention if the percent female mortality of the estimated total GBPU grizzly bear population compared against mortality reference points, averaged over 2008 to 2017. The flag is triggered if the percent female mortality is greater than 1.33%, such that:
 - 0 to 1.33% is negligible risk - below 4% total;
 - 1.33 to 2% is low risk - below the 6% total;
 - 2 to 3.33% is moderate risk - above 6% but below possible maximum; and
 - Above 3.33% is high risk – above absolute maximum of 10% total.

Assessment Results:

- See Figure 5.3

Description:

⁸ 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.

⁹ Mortality limits are established by limited-entry hunt (LEH) zones (within WMUs)

In the CID, reported mortality losses 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, rail kills, and trapping.

From 2000-2013 the CID-reported grizzly bear deaths for the six GPBUs within the Skeena ESI total 618, with 433 (72%) the result of hunting, 126 (20%) the result of animal control, (6%) the result of illegal hunting, 4 (1%) unspecified (pick-ups), 5 (1%) the result of rail kills, 2 (<1%) the result of road kills, and 1 (<1%) the result of trapping.

Important Note

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 mortality by the region, especially given that hunting has traditionally accounted for the vast majority of mortality in the province.

Results suggest the annual mortality exceeded regional limits in seven WMUs (see Figure 5.3) and only the Babine and Bulkley-Lakes fail at the GBPU scale (both Low) due to an extensive amount of their area is flagged at risk. Excessive mortality is identified as a risk in the Bulkley-Lakes GBPU with WMUs 6-09B in the north as low, high in WM 6-04A in the east and high (WMU 6-03) near the major resource industry hub, the District of Kitimat. In the Babine the WMU 6-08 is at Medium risk. High risk from mortality is identified in WMU 5-08C in the central Tweedsmuir GBPU, associated with the Bella Coola river, and the Cranberry WMUs 6-30A and 6-15B are flagged as Low.

High to moderate-level mortality is likely a cumulative effect of multiple types of human-caused mortality within the LUs. The low-level mortality in most of the LUs across the Skeena ESI is likely a result of complicated terrain (coastal mountain range and inlets) and the low density of high-use roads found within this region.

Unreported mortality due to hunters who shoot bears as a defense mechanism, at remote camps due to bear-human conflicts, and on farms/ranches is difficult to estimate. There are many anecdotal reports where people shoot bears to protect people or livestock and do not contact Conservation Officers due to fear of charges. As a result, this indicator should be interpreted cautiously and that the as mortality could be larger or smaller with a high degree of uncertainty.

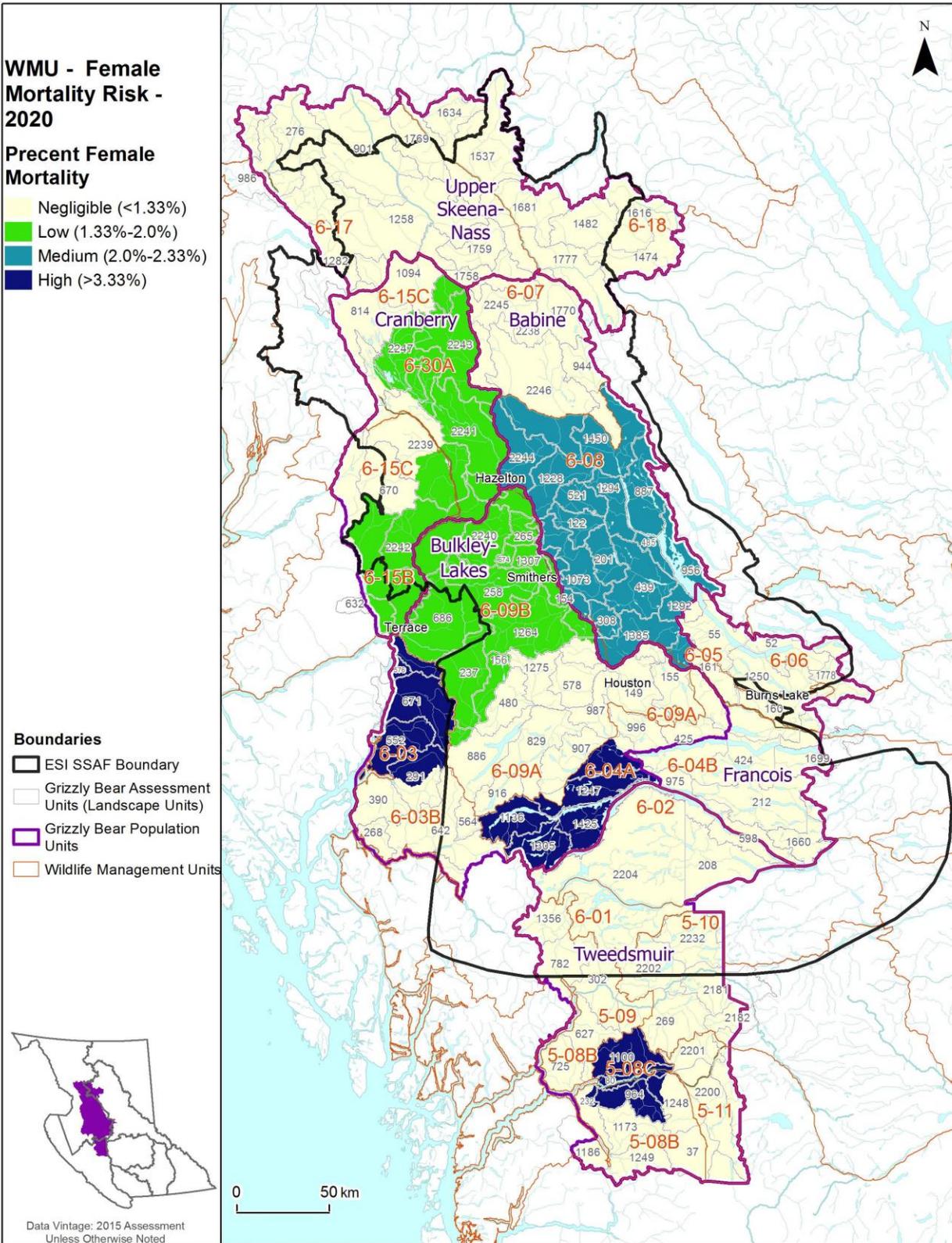


Figure 5.4 Grizzly Bear Mortality Rate, low, medium and high units require more management attention - Skeena ESI

4.5 Front Country

Indicator Description:	This indicator reports the proportion of each LU that is considered front country. Front country includes both urban and rural landscapes that have relatively high human density <i>as well as</i> grizzly bear attractants such as livestock, livestock carcasses and feed, grain crops, fruit trees, and human food and garbage. 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:	<ul style="list-style-type: none">• LUs with less than 20% of the area in front country are low risk to grizzly bears.• LUs with more than 20% of the area in front country are higher risk to grizzly bears and are flagged for management attention.
Assessment Results:	<ul style="list-style-type: none">• See Figure 5.5

Description:

The likelihood of human-bear encounters (and conflicts) and consequent risk of bear mortality in the front country is high. The proportion of front country is very high throughout the central GBPUs of the ESI; associated with a likelihood of human-bear encounter of over 80% (see figure 5.5). In most GBPUs throughout the province, areas of front country typically correlate with areas of core security deficit; which is the case for the Skeena ESI. These areas of high front country align with the major roads that link cities and villages across the region; Hwy #20 to Bella Coola, Hwy #16 linking Burns Lake, Smithers, Terrace and Kitimat, and Hwy # 37 that extends North from Hwy #16 linking Kitwanga, Gitanyow, Dease Lake and beyond. The majority of the northern and southern GBPUs (Upper Skeena-Nass and Tweedsmuir) contain low areas of front country as road density and towns in these areas are much smaller and less dense; resulting in a 0-20% likelihood of a human-bear encounter.

The proportion of each GBPU designated as front country versus back country is described in Appendix 3 – Table 4.

The front-country environments in the Skeena ESI East region are not really comparable to front-country environments in the lower mainland, Okanagan or much more densely populated areas. That said, grizzly mortalities do still occur as we witnessed in the 2017 season where grizzlies were killed in many communities throughout the region. We still have the potential for much improved management of attractants and education of residents that could significantly decrease mortalities. The village of Gitanyow is an example of a community where bear-human conflict management has improved. In 2012 there were five grizzly bears killed in Gitanyow related to unmanaged attractants. Charges were laid that year related to not removing attractants and subsequent killing of bears, which were supported by Gitanyow Hereditary Chiefs. Since that year there have been zero grizzly bears killed in Gitanyow. This decrease is believed to be due in part to the consequences for the killing of the bears, but also largely supported by the active Gitanyow Lax'yip Guardian program. The Lax'yip Guardians are the driving force in the Gitanyow community in terms of leading engaging discussion and fostering proper attractant management with community members, playing a vital role in avoiding bear-human conflict situations

before they arise.

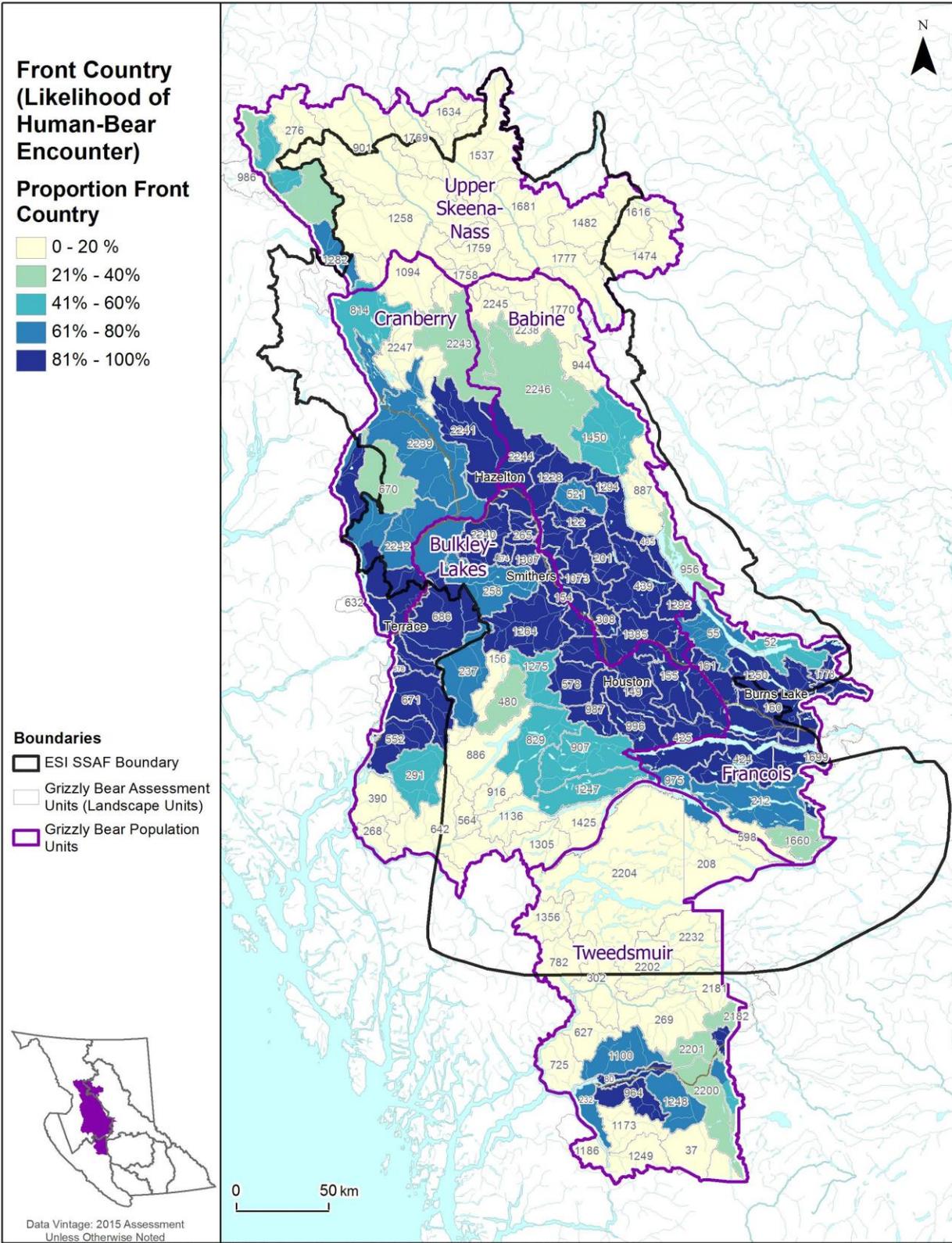


Figure 5.5 Front Country areas with >20% front country are at greater risk to negative human-bear conflicts - Skeena ESI

4.6 Hunter Day Density

- Indicator Description:** This indicator reports average annual hunter day density, which is the number of days per year (calculated over a 5-year period of 2013-2017) that wildlife hunters occupy WMUs. The number of hunter days per km² is reported by LU. 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 (when the grizzly bear hunt was open).
- Interpretation Key:**
- Average annual hunter days greater than 1.87/km² are flagged as a high risk to grizzly bears and are flagged for management attention.
- Assessment Results:**
- See Figure 5.6

Description:

Hunter day density is low to moderate throughout the northern and southern portions of the Skeena, particularly in Upper Skeena-Nass and Tweedsmuir. Hunter day density is highest across the central portion of the Skeena ESI, with the highest density along the eastern boundary of the Francois GBPU. Areas of high hunter day density correlate roughly with areas of high proportion front-county environment (Figure 5.5) and areas of high road density (Figure 5.7). Hunter day density within each GBPU is described in Appendix 3 – Table 5.

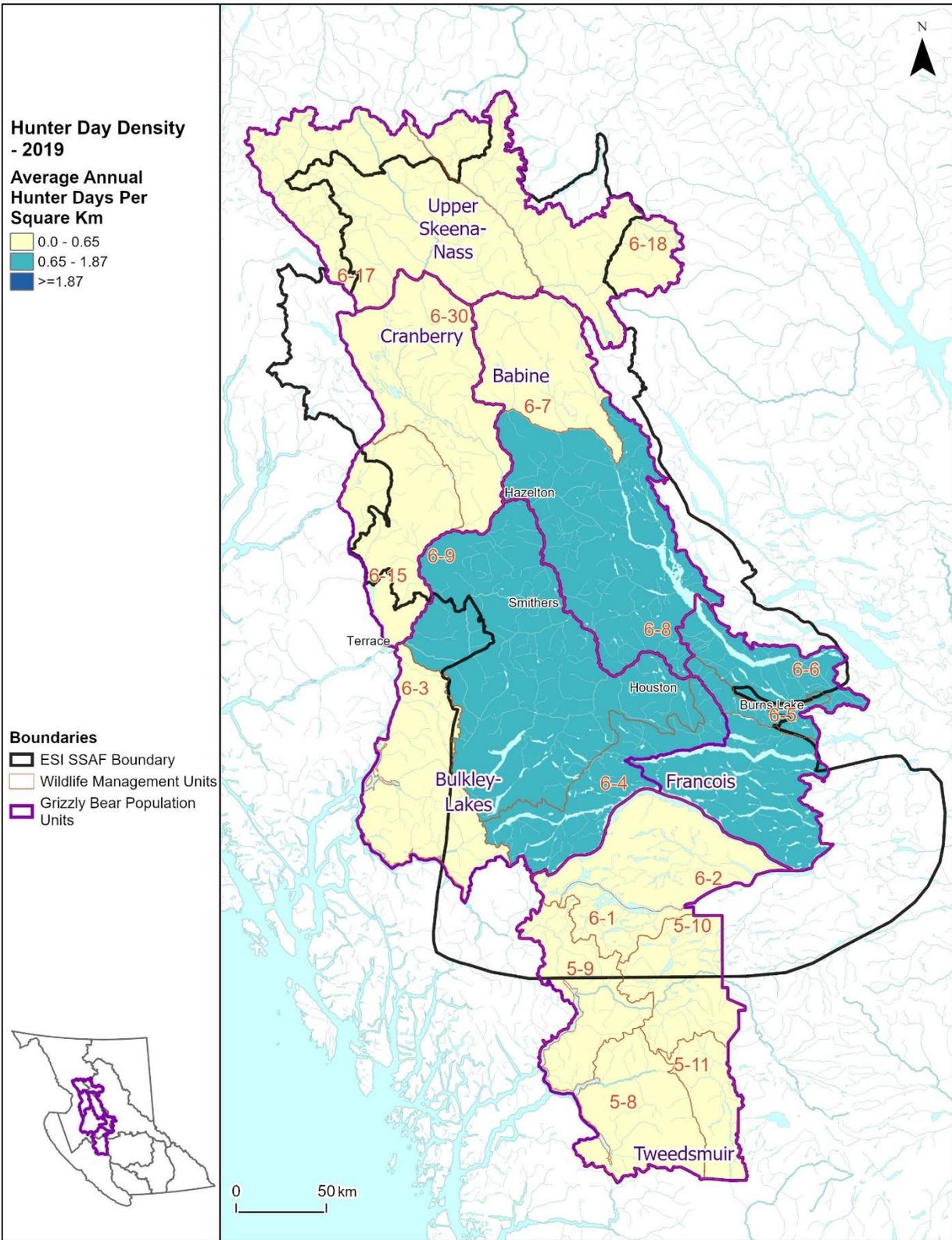


Figure 5.6 Hunter Day Density WMUs with >1.87 hunter days/km² are at risk - Skeena ESI

4.7 Road Density

Indicator Description:	<p>This indicator reports total length of open roads¹⁰ (as well as pipeline corridors, transmission line rights-of-way, and rail lines) divided by total LU area (km/km²). 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 and potential loss of access to key food sources, and ultimately to decline of grizzly bear populations.</p> <p>Data used is based on a 2015 consolidated road coverage used Provincially for CE assessments (see Provincial Grizzly Bear protocol for description of all data sources). Future iterations of this indicator anticipate using local data to update the road inventory.</p>
Interpretation Key:	<ul style="list-style-type: none">• Class 0 [Negligible risk]: Roadless densities of 0.00 km/km² are no risk to grizzly bears.• Class 1 [Low risk]: Road densities of 0.01 - 0.30 km/km² are low risk to grizzly bears.• Class 2 [Moderate risk]: Road densities of 0.31 - 0.60 km/km² are moderate risk to grizzly bears.• Class 3 [High risk]: Road densities of 0.61 - 0.75 km/km² are high risk to grizzly bears.• Classes 4 to 7 [Very High risk]: Road densities greater than 0.75 km/km² are very high risk to grizzly bears¹¹. This group [Very High road density] has been further split into 4 sub-classes to provide more detailed information on road density. This level of result gradient is intended to assist in communicating risk.
Assessment Results:	<ul style="list-style-type: none">• See Figure 5.7

Description:

Risks to grizzly bear populations and habitat correlate more with road density than any other indicator, for two key reasons: most grizzly bear mortality from human encounters occurs within 500 metres of a road, and densely-roaded areas are avoided by grizzly bears. As road density increases, it leads to habitat loss and fragmentation, population isolation, and population decline over time.

The highest concentration of roads is indicated as occurring in the Francois, Bulkley-Lakes, Babine, and Cranberry GBPUs. Road density is highest along Hwy 16, and around cities such as Burns Lake, Smithers, Terrace and Kitimat.

¹⁰ Note that this indicator does not include roads that are permanently deactivated or closed to access.

¹¹ These road density thresholds are based on several research studies, most notably Boulanger and Stenhouse, 2014.

There are a number of LU's that are not flagged for management attention (road density Class 1 and 2; <0.60 km/km²). These areas occur in the Upper Skeena-Nass, Tweedsmuir and northern Babine GBPU's, as would be expected in the more mountainous and remote parts of the region (see figure 5.7). Areas of road density within each GBPU are described in Appendix 3 – Table 6.

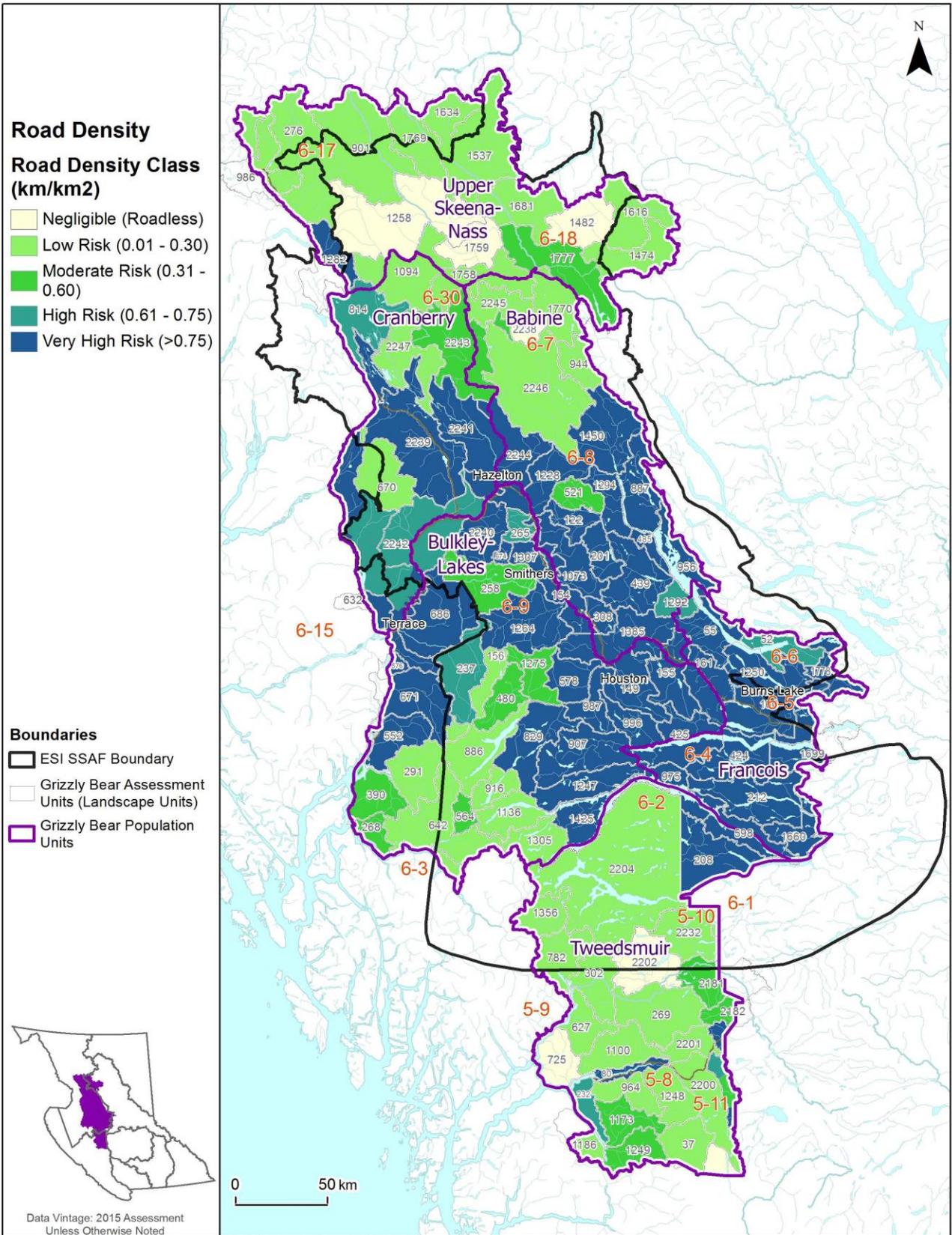


Figure 5.7 Road Density, densities greater than 0.6km/km² increase risk to grizzly bears – Skeena ESI

4.8 BEC Mid-Seral Dense Conifer

Indicator Description: This indicator reports the amount of mid-seral¹² dense conifer forest (by BEC zone) within each LU to represent areas that are *sub-optimal* for forage production. Open canopy forests support greater berry production, which is an important food source for grizzly bears. This indicator flags potential LUs where forage supply could be an issue for grizzly bear due to excess mid seral forest in certain BEC zones that could be rectified (through management responses such as capping the amount of mid seral conifer dominated stands at 30% and/ or reducing stocking standards on selected site series in the Coastal Western Hemlock (CWH), Interior Cedar Hemlock (ICH) and Sub-Boreal Spruce (SBS) zones).

The forest cover data used is based on 2015 inventory. Future iterations will reflect recent fires and harvest and more direct measures of forage supply.

Interpretation Key:

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

Assessment Results:

- See Figure 5.8

Description:

In the Skeena ESI area, optimal forage supply for grizzly bears is associated with mature, open-canopy, mixed forests, alpine meadows, avalanche slopes, and high-elevation regenerating burns that yield high berry density. Mid-seral conifer forests are considered less ideal, and ideally don't make up more than 30% of the seral stages represented by forested areas within any BEC unit within a given landscape unit. When a BEC unit reaches >30% mid-seral, dense conifer representation within a given LU, it is flagged.

There are 9 LUs flagged for management attention because the landscape units contain more than 30% mid-seral dense conifer (and therefore contain sub-optimal forage supply for grizzly bears) in the Skeena ESI. These LUs are located in the east of the Francois, Babine, and Tweedsmuir GBPUs (see figure 5.8).

There are a number of LUs indicated as having insufficient data, due to lack of ecosystem and age information; as such, conditions for this indicator are unknown in those areas. These LUs fall within the Bulkley-Lakes and Cranberry GBPUs.

The majority of LUs across the GBPUs that make up the Skeena ESI are not flagged, meaning they contain less than 30% mid-seral dense conifer (and therefore contain optimal forage supply for grizzly bears).

¹² Mid-seral dense conifer forests are typically 40 to 100 years old depending on the ecosystem (Biodiversity Guidebook, 1995).

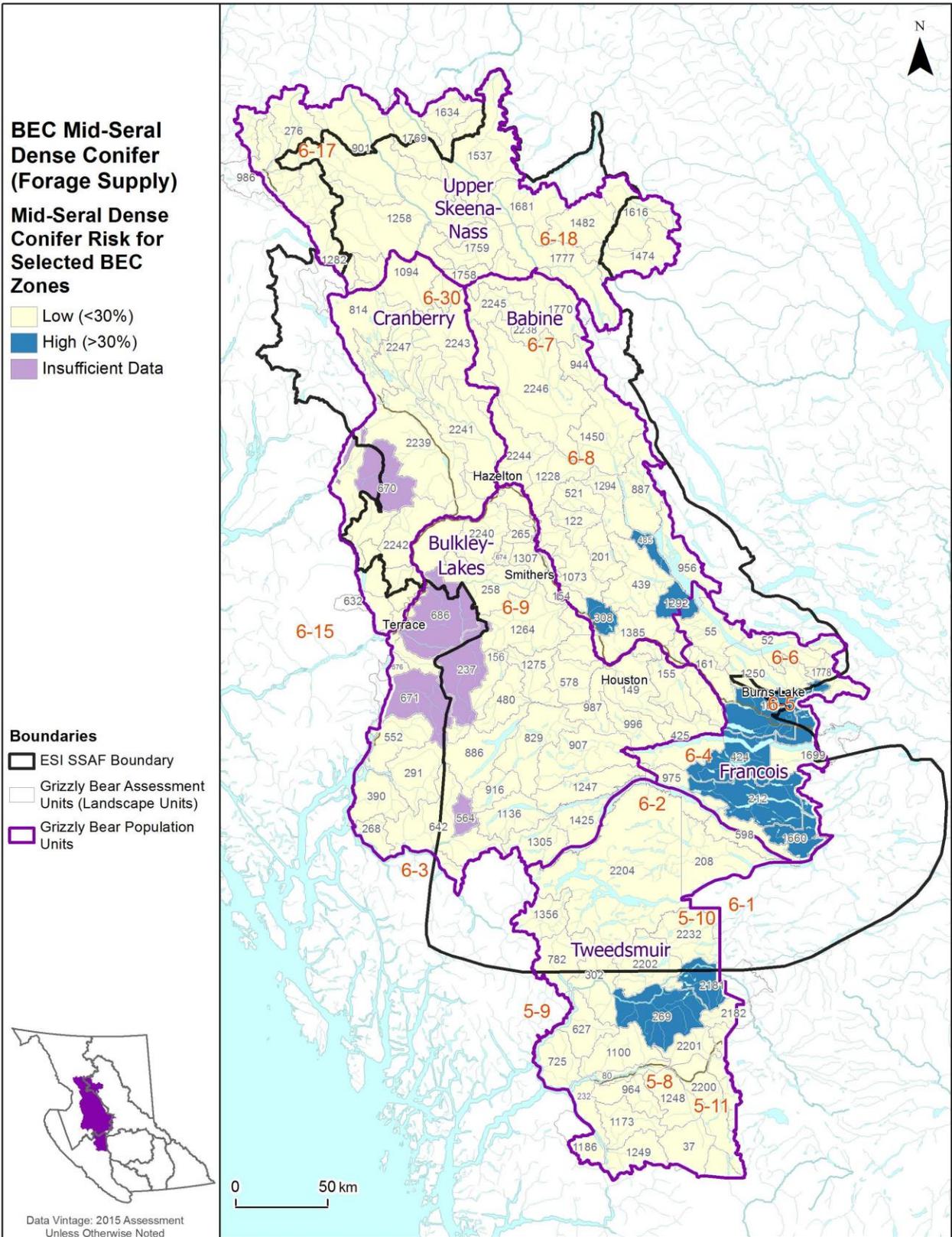


Figure 5.8 Mid-Seral Dense Conifer, areas with >30% mid seral could constrain forage supply – Skeena ESI

4.9 Quality Food

Indicator Description:	<p>This indicator is an assessment of the amount of quality food sources available to grizzly bears. For the purposes of this assessment, provincially available data for forage was limited to salmon biomass and high capability areas. Information on ungulate density (for example) is intended to be used in the future, as information becomes available. Climate change may be contributing to salmon declines and their future availability could be a risk factor for grizzly bears accessing quality food. The quality food indicator assesses the potential of LUs to produce food for grizzly bears by:</p> <ol style="list-style-type: none">1. >10,000 kg Salmon (sum of salmon kg by LU available annually on average, based on historic returns) (depicted on the results map as blue cross-hatched LUs) <p>OR</p> <ol style="list-style-type: none">2. 50% of Landscape Unit with BEI High or Very High Capability¹³ (vegetation for forage). Depicted on the results map as solid green shading of a given LU.3. In some regions, there are LUs that meet both of the above requirements (>10,000 kg salmon AND high/very high BEI capability for >50% of the LU). Where these cases occur, they are indicated on the results map by a combination of solid green shading with a blue cross-hatch overlay.
Interpretation Key:	<ul style="list-style-type: none">• Quality food is considered present if more than 50% of the LU is classified as high or very high capability BEI.• Salmon is considered present if greater than 10,000 kg is available on average (sum of salmon kg by LU).
Assessment Results:	<ul style="list-style-type: none">• See Figure 5.9

Description:

The productivity of vegetation across the Skeena ESI ecosystems is complex. The mountainous terrain creates a diverse array of ecosystems from high alpine ecosystems to dense riparian forests; additionally, numerous inlets extend inward from the coast to drain major rivers and drainage basins that range further into the region. Just less than half of the LUs in this region are assessed as having highly quality food for grizzlies and are distributed along lower elevation mountainous landscape or major rivers. Areas of poor food quality are located in areas of extremely high elevation or coincide with areas of human development.

Another appropriate indicator of habitat capability for grizzly bears in the Skeena may be the presence of terrestrial protein, primarily ungulates. As salmon stocks decline there is potential for bears to increasingly target ungulates. This source of food is not included in this indicator at this time.

¹³ “Capability” refers to potential productivity with optimal vegetation for a species (unlike “suitability,” which refers to existing productivity with present vegetation).

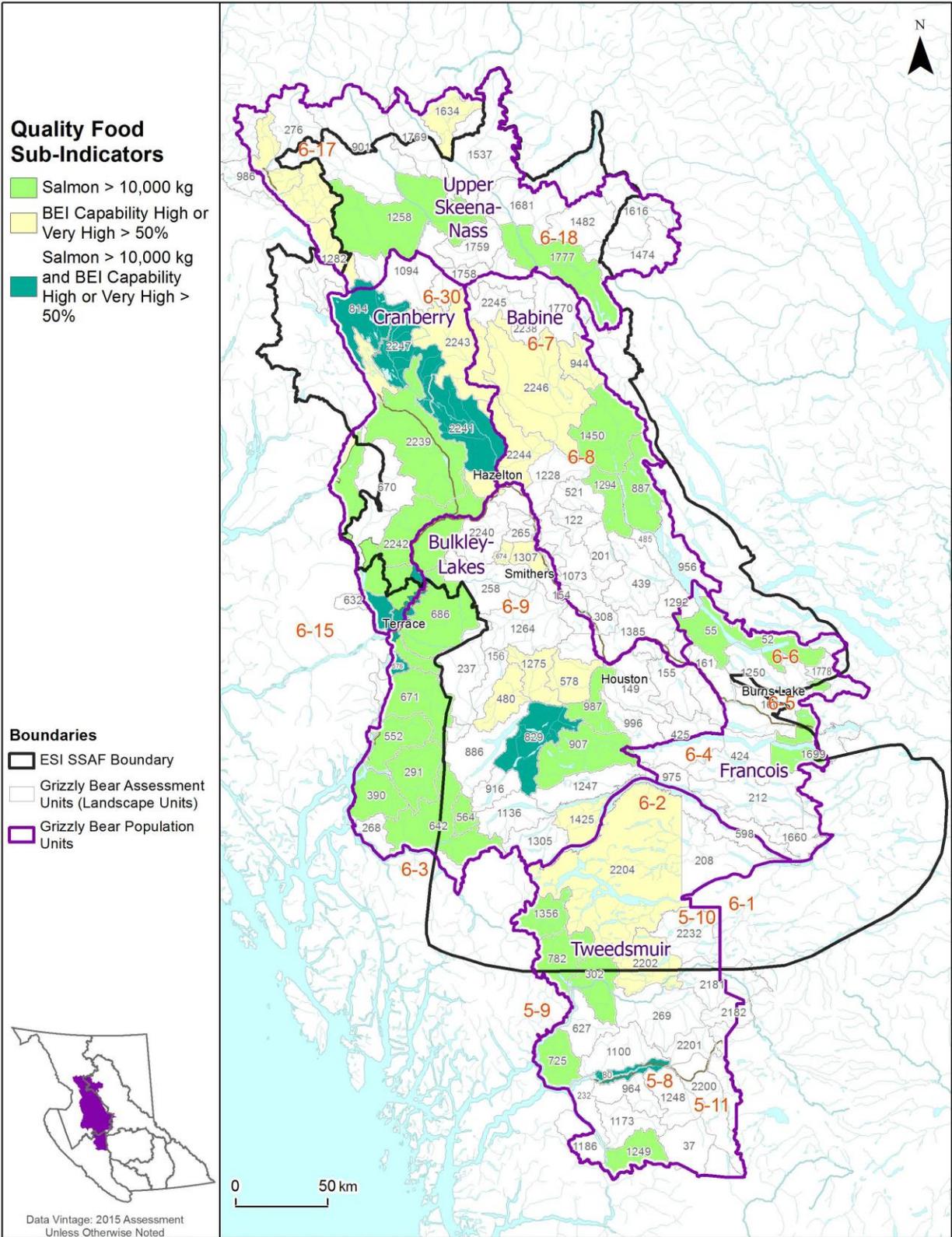


Figure 5.9 Quality Food, coloured units have quality grizzly bear food– Skeena ESI

4.10 Quality Habitat Protected

Indicator Description: At a coarse scale, Broad Ecosystem Inventory (BEI) units can provide an estimate of habitat capability for abundance of seasonal food. At a 1:250,000 scale, BEI has been used to rate grizzly bear habitat capability and suitability across the province into six classes (very high-1, high-2, moderate-3, low-4, very low-5, nil-6)ⁱⁱ. At a finer scale (1:20,000 or sometimes 1:50,000), Terrestrial Ecosystem Mapping (TEM) or Predictive Ecosystem Mapping (PEM) can provide more precise information. Future iterations of habitat capability for abundance of seasonal food can be enhanced using these finer resolution inventories.

Conservation areas provide some level of habitat protection or restrict some human activity and include provincial parks, national parks, wildlife management areas, visual quality areas, etc. (see Provincial Grizzly Bear protocol for a full list of categories used for this assessment).

Habitat protection has two indicators:

1. Habitat capability. This indicator reports the amount of high and very high capability¹⁴ grizzly bear habitat within a LU that is under some form of legal protection (e.g., parks, wildlife management areas, old growth management areas, indigenous protected areas). Habitat capability for grizzly bears is categorized into six classes from very high to nil in the BEI.

2. Wildlife habitat areas. This indicator reports the presence or absence of conservancies that contribute to grizzly bear habitat protection within a LU.

Interpretation Key:

Habitat capability:

- **Class 1:** LUs with >60% of very high and high capability habitat protected are low risk to grizzly bears.
- **Class 2:** LUs with 30 to 60% of very high and high capability habitat protected are moderate risk to grizzly bears.
- **Class 3:** LUs with < 30% of very high and high capability habitat protected are high risk to grizzly bears.

Wildlife habitat areas:

- If > 0.05% of the LU comprises grizzly bear WHAs, WHAs are considered present.
- If <0.05% of the LU comprises grizzly bear WHAs, WHAs are considered absent.

Assessment Results:

See Figure 5.10

¹⁴ Capable habitat is an area that, under optimal natural conditions will provide grizzly bear life requisites.

Description:

In the Skeena ESI, 5 of 78 LUs (6%) have greater than 60% of high-capability grizzly bear habitat protected (e.g., in parks, wildlife management areas, old growth management areas, and WHAs for other species). These LUs are concentrated primarily in the south of the Tweedsmuir GBPU, in the areas of Tweedsmuir Provincial Park; a few additional LUs with 60% of high-capability grizzly bear habitat protected area are scattered in the Bulkley-Lakes, Cranberry, and Upper Skeena-Nass GBPUs.

A total of 16 LUs (21%) in the Skeena ESI area were assessed as having 30-60% of high-capability grizzly bear habitat protected and are scattered evenly across the six GBPUs. The remaining 57 LUs (73%) are assessed as having less than 30% of high-capability grizzly bear habitat protected. The LUs with the lowest amount of high-capability habitat protected are concentrated in the 5 northern GBPUs.

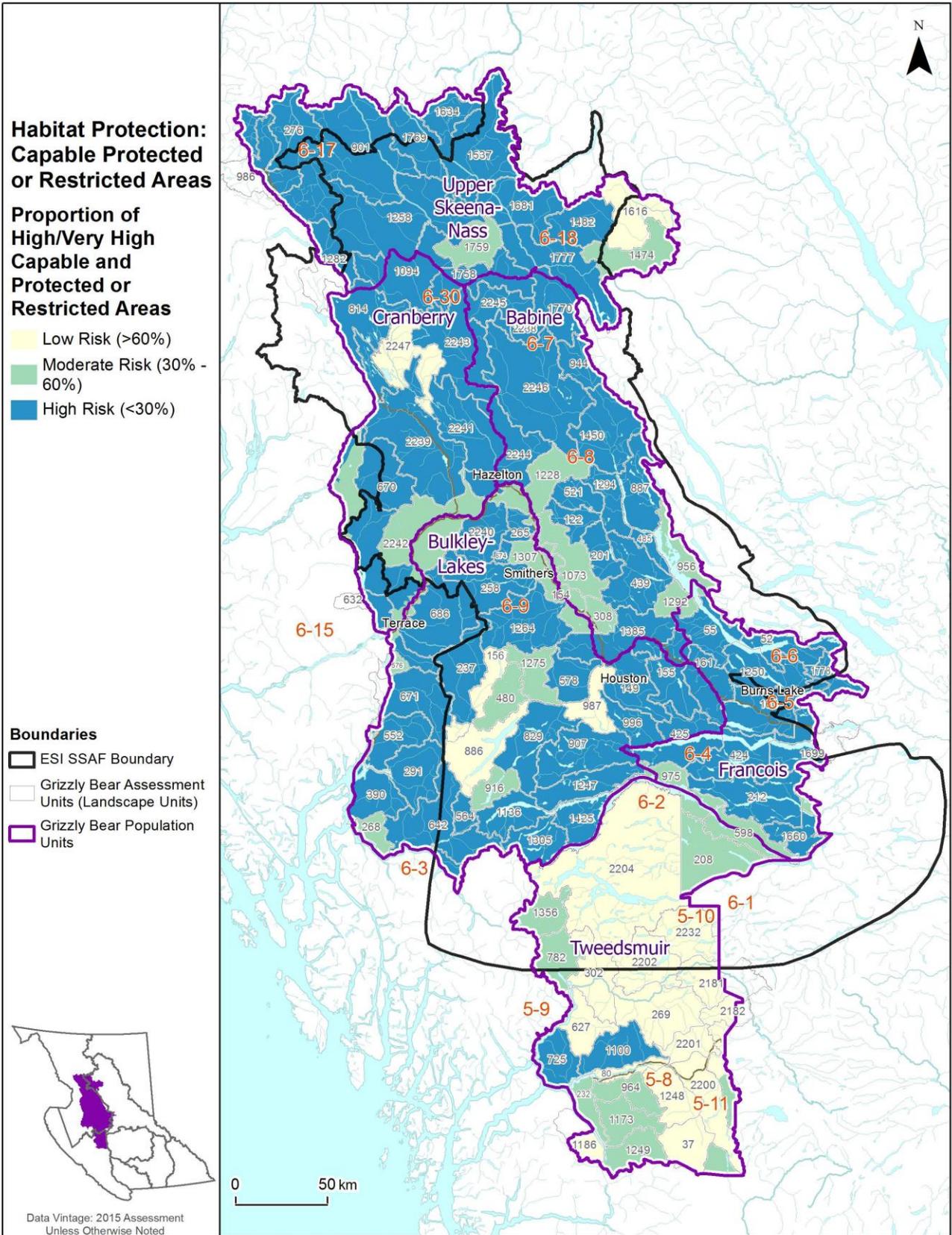


Figure 5.10 Quality Habitat Protected – Skeena ESI

5 Interpretation and Key Drivers of Results

The following section provides a concise summary of the assessment results for each of the indicators along with an interpretation of the key drivers that influence these results. Commentary is provided to identify where attention is needed to improve assessment results within the Skeena ESI area. Finally, potential next steps for improving and enhancing grizzly bear populations and habitat in the region are summarized.

5.1 Summary of Assessment Results

Based on their assessment of the above 10 indicators, regional specialists and First Nations of the Skeena ESI suggest resource managers focus attention on the highest utility indicators: core security area, hunter day density, road density, and quality habitat protected.

In addition to the indicators assessed in this report, other indicators worth exploring in the Skeena ESI include: presence of black bears in grizzly bear habitat (competition) and threats associated with backcountry recreation (i.e., high use trails can displace bears) A measure of connectivity would also provide a good indicator.

Future environmental and industrial trends will be important to consider when determining next steps for managing grizzly bear populations and habitat in the Skeena ESI. For example:

- Liquefied Natural Gas (LNG) pipeline construction and post-construction;
- past logging will create more closed-canopy forests in future, which are not suitable grizzly bear habitat;
- continued industrial and urban expansion would further reduce viable grizzly bear habitat; and,
- effects of climate change on grizzly bears are uncertain, but effects on vegetation productivity in years of drought and rapid declines in salmon stocks may occur. If natural forage production decreases, bears may be more inclined to seek forage in human-dominated areas, potentially leading to increases in human-bear conflicts and consequent bear mortalities.
- consider factors that influence salmon availability in the future (ie. salmon population trends, water temperature);

Recent Government decisions to develop a Provincial Grizzly Bear Management Plan, to ban hunting of grizzly bears across the province, and to modernize land use plans will be instrumental in informing the Skeena ESI's actions to address this report. Moving forwards however, additional monitoring and assessment of grizzly bear population abundance, distribution, genetic isolation and diet will support validation the assumptions underlying the assessments such as provided in this in reporting. Expansion of land use planning, similar to what has been conducted in the Gitanyow Lax'yip Land Use Plan, with very significant, legal protection for species such as grizzly bears will be required and time is of the essence as we already know that most of the Skeena ESI area has already been impacted beyond the point where we can be certain that the landscape will support populations of grizzly bears into the future.

5.2 Skeena ESI Commentary

The Skeena ESI region is an area that has seen extensive resource development over the last 70+ years, supporting several of the world's largest sawmills, a massive hydro-electric reservoir and powerlines to move energy to population centers and large-scale mining developments and now pipelines to support B.C.'s economic agenda for a LNG industry. Climate change and the ensuing mountain pine beetle epidemic has caused intensively rapid deforestation and the road development and transportation effects required to facilitate logging, transportation of logs to mills and ports, fighting of wildfires and efforts to reforest. These developments, along with the development of new communities, new industries such as guided viewing of grizzly bears, commercial fishing of salmon that grizzly bears rely on, has happened on top of, and without the support from, many different First Nations groups, and also without any actual on-the-ground study of grizzly bear populations, until the Cranberry GBPU study conducted through ESI in 2018.

Still, grizzly bears persist in this region. Moving forward, grizzly bears are too important of a species to manage them entirely based on modelling, assumptions, and office-based expert projections. First Nations community members are being trained through ESI on how to conduct studies to determine population densities, how and where to establish hair snag plots, how to collect, store and catalogue hair samples and how to interpret the results. As development continues, a better understanding of grizzly bear population abundance and density, movement behaviour, and diet composition will inform wildlife stewards. This will hold industry accountable for their impacts and better quantify those impacts in terms of grizzly bear individual and population health. In this way, ESI is changing the way we manage grizzly bears and other species in B.C.

6 Monitoring

6.1 Summary of Existing Monitoring Efforts

Gitanyow Indigenous Stewardship Project (ISP)

A representative from Gitanyow First Nation has provided a summary of the Gitanyow Indigenous Stewardship Project (ISP) progress report:

In 2019 the Gitanyow Hereditary Chiefs contracted Clayton Apps of Aspen Consulting to conduct a hair-snag grizzly bear population assessment in the Cranberry Grizzly Bear Population Unit (GBPU). This project was funded primarily through ESI and secondarily through a grant from Natural Resource Canada's Major Projects Management Office. The study focussed on population abundance, distribution and connectivity.

For this study a 7 by 7 km grid was overlaid on a representative portion of the Cranberry GBPU that included Cranberry River lowlands up to alpine areas. Using 42 core sample sites where a 100 foot (maximum) barbed wire perimeter was established, 5 litres of well rotted, liquified fish bait was applied over three sampling sessions, approximately 2-3 weeks apart. Re-detection rate of grizzly bears was relatively high indicating sites were effective at attracting bears within the grid area and 1911 hair samples were collected. Analysis of the data indicated a grizzly bear density of 45.7 grizzly bears / 1000 km², an estimated 102 (95% CI = 74 – 141) grizzly bears in the study area and 516 (95% CI = 375 – 709) grizzly bears estimated in the Cranberry GBPU. These results indicate a healthy population at the upper end of scientifically derived population estimates in the BC interior in recent years (Apps and Koch 2019).

Monitoring from the Office of the Wet'suwet'en

A representative from the Office of the Wet'suwet'en provided a summary on the existing monitoring taking place on Wet'suwet'en territories:

With the issue of grizzly bear populations in the decline, the Skeena Region Nations made a concentrated effort to get more data regarding the range and identification of grizzly bears within our specific territories. Through the ESI project the Skeena region group was able to conduct training utilizing the expertise of Clayton Apps for training. The Office of the Wet'suwet'en have conducted several locations of grizzly bear hair-snare DNA sample sites within Wet'suwet'en territories. Additionally, we've utilized Industry (ex: Telkwa Coal, BC Hydro) to pay for grizzly bear hair-snare studies of their proposed areas of work for sample results. Similarly, Gitanyow has conducted a more in-depth study design regarding this method of sampling. Samples have been submitted into a specific laboratory for analysis, and identification.

Monitoring from the Gitksan Nation:

A representative from Gitksan First Nation provided a summary of the grizzly bear monitoring that is taking place on Gitksan territory:

Through the contract with Clayton Apps, which Gitanyow Nation managed on behalf of the SSAF, there was budget carved aside for training and mentorship of other Nations. The Gitksan Nation was selected to set up two hair snag sample sites within the Gitksan Lax'yip; specifically, within Wilp Gwiiyeehl/Xantwx Lax'yip. The sites were selected strategically based on, first, ensuring we have permission to access the Lax'yip from the Simogyet, and, secondly, the sites would provide valuable DNA information that would help explore if the grizzly bears from the Cranberry area were related to the bears within the Kispiox watershed. The two hair snag locations had game cameras installed as well to understand the wildlife diversity drawn in by the bait. Of the two sampling locations, only one produced evidence of a grizzly presence.

6.2 Other Initiatives to Inform Monitoring

Indigenous Stewardship Project Guardian Programs

Gitksan and Gitwangak have observed the work completed by the Gitanyow Lax'yip Guardians and have chosen to focus their Indigenous Stewardship Projects (ISPs) on piloting guardian programs within their own communities. The creation of these Guardian Programs has demonstrated truly successful collaboration through the development of a Guardian network across Nations, allowing for sharing of information and alignment of approaches and efforts. The Guardian Program provides Guardians on the ground, monitoring and assessing the environment.

Conservation Officers

A Conservation Officer (CO) from the Skeena Region has provided the following outline describing the interactions between CO's and grizzly bears:

Conservation Officers in the Skeena ESI Region are involved with grizzly bears in the following ways:

- Grizzly Bears trapped and relocated by CO's because of a human wildlife conflict are ear tagged for future identification. Occasionally, grizzly bears relocated by CO's will be fitted with a GPS collar for tracking and studying if collars are available and provided by FLNRO
- Grizzly Bears killed by CO's because of a human wildlife conflict are compulsory inspected which includes the submission of hair and tooth samples from any Grizzly Bear
- Grizzly Bear orphaned cubs are delivered to the Northern Lights Wildlife Shelter if strict conditions are met on the condition of the cub at the time of capture
- Grizzly Bears killed in defense of life or property are seized by CO's and are compulsory inspected

- Grizzly Bears that are injured by motor vehicle or rail collisions and are beyond the point of natural healing and recovery are put down by CO's. Compulsory inspections are conducted on these bears.
- Grizzly Bears killed illegally are seized by CO's and are compulsory inspected

British Columbia Compulsory Wildlife Inspection is required provincially for specific species which are: grizzly bears, mountain goats, mountain sheep, cougars and caribou. Compulsory Inspection is also required on a regional basis for: moose, black bear, lynx, bobcat and wolf. The purpose of the Compulsory Inspection is to provide wildlife managers with information, such as sex, age and condition, to better inform management and hunting regulations to protect species populations.

Gitanyow Fisheries Authority and Lax'yip Guardians

A representative from Gitanyow Fisheries Authority provided the following summary of grizzly bear monitoring in the Hanna, Tintina, and Strohn Creeks:

During the 2013, 2015 to 2018 field seasons the Gitanyow Fisheries Authority conducted helicopter surveys of Hanna, Tintina and Strohn Creeks for the purposes of monitoring sockeye salmon spawner abundance and distribution. These creeks support high densities of grizzly bears that congregate to feed on spawning sockeye salmon. Although the helicopter surveys were not designed to enumerate grizzly bears, all incidental grizzly bear sightings were recorded. This work serves as an informal, qualitative form of monitoring that would be beneficial for any future work towards quantitative studies of grizzly bear abundance and distribution in the Meziadin watershed.

An important observation of relevance to grizzly bears through this fisheries work is that sockeye populations in the Meziadin Watershed have been declining, most notably in Hanna and Tintina Creeks. Although this decrease in food availability is expected to have a negative impact to grizzly bears, until further work is done it remains unclear how a substantially declining food source may affect grizzly bear abundance, distribution and health.

The Gitanyow Lax'yip Guardians have also been documenting all grizzly bear roadkills that they encounter or are notified of, along the sections of Highway 37 and 37A that run through the Gitanyow Territory. Two large, mature sows have been killed in recent years in the Strohn and Hanna Creek areas, so this is being monitored closely. As well, a large male grizzly bear was killed by Conservation Officers late in the fall of 2019 after breaking into a residence and causing issues at a nearby camp. It is important to monitor these types of incident in addition to other more quantitative forms of population monitoring (Pers. Comm. Flint Knibbs, Conservation Officer, December 2019).

BC Parks

A representative from BC Parks has provided a summary on the current grizzly bear monitoring, as well as human bear conflict issues, taking place in Babine River Corridor Park:

Babine River Corridor Park was established, via direction in the Bulkley and Kispiox Land and Resource Management Plans, in part due to the high valued grizzly bear habitat within and juxtaposed with the

Babine River valley. The park has a management direction statement and associated background document as well as numerous regulatory recreational restrictions to minimize human bear interactions (MOE 2000). There has been specific management plan direction drafted for the immediate area adjacent with the southern entrance to the park, however, this process has not been completed and, as such, default management direction is as per the management direction statement.

There have been additional higher-level planning processes completed for the area surrounding the park; West Babine Sustainable Resource Management Plan and Bulkley Landscape Unit Plans. The Babine Watershed Monitoring Trust was created concurrent with the West Babine Sustainable Resource Management Plan with grizzly bear habitat monitoring work having been completed (Wellwood 2014). There have also been operational road access considerations given human presence pressure associated with the southern entrance. It has been anecdotally suggested that recent openings of the connector have been occurring outside of the designated time period which, in combination with forest harvesting throughout the watershed, add risk concerns regarding human bear interactions.

The provincial policy of closing an area to recreational pursuits to minimize human bear conflict is not employed in the south entrance area given significant recreational pressures. There are operational commitments from BC Parks staff to monitor angling and associated camping activities in August and early September at the southern entrance given the highest potential period of human bear conflict. Universal signage has been recently developed and deployed to facilitate open communication of rules designed to mitigate human bear interactions. Game trail cameras have been deployed by BC Parks staff over numerous years along trails north and south of the river to monitor human bear interactions. It is evident from the photos that alterations in bear activity (nocturnal and crepuscular time period use) occur given extensive human angling activities during the late summer/early fall timeframe. It is also of concern that in several of the years there has been more observational evidence of black bear versus grizzly bear activity than has generally occurred in the past.

BC Parks supports a population census be implemented in the Babine population unit to attain a baseline for future population monitoring comparisons. BC Parks is currently developing an internal funding request proposal for monitoring human bear interactions associated with river rafting bear viewing activities in and about grizzly drop.

6.3 Tier 1 and Tier 2 Assessment and Monitoring

A landscape level, or Tier 1 assessment, provides a broad overview of the risks to a value. Areas identified as issues require field-based validation, given the limitations of remotely sensed data. It is also a relatively inaccurate representation of an exact location in the world. Tier 2 assessment is designed to test and validate the Tier 1 assessment’s generalizations at a specific location on the ground. This Tier 2, field collected data is integrates into the Tier 1 assessments, both by refining the generalized landscape level assessment models and creating better raw input data for the landscape level assessments. Conversely, the overview Tier 1 assessment guides the Tier 2 assessment to focus on a specific location by providing a broad context of the landscape, as well as helping guide where Tier 2 assessments should occur on the landscape.

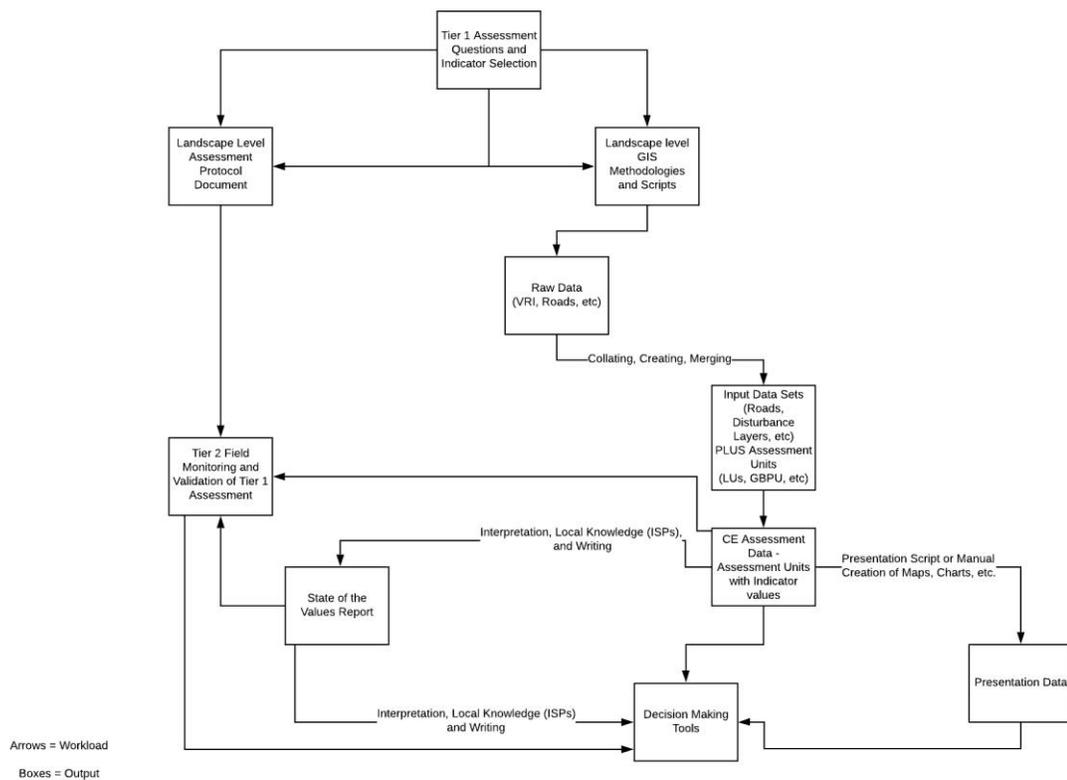


Figure 11 Conceptual diagram of the relationship between Tier 1 assessment and Tier 2 monitoring.

Tier 2 emphasis on monitoring in the Skeena ESI, to date, has focused on DNA hair snag and camera detection, primarily to address the four goals outlined by Apps in 2017: (1) absolute population size and density, (2) population trend and demography, (3) occurrence and distribution relative to influential factors, and (4) population connectivity and fragmentation.

One of the difficulties in immediate or near-term implementation of Tier 2 population monitoring is the lack of available baselines in the Skeena. Decisions about Tier 2 population monitoring should be made in recognition that “year 1 population monitoring” may have to serve as a baseline for future

comparison. For example, the Cranberry / Gitanyow DNA study will function as a 2018 benchmark against which changes may be assessed for that area.

As a first priority, Tier 2 monitoring should be implemented in landscapes where multiple Tier 1 indicators were flagged. Specifically, there are areas in the Skeena ESI where monitoring should begin at the very basic level to address questions such as are those landscape units still occupied by adult female Grizzly bears? This question can be addressed through DNA hair snag and camera detection.

Opportunities for Tier 2 monitoring should be directed at functional, intact ecosystems and areas within higher ranked GBPU's potentially to function as Benchmarks. As well, localized areas where remedial management has been implemented (or will be) should be targeted. Tier 2 monitoring could easily be designed under an adaptive management design that would include indicators chosen deliberately to assess the performance of remedial management intervention. Braid and Nielsen (2015) give the following advice:

“Priority source-like habitats identified key conservation areas where future developments should be limited, whereas priority sink-like habitats identified key areas for mitigating road-related mortality risk with access management. Systematic conservation planning methods can be used to complement traditional habitat-based methods for individual focal species by identifying habitats where conservation actions (both protection and restoration) have the highest potential utility.”

The evaluation of habitat protection of seasonally important habitats, as WHAs, or the implementation of silviculture or prescribed fire treatments to maintain or enhance berry habitats would be ideal targets for Tier 2 Monitoring efforts, as would management to ensure Grizzly bear access to spawning Salmon. Tier 2 monitoring could be implemented to assess landscape – level berry habitat supply where Tier 1 results indicate a potential bottleneck created by extensive areas of closed-canopy, conifer dominated second growth. Alternatively, monitoring could be designed to monitor use of protected WHAs by establishing permanent vegetation plots or salmon census areas and bear use with cameras and hair snags. Note that there are several examples of finer scale habitat mapping and analysis in the Skeena ESI area (MacHutchon and Mahon 2003) to build upon.

Tier 2 monitoring should be contemplated where Tier 1 results indicate road-related: 1) fractures and fragmentation; 2) mortality sinks; and 3) extremely high mortality risks (e.g. high suitability habitats with high open road densities in the front country). Traffic pattern and human use monitoring (e.g. recreational user-days) will help determine if displacement or habitat alienation is occurring. Monitoring closed roads (e.g. for ATV or Motorcycle use) will determine the effectiveness of access controls.

One of the highest priority management actions in the region, in addition to the completion of WHA establishment, should be the recapture expansion and linkage of core security areas where existing patches are small and fragmented such as in parts of the Francois GBPU. Long-term monitoring should be implemented to assess the utility and methodologies used to recover and link core security areas. The actions are complementary; as habitats are identified for the establishment of WHA's, the possibility of surrounding - and linking them - with core security areas should also be explored.

Finally, Tier 1 results currently indicate extensive areas of grizzly habitat in Front Country settings in some parts of the Skeena ESI area. Recreational use, if un-managed, has the potential to displace bears from preferred habitat and/or elevate mortality risks. The Babine at Grizzly Drop may be such an area (Wellwood 2014). Further, Tier 2 monitoring should be implemented in unique settings such as in the Babine River Corridor (Ciarniello et. al. 2012).

7 Potential Next Steps

Based on the results outlined in this report, resource specialists and First Nation and Provincial leaders may wish to consider the following opportunities to enhance grizzly bear populations and habitat in the Skeena ESI:

- Expand on existing research, inventory, and monitoring initiatives to refine the region's understanding of grizzly bear populations and refine the region's understanding of grizzly bear populations, density, habitat use, diet, and threats, especially in higher-risk GBPU's.
- Incorporate results into Provincial Grizzly Bear Management Plan to help identify risks to Grizzly Bears and identify ESI GBPU's management priorities.
- Based on analysis of research, inventory and monitoring outcomes, consider the following actions to reduce risks to grizzly bear populations and habitat:
 - establish grizzly bear WHAs in locations where grizzly bear habitat capability is high but populations are threatened by the combined effects of high road density, high hunter day density, and low core security areas;
 - deactivate and/or restrict access on roads and corridors in high priority grizzly bear habitat, especially in areas where human infrastructure/activity is impacting the ability of grizzly bears to travel across their range (i.e., to connect and enhance core security areas); and
 - adjust forest planning and practices (including prescribed fire) in priority grizzly bear habitat with a view to conserving or enhancing seasonal foraging habitats (e.g., berry production).
 - Apply Huckleberry mapping methods being Provincially developed to capture berry productivity.

Appendix 1—Grizzly Bear Backgrounder

Species Information

Grizzly bears are highly mobile omnivores with large spatial requirements. Grasslands and shrublands integrated with forests, subalpine meadows and forests, and alpine communities are typical grizzly habitat.

Grizzlies feed on a wide variety of plants, alternating throughout the year depending on availability and abundance. Grizzly diet in spring and early summer consists mainly of forbs, grasses, sedges and other herbaceous vegetation. Moist fens and riparian areas produce high densities of prime summer vegetation. In late summer and fall, berries and roots are an important additional component of their diet.

Ridgetops, talus slopes, avalanche chutes, creek/river bottoms, fluvial and alluvial floodplains, wetlands and riparian areas are seasonally important foraging areas. 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. The capacity of most ecosystems to produce abundant vegetation for grizzly bears is limited by annual rainfall and a growing season length.

Ants, ground squirrels, and spawning salmonids are also consumed as well as ungulates opportunistically, typically those in poor condition. Ungulates (primarily elk but also moose, deer, and woodland caribou) are an important food source for grizzly bears throughout the year but especially in the fall. More research is needed to determine the extent to which ungulate meat contributes to the density and productivity of grizzly bear populations throughout the province.

In addition to suitable feeding areas, grizzlies require forest cover for security and bedding. Grizzly den sites vary from alpine/subalpine talus slopes, shrub fields and krummholz¹⁵ areas to various timbered subalpine and lowland areas. Most dens are strategically located to ensure early and long-lasting snow cover for insulation. 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.

Species Status

Given their sensitivity to human activities and disturbance, grizzly bears are a species of “Special Concern” in Canada as assessed by COSEWIC and are listed under the *Species At Risk Act* (Ross 2002). Under B.C.’s Conservation Framework, grizzly bears are a high priority for conservation.

Threats to Grizzly Bears

Natural resource activities disturb grizzly bear habitat, contributing to habitat loss, alteration and fragmentation over time. Secondly, the roads and corridors associated with these activities enable humans to access grizzly bear habitat, which in turn increases the risk of human-caused bear mortality.

¹⁵ Krummholz are areas of stunted windblown trees growing near the tree line on mountains.

Grizzly bears are attracted to livestock and grain crops as non-natural food sources, increasing the potential for bear mortality in these human-bear conflict situations.

Research (Stenhouse et al, 2013) indicates that grizzly bears also use linear corridors for foraging, anting, digging, berry feeding, bedding and travel which increases the chance of encountering humans, human activity and the non-natural attractants therein. This can include urban and rural communities, industrial camps and worksites, and hunting camps.

Not surprisingly, a direct predictor of threats to grizzly bears is human access to grizzly bear habitat, and the behaviour of individuals who enter bear habitat (including whether they carry firearms). The increasing density of roads and other linear corridors increases the potential for bear mortality (due to hunting before the B.C. closure), human-bear conflicts, poaching, or collisions with vehicles and trains), and displacement of bears from their preferred habitats due to noise and human activity¹⁶.

In addition to linear corridors, river boats and helicopters are used by adventure recreation operators, guide-outfitters, trappers and outdoor enthusiasts to access the backcountry.

Reservoirs located in grizzly bear habitat impact the ability of bears to travel across their range, and loss of riparian forests reduces their thermal cover and food sources.

The anticipated effects of climate change on grizzly bears

The climate in the Skeena ESI area has changed over the past century and is expected to continue to change. Projections suggest the region may warm, on average, by about 3.1°C by mid-century, similar to moving from Smithers to Merritt (3.6°C warmer).

Climate change will likely influence grizzly bear habitat via shifts to protein (e.g., salmon and ungulates) and vegetative (e.g., berries, skunk cabbage) food sources. Changed precipitation patterns will alter hydrology, influencing fish habitat. Warmer waters will impact salmon survival in both marine and freshwater systems, decreasing this critical food source for grizzly bears in the region. Ungulate food sources will also change; more frequent freeze/thaw regimes and increased parasites will likely impact moose survival; white-tailed deer and elk are less vulnerable. Increased wildfires may re-establish early seral ecosystems and provide habitat for berry bushes, but drought will potentially reduce the availability and quality of some types of berries (e.g., black huckleberries) as well as other fall vegetation.

Climate change will likely influence grizzly bear mortality by bringing bears and humans into closer contact, either by encouraging bears to forage closer to people as food sources vary in space and time, or by changing human land uses (e.g., by increasing salvage harvest) to bring people closer to bears. Warmer winter air temperatures may bring bears out of hibernation early, leading to possible mismatches with food availability and potentially increased lethal encounters with humans. Considerable uncertainty is associated with these factors.

For more information on the anticipated effects of climate change on ecosystems in the Skeena region, see Adapting natural resource management to climate change in the Skeena Region: Considerations for practitioners and Government staff and Climate Change Vulnerability of BC's Fish and Wildlife: First Approximation <https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/regional-extension-notes/skeenaen151125.pdf> (2016)

¹⁶ 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.

Objectives and Legal Protection

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

The Skeena ESI conducted a Legislative and Policy Gap Analysis that reviewed objectives and legal protection addressing Grizzly Bear in the Skeena Region.

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.”

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 Government may establish legally enforceable wildlife habitat areas and wildlife measures for grizzly bears in areas of high conservation priority. [Grizzly bear accounts and measures](#) provide provincial policy guidance to inform forest and range planning and practices within grizzly bear habitat (Les et. al. 2004).

Land use plans in the Skeena ESI 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.

In December 2017, the B.C. Government announced a provincial ban on grizzly bear hunting (other than hunting by First Nations for food, social and ceremonial purposes). Historically, hunting of grizzly bears was strictly regulated under the provincial *Wildlife Act*. Since 2001, grizzly bear hunting was not permitted in threatened GBPUs or in GBPUs with low bear population densities (i.e., the number of bears per 1000 km²) (FLNRO 2012). Where hunting was permitted, it was managed through limited entry hunts and quotas issued to guide outfitters.

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. 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 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.

Major industrial projects – such as mines, pipelines and hydropower generation projects – can be a threat to the future viability of the Skeena ESI grizzly bears. As such, the most important legal tool for protecting grizzly bear populations and habitat in the Skeena 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 may be subject to legally-binding conditions. These conditions specify that there must be a plan of action to mitigate impacts of the project to grizzly bear populations and habitat.

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 (OAG 2017). The government of B.C. committed to implementing the Auditor General’s recommendations by creating 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 Skeena ESI’s actions to sustain grizzly bear populations and habitat. The December 2017 decision to ban grizzly bear hunting across the province may further assist the Skeena ESI in sustaining grizzly bear populations.

Additional Resources

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

Expert Workshops, Community Engagement Workshops, All Nations Gatherings

- B.C. Government, 1995, [Conservation of Grizzly Bears in British Columbia](#)
- B.C. Government, 2004, [Accounts and Measures for Managing Identified Wildlife \(Grizzly Bear\)](#)

B.C. Government plans:

- 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](#).

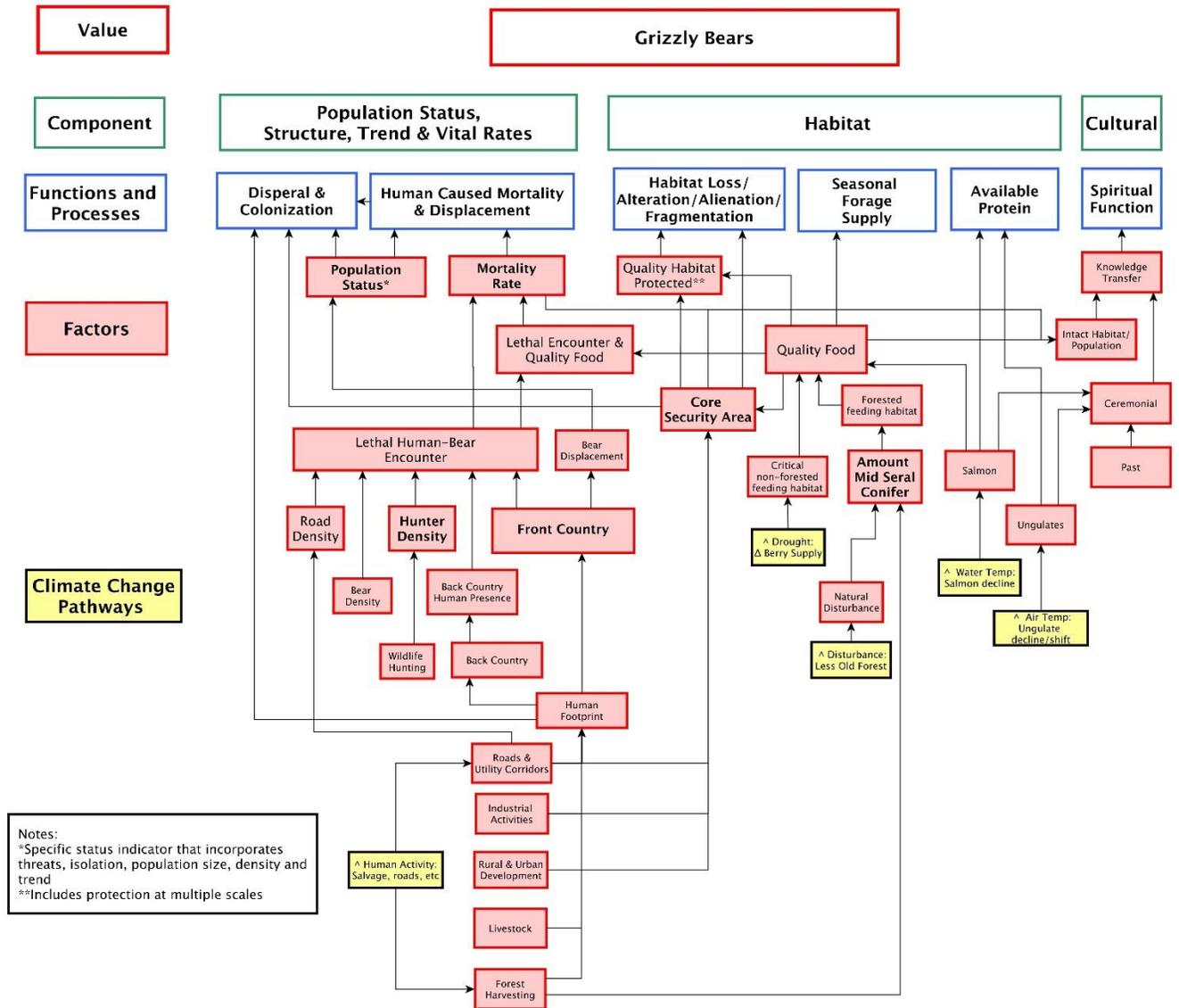
The following reports provide additional information or insights into the current condition of grizzly bears:

- B.C. Government, 2012, [Grizzly bear population status in B.C.](#)

- Stenhouse et al, 2013, [Grizzly bears and pipelines: response to unique linear features](#). This report summarizes research on the use of pipeline rights-of-way by grizzly bears in Alberta.
- Boulanger and Stenhouse, 2014, [The impact of roads on the demography of grizzly bears in Alberta](#). This report summarizes research on how road density affects grizzly bear population demographics and includes threshold road densities that may be used to manage population stability and recovery.
- B.C. Auditor General, 2017, [An Independent Audit of Grizzly Bear Management](#).
- 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. <https://www.for.gov.B.C..ca/tasb/slrp/lrmp/nanaimo/cencoast/docs/2013/cnc/Central-and-North-Coast-Order-Consolidated-Version-2013.pdf>
- Nielsen, S.E., Boyce, M.S., Stenhouse, G.B., 2004. Grizzly bears and forestry I. Selection of clear-cuts by grizzly bears in west-central Alberta, Canada. *Forest Ecology and Management* 199, 51–65.
- Pritchard, G.T., Robbins, C.T. 1990. Digestive and metabolic efficiencies of grizzly and black bears. *Can. J. Zool.* 68:1645-1651.
- Proctor, M.F., Nielsen, S.E., Kasworm, W.F., Servheen, C., Radandt, T.G., Machutchon, A.G., Boyce, M.S., 2015. Grizzly bear connectivity mapping in the Canada–United States trans-border region. *The Journal of Wildlife Management* 79, 544–558.
- Proctor, M.F., Paetkau, D., Mclellan, B.N., Stenhouse, G.B., Kendall, K.C., Mace, R.D., Kasworm, W.F., Servheen, C., Lausen, C.L., Gibeau, M.L., 2012. Population fragmentation and inter-ecosystem movements of grizzly bears in western Canada and the northern United States. *Wildlife Monographs* 180, 1–46.
- Schwartz, C.C., Haroldson, M.A., White, G.C., Harris, R.B., Cherry, S., Keating, K.A., Moody, D., Servheen, C., 2006. Temporal, spatial, and environmental influences on the demographics of grizzly bears in the Greater Yellowstone Ecosystem. *Wildlife Monographs* 161, 1–68.

Appendix 2—Conceptual Model for Assessing Grizzly Bears

This diagram illustrates how the indicators (a sub-set of the factors shown in the diagram)¹⁷ influence the functions and processes that support grizzly bear populations and habitat in B.C.



¹⁷ 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. Climate change pathways show how climate change is anticipated to impact key factors.

Appendix 3—Indicator Tables

Table 1 – Population Status and Density Summary by GBPU

GBPU	Status	Estimated Population ¹⁸	Total GBPU Area Excluding Water and Ice (km ²) ¹⁹	Estimated Bear Density (bears/1000km ²)	Total BEI Capable Weighted Area (km ²)
Babine	M3 - Medium	313	14,323	23	12,528
Bulkley-Lakes	M3 - Medium	439	23,884	20	18,659
Cranberry	M4 - Low	352	11,773	31	9,398
Francois	M2 - High	58	8,702	7	7,235
Tweedsmuir	M5 – Very Low	368	19,366	22	14,705
Upper Skeena-Nass	M5 – Very Low	755	16,999	47	13,028

Table 2 – Human-Caused Mortality by GBPU

GBPU Name	# of LUs in GBPU	# of LUs Flagged
Babine	20	16
Bulkley-Lakes	34	20
Cranberry	9	0
Francois	11	0
Tweedsmuir	24	11
Upper Skeena-Nass	15	2

¹⁸ The population estimate is based on the provincial model results; as a total of population estimates for each LU within the GBPU.

¹⁹ The total area excludes non-viable habitat such as water and ice (km²). Density is also present for area based on broad ecosystem inventory, weighted capable area (km²)

Table 3 - Core Security Area by GBPU

GBPU Name	# of LUs in GBPU	Secure Core BEI Capable Weighted Habitat Area (km ²)	BEI Capable Weighted Habitat Area (km ²)	Average Secure Core Area (%)	# of LUs Flagged for low core security
Babine	20	6,307	12,528	49%	14
Bulkley-Lakes	34	9,303	18,659	53%	20
Cranberry	9	6,134	9,399	65%	4
Francois	11	1,553	7,236	24%	10
Tweedsmuir	24	12,406	14,705	80%	3
Upper Skeena-Nass	15	11,977	13,029	91%	1

Table 4 - Front Country by GBPU

GBPU Name	# of LUs in GBPU	Average Front Country %	Average Back Country %	# of LUs Flagged in the GBPU
Babine	20	62%	38%	15
Bulkley-Lakes	34	58%	42%	24
Cranberry	9	50%	50%	7
Francois	11	79%	21%	11
Tweedsmuir	24	21%	79%	8
Upper Skeena-Nass	15	9%	91%	2

Table 5 – Hunter Day Density by GBPU

GBPU Name	Hunter Day Density from WMUs (hunters/km ²)	# of WMUs with >20% overlap in the GBPU	# of WMUs Flagged
Babine	0.91	2	0
Bulkley-Lakes	0.88	3	0
Cranberry	0.30	2	0
Francois	1.37	3	0
Tweedsmuir	0.17	6	0
Upper Skeena-Nass	0.12	3	0

Table 6 - Road Density by GBPU

GBPU Name	# of LUs in GBPU	Average Road Length (km) per GBPU	Total GBPU Area Excluding Water and Ice (Km ²)	Average Road Density for the GBPU (km / km ²)	# of LUs Flagged within the GBPU (over 0.75 km/km ² road density threshold)
Babine	20	568	14,323	0.9	14
Bulkley-Lakes	34	568	23,884	0.9	21
Cranberry	9	701	11,773	0.7	5
Francois	11	1,071	8,702	1.6	10
Tweedsmuir	24	171	19,366	0.3	4
Upper Skeena-Nass	15	117	16,999	0.1	1

GBPU Name	# of LUs in GBPU	Average % Mid-Seral Dense Conifer	# of LUs Flagged for indicator
Babine	20	8%	3
Bulkley-Lakes	34	5%	0
Cranberry	9	5%	0
Francois	11	15%	4
Tweedsmuir	24	8%	2
Upper Skeena-Nass	15	2%	0

Table 8 – Quality Food by GBPU

GBPU Name	# of LUs in GBPU	# of LUs Flagged for indicator
Babine	20	14
Bulkley-Lakes	34	17
Cranberry	9	2
Francois	11	8
Tweedsmuir	24	16
Upper Skeena-Nass	15	10

Table 9 – Quality Habitat Protected by GBPU

GBPU Name	# of LUs in GBPU	BEI Capable Weighted Habitat (km ²)	Area and Average % Protected*	BEI High Capable Weighted Habitat (km ²)	Area and Average % Protected*
Babine	20	12,528	2,431 km ² /20%	5,156	745 km ² /17%
Bulkley-Lakes	34	18,659	4,658 km ² /25%	7,023	1,770 km ² /25%
Cranberry	9	9,399	2,351 km ² /23%	5,428	1,223 km ² /23%
Francois	11	7,236	1,845 km ² /25%	512	72 km ² /16%
Tweedsmuir	24	14,705	11,773 km ² /60%	6,228	5,441 km ² /68%
Upper Skeena-Nass	15	13,029	2,614 km ² /19%	5,9767	769 km ² /18%

*Protected areas include: protected areas, ecological reserves, management areas, provincial parks, forest recreation sites, old growth management areas, ungulate winter ranges, areas reserved for public use, areas subject to visual quality objectives, and wildlife habitat areas.

Table 10– Summary of Indicator Flags by Landscape Unit Within a GBPU

Indicator	Key to Interpreting Risk Rating
<i>Flag = assessment results indicate a higher risk to grizzly bears and are flagged for management attention</i>	
Population status	Flag = grizzly bear population in GBPU is threatened (Calculated at the GBPU level)
Bear density	Flag = bear densities in LU are less than 10 bears per 1000 km ²
Mortality rate	Flag = annual mortality rate in LU exceeds regionally specified mortality limits
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 1.51/km ²
Road density	Flag = road densities in LU are greater than 0.6 km/km ²
Mid-seral 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 status	Bear density	Mortality rate	Core security area	Front country	Hunter day density	Road density	Mid-seral conifer	Quality food	Quality habitat protected
Babine										
201 Chapman	Flag	0	Flag	Flag	Flag	0	Flag	0	Flag	Flag
308 Deep Creek	Flag	0	Flag	Flag	Flag	0	Flag	Flag	Flag	0
122 Blunt	Flag	0	Flag	Flag	Flag	0	Flag	0	Flag	Flag
521 Harold Price	Flag	0	Flag	0	Flag	0	0	0	Flag	Flag
485 Granisle	Flag	0	Flag	Flag	Flag	0	Flag	Flag	Flag	Flag

GBPU/ Landscape Unit	Population status	Bear density	Mortality rate	Core security area	Front country	Hunter day density	Road density	Mid-seral conifer	Quality food	Quality habitat protected
944 Nilkitkwa	Flag	0	0	0	0	0	0	0	0	Flag
956 North Babine	Flag	0	Flag	Flag	Flag	0	Flag	0	Flag	0
887 Morrison	Flag	0	Flag	Flag	0	0	Flag	0	0	Flag
1228 Suskwa*	Flag	0	Flag	Flag	Flag	0	Flag	0	Flag	0
1073 Reiseter	Flag	0	Flag	Flag	Flag	0	Flag	0	Flag	0
1450 Babine	Flag	0	Flag	Flag	Flag	0	Flag	0	0	Flag
1292 Topley*	Flag	0	Flag	Flag	Flag	0	Flag	Flag	Flag	0
1294 Torkelson	Flag	0	Flag	Flag	Flag	0	Flag	0	0	Flag
1385 Valley*	Flag	0	Flag	Flag	Flag	0	Flag	0	Flag	Flag
1770 Squingula	Flag	0	0	0	0	0	0	0	Flag	Flag
439 Fulton	Flag	0	Flag	Flag	Flag	0	Flag	0	Flag	Flag
2238 Babine	Flag	0	0	0	0	0	0	0	Flag	Flag
2244 Middle Skeena South*	Flag	0	Flag	Flag	Flag	0	Flag	0	0	Flag
2245 Upper Skeena	Flag	0	0	0	0	0	0	0	Flag	Flag
2246 West Babine	Flag	0	Flag	0	Flag	0	0	0	0	Flag
Bulkley-Lakes										
149 Buck	Flag	0	Flag	Flag	Flag	0	Flag	0	Flag	Flag
154 Bulkley*	Flag	0	Flag	Flag	Flag	0	Flag	0	Flag	0
155 Bulkley*	Flag	0	Flag	Flag	Flag	0	Flag	0	Flag	Flag
237 Clore	Flag	0	0	0	Flag	0	Flag	0	Flag	Flag
258 Copper	Flag	0	0	0	Flag	0	0	0	Flag	Flag
265 Corya	Flag	0	0	0	Flag	0	Flag	0	Flag	Flag
268 Crab	Flag	0	Flag	0	0	0	0	0	Flag	0
291 Dala	Flag	0	Flag	0	Flag	0	0	0	0	Flag
390 Falls	Flag	0	Flag	0	0	0	0	0	0	Flag
156 Burnie	Flag	0	0	0	0	0	0	0	Flag	0
161 Burns Lake West*	Flag	Flag	0	Flag	Flag	0	Flag	0	Flag	Flag
552 Hirsch	Flag	0	0	0	Flag	0	Flag	0	0	Flag
671 Kitimat**	Flag	0	0	Flag	Flag	0	Flag	0	0	Flag
674 Kitseguecla	Flag	0	0	Flag	Flag	0	Flag	0	0	Flag
564 Horetzky	Flag	0	Flag	0	0	0	0	0	0	Flag
576 Hot Springs**	Flag	0	0	Flag	Flag	0	Flag	0	0	0
578 Houston - Tommy	Flag	0	Flag	Flag	Flag	0	Flag	0	0	Flag
642 Kemano	Flag	0	Flag	0	0	0	0	0	0	Flag
480 Gosnel	Flag	0	Flag	Flag	Flag	0	0	0	0	0
916 Nanika	Flag	0	Flag	0	0	0	0	0	Flag	0
987 Owen	Flag	0	Flag	Flag	Flag	0	Flag	0	0	0
996 Parrott	Flag	Flag	0	Flag	Flag	0	Flag	0	Flag	Flag
829 Kidprice	Flag	0	Flag	Flag	Flag	0	Flag	0	0	Flag
886 Morice Lake	Flag	0	Flag	0	0	0	0	0	Flag	0
907 Nadina	Flag	0	Flag	Flag	Flag	0	Flag	0	0	Flag
1247 Tahtsa	Flag	Flag	Flag	Flag	Flag	0	Flag	0	Flag	Flag
1136 Sibola	Flag	Flag	Flag	0	0	0	0	0	Flag	Flag

GBPU/ Landscape Unit	Population status	Bear density	Mortality rate	Core security area	Front country	Hunter day density	Road density	Mid-seral conifer	Quality food	Quality habitat protected
1425 Whitesail	Flag	Flag	Flag	Flag	0	0	Flag	0	0	Flag
1264 Telkwa	Flag	0	0	Flag	Flag	0	Flag	0	Flag	Flag
1275 Thautil	Flag	0	Flag	Flag	Flag	0	0	0	0	0
1305 Triotsa	Flag	Flag	Flag	0	0	0	0	0	Flag	Flag
1307 Trout Creek	Flag	0	0	Flag	Flag	0	Flag	0	0	0
2240 Gitsegukla	Flag	0	0	Flag	Flag	0	Flag	0	Flag	Flag
686 Kleanza - Treasure	Flag	0	0	Flag	Flag	0	Flag	0	0	Flag
Cranberry										
670 Kiteen	Flag	0	0	0	Flag	0	0	0	Flag	Flag
632 Kalum**	Flag	0	0	Flag	Flag	0	Flag	0	0	Flag
814 Madely	Flag	0	0	Flag	Flag	0	Flag	0	0	Flag
1094 Sallysout*	Flag	0	0	0	0	0	0	0	Flag	Flag
2242 Lower Skeena*	Flag	0	0	0	Flag	0	Flag	0	0	0
2239 Cranberry	Flag	0	0	Flag	Flag	0	Flag	0	0	Flag
2241 Kispiox South	Flag	0	0	Flag	Flag	0	Flag	0	0	Flag
2243 Middle Skeena North*	Flag	0	0	0	Flag	0	0	0	0	Flag
2247 Kispiox North	Flag	0	0	0	0	0	0	0	0	0
Francois										
212 Cheslatta	Flag	Flag	0	Flag	Flag	0	Flag	Flag	Flag	Flag
424 Francois East	Flag	Flag	0	Flag	Flag	0	Flag	Flag	Flag	Flag
425 Francois West*	Flag	Flag	0	Flag	Flag	0	Flag	0	Flag	Flag
160 Burns Lake East	Flag	Flag	0	Flag	Flag	0	Flag	Flag	Flag	Flag
52 Babine East	Flag	Flag	0	0	Flag	0	Flag	0	0	Flag
55 Babine West	Flag	Flag	0	Flag	Flag	0	Flag	0	0	Flag
975 Ootsa*	Flag	Flag	0	Flag	Flag	0	Flag	0	Flag	0
1250 Taltapin	Flag	Flag	0	Flag	Flag	0	Flag	0	Flag	Flag
1660 Lucas	Flag	Flag	0	Flag	Flag	0	Flag	Flag	Flag	Flag
1778 Sutherland	Flag	Flag	0	Flag	Flag	0	Flag	0	Flag	Flag
1699 Nithi**	Flag	Flag	0	Flag	Flag	Flag	Flag	0	0	Flag
Tweedsmuir										
208 Chelaslie	0	0	0	Flag	0	0	Flag	0	Flag	0
232 Clayton	0	0	Flag	0	Flag	0	Flag	0	Flag	0
269 Crag	0	0	Flag	0	0	0	0	Flag	Flag	0
302 Dean	0	0	Flag	0	0	0	0	0	0	0
37 Ape	0	0	0	0	0	0	0	0	Flag	0
80 Bella Coola	0	0	Flag	Flag	Flag	0	Flag	0	0	0
627 Jump Across	0	0	0	0	0	0	0	0	Flag	0
964 Nusatsum	0	0	Flag	0	Flag	0	0	0	Flag	0
725 Labouchere	0	0	0	0	0	0	0	0	0	Flag
782 Lower Kimsquit	0	0	Flag	0	0	0	0	0	0	0
1100 Saloompt	0	0	Flag	0	Flag	0	0	0	Flag	Flag
1249 Taleomey/Asseek	0	0	0	0	0	0	0	0	0	0
1173 Smitley/Noeick	0	0	0	0	0	0	0	0	Flag	0

GBPU/ Landscape Unit	Population status	Bear density	Mortality rate	Core security area	Front country	Hunter day density	Road density	Mid-seral conifer	Quality food	Quality habitat protected
1186 South Bentinck**	0	0	0	0	0	0	0	0	Flag	0
1356 Upper Kimsquit	0	0	Flag	0	0	0	0	0	0	0
2200 Atnarko	0	0	0	0	Flag	0	0	0	Flag	0
2202 Sigulat	0	0	0	0	0	0	0	0	0	0
2204 Tweedsmuir North	0	0	0	0	0	0	0	0	0	0
2181 Upper Dean**	0	0	Flag	0	0	0	0	Flag	Flag	0
2182 Beeftrail**	0	0	Flag	0	Flag	0	0	0	Flag	0
2232 Nechako	0	0	0	0	0	0	0	0	Flag	0
1248 Talchako/Gyllenspetz	0	0	Flag	0	Flag	0	0	0	Flag	0
2201 Young	0	0	0	0	Flag	0	0	0	Flag	0
598 Intata*	0	0	0	Flag	0	0	Flag	0	Flag	0
Upper Skeena-Nass										
276 Craven	0	0	0	Flag	0	0	0	0	Flag	Flag
986 Oweege**	0	0	Flag	0	Flag	0	0	0	0	Flag
901 Muskaboo	0	0	Flag	0	0	0	0	0	Flag	Flag
1474 Asitka	0	0	Flag	0	0	0	0	0	Flag	0
1482 Birdflat	0	0	0	0	0	0	0	0	Flag	Flag
1258 Taylor-Damdochax	0	0	Flag	Flag	Flag	0	0	0	0	Flag
1282 Tintina**	0	0	0	0	0	0	Flag	0	0	Flag
1537 Duti	0	0	Flag	0	Flag	0	0	0	Flag	Flag
1681 Mosque	0	0	0	0	0	0	0	0	Flag	Flag
1616 Johanson	0	0	Flag	0	0	0	0	0	Flag	0
1777 Sustut	0	0	Flag	0	Flag	0	0	0	0	Flag
1758 Skeena*	0	0	0	0	0	0	0	0	Flag	Flag
1759 Slamgeesh	0	0	0	0	0	0	0	0	Flag	0
1769 Spatsizi	0	0	0	0	0	0	0	0	Flag	Flag
1634 Kluatantan	0	0	Flag	0	0	0	0	0	0	Flag

*These LUs overlap two assessed GBPUs but are only identified as part of the GBPU in which their largest portion is located.

**These LUs are only partially located in the GBPU they are identified under; the rest of these LUs are located outside the scope of this assessment.

Bolded/shaded LUs have 6 or more indicators flagged for management attention, including 3 or more of the highest-value indicators (core security area, hunter day density, road density, and quality habitat protected).

Appendix 4—Gitanyow Huwilp Recognition and Reconciliation Agreement

The following table is located in the Gitanyow Huwilp Recognition and Reconciliation Agreement and provides management direction for Grizzly Bears (2012).

Management Direction for Grizzly Bear

Plan Goal for Grizzly Bear

- Provide adequate grizzly bear habitat to help ensure a healthy population of grizzly bears.

Objectives	Measures / Indicators	Targets
<p>1.0 Preserve the highest value grizzly bear habitat, identified in Schedule A, Maps 1-10 as either:</p> <p>a) Grizzly Bear Habitat Complex (GBHC)</p> <ul style="list-style-type: none"> • Class 1: Very High; provincially significant value • Class 2: High value; <p>Cranberry, Kispiox and Kalum Planning Units</p> <p>or</p> <p>b) Grizzly Bear Specified Areas</p>	<p>1.1 Within 100m of critical habitat types²⁰ occurring within grizzly bear habitat identified on Maps 1-10, proportion of the forested area of each polygon identified and retained as functional thermal or security cover in mature and old growth condition, except for the following cases:</p> <ul style="list-style-type: none"> • access; • operational safety considerations; or • to minimize impacts on adjacent environmental values. <p>Cranberry, Kispiox and Kalum Planning Units</p>	100%
	<p>1.2 Proportion of the forested area of each polygon identified on Schedule A, Maps 1-10 retained as functional thermal or security cover in mature and old growth condition, except for the following cases, where the minimum retention of forested area in each polygon is 90%:</p> <ul style="list-style-type: none"> • access; • operational safety considerations; or • to minimize impacts on adjacent environmental values. <p>Nass South Planning Unit</p>	100%

²⁰ Critical habitat types include Sitka alder-spiny wood fern seepage sites; south aspect Trembling aspen-Douglas maple sites (minimum 5% cover of Douglas maple); Sitka alder-cow parsnip avalanche chutes; Spruce-black twinberry floodplain (ICHmc2/05); trembling aspen-beaked hazelnut sites (ICHmc2/51); paper birch-red osier dogwood fans (ICHmc2/03); south aspect Paper birch-falsebox sites; black cottonwood-red osier dogwood floodplains (CWHws2/08); Spruce-Salmonberry floodplains (CWHws2/07); Cottonwood-Willow Floodplains (CWHws2/09); thimbleberry-cow parsnip moist meadows; willow swamps and willow-sedge wetlands (where willow is the dominant woody vegetation and exceeds 20% cover); Skunk cabbage sites (CWHws2/11; ICHmc2/07; ICHmc1/06).

Objectives	Measures / Indicators	Targets
<p>(SA) Nass South Planning Unit</p>	<p>Management Considerations</p> <ul style="list-style-type: none"> • The term, “Specified Areas” is replacing the term, “Wildlife Habitat Areas” for the Nass South and Cranberry Planning Units. The new term is the result of an administrative need only and will provide the same legal authority under <i>FRPA</i> as would Wildlife Habitat Areas. • Specified Areas (SA) have not yet been mapped for the Cranberry SRMP area. When mapped, they will capture bedding and forage areas as well as provide thermal and security cover. • The target of Measures 1.1 and 1.2 is based on the need for operational flexibility, where necessary. If harvesting is to occur within SAs, it should be located along the edges of the mapped polygons. • Where practicable, from a harvest block layout and forest operation perspective, major grizzly bear trails leading to or connecting grizzly bear SAs, as noted by bite and marked trees, shall have their integrity maintained in terms of existing natural stand structure. • High use grizzly trails should be mapped and managed to maintain their integrity for travel and communication. • Following the establishment of SAs, where harvesting operations may occur within and adjacent to the mapped GBHC, considerations include the following Best Management Practices: <ul style="list-style-type: none"> ▪ Selection and small patch cut systems that create canopy gaps and openings <10 ha, and generally <5 ha. ▪ Cutting unit opening sizes that reflect the adjacent habitat values and are smaller than 2 ha immediately adjacent to the highest value habitat, and larger in lower valued habitat. ▪ Variable levels of retention (e.g. 10 to 30+ %) that minimize line of sight distance and maximize patch heterogeneity. ▪ Concentrated development followed by prompt silviculture and deactivation to minimize the length of operation within a GBHC. ▪ Timing of operations within or adjacent to the GBHC preferably during winter or during times of low or no use by bears. 	
<p>2.0 <i>Maintain the quality and effectiveness of grizzly bear foraging habitat.</i></p>	<p>2.1 Proportion of foraging habitat listed in Table 8: High Value Grizzly Bear Habitat, occupying greater than 1 ha within a cut block, that maintains herbaceous and woody forage supply for grizzly bears through to stand rotation, as assessed at the achievement of free-growing status for regenerated stands.</p> <p>Management Considerations</p> <ul style="list-style-type: none"> • Vegetation management practices, within high value grizzly bear forage habitat to maximize retention of valuable forage species. Practices may include: <ul style="list-style-type: none"> • reduced stocking standards in wetter or richer sites, targeting up to 600 stems/ha at free-to-grow or 	<p>100%</p>

Objectives	Measures / Indicators	Targets
	<ul style="list-style-type: none"> • pruning, spacing or thinning. 	
	<p>2.2 Proportion of non-forested forage areas greater than 2 ha in size, identified in Table 8: High Value Grizzly Bear Habitat, with directly adjacent functional thermal and security cover.</p>	100%
	<p>Management Considerations</p> <ul style="list-style-type: none"> • Adjacent areas should be approximately 100 metres in width and fully surround the forage area where possible. • Thermal cover includes habitat conditions that afford for a dry place when it is cool and wet, and a cool place when it is hot and dry; these conditions are generally provided in old-growth settings utilizing full canopy mature and veteran trees. • Security cover provides visual screening, especially from roads, and exists when vegetation obscures a person’s view of a grizzly bear. • High-use grizzly bear trails should be mapped and managed to maintain their integrity for travel and communication. 	
<p>3.0 <i>Minimize human-bear conflicts.</i></p>	<p>3.1 Proportion of grizzly bears killed or relocated as a result of human-bear conflicts.</p>	Reduction
	<p>Management Considerations</p> <ul style="list-style-type: none"> • For expert resources on minimizing bear-human conflict, see Appendix D: Minimizing Human-Bear Conflicts. • Until replaced by alternative programs, use BMP’s as described by the provincial Conservation Officer Service and the B.C. Conservation Foundation Bear Aware program: https://wildsafebc.com/. • Proponents of industrial development should account for impacts to grizzly bear habitat and the potential interactions between humans and grizzly bear. • The Parties support continuation of the provincial Bear Aware program, or similar efforts to increase public awareness of bear-human interactions and reduce bear mortalities. • It is recognized that grizzly bear mortality cannot be eliminated entirely in areas heavily developed for settlement or agriculture, and that grizzly bears attracted by habitat or human-provided food are likely to be killed as a result of conflicts with humans. 	
<p>4.0 <i>Minimize long-term displacement of grizzly bears from</i></p>	<p>4.1 Minimum distance of permanent roads from high value grizzly bear habitat identified in Table 8. Cranberry, Kispiox and Kalum Planning Units.</p>	150 m (where practicable)

Objectives	Measures / Indicators	Targets
<i>industrial access development</i>	4.2 Minimum distance of permanent roads from high value grizzly bear habitat identified in Schedule A, Maps 1-10. Nass South Planning Unit	150 m (where practicable)
	Management Considerations <ul style="list-style-type: none"> • Access restrictions could be used to minimize roaded motorized access within selected portions of grizzly bear habitat for periods of time (e.g., high value habitat listed in Table 8, High Value Grizzly Bear Habitat). This can be achieved through the identification and use of control points, where access restrictions such as bridge removal or gating can be employed. • Industrial development within or adjacent to valuable grizzly bear habitat should be planned for short periods of time, followed by long periods (10 to 25 years) of no development. 	

Table 8. High Value Grizzly Bear Habitat

BEC variant	Site Series #	Site Series Name
CWH ws2	05	HwBa - Queen's cup
CWH ws2	06	BaCw - Devil's club
CWH ws2	07	Ss - Salmonberry
CWH ws2	08	Act - Red-osier dogwood
CWH ws2	09	Act - Willow
CWH ws2	10	Pl - Sphagnum
CWH ws2	11	CwSs - Skunk cabbage
ESSF wv	06	Bl - Devil's club - Lady fern
ESSF wv	07	Bl - Valerian - Sickle moss
ESSF wv	08	Bl - Horsetail - Glow moss
ESSF wv	09	Bl - Lady fern - Horsetail
ICH mc1	04	HwBl - Devil's club
ICH mc1	05	ActSx - Dogwood
ICH mc1	06	Hw- Azalea - skunk cabbage
ICH vc Nass South	03	Sx – Devil’s club
ICH vc Nass South	04	Sx – Devil’s club – Dogwood
ICH vc Nass South	05	ActSx – Dogwood
ICH vc Nass South	06	Sx - Horsetail
MH mm1 Nass South	02	HmBa – Mountain-heather
MH mm1 Nass South	05	BaHm – Twistedstalk
MH mm1 Nass South	08	HmYc – Sphagnum
MH mm1 Nass South	09	YcHm – Skunk cabbage
ICH mc2 Cranberry	03	HwCw-Oak fern/EP-Red-osier dogwood fans
ICH mc2 Cranberry	05	Sx – Devil’s club- Lady fern/Sx – Black twinberry floodplain
ICH mc2 Cranberry	51	At – Beaked hazelnut
ICH mc2 Cranberry	07	CwSx – Horsetail – skunk cabbage
	Non-forested	Sitka alder – Spiny wood fern (seepage sites)*
	Non-forested	South aspect At-Douglas maple (≥5%) sites*
	Non-forested	Sitka alder – Cow parsnip avalanche chutes*
	Non-forested	Thimbleberry – Cow parsnip moist meadows*
	Non-forested	Willow swamps and willow-sedge wetlands (willow dominant, ≥20% cover)*
MH mm2 Nass South	05	BaHm - Twistedstalk
MH mm2	08	HmYe – Sphagnum
MH mm2	09	YeHm – Skunk cabbage

* - Site complex is found across a range of BEC variants.

Note: CWHws2 04 is excluded from Table 8. In situations where competing vegetation (silviculturally) that is considered to be grizzly bear forage makes achievement of a target stocking standard difficult, then reduced stocking standards should be acceptable to prevent aggressive control of such competing vegetation. CWHws2 04 is a blue listed ecosystem.

Appendix 5—Skeena Region Objectives Related to Grizzly Bears

The following table has been directly extracted from the “Policy Summary for the Skeena Watershed” (Price, K. and Daust, D. 2017). The summary table quotes text taken from legal orders, regulations, policy, and land-use plans that apply to Skeena ESI values, specifically Grizzly Bear. Provincial-level legal objectives and regulations are shaded in blue, regional-level legal objectives are shaded green, and policy and non-legal regulations are unshaded.

Grizzly Bears

Value	Text ³
Grizzly Bear⁴	
Grizzly bear population	<ul style="list-style-type: none"> • Limit road development and the number and duration of entries within moderate-value grizzly bear habitat. (BO2.5c) • Avoid human-bear conflicts in high-value grizzly bear habitat... (BO2.5d) • Provide opportunities for movement with minimal disturbance from humans between important landscape features in Boucher Creek Wetlands, Nicheyskwa South and Nicheyskwa North management units... (BO2.5e) • Limit disruption to bear use of high value habitat in the Upper Kispiox access management zone... Maintain >50% forest > 50 years ... [Restrict] duration and season of activity Restrict motorized access between operational periods. (KXH-2p16) • Limit the impact of road building and forest harvesting on critical habitat within the Upper Kispiox access management zone...No permanent roads located within 150m of critical habitat. (KXH-3p16) • Limit the impact of road building and forest harvesting on high value habitat within the East Kispiox/Kuldo access management zone Restrict motorized access to the road network. (KXH-4p17) • Limit the impact of road building and forest harvesting on high value habitat within the Upper Cranberry access management zone Restrict motorized access to the road network. (KXH-4p18) • Maintain in perpetuity the diversity and abundance of grizzly bears... throughout BC (MELP) • Maintain the diversity and abundance of grizzly bears (NC 5.8.3.1.1) • Ensure a healthy, sustainable population...across their present range (MO 3.4.4.1) • Ensure a healthy population of grizzly bears (CS 2.4.1.6; GI p50) • Minimize long-term displacement of grizzly bears (CS 2.4.1.6.4; GI p51) • Bear mortality from all human causes will not exceed 4% of the estimated population (KAL 2.2.11.4) • Reduce number of human bear interactions (WBS 3.1.2.2.1) • Minimize mortality risk to bears related to motorized road access (NC 5.8.3.1.1) • Minimize road-induced displacement and mortality risk of bears within or adjacent to critical habitats (NC 5.8.3.1.2) • Minimize impacts to bears from wildlife viewing (NC 5.8.3.1.6-8) • Prevent bear mortality resulting from negative bear-human interactions (NC 5.8.3.1.9) • Minimize the risk of ...human induced mortality (MO 3.4.4.1) • Minimize the risk of grizzly bear displacement (MO 3.4.4.1) • Protect grizzly bear affected by increased access north of the Babine River (WBS 3.1.2.2.5) • Minimize potential for human-bear interaction in Babine River SMZ (WBS 3.2.3.1.3) • Maintain grizzly populations (FSJ 3.7) • Minimize the amount and duration of new roaded access (FSJ 3.7) • Minimize conflicts in human/bear interactions (FSJ 3.7) • Minimize human-bear conflicts (CS 2.4.1.6.3; GI p52) • Minimize disturbance to bears in Sommerville (MA C p1)

³ Minor changes from original text for brevity and consistency. Numbers refer to sections of the source documents

⁴ Note: focus is on grizzly bears as a value (rather than on maintaining hunting or viewing as a value).

	<ul style="list-style-type: none"> • Maintain benchmark populations of grizzly bears within the Skeena-Nass grizzly bear management area (NC 5.8.3.2.10)
Grizzly bear habitat	<ul style="list-style-type: none"> • Maintain 100% of class 1 grizzly bear habitat (GBR 2.5.18[1]) • Maintain 50% of class 2 grizzly bear habitat (GB§ 2.5.18[2]) • Protect grizzly bear dens (GBR 2.5.19[1]); adjacent to dens, maintain a reserve zone > 50m (GBR 2.5.19[2]); maintain a management zone = 1 tree length beyond the reserve zone (GBR 2.5.19[4]) • For each landscape unit, prepare a landscape reserve design that contributes to the protection and stewardship of ...habitat important for regionally important wildlife, including... grizzly bears (GBR 1.3.5.[1]) • Provide high-value habitat buffered for security and bedding for grizzly bears in the locations identified... (BO2.5a) • Provide diverse understory within high-value, mixed forest habitat... (BO2.5b) • Maintain... grizzly bear habitat, especially travel corridors and denning areas... by harvesting timber only where required for approved mineral and energy exploration and development... in Barbeau Creek RMZ. (BH15) • Maintain... travel and denning habitat for grizzly bears... by developing timber in a manner which minimizes effects, not constructing permanent, unrestricted road access north of the Babine bridge, avoiding road construction to the Babine River Corridor boundary, and logging by selection harvesting or small clearcuts in Babine River RMZ. (BH22) • Maintain... a corridor for... grizzly bear... by developing timber in a manner which minimizes the effects... in Telkwa River RMZ. (BH31) • Maintain grizzly bear habitat... by not constructing road crossings on Serb Creek, and developing timber in a manner which minimizes effects... in Serb Creek RMZ. (BH33) • Maintain natural level of forage supply for grizzly bears in identified watersheds (KAS 3.1.1) • Maintain natural level of forage for grizzly bears in identified watersheds by providing an adequate supply of berries, maintaining natural old-growth forage, on rich and wetter sites implement listed regeneration and free to grow standards. Maintain < 30% of the forested land base, excluding hardwood, between 25 and 100 years old within McKay-Davies and Copper watersheds (KAH11) • Maintain the integrity of critical grizzly bear habitat within high-value grizzly bear habitat ... No alteration of critical habitat ... Provide ~100m functional forest cover adjacent to non-forested critical habitats (KXH-1p15) • Maintain limiting habitats throughout their current ranges and, where appropriate, their historic ranges (IWMS) • Protect grizzly bear critical habitat (CFN B p9) • Maintain or restore grizzly bear habitats in identified watersheds (KAL 2.2.11.1) • Provide an adequate supply of berry feeding in identified watersheds (KAL 2.2.11.2) • Protect critical stand-level patch habitats (KAL 2.2.11.3) • Maintain landscape level forage supply (NC 5.8.3.1.3) • Maintain integrity of and linkage amongst critical grizzly bear habitats (NC 5.8.3.1.5) • Adequate denning and foraging habitat (MO 3.4.4.1) • Maintain the integrity of and linkage amongst critical grizzly bear habitats (WBS 3.1.2.2.7) • Provide forest cover adjacent to non-forested critical habitats (WBS 3.1.2.2.8) • Minimize the impact of road building and forest harvesting on critical habitat (WBS 3.1.2.2.9) • Maintain grizzly habitat (FSJ 3.7); reduce habitat fragmentation (FSJ 3.7) • Minimize grizzly displacement from preferred habitat (FSJ 3.7) • Preserve the highest value grizzly bear habitat (CS 2.4.1.6.1; GI p50) • Maintain the quality and effectiveness of grizzly bear foraging habitat (CS 2.4.1.6.2; GI p52) • Maintain grizzly bear habitat (various planning units) (BL) • Maintain the quantity and quality of grizzly bear habitat in Sommerville (MA C p1)

	<ul style="list-style-type: none"> • Minimize long-term displacement of grizzly bears from industrial access development in Upper Kispiox SMZ (CS 2.8.1.4.2; GI p67) • Maintain habitat quality within Babine River SMZ (WBS 3.2.3.1.2) • Minimize disruption to bear use of high value habitat within the Babine River Corridor, along Shenismike Creek, in the Sperry/Rosenthal (WBS 3.1.2.2.2-4)
Wildlife populations (broader factor)	<ul style="list-style-type: none"> • Maintain sustainable, healthy, viable, productive and diverse wildlife populations (RPPR10) • Minimise disturbance during critical periods to wildlife (RPPR10) • Manage the risk of interaction between predators and livestock (RPPR10) • No physical disturbance to high priority wildlife (EPMR6) • Provide for wildlife ... populations by... timing road development and maintenance activities... to minimize effects (BO2.1a) • Maintain the quantity and quality of wildlife populations and habitats (KAS 3.1) • Provide and manage sustainable uses of wildlife (MELP) • Prevent or reduce negative effects of wildlife-human encounters (MELP) • Conserve and restore native wildlife species (MELP) • Access management that minimizes the risk to ...wildlife populations (MO 3.3.2) • Maintain naturally occurring species and their habitats (KAL 2.2.18.1) • Sustain viable populations of all native wildlife within their natural ranges (KX 6.13) • Maintain the diversity of wildlife populations (FSJ 3.7) • Conserve the wide abundance of all wildlife populations (BL 2.1.5) • Discourage circle routes (BL 2.1.2.1) • Maintain the diversity and a suitable abundance of wide ranging carnivore species (LA 3.4.47) • Maintain the abundance of ... wildlife within RONV (WBS 3.3.2.4)
Wildlife habitat (broader factor)	<ul style="list-style-type: none"> • Conserve sufficient wildlife habitat...for the survival of species at risk (FPPR7, WLPPR) • Maintain ...wildlife...habitat (RPPR10) • Do not locate activities within a wildlife habitat area unless they will not have a material adverse effect (EPMR6) • Maintain effectiveness of riparian habitats adjacent to wetlands identified as special habitats for general wildlife (CL 2.8.31) • Retain 100% of the forested area of the hydroriparian zone in special habitats (CL 2.8.32) • Provide for wildlife habitat by... timing road development and maintenance activities... to minimize effects (BO2.1a) • Protect high value wildlife habitat by developing forest resources in a manner that minimizes conflicts between agriculture and wildlife (BH14) • Maintain the quantity and quality of wildlife populations and habitats (KAS 3.1) • Maintain wildlife habitat and biodiversity within the Lakelse River SMZ (KAS 4.1) • Maintain wildlife habitat within the Lakelse River RMZ. In Subzone 1 - No harvest/salvage in subzone 1; <27% early seral in subzone 2; opening size <15 ha; retention > 15% within block; >50% volume/5 years harvested by selection (KAH12) • A constant supply of habitats and/or attributes sufficient to conserve species that occur naturally (MOSF 1.2) • Protect known critical wildlife habitat features (NC 5.6.3.1.12) • Support the natural range of wildlife species...through provision of good quality habitat (MO 3.4.4) • Maintain structural features important for...a variety of wildlife species (MO 3.4.4.24) • Maintain ...habitats and features important to species of interest (MO 3.4.4.17) • Maintain naturally occurring species and their habitats including plant communities (KAL 2.2.18.1) • Maintain a diversity of habitats (KAL 2.2.18.3)
	<ul style="list-style-type: none"> • Maintain diversity of wildlife habitats (FSJ 3.7) • Ensure habitat for species where ecologically appropriate. Maintain a range of temporal and spatial distribution of all natural habitats necessary to support native self-sustaining populations (FSJSF 1.2) • Maintain effectiveness of riparian habitats adjacent to wetlands (CS 2.4.1.12.1; GI p57) • Maintain effectiveness of alder brush and aspen patch habitats (CS 2.4.1.12.2; GI p58) • Conserve the wide abundance of all wildlife habitats (BL 2.1.5)
Rare and focal species (broader factor)	<ul style="list-style-type: none"> • Maintain ...habitats and features important to species at risk (MO 3.4.4.16) • Conserve vulnerable, rare, threatened and endangered species and their habitat (KAL 2.2.18.2) • Protect, conserve and reduce risks to rare, threatened and endangered terrestrial and aquatic species (LA 3.4.45) • Maintain rare or threatened plant and animal species and communities (KX 6.1) • Protect or enhance populations and habitat of rare and regionally significant species (KX 6.13) • Maintain populations of animals, plants and ecosystems at-risk (FSJ 3.2, 3.7) • Maintain red and blue-listed, sensitive and vulnerable, and regionally significant species, plant communities (BS 1.1)

**Appendix 6—Skeena Sustainability Assessment Forum (SSAF) Nations
within the Skeena Environmental Stewardship Initiative (ESI)**

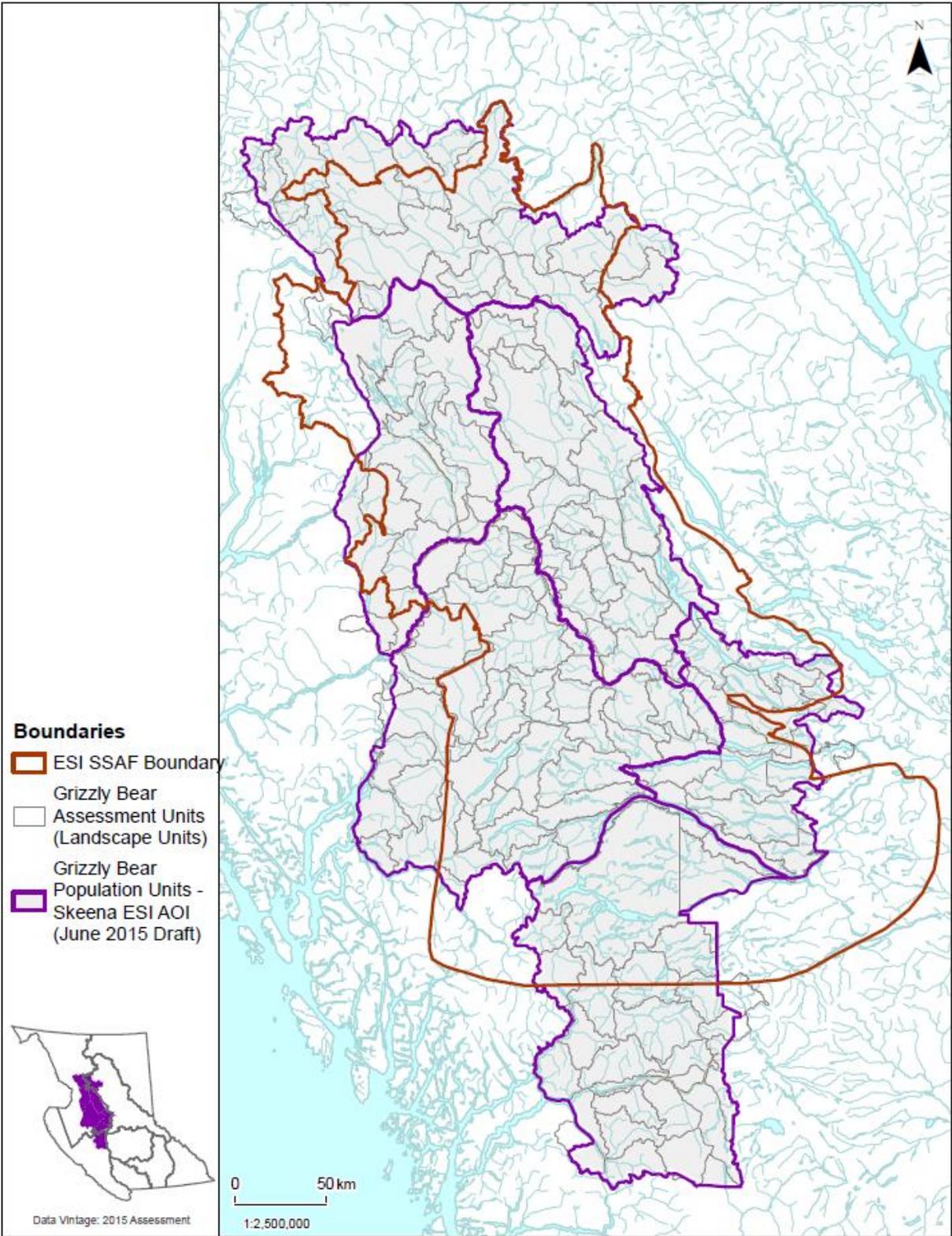


Figure A6-1. Environmental Stewardship Initiative (ESI) Skeena Sustainability Assessment Forum (SSAF) Boundary within the Grizzly Bear Population Units (GBPUs)

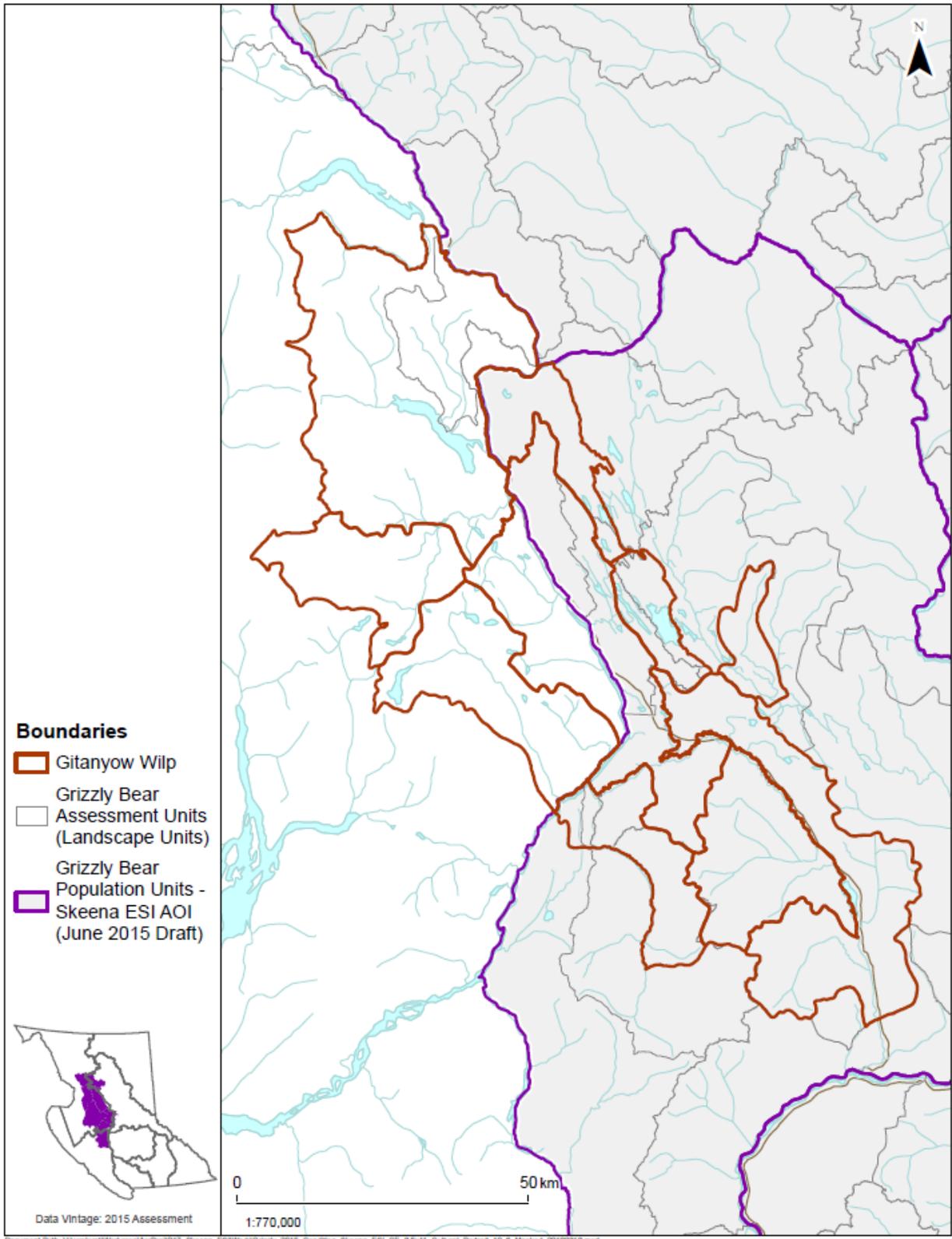


Figure A6-2. Gitanyow Wilp boundaries within the Cranberry GBPU of the Skeena Environmental Stewardship Initiative (ESI).

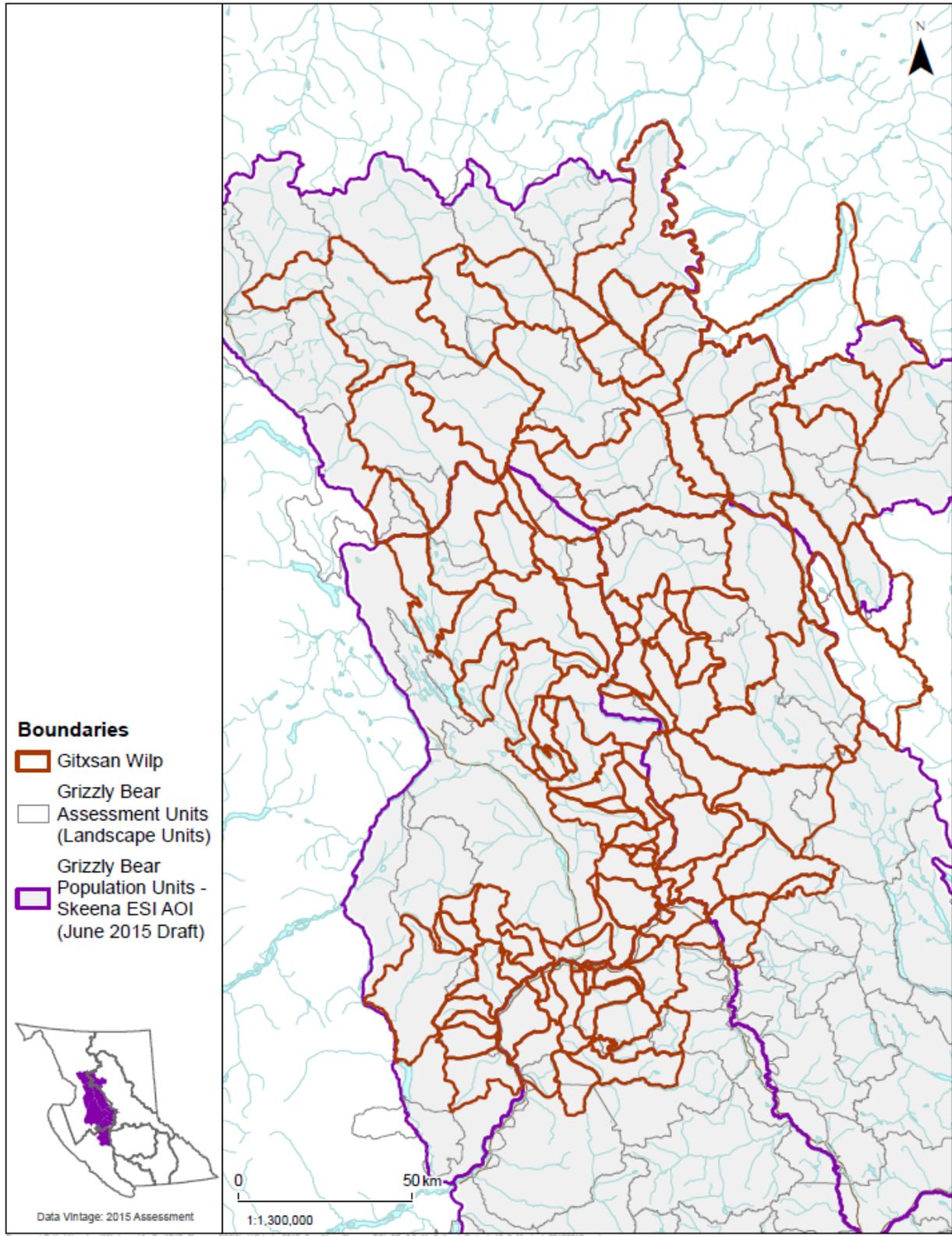


Figure A6-3. Gitksan Wilp boundaries within the GBPU of the Skeena Environmental Stewardship Initiative (ESI).

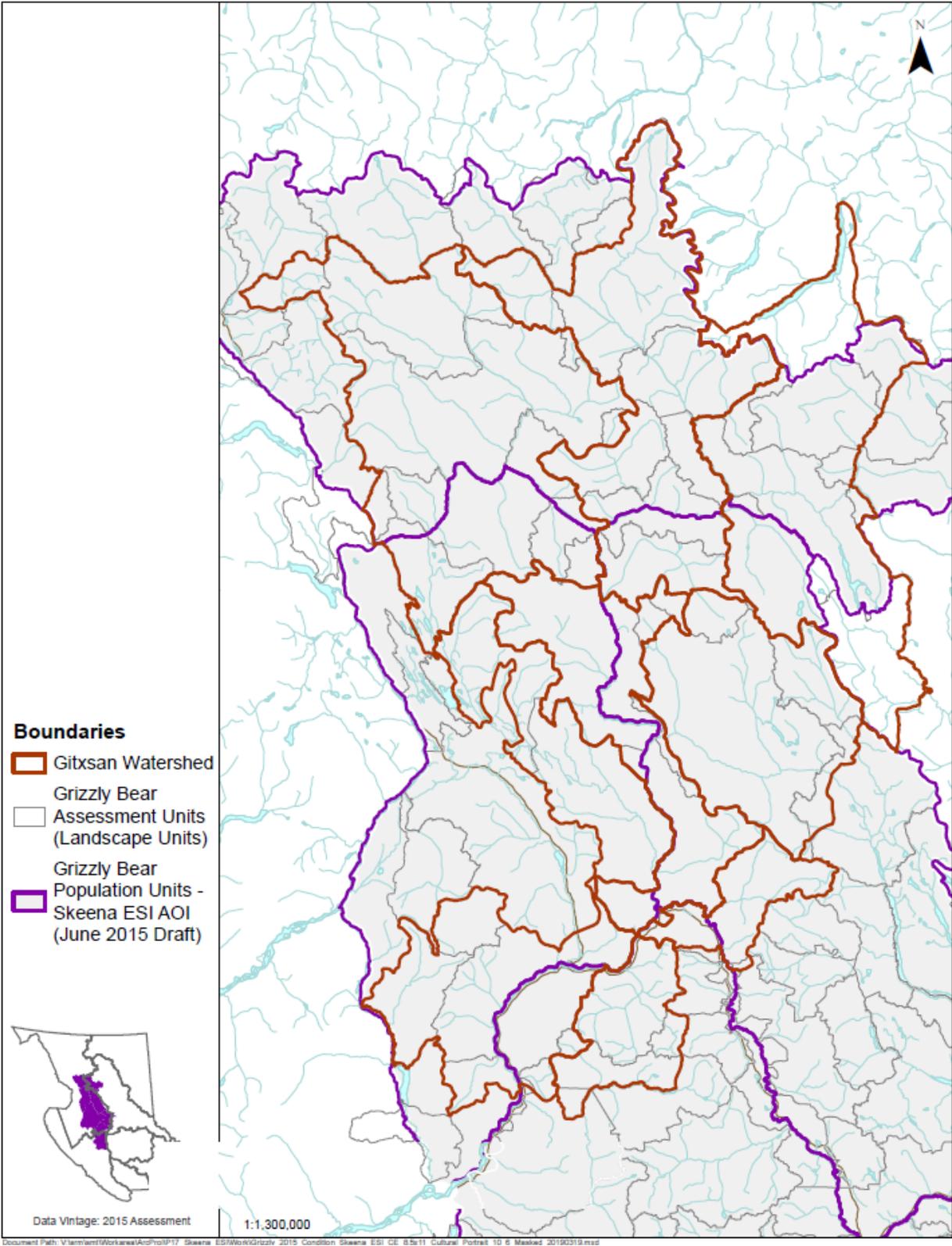


Figure A6-4. Gitksan Watersheds within GBPU of the Skeena Environmental Stewardship Initiative (ESI).

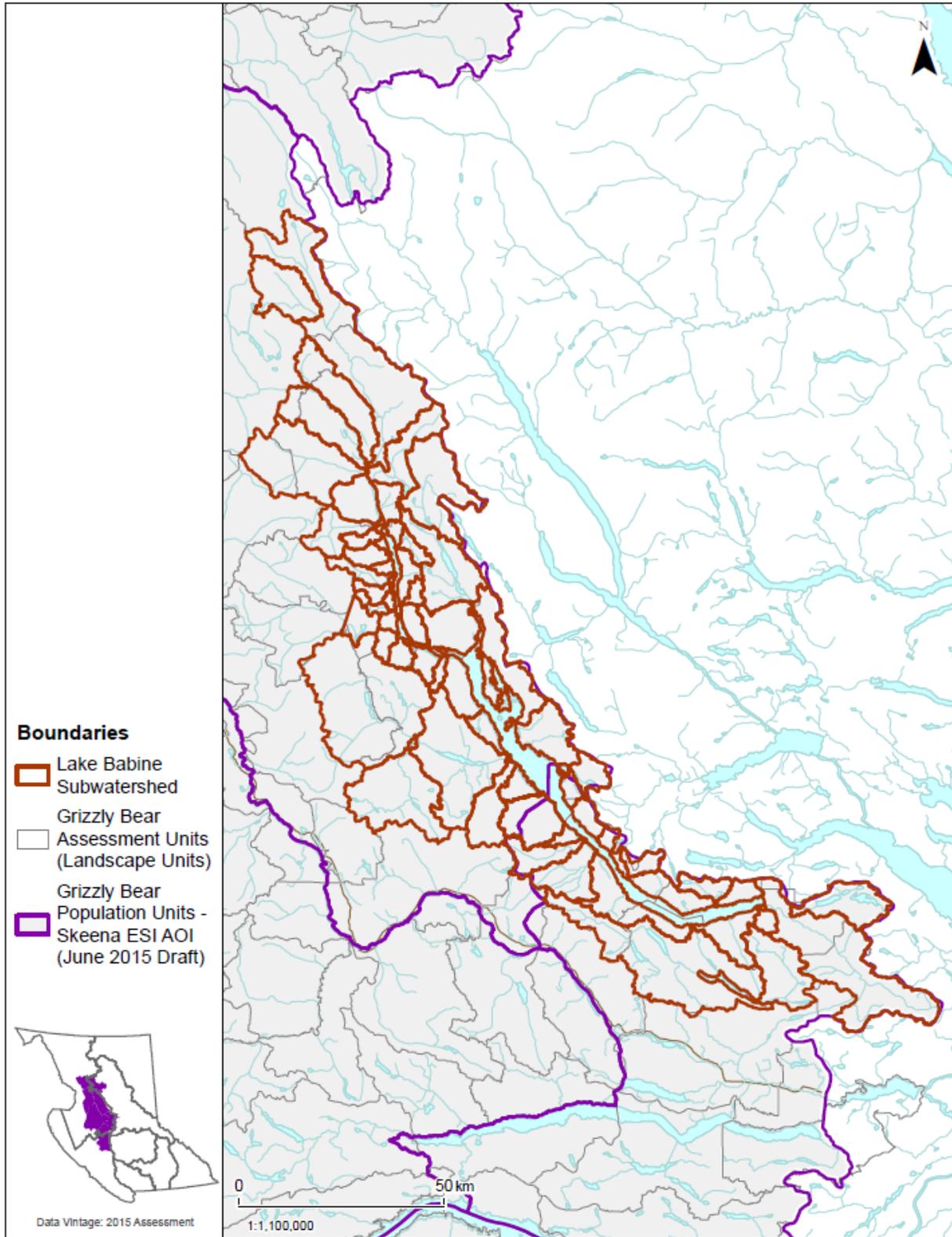


Figure A6-5. Lake Babine Sub-Watershed boundaries within the Babine and Francois GBPUs of the Skeena Environmental Stewardship Initiative (ESI).

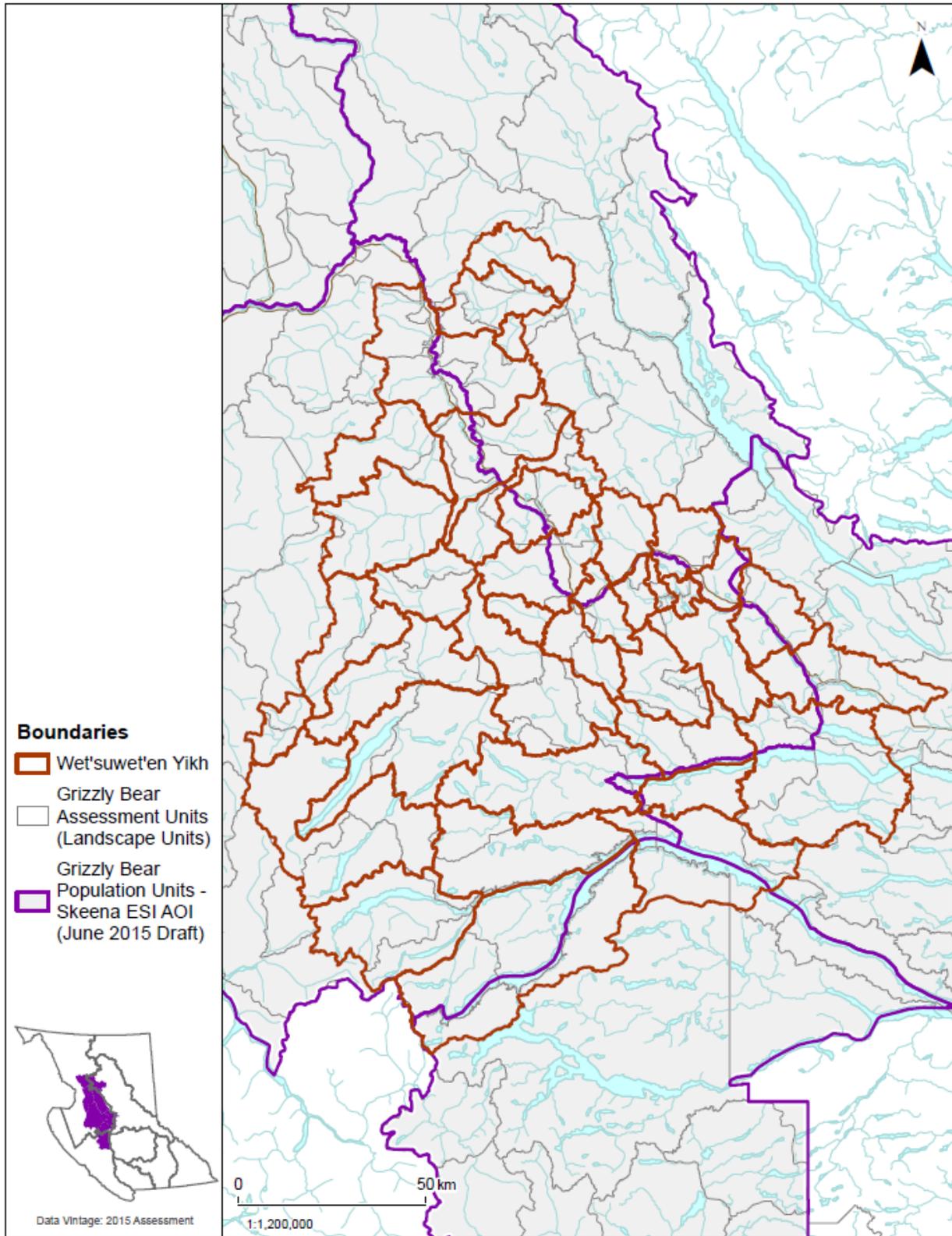


Figure A6-6. Wet'suwet'en Yikh boundaries within the Babine, Bulkley-Lakes, Francois, and Tweedsmuir GBUs of the Skeena Environmental Stewardship Initiative (ESI).

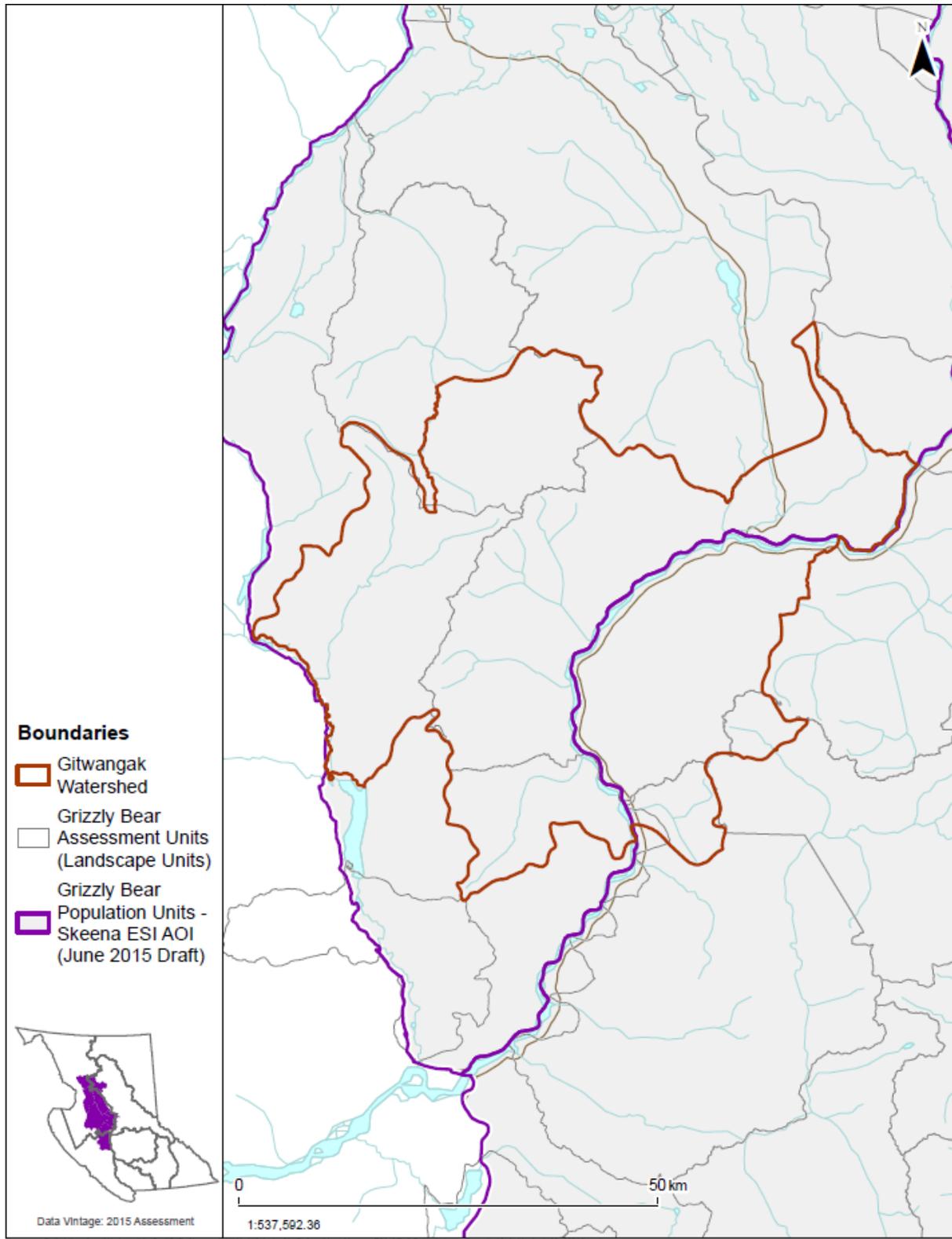


Figure A6-7. Gitwangak Watershed boundaries within the Cranberry and Bulkley-Lakes GBPU of the Skeena Environmental Stewardship Initiative (ESI).

8 Literature Cited

Apps, C. 2017. Goal and design considerations for grizzly bear population survey within the Skeena Region, with example applications. Ministry of Forests, Lands & Natural Resource Operations, Smithers, British Columbia.

Apps, C., K. Koch. 2019. Grizzly Bear Population Abundance, Distribution & Connectivity Within the Skeena ESI Area: 2018 Sampling – Cranberry GBPU & Gitanyow Territory. Prepared for the Nations of the Skeena Environmental Stewardship Initiative and Province of British Columbia.

Braid ACR, Nielsen SE. 2015. Prioritizing Sites for Protection and Restoration for Grizzly Bears (*Ursus arctos*) in Southwestern Alberta, Canada. PLOS ONE 10(7): e0132501.
<https://doi.org/10.1371/journal.pone.0132501>

Ciarniello, L.M., R. Caira, and Jamie Svendsen. 2012. Human-Grizzly Bear Interactions and Education Baseline Data for the Babine Watershed Monitoring Trust. Report prepared for Babine Watershed Monitoring Trust, Smithers.

Four Directions Management Services. 2017. *ESI Community Engagement Workshops Summary Report*. Four Directions Management Services.

Gitanyow Nation and Province of British Columbia. 2012. Gitanyow Huwilp Recognition and Reconciliation Agreement. <http://www.gitanyowchiefs.com/images/uploads/land-use-plans/Gitanyow-R-R-Agreement-2012.pdf>

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 (October 2020). Prepared by the Provincial Grizzly Bear Technical Working Group – Ministry of Environment and Climate Change Strategy and Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 45 pp.. [cef-grizzly-protocol-oct2020_final.pdf \(gov.bc.ca\)](http://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/grizzly-bears/grizzly_protocol-oct2020_final.pdf)

IUCN 2020. The IUCN Red List of Threatened Species. Version 2020-2
<http://www.iucnredlist.org/technical-documents/classification-schemes/threats-classification-scheme>

Les, G, T. Hamilton, M. Austin. 2004. Grizzly Bear, Accounts and Measures for Managing Identified Wildlife – Accounts V.
http://www.env.gov.bc.ca/wld/frpa/iwms/documents/Mammals/m_grizzlybear.pdf

MacHutchon, A.G and T. Mahon. 2003. Habitat use by grizzly bears and implications for forest development activities in the Kispiox Forest District: final report.

Ministry of Environment. 1995. Conservation of Grizzly Bears in British Columbia Background Report. http://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/grizzly-bears/grizzly_background_report.pdf

Ministry of Environment. 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>

Ministry of Environment, BC Parks Division. 2000. Backgrounder on Babine River Corridor Park. http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/babine_river/babriver_backgrounder.pdf?v=1576271614992

Ministry of Environment, BC Parks Division. 2000. Management Direction Statement for Babine River Corridor Provincial Park. http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/babine_river/babriver.pdf?v=1576604979262

Ministry of Environment. 2007. British Columbia Grizzly Bear Harvest Management Procedure Manual. http://www.elp.gov.bc.ca/wld/documents/grizzlybear_harvest_mgmt_proc_2007.pdf

Ministry of Environment. 2015. British Columbia Guide to Recovery Planning for Species and Ecosystems: Appendix 5. Guidance for Threats Assessments. Version 2. http://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/species-ecosystems-at-risk/recovery-planning/appendix_5_threat_guidance_v2_5may2015.pdf

Ministry of Forests. 1995. Forest Practices Code of British Columbia, Biodiversity Handbook. <https://www.for.gov.bc.ca/hfd/library/documents/bib19715.pdf>

Ministry of Forests, Lands, and Natural Resource Operations. 2012. British Columbia Grizzly Bear Population Estimate for 2012. http://www.env.gov.bc.ca/fw/wildlife/docs/Grizzly_Bear_Pop_Est_Report_Final_2012.pdf

Morgan, D, M. Proctor, G. Mowat, B. McLellan, T. Hamilton, and L. Turney. 2019. Ranking the Conservation Concern of Grizzly Bear Population Units. 2019. Ministry of Environment and Climate Change Strategy, Victoria, BC. 37 p.

Mowat G, Heard DC, Schwarz CJ. 2013. Predicting Grizzly Bear Density in Western North America. PLOS ONE 8(12): e82757. <https://doi.org/10.1371/journal.pone.0082757>

NatureServe. 2020. Conservation Rank Calculator. <http://www.natureserve.org/conservation-tools/conservation-rank-calculator>

NatureServe Conservation Status Assessments: Factors for Evaluating Species and Ecosystem Risk. 2012. NatureServe Report Revised Edition. http://www.natureserve.org/sites/default/files/publications/files/natureserveconservationstatusfactors_apr12_1.pdf

Office of the Auditor General of British Columbia. 2017. Annual Report 2017/18. https://www.bcauditor.com/sites/default/files/publications/reports/OAGBC_Annual_Report_2017_18.pdf

Price, K. and Daust D. 2017. "Policy Summary for the Skeena Watershed". Skeena ESI Science and Technical Committee and Province of British Columbia (ENV, FLNRO), Skeena Region, Smithers, BC.

Proctor, M. F., B. N. McLellan, G. B. Stenhouse, G. Mowat, C. T. Lamb, and M. Boyce. 2018. Resource Roads and Grizzly Bears in British Columbia, and Alberta. Canadian Grizzly Bear Management Series, Resource Road Management. Trans-border Grizzly Bear Project. Kaslo, BC. Canada <http://transbordergrizzlybearproject.ca/research/publications.html>.

Ross, P.I. 2002. Update COSEWIC status report on the grizzly bear *Ursus arctos* in Canada, in COSEWIC assessment and update status report on the Grizzly Bear *Ursus arctos* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-91 pp. [Assessment and Update Status Report on the Grizzly Bear in Canada \(Prairie and Northwestern Population\)](#).

Skeena Sustainability Assessment Forum and Indigenous Stewardship Projects Framework, Environmental Stewardship Initiative, March 31, 2018. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/consulting-with-first-nations/agreements/esi_amended_skeena_agreement_march_13-2019.pdf

Stenhouse, G. B., K. Graham. 2013. Foothills Research Institute Grizzly Bear Program 2012 Annual Report. https://friresearch.ca/sites/default/files/GPB_2013_Report_AnnualReport2012.pdf

Wellwood, DW. 2014. Monitoring Grizzly Bear–Human Interactions in the Southern Entrance Area of Babine River Corridor Provincial Park: Review of Methods and Recommendations for Monitoring (Project 2013-3) Final Report. https://www.babinetrust.ca/DocumentsBWMT/2013-3Bear_People_Monitoring_Southern_Park_Entrance_Final_Report_Aug2014.pdf

Wellwood, D. W. 2014. Monitoring Land Use Planning to Maintain Grizzly Bears: A Partial Problem Analysis with 2010 Reconnaissance Survey Results for Grizzly Bear Habitat and Access Control, Babine River Watershed (BWMT Project 2009-3). Prepared for Babine Watershed Monitoring Trust, Smithers BC. https://www.babinetrust.ca/DocumentsBWMT/2009-3_Wellwood_GrizzlyBearMonitoring_14-02-25_revised.pdf
