



# Natural Resource Stewardship Monitoring and Assessment Report for the Wet'suwet'en Hereditary Territory

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November 2017





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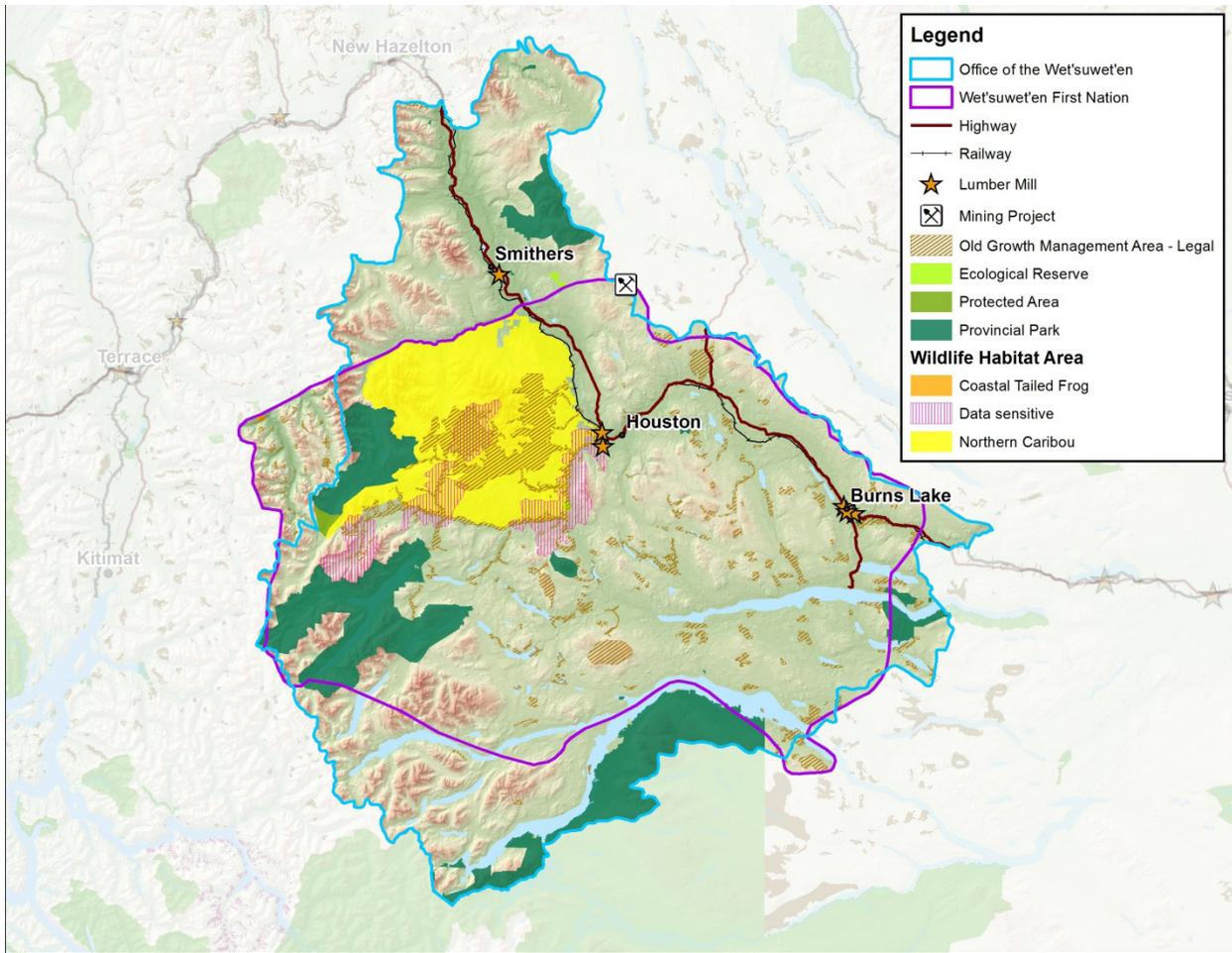


Figure 1: Wet'suwet'en Hereditary Territories context map.

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## Report Context

Natural Resource Stewardship Monitoring and Assessment Reports are a summary of existing resource value monitoring and assessment information for a given geographic area such as a Natural Resource District or First Nation hereditary territory. For each resource value, or source of information, there is a one-two page summary of status, trends, causal factors, and opportunities for improvement. In addition, each report contains a Provincial government statutory decision maker commentary on government expectations for the management of those natural resource values. In the case of First Nation's territory reports, there is also a First Nation's commentary. Each source of information is referenced in a way that describes the data age, sample design, and where more detailed information can be found.

The purpose of these reports is to present available monitoring and assessment information in a single document to help inform multiple levels of decision making and facilitate resource stewardship dialogue based on a common understanding of the status, trends and causal factors associated with resource values. The primary target audience is government decision makers, First Nations, and resource industries.

Specifically, this document is intended to:

- Provide transparency and accountability for the management of public resources;
- Provide information to help inform balanced decision making in consideration of environmental, social, and economic factors; and
- Guide ongoing improvement of resource management practices, policies and legislation.

All natural resource development affects ecosystem conditions. The role of natural resource monitoring and assessments is to assess the impacts of resource development and or natural factors, identify the status and trends of British Columbia's natural resource values, and identify related causal factors and opportunities for ongoing resource management improvement.

There are two levels of results presented in this report – site level and landscape/watershed level. Site-level assessments are generally “boots on the ground” assessments that observe impacts at localized sites, such as where a road crosses a stream, an individual forestry cutblock, or other industrial development. Landscape or watershed-level assessments are usually an office-based GIS analysis. Site-level assessments are often used to validate landscape-level assessments.

Data has been arranged in the following categories:

### **Fish and Water**

- Riparian (Fish) Habitat (FREP)
- Fish Passage (FLNRORD/MOE)
- Water Quality (Sediment) (FREP)
- Benthic Invertebrates (MOE)
- Water Quality Index (MOE)
- Fisheries Sensitive Watersheds (FREP)
- Risk to Fish Habitat (Skeena Salmon)

### **Social and Economic**

- Cultural Heritage (FREP)
- Timber (FREP)
- Visual Quality (FREP)

### **Wildlife**

- Moose (MOE)
- Mountain Goat (MOE)
- Grizzly Bear (MOE)
- Northern Goshawk (Consultant)

### **Forests, Biodiversity and Air Quality**

- Stand-level Biodiversity (FREP)
- Soils (FREP)
- Air Quality (MOE)
- Forest Practices Board Compliance Audits
- Landscape-Level Biodiversity

This report summarizes monitoring results for the Wet'suwet'en Hereditary Territory as defined by the asserted traditional boundaries of the Office of the Wet'suwet'en (Hereditary Chiefs) and the Wet'suwet'en First Nation<sup>1</sup>. The Wet'suwet'en context and commentary sections assist in identifying the Aboriginal interests of the Wet'suwet'en people and the success of resource managers in achieving

results that meets these interests. The Provincial government statutory decision maker commentary in this report is intended to clarify government's resource stewardship expectations, and promote the open and transparent discussion needed to achieve short- and long-term sustainable resource management in British Columbia.

## Sources of Information

This report contains monitoring information from a variety of sources within the Wet'suwet'en Hereditary Territories. Not all data have the same level of scientific rigour and this is noted in each data summary and in Figure 2 on page 9. Over time, it is expected that these data sources

will be further improved and other reliable monitoring data will become available for future reports.

A brief description of the data source is provided with the results for each resource value. Appendix 3 details the original data source, reports, web links, and contact names.

## List of Acronyms

AQHI	Air Quality Health Index	GIS	Geographic Information System
BEAST	Benthic Assessment of Sediment	GMZ	Game Management Zone
BEC	Biogeoclimatic Ecosystem Classification	H60	the elevation above which 60% of a watershed lies
BVLD	Bulkley Valley/Lakes District	LBIS	Land Based Investment Strategy
CABIN	Canadian Aquatic Biomonitoring Network	LRMP	Land and Resource Management Plan
CCME	Canadian Conference on Medical Education	MPB	Mountain Pine Beetle
CHR	Cultural Heritage Resource	MRVA	Multiple Resource Value Assessment
CMT	Culturally Modified Tree	MU	Management Unit
ECA	Equivalent Clearcut Area	NO <sub>2</sub>	Nitrogen Dioxide
FDP	Forest Development Plan	O <sub>3</sub>	Ozone
FLNRORD	Ministry of Forests, Lands, Natural Resource Operations and Rural Development	PM <sub>2.5</sub>	Fine Particulate Matter
FPB	Forest Practices Board	SDM	Stand Development Monitoring
FPC	Forest Practice Code	SP	Site Plan
FPPR	Forest Planning and Practices Regulation	THLB	Timber Harvesting Land Base
FREP	Forest and Range Evaluation Program	TSA	Timber Supply Area
FRPA	Forest and Range Practices Act	TSS	Target Stocking Standard
FSR	Forest Service Road	VQO	Visual Quality Objective
FSW	Fisheries Sensitive Watershed	VRI	Vegetation Resources Inventory
		WQI	Water Quality Index

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## Resource Value Assessment Classifications and Meanings

Much of the information in this report summarizes site-level field-based assessments that inform us of the ecological condition of resource values. The results of site-level assessments are confined to the working landbase and do not include the ecological contribution of parks and other protected areas. The landscape-level assessments in this report include the entire forested landbase including parks and commercial forest. The “natural cause and resource development impact ratings” indicate the effect of resource development (e.g., forest harvesting) and natural impacts (e.g., forest health and flood events) on individual resource values. The “very low” and “low” impact ratings are considered consistent with the Province’s goal of sustainable resource management. Through the use of impact ratings, resource managers/decision makers can apply the “consequence” lens (social, economic, environmental) to better understand and be able to make decisions based on defining overall acceptable risk levels to each of the resource values.

The information presented in this report that is focused on the ecological state of the values provides useful information to resource managers and other professionals on the outcomes of plans and practices. Additional information is provided to enhance the broader context of the ecological state of the land base for future management

### Wet’suwet’en Context

The Wet’suwet’en people are a matrilineal society organized into five clans: Gilseyhu (Big Frog), Laksilyu (Small Frog), Gitdumden (Wolf/Bear), Laksamshu (Fireweed), and Tsayu (Beaver Clan). Within each clan are a number of kin-based groups known as Yikhs or House groups. Each House group has jurisdiction over one or more House territories. In the Wet’suwet’en area, there are 38 House territories managed by 13 House groups and 13 Hereditary Chiefs.

From a Wet’suwet’en perspective, a head Chief’s task is to ensure the House territory is managed in a responsible, sustainable manner so that each House territory will always produce enough game, fish, berries and medicines to support the subsistence, trade, and customary needs of house members. The main game animals the Wet’suwet’en hunt for food are moose, deer and bear. There is concern

and monitoring activities. Some of the key cultural values that support aboriginal rights have not been incorporated into this report; however, the intent is to incorporate such values, as identified by the Wet’suwet’en, in future reports. With additional data collection, the scale at which monitoring information is reported can be further enhanced to better reflect local information and decision making needs. For a description of the criteria used for determining resource development and natural causes impact ratings, see Appendix 1.

The presentation style used in this report includes an “Impact Ratings” diagram illustrating the effect of resource development and natural impacts on the resource value, from “very low” to “high” impact. The “Summary” presents a descriptive outline of the monitoring results. The “Causal Factors” for the impact ratings are derived from field-based data and/or an interpretation of potential reasons for the state of the value. The “Opportunities for Improvement” are based on practices that resulted in the best outcomes and (or) expert knowledge.

Where sufficient<sup>2</sup> data is available, the “Overall Stewardship Trend” shows trends between time periods. A chi-squared test, which determines a probability value, is used to determine trends between sampling eras for riparian, water quality, stand-level biodiversity, and visual quality results.

within the Wet’suwet’en that local populations of moose, bear and fish are on the decline and that these declines may affect the sustainability of the House territories.

The Wet’suwet’en are also concerned that risks to sustainability can only increase with the cumulative impacts of timber harvest, natural disturbances, proposed large-scale linear developments (e.g. oil and gas pipelines), and climate change.

Cultural heritage features include seasonal and permanent village sites, major trade and territorial access trail networks and associated cache pits and culturally modified trees, grave sites, cabins, spiritual sites (pictographs, Nadina Mountain), and footprints (human/grizzly) embedded into the ground.

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The Wet'suwet'en Territory is home to a wide variety of diverse wildlife and fish populations. Larger game animals include grizzly and black bear, caribou, mountain goat, moose, deer, wolves, and coyote. Smaller game known to be of importance to the Wet'suwet'en include marmots, beaver, snowshoe hares, muskrats, squirrel, marten, weasel, lynx, groundhogs, and grouse. Anadromous fish include chinook, steelhead, coho, pink and sockeye salmon, as well as Pacific lamprey and bull trout. Freshwater fish include white sturgeon, kokanee, burbot, lake trout, mountain whitefish, suckers, northern pikeminnow, dace, sculpin, lake trout, Dolly Varden, chub, and rainbow trout. Morice sockeye are the largest and most important sockeye stock in the Bulkley/Nanika/Atna/Upper Bulkley/McDonnell/Dennis basin.

The Wet'suwet'en use an array of plant species for food, medicine, and cultural purposes. Plant foods include green vegetables, fruits and berries, inner bark–cambium, roots and rhizomes, mushrooms, and a few beverages. Medicines are derived from plant leaves, foliage, roots, and inner barks from a variety of species. Cultural materials

used include fibrous plants, wood, dyes, and pigments. The Wet'suwet'en use about sixty plants for food, mostly harvested in forest or woodland settings.

The salmon fishery is a central focus of Wet'suwet'en culture, sustenance, and trade. Wet'suwet'en laws governing Wet'suwet'en resources generally (fishing specifically) are based on values founded on thousands of years of interacting with social, subsistence, and local environment dynamics. Subsistence activities are tightly interwoven within the social structure of the Wet'suwet'en and their territories. The Wet'suwet'en mandate is for sustainable resource management practices which support cultural strengthening, revitalization, and continuity.

The intent is to provide the maximum amount of security for sustaining salmon, wildlife, and the natural food supply necessary for the health and well-being of the Wet'suwet'en. The Land (Yintahk) continues to be at the center of Wet'suwet'en life and culture and must be managed in a way that is adherent of Wet'suwet'en people, laws, and traditions.

## Wet'suwet'en Hereditary Territory Environmental and Stewardship Context

In the 2.2 million hectares included within the Wet'suwet'en Hereditary Territory, there is a population of approximately 25,000 people, of which 5000 are Wet'suwet'en. The population resides in rural areas, larger communities including Smithers, Telkwa, Houston, and Burns Lake, and First Nations communities including Hagwilget, Moricetown, Wet'suwet'en Village, Broman Lake, Decker Lake, and Francois Lake.

The Wet'suwet'en Territory overlies two Natural Resource Districts: Skeena Stikine District (a portion of Bulkley TSA) and Nadina District (portions of Morice and Lakes TSAs).

The Wet'suwet'en Territory transitions coastal and interior climates, and is ecologically diverse: the Sub-Boreal Spruce biogeoclimatic zone dominates, with Engelmann Spruce-Sub-Alpine Fir (ESSF) a distant second in area. Terrain ranges from flat to mountainous, with numerous coastal outlet valleys present along the western boundary. Interior plateaus with large lakes predominate. The Bulkley River and the majority of its tributaries are present, draining northwest to the Skeena River. The Nechako River is also present, draining southeast to its confluence with the Fraser River near Prince George.

Landscapes within the Wet'suwet'en Territory are subject to frequent and large fire-related disturbances. The China Nose (3500 ha), Eutsuk Lake (3750 ha), and Atna Lake (2400 ha) wildfires are recent examples. Native burning was historically practiced to manage plant communities (berries, shrubs, nutritious herbs) and to enhance wildlife habitats for population management. The majority of the Bulkley River valley bottom and lower uplands were systematically burned until the 1930s, resulting in expanses of prairie, open meadows, and berry patches.

Forests are comprised primarily of subalpine fir-, pine- and spruce-leading stands, with extensive areas of deciduous forest occurring through the Bulkley River valley. The timber harvesting land base is dominated by pine- and spruce-leading stands.

The Wet'suwet'en Territory is found at the northwest extent of the recent mountain pine beetle (MPB) epidemic. The epidemic resulted in the mortality of approximately 80% of mature pine in the Lakes TSA, 50% in the Morice TSA, and 30% in the Bulkley TSA. It is estimated that by 2019, most of the MPB-killed timber will be unmerchantable, leading to several decades of significant timber supply shortfalls in the Lakes and Morice TSA portions of the Wet'suwet'en area.

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There is a culture of respect for strategic planning. Local planning processes led to the establishment of legal land-use objectives for landscape-level biodiversity, habitat connectivity, and wildlife tree retention within two of the three TSAs comprising the Wet'suwet'en Territory. In the late 1990s, the provincial government and the Wet'suwet'en also engaged in landscape-level planning, resulting in valuable dialogue and the identification of specific value and feature locations (e.g. wildlife wintering and natal areas, caribou migration corridors, trail and cultural feature locations, etc.).

The agriculture, forestry and mining sectors provide the majority of employment within the area. Sawmills that provide significant employment include the West Fraser –

Pacific Inland Resources mill in Smithers, the Canadian Forest Products mill in Houston, and the Hampton Affiliates' Decker Lake and Babine Forest Products mills. The Huckleberry Mine is a significant mining sector employer.

There is increased interest in full utilization of mill residues, and in utilizing non-traditional fibre sources such as small-diameter, high density stands close to larger communities along the Highway 16 corridor. Two Pinnacle-owned pellet mills now set up in Houston and Burns Lake are taking advantage of these "new" fibre opportunities.

Management of potential forest fire fuels, in particular near the public/private land interface needs careful future attention, and is becoming a priority that involves various levels of government.

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## Wet'suwet'en Commentary

It is important to note what the Natural Resource Stewardship Monitoring and Assessment Reports are and what they are not. Natural resource values that solely rely on FREP results only evaluate “recently” harvested areas by random sampling. This method does provide some insight into how modern forest practices are affecting natural resource values at the site level in recently harvested areas. What this method does not do is provide insight into how forestry has affected natural resource values at the landscape level, or how resource development as a whole has affected natural resource values.

As the Timber Harvesting Land Base declines, it is important to evaluate, make decisions and enhance management practices based on the condition of the landscape and the ecological condition. To achieve this, the FREP sampling design needs to change or incorporate sampling results from historic forestry development areas.

It is also important to recognise that natural resource values are provincially selected and do not necessarily represent Wet'suwet'en or other First Nations values which support their practice of aboriginal rights and title. The Skeena Sustainability Assessment Forum is currently developing protocols to evaluate and assess five First Nation-specific values. It is highly recommended to utilise these protocols and values once completed in future Natural Resource Stewardship Monitoring and Assessment Reports.

Our landscape is experiencing noticeable changes from resource development and changes due to climate change. Effective monitoring and assessment is required to quantify impacts to our ecosystems, as these impacts limit the ability for First Nations to exercise their aboriginal rights and practices. Management practices need to be modified to mitigate these impacts, and restoration activities need to be supported by both government and industry. As better information becomes available, applying both

scientific and cultural principles will allow decision makers to adapt to changing social expectations and demands on Wet'suwet'en territories. Only then can the realities of reconciliation and cooperative management reflect sustainable land-use objectives.

Wet'suwet'en Hereditary Chiefs want to ensure that their cultural and traditional interests are understood and managed. This can only be achieved through effective consultation processes that result in awareness and comprehension of Wet'suwet'en values and principles, which honor Wet'suwet'en Law (*Inuk Nu'at'en* “our laws”). It must be recognised that the Office of the Wet'suwet'en does not have a Forest Consultation and Revenue Sharing Agreement, yet we are actively engaged and committed to culturally sustainable management of our territory.

Key habitat features of traditionally used species, that are sensitive to anthropogenic impacts, need protection and management practices that support their biological fitness. Maintaining structural biodiversity that supports Wet'suwet'en values with supporting data allows for a reasonable assessment of impacts on the Wet'suwet'en territories; this is required for consultation purposes. The land provides for the people; better management practices will benefit those who rely on these resources.

First Nations depend on their territories for their cultural needs, and are among the most vulnerable with respect to effects of industrial development. It is imperative that we work together to make a better future, as not all resources are renewable, and we have a responsibility to our children yet to be born. The Wet'suwet'en objective is to work within the consultation, monitoring, assessment, and restoration processes; however, the processes must include Wet'suwet'en interests for collaborative sound decision making.

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## Provincial Government Statutory Decision Maker Commentary<sup>3</sup>

This document makes a significant step forward in the reporting of natural resource value monitoring. Natural Resource Stewardship Monitoring and Assessment Reports present an assemblage of monitoring information including data collected through the Forest and Range Evaluation Program (FREP) and other sources. FREP monitoring was established as one of the foundations of the *Forest and Range Practices Act* (FRPA) oversight framework to assess the delivery of the resource value objectives established by the Act. The FRPA legislation regulates Forest and Range practices on public lands within the Province and establishes 11 resource values with specific objectives<sup>4</sup> that must be achieved by Forest and Range based activities. This report, includes an expanded suite of values and monitoring information. While some of this is strongly linked to the forest sector (FREP), others such as water quality, air quality, and landscape level biodiversity report out on broader landscape conditions.

This report has deliberately been assembled in a different way than previous versions, it uses the identified traditional territory of the Wet'suwet'en people as its geographical extent. This has been done as a step forward to working with the Wet'suwet'en as partners, in assembling information on resource values within their territory and on the indicators of how those values are being influenced by resource development.

Due to a lack of existing data, some of the key cultural values that support the practices of aboriginal rights have not been incorporated into this report; however, the intent is to incorporate such values, as identified by Wet'suwet'en, in future reports. Over time, with additional data, the values being reported on and the scale at which monitoring information is reported can be refined to best reflect local information and decision making needs. This report is a first step towards creation of a reporting tool that reflects commonly-held values, in a simple format, designed to inform resource management decision making and sustainable ecological and cultural values.

Each monitored value defines data source, summarizes monitoring results relative to selected indicators, makes a statement on overall stewardship trend, and discusses opportunities for improvement. This information provides solid grounding for strategic dialogue and could advise

(e.g.) future collaborative monitoring projects, and potential environmental mitigation project types and specific areas.

Decision makers are charged with considering the cumulative effect of activities on environmental, economic and social values prior to reaching new resource decisions. This is a challenging task with multiple natural resource uses occurring simultaneously over the landbase, and increasing environmental and social pressures. Monitoring results, considered in combination with objectives set by government with established indicators/ thresholds can assist with this.

Notwithstanding its limitations, this report has several key uses: as a vehicle for dialogue with the Wet'suwet'en people regarding the present status of some commonly-held values within their territory, as a means of communicating with forestry and non-forestry clients on sub-regional values management issues and trends, and as a cumulative effects decision support tool for FLNRORD decision makers.

In the context of the FRPA, results-based model of legal requirements and professional reliance, more specific commentary on values known to be of interest to Wet'suwet'en, and on management actions being employed to address them are as follows:

- For Cultural Heritage monitoring we acknowledge the Wet'suwet'en comments regarding the need to broaden the scope of our monitoring to better reflect First Nations values. Results collected to date show that impact ratings are improving over time, with a decrease in "high" and "medium" ratings combined with an increased in "very low" ratings. The best outcomes for cultural heritage were associated with exclusion of cultural features from harvest areas (modifying block boundaries, wildlife tree patches and riparian reserves), stubbing of CMT's was effective, as was ribboning features before harvest to facilitate easy avoidance. Poorer outcomes were associated with lack of communication between operators and planners and/or First Nations, lack of buffers, nonwindfirm buffers and piling of logging debris on top of features. Actions on these results will include the setting of clear expectations for Forest licensees to address these issues, and to utilize

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best practices such as ensuring cultural heritage features are placed on site plans and logging plans, and ribboned in the field to ensure avoidance.

- Stand-level Biodiversity is connected with other values, including wildlife habitat and landscape-level biodiversity. This report notes that 30% of blocks sampled in the FRPA era show low post-harvest levels of important stand-level biodiversity attributes including the amount of wildlife tree retention, retention quality (tree size), and coarse woody debris (amount and size). Consequently, Forest licensees will be expected to leave a range of retention over many cutblocks and improve retention quality by retaining higher densities of large and dead trees and coarse woody debris. Future data analysis will provide additional context that reflects both the landscape-level condition and the requirements of higher-level plans.
- For Fish Passage, this report notes that of 1193 assessed stream crossings within the Wet'suwet'en traditional territory, 19% (226 crossings) are considered high impact as they block or impede fish movement. Road types include Highway 16, other public and private roads, and resource use roads that are within FLNRORD jurisdiction. Actions being employed as a result of these findings include the scheduling of verification of all FLNRORD administered structures. Upon confirmation, these structures will

be prioritized for remediation works as enabled by budgets. This report will also be shared with the administrative entities such as the Ministry of Transportation and Infrastructure who share the jurisdiction over many of the identified structures.

- For Fisheries Sensitive Watersheds (FSW's), this report states there are two designated and three candidate FSW's, and that the designated FSW's (Cumming Creek and Jonas Creek) are both at high risk of fish habitat degradation based on an analysis of nine GIS-derived variables. As Forest Stewardship Plans make specific commitments in these watersheds to mitigate this risk, the effectiveness of these measures will continue to be assessed and reported on in future iterations of this assessment. Information gathered through the developing 'Risk to Fish Habitat' indicator, will also help to inform these considerations.

Given this is the first report of its kind, a debrief will be conducted to ensure future reports incorporate "lessons learned" as well as:

- Address the issues identified in both the Wet'suwet'en and the Provincial Government Statutory Decision Maker Commentaries;
- Add new or more information; and
- Determine where more value can be added for the stewardship and decision-making purposes of resource professionals and land managers

## Monitoring Results In Brief

Effective resource management requires understanding of the condition of individual resource values and how these values relate to each other. This report provides a summary snapshot for monitoring conducted in the Wet'suwet'en Hereditary Territory and includes both a Wet'suwet'en commentary and a Provincial

government statutory decision maker commentary. Some of the data presented below has been labeled as "developmental". Developmental values fall into one or more of the following: they have not been reported in this format before, they are not fully implemented and/or they do not include an assessment of habitat.

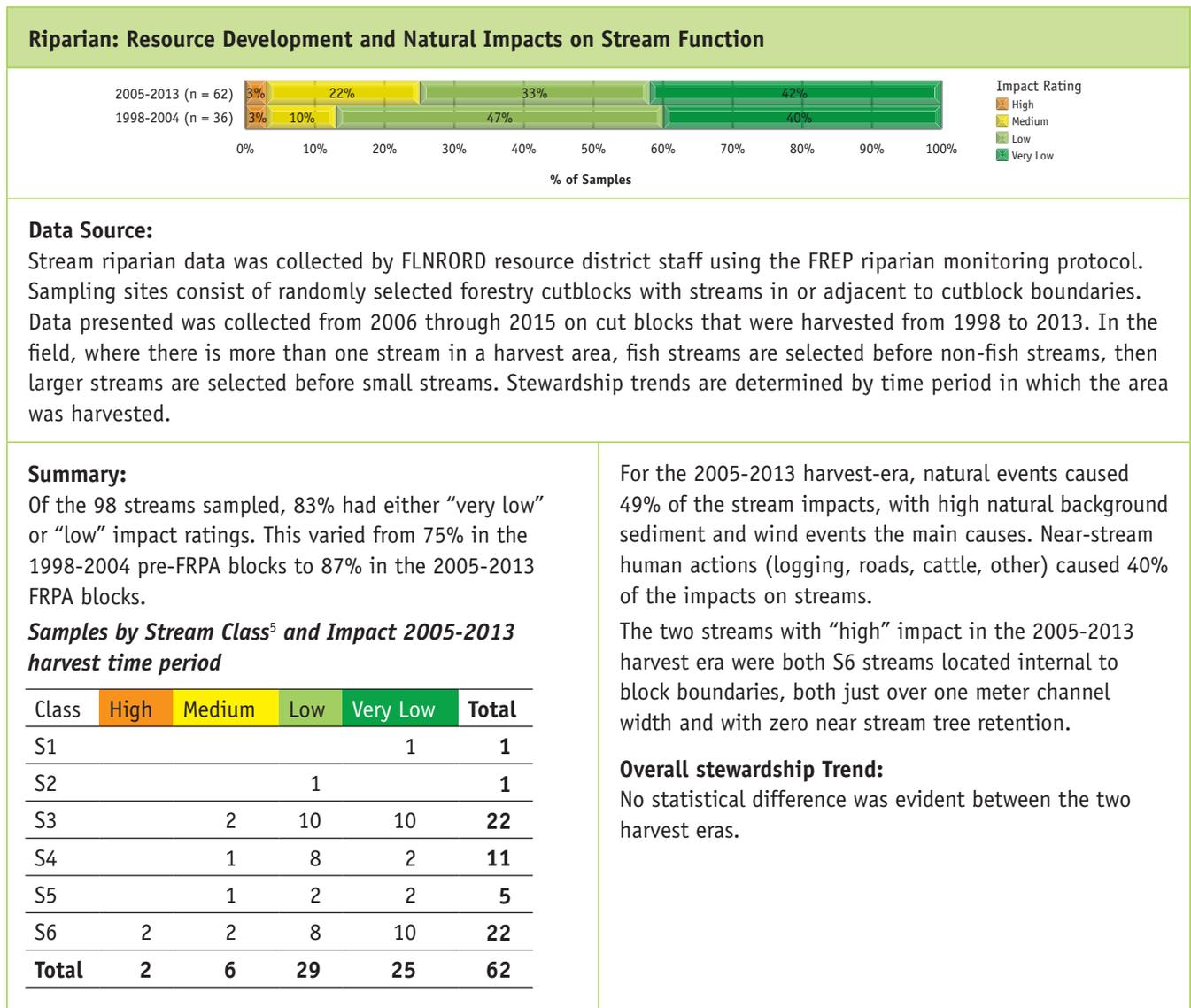
Figure 2: Wet'suwet'en Hereditary Territory impact rating by resource value.



## Monitoring and Assessment Results: Fish and Water

### Riparian (Fish) Habitat Value

Monitoring the condition of stream channels and their adjacent riparian management areas determines whether resource management practices are achieving the desired result of protecting fish values by maintaining stream channel integrity and riparian functions. The fish passage protocol assesses the resource road structures put in place at fish stream crossings such as culverts and bridges to determine if there are any barriers to fish passage. Unimpeded fish passage is important to maintaining access to fish habitat and maintaining healthy fish populations.



**Samples by Stream Class and Impact 1998-2004 harvest time period**

Class	High	Medium	Low	Very Low	Total
S2		1			1
S3		3	4	7	14
S4			3		3
S5				3	3
S6	1	4	5	5	15
<b>Total</b>	<b>1</b>	<b>8</b>	<b>12</b>	<b>15</b>	<b>36</b>

**Factors responsible for stream impacts on 2005-2013 cut blocks:**

% of total	Most common specific impact in order of frequency
<b>Natural events 49%</b> <i>Naturally high sediments &amp; windthrow</i>	<ul style="list-style-type: none"> <li>• In-stream sediments increased</li> <li>• Moss levels decreased</li> </ul>
<b>Logging 28%</b> <i>Windthrow &amp; low retention</i>	<ul style="list-style-type: none"> <li>• Windthrow protection decreased</li> <li>• In-stream sediments increased</li> </ul>
<b>Roads 11%</b> <i>Erosion, sediment from roads and crossings</i>	<ul style="list-style-type: none"> <li>• In-stream sediments increased</li> </ul>
<b>Upstream factors 10%</b> <i>Natural events</i>	<ul style="list-style-type: none"> <li>• In-stream sediments increased</li> <li>• Moss levels decreased</li> </ul>
<b>Other manmade 1%</b>	<ul style="list-style-type: none"> <li>• Bare erodible ground increased</li> </ul>

**Opportunities for Improvement and/or Continuation of Practices that Protect Stream and Riparian Conditions:**

High natural sediment is a significant issue in this area. Minimization of human caused sediment is an important goal.

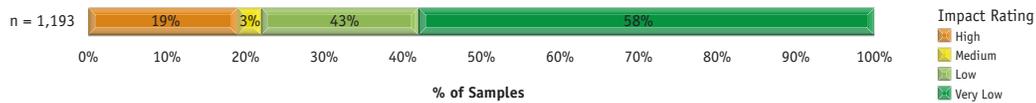
- Minimize sediment sources near streams
- Reduce windthrow by increasing buffer widths if narrow buffer strips are a problem, or use more selective harvest practices if windthrow-prone timber is an issue
- Increase retention generally on small streams, especially the wider, perennial small streams that make significant contributions of water, sediments, debris, nutrients, etc. to downstream fish habitats and watershed function.

A small stream monitoring initiative is currently being conducted. Morice TSA licensees have increased retention on small streams as a result of this monitoring information. In addition, a number of other activities focused on streams have taken place, including:

- Forest Stewardship Plan expectations letters have clearly communicated an objective for increased retention on small streams
- A series of industry/govt workshops on improving small stream management were delivered across the Province
- Licensee specific analysis of monitoring results was conducted using the data presented in this report and was presented and discussed with licensee representatives and prescribing forest professionals.

## Fish Passage Value

### Fish: Ability of Stream Crossings to Successfully Pass Fish



**Data Source:** Fish Passage data was collected using a standardized protocol developed by a federal and provincial Fish Passage Technical Working Group. The sampling population is a census of all road crossings in a given geographic area. Potential fish streams are identified based on a combination of historical fish observation points, natural barriers, and GIS-derived stream gradients less than 30%. Data are collected by government staff and contractors, and made public through iMap BC and the Provincial Stream Crossing Inventory System.

**Summary:** 1193 stream crossings were assessed from 2009 to 2013. 19% of these crossings are “high” impact since they block or impede fish movement upstream to 372 km of low gradient fish habitat (0-15% gradient), representing 21% of the total valuable habitat present (1784 km). The amount of low gradient (high value) fish habitat isolated at road crossings varied from 0.1 to 15.0 km (average 1.6 km per crossing). Road types also varied, including Highway 16 and many other public, private, and resource roads. 10% of the “high” impact crossings isolated 44% of the low gradient habitat. Significant blockages were: Coffin Creek and Helps Creek on the Walcott Forest Service Road, Vallee Creek on Walcott Road, Porphyry Creek and Robin Creek tributaries on Highway 16, Tyhee Creek on Tyhee Lake Road, and two unnamed streams on North Road.

3% of crossings are considered “medium” impact because they block or impede fish movements to 53 km of less suitable, steeper gradient fish habitat (15-25%, depending on stream order). The 20% of crossings with a “low” impact were either passable to fish (n= 209, mostly bridges, but also fords, culverts, pipe arches, wood box culverts, and some ovals), or they blocked access to only very steep fish habitat (n=29). Crossings with a “very low” impact (39%) had little or no upstream fish habitat.

**Causal Factors:** Closed bottomed round metal culverts account for most of the fish passage problems encountered. Other closed bottom structures with poor records included oval or square concrete culverts. Culverts that blocked or impeded fish did so because they: lacked natural stream bed roughness (to break up water flow and provide micro-rest areas for fish), increased stream velocity

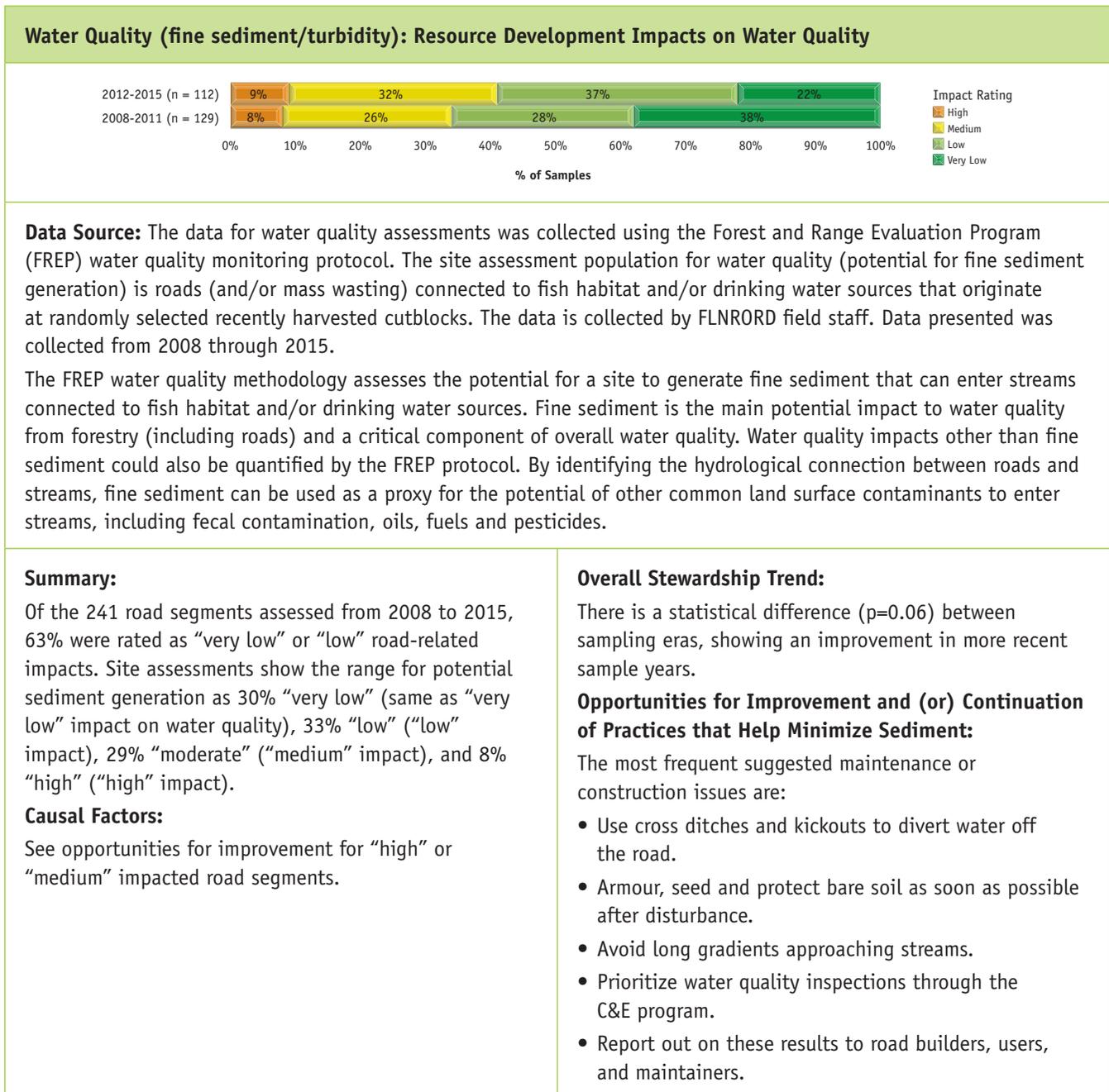
(were not embedded), constricted the stream channel (were too small a diameter for the stream), or were placed at too steep an angle. All new fish stream crossings are legally required to maintain fish passage. This will create a positive trend on new crossings.

#### Opportunities for Improvement and (or) Continuation of Resource Road Management Practices that Successfully Pass Fish:

- On new crossings, ensure normal channel width, slope, bed roughness and stream velocities are maintained.
- Remediation of past practices would improve fish access to valuable habitat. Under the land based investment strategy, remediation is being targeted on high impact crossings that affect the longest lengths of high-value habitat. Since 2006, seven remediation projects were reported. These include replacements of structures that blocked fish passage with open bottomed structures, and are located in Blunt (2), Kidprice, Owen, Parrott, and Valley (2) landscape units.
- A four-step process is recommended for further restoring fish passage. (Funding opportunities for further assessments and restoration plans should be pursued to extend sampling to the remainder of the Wet’suwet’en Territory).
  1. Confirm the quantity and quality of habitat to be gained if the site merits remediation.
  2. Prioritize structures for remediation.
  3. Commission a site plan and design.
  4. Carry out construction to remediate stream crossings and reconnect fish habitat.

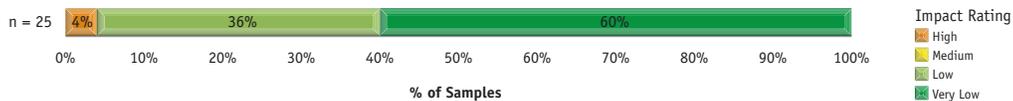
## Water Quality (Sediment) Value

Water quality refers to a number of key factors, including chemical, physical, biological, and radiological characteristics of water. The most common standards used to assess water quality relate to the health of ecosystems, safety of human contact, and drinking water. The following section shows water quality results from several monitoring initiatives. Forest Stewardship Plan expectations letters clearly communicated an objective for increased retention on small streams. A series of industry/govt workshops on improving small stream management were delivered across the Province. Licensee specific analysis of monitoring results was conducted using the data presented in this report and was presented and discussed with licensee representatives and prescribing forest professionals.



## Benthic Invertebrates Value

### Water Quality: Resource Development Impacts on Benthic Invertebrates



**Data Source:** Sampling protocols for the collection and analysis of benthic invertebrate data were developed by the Canadian Aquatic Biomonitoring Network (CABIN), a national aquatic biomonitoring program that uses a reference condition approach for study design and site assessment. Test sites tend to be targeted at specific developments, and assessed against reference sites using the bioassessment models. The divergence between benthic invertebrate communities at reference sites and a test site indicates the extent of stress/impairment. To date, most data in BC is collected by federal/provincial environmental staff and their contractors, though independent developers are encouraged to make greater use of the CABIN database to store, manage, analyze and report on their biological monitoring data.

Because CABIN assessments are not on randomly selected sites, these results apply only to the sites sampled. No inference can be made to other streams within Wet'suwet'en territory.

#### Summary and Causal Factors:

From 2004 to 2008, benthic invertebrates were sampled and analyzed using the CABIN methodology at 25 stream sites in the Wet'suwet'en Traditional Territories. Most sites had varying degrees of logging activity in the watersheds; however, one site was located below an old mine entrance. Results indicate that the majority of sites (60%, n=15) were comparable to sites in reference condition (i.e., sites in watersheds with little to no human disturbance). All but one of the remaining sites (36%, n=9) were only slightly stressed, and not indicative of any significant watershed issues. One site (4%, n=1) that showed a significant deviation from reference condition (Berg Creek Far Field) is located downstream of an old mine entrance that discharged metals-laden mine water. The benthic invertebrate community at this site was highly divergent from reference conditions and thus indicative of very poor water quality.

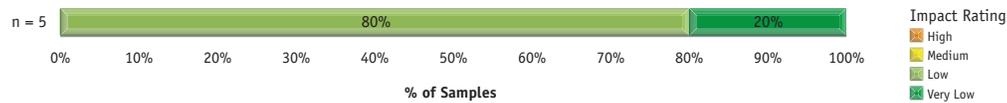
#### Opportunities For Improvement:

For the streams sampled using CABIN, the status of benthic invertebrate communities suggests, with one exception, that there are no concerns over water quality. The sampling in the area covered for this report was limited to a relatively small number of streams and land activities. More sampling of different watersheds and land activities would provide a fuller picture and track water quality trends in the Wet'suwet'en area.

An expansion of the sampling intensity for this protocol by providing training to current FREP practitioners and Wet'suwet'en monitoring participants so as to gather this data as part of riparian sampling.

## Water Quality Index Value

### Water Quality: The Water Quality Index for the Skeena River at Usk, 2005-2007 to 2009-2011



**Data Source:** The Water Quality Indicator (WQI) is reported nationally on an annual basis and provides an overall measure of water quality in freshwater bodies. It utilizes water quality guidelines to assess large amounts of water quality data at a monitoring site to calculate a single index. The indicator is based on the CCME Water Quality Index and the index is calculated by comparing three years – usually comprised of eight to twelve parameters representing nutrients, metals and physicochemical parameters – of seasonal data against relevant water quality guidelines. Information on the WQI in this report was obtained from a 2007 report by Environment Canada, the BC Ministry of Environment, and the Yukon Department of Environment (British Columbia and Yukon Territory Water Quality Report (2001-2004), and the Environment Canada website on “Freshwater Quality Monitoring and Surveillance – Online Data” <http://aquatic.pyr.ec.gc.ca/webdataonlinenational/en/Home>.

**Summary:** There is one long-term water quality sampling station at Usk on the Skeena River, 15 km upstream from Terrace and downstream of the Wet’suwet’en Traditional Territories. Water quality at this station was rated fair for the first four reporting periods from 2005 to 2010 (2005-2007, 2006-2008 and 2007-2009, 2008-2010), and good for the 2009-2011 period.

Criteria used to assess water quality at this site included: cadmium, chromium, copper, lead, nitrogen, phosphorus, silver, and zinc levels as well as temperature and pH.

Causal Factors: From the Environment Canada website, “The Skeena River at Usk drains 42,200 km<sup>2</sup> of the Coast Mountains in north central British Columbia and supports major runs of salmon. Its major tributaries are the Bulkley and Babine Rivers. The main potential influences on water quality are forestry, mining, agriculture, urban development, and treated municipal wastewater from Houston, Telkwa, Smithers and Hazelton.

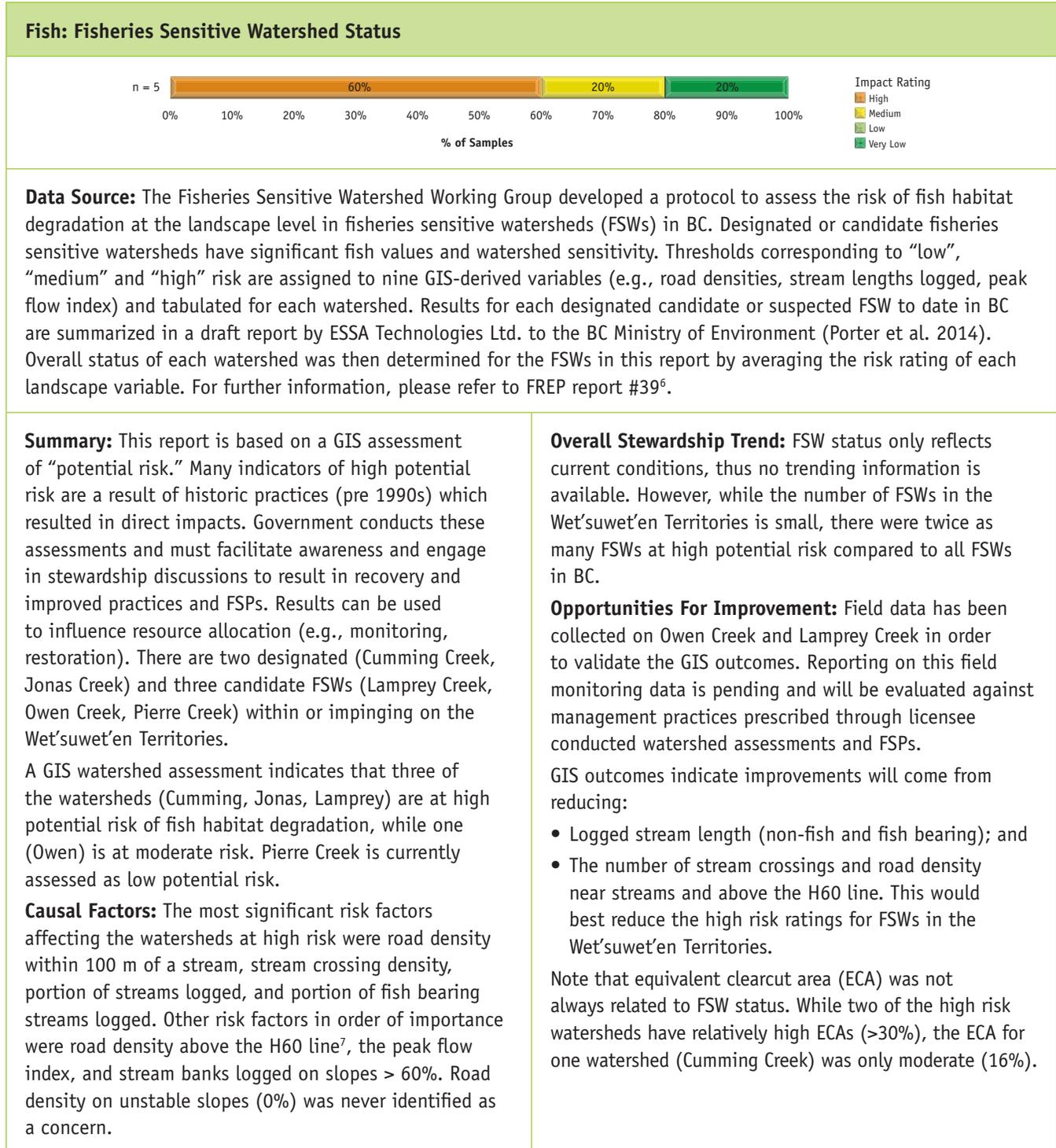
#### Overall Stewardship Trend:

There were no environmentally significant changes. There were seasonal exceedances in total cadmium and total phosphorus. These exceedances appear related to spring freshet and resulting increases in turbidity.

Fish sensitive watersheds must meet two criteria: they must have significant fisheries values and watershed sensitivity. Watersheds which meet these criteria and that have been designated by way of an order by the Minister as Fish Sensitive Watersheds (FSW) require Forest Act agreement holders to establish results and strategies in their Forest Stewardship Plans consistent with the objective(s) set by the Minister. An FSW order established by the Minister sets out management direction to conserve important watershed level attributes protecting fisheries values. These attributes include the:

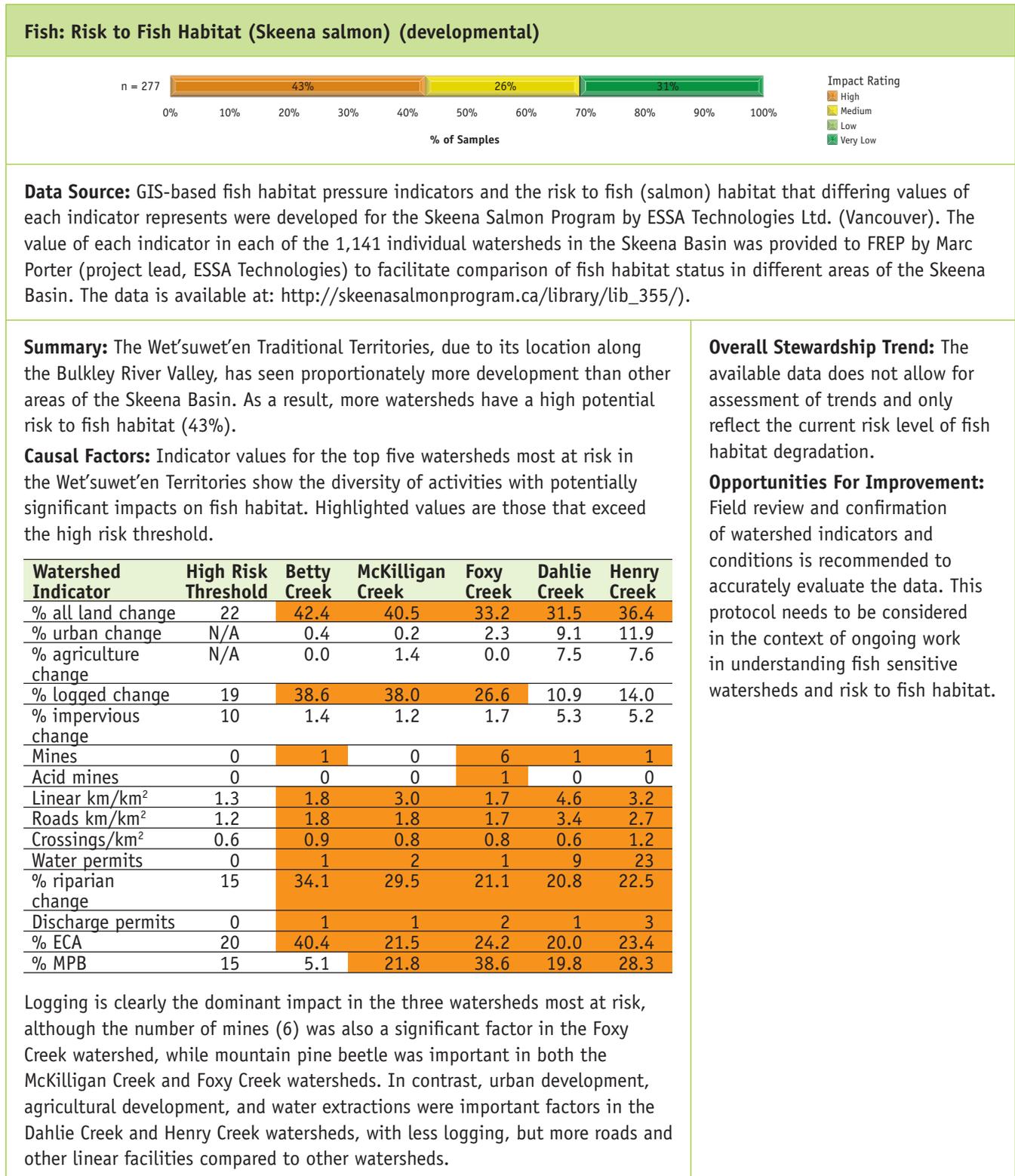
- natural stream bed dynamics;
- stream channel integrity;
- quality, quantity and timing of water flow; and
- natural, watershed level, hydrological conditions and integrity.

## Fisheries Sensitive Watersheds Value



## Risk to Fish Habitat (Skeena Salmon) Value

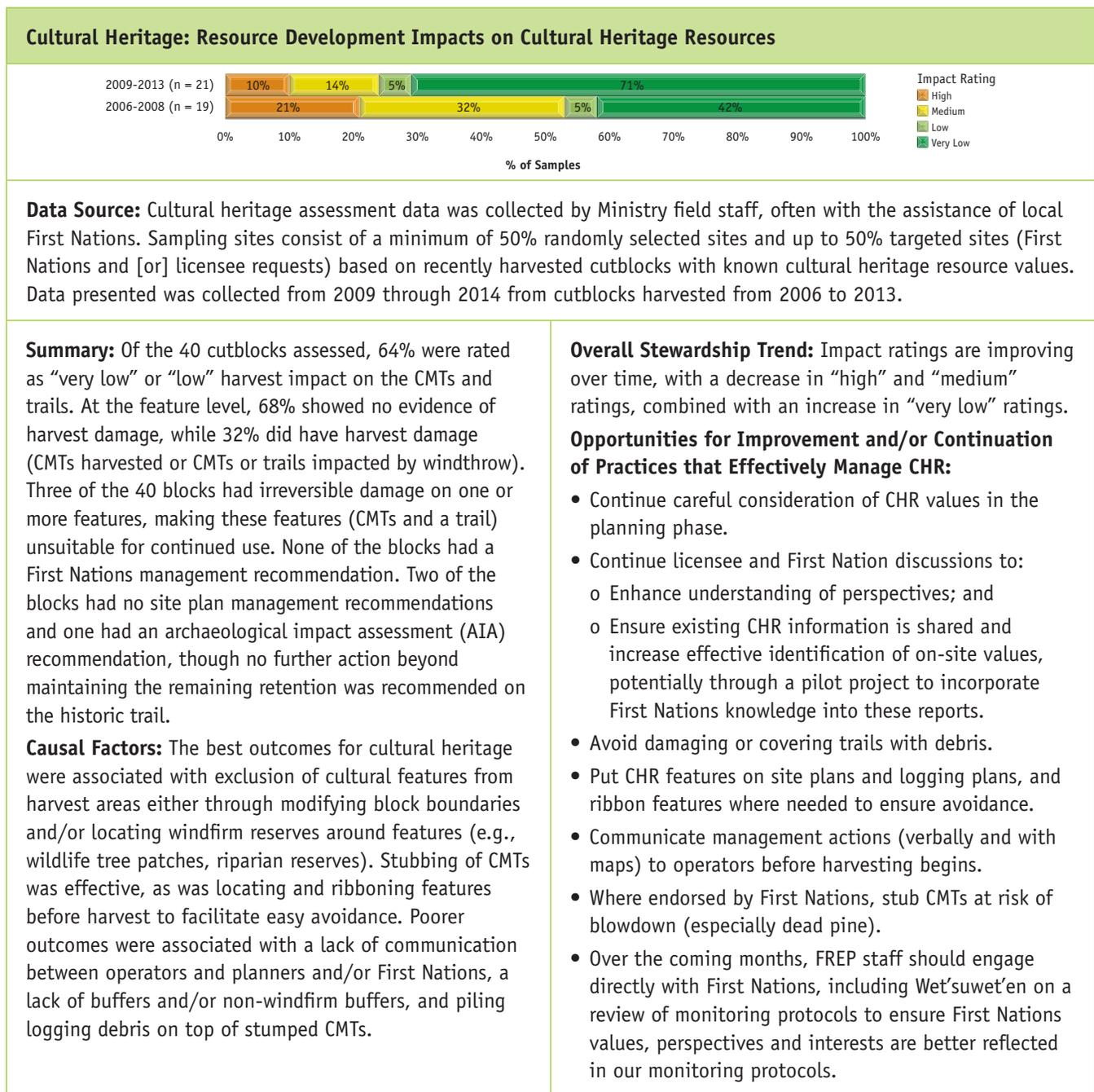
The following information is based on data provided by Skeena Salmon Program in their efforts to strengthen the baseline of information for wild salmon populations.



## Monitoring and Assessments Results: Social and Economic

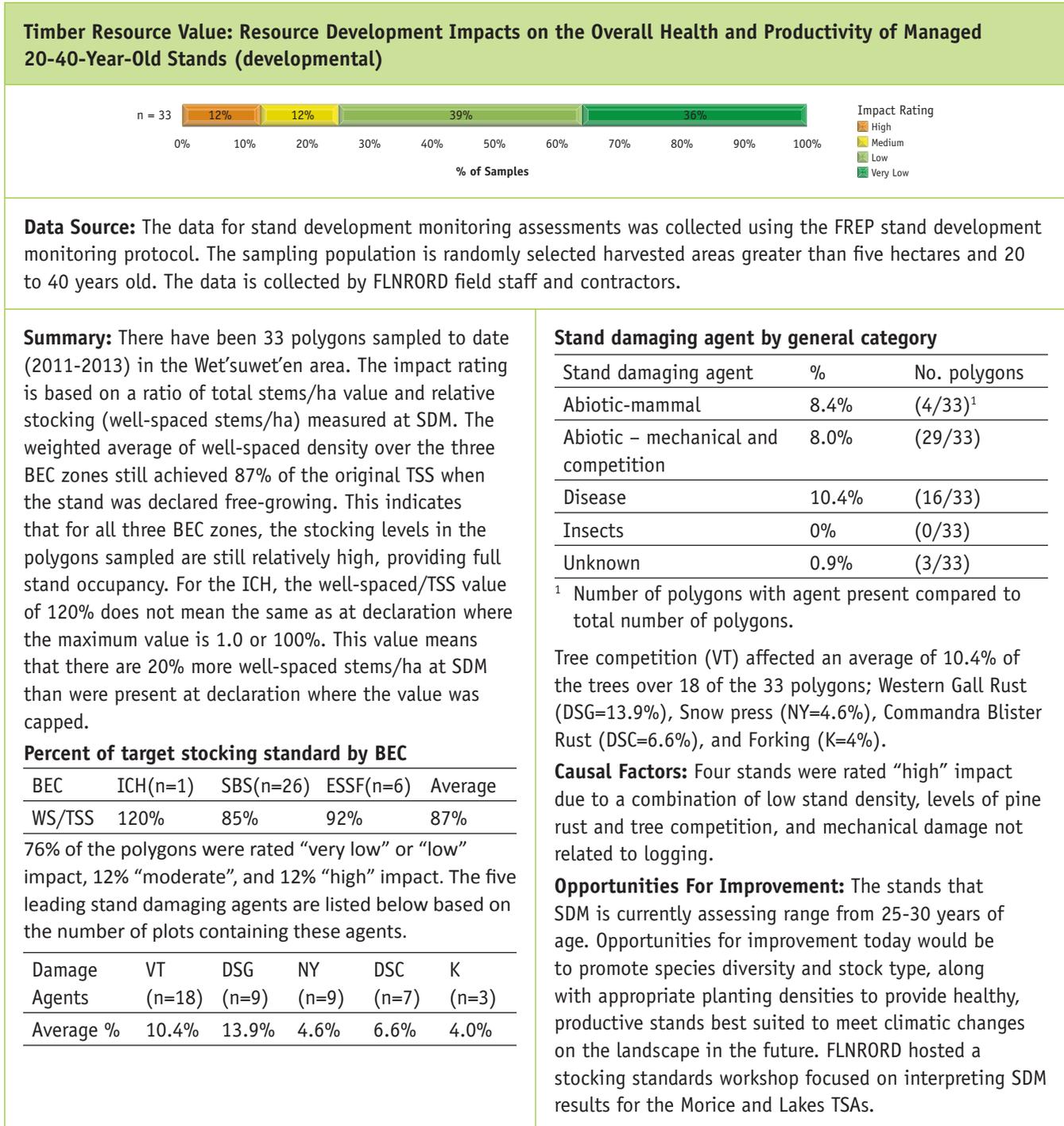
The *Forest Act* defines a cultural heritage resource (CHR) as “an object, a site or the location of a traditional societal practice that is of historical, cultural or archaeological significance to British Columbia, a community or an aboriginal people.” For example, culturally modified trees (CMTs), cultural trails, traditional use sites, cultural plant sites, cultural depressions (cache pits, house pits), lithics (stone tool/chips), grave sites, cabins, spiritual sites (pictographs, Nadina Mountain), and footprints (human/grizzly) embedded into the ground. The *Forest Planning and Practices Regulation* (FPPR) states the government objective: “to conserve, or, if necessary, protect cultural heritage resources that are: the focus of a traditional use, by an aboriginal people and that are of continuing importance to that people; and; not regulated under the *Heritage Conservation Act*.” CHRs that are not archaeological sites are managed under FRPA.

### Cultural Heritage Value



## Timber Value

The following section reports the results of monitoring that focus on forest health. The source of information for this section is FREP stand development monitoring protocol. Future sources of information may include monitoring outcomes for the five timber objectives articulated in “Provincial Timber Management Goals and Objectives” (FLNR, May 2014).

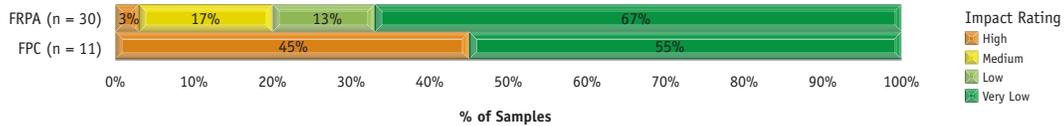


Values that have not been reported in this format before, are not fully implemented and/or do not include an assessment of habitat have been labeled “developmental”.

## Visual Quality Value

Visual Quality Objectives are defined in legislation to provide qualitative descriptions of expected visual conditions. These areas are required to be managed in a manner that timber harvesting does not compromise the designated objective. Visual Quality Research suggests that scale of alteration for clearcutting and remaining tree density (volume/stems per hectare) for partial cutting are useful indicators of achieved visual condition.

### Visual Quality: Resource Development Impacts on Achievement of Visual Quality Objectives (VQO)



**Data Source:** Visual quality assessment data was collected by FLNRORD field staff using the FREP visual quality monitoring protocol. Sampling sites consist of landforms with established visual quality objectives (VQOs) located in randomly selected, recently harvested cutblocks. Sampling was conducted from 2007 to 2015.

#### Summary:

Of the 41 landforms assessed (11 FPC and 30 FRPA), 73% were rated with “very low” or “low” harvest-related impacts on achieving the VQO. VQOs were “well met” (“very low” impact to achieving objective) on 63% of landforms, “met” (“low” impact) on 10%, “borderline” (“medium” impact) on 12%, “not met” on 2%, and “clearly not met” (“high” impact includes two categories) on 12%.

#### Causal Factors:

21% of the openings contained visually effective levels of tree retention (>22% by volume or stem count) and 39% of landforms sampled had good visual quality design (cutblock shaping).

#### Number of FRPA Samples by VQO and Impact Rating:

VQO <sup>1</sup>	High	Medium	Low	Very Low	Total
M	1	1		3	5
PR		4	1	14	19
R			3	3	6
<b>Total</b>	<b>1</b>	<b>5</b>	<b>4</b>	<b>20</b>	<b>30</b>

<sup>1</sup> M = modification, PR = partial retention, R = retention

#### Number of FPC Samples by VQO and Impact Rating:

VQO	High	Medium	Low	Very Low	Total
M				2	2
PR	3			4	7
R	2				2
<b>Sum</b>	<b>5</b>			<b>6</b>	<b>11</b>

#### Overall Stewardship Trend:

There is a decrease in “high” impacted landforms with FRPA cutblocks compared to FPC cutblocks. There is also better visual quality design in the FRPA era (43% vs 27%) and better levels of tree retention (30% vs 0%).

#### Opportunities for Improvement Based on Viewscapes that Meet Visual Quality Objectives:

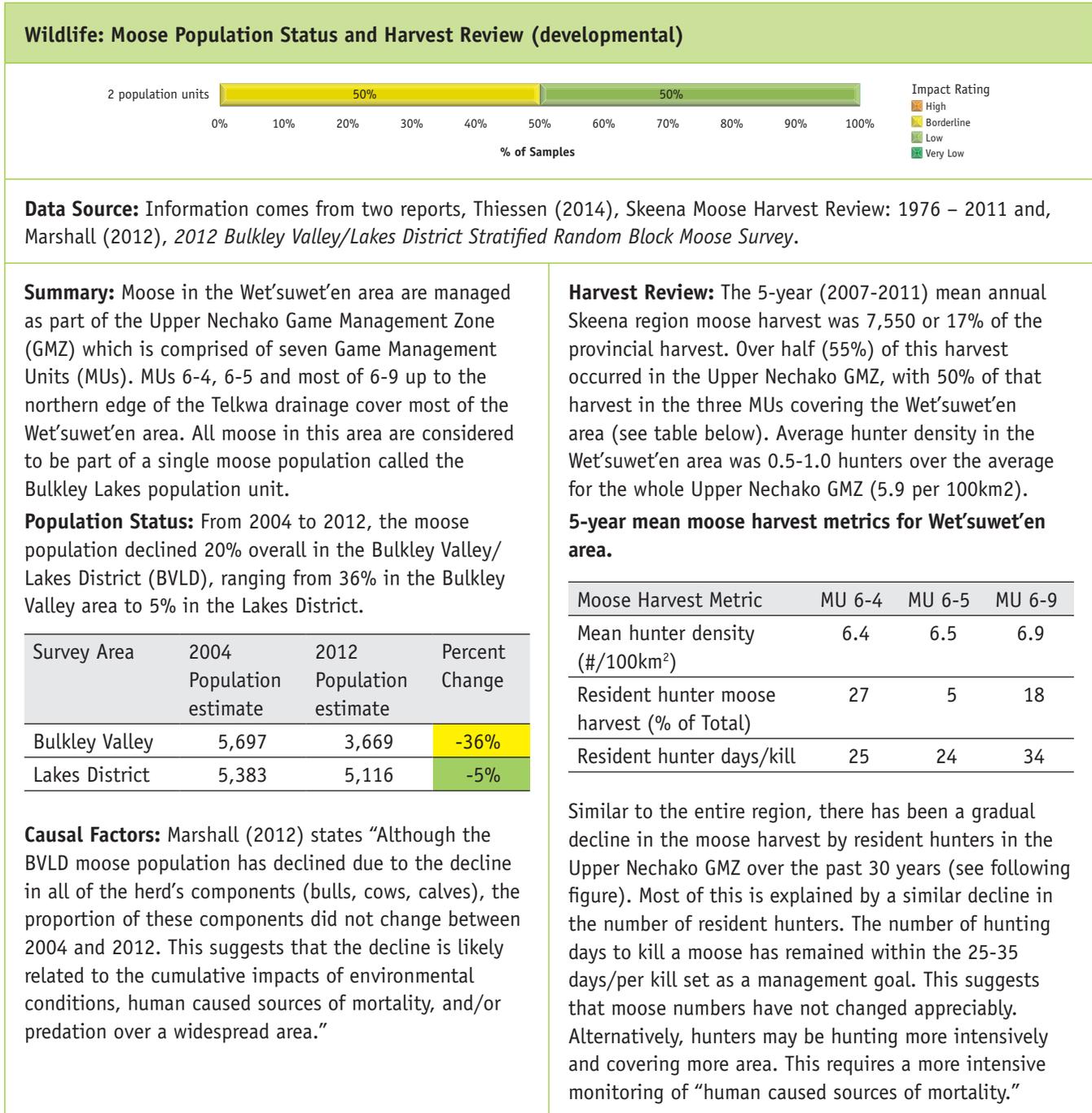
When in viewscapes:

- Use existing visual design techniques to create more natural looking openings and better achieve VQOs.
- Use partial cutting to retain higher levels of volume/stems.
- Reduce opening size in retention and partial retention VQO areas.

## Monitoring and Assessments Results: Wildlife

Moose are a highly valued big game species. Over the last decade, populations have declined significantly in the central interior regions of British Columbia. First Nations and stakeholders are concerned about this population decline.

### Moose Value

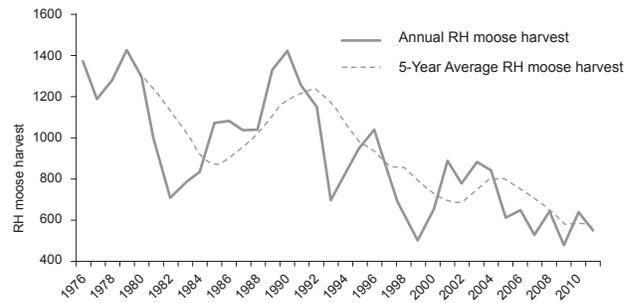


Values that have not been reported in this format before, are not fully implemented and/or do not include an assessment of habitat have been labeled “developmental”.

Marshall goes on to say there has not been a decline in the bull:100 cow ratio sufficient enough to cause a lack of pregnancies. Calf production, as measured by the calf:100 cow ratio near the end of winter ( $37 \pm 7$  calves:100 cows) also appears to be sufficiently high to offset both natural and hunting related mortality rates (Marshall 2012).

**Opportunities For Improvement:** Specific opportunities to improve moose abundance cannot presently be determined. Marshall (2012) recommended repeating the survey in five years, with strip surveys in a few years in the Lakes District to assess the bull:cow ratios, review hunter success rates in the Skeena Region, and contact moose managers in adjacent regions (Omineca, Cariboo) to determine if they are experiencing similar declines.

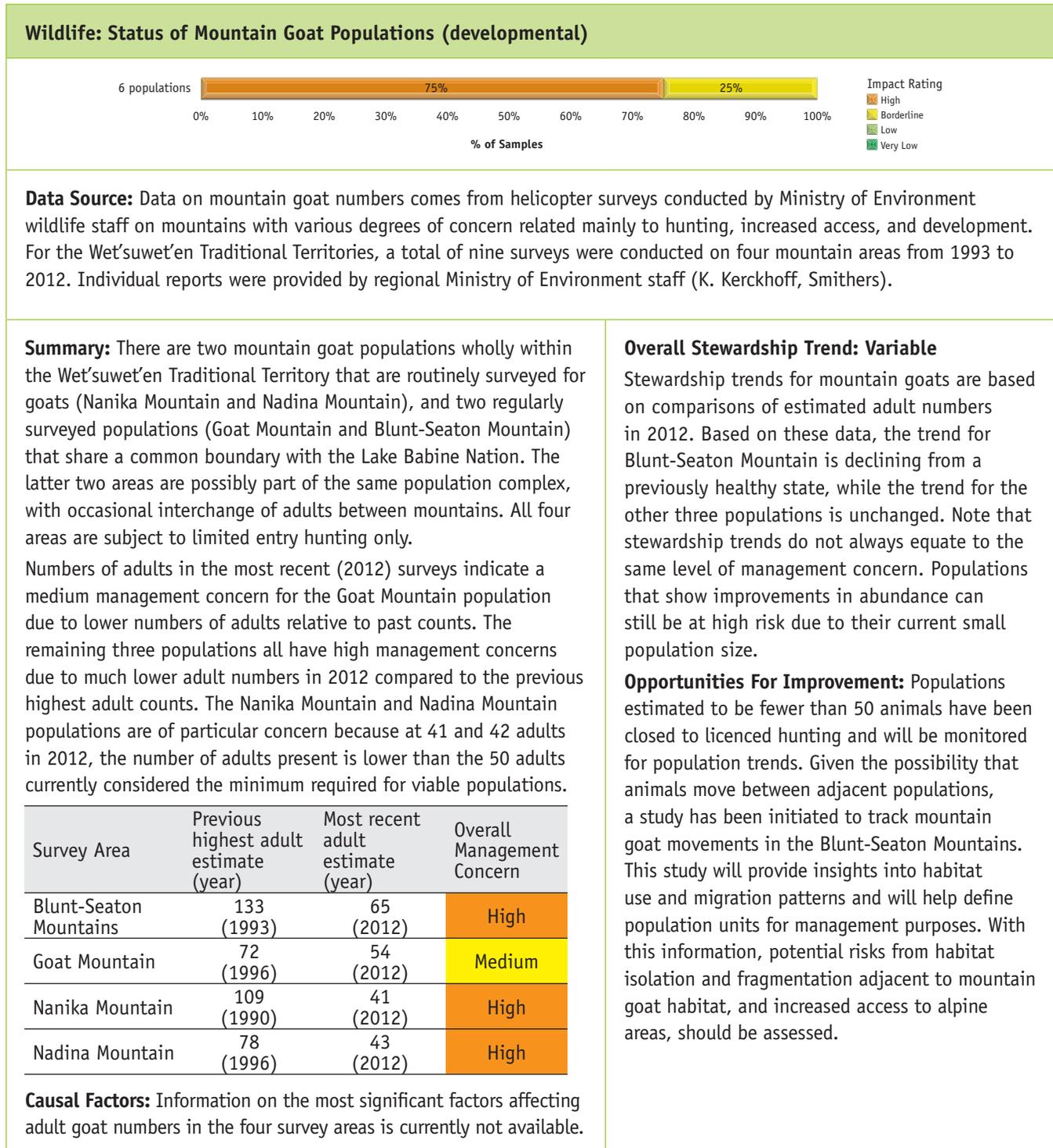
### Moose harvest 1976-2011, Bulkley Valley/Lakes District



There is a strong positive correlation between the number of hunters and the number of moose killed over the years. Given this relationship, the general decline in the number of resident hunters explains a large portion of the decline in the number of moose harvested in the Upper Nechako GMZ. However, the relationship does not include non-Wet'suwet'en Aboriginal and Metis Hunters getting their moose without consent in the Wet'suwet'en Territories. This and the possibility that hunters in general may be hunting more intensively and covering more area requires more intensive monitoring of human caused sources of mortality.

## Mountain Goat Value

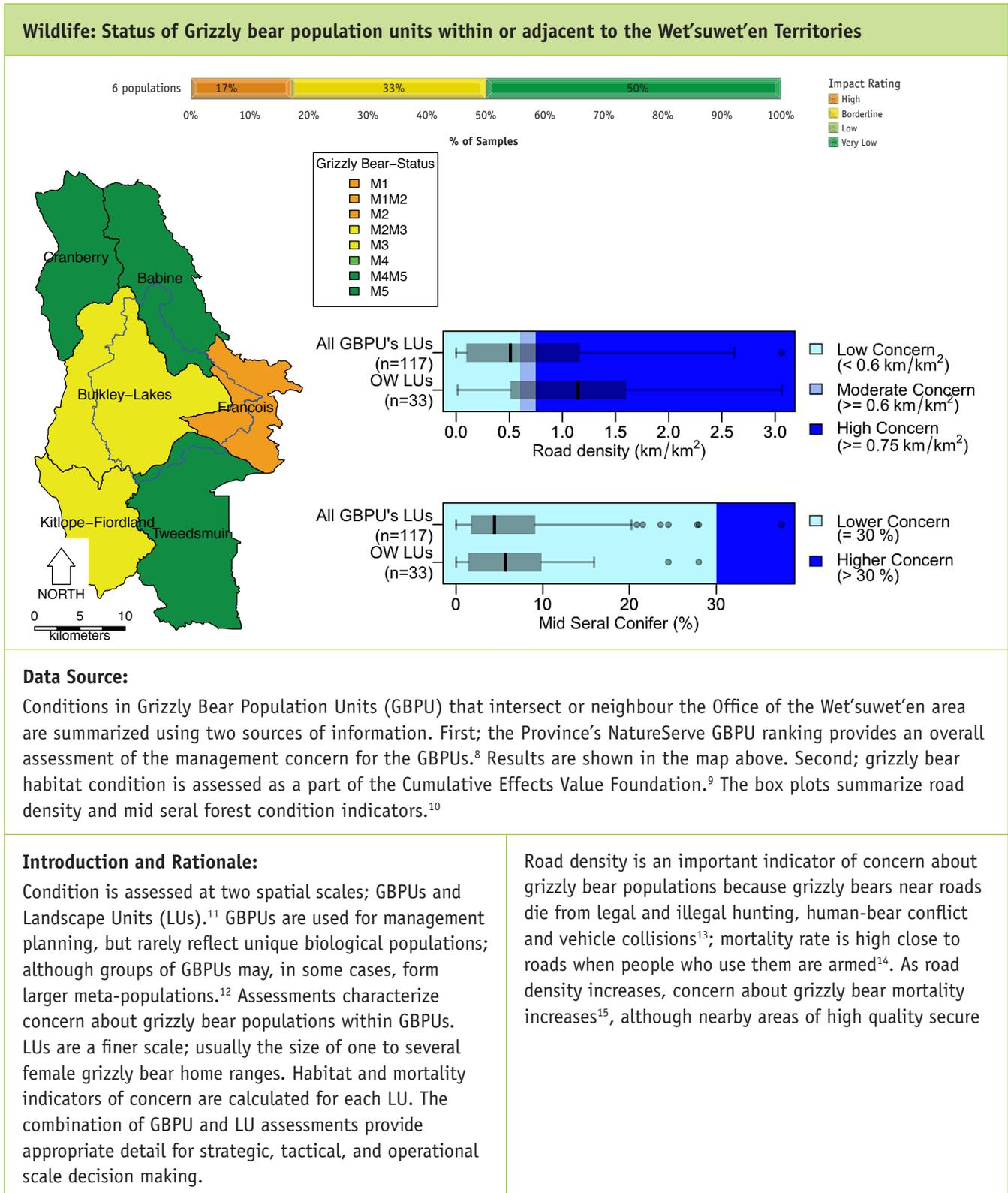
Approximately one half of the world’s mountain goats are found in British Columbia; the province has a global responsibility to ensure their long-term persistence. Mountain goats are a valued species, having social and economic value to First Nations for ceremonial use and as a source of food and clothing.



Values that have not been reported in this format before, are not fully implemented and/or do not include an assessment of habitat have been labeled “developmental”.

## Grizzly Bear Value

Approximately 15,000, or 25% of the North American population of grizzly bears live in British Columbia. Grizzly bears are an iconic international symbol of British Columbia's wild areas and are important to First Nations culture.



### **Office of the Wet'suwet'en Area Summary and Causal Factors:**

Levels of management concern for the GBPUs that include or neighbor the Office of the Wet'suwet'en area are: Low for the Tweedsmuir, Cranberry and Babine, moderate for the Kitlope-Fiordland and Bulkley Lakes and high for the Francois.

Three quarters (74%) of the LUs in the Office of the Wet'suwet'en area have road densities higher than the low concern threshold of 0.6 km/km<sup>2</sup>. The median road density by LU is approximately 1 km/km<sup>2</sup>. This is well above road densities that have been associated with population decreases in other areas.<sup>20</sup> On average the Office of the Wet'suwet'en area has high concern about grizzly bear mortality due road density and this rating is higher than the surrounding area. Although areas to the east have high road densities those to the west and north are much lower. For mid-seral forest condition the area is a lower concern.

Landscape-level forage supply is not currently an issue for the Office of the Wet'suwet'en area grizzly bears. All LUs (with two exceptions) have less than 30% mid-seral forest.

### **GBPU Summary**

#### *Babine GBPU*

The Babine GBPU is of low management concern (M5). The GBPU is open for resident and non-resident hunting. Babine River Corridor Provincial Park and Babine Mountain Provincial Park provide some habitat protection in the GBPU. Development of Wildlife Habitat Areas specifically for grizzly bears is currently underway. The Babine GBPU has been identified as a priority unit for monitoring.<sup>21</sup>

#### *Francois*

The Francois GBPU is of high management concern (M1M2). The GBPU has been closed to hunting since 2010 (because of a reduced population estimate in 2011 and the no female harvest since 1999 and the level of unreported human caused mortality is likely underestimated). Highway 16, the agricultural/settlement zone and Oosta Lake (also Francois & Babine Lakes) have a negative effect on bear movements. Recent logging activity in the northern ½ have removed some of the last remaining forested linkages. Human-conflict kills associated with cattle farming are an issue in the southern half of the GBPU. The GBPU is a priority for population and habitat monitoring.

#### *Bulkley-Lakes*

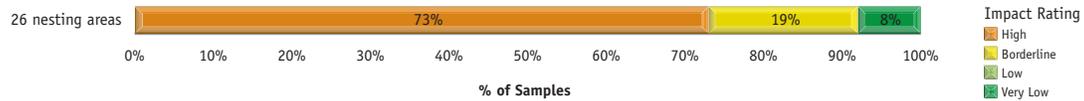
The Bulkley Lakes GBPU ranks in the middle of the NatureServe scale (M3) and is a moderate management concern. The Bulkley Lakes GBPU is open to resident and non-resident grizzly bear hunting with the exception of one area. Resident hunter effort is spatially separated into 6 LEH zones within no hunting 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 units isolation.

#### *Tweedsmuir*

The Tweedsmuir GBPU is of low management concern (M4M5).

## Northern Goshawk Value

### Wildlife: Forest Harvest Impacts on the Probable Recolonization of Northern Goshawk Nest (Breeding) Areas (report summary)



**Data Source:** The data in this report on the status of northern goshawk breeding areas comes from a 2012 report by Frank Doyle (Wildlife Dynamics Consulting, Smithers), a 10-year study (1999-2009) of 48 known northern goshawk breeding areas in the Nadina Forest District. Funded initially through Forest Renewal BC, then later by the Forest Investment Account, the study is one of several that a team of goshawk biologists have published in the northwest and south-east portions of the province on the effects of logging on northern goshawks.

**Summary:** Northern goshawk habitat requirements are large areas of mixed forest types that produce a range of prey species adjacent to a minimum 100-ha patch of old seral forest nesting habitat. The bird is a focal management species under the Morice LRMP, which has a goal requiring maintenance of “adequate nesting and foraging habitat to ensure a healthy and sustainable population of northern goshawks across their present range.” The distance between goshawk territories is primarily dictated by prey availability. Goshawk predate on a wide variety of medium-sized mammals and birds that occupy a mix of young to old forest settings. Nest site occupancy indicates prey abundance, and provides a valuable indicator of prey species presence within the mixed and old forest of the broader foraging territory (A. Hetherington, pers. comm.), which in the BC interior can be up to 2400 hectares in size. Additionally, as northern goshawk prefers to hunt in older forests with relatively closed canopy, its absence is considered to be an indicator of landscape-scale forest fragmentation.

Of 26 northern goshawk nesting areas identified in the Wet’suwet’en area, 19 of these nesting areas were considered unlikely to be recolonized (“poor”), 5 were assessed as “borderline” condition, and 2 nest areas were assessed in “good” condition.

**Causal Factors:** All nesting areas were affected to varying degrees by mountain pine beetle attacks, the implications of which are still the subject of study. Other critical factors included the degree of harvesting within or close to the nest area and/or how isolated from adjacent mature/old forest the nest area became.

For nest areas unlikely to be recolonized (“poor”), the average portion of the nest area logged was 32% (range 5-90%). Connectivity to mature/old forests was 37%. Borderline nest areas, although unlogged within the nest area boundary, had logging within 500 m of the nest areas, and reduced connectivity to mature/old forest habitat due to logging. Fire led to a poor rating at two sites. There are no legal management objectives for northern goshawk, but it is a species whose habitat requirements (large areas of connected, undisturbed mature and old seral forest) are representative of those for a broad cross-section of other wildlife species.

#### Nest Area Logged (%) and Degree of Connectivity to Mature/Old Forest by Probability of Recolonization:

Probability of Recolonization	Sample Size (n)	% Logged	Logged within 500 m	% Connectivity
Good	2	0	No	90
Borderline	5	0	Yes	82
Poor	19	32	Yes	37

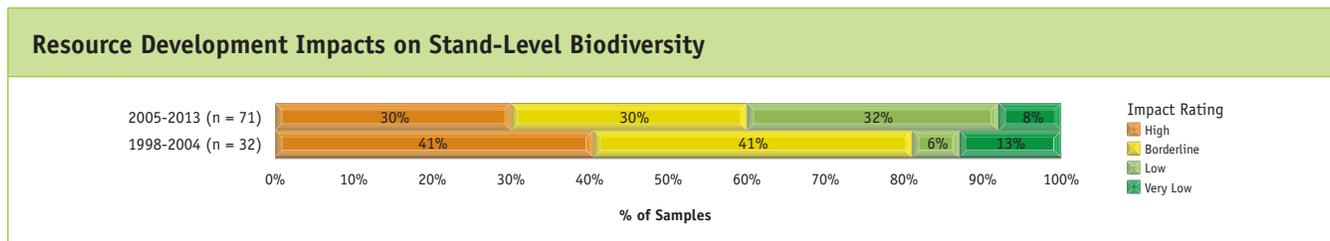
**Opportunities For Improvement:** Better tracking of northern goshawk nest area locations and conditions is required by industry and government, and when nests are found, the application of best management practices.

Reserves smaller than 25 ha are typically ineffective; reserves larger than 100 ha have the highest likelihood of continued occupancy. Connecting the reserves to adjacent mature/old forest will increase the effective size of the reserve and provide linkages to foraging areas beyond the breeding area. A study of goshawk survival and impacts to goshawk habitat is ongoing. This information would be very valuable to help inform resource development decision making.

# Monitoring and Assessments Results: Forest, Biodiversity and Air Quality

## Stand-level Biodiversity Value

The goal of stand-level biodiversity monitoring is to determine whether the retaining wildlife tree patches and riparian reserves is achieving the desired levels and types of structures to maintain species diversity. Stand-level biodiversity assesses the quality (size, species, condition) and quantity (amount) of tree and woody debris retention left after forest harvesting.



**Data Source:** The data for stand-level biodiversity assessments was collected using the FREP stand-level biodiversity monitoring protocol. The sampling population is randomly selected recently harvested cutblocks. The data is collected by FLNRORD field staff. Data presented was collected from 2008 through 2015 from cutblocks harvested from 1998 to 2013.

**Summary:** Of the 1034<sup>22</sup> cutblocks, 34% of sites were rated as having “very low” or “low” harvest-related impacts. The table below shows the percentage of sampled cutblocks by impact category. It also gives the average size of cutblock by category, with smaller cutblocks more likely to be in the “high” impact category.

2005-2013 harvest	High	Medium	Low	Very Low
% of blocks	30%	30%	32%	8%
Average gross (ha)	7	26	43	51
% of area sampled	7%	27%	50%	15%

1998-2004 harvest	High	Medium	Low	Very Low
% of blocks	41%	41%	6%	13%
Average gross (ha)	14	27	37	117
% of area sampled	17%	33%	7%	43%

### Causal Factors for 2005-2013 harvest era:

76% of all sampled cutblocks harvested after 2004 had more than 3.5% tree retention, 3% (two cutblocks) had zero retention. The density of large snags ( $\geq 30$  cm dbh and  $\geq 10$  m high) is lower than that found in baseline conditions (timber cruise data in the same ecosystem). The number of live tree species and density of big trees (generally  $> 40$  cm dbh) is also lower than baseline. The range of coarse woody debris volume over many cutblocks is similar or slightly lower than expected from baseline (as in retention patches). Coarse woody debris quality (i.e., volume from  $\geq 20$  cm pieces and density of big pieces per hectare of  $\geq 20$  cm diameter and  $\geq 10$  m long) is skewed towards lower amounts compared to the baseline.

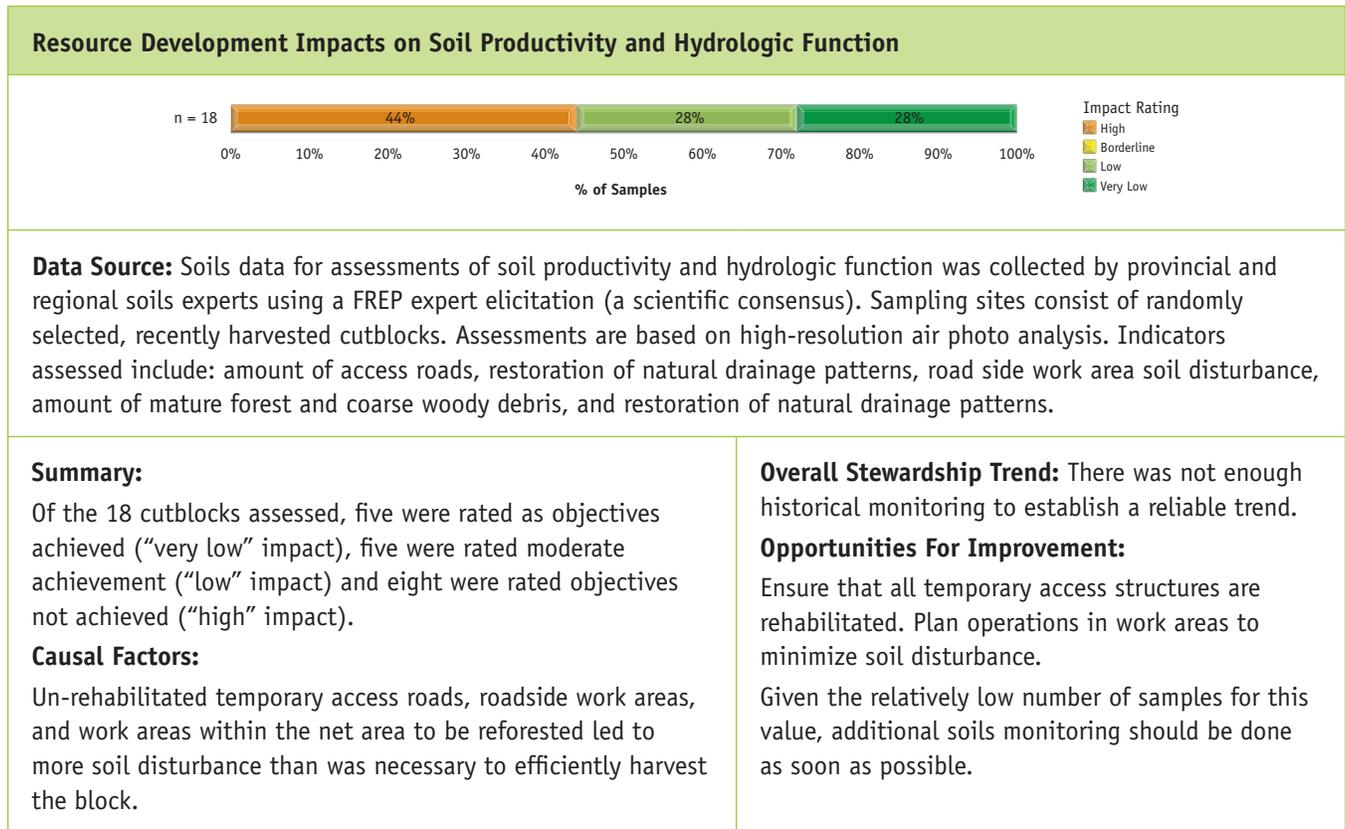
**Overall Stewardship Trend:** A statistical difference ( $p = 0.01$ ) was evident between harvest eras, with improvement in the later harvest era. Retention increased slightly from an average 15.4% for cutblocks harvested before 2005 to 16.8% for blocks harvested from 2005-on. There is a decrease in blocks with zero retention in the 2005-on harvest era. Average retention quality increased slightly between harvest eras. CWD quantity and quality did not change.

### Opportunities for Improvement and (or) Continuation of Practices that Effectively Manage Stand-level Biodiversity:

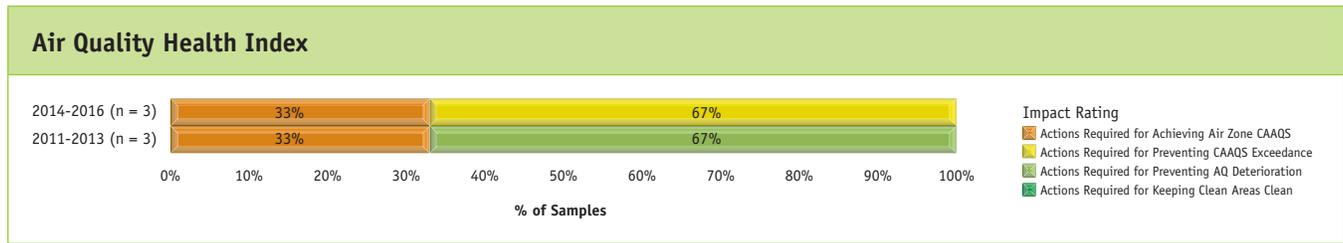
- Leave a range of retention (e.g., 3% to 30%) over many cutblocks.
- Look for opportunities to safely leave large snags as ecological anchors within retention patches.
- Leave big trees, and numbers of tree species in the full range compared to pre-harvest conditions.
- Leave higher amounts of big coarse woody debris pieces on-site.

A portion of the Wet’suwet’en territory has a spatially identified landscape-level retention prescribed to enhance stand-level biodiversity. Future analysis will take into account the overall landscape condition and the higher-level guidance.

## Soils Value



## Air Quality Value



**Data Source:** Air quality data comes from monitoring stations that measure and upload pollutant concentrations to a publicly available website on an hourly basis. Commonly measured pollutants include:  $PM_{2.5}$ ,  $PM_{10}$ ,  $O_3$  and  $NO_2$ . Stations are operated and maintained either by MOE or industry (permittee) staff. The stations are located primarily in urban areas or at industrial sites where concerns over air quality are greatest. The data generally only reflect conditions in those areas, i.e., they are usually not a measure of average conditions across a region. First Nations communities may experience significantly different air quality than that measured within larger communities, particularly in the winter. Data at these stations are automatically checked, but are only considered valid after they have been manually analyzed and reviewed by MOE staff, a process that may take up to three months.

**Summary:** Within the borders of the Wet’suwet’en territories, air quality is measured in Smithers, Houston and Burns Lake. In all communities,  $PM_{2.5}$  and  $PM_{10}$  are measured, while in Smithers,  $O_3$  and  $NO_2$  are additionally measured. The most prevalent pollutant in the area is  $PM_{2.5}$ , while  $PM_{10}$  is sometimes an issue. The federal government has set standards for  $PM_{2.5}$  as part of the Canadian Ambient Air Quality Standards (CAAQS). There are two CAAQS for  $PM_{2.5}$ , one based on the annual average concentration and the other on the annual daily 98th percentile concentration (i.e., the eighth-highest daily concentration over one year). Achievement for both is calculated by averaging results over three years. Results are categorized into one of four groups (colour coded), details of which can be found in Appendix 5.\*

Community	Year	$PM_{2.5}$ Annual Mean ( $\mu g/m^3$ )	$PM_{2.5}$ Daily Mean (98 <sup>th</sup> Percentile) ( $\mu g/m^3$ )
Smithers	2011 – 2013	9.4	29
	2014 – 2016	7.9	25
Houston	2011 – 2013	5.2**	18**
	2014 – 2016	9.3	29
Burns Lake	2011 – 2013	4.8**	16**
	2014 – 2016	7.2	20

\* Colours used in the table represent management levels consistent with CAAQS and are not the same colour codes use to measure impact rating.

\*\* denotes data collected at an instrument known to undermeasure  $PM_{2.5}$  levels in cold temperatures.

**Causal Factors:** Air pollution issues in much of BC are caused by emissions of fine particulate matter,  $PM_{2.5}$ . The term  $PM_{2.5}$  refers to microscopic solid or liquid particles smaller than 2.5 micrometers in diameter.  $PM_{2.5}$  can be directly emitted into the atmosphere from combustion sources or formed by chemical reactions of precursor gasses.

Sources of  $PM_{2.5}$  in this geographic area include emissions from:

- Wood burning stoves;
- Open burning of forestry waste;
- Industrial processes;
- The transportation sector (large trucks and trains); and
- Forest fires.

$PM_{10}$  in this geographic area is caused by road dust. These sources are described in detail in the Bulkley Valley – Lakes District Airshed Management Plan, available online at: <http://cleanairplan.ca/>.  $PM_{2.5}$  levels are typically elevated in the autumn and winter months when many of the emission sources described above are active. Periodically, summertime  $PM_{2.5}$  is elevated due to forest fires.  $PM_{10}$  levels are typically elevated in the spring when winter traction material becomes exposed and is emitted into the air as dust. Health effects of wood smoke are aptly summarized in Naeher et al. (2007), and the effects of  $PM_{2.5}$  are more generally explained by the World Health Organization (2013). Exposure to  $PM_{2.5}$  is associated with increased morbidity and mortality; reducing concentrations results in improved health outcomes and increased life expectancy (Pope et al., 2009).

*continued on next page*

Area-specific smoke management plans have been prepared for logging related prescribed burning activities in the Bulkley and Morrice TSAs. These plans require enhanced responsibilities for those conducting burning operations in these areas.

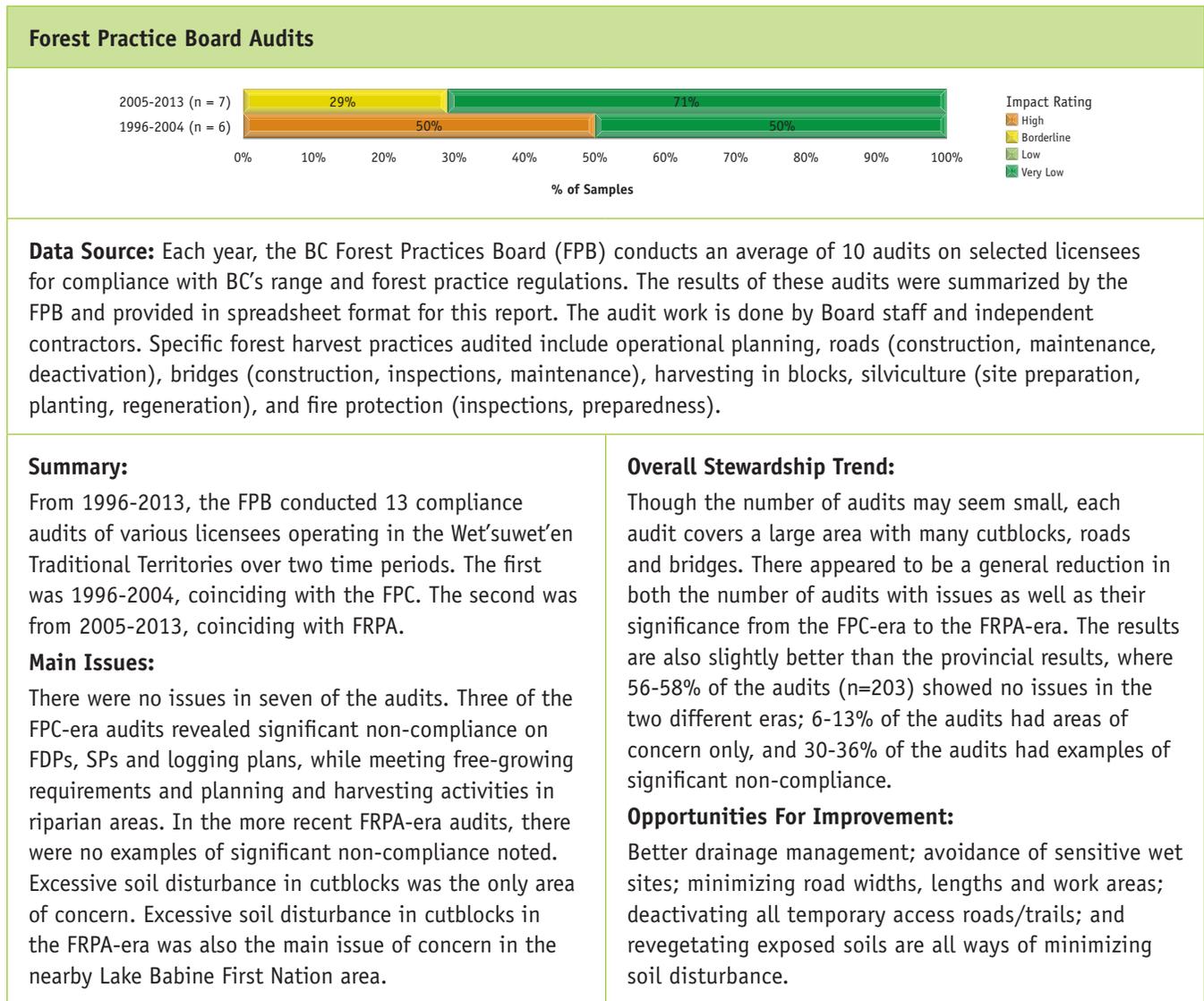
As these communities are categorized in orange and red according to CAAQS, management actions are required to improve air quality in these areas (CCME, 2012). This includes actions such as: additional monitoring, airshed emissions inventory, multi-stakeholder collaboration, and planning and public education. More information can be found at: [http://www.ccme.ca/files/Resources/air/aqms/pn\\_1481\\_gdazm\\_e.pdf](http://www.ccme.ca/files/Resources/air/aqms/pn_1481_gdazm_e.pdf).

**Overall Stewardship Trend:** Improvement in Smithers, regression in Houston.

**Opportunities for Improvement:** Increased participation in airshed management; assess opportunities to: reduce woodstove use, minimize open burning, improve industrial emissions, and curtail spring road dust.

## Forest Practices Board Compliance Audits Value

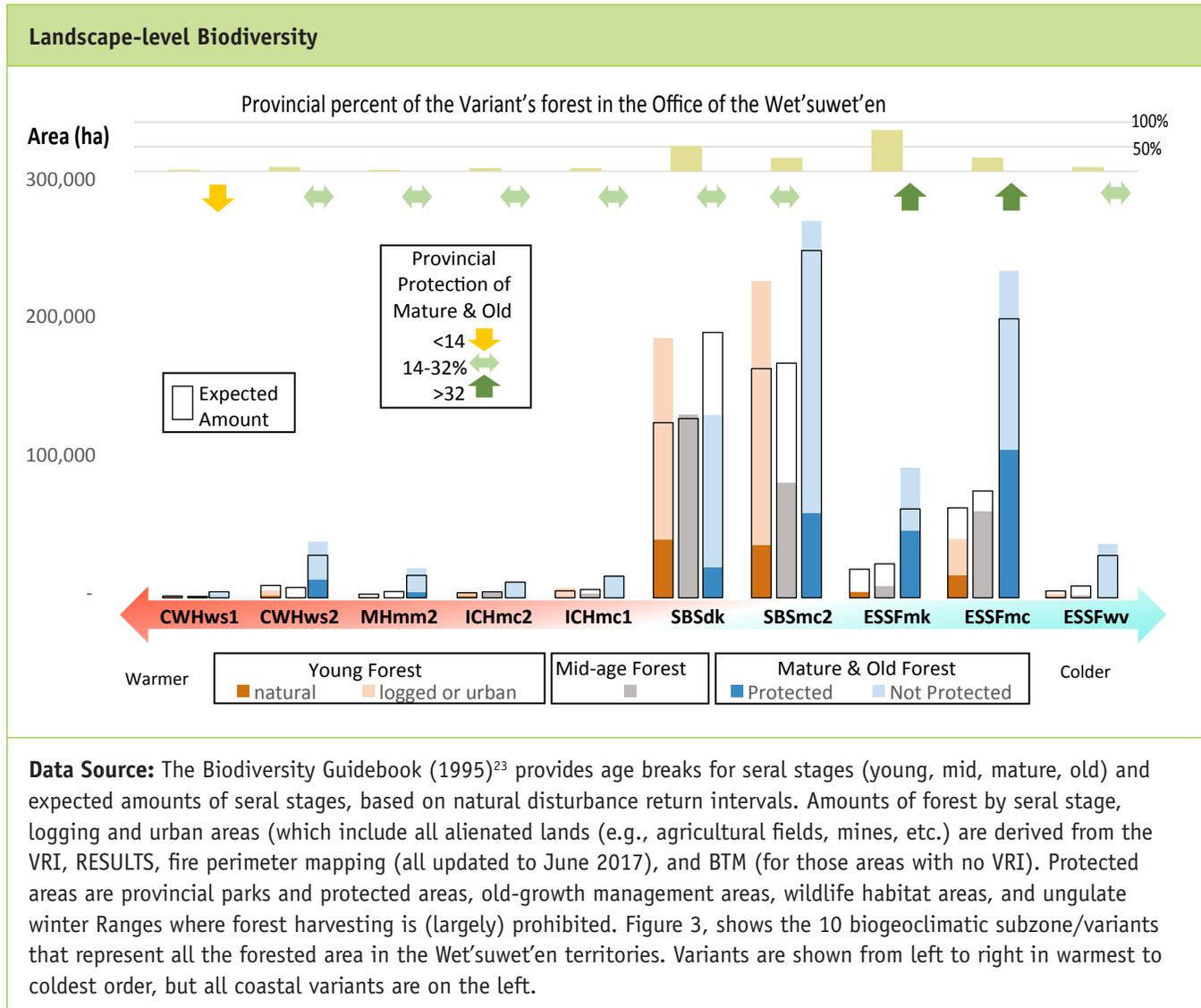
Additional context for the Forest Practices Board Compliance audits can be found in their detailed audit reports. These audits are focused on forest practices and the outcomes help provide additional context for the monitoring results contained in this report. The Board assessments were full scope compliance audits that each involved an extensive sample of cutblocks and roads associated with forest harvesting.



## Landscape-Level Biodiversity Value

In British Columbia, it is assumed that biodiversity can be more likely maintained if forest management seeks to create or maintain a seral stage distribution similar to that of the natural landscape prior to harvesting.<sup>24</sup>

Therefore, the degree of departure between the observed and the expected seral stage distribution after harvest is an indicator of risk to landscape-level biodiversity. The amount of young natural forest and the amount of protected older forest are used as indicators of condition since these elements are known to be in short supply in some areas of the province. The distinction between mature forest and old forest is not made because the ages reported in forest cover maps are often not precise enough to do so.<sup>25</sup>



**Provincial Context:** The Wet'suwet'en territories contain a small proportion (<10%) of all the coastal and ICH variants and the ESSFwv. The area contains more than 25% of the SBSmc2 and ESSFmc, and more than 50% of the SBSdk and ESSFmk variants. Provincially, protection of mature and old forest variants in the area is either in the range of the average (14-32%; 2nd and 3rd quartile) or well above average (>32%; 4th quartile), with the exception of the CWHws1, where only 11% of the mature and old forest variants is protected.

**Area Summary and Causal Factors:** Over the entire forest (all variants combined), there is a little more mature and old forest than expected (106%); although there is much less than expected in the SBSdk (70%). Overall, there is much less mid-aged forest than expected (69%). Where this occurs, it indicates that over the last century (prior to the recent MPB infestation), the area has experienced fewer natural disturbances than would be expected, either because of chance events or because there has been a change in the disturbance regime. In recent years, there has been substantial logging to salvage value from MPB affected stands, particularly in the SBSdk and SBSmc2, and this is reflected in the higher than expected amounts of young forest in those variants.

The amount of mature and old forest protected over the entire area (30%) is slightly higher than the provincial average (27%); however, protection is very low (nearly zero) in ICH variants and the ESSFwv. (Note that very little of those variants occur in the area; 6% and 9%, respectively.) About half the protection is in provincial parks and about half of that total is in Tweedsmuir Provincial Park. Almost all of the remaining protection is in OGMAs and WHAs for northern caribou.

The amount of young forest of natural origin is reasonably high in the coastal and mountain (ESSF) variants, ranging from 30 to 90%. The percentage of natural young in the SBS variants, where there has been extensive recent salvage harvesting, is lower (SBSmc2=17%; SBSdk=23%).

**Wet'suwet'en territory caveats and opportunities for improvement:** Care must be taken when interpreting these results for two principal reasons:

- Over 80% of the forest in the area occurs in three variants; SBSdk, SBSmc2 and ESSFmc. The results show the overall condition of those variants; however, because of their size, some substantial variability in condition is to be expected.

- The reported seral stage distributions in the SBS and ESSFmc variants do not reflect the extensive MPB infestation that has occurred (up to 40% of the 'mature' forest in the SBSdk may have been heavily infested). Some of these areas should likely be reported in the 'natural young' category.

Planning for future salvage harvesting in the SBSdk and SBSmc2 needs to be done with the knowledge that the amount of young forest there is already exceeding the expected amounts. Particularly in the SBSdk, where the amount of mature and old forest is less than expected, and much of that old forest has been infested with MBP. Landscape-scale plans to retain areas from harvesting should be completed and implemented.

**General opportunities for improvement:** This assessment will be refined in collaboration with the Provincial Cumulative Effects Assessment program, including refinements to:

- Seral stage mapping as the VRI map improves and methods of incorporating the effects of fire and MPB infestations are developed; and
- Natural disturbance return intervals, based on recent literature and computer modeling.

This information will:

- Allow site/stand-level results to be seen in a landscape context (e.g., does a decision maker/licensee want to consider more site-level retention in those variants where mature forest occurs in amounts that are substantially lower than expected under a natural disturbance regime?); and
- Identify areas where observed levels of mature forest are substantially above or below naturally expected levels, and use the information to help decide on locations for any new and/or the relocation of existing retention areas (e.g., OGMAs, WHAs, etc.) or areas where harvesting might be temporarily deferred until the seral stage distribution begins to resemble the natural distribution.

More detailed information than presented here on landscape-level forest condition is available from FREP. In particular, information is available that summarizes the results by landscape units and estimates the amount of old forest.

## Resource Stewardship Effectiveness Results Comparison

Table 2 provides ratings of stewardship effectiveness for the resource values monitored under FREP at varying scales. Effectiveness is determined by the percentage of samples with a “very low” or “low” resource development impact rating. Appendix 2 shows results by resource value for the north, south and coast areas, and the province as a whole.

**Table 2: Stewardship effectiveness within the Skeena Region as determined by resource development impact rating (ID = Insufficient Data; sample sizes in brackets).**

Resource Value	Effectiveness of Practices in Achieving Resource Stewardship Objectives: % very low + low resource development impact rating				
	Skeena Region Comparison				
	Wet’suwet’en Territories	Coast Mountain District	Skeena Stikine District	Nadina District	Skeena Region*
FREP riparian – all data	<b>83%</b> (98)	<b>75%</b> (122)	<b>90%</b> (73)	<b>75%</b> (96)	<b>79%</b> (291)
FRPA-era data	87% (62)	76% (55)	93% (38)	83% (55)	83% (148)
FPC-era data	75% (36)	77% (65)	86% (35)	63% (41)	75% (141)
FREP water quality – all data	<b>63%</b> (241)	<b>75%</b> (356)	<b>86%</b> (161)	<b>49%</b> (231)	<b>70%</b> (748)
2012–2015 samples	66% (112)	70% (221)	73% (65)	51% (78)	66% (364)
2008–2011 samples	59% (129)	83% (135)	96% (96)	48% (153)	73% (384)
FREP stand-level biodiversity –all data	<b>34%</b> (103)	<b>64%</b> (114)	<b>54%</b> (100)	<b>30%</b> (96)	<b>50%</b> (310)
FRPA-era data	41% (71)	90% (50)	52% (63)	33% (58)	57% (171)
FPC-era data	19% (32)	44% (64)	57% (37)	26% (38)	42% (139)
FREP visual Quality					
FRPA	<b>80%</b> (30)	<b>68%</b> (66)	<b>93%</b> (27)	<b>67%</b> (18)	<b>74%</b> (111)
FPC	<b>55%</b> (11)	<b>50%</b> (34)	<b>ID</b> (1)	<b>67%</b> (18)	<b>55%</b> (53)

\* Coast Mountain, Skeena Stikine, and Nadina Natural Resource Districts

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## Appendix 1 – Summary Description of Resource Development Impact Rating Criteria

Table A1.1 shows the criteria used to determine the resource development impact ratings for each resource value. Detailed rating criteria, methodology, and definition of terms used are described in the companion document *FREP Technical Note #6: Methodologies for Converting FREP Monitoring Results to Multiple Resource Value Assessment (MRVA) Resource Development Impact Ratings* ([http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep\\_technical\\_note\\_06.pdf](http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep_technical_note_06.pdf)). The ratings of “very low,” “low,” “medium,” and “high” are technical ratings based on best available science.



**Table A1.1: Criteria for determining resource development impact rating outcomes for each resource subject.**

Resource Value	Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low	Low	Medium	High
Riparian	Are riparian forestry and range practices effective in maintaining the proper functioning of riparian areas?	Fifteen key questions (e.g., intact channel banks, fine sediments, riparian vegetation)	Number of "no" answers on assessment questions of channel and riparian conditions	0-2	3-4	5-6	> 6
Stand-level Biodiversity	Is stand-level retention providing the range of habitat and attributes understood as necessary for maintaining species dependent on wildlife trees and coarse woody debris?	% retention, retention quality (e.g., big patches, density of large diameter trees), coarse woody debris volume, coarse woody debris quality (e.g., density of pieces $\geq$ 10 m and 20 cm, and volume of large diameter pieces).	Cumulative score. A 60/40 weighting is used for tree retention versus coarse woody debris, recognizing the longer-term ecological value of standing retention.	> 70%	55-70%	40-55%	< 40%
Water Quality (sediment)	Are forest practices effective in protecting water quality?	Fine sediment potential	Fine sediment (m3) due to expected surface erosion or past mass wasting	< 0.1	< 1	1-5	> 5
Soils	Are forest practices preventing site disturbance that is detrimental to soil productivity and hydrologic function?	Amount of access, restoration of natural drainage patterns, road side work area soil disturbance, amount of mature forest and coarse woody debris, and restoration of natural drainage patterns	Overall assessment of practices on cutblock to maintain soil productivity and hydrologic function	Well	Moderately		Poor

Resource Value	Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low	Low	Medium	High
Cultural Heritage	Are cultural heritage resources being conserved and where necessary protected for First Nations cultural and traditional activities?	Evidence and extent of damage to features, operational limitations, management strategies, and type and extent of features	Combined overall cutblock assessment results with consideration of individual feature assessment results	See methodology report			
Timber: Stand Development Monitoring	What is the overall health and productivity of managed 20-40 year stands?	Relative stand productivity (stand stocking and total density) as reflected in the ratio of total to well-spaced stems/ha	Stand damaging agents (abiotic and biotic factors) are already reflected in the stands at SDM. Relative stand health and productivity is reflected in total to well-spaced stems/ha indicator. Forest health specialists determine the impact of the current level of stand damaging agents (at SDM) on subsequent health and productivity at harvest.	≥ 1.7	0.8–1.69	0.3–0.79	0–0.29

Resource Value	Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low	Low	Medium	High
Visual Quality	<p>Compared to the province as a whole, how well is the forested matrix at the landscape-level receiving protection and providing the range of habitat understood as necessary for maintaining ecosystem function and old and mature forest dependent species?</p> <p>How are we managing views in scenic areas and achieving visual quality objectives?</p>	<p>Visual evaluation of block, design of block, percent of landform altered, impact of roads, tree retention, and view point importance</p>	<p>Basic visual quality class (determined using the VQC definitions) is compared with the Adjusted VQC (derived using percent alteration measurements and adjustment factors) to determine if VQO is achieved.</p>	<p>VQO achieved, and % alteration low or mid-range</p>	<p>VQO achieved, but % alteration for one or both close to alteration limit</p>	<p>Only one method indicates VQO achieved</p>	<p>Both methods indicate VQO not achieved</p>

Resource Value	Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low	Low	Medium	High
Goshawk Breeding Areas	Are breeding (nesting) areas for northern goshawks being maintained to ensure continued use or recolonization?	Goshawk nest sites, breeding areas, seral stage characteristics, annual use of breeding areas, distance to forest harvesting, MPB areas and recent fires, amount of harvesting, MPB and fire within and adjacent to breeding areas, connectivity to late seral stage forest outside the breeding area	Distance from breeding areas to harvested areas, and connectivity of breeding areas to late seral stage forest outside the breeding area	No harvesting within 1,000 m of a breeding area, or if present, degree of connectivity to late seral stage forest is >80%		Harvesting within 500 m of breeding area	Harvesting within 270 m of center of breeding area
Moose	To what degree have moose population numbers changed since FRPA was first enabled in 2004?	Moose population estimates (bulls, cows, and calves) as determined with stratified random block surveys (corrected for sightability) in January of 2004 and 2012 for the Lakes and Bulkley Valley moose population unit.	Change in overall moose population numbers from 2004 to 2012. 2004 was chosen as the baseline due to the absence of comparable estimates in other years, and the difficulty ascertaining what the desirable population number is for an expanding moose population. 2004 is also the date forest harvest legislation changed from the FPC to FRPA.	< 25% change from the 2004 population estimate (positive or negative)		A 25-50% change in the 2004 population estimate (positive or negative)	>50% change in the 2004 population estimate (positive or negative)
Mountain Goat	Are mountain goat populations stable and of sufficient size to be considered viable in the long term?	Adult goat population numbers as determined by aerial surveys (corrected for sightability) in identified home ranges	Change in overall adult goat population estimates and/or adult goat population estimates <50, the minimum number of adults considered necessary for a viable population.	<15% decline in adult numbers from the previous highest count, and more than 50 adult animals present		15-40% decline in adult numbers from the previous highest count, and more than 50 adult animals present	More than a 40% decline in adult numbers from the previous highest count, or less than 50 adult animals present

Resource Value	Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low	Low	Medium	High
Benthic Invertebrates	Are benthic invertebrate communities at sample sites representative of communities at reference sites with minimal human activity?	Benthic invertebrate composition and abundance in precisely timed 3-minute kick-net samples of riffle habitats, plus measurement of fixed habitat variables (e.g., geology, elevation)	Degree of divergence from community structure at reference sites, as determined with a BEAST analysis available on Environment Canada's Canadian Aquatic Biomonitoring Network (CABIN) website	Community is unstressed or not divergent from reference sites	Community is slightly stressed, or mildly divergent from reference sites	Community is stressed, or divergent from reference sites	Community is very stressed, or highly divergent from reference sites
Fish Passage	Are stream crossings allowing for unobstructed fish movements on streams with medium- and high-value fish habitat or confirmed fish use?	Stream width/crossing structure width ratio, structure length, slope, embeddedness, outlet drop at zero flow	Cumulative score of all indicators on streams deemed to have medium- and high-fish habitat values, where scores are 0, 5 or 10 for embeddedness, outlet drop and slope, and 0, 3 or 6 for structure length and stream width/structure width ratio	Passable (cumulative score <15)		Potential barrier (cumulative score 15-20), or structure is a barrier but fish use is unconfirmed	Barrier (cumulative score >20)
Fisheries Sensitive Watersheds	Is the risk of fish habitat degradation in identified Fisheries Sensitive Watersheds (FSWs) being minimized?	Nine GIS-derived measures of road density, road density within 100 m of streams, above the H60 line, across streams and on unstable slopes, portion of streams and fish streams logged, portion of streams with adjacent slopes >60% logged, peak flow index	Average score of all nine indicators, where scores of 1, 2 or 3 for individual indicators correspond to thresholds for low, medium or high risk of fish habitat degradation	1.00 – 1.66		1.67 – 2.33	2.34 – 3.00

Resource Value	Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low	Low	Medium	High
Forest and Range Management	Are forest and range management activities in compliance with current legislation?	BC Forest Practices Board compliance audits of randomly selected individual licensees. Specific indicators include all operational plans, and subsamples of road construction, maintenance and deactivation activities, bridge construction and maintenance activities, harvesting in blocks, silviculture activities (site preparation, planting/seeding), regeneration and free growing assessments, fire protection and abatement procedures	Degree of compliance with range and forest harvest regulations	No issues, audit outcome is "squeaky clean", all aspects of audit in compliance, or if out of compliance, of a non-consequential nature		Audit identifies areas of concern that are not out of compliance, but close to it and/or pervasive	Audit identifies examples of significant non-compliance with forest regulations
Air Quality	Is air quality being adversely affected?	Daily average concentration of PM <sub>2.5</sub> (µg/m <sup>3</sup> ) at monitoring stations for the 8th worst day of each year, averaged over three years.	PM <sub>2.5</sub> daily mean (µg/m <sup>3</sup> ) is given a management level and action according to Canadian Ambient Air Quality Standards.	Actions Required for Keeping Clean Areas Clean (<10 µg/m <sup>3</sup> PM <sub>2.5</sub> )	Actions Required for Keeping Clean Areas Clean (<10 µg/m <sup>3</sup> PM <sub>2.5</sub> )	Actions Required for Preventing CAAQS (19-28 µg/m <sup>3</sup> PM <sub>2.5</sub> )	Actions Required for Achieving Air Zone (>28 µg/m <sup>3</sup> PM <sub>2.5</sub> )

Resource Value	Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low	Low	Medium	High
Water Quality	Is water quality being maintained?	The indicator is the CCME Water Quality Index (WQI) which is calculated by comparing three years of data – usually comprised of 8 to 12 parameters representing nutrients, metals and physicochemical parameters – against relevant water quality guidelines.	The results are assessed based on three factors: scope, frequency and amplitude of the water quality exceedances. Scope refers to the percentage of parameters where water quality guidelines are not met; frequency refers to the percentage of samples where water quality guidelines are not met; and amplitude refers to the amount by which the water quality guidelines are not met. The score is normalized to produce a score between 1 and 100. The results are rated as ‘Excellent/Good’, ‘Fair’, ‘Marginal’ and ‘Poor’.	WQI = 80-100 (Good/Excellent)	WQI = 65-79 (Fair)	WQI = 45-64 (Marginal)	WQI = 0-44 (Poor)

Resource Value	Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low	Low	Medium	High	
Fish Spawning and Rearing Habitat (Level 1 Analysis)	Based on 2013 data, what is the risk to fish spawning and rearing habitats in a watershed due to human activities?	Hydrologic processes	% of watershed equivalent to a clearcut forest (ECA)		< 15	> 15 – < 20	> 20	
			% of watershed logged or recently burned (forest disturbance)		< 4.8	> 4.8 – < 19.0	> 19.0	
		Surface erosion (km/km <sup>2</sup> )	Watershed road density (km/km <sup>2</sup> )		< 0.4	> 0.4 – < 1.2	> 1.2	
			# crossings/km of fish accessible streams, + proportion of culverts passable on fish streams where data available		< 0.20	> 0.20 – < 0.58	> 0.58	
		Vegetation quality	% of forest killed by insects or disease		< 3.3	> 3.3 – < 15	> 15	
			% of riparian zone disturbed (forestry, agriculture, urbanization, recent fires)		< 5	> 5 – < 15	> 15	
		Water quality	# of permitted waste water discharges		0		> 0	
			# of acid generating mines		0		> 0	
		Water quantity Human development footprint	# of licensed water use permits		0		> 0	
			Total % of watershed developed		< 6.4	> 6.4 – < 22.0	> 22.0	
Linear facility density (km/km <sup>2</sup> )			< 0.59	> 0.59 – < 1.3	> 1.3			
# of mines (any)			0		> 0			
Fish Spawning and Rearing Habitat (Level 2 Analysis)	Based on Level 1 Indicator scores, what is the risk to fish spawning and rearing habitats in a watershed attributable to human activities?	Impact indicators in the Level 1 Analysis	% of watershed with impervious surfaces		< 3	> 3 – < 10	> 10	
			Number of impact indicators rated low, medium or high		> 5 low	< 3 high < 5 low	> 3 high	

## Appendix 2 – Comparative FREP Results by Resource Value for other AREAS

Table 2 in the main body of the report describes overall ratings for the Wet’suwet’en Traditional Territories as compared to adjacent TSAs or districts. The table below describes the same results by the north, south and coast areas, and the province as a whole. The three operational areas represent combined natural resource regions.

**Table A2.1: FREP monitoring results by resource value for the north, south, and coast areas, and the province as a whole compared to Wet’suwet’en Traditional Territories.**

Resource Value	Effectiveness of Practices in Achieving Resource Stewardship Objectives: % Very low + low resource development impact rating (sample size in brackets)				
	Forests, Lands and Natural Resource Operations Areas				
	Wet’suwet’en Territories	North	South	Coast	Province
FREP riparian – all data	<b>83%</b> (98)	<b>73%</b> (807)	<b>70%</b> (768)	<b>59%</b> (593)	<b>68%</b> (2168)
FRPA-era data	87% (62)	75% (411)	69% (367)	61% (340)	69% (1118)
FPC-era data	75% (36)	70% (396)	70% (401)	55% (253)	67% (1050)
FREP water quality – all data	<b>63%</b> (241)	<b>64%</b> (1497)	<b>70%</b> (1956)	<b>76%</b> (2508)	<b>71%</b> (5961)
2012–2015 samples	66% (112)	60% (700)	73% (618)	67% (1253)	71% (2571)
2008–2011 samples	59% (129)	67% (797)	69% (1338)	75% (1255)	71% (3390)
FREP stand-level biodiversity –all data	<b>34%</b> (103)	<b>46%</b> (799)	<b>51%</b> (880)	<b>77%</b> (620)	<b>56%</b> (2299)
FRPA-era data	41% (71)	51% (413)	57% (447)	80% (366)	62% (1226)
FPC-era data	19% (32)	49% (386)	44% (433)	74% (254)	49% (1073)
FREP visual Quality					
FRPA	<b>80%</b> (30)	<b>71%</b> (194)	<b>61%</b> (198)	<b>81%</b> (233)	<b>71%</b> (625)
FPC	<b>55%</b> (11)	<b>56%</b> (96)	<b>65%</b> (85)	<b>68%</b> (68)	<b>63%</b> (249)

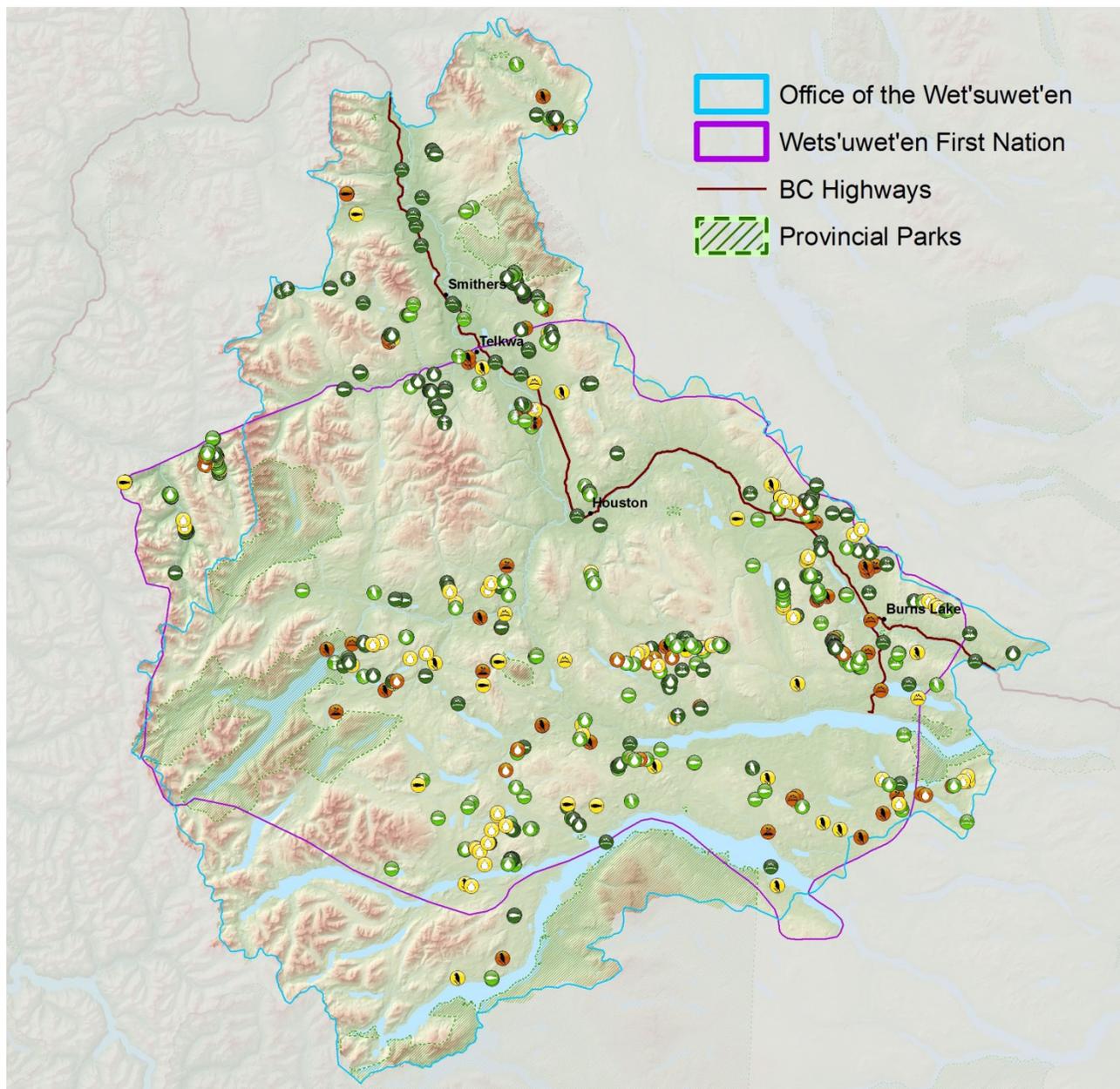
## Appendix 3 – Information Source Details

The follow table lists the data sources used in this report, as well as links to contacts, websites reports, and data (as available). Primary report contact Jevan Hanchard, District Manager, Skeena Strikine Natural Resource District, 250 847-6305, Jevan.Hanshard@gov.bc.ca <https://www.for.gov.bc.ca/dss/>.

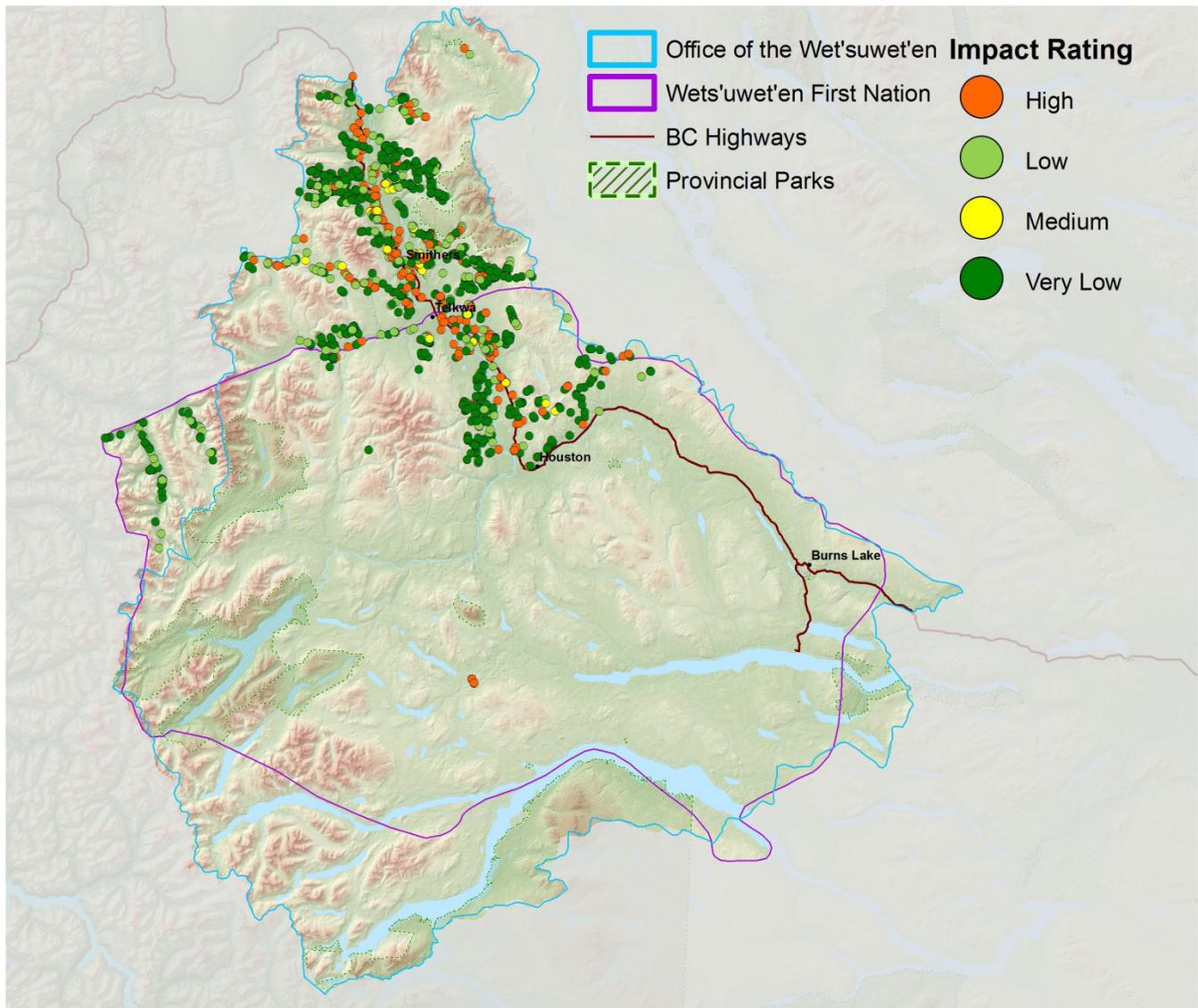
Data Source	Contact	Website	Reports	Data
Forest Practices Board Audits	250-213-4700 bcfpb.ca	<a href="http://www.bcfpb.ca/">http://www.bcfpb.ca/</a>	Audit Reports for the Skeena Natural Resource Region	Pulled from reports
FREP Riparian	Lisa.Nordin@gov.bc.ca	<a href="http://www2.gov.bc.ca/gov/content?id=264E8CCD546044B5B3CEA2DA8FD2F0D3">http://www2.gov.bc.ca/gov/content?id=264E8CCD546044B5B3CEA2DA8FD2F0D3</a>		Available from contact
Fish Passage	Richard.Thompson@gov.bc.ca, Lars.ReeseHansen@gov.bc.ca	<a href="http://www2.gov.bc.ca/gov/content?id=8E79C6B1F4A7475CBFA14EA06404A0C7">http://www2.gov.bc.ca/gov/content?id=8E79C6B1F4A7475CBFA14EA06404A0C7</a>		Provincial Stream Crossing Inventory System
Fisheries Sensitive Watershed	Lars.ReeseHansen@gov.bc.ca	<a href="http://www.env.gov.bc.ca/wld/frpa/fsw/index.html">http://www.env.gov.bc.ca/wld/frpa/fsw/index.html</a>	Evaluating and Designating Fisheries Sensitive Watersheds	Draft consultant report
Skeena Salmon Program	604-664-7664 skeena@psf.ca	<a href="http://skeenasalmonprogram.ca/">http://skeenasalmonprogram.ca/</a>	Skeena Salmon Habitat Report Cards	GIS Data
FREP Water Quality	David.Maloney@gov.bc.ca	<a href="http://www2.gov.bc.ca/gov/content?id=1A902ED2C6A04A13880FC2EDE3BC5785">http://www2.gov.bc.ca/gov/content?id=1A902ED2C6A04A13880FC2EDE3BC5785</a>		Available from contact
Canadian Aquatic Biomonitoring Network (CABIN)	stephanie.strachan@ec.gc.ca EC.CABIN.ECCanada.ca	<a href="http://www.ec.gc.ca/rcba-cabin/">http://www.ec.gc.ca/rcba-cabin/</a>	Reports (scroll to bottom)	CABIN Database
FREP Stand Development Monitoring	Barry.Snowdon@gov.bc.ca	<a href="http://www.for.gov.bc.ca/hfp/frep/values/timber.htm">http://www.for.gov.bc.ca/hfp/frep/values/timber.htm</a>		Available from contact
FREP Visual Quality	Peter.williams@gov.bc.ca	<a href="http://www.for.gov.bc.ca/hfp/frep/values/visual.htm">http://www.for.gov.bc.ca/hfp/frep/values/visual.htm</a>		Available from contact
FREP Cultural Heritage	peter.bradford@gov.bc.ca	<a href="http://www.for.gov.bc.ca/hfp/frep/values/heritage.htm">http://www.for.gov.bc.ca/hfp/frep/values/heritage.htm</a>		Available from contact
Northern Goshawk Consultant Report	Frank Doyle doyle@bulkley.net			
FREP Stand-level Biodiversity	Barry.Snowdon@gov.bc.ca	<a href="http://www.for.gov.bc.ca/hfp/frep/values/biodiversity.htm">http://www.for.gov.bc.ca/hfp/frep/values/biodiversity.htm</a>		Available from contact
Landscape-level Biodiversity	Barry.Snowdon@gov.bc.ca	<a href="http://www.for.gov.bc.ca/hfp/frep/values/biodiversity.htm">http://www.for.gov.bc.ca/hfp/frep/values/biodiversity.htm</a>		Available from contact
Air Quality	Ben.Weinstein@gov.bc.ca	<a href="http://www.bcairquality.ca/">http://www.bcairquality.ca/</a>		Available from contact
Grizzly Bear	Don.Morgan@gov.bc.ca Tony.Hamilton@gov.bc.ca			
Mountain Goat	Krystal.Dixon@gov.bc.ca Conrad.Thiessen@gov.bc.ca			
Moose	Conrad.Thiessen@gov.bc.ca			
Soils	Chuck.Bulmer@gov.bc.ca			
Water Quality Index		<a href="http://aquatic.pyr.ec.gc.ca/webdataonline/national/en/Home">http://aquatic.pyr.ec.gc.ca/webdataonline/national/en/Home</a>		

## Appendix 4 – Locations of FREP Samples

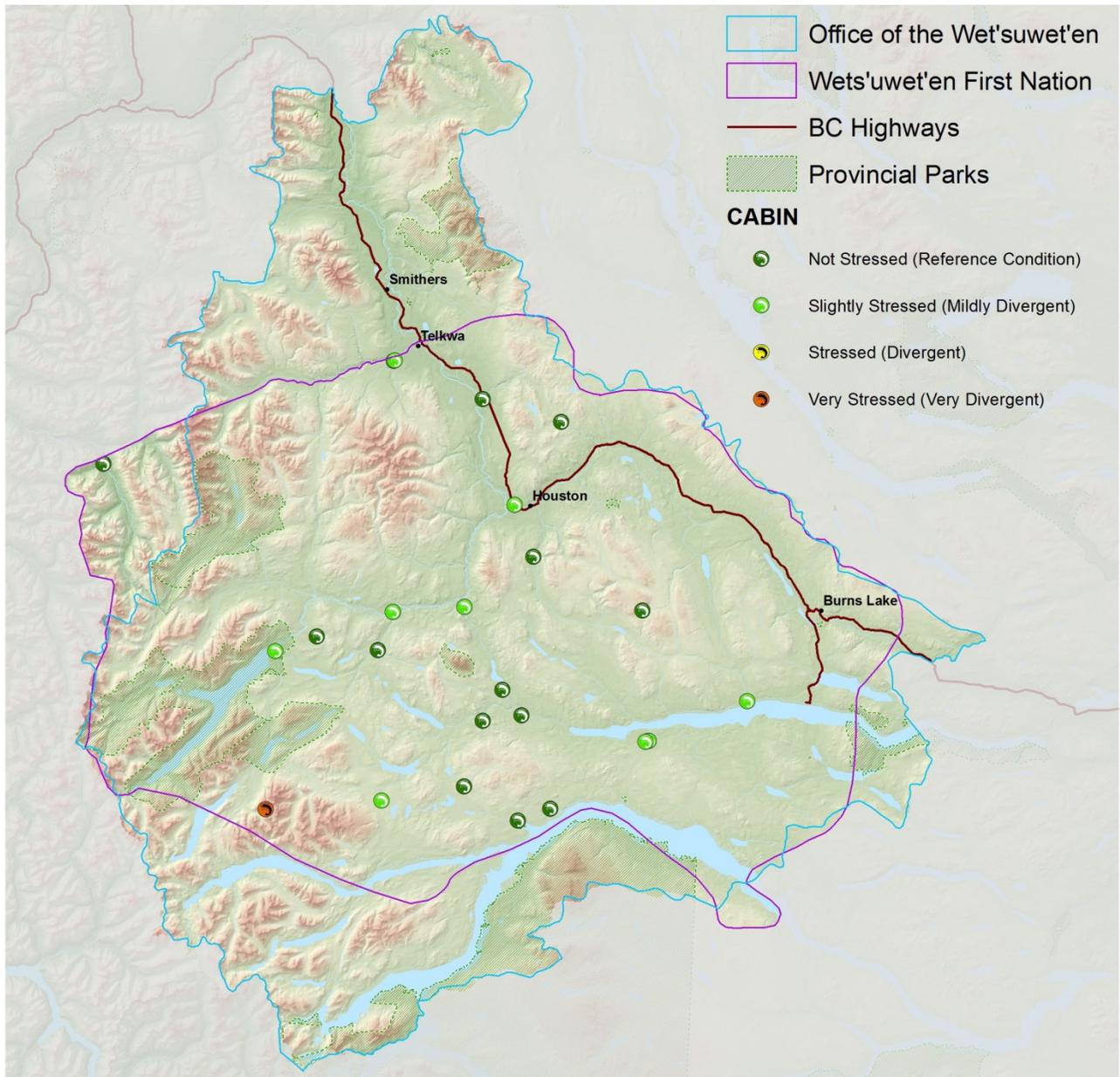
Figure 1: Wet'suwet'en First Nation and Office of the Wet'suwet'en boundaries, showing sample locations and scoring for FREP samples.<sup>26</sup>



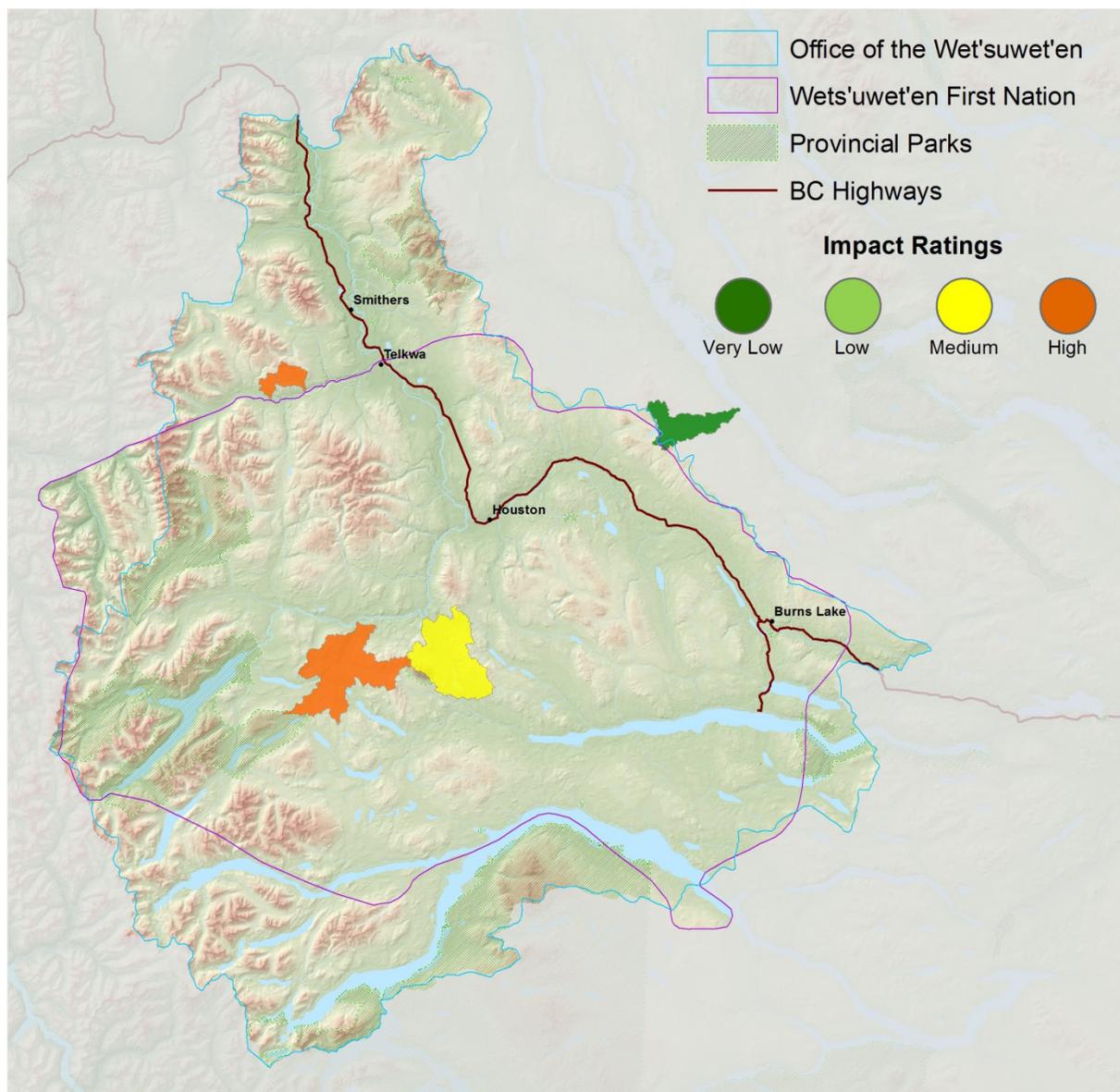
## Appendix 5 – Stream Crossing Locations Assessed and Impact Ratings Within the Wet'suwet'en Territories



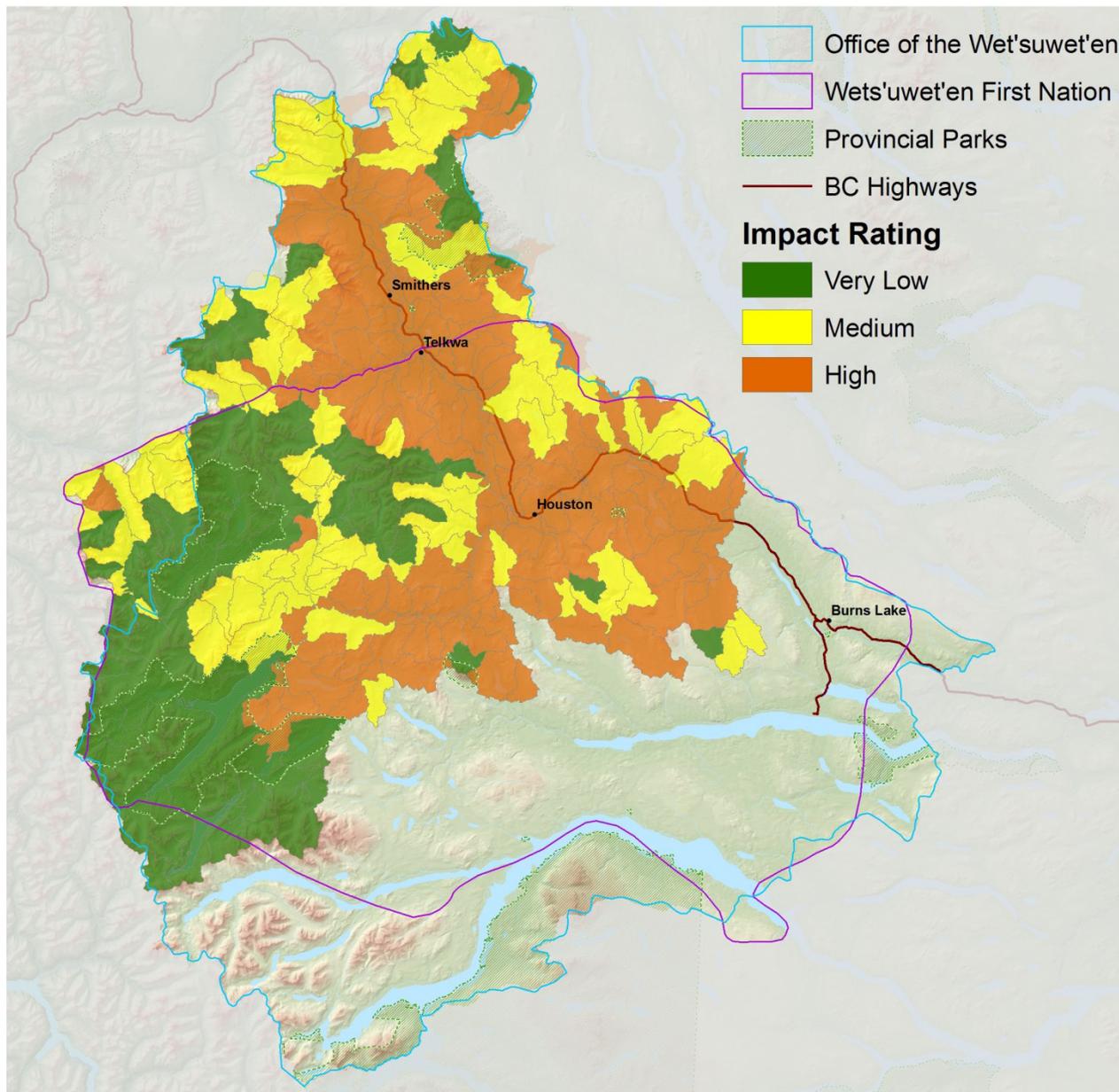
## Appendix 6 – CABIN Sample Sites Within the Wet'suwet'en Territories



## Appendix 7 – Fish Sensitive Watershed Samples

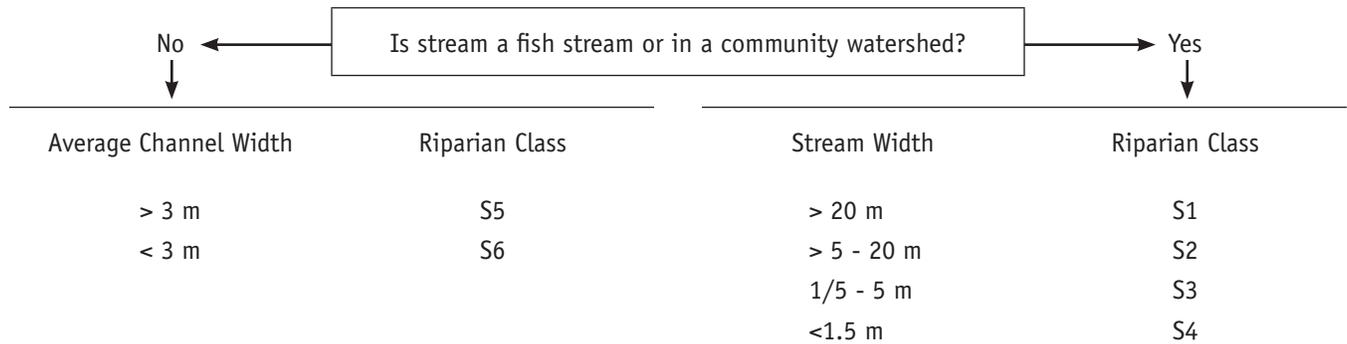


## Appendix 8 – Fish Habitat Risk Ratings for Skeena River watersheds in the Wet'suwet'en Territories



## Appendix 9 – Key to British Columbia Riparian Stream Classification

Key to British Columbia riparian stream classification (from the Riparian Management Area Guidebook, December 1995)



## Appendix 10 – Proposed Air Management Threshold Values

Management Level	Management Actions	Proposed Air Management Threshold Values					
		Ozone (ppb)		PM <sub>2.5</sub> Annual (µg/m <sup>3</sup> )		PM <sub>2.5</sub> 24h (µg/m <sup>3</sup> )	
		2015	2020	2015	2020	2015	2020
<b>RED</b>	<b>Actions for Achieving Air Zone CAAQS</b>						
Threshold	63 ppb	62 ppb	10.0 µg/m <sup>3</sup>	0.0 µg/m <sup>3</sup>	28 µg/m <sup>3</sup>	27 µg/m <sup>3</sup>	
<b>ORANGE</b>	<b>Actions for Preventing CAAQS Exceedance</b>						
Threshold	56 ppb		6.4 µg/m <sup>3</sup>		19 µg/m <sup>3</sup>		
<b>YELLOW</b>	<b>Actions for Preventing Air Quality Deterioration</b>						
Threshold	50 ppb		4.0 µg/m <sup>3</sup>		10 µg/m <sup>3</sup>		
<b>GREEN</b>	<b>Actions for Keeping Clean Areas Clean</b>						

# Appendix 11 – Data used in the Landscape-Level Biodiversity Account

## Office of the Wet'suwet'en Area specific data

Climate Ordered	all in hectares		Early		Mid-age	Mature & Old		Expected Amounts		% of Expected		% of young that is natural	% of Mature & Old Protected	MPB Effect (%)
	BGC Subzone/Variant	Total Forest Area	logged or urban	natural		Not Protected	Protected	Early	Mid-Age & Old	young	Mature & Old			
1	CWH ws 1	6,800	1,384	561	1,432	3,139	284	1,233	1,032	158%	139%	29%	8%	0.0
2	CWH ws 2	48,242	3,521	1,729	496	28,515	13,981	8,745	7,321	60%	7%	33%	33%	1.0
3	MH mm 2	24,011	800	515	232	18,092	4,372	2,593	4,425	51%	5%	39%	19%	0.0
4	ICH mc 2	18,583	3,335	1,342	3,781	11,136	-	3,552	4,217	132%	90%	29%	0%	3.5
5	ICH mc 1	27,124	6,345	520	3,052	17,046	172	4,919	5,840	140%	52%	8%	1%	3.0
6	SBS dk	408,620	141,663	41,175	128,969	115,086	23,156	123,246	126,194	148%	102%	23%	17%	23.2
7	SBS mc 2	586,434	185,888	37,106	81,094	220,978	64,052	161,331	165,189	138%	49%	17%	22%	22.3
8	ESSFmk	111,205	545	4,158	8,255	47,405	50,842	20,158	23,934	23%	34%	88%	52%	3.3
9	ESSFmc	348,863	25,586	15,843	60,903	135,109	112,089	63,359	75,228	65%	81%	38%	45%	12.9
10	ESSFwv	45,259	1,634	1,088	1,779	40,478	288	4,889	8,342	56%	21%	40%	1%	1.2
Totals		1,625,141	370,701	104,037	289,993	636,984	269,236	394,024	421,722	120%	69%	22%	30%	17.1

## Provincial context data

BGC	Provincial		Proportion in Mature & Old		Mature & Old Protected Forest	Provincial Protection
	Forest Area	Report Unit	Forest Area	Protected Forest		
CWH ws 1	216,192	3%	106,110	12,138	11.4%	
CWH ws 2	548,912	9%	465,334	123,129	26.5%	
MH mm 2	835,433	3%	731,086	198,017	27.1%	
ICH mc 2	290,098	6%	158,884	21,813	13.7%	
ICH mc 1	432,500	6%	351,243	60,130	17.1%	
SBS dk	787,109	52%	266,705	47,229	17.7%	
SBS mc 2	2,130,748	28%	1,070,546	322,583	30.1%	
ESSFmk	132,316	84%	119,688	71,892	60.1%	
ESSFmc	1,253,380	28%	987,790	359,787	36.4%	
ESSFwv	519,064	9%	483,141	67,327	13.9%	

- CWHws1 Coastal Western Hemlock; Wet Submaritime; Submontane
- CWHws2 Coastal Western Hemlock; Wet Submaritime; Montane
- MHmm2 Mountain Hemlock; Moist Maritime; Leeward
- ICHmc2 Interior Cedar – Hemlock; Moist Cold; Hazelton
- ICHmc1 Interior Cedar – Hemlock; Moist Cold; Nass
- SBSdk Sub-Boreal Spruce; Dry Cool;
- SBSmc2 Sub-Boreal Spruce; Moist Cold; Babine
- ESSFmk Engelmann Spruce – Subalpine Fir; Moist Cool;
- ESSFmc Engelmann Spruce – Subalpine Fir; Moist Cold;
- ESSFwv Engelmann Spruce – Subalpine Fir; Wet Very Cold;

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## Endnotes

- <sup>1</sup> For this report, the asserted traditional territories of the Skin Tye Band, Nee-Tahi-Buhn Band, and Ts'il Kaz Koh First Nation are not included in the definition of Wet'suwet'en Territories, despite these three aboriginal groups being of Wet'suwet'en ethnographic decent.
- <sup>2</sup> Minimum 10 samples per time period.
- <sup>3</sup> FLNROD Skeena Regional Management Team.
- <sup>4</sup> FRPA values include; Biodiversity, Cultural Heritage, Fish/Riparian, Forage and associated plant communities, Recreation, Resource Features, Soils, Timber, Visual Quality, Water Quality, and Wildlife.
- <sup>5</sup> See appendix 4 for a key to British Columbia's riparian stream classification.
- <sup>6</sup> <http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep-fsw-watershedeval-2015.pdf>
- <sup>7</sup> H60 line - In much of the British Columbia interior, snow typically covers the upper 60% of a watershed when streamflow levels begin to rise in the spring. The H60 is the elevation at which 60% of the watershed area is above.
- <sup>8</sup> Ranging from M1 and M2 = high concern through M3 = moderate concern to M4 and M5 = low concern
- <sup>9</sup> Provincial Grizzly Bear Technical Working Group. 2016. Assessment Methods for Grizzly Bears in BC (Tier 1 Provincial Scale Grizzly Bear Assessment Protocol) Standards for British Columbia's Values Foundation (ver. 2.2; March 24, 2016). 42 pp.
- <sup>10</sup> Box plot description: Dark bar is median value, shaded area defines the 2nd and 3rd quartile. Maximum and minimum values are the end of the lines, excluding outliers. Outliers are  $<Q1 - 1.5 * \text{Inter Quartile Range}$  and  $>Q3 + 1.5 * \text{Inter Quartile Range}$ .
- <sup>11</sup> A spatially identified area of land and/or water used for long-term planning of resource management activities. <https://catalogue.data.gov.bc.ca/dataset/landscape-units-of-british-columbia-all>
- <sup>12</sup> IUCN 2016
- <sup>13</sup> **Gunther KA, Biel MJ, Robison HL. 1998.** Factors influencing the frequency of road-killed wildlife in Yellowstone National Park. PP 32-42 in GL Evinck (ed) Proceedings of the International Conference on Wildlife Ecology and Transportation, Florida department of Transportation, Tallahassee, Florida; **Bertch B, Gibeau M. 2009.** Grizzly bear monitoring in and around the Mountain National Parks: mortalities and bear/human encounters 1990-2008. Parks Canada, Lake Louise, Alberta.
- <sup>14</sup> **Mattson DJ, Herrero S, Wright RG, Pease CM. 1996.** Science and management of Rocky Mountain grizzly bears. Conservation Biology 10:1013-1025. **McLellan BN, Hovey FW, Mace RD, Woods JG, Carney DW, Gibeau ML, Wakkinen WL, Kasworm WF. 1999.** Rates and causes of grizzly bear mortality in the interior mountains of British Columbia, Alberta, Montana, Washington, and Idaho. Journal of Wildlife Management 63: 911-920; **Johnson CJ, Boyce MS, Schwartz CC, Haroldson MA, 2004.** Modelling survival: application of the Andersen-Gill model to Yellowstone grizzly bears. Journal of Wildlife Management 68:966-978; **Ciarniello LA, Boyce MS, Heard DC, Seip DR. 2007.** Components of grizzly bear habitat selection: density, habitats, roads, and mortality risk. Journal of wildlife Management 71:1446-1457; **Schwartz et al. 2010; McLellan BN in review.** Some mechanism underlying variation in vital rates of grizzly bears on a multiple use landscape. Journal of wildlife Management
- <sup>15</sup> **Kasworm W, Manley T. 1990.** Road and trail influences on grizzly bears and black bears in northwest Montana. International Conference on Bear Research and Management 8:79-84; **Mace et al. 1996; Aps CS, McLellan BN, Woods JG, Proctor JF. 2004.** Estimating grizzly bear distribution and abundance relative to habitat and human influence. Journal of Wildlife Management 68:138-152; **Schwartz et al. 2010; Boulanger et al. 2013; Boulanger and Stenhouse 2014; MacHutchon AG, Proctor M. 2015.** Management plan for the Yahk and South Selkirk grizzly bear (*Ursus arctos*) sub-populations, British Columbia. Trans-border Grizzly Bear Project, Kaslo 104pp.
- <sup>16</sup> **McLellan in review**
- <sup>17</sup> **Mace et al. 1996; Noss RF, Quigley HB, Hornocker MG, Merrill T, Paquet PC. 1996.** Conservation biology and carnivore conservation in the Rocky Mountains. Conservation Biology 10:949-963; Alberta Grizzly Bear Recovery Plan 2008-2013. 2008. **McLellan BN, Hovey FW. 2001.** Habitats selected by grizzly bears in a multiple use landscape. Journal of Wildlife Mangement 65:92-99. BC Ministry of Ministry of Environment, Lands and Parks 2000. Environmental trends in BC 2000. State of Environment Reporting. Accessed April 30, 2014: [http://www.env.gov.bc.ca/soe/archive/reports/93\\_98\\_00/enviro-trends2000.pdf](http://www.env.gov.bc.ca/soe/archive/reports/93_98_00/enviro-trends2000.pdf); **Antoniuk T, Ainslie B. 2003.** CEAMF Study Volume 2: cumulative effects indicators, thresholds, and CEAMF, edited by Salmo Consulting Inc. and Diversified Environmental Services: Prepared for the BC Oil and Gas Commission. Muskwa-Kechika Advisory Board.
- <sup>18</sup> as defined by the Biodiversity Guidebook. 1995. <https://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/biodiv/biotoc.htm>

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- <sup>20</sup> **MacHutchon and Proctor 2015**
- <sup>21</sup> **Apps, C.** 2011. Grizzly bear population inventory and monitoring across the Skeena Region of British Columbia: needs assessment and design recommendations. Ministry of Environment, Smithers, British Columbia.
- <sup>22</sup> One other cutblock could not be ranked because of a lack of baseline data (ESSFwv).
- <sup>23</sup> Ministry of Forests, and Ministry of Environment. Biodiversity Guidebook. Forest Practices Code of British Columbia. Victoria BC, 1995. <http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/biodiversityguidebook.pdf>.
- <sup>24</sup> *ibid.*
- <sup>25</sup> Wong, Carmen, Brigitte Dorner, and Holger Sandmann. Estimating Historical Variability of Natural Disturbances in British Columbia, 2003. <https://www.for.gov.bc.ca/hfd/pubs/docs/lmh/lmh53.htm>.
- <sup>26</sup> This overview map illustrates general sample locations and outcomes. The scale does not allow representation of all samples.

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