

FREP Report #41

Assistant Deputy Minister Resource Stewardship Report: Regional Results of the Forest and Range Evaluation Program



Carl Creek flowing through a wildlife tree patch, Cascades Resource District. Photo credit: Christine Galliazzo.

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MESSAGE FROM THE ASSISTANT DEPUTY MINISTER OF RESOURCE STEWARDSHIP

I am pleased to present the sixth annual ADM Stewardship Report on the results of the Forest and Range Evaluation Program (FREP). This year's report contains results by natural resource region. In 2015, FREP developed a new three year strategic plan aimed at continuous improvement of monitoring protocols and ensuring full monitoring of *Forest and Range Practices Act (FRPA)* values throughout the province.

With a target audience of natural resource professionals and decision-makers, this report aims to encourage dialogue and inform decision-making among those who manage British Columbia's natural resource values on behalf of the public. Much of this report summarizes site-level field-based assessments that determine the ecological condition of *FRPA* resource values on, or near, recently harvested cutblocks. Thus, these assessments are confined to the working land base, and do not include the ecological contributions of parks, protected areas, and other conservancy areas. Landscape-level biodiversity assessments in this report include all of the forested landscape, including parks and commercial forest.

FREP is a cornerstone in the governance of the *Forests and Range Practices Act*. Under the results-based approach, FREP is responsible for monitoring and evaluating the eleven *FRPA* values. This valuable data informs resource managers and provides a foundation of evidence to enable continuous improvement in resource stewardship practices. The processes used in FREP are science-based, resulting in trusted and high quality data. Since 2005, over 10,000 samples have been collected and reported on. In addition, other data sources such as GIS analysis, air photo analysis and Google Earth are being used by FREP to augment ground sampling. The majority of FREP monitoring evaluates the effects of resource development at a stand or site level. This information is important in helping local resource managers and decision-makers evaluate the ongoing balance between ecological, social and economic factors. FREP results also identify when stand-level values could be managed more sustainably, identifying areas that warrant improvement of on-the-ground management practices. In addition to the stand-level information provided, this year's report includes an assessment of landscape-level biodiversity for the 10 largest biogeoclimatic subzones in each region. The landscape-level assessments will help provide context to stand-level results and provide further valuable information for decision making.

In the coming year there will be reporting of soils, wildlife and karst using new protocols. In addition, there will be increasing collaboration between FREP and other initiatives such as cumulative effects as we move towards an integrated natural resource sector (NRS) monitoring and evaluation approach. The reporting format in this report is based on the multiple resource value assessment (MRVA) approach; future NRS MRVA reports will use this format for reporting on a broad range of NRS monitoring and evaluation initiatives.

Tom Ethier
Assistant Deputy Minister
Resource Stewardship Division
Ministry of Forest, Lands and Natural Resource Operations

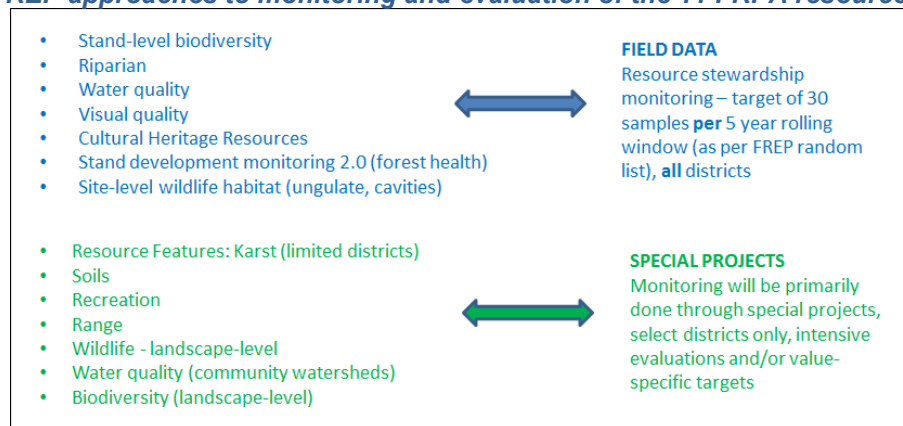
INTRODUCTION

This sixth annual overview of FREP summarizes regional-level program findings and makes recommendations for continued improvement of on-the-ground resource management practices. The development of *FRPA* had several key goals, including:

- Simplifying the forest management legal framework;
- Creating a “freedom to manage” approach for defined results; and
- Maintaining the high environmental standards laid out in the *Forest Practices Code of British Columbia Act (FPC)*.

FREP began resource value monitoring in 2005. By providing science-based monitoring and evaluation information to resource managers, FREP supports professional reliance and the continuous improvement of land and resource stewardship. Ultimately, this information should be used to make necessary adjustments to practices, policies and legislation. As shown in Figure 1, FREP uses a variety of monitoring and evaluation approaches to assess the status, trends and causal factors related to the 11 *FRPA* resource values.

Figure 1: FREP approaches to monitoring and evaluation of the 11 *FRPA* resource values



For information on the individual monitoring protocols and how MRVA ratings are derived (i.e., how on the ground results meet stewardship objectives), go to:

FREP Technical Note #6: Methodologies for Converting FREP Monitoring Results to MRVA Impact Ratings <http://www2.gov.bc.ca/assets/download/15151C4620BC4C859BCF9EB28A424FE7>

FREP Monitoring Protocols

<http://www2.gov.bc.ca/gov/content?id=BFD4A19913F44973A134F96F5E042404>

For more information on FREP, and to see how FREP is influencing change, please go to:

<http://www2.gov.bc.ca/gov/content?id=F799814F5E004CA0A02A02D63CB69E55>

This report spans the entire province providing results at a regional level. For those who require additional detail it is recommended that you look at individual district/timber supply area MRVA reports (<http://www2.gov.bc.ca/gov/content?id=3404A95D195C48A5BAE6DA51462014A0>) and/or request the actual data this report is based on (see the report summary for contact information).

IMPORTANT CONTEXT FOR UNDERSTANDING THIS REPORT

With the exception of landscape-level biodiversity (LLBD), the intention of FREP monitoring is to evaluate the effects of forest resource development at a stand or site level, rather than the overall condition of the resource value.

Resource Development Impact Ratings

The presentation style used in this report is similar to that used in MRVAs.¹ The “Impact Ratings” colour horizontal bar graph indicates the effect of resource development 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 the field-based data. The “Opportunities for Improvement” are based on practices that resulted in the best outcomes and/or expert knowledge.

Results for field-based assessments are summarized using four impact ratings:

1. very low
2. low
3. medium
4. high

“Very low” and “low” impact ratings are considered consistent with the Province’s goal of sustainable management of the resource values within *FRPA*. The “medium” impact rating is considered borderline and the “high” rating is generally considered unsustainable. For district-level results, please refer to the MRVA reports provided on the FREP website at:

<http://www2.gov.bc.ca/gov/content?id=3404A95D195C48A5BAE6DA51462014A0>

Where sufficient data is available, the “Overall Stewardship Trend” shows trends between time periods. A chi-squared test of homogeneity is used to determine trends between sampling eras for riparian, water quality, stand-level biodiversity, and visual quality results. The p-value from this test indicates whether the difference between two populations (e.g., 2005–2012 and 1997–2004 eras) is statistically significant. When interpreting our p-value, we use 0.10 as our level of significance, because FREP evaluations reflect monitoring results, as opposed to a controlled research study. This level of significance sets the (maximum) probability of incorrectly deeming something to be significant at 10%.

¹ See <http://www2.gov.bc.ca/gov/content?id=3404A95D195C48A5BAE6DA51462014A0>. The methodology is described in FREP Technical Note No. 6 (<http://www2.gov.bc.ca/assets/download/15151C4620BC4C859BCF9EB28A424FE7>).

Landscape-level Biodiversity

In addition to site-level data, this year's report includes LLBD data, which is an inventory of the current state using corporately available GIS data. This is not a compliance report against legal orders and no ecological score has been provided. That said, the authors of the *1995 Biodiversity Guidebook* assumed biodiversity can be more likely maintained if forest management seeks to retain habitat patterns and seral stages that are similar to those of natural landscapes.

In the sections on LLBD, only forested ecosystems have been considered and three metrics have been provided by biogeoclimatic subzone:

1. The observed seral stage distribution (the amount of young, intermediate, mature and old forest in hectares);
2. The degree of protection from harvest (percent); and
3. Each observed seral stage expressed as a percentage of that expected under a natural disturbance regime as per the Biodiversity Guidebook (i.e., the actual amount of each seral stage/expected amount expressed as a percentage.)

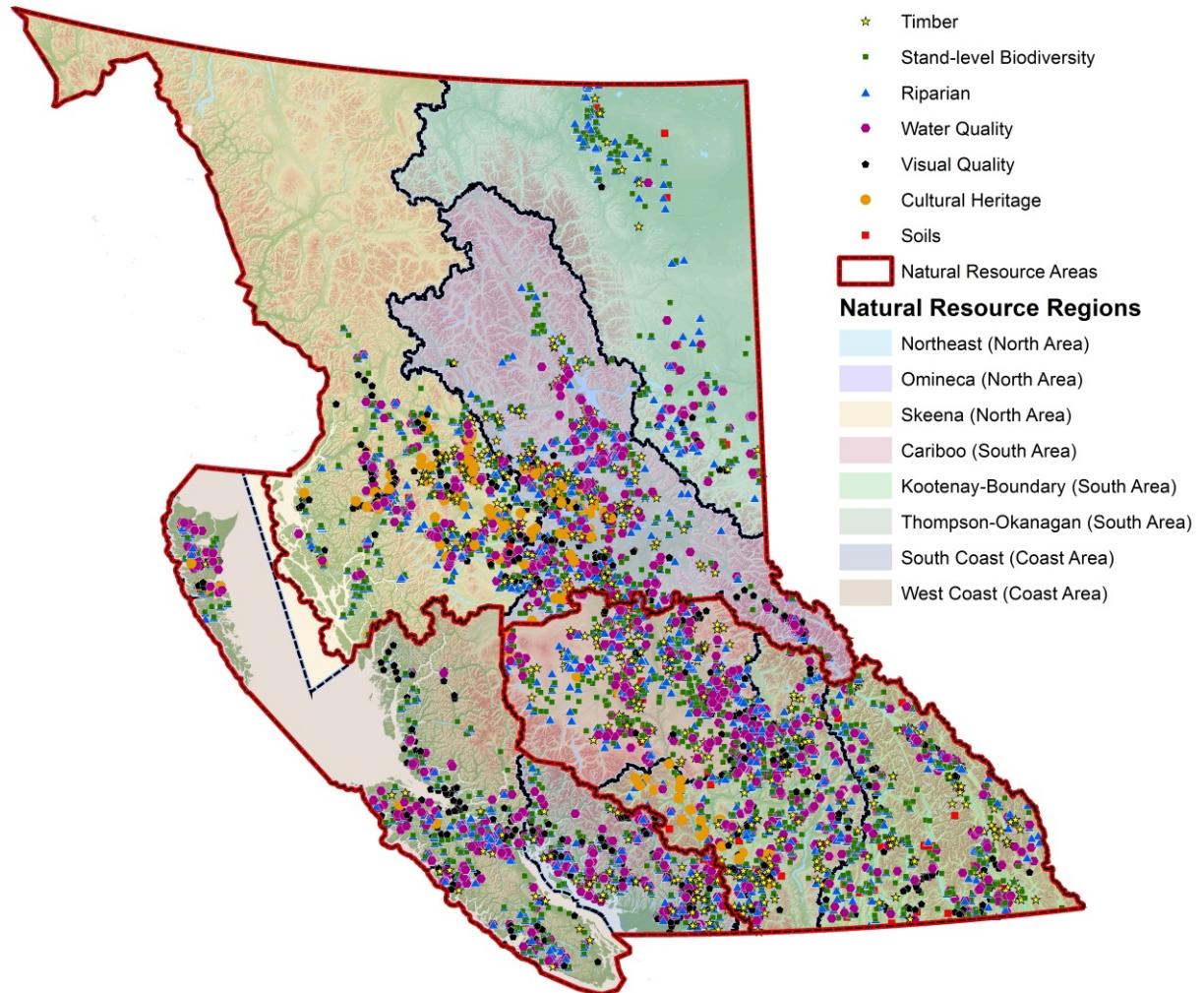
For consistency, across the province the Biodiversity Guidebook was used to derive the expected amounts of each seral stage in each biogeoclimatic subzone. Future analysis may refine this analysis to include "natural disturbance units" where appropriate. The location of major sawmills (greater than 40 board feet per year) was identified in order to illustrate that there is generally more resource development around these centers.

Using the FREP landscape-level biodiversity information:

The following information on landscape-level biodiversity is the first version of a FREP landscape-level biodiversity assessment tool. This assessment approach will be refined over time in collaboration with cumulative effects. The immediate intended uses for this information are:

- 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 BEC subzones where mature and old forest occurs in amounts that are substantially lower expected under a natural disturbance regime?)
- Identify areas where observed levels of mature and old forest are substantially above or below naturally expected levels and use the information to help decide on locations for any new and/or relocation of set aside areas (e.g., old growth management areas, wildlife habitat areas etc.)

Figure 2. Sample Locations of FREP Resource Stewardship Monitoring.



CARIBOO NATURAL RESOURCE REGION

The following section presents the status of LLBD and the outcomes of site-level FREP monitoring in the Cariboo Natural Resource Region.

Cariboo Landscape-level Biodiversity

For brevity, LLBD is only reported for the 10 largest biogeoclimatic (BGC) subzones covering 81% of the forested ecosystems (by area) in the Cariboo Region.

The biogeoclimatic subzone coding is as follows:

| | |
|---------|---|
| ESSFwc: | Engelmann spruce subalpine fir wet cold |
| ESSFwk: | Engelmann spruce subalpine fir wet cool |
| ESSFxv: | Engelmann spruce subalpine fir very dry very cold |
| ICHwk: | interior cedar hemlock wet cold |
| IDFdk: | interior Douglas Fir dry cool |
| MSxv: | montane spruce very dry very cold |
| SBPSdc: | sub boreal pine spruce dry cold |
| SBPSmk: | sub boreal pine spruce moist cool |
| SBPSxc: | sub boreal pine spruce very dry cold |
| SBSdw: | sub boreal spruce dry warm |

Figure 3: 10 largest forested BGC subzones in the Cariboo Region (locations shown have major sawmills).

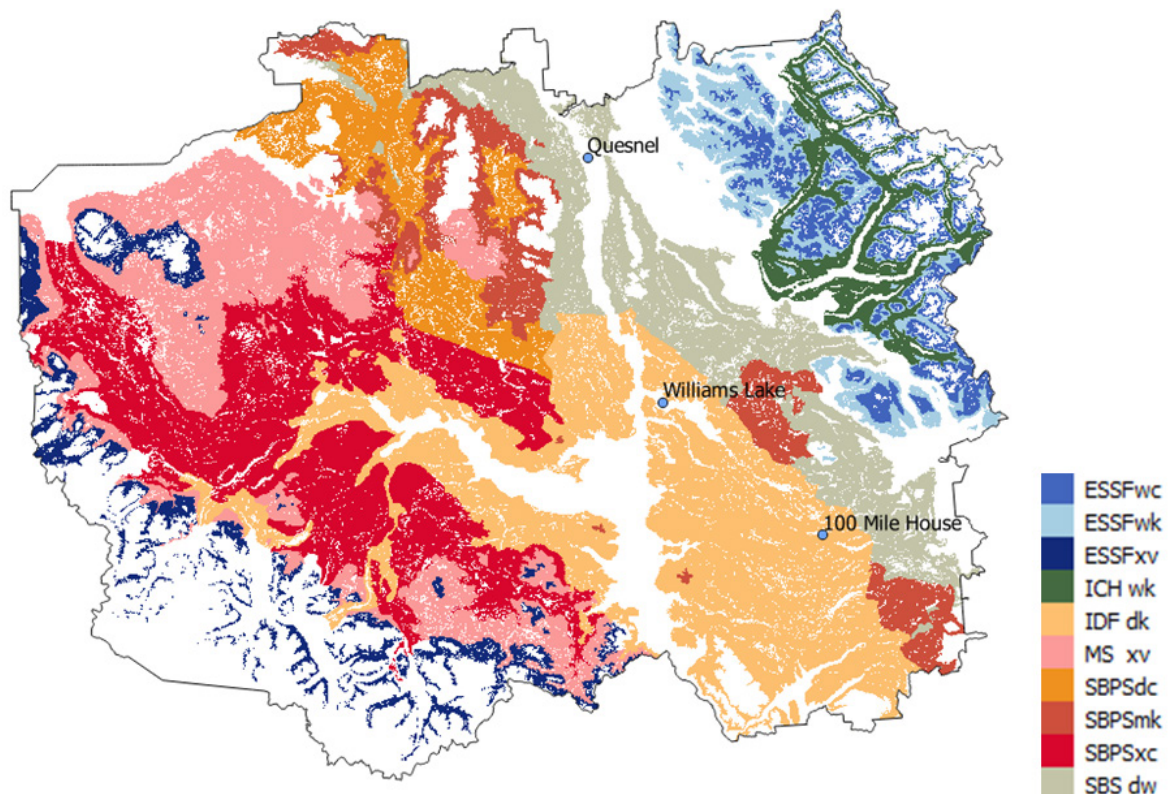


Figure 4: Amount of forest by seral stage and BGC subzone² in the Cariboo Region

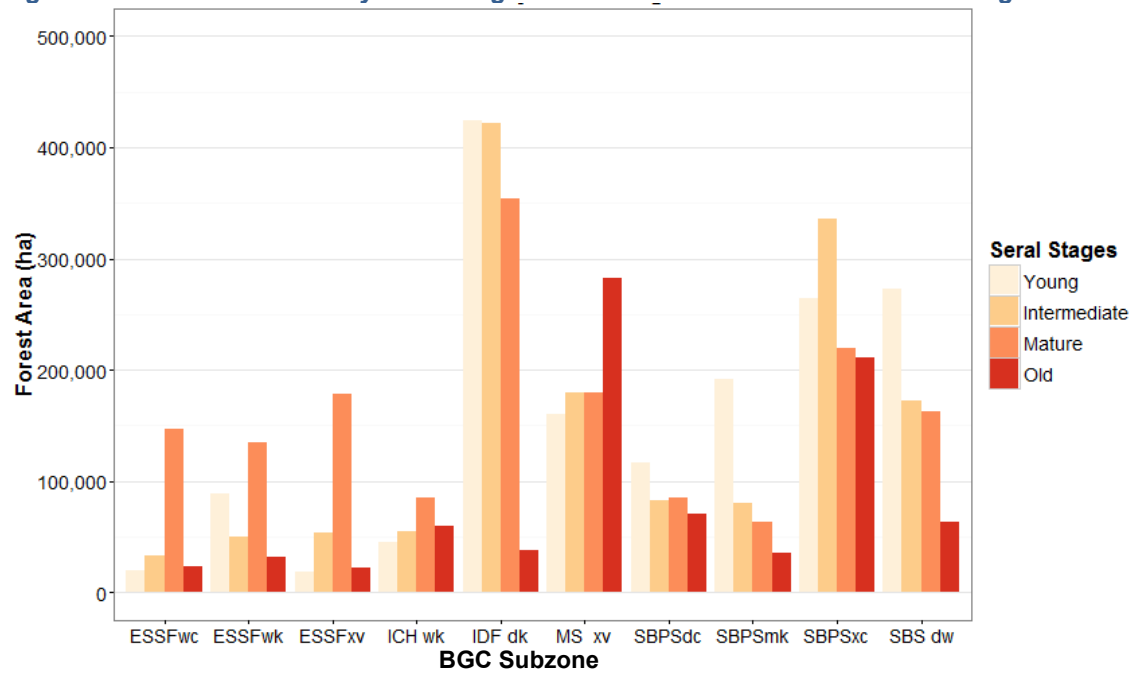
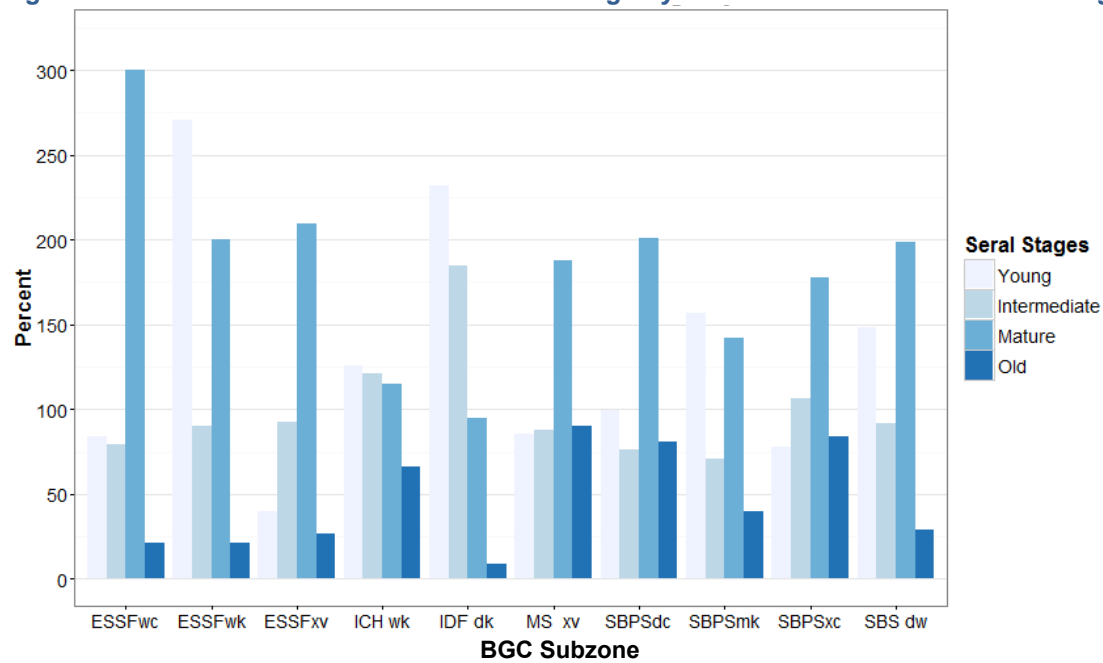


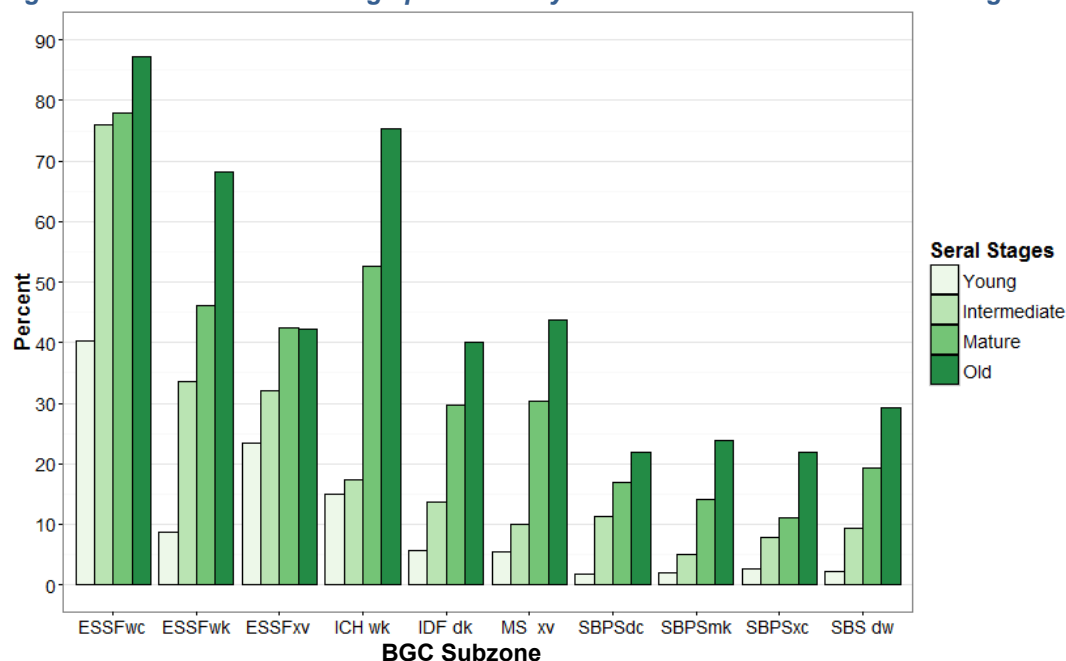
Figure 5: Percent of theoretical natural seral stage by BGC subzone³ in the Cariboo Region



² Referred to as the "observed plot" in the subsequent discussion.

³ Referred to as the "percent of natural plot" in the subsequent discussion.

Figure 6: Percent of seral stage protected by BGC subzone⁴ in the Cariboo Region



The “observed plot” shows the MSxv subzone as the only large subzone within the Cariboo Region where “old” forest is the dominant seral stage. The mature seral stage dominates the ESSF and ICH subzones. In the case of the ESSF, the lesser amount of old forest may reflect historic disturbance events.

With the exception of the SBPSxc, where the intermediate seral stage dominates, the SBPS and SBS subzones are dominated by young forest. This reflects efforts to salvage mountain pine beetle (MPB) impacted stands over the past 10 to 15 years. The IDFdk is also dominated by young to intermediate forest. As can be seen from the subzone map, common to the IDFdk, SBPSdc, SBPSmk, SBSdw is the proximity to the major milling centres of Quesnel, Williams Lake and 100 Mile House. The “percent protected plot” shows that in percentage terms, protection efforts have focused on old forest.

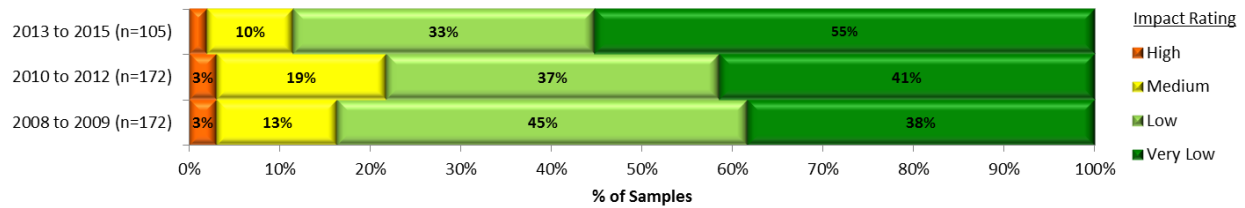
The “percent of natural plot,” the “percent protected plot,” and the subzone map show that the ESSFwk is the only ESSF subzone where the amount of young forest is more than expected, reflecting its lower elevation (likely higher volumes) and lower levels of protection than the ESSFwc. Despite its low levels of protection (compared to the ESSFwc), the ESSFvx has less than half the amount of young forest than expected, reflecting its low volumes and greater distance to milling centres.

With the exception of the ICHwk and IDFdk, the other eight subzones have 140% or more mature forest, reflecting fire suppression efforts over the past century. In the case of the SBPS and SBS subzones, this is despite the salvage of MPB-impacted stands.

The only subzone where both the young and intermediate seral stages are more than expected (greater than 100%) is the IDFdk. The seral stage distribution of the IDFdk is confused by the long history of partial cutting in this subzone. The seral stage reported is “the time since last harvest.” In the case of dry belt Douglas-fir stands, some mature and old trees remain after harvest and may provide some mature/old forest characteristics. This is acknowledged in the 1995 Biodiversity Guidebook.

⁴ Referred to as the “percent protected plot” in the subsequent discussion.

Cariboo Water Quality (fine sediment generation): Resource Development Impacts



Data Source: Water quality data (potential for fine sediment generation) was collected by ministry staff using the FREP water quality monitoring protocol. Sampling sites consist of roads and/or areas of mass wasting connected to fish habitat and/or drinking water sources that originate at randomly selected, recently harvested cutblocks. Sampling occurred from 2008 to 2015. Stewardship trends are based on survey years to capture the effects of road traffic and maintenance and are broken into three roughly equal time periods.

Summary: Of 449 road segments, 83% were rated as “very low” or “low” road-related impact.

Causal Factors for 2013 to 2015 Field Seasons: See opportunities for improvement on road segments with “high” or “medium” impact ratings. Some opportunities will apply to ongoing maintenance issues, whereas others mainly apply to new road construction.

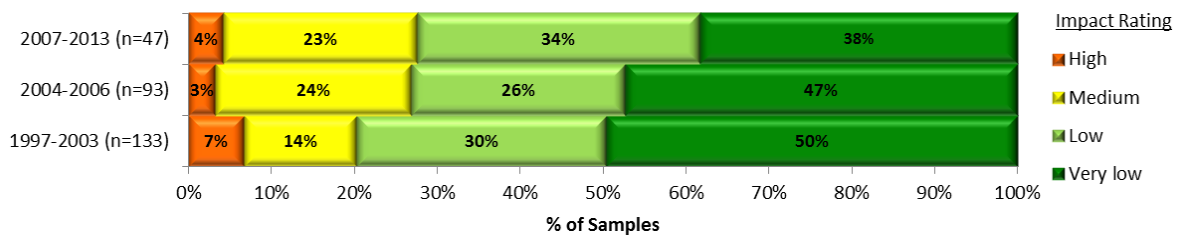
Overall Stewardship Trend: There was no statistical difference ($p = 0.13$) between sampling eras.

Opportunities for Improvement and/or Continuation of Practices that Help Minimize Sediment:

The most frequently suggested solutions to improve road segments with “high” or “medium” impact ratings for road segments sampled in 2013 through 2015 are:

- Armour, seed, and protect bare soil as soon as possible after disturbance.
- Construct sediment traps.
- Use cross-ditches or kickouts to move sediment off the road.

Cariboo Riparian: Resource Development and Natural Impacts on Stream Function



Data Source: Stream riparian data was collected by ministry staff using the FREP riparian monitoring protocol. Sampling sites consist of randomly selected cutblocks with streams in or adjacent to cutblock boundaries. Data presented was collected from 2006 through 2015 from cutblocks harvested from 1997 to 2013. The largest stream of sufficient length is sampled. Stewardship trends are determined by harvest era.

Summary: Of 273 streams, 76% were rated as “very low” or “low” harvest-related impact.

Samples by Stream Class and Impact Rating 2007-2013 Harvest

| Class | High | Medium | Low | Very low | Total |
|-------|------|--------|-----|----------|-------|
| S2 | | | 1 | 3 | 4 |
| S3 | | 4 | 8 | 7 | 19 |
| S4 | | 3 | | 1 | 4 |
| S5 | | | | 1 | 1 |
| S6 | 2 | 4 | 7 | 6 | 19 |
| Total | 2 | 11 | 16 | 18 | 47 |

Causal Factors for 2007-2013 Harvest Streams:

| % of total | Most common specific impact in order of frequency |
|--|--|
| Logging 36% <i>Windthrow</i> <i>Low retention</i> | <ul style="list-style-type: none"> In-stream sediments increased Bare erodible ground increased Moss levels decreased |
| Natural events 29% <i>Beetle kill</i> <i>Wind</i> | <ul style="list-style-type: none"> In-stream sediments increased Stream or riparian blockages increased Moss levels decreased |
| Upstream factors 15% <i>Natural events, roads</i> | <ul style="list-style-type: none"> In-stream sediments increased |
| Roads 12% <i>Erosion, sediment, and channel infill</i> | <ul style="list-style-type: none"> In-stream sediments increased |
| Cattle 6% <i>Trampling by livestock</i> | <ul style="list-style-type: none"> In-stream sediments increased |
| Other manmade 2% <i>Mining</i> | <ul style="list-style-type: none"> Bare erodible ground increased |

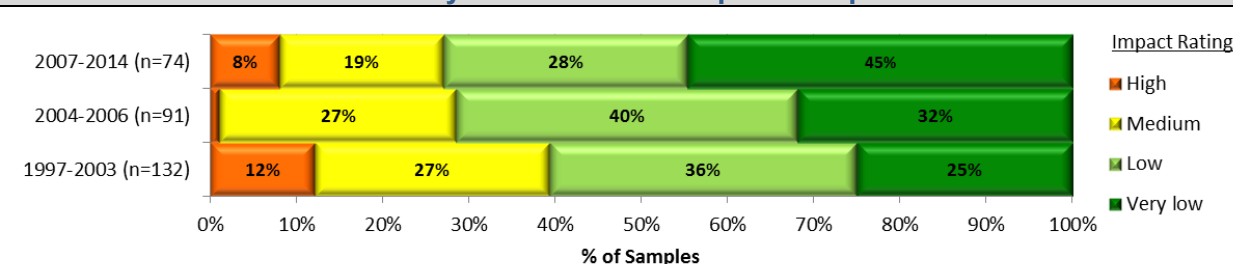
For the 2007-2013 harvest era, natural events caused 29% of the stream impacts, with beetle kill the main natural event. Near-stream human actions (logging, roads, cattle, other) caused 56% of the impacts on streams. Windthrow, low retention, sediment from roads, and trampling by cattle were main human-caused impacts. The two streams with “high” impact in the 2007-2013 harvest era were both S6 streams located internal to block boundaries, under one-metre in channel width, and with very low tree retention (2.5 metres for the one and zero for the other). S3 “medium” impact streams were predominantly impacted by roads and natural events.

Overall Stewardship Trend: No statistical difference ($p = 0.34$) was evident between the three harvest eras.

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

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

Cariboo Stand-level Biodiversity: Resource Development Impacts



Data Source: Stand-level biodiversity data was collected by ministry staff using the FREP stand-level biodiversity monitoring protocol. Sampling sites consist of randomly selected, recently harvested cutblocks. Impact rating considers total treed retention, retention quality, and coarse woody debris quantity and quality. Data presented was collected from 2006 through 2015 from cutblocks harvested from 1997 to 2014. Stewardship trends are based on differences in outcomes between harvest years.

Summary: Of the 297⁵ cutblocks, 67% of sites were rated as “very low” or “low” harvest-related impact. The table below shows the percentage of sampled cutblocks by impact category for 2007-2014 harvest years. It also gives the average size of cutblock by category, with smaller cutblocks more likely to be in “high” impact category in this harvest era.

| 2007-2014 harvest | High | Medium | Low | Very low |
|--------------------|------|--------|-----|----------|
| % of blocks | 8% | 19% | 28% | 45% |
| Average gross (ha) | 5 | 44 | 38 | 71 |
| % of area sampled | 1% | 16% | 21% | 62% |

Causal Factors for 2007-2014 Harvest Era:

84% of all sampled cutblocks harvested after 2006 had more than 3.5% tree retention; 3% (two cutblocks) had zero retention. The density of large snags (≥ 30 cm diameter at breast height (dbh) and ≥ 10 m high) is similar to that found in baseline data (timber cruise data in the same ecosystem). The number of live tree species and density of big trees (generally > 40 cm dbh) is representing baseline conditions. The range of coarse woody debris volume over many cutblocks is similar or slightly higher than expected from baseline (as in retention patches). Coarse woody debris quality (i.e., volume from ≥ 20 cm pieces and density of big pieces per hectare of ≥ 20 cm diameter and ≥ 10 m long) is skewed towards lower amounts compared to the baseline.

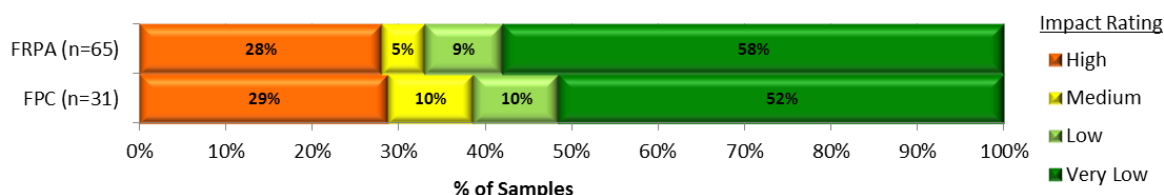
Overall Stewardship Trend: A statistical difference ($p = 0.01$) was evident between harvest eras with some improvement in the later two harvest eras compared to the earliest. Retention increased from an average 19.3% for cutblocks harvested before 2004 to 25.5% for blocks harvested after 2006. Average retention quality increased slightly between harvest eras. Coarse woody debris volume increased.

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

- Continue leaving large snags, big trees, and numbers of tree species in the full range compared to pre-harvest conditions.
- Leave at least some retention on every cutblock with a range of retention (e.g. 3% to 30%) over many cutblocks.
- Leave higher densities of big coarse woody debris pieces on-site.

⁵ An additional eight cutblocks could not be ranked because of a lack of baseline data (all for blocks harvested before 2005).

Cariboo Visual Quality: Resource Development Impacts on Achievement of Visual Quality Objectives



Data Source: Visual quality assessment data was collected by ministry staff and consultants using the FREP visual quality monitoring protocol. Sampling sites consist of landforms with visual quality objectives (VQOs) located in randomly selected, recently harvested cutblocks. Stewardship trends are based on comparisons of samples collected under *FPC* forest development plans versus *FRPA* forest stewardship plans. *FRPA* data came from the Quesnel, Williams Lake, and 100 Mile timber supply areas (TSAs). *FPC* data came from the 100 Mile and Quesnel TSAs.

Summary: Of 65 landforms evaluated under *FRPA*, 67% were rated as “very low” or “low” harvest-related impact, while 33% were rated “medium” or “high” impact. The data suggests that the visual quality value is at risk in this region as a large proportion of VQOs are not achieved.

Number of FRPA Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very low | Total |
|------------------|-----------|----------|----------|-----------|-----------|
| M | 6 | | 1 | 18 | 25 |
| PR | 10 | 3 | 5 | 20 | 38 |
| R | 2 | | | | 2 |
| Total | 18 | 3 | 6 | 38 | 65 |

Number of FPC Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very low | Total |
|------------------|----------|----------|----------|-----------|-----------|
| M | 1 | 1 | | 8 | 10 |
| PR | 8 | 1 | 3 | 8 | 20 |
| R | | 1 | | | 1 |
| Total | 9 | 3 | 3 | 16 | 31 |

^a M = Modification, PR = Partial Retention, R = Retention

Causal Factors for FRPA Landforms: For the two R landforms where the VQO was not achieved (“high” impact), the % of landform altered by openings was consistent with a PR VQO in one case (3%) and an M VQO (14%) in the other; both had poor tree retention and either no design or poor design. The adjusted visual quality classes were MM and PR.

For the 10 “high” impact PR landforms, the % of landform altered by openings ranged from four to 40%, averaging 14%. Non-vegetated areas from old openings contributed to several landforms, increasing average total % alteration to 17%. There was generally moderate or poor tree retention and neutral, or no design or poor design. In-block roads were significant for five of the “high” impact landforms.

Thirty-eight landforms had VQOs that were fully achieved (“very low” impact). For the 20 of these that were PR:

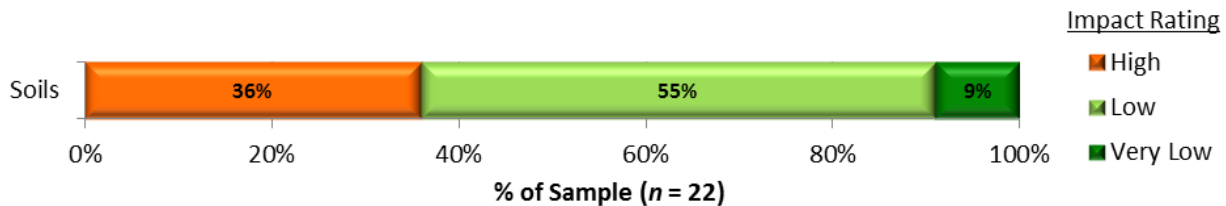
- 13 had good design, four neutral, and three no design or poor design.
- Nine had good or moderate levels of tree retention within openings.
- All but one had % landform alteration consistent with their VQO. The one with higher alteration had good tree retention and good design, which made it consistent with a PR VQO.

Overall Stewardship Trend: No direct comparison is possible since the *FPC* and *FRPA* sampling took place on different TSAs; however, practices in general seem not to have changed from the *FPC* to the *FRPA* eras and there is no statistical difference ($p = 0.73$) when looking at only the TSAs sampled during both legislative eras.

Opportunities for Improvement Based on FRPA Viewscapes Meeting Visual Quality Objectives:

- Reduce the opening size in retention and partial retention VQO areas to ensure the percent alteration range for the landform falls within Visual Impact Assessment Guidebook Standards.
- Use visual design techniques to create more natural-looking openings.
- Use partial cutting to retain higher levels of volume per stems.
- Consider road impacts and non-vegetated old openings on landform alteration.

Cariboo Soils: Resource Development Impacts on Soil Productivity and Hydrologic Function



Data Source: Soils data for assessments of soil productivity and hydrologic function was collected by provincial and regional soils experts using air photo interpretation. Sampling sites consist of randomly selected, recently harvested cutblocks. Assessments are based on high-resolution air photo analysis.

Summary: Of 22 cutblocks, 64% were rated as “very low” or “low” harvest-related impact, and 36% were rated as “high” harvest-related impact.

Causal Factors:

Excessive soil disturbance, both in roadside work areas and outside work areas, is a major factor that contributes to “highly” affected soil productivity. Several sites also show a lack of mature forest, which is required to allow re-colonization of the cutblock with slowly dispersing soil organisms. In addition, a lack of effort was evident in maintaining sufficient coarse woody debris. Access design was a significant issue over much of the province; more recent work identifies a lack of reclaimed temporary access structures (e.g., short-term roads) and the deteriorating condition of abandoned short-term roads.

Overall Stewardship Trend: Not enough historical monitoring has taken place to establish a trend.

Opportunities for Improvement:

- Plan operations in and outside roadside work areas to minimize soil disturbance, including excessive construction of temporary roads.
- Implement measures to conserve coarse woody debris and well-dispersed remnants of mature forest.
- Introduce simple low-cost rehabilitation of roads as an alternative to deactivation.

KOOTENAY-BOUNDARY NATURAL RESOURCE REGION

The following section presents the status of LLBD and the outcomes of site-level FREP monitoring in the Kootenay-Boundary Natural Resource Region.

Kootenay-Boundary Landscape-level Biodiversity

For brevity, LLBD is only reported for the 10 largest BGC subzones covering 84% of the forested ecosystems (by area) in the Kootenay-Boundary Region.

The biogeoclimatic subzone coding is as follows:

| | |
|---------|--|
| ESSFdk: | Engelmann spruce subalpine fir dry cool |
| ESSFvc: | Engelmann spruce subalpine fir very wet cold |
| ESSFwc: | Engelmann spruce subalpine fir wet cold |
| ESSFwm: | Engelmann spruce subalpine fir wet mild |
| ICHdw: | interior cedar hemlock dry warm |
| ICHmk: | interior cedar hemlock moist cool |
| ICHmw: | interior cedar hemlock moist warm |
| ICHwk: | interior cedar hemlock wet cool |
| IDFdm: | interior Douglas-fir dry mild |
| MSdk: | montane spruce dry cool |

Figure 7: 10 largest forested BGC subzones in the Kootenay-Boundary Region (locations shown have major sawmills)

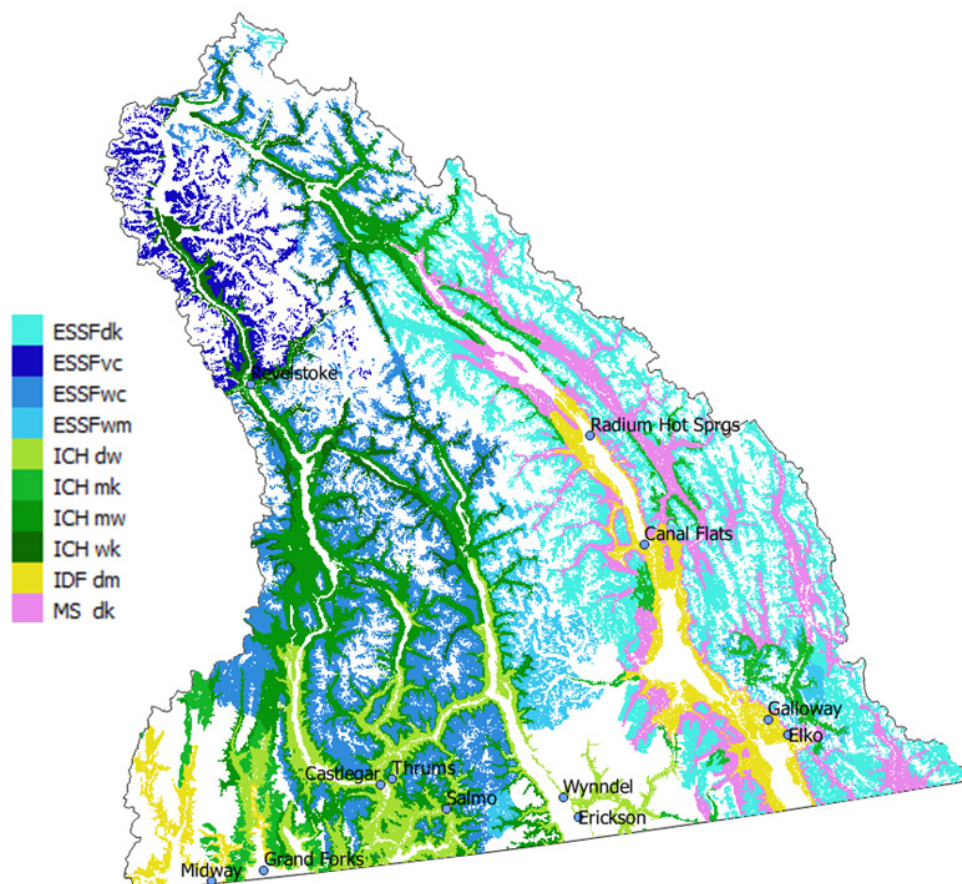


Figure 8: Amount of forest by seral stage and BGC subzone⁶ in the Kootenay-Boundary Region.

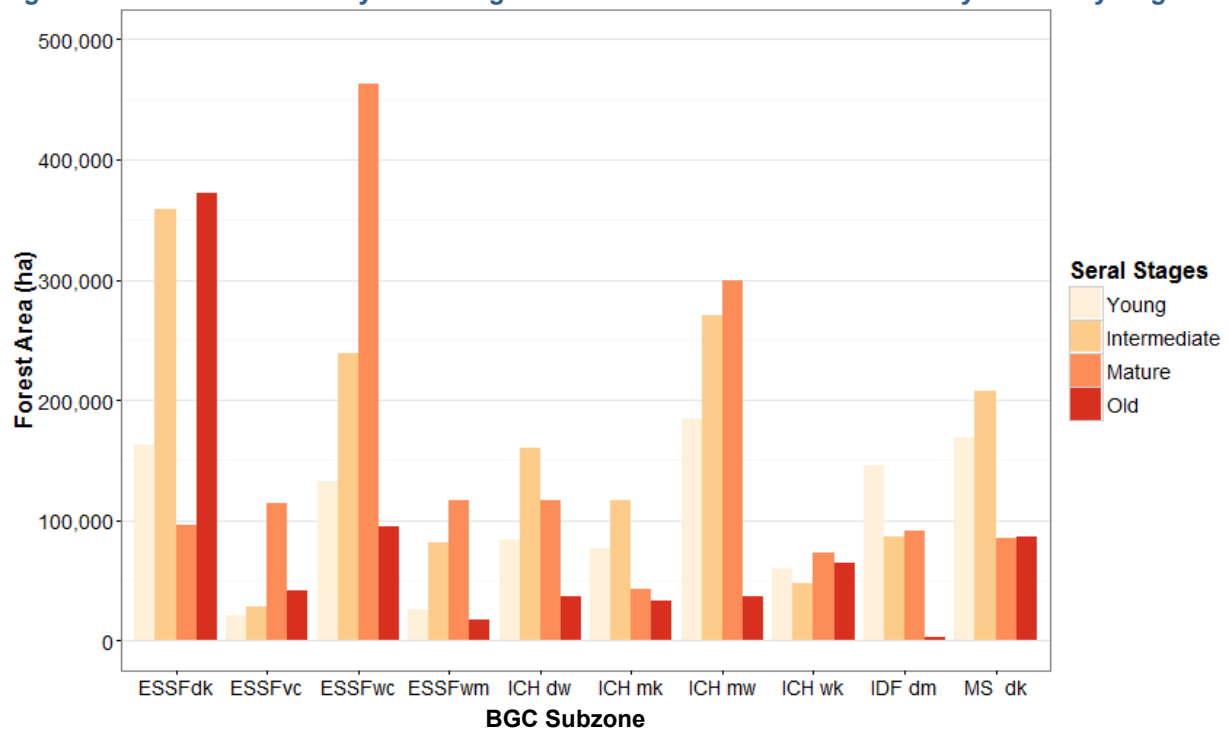
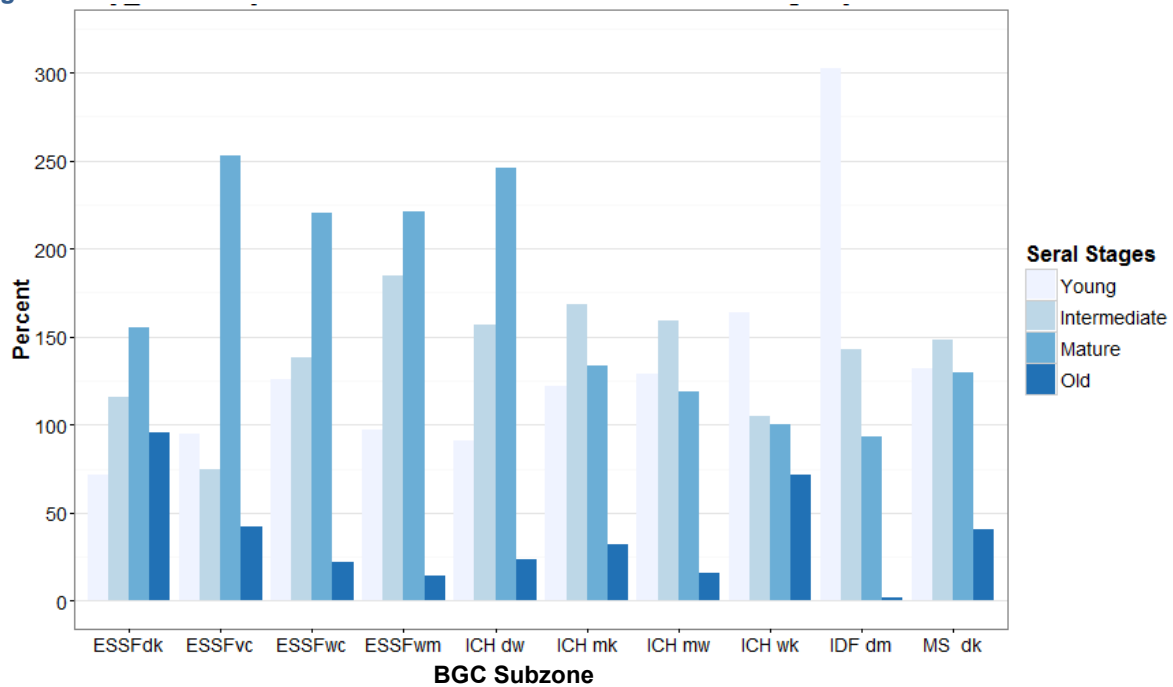


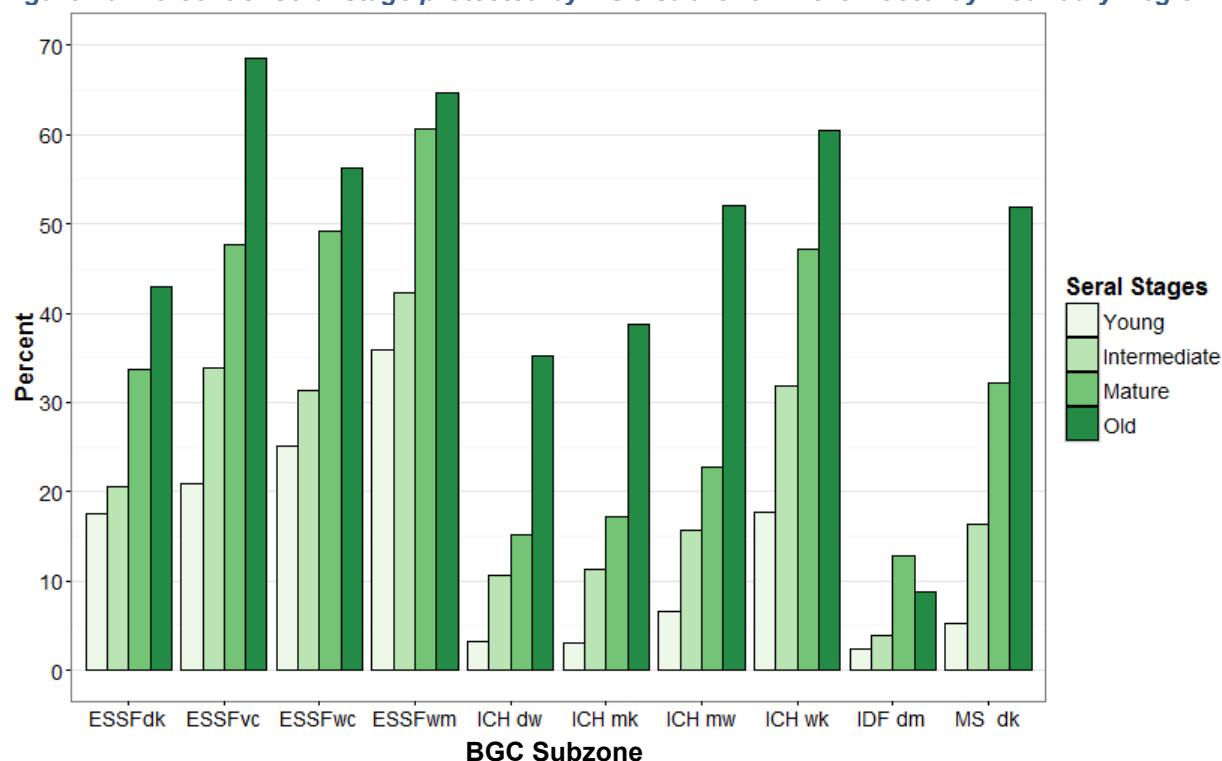
Figure 9: Percent of theoretical natural seral stage by BGC subzone⁷ in the Kootenay-Boundary Region.



⁶ Referred to as the "observed plot" in the subsequent discussion.

⁷ Referred to as the "percent of natural plot" in the subsequent discussion.

Figure 10: Percent of seral stage protected by BGC subzone⁸ in the Kootenay-Boundary Region.



A comparison of the “observed plot” and “percent of natural plot” for the ESSFdk may lead the reader to assume something is wrong with the data. The intermediate seral stage is more than three times the area of mature, yet the intermediate seral stage is approximately 120% of expected and the mature stage approximately 160% of expected. This is an artifact of the 1995 Biodiversity Guidebook seral stage definition for intermediate and mature for the ESSFdk—40 to 120 years and 120 to 140 years respectively. Mature has a narrow age range and therefore occupies a small area, while intermediate occupies an age range that is four times wider and therefore occupies close to four times the land area.

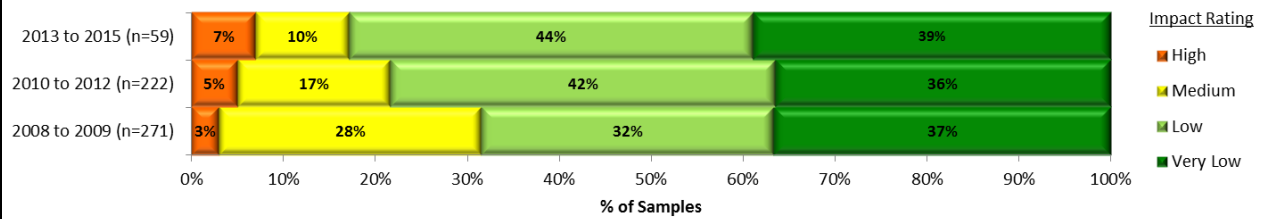
Again similar to the Cariboo Region, the IDF subzone is dominated by stands that have experienced recent harvest, but this may not equate to the total absence of mature and old trees due to a history of partial harvest in some cases. Similar to the SBPS and SBS subzones in the Cariboo, the MSdk in the Kootenay-Boundary is dominated by young forest and reflects pine salvage. Despite this, there are still more mature MS stands on the landscape than expected under a natural disturbance regime.

Among ICH subzones, the ICHdw and ICHmk have larger relative amounts of young and intermediate forest than the ICHmw and ICHwk subzones, the former being either lower elevation and/or closer to milling centres. Despite this, the ICHdw still has more mature than expected, likely reflecting fire suppression efforts over the past century. It is a similar situation for the ESSF subzones.

With the exception of the ESSFdk, despite the prevalence of mature stands in the ICH and ESSF subzones, these subzones have less than 50% of the old forest expected under a natural disturbance regime. This may reflect historical disturbance events or indicate an issue with the seral stage definitions in the Biodiversity Guidebook. The “percent protected plot” shows the focus of the Province’s protection strategies have been on what old growth remains.

⁸ Referred to as the “percent protected plot” in the subsequent discussion.

Kootenay-Boundary Water Quality (fine sediment generation): Resource Development Impacts



Data Source: Water quality data (potential for fine sediment generation) was collected by ministry staff using the FREP water quality monitoring protocol. Sampling sites consist of roads and/or areas of mass wasting connected to fish habitat and/or drinking water sources that originate at randomly selected, recently harvested cutblocks. Sampling occurred from 2008 to 2015. Stewardship trends are based on survey years to capture the effects of road traffic and maintenance and are broken into three roughly equal time periods.

Summary: Of 552 road segments, 74% were rated as “very low” or “low” road-related impact.

Causal Factors for 2013 to 2015 Field Seasons: See opportunities for improvement on road segments with “high” or “medium” impact ratings. Some opportunities will apply to ongoing maintenance issues, whereas others mainly apply to new road construction.

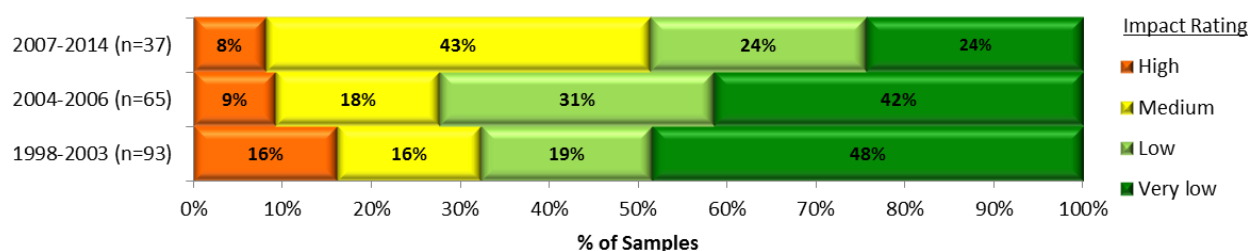
Overall Stewardship Trend: A statistical difference ($p = 0.01$) was evident between sampling eras with potentially better outcomes in the 2010 onwards field seasons. However, the sample size is low in the 2013 to 2015 sampling years.

Opportunities for Improvement and/or Continuation of Practices that Help Minimize Sediment:

The most frequent suggested solutions to improve road segments with “high” or “medium” impact ratings in the 2013 to 2015 field seasons are:

- Construct sediment traps.
- Increase the number of strategically located culverts.
- Armor, seed, and protect bare soil as soon as possible after disturbance.

Kootenay-Boundary Riparian: Resource Development and Natural Impacts on Stream Function



Data Source: Stream riparian data was collected by ministry staff using the FREP riparian monitoring protocol. Sampling sites consist of randomly selected cutblocks with streams in or adjacent to cutblock boundaries. Sampling occurred from 2006 to 2015 on cutblocks harvested from 1998 to 2014. The largest stream of sufficient length is sampled. Stewardship trends are determined by harvest era.

Summary: Of 195 streams, 66% were rated as “very low” or “low” harvest-related impact.

Samples by Stream Class and Impact Rating 2007-2014 Harvest

| Class | High | Medium | Low | Very low | Total |
|--------------|----------|-----------|----------|----------|-----------|
| S1 | | | | 1 | 1 |
| S2 | | | 2 | | 2 |
| S3 | | | 3 | 1 | 4 |
| S4 | 1 | | 1 | | 2 |
| S5 | | 2 | | 2 | 4 |
| S6 | 2 | 14 | 3 | 5 | 24 |
| Total | 3 | 16 | 9 | 9 | 37 |

Causal Factors for 2007-2014 Harvest Era

| % of total | Most common specific impact in order of frequency |
|--|--|
| Logging 50% <i>Low retention</i> <i>Windthrow</i> <i>Falling and yarding</i> | <ul style="list-style-type: none"> Riparian vegetation decreased Large woody debris processes altered Stream or riparian blockages increased Large Woody Debris supply decreased |
| Natural events 35% <i>Wind</i> <i>High natural sediment</i> | <ul style="list-style-type: none"> Stream or riparian blockages increased Moss levels decreased In-stream sediments increased |
| Roads 10% <i>Erosion causing sedimentation</i> | <ul style="list-style-type: none"> In-stream sediments increased |
| Upstream factors 4% <i>Natural events, logging</i> | <ul style="list-style-type: none"> Stream or riparian blockages increased Moss levels decreased |
| Cattle 1% | <ul style="list-style-type: none"> In-stream sediments increased |
| Other manmade 1% | <ul style="list-style-type: none"> Riparian vegetation decreased |

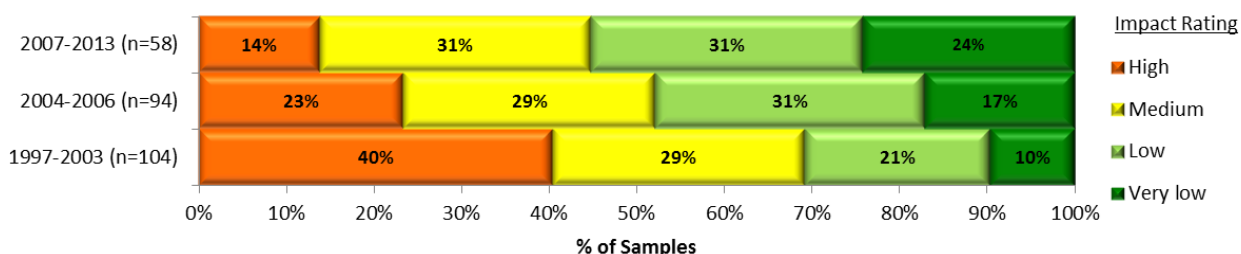
On average, near-stream human actions (logging, roads, cattle, other) caused 61% of the impacts. Low retention, windthrow, and eroding roads were the main human-caused impacts. High wind events were a main source of natural event impacts.

Overall Stewardship Trend: A statistical difference ($p = 0.01$) was evident between the three harvest eras with poorer outcomes in the 2007-2014 harvest era. In particular, stream or riparian blockages increased in the 2007-2014 harvest era. Of the streams on or near blocks harvested from 2007-2014, the three high impact streams (two S6 and one S4) were all in-block streams. The S6 streams had no tree retention and both had channel bed disturbance and blockages. The S4 had a 10 metre buffer, but windthrow and sedimentation caused problems.

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

- 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.
- Decrease stream or riparian blockages by minimizing logging slash and sediment entering streams.

Kootenay-Boundary Stand-level Biodiversity: Resource Development Impacts



Data Source: Stand-level biodiversity data was collected by ministry field staff using the FREP stand-level biodiversity monitoring protocol. Sampling sites consist of randomly selected, recently harvested cutblocks. The impact rating considers total treed retention, retention quality, and coarse woody debris quantity and quality. The data presented was collected from 2006 through 2015 from cutblocks harvested from 1997 to 2013. Stewardship trends are based on differences in outcomes between harvest years.

Summary: Of 256⁹ cutblocks, 43% of sites were rated as “very low” or “low” harvest-related impact. The table below shows the percentage of sampled cutblocks by impact category. It also gives the average size of cutblock by category.

| 2007-2013 harvest | High | Medium | Low | Very low |
|--------------------|------|--------|-----|----------|
| % of blocks | 14% | 31% | 31% | 24% |
| Average gross (ha) | 14 | 14 | 33 | 30 |
| % of area sampled | 8% | 19% | 43% | 30% |

Causal Factors for 2007-2013 Harvest: 72% of all cutblocks had more than 3.5% tree retention; 10% (six cutblocks) had zero retention. The density of big trees (generally > 40cm dbh in this region) is good in the ESSF, but low in the MS. The diversity of retained live tree species compared to baseline is low, other than the four IDF cutblocks sampled in this most recent harvest era. The range of coarse woody debris volume over many cutblocks is similar or slightly higher than expected from baseline (as in retention patches). Coarse woody debris total volume is similar or higher than found within retention patches. The range of coarse woody debris volume from large diameter pieces (>20 cm) is similar to baseline in the ICH, but low in the MS zone.

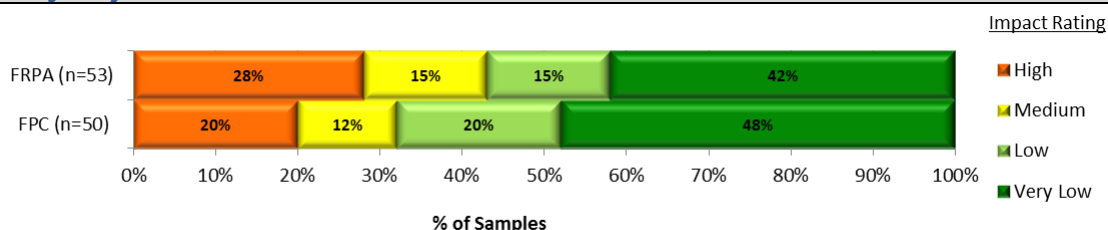
Overall Stewardship Trend: A statistical difference ($p = 0.01$) was evident between harvest eras, with an improving trend in later harvest years. Retention increased from an average 12.7% for blocks harvested before 2004 to 16.6% for blocks harvested after 2006. Average retention quality increased slightly between harvest eras. Coarse woody debris volume increased.

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

- Leave at least low levels of retention on every cutblock.
- Have a range of retention (e.g., 3–30%) over many cutblocks.
- Retain the full range of tree species present pre-harvest.
- Continue leaving large trees on the site in ESSF cutblocks, and increase in other zones (ICH and MS).
- Continue leaving CWD volumes on the harvested components of the site similar to pre-harvest conditions.

⁹ Four cutblocks could not be ranked since they had patch retention, but no plots were established (likely a safety issue). An additional seven cutblocks were sampled and assessed for individual indicators, but could not be ranked because of a lack of baseline data.

Kootenay-Boundary Visual Quality: Resource Development Impacts on Achievement of Visual Quality Objectives



Data Source: Visual quality assessment data was collected by ministry field staff and consultants using the FREP visual quality monitoring protocol. Sampling sites consist of landforms with VQOs located in randomly selected, recently harvested cutblocks. Stewardship trends are based on comparisons of samples collected under *FPC* forest development plans versus *FRPA* forest stewardship plans. *FRPA* data came predominantly from the Cranbrook and Arrow TSAs, with minor sampling in Boundary, Revelstoke, Invermere, and Kootenay Lake. *FPC* data came predominantly from the Kootenay Lake and Revelstoke TSAs, with minor sampling in Golden and Arrow.

Summary: Of 53 landforms assessed under *FRPA*, 57% were rated as “very low” or “low” harvest-related impact, while 43% were rated “medium” and “high” impact. This data suggests that the visual quality value is at risk in this region as a significant number of VQOs were not achieved.

Number of FRPA Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very low | Total |
|------------------|-----------|----------|----------|-----------|-----------|
| M | 4 | 3 | 3 | 16 | 26 |
| PR | 10 | 4 | 5 | 5 | 24 |
| R | 1 | 1 | | 1 | 3 |
| Total | 15 | 8 | 8 | 22 | 53 |

Number of FPC Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very low | Total |
|------------------|-----------|----------|-----------|-----------|-----------|
| MM | | 2 | | 1 | 3 |
| M | | | 3 | 4 | 7 |
| PR | 5 | 3 | 5 | 16 | 29 |
| R | 5 | 1 | 2 | 3 | 11 |
| Total | 10 | 6 | 10 | 24 | 50 |

^a MM = Maximum Modification, M = Modification, PR = Partial Retention, R = Retention

Causal Factors for FRPA Landforms: The single R landform where the VQO was not achieved (“high” impact) had 13% alteration of landform altered by openings. It had poor tree retention and neutral design. The achieved visual quality class was M. Of the 10 PR “high” impact landforms, there was an average of 16% landform alteration, with all but one sample consistent with M or MM VQO. All but one had poor tree retention and neutral or no design or poor design.

Twenty-two landforms had VQOs that were fully achieved (“very low” impact). For the six of these that were PR or R:

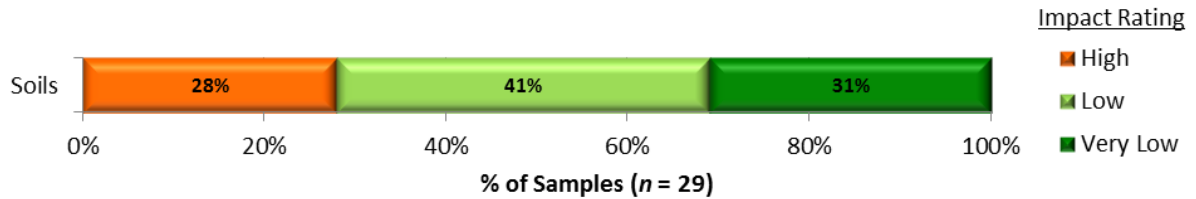
- One had good design, four neutral, and one no design or poor design.
- All had poor tree retention within openings.
- All had % landform alteration consistent with their VQO.

Overall Stewardship Trend: No direct comparison is possible since the *FPC* and *FRPA* sampling took place on different timber supply areas.

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

- Reduce the opening size in retention and partial retention VQO areas to ensure the percent alteration range for the landform falls within Visual Impact Assessment Guidebook Standards.
- Use visual design techniques to create more natural-looking openings and better achieve VQOs.
- Use partial cutting to retain higher levels of volume per stems.

Kootenay-Boundary Soils: Resource Development Impacts on Soil Productivity and Hydrologic Function



Data Source: Soils data for assessments of soil productivity and hydrologic function was collected by provincial and regional soils experts using air photo interpretation. Sampling sites consist of randomly selected, recently harvested cutblocks. Assessments are based on high-resolution air photo analysis.

Summary: Of 29 cutblocks, 72% were rated as “very low” or “low” harvest-related impact, indicating that soil management objectives were achieved; 28% were rated as “high” harvest-related impact.

Causal Factors:

Excessive soil disturbance, both in roadside work areas and outside work areas, is a major factor that contributes to “highly” affected soil productivity. On many sites, measures were not taken to restore natural drainage patterns, and harvesting, access construction, or maintenance practices have led to (or increased the potential for) mass movement or erosion.

Overall Stewardship Trend: Not enough historical monitoring has taken place to establish a trend.

Opportunities for Improvement:

- Plan operations in and outside roadside work areas to minimize soil disturbance.
- Ensure sufficient drainage control is in place to prevent erosion and restore natural drainage when site work is complete.
- Introduce simple low-cost rehabilitation of roads as an alternative to deactivation.

NORTHEAST NATURAL RESOURCE REGION

The following section presents the status of LLBD and the outcomes of site-level FREP monitoring in the Northeast Natural Resource Region.

Northeast Landscape-level Biodiversity

LLBD is reported for all nine forested BGC subzones in the Northeast Region.

The biogeoclimatic subzone coding is as follows:

| | |
|---------|--|
| BWBSdk: | boreal black and white spruce dry cool |
| BWBSmk: | boreal black and white spruce moist cool |
| BWBSmw: | boreal black and white spruce moist warm |
| BWBSwk: | boreal black and white spruce wet cool |
| ESSFmv: | Engelmann spruce subalpine fir moist very cold |
| ESSFwc: | Engelmann spruce subalpine fir wet cold |
| ESSFwk: | Engelmann spruce subalpine fir wet cool |
| SBSwk: | sub boreal spruce wet cool |
| SWBmk: | spruce willow birch moist cool |

Figure 11: Forested BGC subzones in the Northeast Region (locations shown have major sawmills).

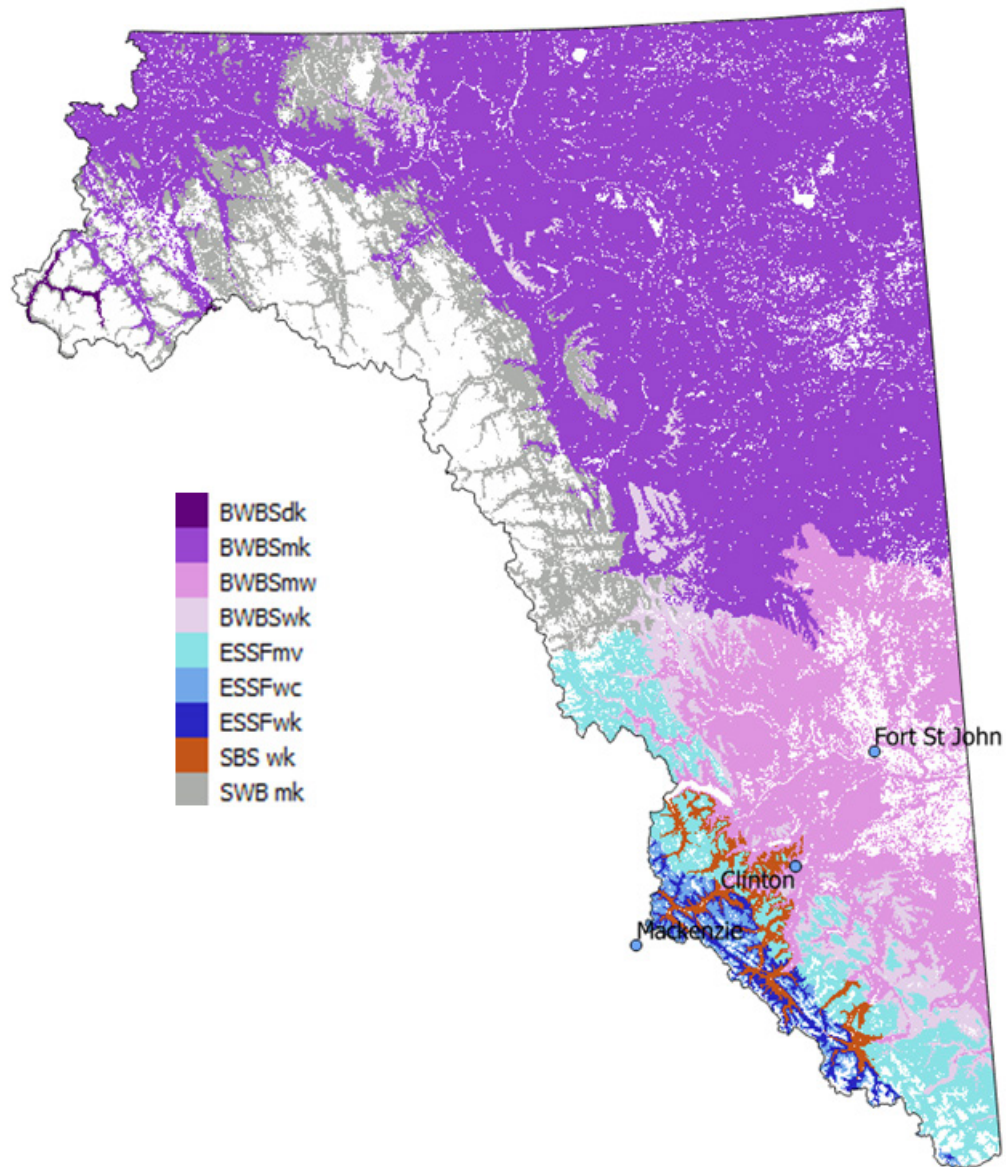


Figure 12: Amount of forest by seral stage and BGC subzone¹⁰ in the Northeast Region.

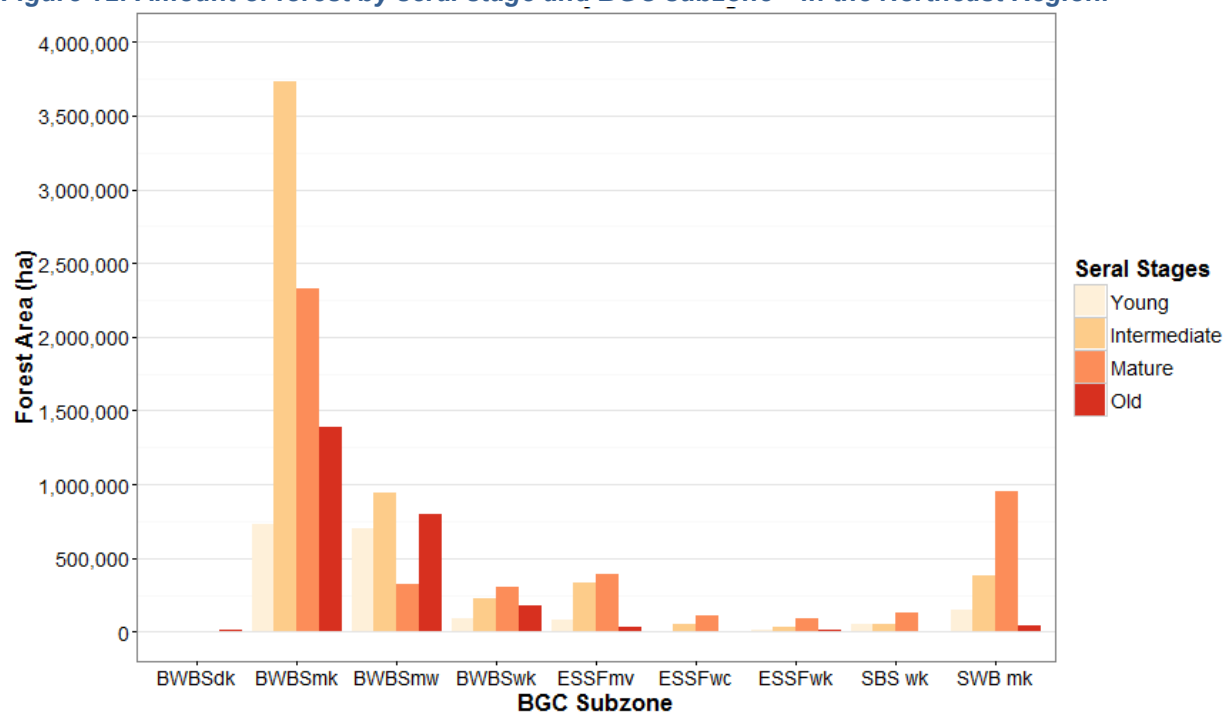
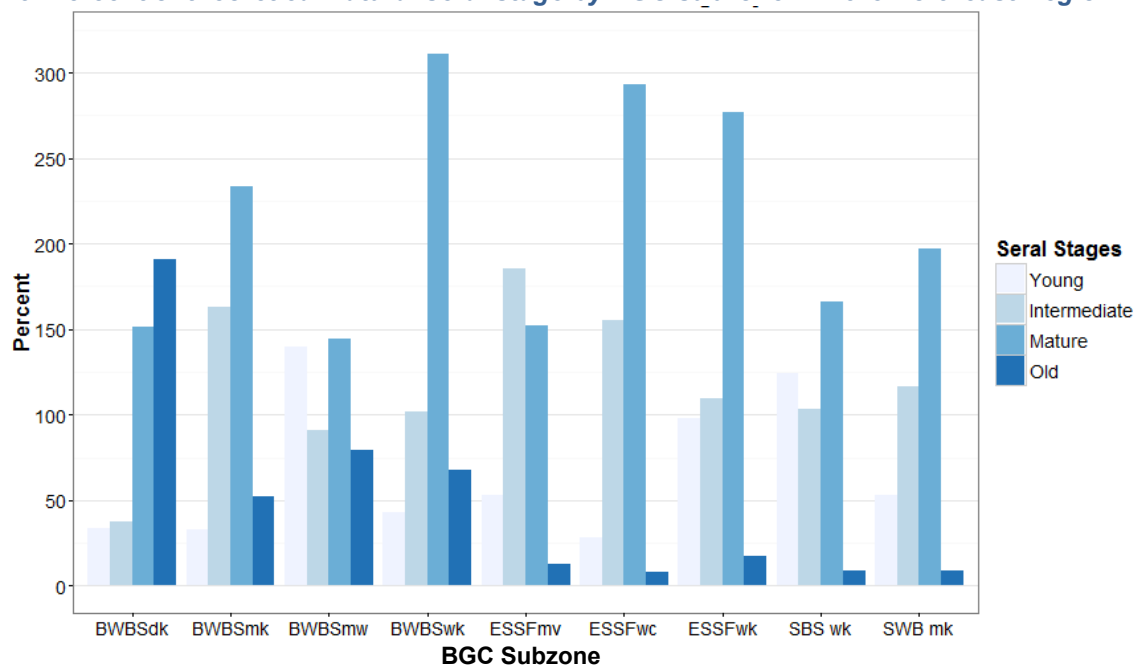


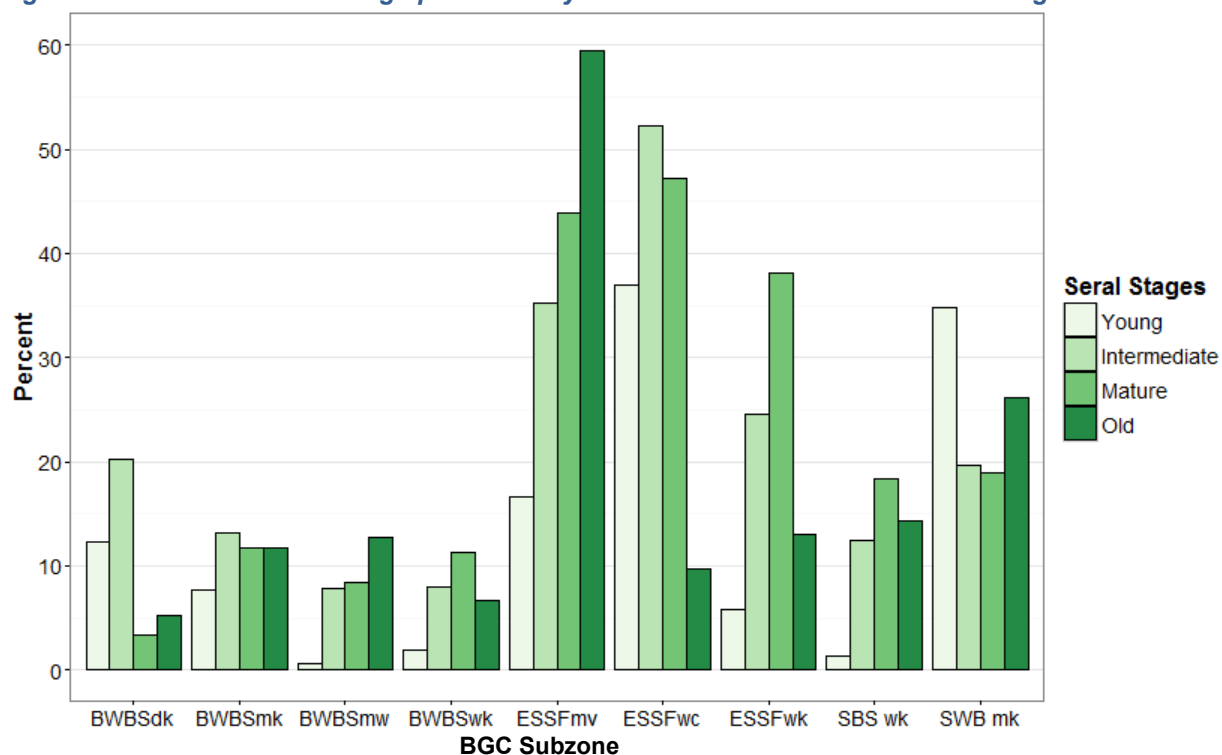
Figure 13: Percent of theoretical natural seral stage by BGC subzone¹¹ in the Northeast Region.



¹⁰ Referred to as the "observed plot" in the subsequent discussion.

¹¹ Referred to as the "percent of natural plot" in the subsequent discussion.

Figure 14: Percent of seral stage protected by BGC subzone¹² in the Northeast Region



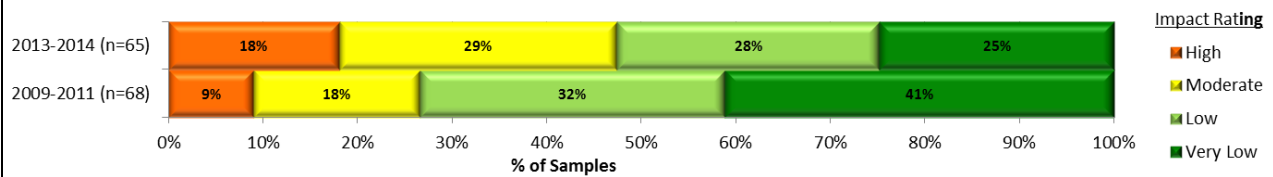
Unlike the BWBSmw, the seral stage distribution of the BWBSmk (see “observed plot”) is surprising. It is a very large unit, is thought to have a relatively small timber harvesting landbase, and is more than 100 kilometers from a major milling centre, yet it is dominated by the intermediate seral stage (41-100 years). In the case of the BWBSmw, which surrounds Fort St. John, the relative abundance of young and intermediate forest would be consistent with industrial activity. In the case of the BWBSmk, the dominance of 41-100 year old forest is presumably due to natural disturbance.

Unlike the Caribou and Kootenay-Boundary Regions, the “percent protected plot” shows much lower levels of relative protection for remaining old growth, with the exception being old growth in the ESSFmv. However, in absolute terms, the amount of protected old ESSFmv is low because the total number of hectares of old ESSFmv is low (approximately 32 000 hectares (ha)). Conversely, despite the relative amount of protected old growth BWBSmk and BWBSmw being low (12% and 13% respectively) the actual area of old growth is 1.4 and 0.8 million ha respectively.

Given the lack of development in the SWB, ESSF and BWBSmk subzones, the surplus of mature forest and the lack of old forest indicates a classification problem in the 1995 Biodiversity Guidebook. It would appear these forests do not get as old as portrayed in the guidebook.

¹² Referred to as the “percent protected plot” in the subsequent discussion.

Northeast Water Quality (fine sediment generation): Resource Development Impacts



Data Source: Water quality data (potential for fine sediment generation) was collected by ministry staff using the FREP water quality monitoring protocol. Sampling sites consist of roads and/or areas of mass wasting connected to fish habitat and/or drinking water sources that originate at randomly selected, recently harvested cutblocks. Sampling occurred from 2009 to 2014. Stewardship trends are based on survey years to capture the effects of road traffic and maintenance.

The water quality data is from the Peace Natural Resource District. In the Fort Nelson Natural Resource District, resource roads for movement of heavy equipment, such as logging trucks, are for winter use only. These winter-use roads are functional only when the sub-grade and grade are completely frozen. Since the water quality protocol addresses gravel roads that are used in all seasons, it is not applicable to the Fort Nelson situation.

Summary: Of 133 road segments, 63% were rated as “very low” or “low” road-related impact.

Causal Factors for 2013 and 2014 Field Seasons:

See opportunities for improvement on road segments with “high” or “medium” impact ratings. Some opportunities will apply to ongoing maintenance issues, whereas others mainly apply to new road construction.

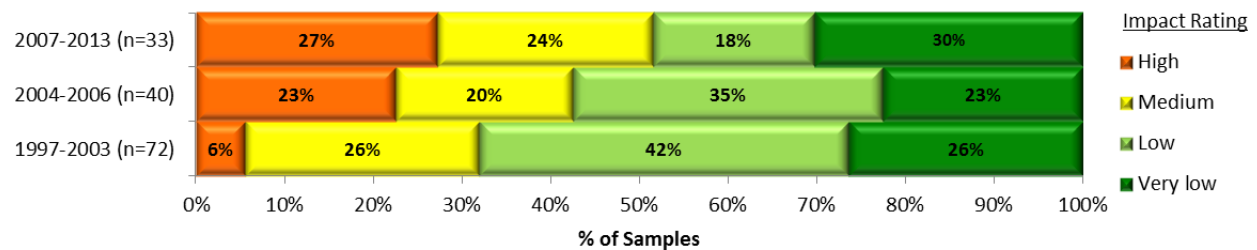
Overall Stewardship Trend: A statistical difference ($p = 0.08$) was evident between the two sampling eras, with an increase in potential for sediment generation from earlier to later sample years.

Opportunities for Improvement and/or Continuation of Practices that Help Minimize Sediment:

The most frequent suggested solutions to improve road segments with “high” or “medium” impact ratings for the 2013 and 2014 field seasons are:

- Avoid long gradients approaching streams.
- Use good-quality materials for road building.
- Armour, seed, and protect bare soil.

Northeast Riparian: Resource Development and Natural Impacts on Stream Function



Data Source: Stream riparian data was collected by ministry staff using the FREP riparian monitoring protocol. Sampling sites consist of randomly selected cutblocks with streams in or adjacent to cutblock boundaries. Sampling occurred from 2006 to 2014 on cutblocks harvested from 1997 to 2013. The largest stream of sufficient length is sampled. Stewardship trends are determined by harvest era.

Summary: Of 145 streams, 61% were rated as “very low” or “low” harvest-related impact.

Samples by Stream Class and Impact Rating 2007-2013 Harvest

| Class | High | Medium | Low | Very low | Total |
|--------------|----------|----------|----------|-----------|-----------|
| S2 | 1 | | 1 | | 2 |
| S3 | | 3 | | 1 | 4 |
| S4 | | 1 | | 2 | 3 |
| S5 | 1 | | | | 1 |
| S6 | 7 | 4 | 5 | 7 | 23 |
| Total | 9 | 8 | 6 | 10 | 33 |

Causal Factors for 2007-2013 Harvest:

| % of total | Most common specific impact in order of frequency |
|---|---|
| Natural events 51% <i>High natural sediment Floods Wind</i> | <ul style="list-style-type: none"> In-stream sediments increased Moss levels decreased Channel morphology altered |
| Logging 47% <i>Windthrow Low retention</i> | <ul style="list-style-type: none"> Windthrow protection decreased In-stream sediments increased Channel morphology altered |
| Roads 2% <i>Erosion causing sedimentation</i> | <ul style="list-style-type: none"> In-stream sediments increased |

Near-stream human actions (logging, roads) caused 49% of the impacts on streams. Natural events, mainly high natural background sediment, are a key Northeast attribute causing 51% of the impact.

This region’s geology provides the highest natural background sediment levels in the province and proportionately fewer “very low” impact streams can be expected.

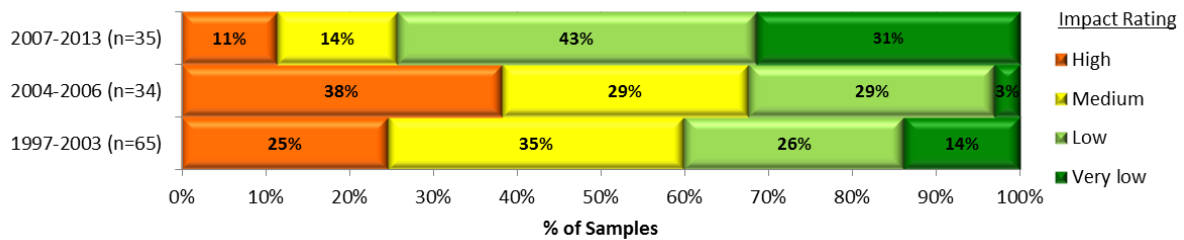
The seven S6 streams in “high” impact category in the 2007-2013 harvest era averaged less than 0.5 metre retention, and all but one were internal to harvest boundaries.

Overall Stewardship Trend: A statistical difference ($p = 0.04$) was evident between the three harvest eras, with decreasing stream conditions.

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

- 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 those wider perennial streams that make significant contributions of water, sediment, debris, and nutrients to downstream fish habitats and watershed function.

Northeast Stand-level Biodiversity: Resource Development Impacts



Data Source: Stand-level biodiversity data was collected by ministry staff using the FREP stand-level biodiversity monitoring protocol. Sampling sites consist of randomly selected, recently harvested cutblocks. The impact rating considers total treed retention, retention quality, and coarse woody debris quantity and quality. The data presented was collected from 2006 through 2015 from cutblocks harvested from 1997 to 2013. Stewardship trends are based on differences in outcomes between harvest years.

Summary: Of 134 cutblocks, 47% of sites were rated as “very low” or “low” harvest-related impact. The table below shows the percentage of sampled cutblocks by impact category. It also gives the average cutblock size by category, with smaller cutblocks potentially more likely to be in the “high” impact category, although, particularly in the 2007-2013 harvest era, representing just 3% of the area sampled.

| 2007-2013 harvest | High | Medium | Low | Very low |
|--------------------|------|--------|-----|----------|
| % of blocks | 11% | 14% | 43% | 31% |
| Average gross (ha) | 19 | 119 | 81 | 72 |
| % of area sampled | 3% | 22% | 45% | 30% |

Causal Factors for 2007-2013 Harvest: 91% of the 35 cutblocks harvested from 2007-2013, had 3.5% or more tree retention. The majority of the data (29 samples) is from the BWBS biogeoclimatic zone. In this most recent harvest era, live tree species diversity in the BWBS zone is consistent with that expected from baseline. The density of big trees (> 40 cm dbh) is similar to baseline for the BWBS cutblocks as is the density of large snags (> 30 cm dbh and > 10 m height). The range of coarse woody debris volume over many cutblocks is consistently similar or slightly higher than expected from the baseline (compared to retention patches). The range of coarse woody debris volume from ≥ 20 cm pieces is just slightly below baseline, although the density of log size pieces per hectare (≥ 20 cm diameter and ≥ 10 m long) is low compared to the baseline. Of the four blocks in the “high” impact category, all were BWBS blocks. Two had 0% retention, one had 9% retention from dispersed trees only, and one had 5% retention with few tree species or large trees retained.

Overall Stewardship Trend: A statistical difference ($p = 0.00$) was evident between harvest eras, with an improving trend in the latest harvest years compared to the 2004-2006 harvest years. Retention increased from an average 10.1% before 2004 to 10.5% for blocks harvested during 2004–2006, and 12.7% for blocks harvested after 2006.

Average retention quality was highest for the 2007-2013 era, as was average coarse woody debris quality.

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

- Leave at least low levels of retention on every cutblock with a range of retention (e.g., 3% –30%) over many cutblocks.
- Continue to retain the full range of tree species and leaving large trees and large snags on the site.
- Continue to maintain volumes of large diameter coarse woody debris similar to that found in retention patches or pre-harvest condition.
- Continue the improvement in maintaining closer to natural densities of log size pieces of CWD in the harvest areas.

OMINECA NATURAL RESOURCE REGION

The following section presents the status of LLBD and the outcomes of site-level FREP monitoring in the Omineca Natural Resource Region.

Omineca Landscape-level Biodiversity

For brevity, LLBD is only reported for the 10 largest BGC subzones covering 85% of the forested ecosystems (by area) in the Omineca Region.

The biogeoclimatic subzone coding is as follows:

| | |
|---------|--|
| BWBSdk: | boreal white and black spruce dry cool |
| ESSFmv: | Engelmann spruce subalpine fir moist very cool |
| ESSFwc: | Engelmann spruce subalpine fir wet cold |
| ESSFwk: | Engelmann spruce subalpine fir wet cool |
| SBSdw: | sub boreal spruce dry warm |
| SBSmc: | sub boreal spruce moist cold |
| SBSmk: | sub boreal spruce moist cool |
| SBSvk: | sub boreal spruce very wet cool |
| SBSwk: | sub boreal spruce wet cool |
| SBSmk: | sub boreal spruce moist cool |

Figure 15: 10 largest forested BGC subzones in the Omineca Region (locations shown have major sawmills)

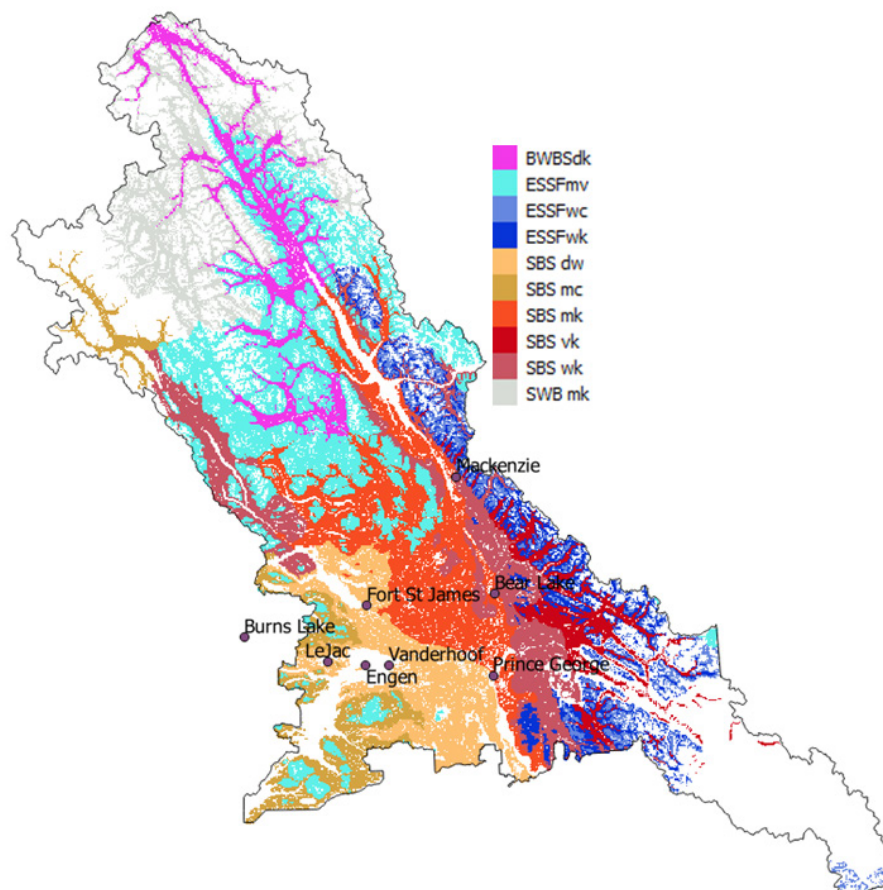


Figure 16: Amount of forest by seral stage and BGC subzone¹³ in the Omineca Region.

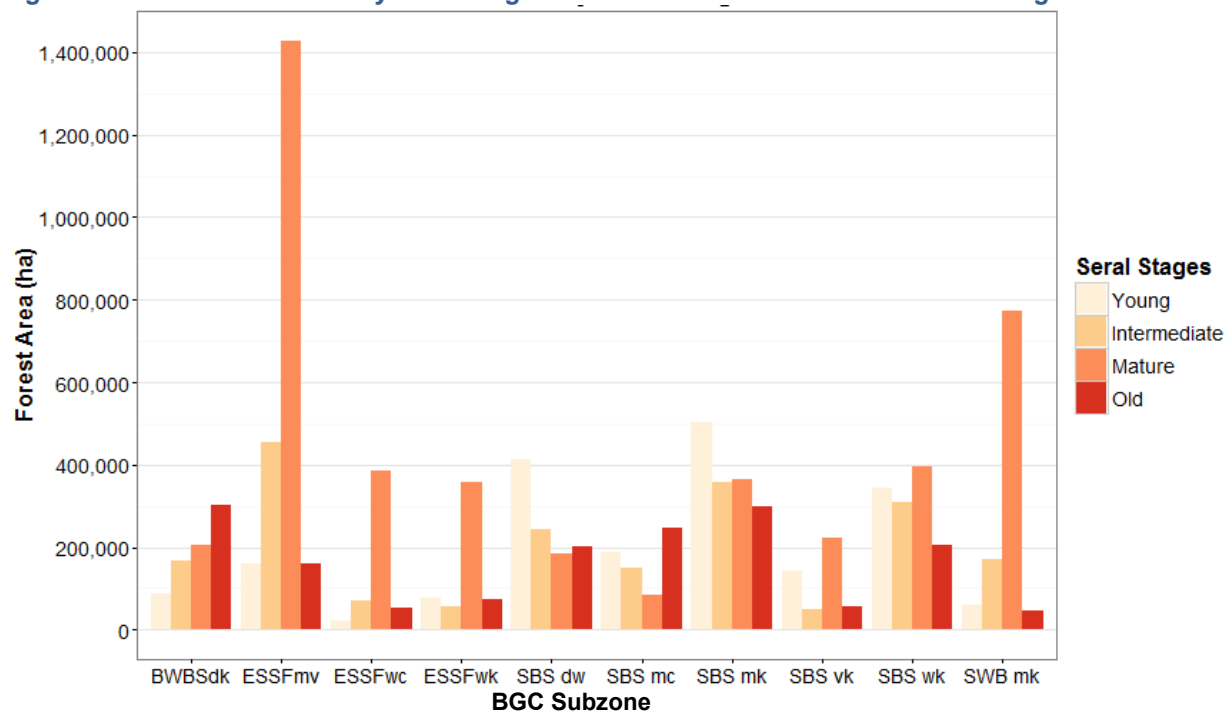
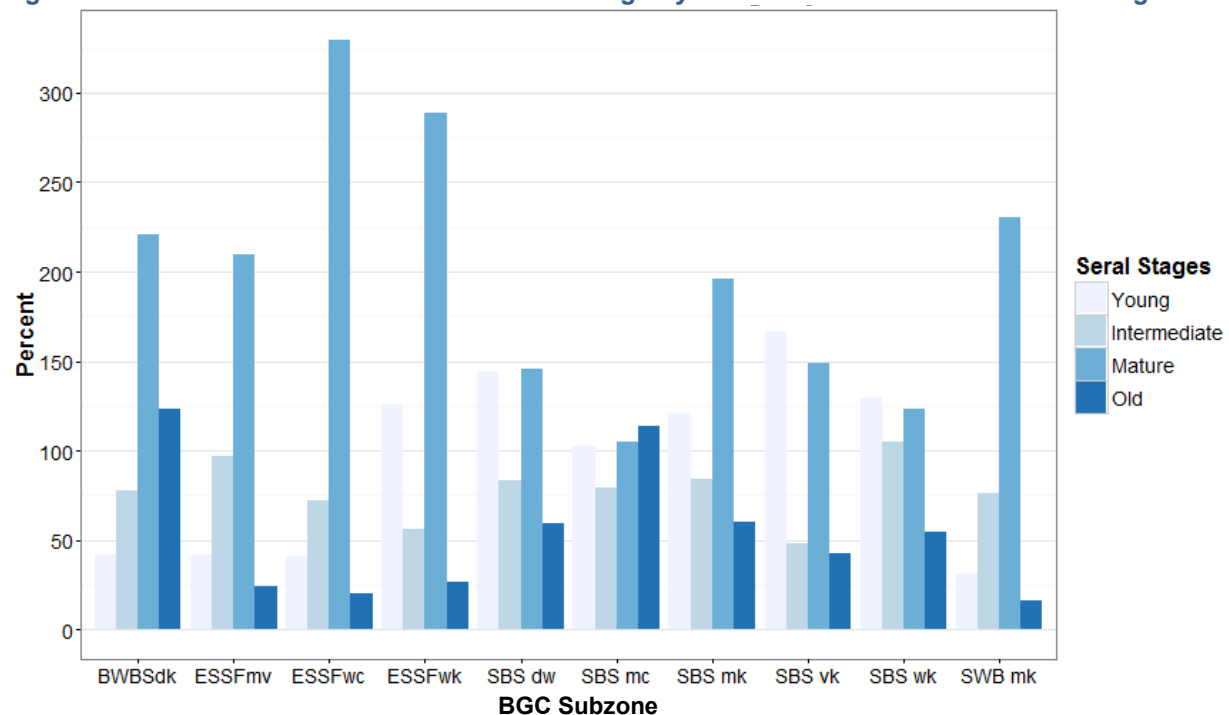


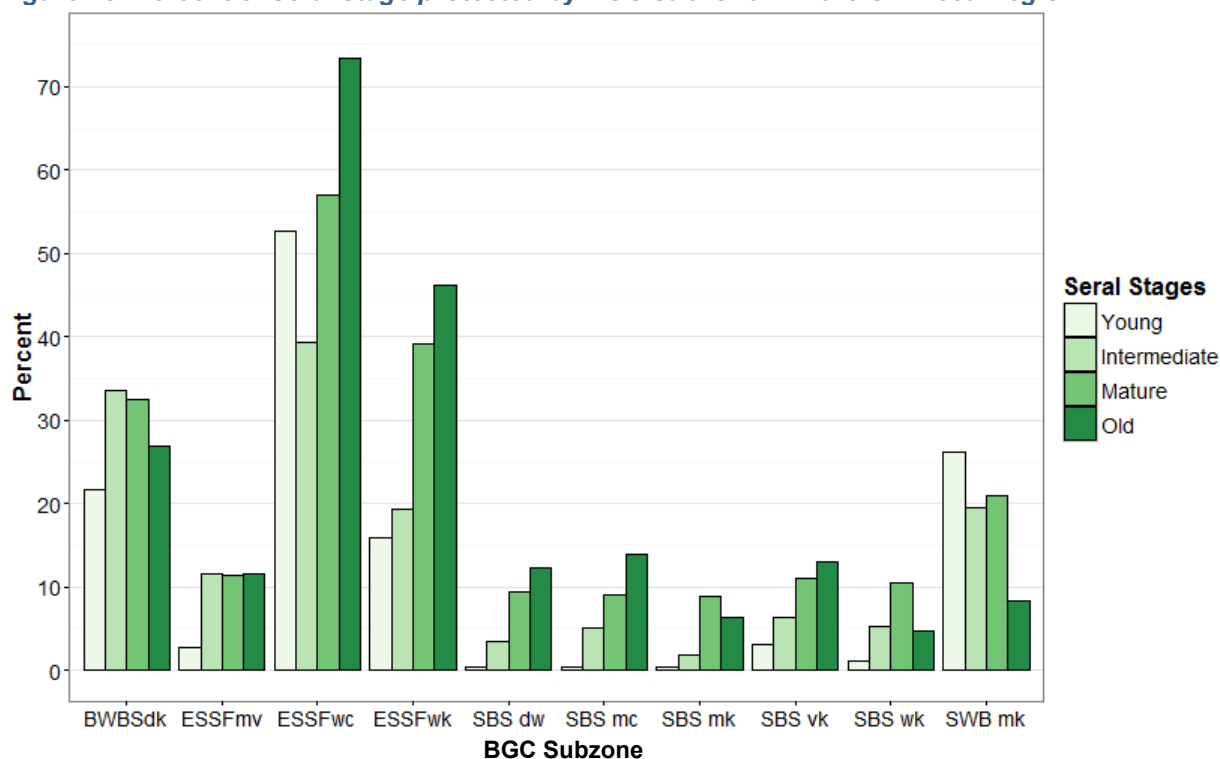
Figure 17: Percent of theoretical natural seral stage by BGC subzone¹⁴ in the Omineca Region.



¹³ Referred to as the “observed plot” in the subsequent discussion.

¹⁴ Referred to as the “percent of natural plot” in the subsequent discussion.

Figure 18: Percent of seral stage protected by BGC subzone¹⁵ in the Omineca Region.



From the “observed plot”, it can be seen that with the exception of the SBSdw, SBSwk and SBSmk, the dominant seral stage in the Omineca Region is mature or old. Young forest dominates the SBSmk and SBSdw and approximates the amount of mature in the SBSwk, reflecting the salvage of MPB-impacted stands primarily in the Prince George TSA and southwest of the Mackenzie TSA.

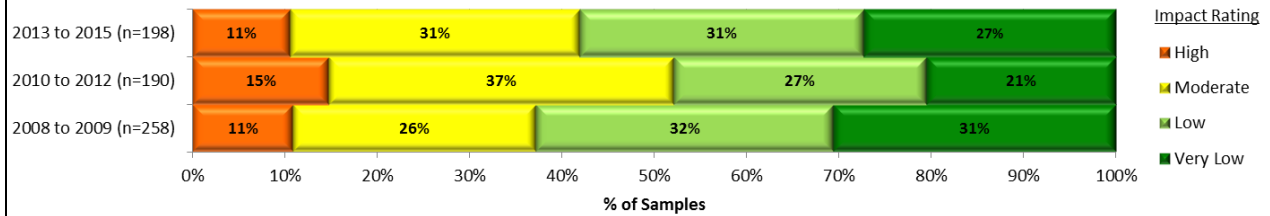
Similar to the Northeast Region, relative protection of old forest is greatest in higher elevation subzones, such as the ESSFwc and ESSFwk, where the absolute number of old forest hectares are low.

Once again the “percent of natural plot” shows the amount of mature forest to be more than expected under a natural disturbance regime despite the salvage of pine in the SBS subzones. That said, in the SBSdw and the SBSvk, the amount of young forest is 144% and 166%, respectively, of what is naturally expected. In the case of the SBSdw, this is consistent with the salvage of MPB-impacted stands and their proximity to the major milling centres of Prince George, Vanderhoof, Lejac and Fort St. James. In the case of the SBSvk subzone, it naturally experiences stand replacing events at approximately two thirds the rate of the SBSdw, SBSmc, and SBSmk.

Given the lack of development in the ESSF and SWB subzones, the surplus of mature forest and lack of old forest indicates a classification problem in the 1995 Biodiversity Guidebook. It would appear ESSF and SWB forests do not get as old as portrayed in the guidebook.

¹⁵ Referred to as the “percent protected plot” in the subsequent discussion.

Omineca Water Quality (fine sediment generation): Resource Development Impacts



Data Source: Water quality data (potential for fine sediment generation) was collected by ministry staff using the FREP water quality monitoring protocol. Sampling sites consist of roads and/or areas of mass wasting connected to fish habitat and/or drinking water sources that originate at randomly selected, recently harvested cutblocks. Sampling occurred from 2008 to 2015. Stewardship trends are based on survey years to capture the effects of road traffic and maintenance and are broken into three roughly equal time periods.

Summary: Of 646 road segments, 57% were rated as “very low” or “low” road-related impact.

Causal Factors for 2013 to 2015 Field Seasons: See “opportunities for improvement” on road segments with “high” or “medium” impact ratings. Some opportunities apply to ongoing maintenance issues, whereas others mainly apply to new road construction.

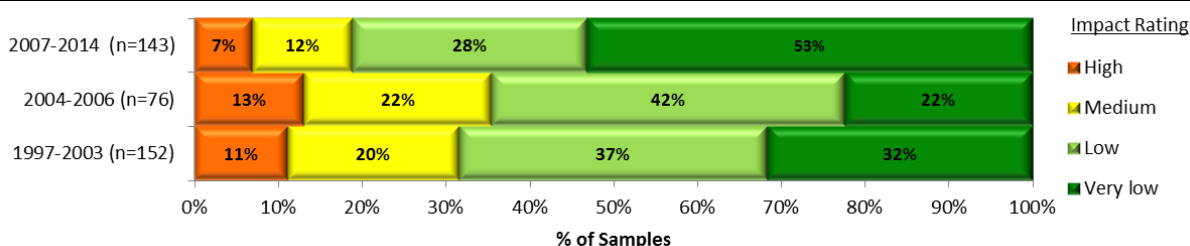
Overall Stewardship Trend: A statistical difference ($p = 0.00$) was evident between the three sampling eras, with best outcomes in the earliest sample years and poorest in the middle sample years.

Opportunities for Improvement and/or Continuation of Practices that Help Minimize Sediment:

The most frequent suggested solutions to improve road segments for samples from the 2013 to 2015 field season with “high” or “medium” impact ratings are:

- Use good-quality materials for road building;
- Remove or break berms that channel water towards streams.
- Increase the number of strategically located culverts.
- Crown roads to quickly move water off.
- Armour, seed and protect bare soil.
- Avoid long gradients approaching streams.

Omineca Riparian: Resource Development and Natural Impacts on Stream Function



Data Source: Stream riparian data was collected by ministry staff using the FREP riparian monitoring protocol. Sampling sites consist of randomly selected cutblocks with streams in or adjacent to cutblock boundaries. Sampling occurred from 2006 to 2015 on cutblocks harvested from 1997 to 2014. Where there is more than one stream per cutblock, the largest stream of sufficient length is sampled. Stewardship trends are determined by harvest era.

Summary: Of 371 streams, 73% were rated as “very low” or “low” harvest-related impact.

Samples by Stream Class and Impact Rating 2007-2014 Harvest

| Class | High | Medium | Low | Very low | Total |
|--------------|-----------|-----------|-----------|-----------|------------|
| S2 | | 2 | 6 | 4 | 12 |
| S3 | 2 | 2 | 15 | 45 | 64 |
| S4 | 2 | 5 | 6 | 19 | 32 |
| S5 | | 1 | | | 1 |
| S6 | 6 | 7 | 13 | 8 | 34 |
| Total | 10 | 17 | 40 | 76 | 143 |

Causal Factors for 2007-2014 Harvest:

| % of total | Most common specific impact in order of frequency |
|---|---|
| Natural events 44% <i>High natural sediment</i> <i>Beetle kill</i> | <ul style="list-style-type: none"> In-stream sediments increased Moss levels decreased |
| Logging 30% <i>Windthrow</i> <i>Low retention</i> | <ul style="list-style-type: none"> Stream or riparian blockages increased In-stream sediments increased |
| Roads 14% <i>Erosion causing sediment and channel infilling</i> | <ul style="list-style-type: none"> In-stream sediments increased |
| Upstream factors 12% <i>Natural events</i> <i>Logging</i> | <ul style="list-style-type: none"> In-stream sediments increased |

Where there were impacts on streams, 44% were caused by near-stream human actions (logging, roads). Naturally high background sediment and beetle kill related to natural events was an equivalent source of impact (44%).

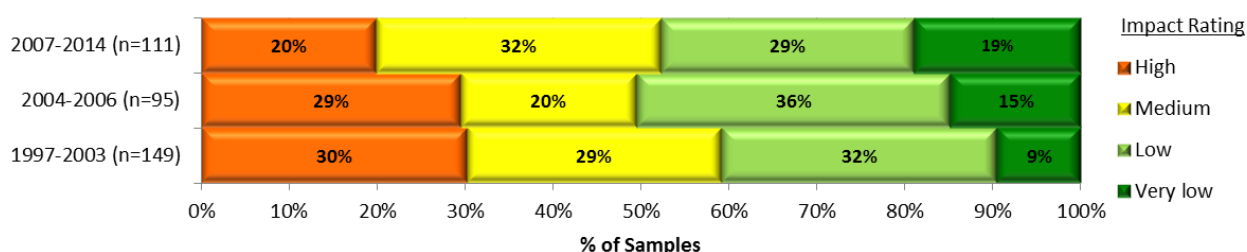
Overall Stewardship Trend: A statistical difference ($p = 0.00$) was evident between the three harvest eras, with improving outcomes in the latest harvest era.

Of the eight S6 and S4 streams that are in the “high” impact category for harvesting from 2007-2014, seven are located internal to harvest boundaries and one is external. Five of these eight streams have less than two metres of retention (four are zero retention) and all have low moss levels and high sediment, with logging noted as the predominant cause.

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

- Minimize the introduction of fine and coarse sediment from logging.
- 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 those wider perennial streams that make significant contributions of water, sediment, debris, and nutrients to downstream fish habitats and watershed function.

Omineca Stand-level Biodiversity: Resource Development Impacts



Data Source: Stand-level biodiversity data was collected by ministry field staff using the FREP stand-level biodiversity monitoring protocol. Sampling sites consist of randomly selected, recently harvested cutblocks. The impact rating considers total treed retention, retention quality, and coarse woody debris quantity and quality. The data presented was collected from 2006 through 2015 from cutblocks harvested from 1997 to 2014. Stewardship trends are based on differences in outcomes between harvest years.

Summary: Of 355¹⁶ cutblocks, 46% of sites were rated as “very low” or “low” harvest-related impact. 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 potentially more likely to be in the “high” impact category.

| 2007-2014 harvest | High | Medium | Low | Very low |
|--------------------|------|--------|-----|----------|
| % of blocks | 20% | 32% | 29% | 19% |
| Average gross (ha) | 13 | 91 | 74 | 94 |
| % of area sampled | 4% | 42% | 30% | 25% |

Causal Factors for 2007-2014 Harvest: This latest harvest era had 85% of cutblocks with 3.5% or more retention. The SBS¹⁷ zone represents 78% of the samples in the post-2007 harvest era. The SBS samples overall have similar to baseline amounts for the density of large diameter trees (> 40 cm dbh), but the density of large trees in the ICH (generally >50 cm dbh) is low. In the SBS, the range of coarse woody debris volume over many cutblocks is slightly lower than expected from baseline (compared to retention patches). Coarse woody debris quality (i.e., volume from ≥ 20 cm dbh pieces and density of big pieces per hectare of ≥ 20 cm diameter and ≥ 10 m long) is low compared to the baseline.

Overall Stewardship Trend: A statistical difference ($p = 0.09$) was evident between harvest eras with a slightly improving trend in the most recent harvest years. Retention increased from an average of 12% for cutblocks harvested before 2004, to 15.4% for blocks harvested during 2004–2006, and 15.9% for blocks harvested after 2006. Retention quality increased from the 1997–2003 harvest through 2007–2014 harvest eras. Gross cutblock size has increased from 40 ha during 1997–2003 harvest to 53 ha in the middle harvest era, and an average of 70 ha in the 2007–2014 harvest.

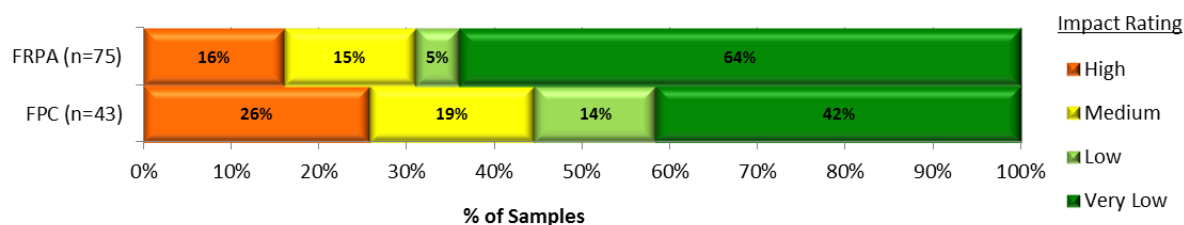
Opportunities for Improvement and/or Continuation of Practices that Effectively Manage Stand-level Biodiversity:

- Continue leaving large diameter trees in densities similar to pre-harvest conditions for the SBS zones.
- Increase densities of retained large diameter trees in the ICH.
- Leave at least low levels of retention on every cutblock.
- Have a range of retention (e.g., 3–30%) over many cutblocks.
- Improve coarse woody debris quality by leaving more large diameter pieces in the harvest area.

¹⁶ An additional 27 cutblocks were assessed for individual indicators, but could not be ranked because of a lack of baseline data.

¹⁷ Biogeoclimatic zones mentioned in this section are: Engelmann spruce-subalpine fir (ESSF), sub-boreal spruce (SBS), and Interior cedar-hemlock (ICH).

Omineca Visual Quality: Resource Development Impacts on Achievement of Visual Quality Objectives



Data Source: Visual quality assessment data was collected by ministry field staff and consultants using the FREP visual quality monitoring protocol. Sampling sites consist of landforms with VQO objectives located in randomly selected, recently harvested cutblocks. Stewardship trends are based on comparisons of samples collected under *FPC* forest development plans versus *FRPA* forest stewardship plans. Both *FRPA* and *FPC* data came from the Prince George and Robson Valley TSAs; however, there were no Vanderhoof District samples for the *FPC* data.

Summary: Of 75 landforms assessed under *FRPA*, 69% were rated as “very low” or “low” harvest-related impact, while 31% were rated “medium” or “high” impact. This data suggests that the visual quality value is at risk in this region as a significant number of VQOs were not achieved.

Number of FRPA Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very low | Total |
|------------------|-----------|-----------|----------|-----------|-----------|
| MM | | | | 2 | 2 |
| M | 2 | 5 | 1 | 19 | 27 |
| PR | 8 | 5 | 3 | 23 | 39 |
| R | 2 | 1 | | 4 | 7 |
| Total | 12 | 11 | 4 | 48 | 75 |

Number of FPC Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very low | Total |
|------------------|-----------|----------|----------|-----------|-----------|
| MM | | | 1 | | 1 |
| M | 2 | 1 | | 6 | 9 |
| PR | 5 | 5 | 5 | 8 | 23 |
| R | 4 | 2 | | 4 | 10 |
| Total | 11 | 8 | 6 | 18 | 43 |

^a MM = Maximum Modification, M = Modification, PR = Partial Retention, R = Retention

Causal Factors for FRPA Landforms: The two R landforms where the VQO was not achieved (“high” impact) both had high % alteration for the VQO, with one at 9% alteration and the other 3%. The landform with 3% alteration also had good design and moderate tree retention, bringing down the adjusted alteration, but not sufficient for the R VQO. Of the 8 PR “high” impact landforms there was average 16% landform alteration, with all samples consistent with M or MM VQO. All had no design or poor design.

Forty-eight landforms had VQOs that were fully achieved (“very low” impact). For the 27 of these that were PR or R:

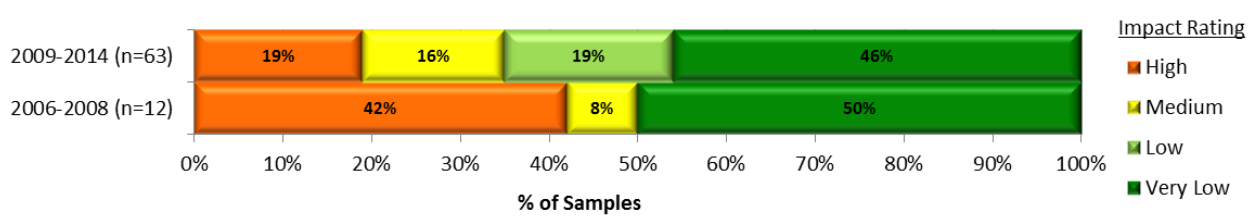
- 16 had good design, eight neutral, and three no design or poor design.
- 11 had good tree retention, six moderate, and nine poor tree retention within openings.
- All but one had landform alteration consistent with their VQO. The one PR landform with high alteration (8.4%) also had good tree retention and good design, decreasing the adjusted alteration consistent with the PR VQO.

Overall Stewardship Trend: A statistical difference ($p = 0.10$) was evident between the two eras, indicating an improving trend for the *FRPA* assessments.

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

- Reduce the opening size in retention and partial retention VQO areas to ensure the percent alteration range for the landform falls within Visual Impact Assessment Guidebook Standards.
- Use visual design techniques to create more natural-looking openings.
- Use partial cutting to retain higher levels of volume per stems.

Omineca Cultural Heritage: Resource Development Impacts



Data Source: Cultural heritage assessment data was collected by ministry field staff, often with the assistance of local First Nations. Sampling sites consist of a minimum of 50% randomly selected sites and up to 50% targeted sites (First Nations and/or licensee requests) based on recently harvested cutblocks with known cultural heritage resource values.

Summary: The impact rating accounts for both overall block management of cultural heritage resources and protection of individual cultural features. Of 75 cutblocks, 47% were rated as “very low” impact, 16% as “low,” 15% as “medium,” and 23% as “high.”

At the cultural feature level, 57% of cutblock features showed no evidence of harvest-related damage, whereas 43% showed evidence of damage - 1% of the damaged features were rendered unsuitable for continued use.

Causal Factors:

Best outcomes were associated with stubbing of culturally modified trees, avoidance of cultural features (with sufficient buffers), and ensuring features are dated. Where there were impacts on sites and features, the primary causes were covering or damaging trails, harvesting of culturally modified trees, road building crossing trails, and windthrow directly damaging features or cultural modified tree blown over.

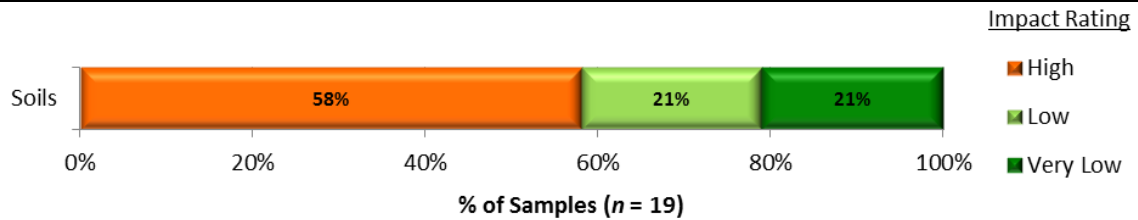
Overall Stewardship Trend: Due to the monitoring protocol used for monitoring cultural heritage values, there are insufficient random samples to show trend data at this time.

Opportunities for Improvement:

Opportunities for improvement are associated with the following practices that resulted in the best cultural heritage resource outcomes:

- Reviewing cultural heritage resource documentation during planning and operations.
- Avoiding cultural features through the use of windfirm reserves such as wildlife tree patches, machine-free zones, and block boundary changes.
- Stubbing dead culturally modified trees above cultural marks to avoid future windfall or breakage.
- Avoiding skidding across cultural trails (or in some cases, use of designated crossings).

Omineca Soils: Resource Development Impacts on Soil Productivity and Hydrologic Function



Data Source: Soils data for assessments of soil productivity and hydrologic function was collected by provincial and regional soils experts using air photo interpretation. Sampling sites consist of randomly selected, recently harvested cutblocks. Assessments are based on high-resolution air photo analysis.

Summary: Of 19 cutblocks, 42% were rated as “very low” or “low” harvest-related impact, indicating that soil management objectives were achieved. Fifty-eight percent (58%) were rated as “high” harvest-related impact.

Causal Factors:

Excessive soil disturbance, both in roadside work areas and outside work areas, is a major factor that contributes to “highly” affected soil productivity. Several sites also showed a lack of mature forest, which is required to allow re-colonization of the cutblock with slowly dispersing soil organisms.

Overall Stewardship Trend: Not enough historical monitoring has taken place to establish a trend.

Opportunities for Improvement:

- Plan operations in and outside roadside work areas to minimize soil disturbance.
- Ensure that measures to conserve well-distributed remnants of mature forest are implemented.

SKEENA NATURAL RESOURCE REGION

The following section presents the status of LLBD and the outcomes of site-level FREP monitoring in the Skeena Natural Resource Region.

Skeena Landscape-level Biodiversity

For brevity, LLBD is only reported for the 10 largest BGC subzones covering 77% of the forested ecosystems (by area) in the Skeena Region.

The biogeoclimatic subzone coding is as follows:

| | |
|---------|--|
| BWBSdk: | boreal white and black spruce dry cool |
| BWBSmk: | boreal white and black spruce moist cool |
| CWHvh: | coastal western hemlock very wet hypermaritime |
| CWHws: | coastal western hemlock submontane wet submaritime |
| ESSFmc: | Engelmann spruce subalpine fir moist cold |
| ICHmc: | interior cedar hemlock moist cold |
| MHmm: | mountain hemlock moist maritime |
| SBSmc: | sub boreal spruce moist cold |
| SWBmk: | spruce willow birch moist cool |
| SWBun: | spruce willow birch undifferentiated |

Figure 19: 10 largest forested BGC subzones in Skeena Region (locations shown have major sawmills).

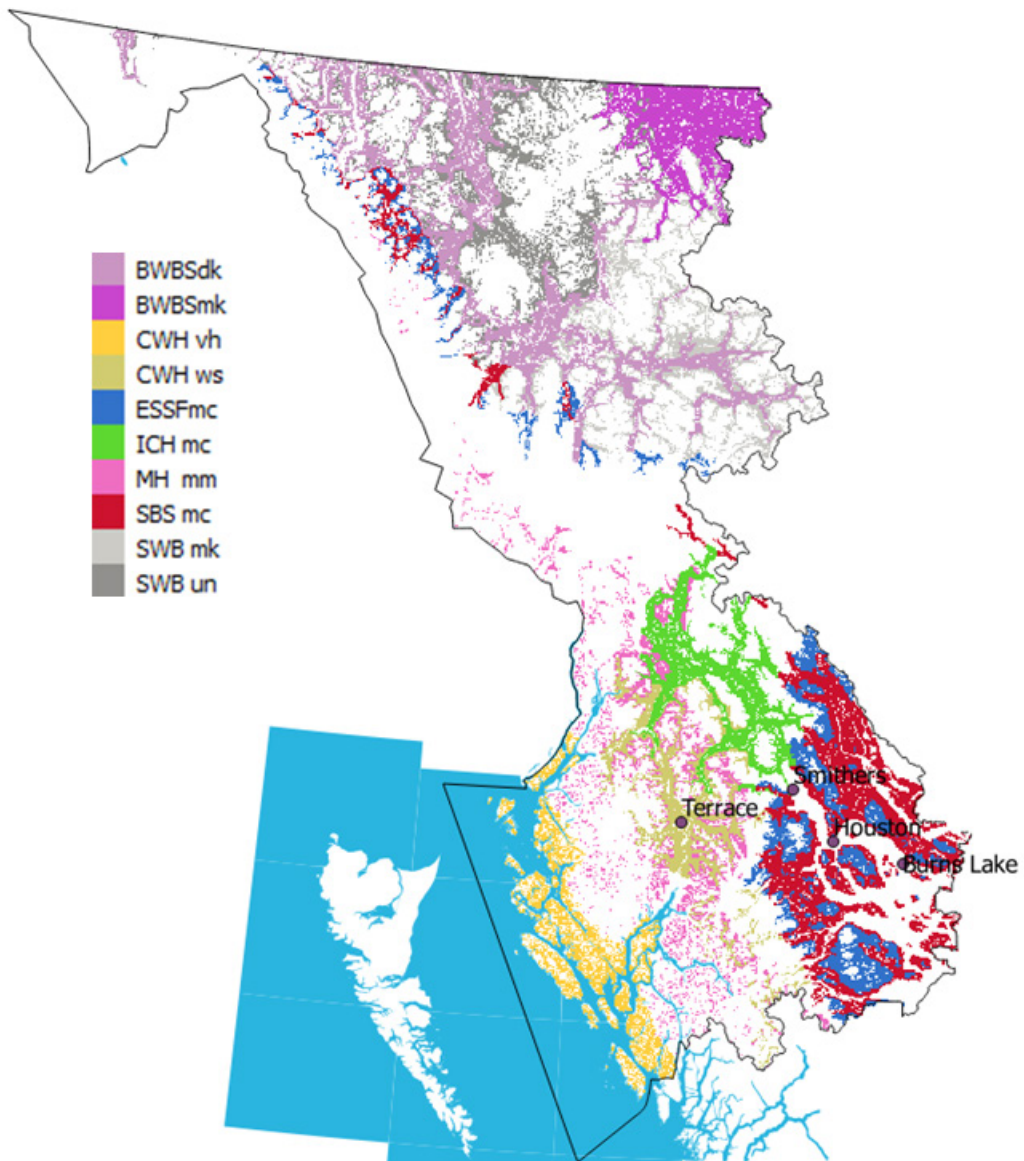


Figure 20: Amount of forest by seral stage and BGC subzone¹⁸ for the Skeena Region.

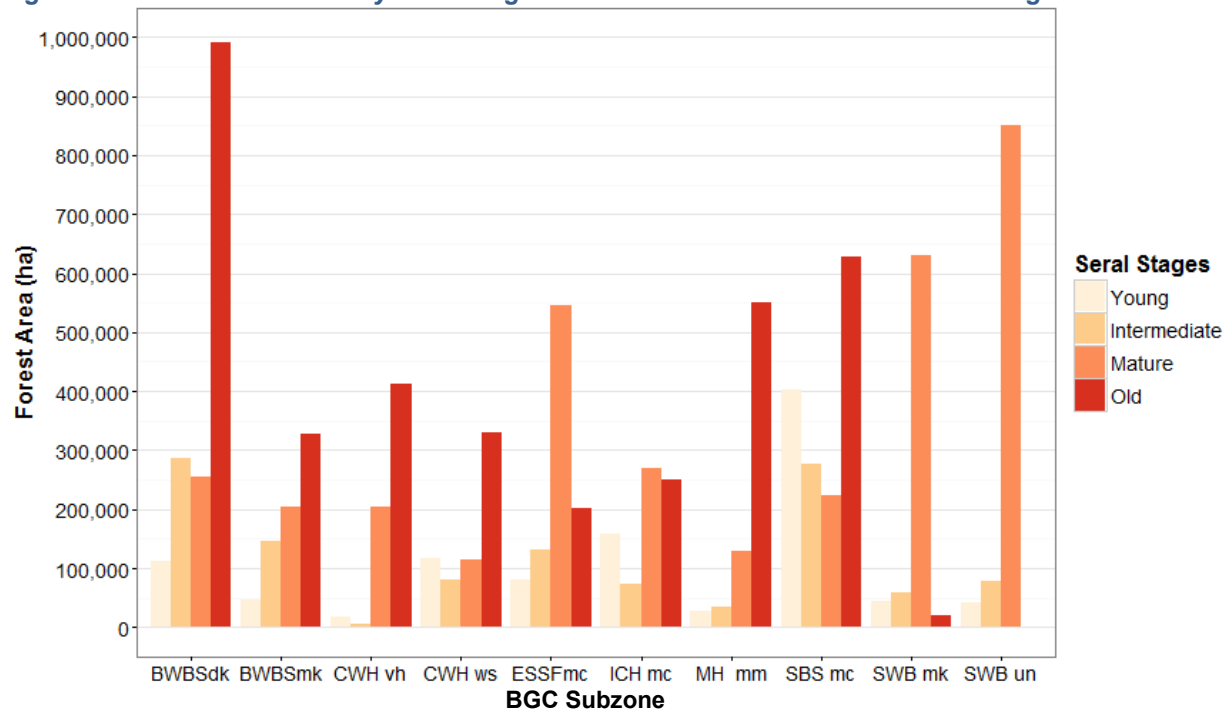
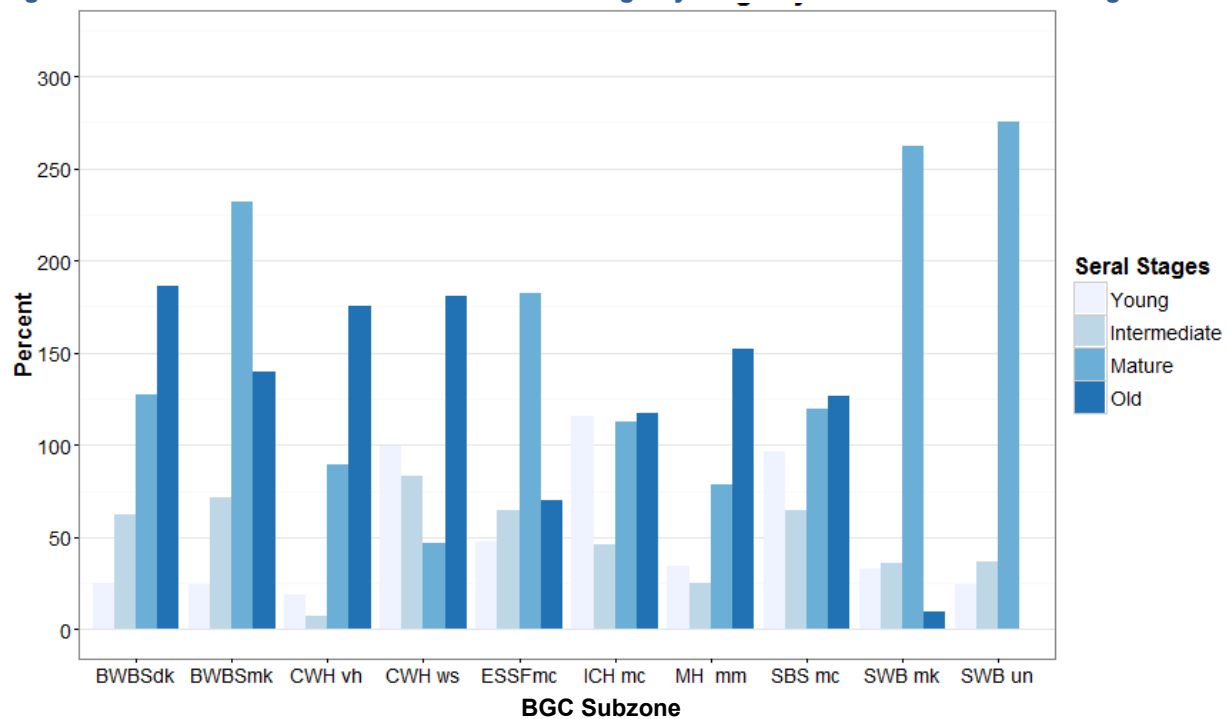


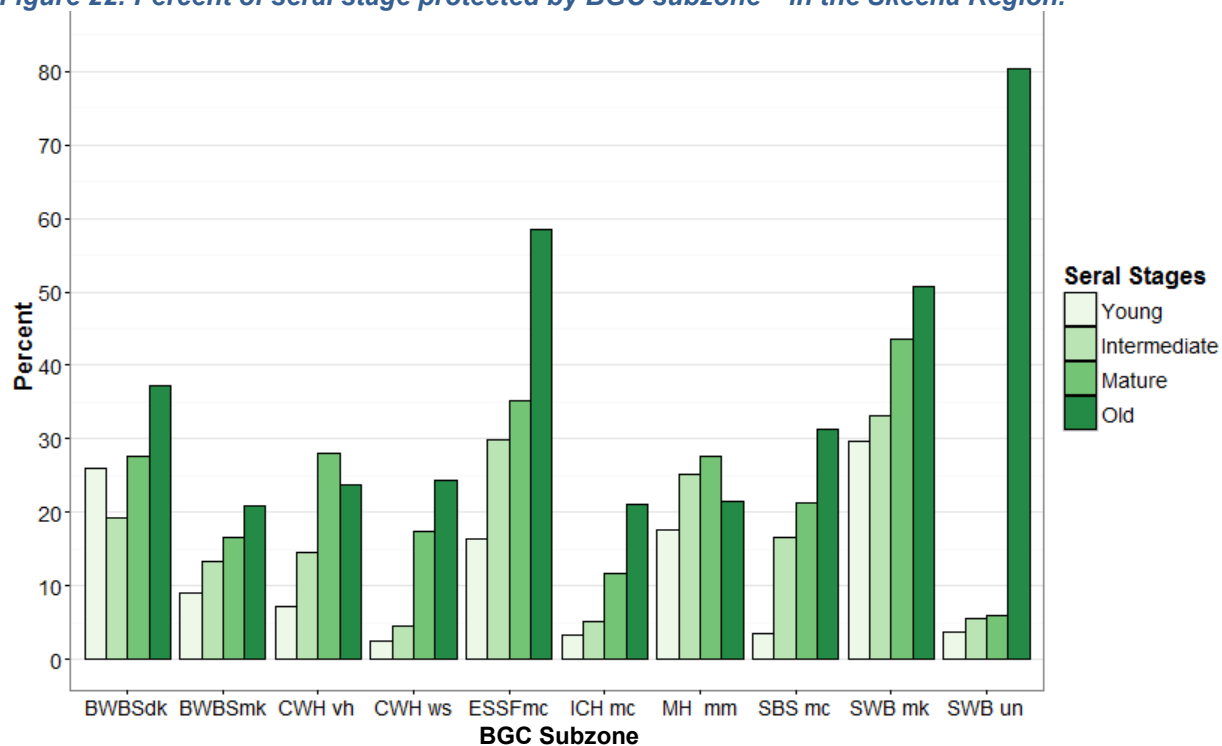
Figure 21: Percent of theoretical natural seral stage by BGC subzone¹⁹ in the Skeena Region.



¹⁸ Referred to as the “observed plot” in the subsequent discussion.

¹⁹ Referred to as the “percent of natural plot” in the subsequent discussion.

Figure 22: Percent of seral stage protected by BGC subzone²⁰ in the Skeena Region.

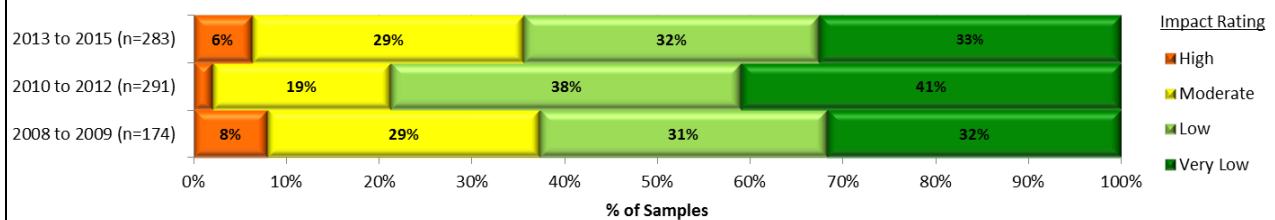


From the “observed plot”, it can be seen that mature or old forest dominates the landscape. The only subzone where young forest is at least half of the mature or old forest is the SBSmc. This reflects the SBSmc’s low elevation, proximity to major milling centers, and salvage of MPB-impacted stands. Within the SBSmc, the dominant seral stage is old forest covering approximately 630 000 ha, with approximately 200 000 hectares of old forest being protected from harvest. That said, this old forest may be impacted by MPB.

Given the lack of development in the SWB subzones, the surplus of mature forest, and the lack of old forest indicates a classification problem in the 1995 Biodiversity Guidebook. It would appear SWB forests do not get as old as portrayed in the guidebook.

²⁰ Referred to as the “percent protected plot” in the subsequent discussion.

Skeena Water Quality (fine sediment generation): Resource Development Impacts



Data Source: Water quality data (potential for fine sediment generation) was collected by ministry staff using the FREP water quality monitoring protocol. Sampling sites consist of roads and/or areas of mass wasting connected to fish habitat and/or drinking water sources that originate at randomly selected, recently harvested cutblocks. Sampling occurred from 2008 to 2015. Stewardship trends are based on survey years to capture the effects of road traffic and maintenance and are broken into three roughly equal time periods.

Summary: Of 748 road segments, 70% were rated as “very low” or “low” road-related impact.

Causal Factors for 2013 to 2015 Field Seasons:

See opportunities for improvement on road segments with “high” or “medium” impact ratings. Some opportunities will apply to ongoing maintenance issues, whereas others mainly apply to new road construction.

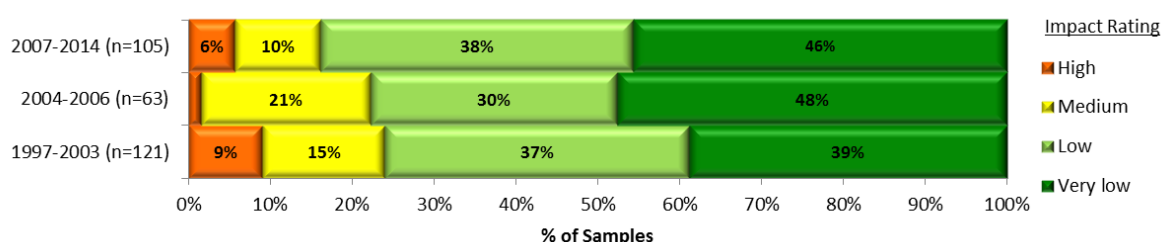
Overall Stewardship Trend: A statistical difference ($p = 0.00$) was evident between the three sampling eras, indicating a fluctuation in potential for sediment generation from roads and with less potential sediment during the 2010-2012 sample era.

Opportunities for Improvement and/or Continuation of Practices that Help Minimize Sediment:

The most frequent suggested solutions to improve road segments for samples from the 2013 to 2015 field season with “high” or “medium” impact ratings are:

- Use cross-ditches and kickouts.
- Armour, seed and protect bare soil.
- Increase the number of strategically located culverts.
- Use good quality materials and crown roads;
- Remove or break berms that channel water toward streams.
- Avoid long gradients approaching streams.

Skeena Riparian: Resource Development Impacts on Stream Function



Data Source: Stream riparian data was collected by ministry staff using the FREP riparian monitoring protocol. Sampling sites consist of randomly selected cutblocks with streams in or adjacent to cutblock boundaries. Sampling occurred from 2006 to 2015 on cutblocks harvested from 1997 to 2014. The largest stream of sufficient length is sampled. Stewardship trends are determined by harvest era.

Summary: Of 289 streams, 79% were rated as “very low” or “low” harvest-related impact.

Samples by Stream Class and Impact Rating 2007-2014 Harvest

| Class | High | Medium | Low | Very low | Total |
|--------------|----------|-----------|-----------|-----------|------------|
| S1 | | | | 1 | 1 |
| S2 | | | 2 | 3 | 5 |
| S3 | | | 10 | 12 | 22 |
| S4 | | 4 | 11 | 4 | 19 |
| S5 | | 1 | 2 | 5 | 8 |
| S6 | 6 | 6 | 15 | 23 | 50 |
| Total | 6 | 11 | 40 | 48 | 105 |

Causal Factors for 2007-2014 Harvest:

| % of total | Most common specific impact in order of frequency |
|---|---|
| Natural events 44% High natural sediment Wind | <ul style="list-style-type: none"> In-stream sediments increased Moss levels decreased Stream or riparian blockages increased |
| Logging 39% Windthrow Low retention Felling and yarding | <ul style="list-style-type: none"> Stream or riparian blockages increased Bare erodible ground increased In-stream sediments increased |
| Roads 9% Erosion causing sedimentation | <ul style="list-style-type: none"> In-stream sediments increased |
| Upstream factors 7% Natural impacts Logging | <ul style="list-style-type: none"> In-stream sediments increased |

Near-stream human actions (logging, roads) in the latest harvest era caused 49% of the impacts to streams. Naturally high background sediment levels were a main natural event affecting 44% of these streams.

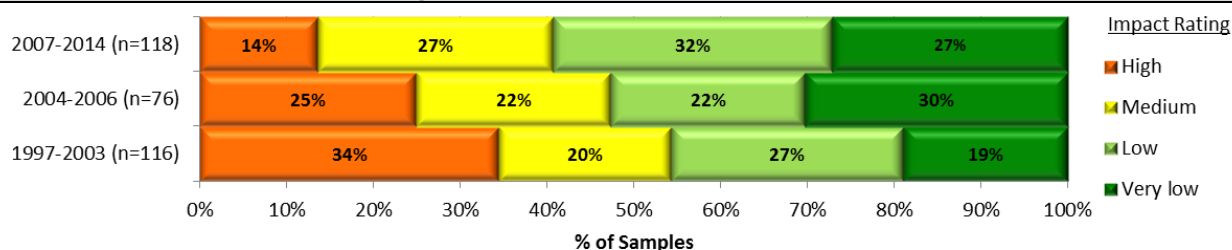
Of the six S6 streams in the “high” impact category in the latest harvest era, five of them were internal to the harvest boundary. Three of these internal high impact S6 streams had zero retention. Of the two internal “high” impact S6 streams with retention, one was impacted by a major 2010 wind event and the other was impacted by slides and wind.

Overall Stewardship Trend: No statistical difference ($p = 0.21$) was evident between the three harvest eras.

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

- 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 those wider perennial streams that make significant contributions of water, sediment, debris, and nutrients to downstream fish habitats and watershed function.

Skeena Stand-level Biodiversity: Resource Development Impacts



Data Source: Stand-level biodiversity data was collected by ministry field staff using the FREP stand-level biodiversity monitoring protocol. Sampling sites consist of randomly selected, recently harvested cutblocks. The impact rating considers total treed retention, retention quality, and coarse woody debris quantity and quality. The data presented was collected from 2006 through 2015 from cutblocks harvested from 1997 to 2014. Stewardship trends are based on differences in outcomes between harvest years.

Summary: Of 310²¹ cutblocks, 46% of sites were rated as “very low” or “low” harvest-related impact. The table below shows the percentage of cutblocks by impact category. It also gives the average size of cutblock by category, with smaller cutblocks potentially more likely to be in the “high” impact category.

| 2007-2014 harvest | High | Medium | Low | Very low |
|--------------------|------|--------|-----|----------|
| % of blocks | 20% | 32% | 29% | 19% |
| Average gross (ha) | 8 | 38 | 44 | 37 |
| % of area sampled | 3% | 29% | 40% | 29% |

Causal Factors for 2007-2014 Harvest:

The majority of cutblocks sampled in this latest harvest era were in the SBS and CWH zones, with a small component of ICH. Eighty-five percent of all cutblocks had 3.5% or more tree retention, although this was higher in the CWH than the SBS. The density of large snags retained is similar to baseline data (timber cruise in same ecosystems) in the CWH, but lower for the SBS²² and ICH zones. The density of large diameter trees is low for the CWH (≥ 70 cm dbh) and the SBS (≥ 40 cm dbh). The diversity of live tree species is similar to baseline for SBS, but lower than baseline for the CWH. The range of coarse woody debris volume in the harvest area of the cutblocks is similar or higher than found within retention patches of the same ecosystems.

CWD quality in terms of volume from larger diameter pieces is similar or higher to retention patches for CWH, but lower for SBS.

Overall Stewardship Trend: A statistical difference ($p = 0.01$) was evident between harvest eras, with improving outcomes. Retention averaged 16% for cutblocks harvested before 2004, 21.5% for blocks harvested between 2004 and 2006, and 17.9% for blocks harvested after 2006. Retention quality increased slightly in the later harvest years. CWD quantity or quality remained fairly constant between the harvest eras.

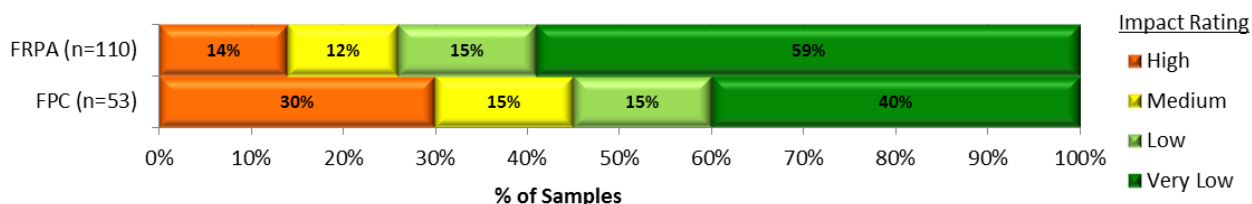
Opportunities for Improvement and/or Continuation of Practices that Effectively Manage Stand-level Biodiversity:

- Continue leaving a good diversity of tree species in the SBS.
- Continue leaving good densities of large snags in the CWH.
- Leave at least low levels of retention on every cutblock.
- Look for opportunities to leave large snags safely as ecological anchors within retention patches in SBS zone cutblocks.
- Leave higher densities of large diameter live or dead trees.

²¹ An additional 11 cutblocks were assessed for individual indicators, but could not be ranked because of a lack of baseline data, or the cutblocks had retention patches, but no sample data from the patch (likely related to safety issues).

²² Biogeoclimatic zones mentioned in this section: Interior cedar–hemlock (ICH), sub-boreal spruce (SBS) and coastal western hemlock (CWH).

Skeena Visual Quality: Resource Development Impacts on Achievement of Visual Quality Objectives



Data Source: Visual quality assessment data was collected by ministry field staff and consultants using the FREP visual quality monitoring protocol. Sampling sites consist of landforms with VQOs located in randomly selected, recently harvested cutblocks. Stewardship trends are based on comparisons of samples collected under *FPC* forest development plans versus *FRPA* forest stewardship plans. *FRPA* data came predominantly from the Kalum, Bulkley and Lakes TSAs, with minor sampling in the North Coast, Morice, Kispiox and Nass. *FPC* data came predominantly from the Kalum and Lakes TSAs, with minor sampling in North Coast, Morice and Kispiox.

Summary: Of 110 landforms assessed under *FRPA*, 74% were rated as “very low” or “low” harvest-related impact, while 24% were rated “medium” or “high” impact. This data suggests that the visual quality value is not at undue risk in this region.

Number of FRPA Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very Low | Total |
|------------------|-----------|-----------|-----------|-----------|------------|
| M | 3 | 4 | 6 | 28 | 42 |
| PR | 11 | 8 | 7 | 28 | 54 |
| R | 1 | 1 | 4 | 9 | 15 |
| Total | 15 | 13 | 17 | 65 | 110 |

Number of FPC Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very Low | Total |
|------------------|-----------|----------|----------|-----------|-----------|
| M | 1 | 3 | 4 | 6 | 14 |
| PR | 11 | 2 | 2 | 15 | 30 |
| R | 4 | 1 | 2 | | 7 |
| P | | 2 | | | 2 |
| Total | 16 | 8 | 8 | 21 | 53 |

^a M = Modification, PR = Partial Retention, R = Retention, P = Preservation

Causal Factors for FRPA Landforms: The single R landform where the VQO was not achieved (“high” impact) had a high % alteration for the VQO (2.6%). The landform had good design and poor tree retention, bringing down the adjusted alteration, but not sufficient for the R VQO. Of the 11 PR “high” impact landforms, there was an average of 12% landform alteration, with all but two samples consistent with M VQO. All had poor tree retention, eight had no design or poor design, two neutral design, and one good design.

Sixty-five landforms had VQOs that were fully achieved (“very low” impact). For the 37 of these that were PR or R:

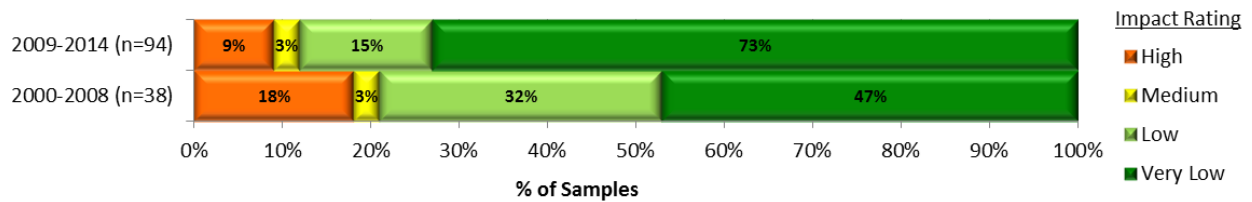
- 26 had good design, nine neutral, and two no design or poor design.
- 15 had good tree retention, five moderate, and 14 poor tree retention within openings (three unknown).
- All had % landform alteration consistent with their VQO.

Overall Stewardship Trend: No direct comparison is possible since the *FPC* and *FRPA* sampling took place on different timber supply areas.

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

- Reduce the opening size in retention and partial retention VQO areas to ensure the percent alteration range for the landform falls within Visual Impact Assessment Guidebook Standards.
- Use visual design techniques to create more natural-looking openings and better achieve visual quality objectives.
- Use partial cutting to retain higher levels of volume per stems.

Skeena Cultural Heritage: Resource Development Impacts



Data Source: Cultural heritage assessment data was collected by ministry field staff, often with the assistance of local First Nations. Sampling sites consist of a minimum of 50% randomly selected sites and up to 50% targeted sites (First Nations and/or licensee requests) based on recently harvested cutblocks with known cultural heritage resource values.

Skeena Region samples are predominantly from the Skeena–Stikine Natural Resource District (49%), with a lower amount of sampling from the Coast Mountain (27%) and Nadina (23%) districts.

Summary: The impact ratings account for both overall block management of cultural heritage resources and protection of individual cultural features. Of 135 cutblocks, 66% were rated as “very low” impact, 20% as “low,” 3% as “medium,” and 11% as “high.”

At the cultural feature level, 60% of cutblocks showed no evidence of harvest-related damage, whereas 40% showed evidence of damage -- 30% of the damaged features were rendered unsuitable for continued use.

Causal Factors:

Best outcomes were associated with stubbing of culturally modified trees, avoidance of cultural features, and reserves and buffers. On sites with impacts, the primary causes of damage were windthrow, harvesting activity causing damage to trails, and removal of cultural features.

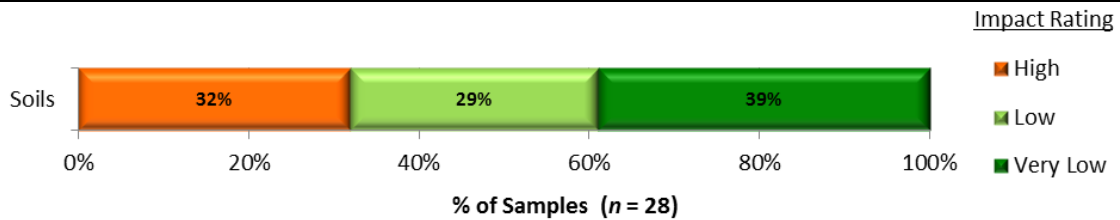
Overall Stewardship Trend: Due to the monitoring protocol used for monitoring cultural heritage values, there are insufficient random samples to show trend data at this time.

Opportunities for Improvement:

Opportunities for improvement are associated with the following practices that resulted in the best cultural heritage resource outcomes:

- Reviewing cultural heritage resource documentation during planning and operations.
- Identifying cultural features with flagging tape during the pre-harvest site inspection for easy recognition during operations.
- Avoiding cultural features through the use of windfirm reserves such as wildlife tree patches, machine-free zones, and block boundary modification.
- Combining reserves with visual quality objectives, retention, or other reserve needs.
- Stubbing dead culturally modified trees above cultural marks to avoid future windfall or breakage.
- Avoiding skidding across cultural trails (or in some cases, use of designated crossings).
- Considering harvesting during winter (e.g., frozen ground to protect cultural plants).

Skeena Soils: Resource Development Impacts on Soil Productivity and Hydrologic Function



Data Source: Soils data for assessments of soil productivity and hydrologic function was collected by provincial and regional soils experts using air photo interpretation. Sampling sites consist of randomly selected, recently harvested cutblocks. Assessments are based on high-resolution air photo analysis.

Summary: Of 28 cutblocks, 68% were rated as “very low” or “low” harvest-related impact, indicating that soil management objectives were achieved; 32% were rated as “high” harvest-related impact.

Causal Factors:

Excessive soils disturbance, both in roadside work areas and outside work areas, is a major factor that contributes to “highly” affected soil productivity. Several sites also show a lack of rehabilitated access roads.

Overall Stewardship Trend: Not enough historical monitoring has taken place to establish a trend.

Opportunities For Improvement:

- Plan operations in and outside roadside work areas to minimize soil disturbance.
- Implement road and structure rehabilitation for permanent deactivation.

SOUTH COAST NATURAL RESOURCE REGION

The following section presents the status of LLBD and the outcomes of site-level FREP monitoring in the South Coast Natural Resource Region.

South Coast Landscape-level Biodiversity

For brevity, LLBD is reported for the nine largest BGC subzones covering almost 100% of the forested ecosystems (by area) in the South Coast Region.

The biogeoclimatic subzone coding is as follows:

| | |
|---------|---|
| CDFmm: | coastal Douglas Fir moist maritime |
| CWHdm: | coastal western hemlock dry maritime |
| CWHds: | coastal western hemlock dry submarine |
| CWHms: | coastal western hemlock moist submarine |
| CWHvm: | coastal western hemlock very wet maritime |
| CWHxm: | coastal western hemlock very dry maritime |
| ESSFmw: | Engelmann spruce subalpine fir moist warm |
| IDFww: | interior Douglas-fir wet warm |
| MHmm: | mountain hemlock moist maritime |

Figure 23: Forested BGC subzones in the South Coast Region (locations shown have major sawmills).

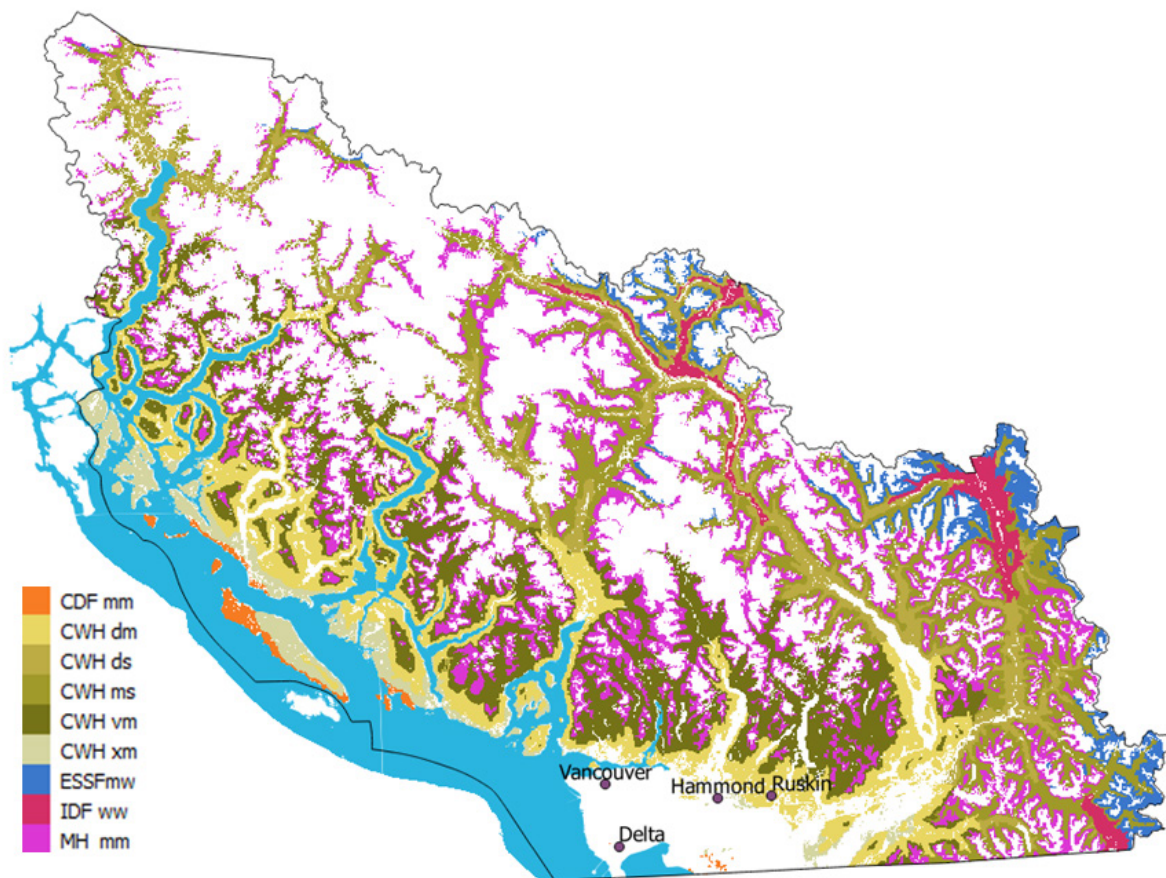


Figure 24: Amount of forest by seral stage and BGC subzone²³ in the South Coast Region.

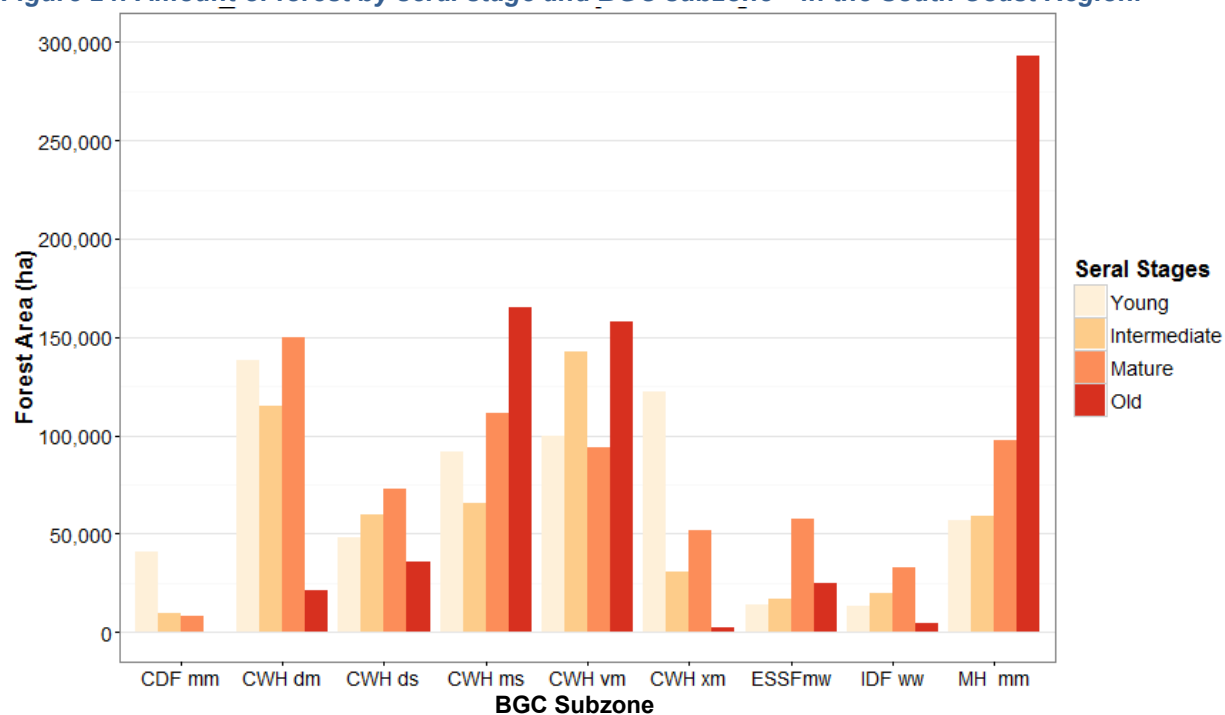
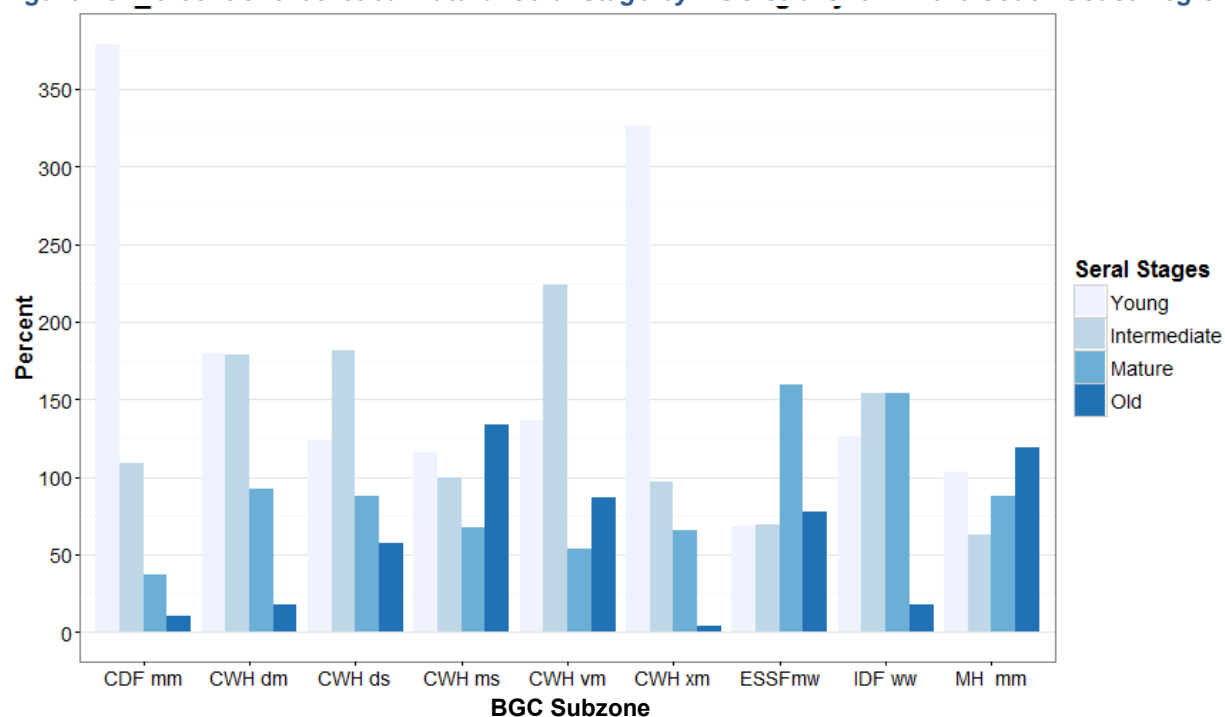


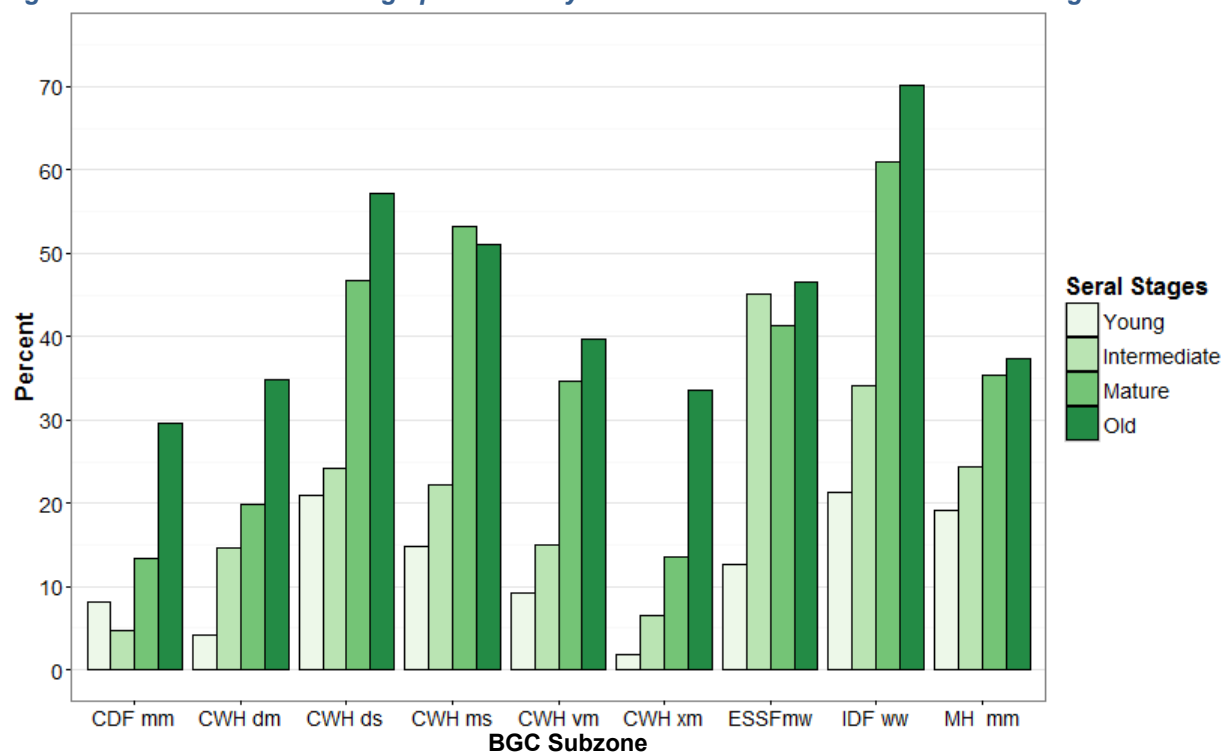
Figure 25: Percent of theoretical natural seral stage by BGC subzone²⁴ in the South Coast Region.



²³ Referred to as the “observed plot” in the subsequent discussion.

²⁴ Referred to as the “percent of natural plot” in the subsequent discussion.

Figure 26: Percent of seral stage protected by BGC subzone²⁵ in the South Coast Region.



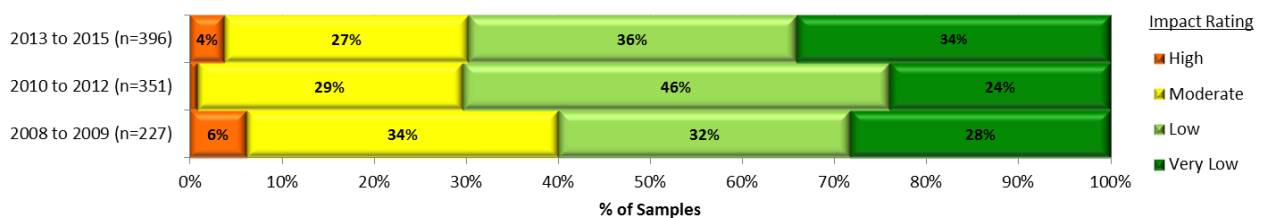
From the “observed plot”, it can be seen that the CDFmm, CWHxm and CWHdm have a high proportion of young forest. The amount of young forest ranges from 179% to 378% of what would be expected under a natural disturbance regime (see the “percent of natural plot”). All three subzones are either adjacent to the coastline or valley bottoms.

Those subzones where old forest still dominates are the CWHms and MHmm. The CWHms is a higher elevation subzone and the MHmm is even higher elevation. Overall, only three of the nine subzones have either more mature or old forest than naturally expected the CWHms, ESSFmw and MHmm.

From the “percent protected plot,” it can be seen that 30% or more of the old forest left in each subzone of the South Coast is protected from harvest, although in absolute terms, the areas involved range from 155 ha for the CDFmm to 109,000 ha for the MHmm.

²⁵ Referred to as the “percent protected plot” in the subsequent discussion.

South Coast Water Quality (fine sediment generation): Resource Development Impacts



Data Source: Water quality data (potential for fine sediment generation) was collected by ministry staff using the FREP water quality monitoring protocol. Sampling sites consist of roads and/or areas of mass wasting connected to fish habitat and/or drinking water sources that originate at randomly selected, recently harvested cutblocks. Sampling occurred from 2008 to 2015. Stewardship trends are based on survey years to capture the effects of road traffic and maintenance and are broken into three roughly equal time periods.

Summary: Of 974 road segments, 68% were rated as “very low” or “low” road-related impact.

Causal Factors for 2013 to 2015 Field Seasons:

See opportunities for improvement on road segments with “high” or “medium” impact ratings. Some opportunities will apply to ongoing maintenance issues, whereas others mainly apply to new road construction.

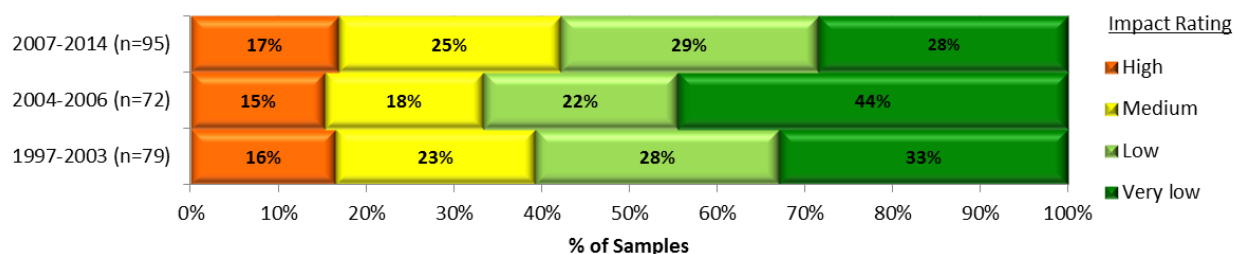
Overall Stewardship Trend: A statistical difference ($p = 0.00$) was evident between the three sampling eras, with slight improvement in outcomes in the latter two eras.

Opportunities for Improvement and/or Continuation of Practices that Help Minimize Sediment:

The most frequent suggested solutions to improve road segments for samples from the 2013 to 2015 field season with “high” or “medium” impact ratings are:

- Increase the number of strategically located culverts.
- Use cross-ditches and kickouts.
- Remove or break berms that channel water down the road towards streams.
- Use good quality materials and crown roads.
- Armour, seed and protect bare soil.

South Coast Riparian: Resource Development and Natural Impacts on Stream Function



Data Source: Stream riparian data was collected by ministry staff using the FREP riparian monitoring protocol. Sampling sites consist of randomly selected cutblocks with streams in or adjacent to cutblock boundaries. Sampling occurred from 2006 to 2015 on cutblocks harvested from 1997 to 2014. The largest stream of sufficient length is sampled. Stewardship trends are determined by harvest era.

Summary: Of 246 streams (all harvest years), 61% were rated as “very low” or “low” harvest-related impact.

Samples by Stream Class and Impact Rating 2007-2014

Harvest

| Class | High | Medium | Low | Very low | Total |
|--------------|-----------|-----------|-----------|-----------|-----------|
| S2 | | 2 | | 2 | 4 |
| S3 | | 1 | 7 | 8 | 16 |
| S4 | 1 | | 5 | | 6 |
| S5 | | 3 | 1 | 6 | 10 |
| S6 | 15 | 18 | 15 | 11 | 59 |
| Total | 16 | 24 | 28 | 27 | 95 |

Causal Factors for 2007-2014 Harvest:

| % of total | Most common specific impact in order of frequency |
|---|--|
| Logging 66% <i>Falling and yarding</i> <i>Low retention</i> | <ul style="list-style-type: none"> Riparian vegetation decreased Large woody debris supply decreased Large woody debris processes altered |
| Roads 16% <i>Erosion causing sedimentation</i> | <ul style="list-style-type: none"> Bare erodible ground increased In-stream sediments increased |
| Natural events 9% <i>Torrents</i> <i>Organic stream beds</i> | <ul style="list-style-type: none"> Moss levels decreased Stream or riparian blockages increased |
| Upstream factors 8% <i>Roads</i> <i>Logging</i> | <ul style="list-style-type: none"> In-stream sediments increased Moss levels decreased |
| Other human-caused 1% <i>Bike trail</i> | <ul style="list-style-type: none"> Riparian vegetation decreased |

Near-stream human actions (logging, roads, other) caused 83% of the impacts on streams in the 2007-2014 harvest-era. Natural events caused 9% of impacts, with torrents as a main factor.

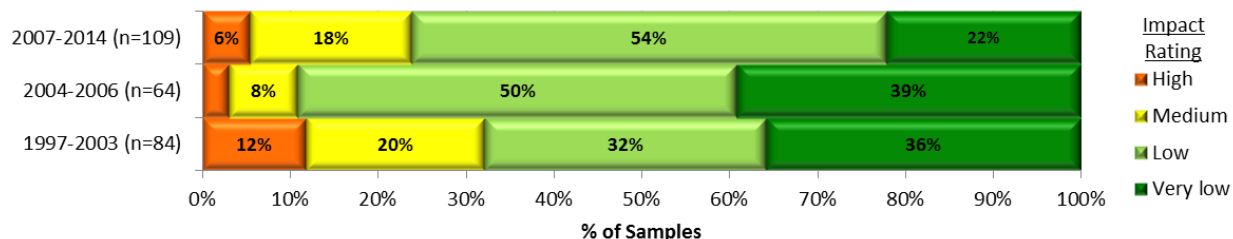
Of the 15 S6 and one S4 streams in the “high” impact category in the 2007-2014 harvest era, 15 are in-block streams, with zero tree retention in the first 10 metres for 13 of these streams. All 15 streams had impacted non-merchantable trees and understory in the first five metres of the channel, and 13 had stream or riparian blockages.

Overall Stewardship Trend: No statistical difference ($p = 0.54$) was evident between the three harvest eras.

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

- Minimize introduction of fine and coarse sediment from roads and maintain natural drainage patterns by keeping streams clear of logging slash.
- Maintain deep-rooted vegetation near stream banks.
- Increase retention on small streams, especially those wider perennial streams that make significant contributions of water, sediment, debris, and nutrients to downstream fish habitats and watershed function.

South Coast Stand-level Biodiversity: Resource Development Impacts



Data Source: Stand-level biodiversity data was collected by ministry field staff using the FREP stand-level biodiversity monitoring protocol. Sampling sites consist of randomly selected, recently harvested cutblocks. The impact rating considers total treed retention, retention quality, and coarse woody debris quantity and quality. The data presented was collected from 2006 through 2015 from cutblocks harvested from 1997 to 2014. Stewardship trends are based on differences in outcomes between harvest years.

Summary: Of 257²⁶ cutblocks, 77% of sites were rated as “very low” or “low” harvest-related impact. The tables below show the percentage of all sampled cutblocks by impact category and average cutblock size by category.

| 2007-2014 harvest | High | Medium | Low | Very low |
|--------------------|------|--------|-----|----------|
| % of blocks | 6% | 18% | 54% | 22% |
| Average gross (ha) | 5 | 14 | 19 | 27 |
| % of area sampled | 2% | 15% | 58% | 26% |

Causal Factors for 2007-2014 Harvest: 94% of all the cutblocks harvested from 2007-2014 had 3.5% or more tree retention. The density of large snags (≥ 30 cm dbh and 10 m height) and large diameter trees (> 70 cm dbh) retained is similar to baseline data (timber cruise data from the same ecosystems) for the predominant sampled CWHdm and CWHds, but lower for the CWHms and CWHvm. The count of live tree species is increasing and similar to baseline amounts for CWHvm, but lower for the CWHdm, ds and ms. The volume of coarse woody debris left on cutblocks is similar or slightly higher than baseline range (CWD within retention patches of the same ecosystem). CWD quality in terms of volume from large diameter pieces (≥ 30 cm at transect crossing) is slightly lower than baseline.

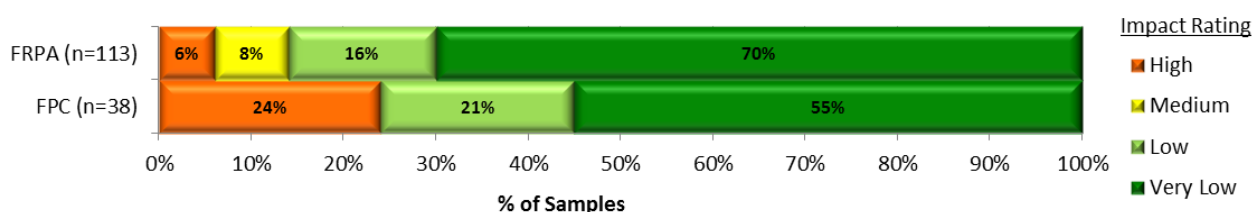
Overall Stewardship Trend: A statistical difference ($p = 0.00$) was evident between harvest eras, with the best outcomes in the middle era. Retention averaged 20% for cutblocks harvested before 2004, 26% for blocks harvested during 2004-2006, and 20% for blocks harvested after 2006. The CWHdm had an average of 20% retention prior to 2007, but this changed to 14% after 2006. Retention quality increased slightly in the later harvest years, compared to harvesting from 1997-2003. This is partially related to higher densities of retained large diameter trees and increased tree species diversity.

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

- Continue trend to leave at least low levels of retention on every cutblock.
- Continue leaving densities of large diameter trees in the CWHdm, ds and xm.
- Retain a full diversity of tree species.
- Look for opportunities to leave large snags safely as ecological anchors within retention patches within CWHms, vm and xm.

²⁶ An additional 38 cutblocks were assessed for individual indicators, but could not be ranked because of a lack of baseline data, or cutblocks with retention patches had no sample data from the patch (likely related to safety issues).

South Coast Visual Quality: Resource Development Impacts on Achievement of Visual Quality Objectives



Data Source: Visual quality assessment data was collected by ministry field staff and consultants using the FREP visual quality monitoring protocol. Sampling sites consist of landforms with visual quality objectives located in randomly selected, recently harvested cutblocks. Stewardship trends are based on comparisons of samples collected under *FPC* forest development plans versus *FRPA* forest stewardship plans. *FRPA* landform samples came from the Sunshine Coast, Soo and Fraser TSAs. *FPC* data came from the Fraser and Soo TSAs only.

Summary: Of 113 landforms assessed under *FRPA*, 86% were rated as “very low” or “low” harvest-related impact, while 14% were rated “medium” or “high” impact. Existing data suggests that visual quality values are not at risk in this region.

Number of FRPA Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very low | Total |
|------------------|----------|----------|-----------|-----------|------------|
| M | 1 | 1 | 4 | 27 | 33 |
| PR | 6 | 6 | 14 | 51 | 77 |
| R | | 2 | | 1 | 3 |
| Total | 7 | 9 | 18 | 79 | 113 |

Number of FPC Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very low | Total |
|------------------|----------|--------|----------|-----------|-----------|
| M | | | 1 | 2 | 3 |
| PR | 7 | | 7 | 18 | 32 |
| R | 2 | | | 1 | 3 |
| Total | 9 | | 8 | 21 | 38 |

^a M = Modification, PR = Partial Retention, R = Retention

Causal Factors for *FRPA* Landforms: Of the six PR landforms where VQOs were not achieved (“high” impact,) three had a high % alteration for the VQO (8-15%). Five had no design or poor design, and one neutral design. All had poor tree retention. In-block roads were significant for five of the seven “high” landforms. Seventy-nine landforms had VQOs that were fully achieved (“very low” impact). For the 52 of these that were PR or R:

- 27 had good design, 14 neutral, and nine no design or poor design;

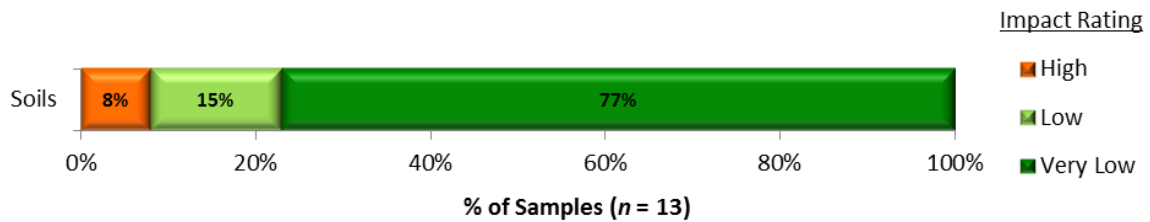
- Eight had good tree retention, 14 moderate, and 25 poor tree retention within openings (five unknown).
- All but one had % landform alteration consistent with their VQO. The one landform with higher % alteration had good design and good tree retention, bringing down its adjusted % alteration to be consistent with PR.

Overall Stewardship Trend: No direct comparison is possible since the *FPC* and *FRPA* sampling took place on different timber supply areas. However, when comparing just the Fraser and Soo data between the two legislative eras, there is a statistical difference ($p = 0.00$) with improving outcomes in the *FRPA* landforms.

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

- Continue keeping the % alteration within the prescribed range to meet VQOs on the majority of landforms.
- Use visual design techniques to create more natural-looking openings and better achieve VQOs.
- Use retention cutting to keep higher levels of volume per stems.

South Coast Soils: Resource Development Impacts on Soil Productivity and Hydrologic Function



Data Source: Soils data for assessments of soil productivity and hydrologic function was collected by provincial and regional soils experts using air photo interpretation. Sampling sites consist of randomly selected, recently harvested cutblocks. Assessments are based on high-resolution air photo analysis.

Summary: Of 13 cutblocks, 92% were rated as “very low” or “low” harvest-related impact, indicating that soil management objectives were achieved; 8% were rated as “high” harvest-related impact.

Causal Factors:

Although soil disturbance is less of an issue in this region, access construction or maintenance that led to (or increased the potential for) mass movement or erosion contributed to the high ratings.

Overall Stewardship Trend: Not enough historical monitoring has taken place to establish a trend.

Opportunities for Improvement:

- Full road rehabilitation has the potential to alleviate the risks associated with abandoned roads; however, these techniques should be tried on a wide range of materials, including those that are assumed impossible to rehabilitate.

THOMPSON-OKANAGAN NATURAL RESOURCE REGION

The following section presents the status of LLBD and the outcomes of site-level FREP monitoring in the Thompson-Okanagan Natural Resource Region.

Thompson-Okanagan Landscape-level Biodiversity

For brevity, LLBD is only reported for the 10 largest BGC subzones covering 78% of the forested ecosystems (by area) in the Thompson-Okanagan Region.

The biogeoclimatic subzone coding is as follows:

| | |
|---------|--|
| ESSFdk: | Engelmann spruce subalpine fir dry cool |
| ESSFwc: | Engelmann spruce subalpine fir wet cold |
| ESSFxc: | Engelmann spruce subalpine fir very dry cold |
| ICHmw: | interior cedar hemlock moist warm |
| ICHwk: | interior cedar hemlock wet cool |
| IDFdk: | interior Douglas-fir dry cool |
| IDFmw: | interior Douglas-fir moist warm |
| IDFhx: | interior Douglas-fir very dry hot |
| MSdm: | montane spruce dry mild |
| MSxk: | montane spruce very dry cool |

Figure 27: 10 largest forested BGC subzones in the Thompson-Okanagan region (locations shown have major sawmills).

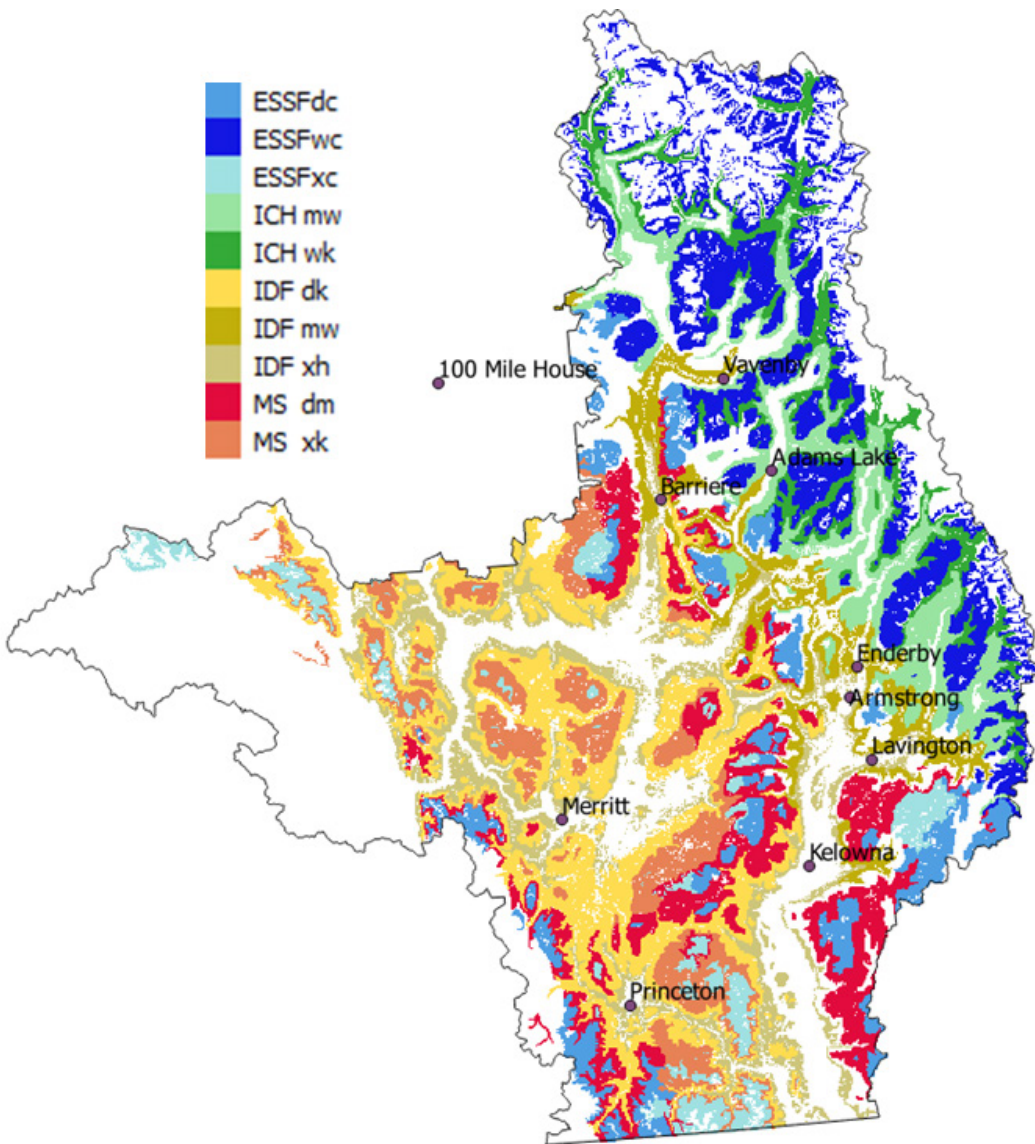


Figure 28: Amount of forest by seral stage and BGC subzone²⁷ in the Thompson-Okanagan region.

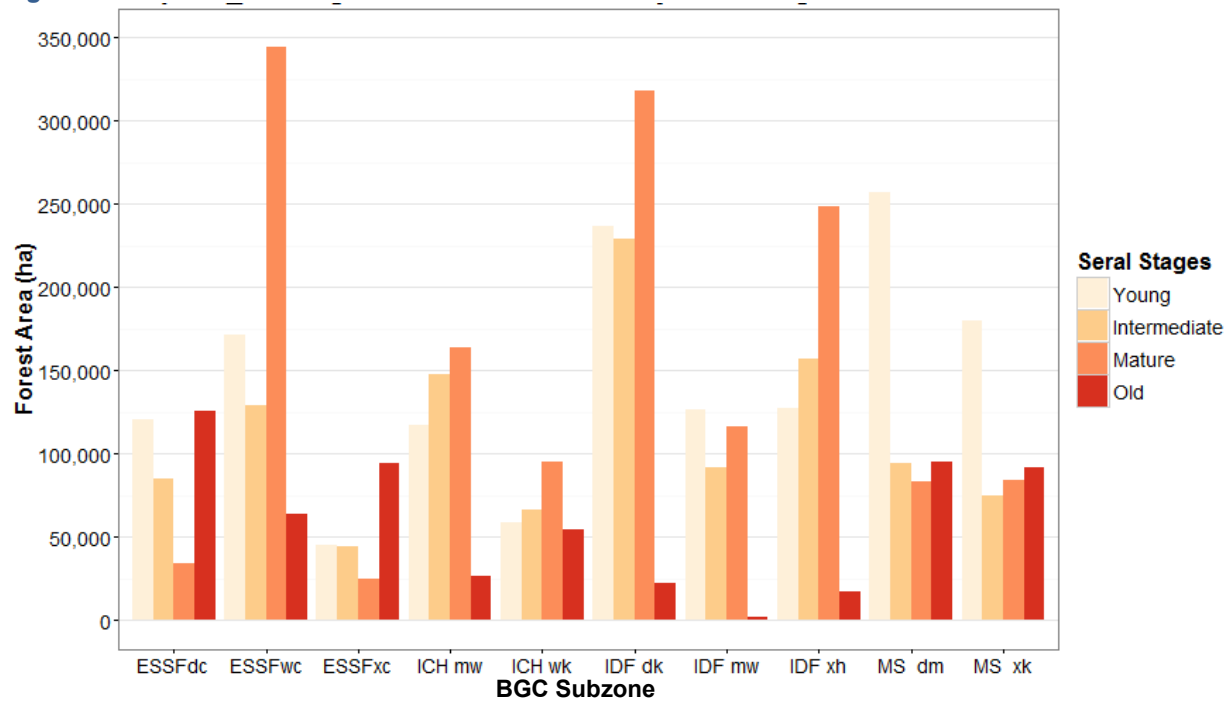
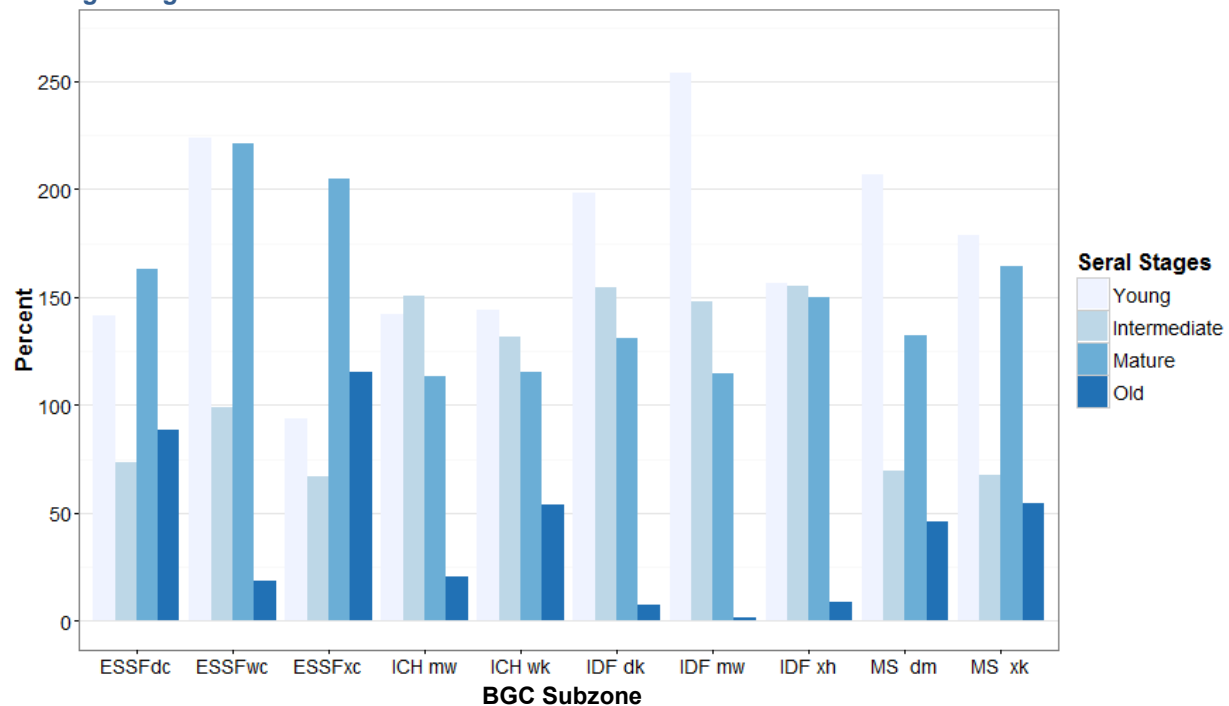


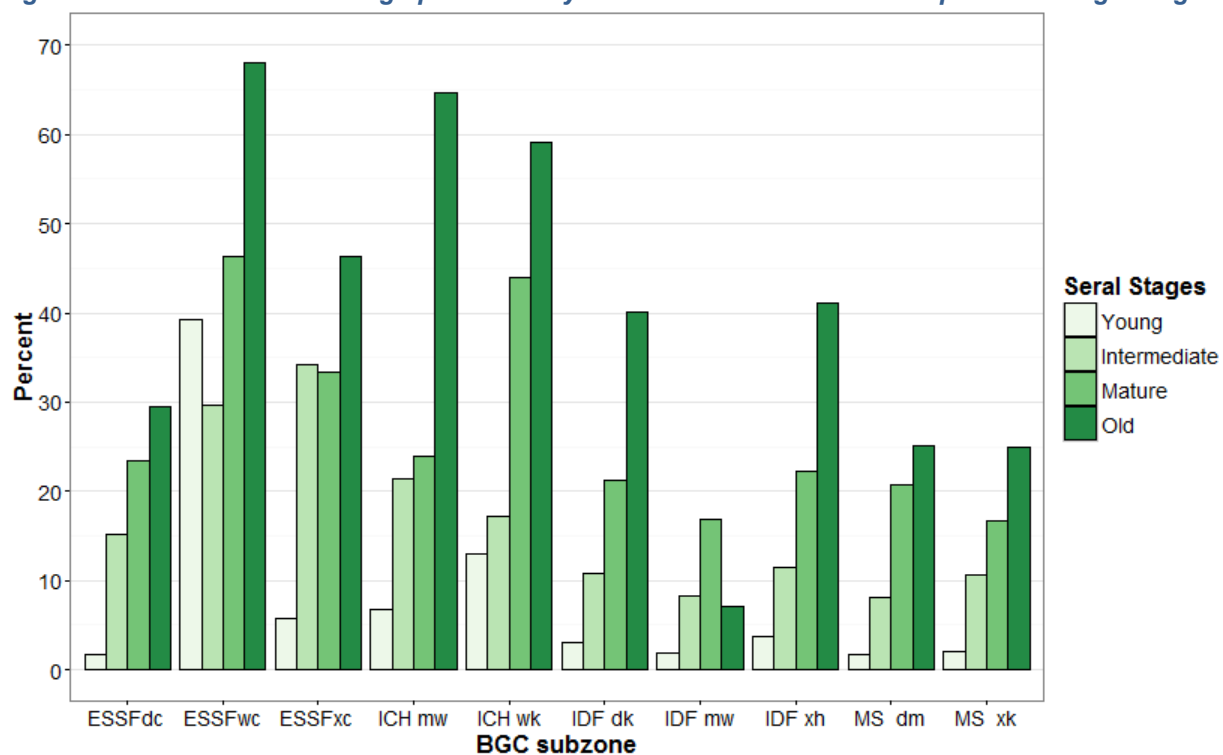
Figure 29: Percent of theoretical natural seral stage by BGC subzone²⁸ in the Thompson-Okanagan region.



²⁷ Referred to as the “observed plot” in the subsequent discussion.

²⁸ Referred to as the “percent of natural plot” in the subsequent discussion.

Figure 30: Percent of seral stage protected by BGC subzone²⁹ in the Thompson-Okanagan region.



From the “observed plot,” it can be seen that the MS subzones are dominated by young forest and this is more than expected under a nature disturbance regime (see “percent of natural plot”). This reflects the substantial salvage of MPB-impacted stands in the region. Despite these high levels of salvage, the amount of mature forest observed in the MS is still more than expected (see “percent of natural plot”) and this likely reflects a century of fire suppression.

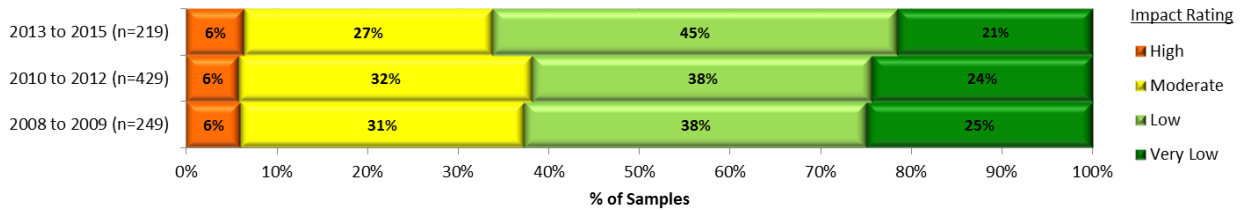
Lower elevation ICHmw, ESSFdc and ESSFwc subzones were comprised of approximately 33%, 25% and 24% young forest, respectively. In the case of the ICHmw and the ESSFdc, the amount of young forest was approximately 140% and 90% of that expected under a natural disturbance regime. In the case of the ESSFwc, the amount was more than twice that expected because this subzone has longer stand replacement intervals.

Similar to the IDF subzones of the Kootenay-Boundary and the Cariboo Regions, the young seral stage dominates the IDFdk and IDFMw (see “observed plot”). This is not the case for the IDFxh, where mature forest dominates (see “observed plot”). All three IDF subzones have relatively small areas of old forest, although 40% of what remains is under some form of protection from harvest for the IDFdk and IDFxh. In the case of the IDFMw, the amount of protection from harvest is 7% (see “percent protected plot”).

Similar to the Cariboo Region, both the young and intermediate seral stages are more than expected (greater than 145%) for the IDF subzones. The seral stage distributions of the IDF subzones are confused by the long history of partial cutting in these subzones. The seral stage reported is “the time since last harvest.” In the case of dry belt Douglas-fir stands, some mature and old trees remain after harvest and may provide some mature/old forest characteristics. This is acknowledged in the 1995 Biodiversity Guidebook.

²⁹ Referred to as the “percent protected plot” in the subsequent discussion.

Thompson-Okanagan Water Quality (fine sediment generation): Resource Development Impacts



Data Source: Water quality data (potential for fine sediment generation) was collected by ministry staff using the FREP water quality monitoring protocol. Sampling sites consist of roads and/or areas of mass wasting connected to fish habitat and/or drinking water sources that originate at randomly selected, recently harvested cutblocks. Sampling occurred from 2008 to 2015. Stewardship trends are based on survey years to capture the effects of road traffic and maintenance and are broken into three roughly equal time periods.

Summary: Of 897 road segments, 63% were rated as “very low” or “low” road-related impact.

Causal Factors for 2013 to 2015 Field Seasons:

See opportunities for improvement on road segments with “high” or “medium” impact ratings. Some opportunities will apply to ongoing maintenance issues, whereas others mainly apply to new road construction.

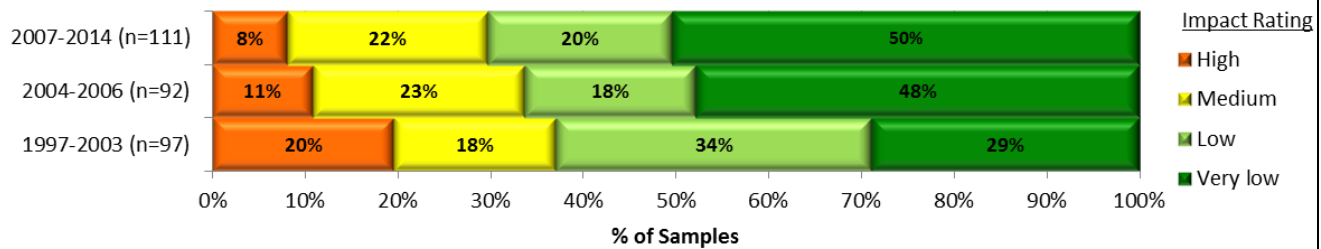
Overall Stewardship Trend: No statistical difference ($p = 0.67$) was evident between the three sampling eras.

Opportunities for Improvement and/or Continuation of Practices that Help Minimize Sediment:

The most frequent suggested solutions to improve road segments for samples from the 2013 to 2015 field season with “high” or “medium” impact ratings are:

- Use cross-ditches and kickouts.
- Armour, seed and protect bare soil.
- Increase the number of strategically located culverts.
- Remove or break berms that channel water along the road towards water bodies.
- Avoid long gradients approaching streams.

Thompson-Okanagan Riparian: Resource Development and Natural Impacts on Stream Function



Data Source: Stream riparian data was collected by ministry staff using the FREP riparian monitoring protocol. Sampling sites consist of randomly selected cutblocks with streams in or adjacent to cutblock boundaries. Sampling occurred from 2006 to 2015 on cutblocks harvested from 1997 to 2014. The largest stream of sufficient length is sampled. Stewardship trends are determined by harvest era.

Summary: Of 300 streams, 67% were rated as “very low” or “low” harvest-related impact.

Samples by Stream Class and Impact Rating 2007-2014 Harvest

| Class | High | Medium | Low | Very low | Total |
|--------------|----------|-----------|-----------|-----------|------------|
| S2 | | | 1 | 5 | 6 |
| S3 | | | 4 | 12 | 16 |
| S4 | 3 | 5 | 2 | 5 | 15 |
| S5 | | 2 | | 3 | 5 |
| S6 | 6 | 17 | 15 | 31 | 69 |
| Total | 9 | 24 | 22 | 56 | 111 |

Causal Factors for 2007-2014 Harvest:

| % of total | Most common specific impacts in order of frequency |
|---|--|
| Logging 47% <i>Low retention</i> <i>Windthrow</i> <i>Falling and yarding</i> | <ul style="list-style-type: none"> Riparian vegetation decreased In-stream sediments increased |
| Natural events 27% <i>High natural sediment</i> <i>Organic stream bed</i> <i>Torrents, Wind</i> | <ul style="list-style-type: none"> Moss levels decreased In-stream sediments increased |
| Roads 14% <i>Erosion causing sedimentation</i> | <ul style="list-style-type: none"> In-stream sediments increased |
| Upstream factors 8% <i>Natural impacts</i> <i>Logging, Roads</i> | <ul style="list-style-type: none"> In-stream sediments increased Moss levels decreased |
| Cattle 3% Trampling | <ul style="list-style-type: none"> In-stream sediments increased |
| Other manmade 1% <i>Fire guard</i> | <ul style="list-style-type: none"> In-stream sediments increased |

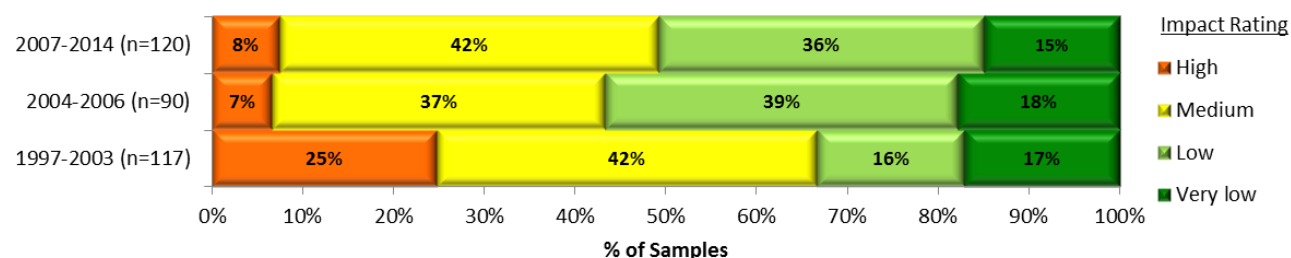
Near-stream human actions (logging, roads, cattle, other) caused 66% of stream impacts. Natural events caused 27% of stream impacts, with high natural sediment the main cause.

Overall Stewardship Trend: A statistical difference ($p = 0.00$) was evident between the three harvest eras, with improvement in outcomes over time.

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

- 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 those wider perennial streams that make significant contributions of water, sediment, debris, and nutrients to downstream fish habitats and watershed function.
- Minimize the introduction of fine and coarse sediment from roads.

Thompson-Okanagan Stand-level Biodiversity: Resource Development Impacts



Data Source: Stand-level biodiversity data was collected by ministry field staff using the FREP stand-level biodiversity monitoring protocol. Sampling sites consist of randomly selected, recently harvested cutblocks. The impact rating considers total treed retention, retention quality, and coarse woody debris quantity and quality. The data presented was collected from 2006 through 2015 from cutblocks harvested from 1997 to 2014. Stewardship trends are based on differences in outcomes between harvest years.

Summary: Of 327³⁰ cutblocks, 46% of sites were rated as “very low” or “low” harvest-related impact. The table below shows the percentage of sampled cutblocks by impact category. It also shows the average size of cutblock by category, with smaller cutblocks potentially more likely to be in the “high” impact category.

| 2007-2014 harvest | High | Medium | Low | Very low |
|--------------------|------|--------|-----|----------|
| % of blocks | 8% | 42% | 36% | 15% |
| Average gross (ha) | 11 | 28 | 38 | 50 |
| % of area sampled | 2% | 35% | 41% | 22% |

Causal Factors for 2007-2014 Harvest: 86% of cutblocks had $\geq 3.5\%$ tree retention. The predominant zones sampled were MS (43), ICH (40), ESSF (17), and IDF (17). The density of large snags (≥ 30 cm dbh & 10 m ht) is equal or better than baseline for the MS, but lower for the other zones. The density of big diameter trees retained (≥ 40 – 50 cm dbh depending on BEC zone) is much lower than baseline data (timber cruise) for the ESSF zone, and slightly lower for the ICH, IDF and MS zones. The number of tree species retained is similar to baseline for MS cutblocks, but lower for ESSF, IDF and ICH cutblocks. The range of CWD volume in the harvest areas is equal to or higher than that found in baseline (retention patches in same ecosystem). CWD quality in terms of volume from ≥ 20 cm pieces is similar to baseline.

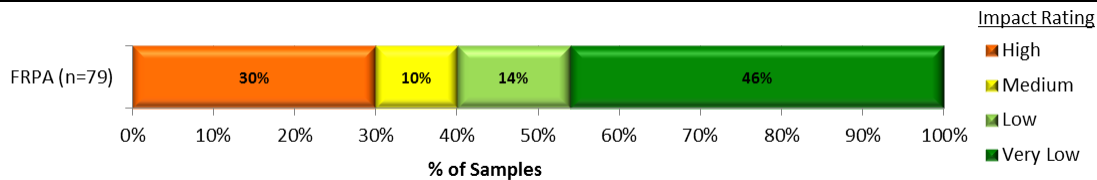
Overall Stewardship Trend: A statistical difference ($p = 0.00$) was evident between harvest eras, with the later two harvest eras showing better outcomes than those blocks harvested from 1997-2003. Retention was an average of 16% for blocks harvested before 2004, 14% for blocks harvested during 2004-2006, and 13% for blocks harvested after 2006. Retention quality was constant between eras. Coarse woody debris quality increased in the later eras.

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

- Leave at least low levels of retention on every cutblock.
- Continue leaving a full range of tree species and density of large snags in the MS zone.
- Retain some large diameter trees for the site, particularly for the ESSF zone.
- In all but the MS zone, look for opportunities to leave large snags safely as ecological anchors within retention patches.

³⁰ An additional eight cutblocks were assessed for individual indicators, but could not be ranked because of a lack of baseline data.

Thompson-Okanagan Visual Quality: Resource Development Impacts on Achievement of Visual Quality Objectives



Data Source: Visual quality assessment data was collected by ministry field staff and consultants using the FREP visual quality monitoring protocol. Sampling sites consist of landforms with visual quality objectives located in randomly selected, recently harvested cutblocks. Stewardship trends are based on comparisons of samples collected under *FPC* forest development plans versus *FRPA* forest stewardship plans. There were four landforms assessed during *FPC* years. TSAs sampled during the *FRPA* years were Okanagan, Kamloops and Merritt.

Summary: Of 79 landforms assessed under *FRPA*, 60% were rated as “very low” or “low” harvest-related impact, while 40% were rated as “medium” or “high” impact. Current data suggest that the visual quality value is at risk in this region as a significant number of VQOs were not achieved.

Number of *FRPA* Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very Low | Total |
|------------------|-----------|----------|-----------|-----------|-----------|
| M | 2 | 1 | 3 | 14 | 20 |
| PR | 17 | 7 | 7 | 20 | 51 |
| R | 5 | | 1 | 2 | 8 |
| Total | 24 | 8 | 11 | 36 | 79 |

^a M = Modification, PR = Partial Retention, R = Retention

Causal Factors for *FRPA* Landforms: The five R landforms where VQO was not achieved (“high” impact) had high % alteration for the VQO (5-44%). The two highest alteration cutblocks had operational exceptions (i.e., self-exemption language in their FSP). All these cutblocks had poor tree retention and either neutral, or no design or poor design. Of the 17 PR “high” impact landforms, there was an average of 18% total landform alteration, with all but one sample consistent with M or MM VQO. 15 had poor tree retention, 11 had no design or poor design, five had neutral design, and one had good design.

Thirty-six landforms had fully achieved VQOs (“very low” impact). For the 22 of these that were PR or R:

- Eight had good design, 10 neutral, and four no design or poor design.

- Two had good tree retention, three moderate, and 16 poor tree retention within openings (one unknown).
- All but two had % total landform alteration consistent with their VQO. One landform with 13% total alteration had good design and tree retention, bringing down its adjusted % alteration to be consistent with PR. The other cutblock was re-assessed as sitting on a less visually prominent landform.

Overall Stewardship Trend: There is insufficient data to allow comparison between legislative eras. The four *FPC* samples were all in the Okanagan TSA, two were “very low” impact, one “low” and one “medium” impact.

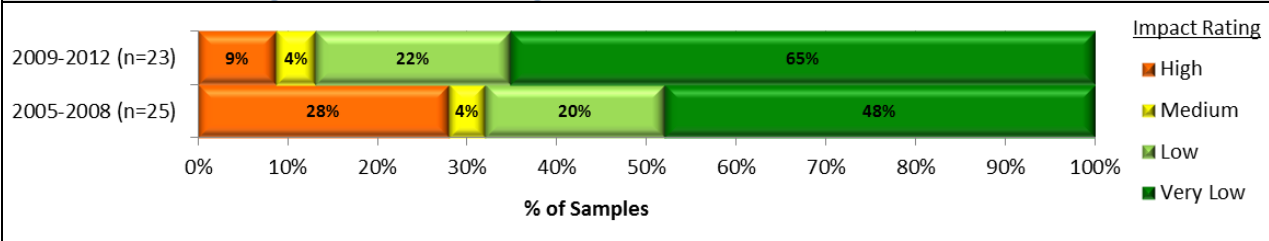
Opportunities for Improvement Based on Viewscapes that Meet Visual Quality Objectives:

- Eliminate self-exemption language from forest stewardship plans at time of renewal.
- Where exemptions are necessary, use the appropriate tools within *FRPA* (i.e., *Forest Planning and Practices Regulation* sections 12(7) or 25.1(1).³¹ In addition, *FRPA* Bulletin 25 provides advice on how to write defensible practicable statements³²
- Reduce opening size in retention and partial retention VQO areas to ensure the percent alteration range for the landform falls within Visual Impact Assessment Guidebook Standards.
- Use visual design techniques to create more natural-looking openings and better achieve VQOs.
- Use partial cutting to retain higher levels of volume per stems.

³¹ See: http://www.bclaws.ca/civix/document/id/complete/statreg/14_2004.

³² See: <https://www.for.gov.bc.ca/ftp/HTH/external/lpublish/web/frpa-admin/frpa-implementation/bulletins/frpa-general-no-25-comparison-of-fsp-results-or-strategies-flexibility-options-jul-21-2011.pdf>.

Thompson-Okanagan Cultural Heritage: Resource Development Impacts



Data Source: Data for cultural heritage assessment was collected by ministry field staff, often with the assistance of local First Nations. Sampling sites consist of a minimum of 50% randomly selected sites and up to 50% targeted sites (First Nations and/or licensee requests) based on recently harvested cutblocks with known cultural heritage resource values.

The Thompson-Okanagan Region samples are from the Cascades Natural Resource District.

Summary: The impact rating accounts for both overall block management of cultural heritage resources and protection of individual cultural features. Of 53 cutblocks, 57% were rated as “very low” impact, 21% as “low,” 6% as “medium,” and 17% as “high.”

At the cultural feature level, 59% of cutblocks showed no evidence of harvest-related damage, whereas 41% showed evidence of damage, 29% of the damaged features were rendered unsuitable for continued use.

Causal Factors:

Best outcomes were associated with stubbing and flagging of culturally modified trees, avoidance of features, and use of reserves and buffers. On sites with impacts, the primary causes of damage were windthrow, harvesting activity causing damage to cultural trails, and removal of cultural features.

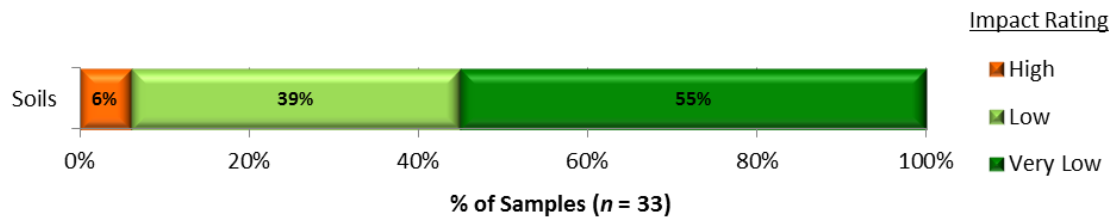
Overall Stewardship Trend: Due to the monitoring protocol used for monitoring cultural heritage values, there are insufficient random samples to show trend data at this time.

Opportunities for Improvement:

Opportunities for improvement are associated with the following practices that resulted in the best cultural heritage resource outcomes:

- Reviewing cultural heritage resource documentation during planning and operations.
- Identifying cultural features with flagging tape during pre-harvest site inspections for easy recognition during operations.
- Avoiding cultural features through use of windfirm reserves such as wildlife tree patches, machine-free zones, and block boundary modification.
- Combining reserves with visual quality objectives, retention, or other reserve needs.
- Stubbing dead culturally modified trees above cultural marks to avoid future windfall or breakage.
- Avoiding skidding across cultural trails (or in some cases, use of designated crossings);
- Considering harvesting during winter (e.g., frozen ground) to protect cultural plants.
- Locating burn or slash piles well away from cultural features and reserves.

Thompson-Okanagan Soils: Resource Development Impacts on Soil Productivity and Hydrologic Function



Data Source: Soils data for assessments of soil productivity and hydrologic function was collected by provincial and regional soils experts using air photo interpretation. Sampling sites consist of randomly selected, recently harvested cutblocks. Assessments are based on high-resolution air photo analysis.

Summary: Of 33 cutblocks, 94% were rated as “very low” or “low” harvest-related impact, indicating that soil management objectives were achieved; 6% were rated as “high” harvest-related impact.

Causal Factors:

For those sites with high impact ratings, excessive soil disturbance, both in roadside work areas and outside work areas, is a major factor that contributes to “highly” affected soil productivity.

Overall Stewardship Trend: Not enough historical monitoring has taken place to establish a trend.

Opportunities for Improvement:

- Plan operations in and outside roadside work areas to minimize soil disturbance.

WEST COAST NATURAL RESOURCE REGION

The following section presents the status of LLBD and the outcomes of site-level FREP monitoring in the West Coast Natural Resource Region.

West Coast Landscape-level Biodiversity

For brevity, LLBD is only reported for the 10 largest BGC subzones covering 94% of the forested ecosystems (by area) in the West Coast Region.

The biogeoclimatic subzone coding is as follows:

| | |
|--------|--|
| CDFmm: | Coastal Douglas-fir moist maritime |
| CWHmm: | Coastal western hemlock moist maritime |
| CWHms: | Coastal western hemlock moist submarine |
| CWHvh: | Coastal western hemlock very wet hypermaritime |
| CWHvm: | Coastal western hemlock very wet maritime |
| CWHwh: | Coastal western hemlock wet hypermaritime |
| CWHws: | Coastal western hemlock wet submarine |
| CWHxm: | Coastal western hemlock very dry maritime |
| MHmm: | Mountain hemlock moist maritime |
| SBSmc: | Sub boreal spruce moist cold |

Figure 31: 10 largest forested BGC subzones in the West Coast region (locations shown have major sawmills)

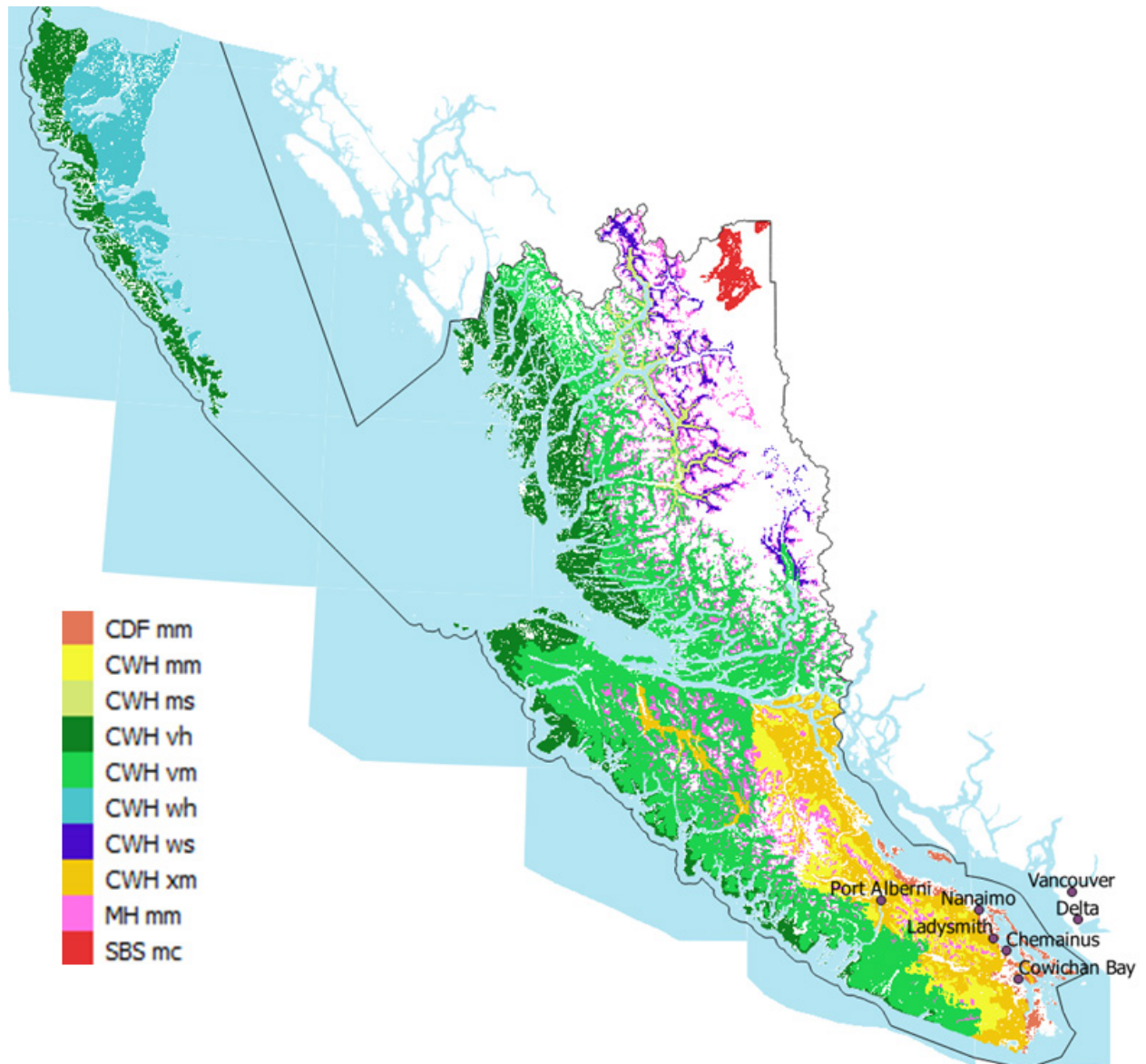


Figure 32: Amount of forest by seral stage and BGC subzone³³ in the West Coast Region.

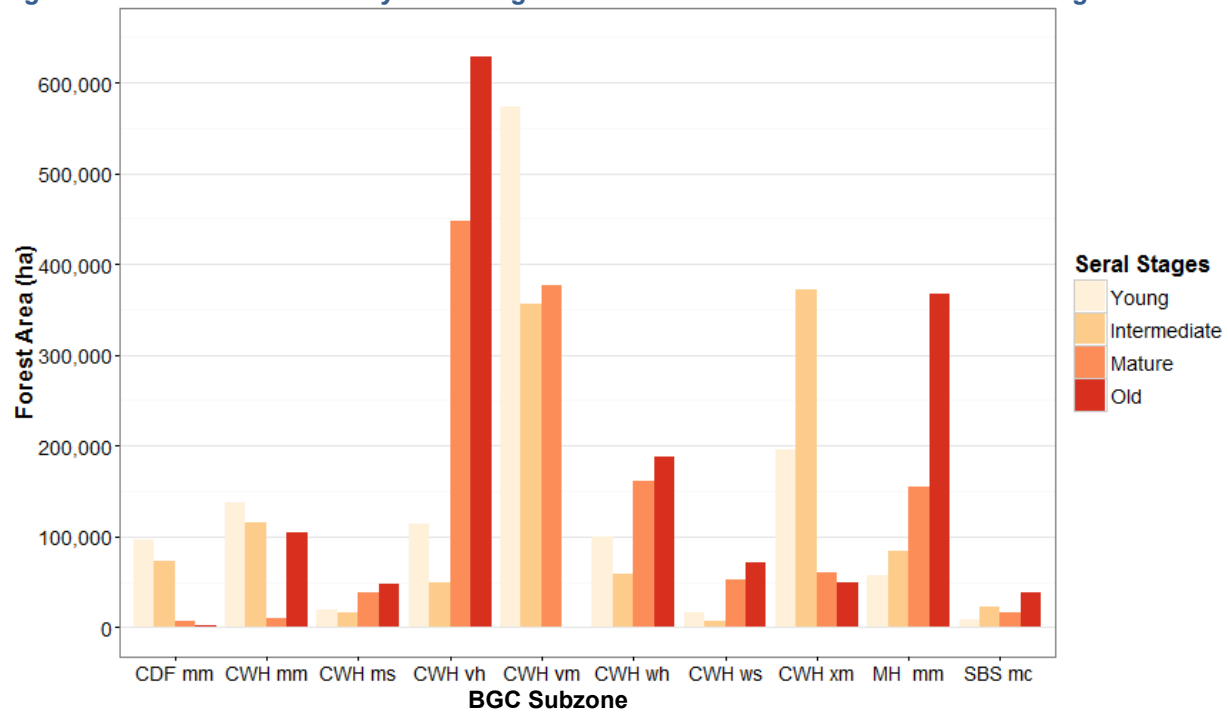
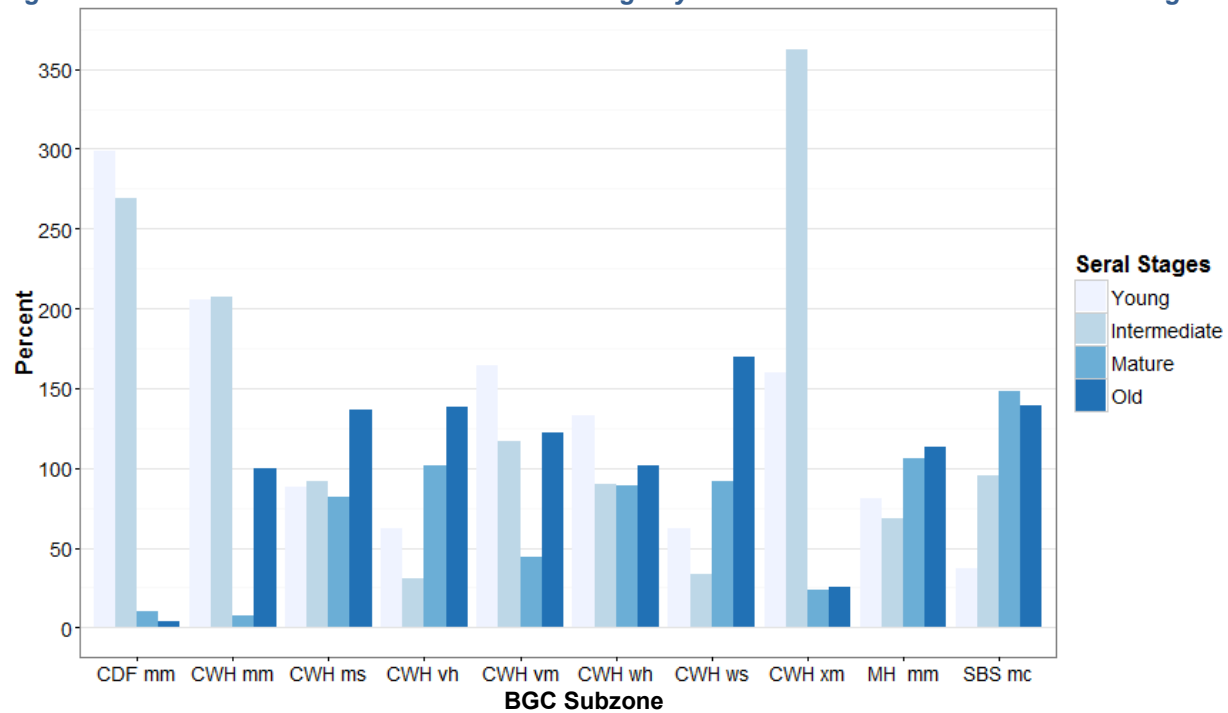


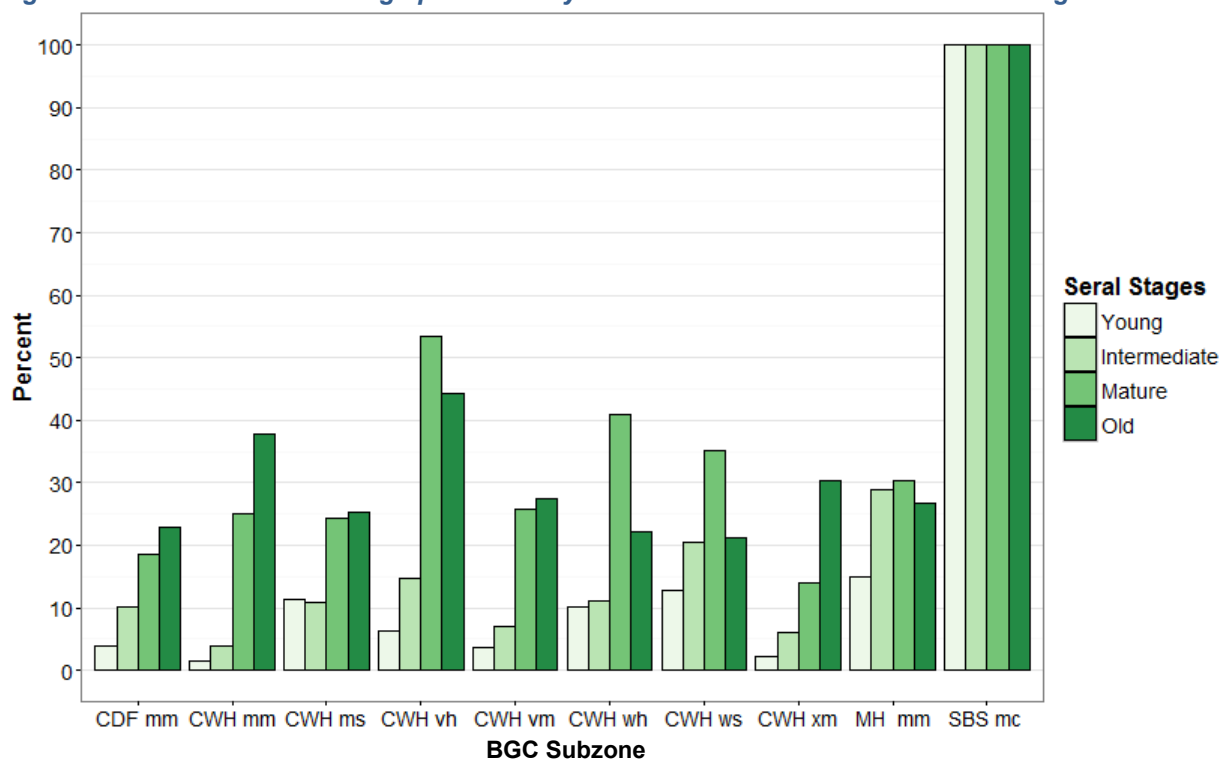
Figure 33: Percent of theoretical natural seral stage by BGC subzone³⁴ in the West Coast Region.



³³ Referred to as the “observed plot” in the subsequent discussion.

³⁴ Referred to as the “percent of natural plot” in the subsequent discussion.

Figure 34: Percent of seral stage protected by BGC subzone³⁵ in the West Coast Region



From the above plots and map, it can be seen that the subzone with the smallest portion of mature and old forest is the CDFmm located along the lower east coast of Vancouver Island and in the Capital Regional District. Furthermore, the amount of young and/or intermediate forest is more than 250% of that expected under a natural disturbance regime. This analysis shows all land. It is important to note that most of the land in this subzone is private forest land.

The next subzone with relatively little mature and/or old forest is the CWHxm, which like the CDFmm is located in southeastern Vancouver Island. Both subzones have high levels of residential and agricultural development. As with the CDFmm, much of the CWHxm is private land.

The CWHmm subzone also has much higher levels of young and intermediate seral forest than expected under a natural disturbance regime and a relatively small amount of mature forest. Nevertheless, the amount of old forest is approximately 100% of expected and is concentrated either within or in the vicinity of Strathcona Provincial Park.

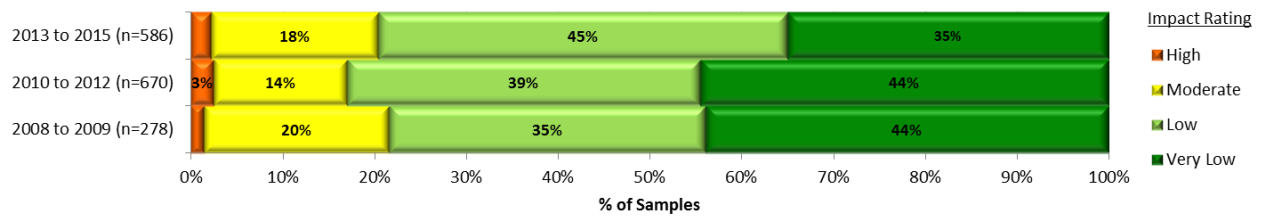
Those CWH subzones with mature and/or old forest in proportions of 100% or greater than that expected under a natural disturbance regime are located either on the western half and northern third of Vancouver Island, within the Great Bear Rainforest, or on Haida Gwaii. All these areas are further from major sawmills and residential and agricultural development than the CDFmm, CWHxm and CWHmm.

The seral stage distribution of the MHmm subzone approximates natural conditions and reflects the lack of development in this subzone.

The SBSmc has 100% protection from harvest because it is located in Tweedsmuir Park.

³⁵ Referred to as the “percent protected plot” in the subsequent discussion.

West Coast Water Quality (fine sediment generation): Resource Development Impacts



Data Source: Water quality data (potential for fine sediment generation) was collected by ministry staff using the FREP water quality monitoring protocol. Sampling sites consist of roads and/or areas of mass wasting connected to fish habitat and/or drinking water sources that originate at randomly selected, recently harvested cutblocks. Sampling occurred from 2008 to 2015. Stewardship trends are based on survey years to capture the effects of road traffic and maintenance and are broken into three roughly equal time periods.

Summary: Of 1534 road segments, 81% were rated as “very low” or “low” road-related impact.

Causal Factors for 2013 to 2015 Field Seasons:

See opportunities for improvement on road segments with “high” or “medium” impact ratings. Some opportunities will apply to ongoing maintenance issues, whereas others mainly apply to new road construction.

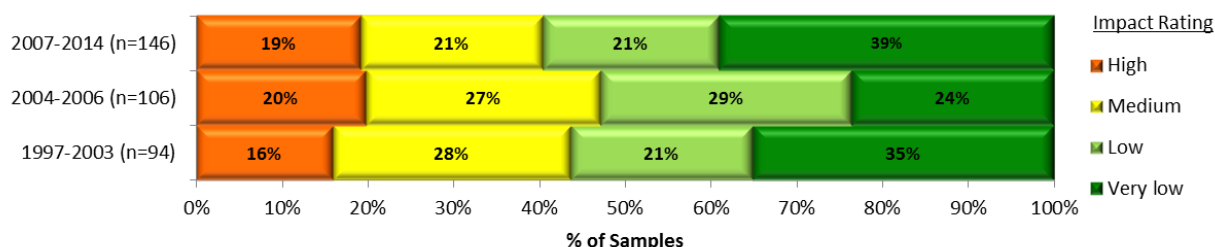
Overall Stewardship Trend: A statistical difference ($p = 0.00$), influenced by the large sample size, was evident between the three sampling eras, with minor fluctuations in potential for sediment generation.

Opportunities for Improvement and/or Continuation of Practices that Help Minimize Sediment:

The most frequent suggested solutions to improve road segments for samples from the 2013 to 2015 field season with “high” or “medium” impact ratings are:

- Increase the number of strategically located culverts.
- Remove or break berms that channel water along the road towards water bodies; and
- Use cross ditches and kickouts.

West Coast Riparian: Resource Development and Natural Impacts on Stream Function



Data Source: Stream riparian data was collected by ministry staff using the FREP riparian monitoring protocol. Sampling sites consist of randomly selected cutblocks with streams in or adjacent to cutblock boundaries. Sampling occurred from 2006 to 2015 on cutblocks harvested from 1997 to 2014. The largest stream of sufficient length is sampled. Stewardship trends are determined by harvest era.

Summary: Of 346 streams, 57% were rated as “very low” or “low” harvest-related impact.

Samples by Stream Class and Impact Rating 2007-2014 Harvest

| Class | High | Medium | Low | Very low | Total |
|--------------|-----------|-----------|-----------|-----------|------------|
| S2 | | 3 | 1 | 9 | 13 |
| S3 | | 5 | 6 | 8 | 19 |
| S4 | 2 | | 2 | 1 | 5 |
| S5 | 7 | 5 | 6 | 16 | 34 |
| S6 | 19 | 18 | 15 | 23 | 75 |
| Total | 28 | 31 | 30 | 57 | 146 |

Causal Factors for 2007-2014 Harvest:

| % of total | Most common specific impact in order of frequency |
|--|---|
| Logging 69% <i>Falling and yarding</i> <i>Low retention</i> | <ul style="list-style-type: none"> Stream or riparian blockages increased Riparian vegetation decreased Large woody debris processes altered |
| Natural events 17% <i>Wind</i> <i>High natural sediment</i> | <ul style="list-style-type: none"> Stream or riparian blockages increased In-stream sediments increased |
| Roads 7% <i>Erosion, sediment, and channel infilling</i> | <ul style="list-style-type: none"> In-stream sediments increased Stream or riparian blockages increased |
| Upstream factors 5% <i>Logging</i> | <ul style="list-style-type: none"> In-stream sediments increased |
| Other human-caused 2% | <ul style="list-style-type: none"> In-stream sediment increased |

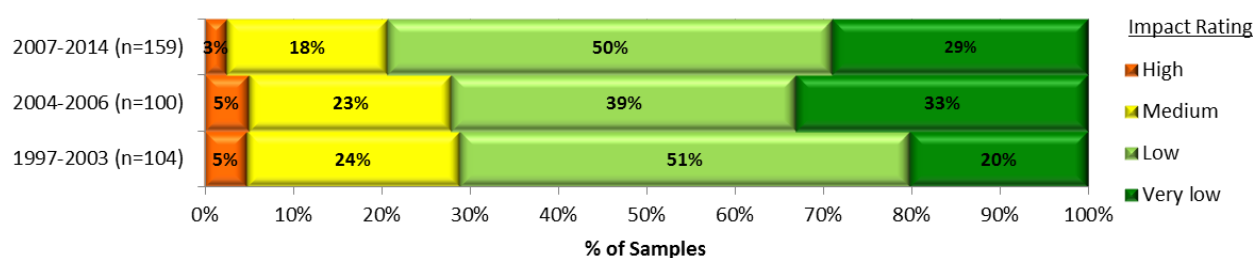
In the 2007-2014 harvest era, near-stream human actions (logging, roads, other) caused 78% of stream impacts, whereas natural events were responsible for 17%. Of the 28 “high” impact streams, 25 were in-block streams and three adjacent. Two S5 streams had full retention (30 metres) with windthrow, while the remainder averaged less than one metre of retention. Of the 40, 2007-2014 harvest era S4, S5, S6 streams that were “very low” impact, all had a full five metres of non-merchantable trees and shrubs, and all but four had a full 10m of riparian retention. Blockages were the most common issue in these streams, mostly caused by natural events.

Overall Stewardship Trend: No statistical difference ($p = 0.20$) was apparent between the three eras.

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

- Maintain natural drainage patterns by keeping streams clear of logging slash.
- Increase retention generally on small streams, especially those wider perennial streams that make significant contributions of water, sediment, debris, and nutrients to downstream fish habitats and watershed function.
- If full treed retention is not possible, look to maintain near stream non-merchantable trees and shrubs to protect channel banks.

West Coast Stand-level Biodiversity: Resource Development Impacts



Data Source: Stand-level biodiversity data was collected by ministry field staff using the FREP stand-level biodiversity monitoring protocol. Sampling sites consist of randomly selected, recently harvested cutblocks. The impact rating considers total treed retention, retention quality, and coarse woody debris quantity and quality. The data presented was collected from 2006 through 2015 from cutblocks harvested from 1997 to 2014. Stewardship trends are based on differences in outcomes between harvest years.

Summary: Of 363³⁶ cutblocks, 75% were rated as “very low” or “low” harvest-related impact. The table below shows the percentage of sampled cutblocks by impact category. It also shows the average size of cutblock by category, with very small cutblocks potentially more likely to be in the “high” impact category.

| 2007-2014 harvest | High | Medium | Low | Very low |
|--------------------|------|--------|-----|----------|
| % of blocks | 3% | 18% | 50% | 29% |
| Average gross (ha) | 4 | 17 | 23 | 27 |
| % of area sampled | 0.4% | 13% | 52% | 34% |

Causal Factors for 2007-2014 Harvest:

For the 2007-2014 harvest era, 97% of all cutblocks had 3.5% or more tree retention. The predominant subzones sampled were CWHvm (78), CWHwh (30), CWHvh (24), and CWHxm (21). The density of big diameter trees (≥ 70 cm dbh) retained is lower than baseline data (timber cruise), as is the density of large snags (≥ 30 cm dbh and 10 m height). The range of tree species retained is equal or higher than baseline for the CWHwh, although lower for the other subzones. The range of coarse woody debris volume in harvested areas is similar or higher than that found in retention patches of the same ecosystems for all but the CWHxm, as is CWD quality (i.e., volume from pieces ≥ 30 cm diameter at transect crossing).

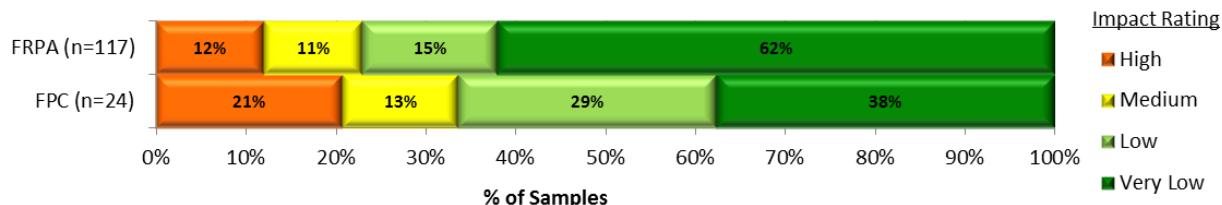
Overall Stewardship Trend: No statistical difference ($p = 0.25$) was evident between harvest eras. Retention averaged 17% for cutblocks harvested before 2004, 19% for blocks harvested during 2004-2006, and 17% for blocks harvested after 2006. Retention quality was basically consistent between the harvest eras. Coarse woody debris quality increases were the main factor in a slight increase in cutblocks with a “low” impact rating in blocks harvested from 2007-2014.

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

- Continue the trend of leaving at least low levels of retention on every cutblock.
- Retain some large diameter trees on the site.
- Look for opportunities to leave large snags safely as ecological anchors within retention patches.
- Retain a full representation of pre-harvest tree species.

³⁶ An additional twelve cutblocks were assessed for individual indicators but could not be ranked because of a lack of baseline data.

West Coast Visual Quality: Resource Development Impacts on Achievement of Visual Quality Objectives



Data Source: Visual quality assessment data was collected by ministry field staff and consultants using the FREP visual quality monitoring protocol. Sampling sites consist of landforms with VQOs located in randomly selected, recently harvested cutblocks. Stewardship trends are based on comparisons of samples collected under *FPC* forest development plans versus *FRPA* forest stewardship plans. *FRPA* data came from the Kingcome, Mid Coast, Strathcona, Arrowsmith and Queen Charlotte TSAs. *FPC* data came from the Kingcome and Strathcona TSAs.

Summary: Of 117 landforms assessed under *FRPA*, 77% were rated with “very low” or “low” harvest-related impact, while 23% were rated as “medium” or “high” impact. Existing data suggest that the visual quality value is not at risk in this region.

Number of *FRPA* Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very low | Total |
|------------------|-----------|-----------|-----------|-----------|------------|
| MM | | | | 4 | 4 |
| M | | 3 | 5 | 23 | 31 |
| PR | 12 | 10 | 11 | 43 | 76 |
| R | 2 | | 2 | 2 | 6 |
| Total | 14 | 13 | 18 | 72 | 117 |

Number of *FPC* Samples by VQO and Impact Rating

| VQO ^a | High | Medium | Low | Very low | Total |
|------------------|----------|----------|----------|----------|-----------|
| MM | | | 1 | 2 | 3 |
| M | | 1 | 2 | 4 | 7 |
| PR | 4 | 1 | 3 | 3 | 11 |
| R | 1 | 1 | 1 | | 3 |
| Total | 5 | 3 | 7 | 9 | 24 |

^a MM = Maximum Modification, M = Modification, PR = Partial Retention, R = Retention

Causal Factors for *FRPA* Landforms: Of the two R landforms where VQO was not achieved (“high” impact), both had high % alteration for the VQO (3.2%). One of these landforms was impacted by non-vegetation in old openings. These blocks both had good design and one had moderate tree retention, which reduced the adjusted % alteration to an average of 1.8%. Of the 12 “high” impact landforms with PR VQO, 11 had high % total alteration (8-19%).

Poor design and tree retention for the one lower % alteration block resulted in increased adjusted % alteration.

Seventy-two landforms had VQOs that were fully achieved (“very low” impact). For the 45 of these that were PR or R:

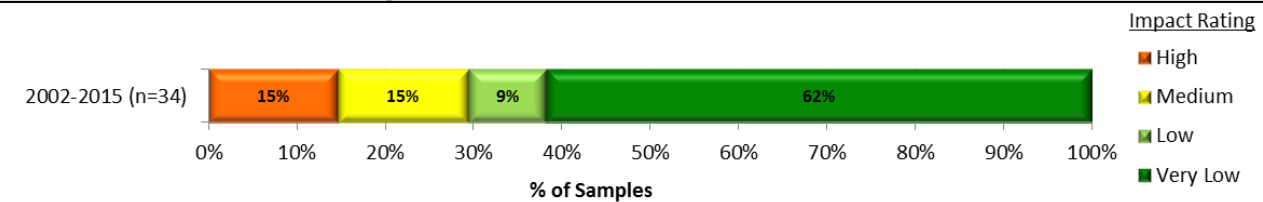
- 26 had good design, 14 neutral, and five no design or poor design.
- Six had good tree retention, 13 moderate, and 22 poor tree retention within openings (four missing).
- All but one % landform alteration was consistent with their VQO. The one PR landform with high alteration (9.4%) also had moderate tree retention and good design, decreasing adjusted alteration consistent with the PR VQO.

Overall Stewardship Trend: No direct comparison is possible since the *FPC* and *FRPA* sampling took place on different timber supply areas.

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

- Continue to ensure the percent alteration range for the landform falls within Visual Impact Assessment Guidebook Standards for the VQO.
- Continue the use of existing visual design techniques to create more natural-looking openings and better achieve VQOs.
- Use retention cutting to keep higher levels of volume per stems.

West Coast Cultural Heritage: Resource Development Impacts



Data Source: Cultural heritage assessment data was collected by ministry field staff, often with the assistance of local First Nations. Sampling sites consist of a minimum of 50% randomly selected sites and up to 50% targeted sites (First Nations and/or licensee requests) based on recently harvested cutblocks with known cultural heritage resource values.

West Coast Region samples are from the Haida Gwaii Natural Resource District and North Island Natural Resource Districts.

Summary: The impact rating accounts for both overall block management of cultural heritage resources and protection of individual cultural features.
At the cultural feature level, 50% showed no evidence of harvest-related damage, whereas 48% showed evidence of damage - 45% of the damaged features were rendered unsuitable for continued use.

Causal Factors:

Best outcomes were associated with the use of reserves and buffers to leave features standing or to protect them from windthrow. On sites with impacts, the primary causes of damage were windthrow and harvesting activity causing damage to cultural features.

Overall Stewardship Trend: Due to the monitoring protocol used for monitoring cultural heritage values, there are insufficient random samples to show trend data at this time.

Opportunities for Improvement:

Opportunities for improvement are associated with the following practices that resulted in the best cultural heritage resource outcomes:

- Reviewing cultural heritage resource documentation during planning and operations.
- Avoiding features through the use of windfirm reserves such as wildlife tree patches (some topping used), machine-free zones, and block boundary modification.
- Combining cultural heritage resource reserves with other reserves such as wildlife tree patches.
- Using higher levels of retention in culturally modified tree management zones.

Resource Value Stewardship Results Comparison

Table 1 provides the ratings of stewardship effectiveness for the eight natural resource regions. Effectiveness is shown by the percentage of samples with a “very low” or “low” resource development impact rating. Only those values with sufficient sampling data to allow for comparisons between most regions are presented below.

Table 1. Stewardship effectiveness by natural resource region as determined by resource development impact rating.

| Resource value | Percentage of “Very low” + “Low” Resource Development Impact Ratings ^a | | | | | | | |
|--|---|-------------------|------------------------------|-----------------|-----------------|-----------------|-------------------|------------------|
| | Cariboo | Kootenay–Boundary | Northeast | Omineca | Skeena | South Coast | Thompson–Okanagan | West Coast |
| Riparian – all data | 76 (273) | 66 (195) | 61 (145) | 73 (371) | 79 (289) | 61 (246) | 67 (300) | 57 (346) |
| post-2006 harvest years | 72 (47) | 49 (37) | 48 (33) | 81 (143) | 84 (105) | 58 (95) | 70 (111) | 60 (146) |
| 2004–2006 harvest years | 73 (93) | 72 (65) | 58 (40) | 64 (76) | 78 (63) | 67 (72) | 66 (92) | 53 (106) |
| pre-2004 harvest years | 80 (133) | 68 (93) | 68 (72) | 68 (152) | 76 (121) | 61 (79) | 63 (97) | 56 (94) |
| Water quality – all data | 83 (449) | 74 (552) | 63 (133) ^b | 57 (646) | 78 (748) | 68 (974) | 63 (897) | 81 (1534) |
| 2013–2015 sample years | 89 (105) | 83 (59) | 52 (65) | 58 (198) | 64 (283) | 70 (396) | 66 (219) | 80 (586) |
| 2010–2012 sample years | 78 (172) | 78 (222) | ID (13) | 48 (190) | 79 (291) | 70 (351) | 62 (429) | 83 (670) |
| 2008–2009 sample years | 84 (172) | 68 (271) | 78 (55) | 63 (258) | 63 (174) | 60 (227) | 63 (249) | 78 (278) |
| Stand-level biodiversity – all data | 67 (297) | 43 (256) | 47 (134) | 46 (355) | 53 (310) | 77 (257) | 46 (327) | 75 (363) |
| post-2006 harvest years | 73 (74) | 55 (58) | 74 (35) | 48 (111) | 59 (118) | 76 (109) | 51 (120) | 79 (159) |
| 2004–2006 harvest years | 70 (91) | 48 (94) | 32 (34) | 51 (95) | 53 (76) | 89 (64) | 57 (90) | 72 (100) |
| pre-2004 harvest years | 61 (132) | 31 (104) | 49 (65) | 41 (149) | 46 (116) | 68 (84) | 33 (117) | 71 (104) |
| Visual Quality | | | | | | | | |
| FRPA | 68 (65) | 57 (53) | ID (8) | 69 (75) | 75 (110) | 86 (113) | 59 (79) | 77 (117) |
| FPC | 61 (31) | 68 (50) | ID (0) | 56 (43) | 55 (53) | 76 (38) | ID (4) | 67 (24) |

^a ID = insufficient data; sample sizes in brackets.

^b Peace District only for Northeast Region water quality.

SUMMARY

As a regional-level summary of FREP monitoring results to date, this sixth annual report communicates continuous improvement perspectives and recommendations to natural resource professionals, land managers, and decision makers. This information is intended to support and promote dialogue necessary to achieve short- and long-term sustainable resource management goals in British Columbia. Natural resource professionals, land managers, and decision makers are strongly encouraged to consider this information in their practices, along with other FREP reports (i.e., local MRVA Reports), extension notes, monitoring protocols, and other relevant data. Monitoring results should assist resource professionals to understand the outcomes associated with their plans and practices, and also inform their recommendations and decisions, particularly where these need to balance environmental, social and economic values.

To ensure the resource management community gains the maximum value from FREP monitoring, natural resource professionals and land managers are encouraged to:

1. Carefully review this report in the context of their specific roles and responsibilities.
2. Contact their natural resource district to arrange a field visit to view local results and discuss outcomes and appropriate actions moving forward.
3. Ask for the data pertaining to their area to conduct their own analysis and interpretation. Local data and support is available to individual licensees by contacting FREP@gov.bc.ca.
4. Review the FREP monitoring protocols. These documents identify the best available information on key attributes and indicators of forest and range resource health and sustainability.
5. Visit the FREP website at:
<http://www2.gov.bc.ca/gov/content?id=F799814F5E004CA0A02A02D63CB69E55>
6. Send any feedback or questions relating to this report, or FREP in general, to FREP@gov.bc.ca or by telephone at (250) 387-1946.