Northern Interior Region: Summary of Stand-level Biodiversity Sampling

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FREP

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Introduction

The purpose of this extension note is to improve understanding of a subset of stand-level biodiversity outcomes related to harvesting and retention forest practices at the regional level. The information presented here can facilitate discussions on biodiversity practices and highlight opportunities for continuous improvement. This analysis provides an overview of the Northern Interior Forest Region with a more detailed look at its predominant biogeoclimatic subzones. The data is from cutblocks harvested between 1997 and 2007 and sampled by the Forest and Range Evaluation Program (FREP) during the 2006–2009 field seasons (see Figure 1, Table 1).

Stand-level biodiversity is one component of the biodiversity value noted in the Forest Planning and Practices Regulation under the *Forest and Range Practices Act* (*FRPA*). The FREP is assessing how well these values are being maintained. Though the data presented here is from cutblocks harvested under the previous legislative regime (*Forest Practices Code of British Columbia Act*), the results provide a baseline for

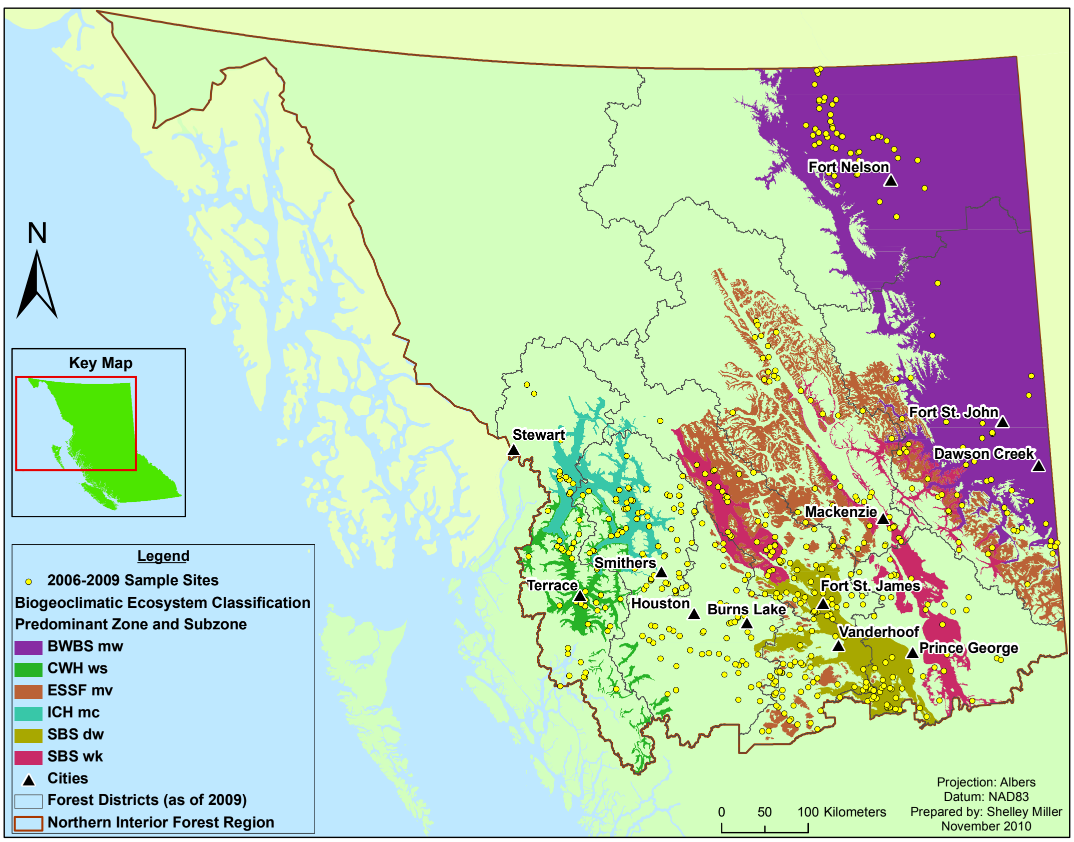

Figure 1. FREP stand-level biodiversity assessment location and predominant subzones.

The FREP Mission:

To be a world leader in resource stewardship monitoring and effectiveness evaluations; providing the science-based information needed for decision-making and continuous improvement of British Columbia's forest and range practices, policies and legislation.

http://www.for.gov.bc.ca/hfp/frep/index.htm

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future monitoring of *FRPA* cutblocks. Stand-level biodiversity, particularly the retention of live and dead standing trees and coarse woody debris (CWD) within harvested cutblocks, is an important (if not essential) component of wildlife habitat maintenance (for species dependent on mature and old-forest characteristics), and vital for maintaining healthy ecological functions, such as hydrology, soil productivity, and species dispersal.

GENERAL DESCRIPTION OF NORTHERN INTERIOR FOREST REGION SAMPLE CUTBLOCKS

- 510 cutblocks sampled
- 81% of cutblocks had retention (≥ 0.5% of cutblock area has retention)
- 23 264 ha total gross area
- 11.2% (2596 ha) of patch (long-term) retention
- 2.2% (508 ha) of dispersed retention (basal area equivalent)
- 13.4% average retention
- 23% of retention constrained[1]
- 63% of patches are less than or equal to 2 ha
- 37% of patches are greater than 2 ha
- Average of 1.7 ecological anchors[2] per hectare of retention, patch or dispersed (range 0–27)
- Average of 9% windthrow in the 414 cutblocks with retention measured
- 43% of patches internal to cutblock; 55% on the edge; and 2% external and non-contiguous to the cutblock
- Invasive species were found on 11% of the cutblocks

Figure 2. Fort Nelson Forest District, internal to harvest retention. Photo credit: Bob Krahn.

1 Retention is considered constrained for one or more of the following reasons: wet area, riparian management zone, riparian reserve zone, rock outcrop, non-commercial brush, non-merchantable timber, sensitive terrain or soil, ungulate winter range, wildlife habitat area, old growth management area, recreation feature, visuals, cultural heritage feature.

2 Ecological anchors include features such as large hollow trees, large witches broom, active wildlife trails, and active feeding on wildlife trees.

BOREAL WHITE AND BLACK SPRUCE MOIST WARM SUBZONE (BWBSmw) DISCUSSION

The BWBSmw subzone had retention within 87% of the sampled cutblocks, with an overall average retention of 9.9% (Table 1). The average windthrow was 6.9%. There was a good mixture of retention patch locations, both internal to harvest boundary (see example in Figure 2) and on the edge, with essentially no retention patches external and non-contiguous to the harvest boundary.

The average density of large snags in the FREP sampled retention was 78% of the cruise baseline. The average density of large trees increased from that found in the baseline (134%). The average number of tree species retained was 79% of that found in the baseline, but with generally less than one tree species difference, this small decrease may be due to the difference in sampling intensities between the baseline and the FREP sample. CWD volume on the harvested areas was similar to that found in the retention patches, although the density of big CWD pieces (as compared to the retention patches) is the lowest of the six predominant northern interior subzones. In addition, the low amount of dispersed retention (0.8%) will provide only minor inputs of future CWD.

BWBSmw Consideration: Continue the good mix of retention patch locations (internal to, and on the edge of, the harvest boundary with minimal external and non-contiguous patches). Continue choosing retention areas that contain representative or higher densities of large trees. Increase the density of big CWD pieces left on cutblocks. Look for opportunities to leave some level of treed retention within every cutblock (even if a low density of dispersed trees). Increasing the amounts of dispersed standing retention could also enhance current internal-to-cutblock biodiversity and provide a source of material for future CWD.

COASTAL WESTERN HEMLOCK WET SUBMARITIME SUBZONE (CWHws) DISCUSSION

The CWHws subzone had retention on 67% of cutblocks (Table 1). Therefore, one-third of the sampled cutblocks had no retention (less than 0.5%), and these cutblocks made up 20% of the gross area from the FREP samples. Despite the high percentage of zero retention cutblocks, the average retention (at 17%) was the highest of the six predominant northern interior subzones reported here. Average windthrow was 14%, also high compared to the other predominant subzones.

Table 1 gives an overall summary of key biodiversity indicators within the six predominant subzones. The tree and CWD indicators are given as a percentage of average from the full FREP-sampled dataset compared to the average from the baseline timber cruise data (for the tree indicators) or retention patch data (for the CWD indicators).

Table 1. Summary of sampled biogeoclimatic subzones[a]

	Cutblock size (ha)		Retention (average)				Windthrow	Retention patch location in relation to harvest boundary (%)			Retention patches > 2 ha		FREP tree indicator average as percentage of average baseline value			CWD average in harvested areas as % of average in retention patches	
Subzone (sample size)	Average	Maximum	Total (%)	Patch (%)	Dispersed (%)*	% of cutblocks with retention[b]	Average (%)	Internal[c]	On edge[d]	External[e]	% of total number of retention patches	% of cutblocks with a > 2 ha patch	Large snags	Large trees	No. tree species	CWD volume per hectare	CWD big pieces per hectare
BWBSmw (76)	58	332	9.9	9.1	0.8	86.8	6.9	49	51	0	32	50	78	134	79	91	24
CWHws (33)	36	177	17.0	16.0	1.0	66.7	14.0	43	57	0	46	46	134	39	75	138	44
ESSFmv (38)	50	158	9.5	8.3	1.2	84.2	9.2	39	59	2	33	47	123	258	68	129	38
ICHmc (38)	38	133	15.2	11.6	3.6	76.3	6.6	38	62	0	37	42	69	34	79	129	54
SBSdw (63)	55	324	14.4	10.5	3.9	92.1	10.0	43	55	2	47	51	40	109	106	90	38
SBSwk (47)	44	261	14.9	11.5	3.4	74.5	12.6	42	53	4	25	45	33	87	77	80	26

[a] For subzone descriptions please go to: http://www.for.gov.bc.ca/hre/becweb/resources/classificationreports/subzones/index.html

[b] Blocks with 0.5% or more retention

[c] The internal patches provide areas of cover within the harvest cutblock, potentially allowing more movement of small animals and easier recruitment of understorey species throughout the cutblock.

[d] The edge patches have the potential of merging with forest cover outside of the cutblock, giving larger forested patches (even if temporarily); edge patches often supply more linear retention from stream riparian reserves, which can provide travel corridors.

[e] The external and non-contiguous retention patches are least preferred for stand-level biodiversity since there is little likelihood of providing direct ecologic benefits to the harvested area.

* Dispersed retention area is given as basal area equivalent area (i.e., a scaling down of the actual dispersed area). It can be thought of as converting dispersed retention to an equivalent amount of patch area retention. For example, if a dispersed area contains 20% of the pre-harvest basal area, then reduce the actual area by 80%. Because pre-harvest data did not exist, for comparison purposes we used the basal area from retention patches on the same opening. If no retention patches were available, we used the average basal area for all other retention patches in the same biogeoclimatic subzone.

The average density of large snags within retention areas was higher than the cruise baseline, however this was not a significant difference. The percentage of large retention patches was good (second highest of the six predominant subzones) at 46%, potentially contributing to the high percent retention. However, these large strata seemingly did not help in retention of a representative number of big trees (≥ 70 cm dbh live or dead), since the average density was low (i.e., at 39% of the cruise baseline). The retention of a variety of tree species representative of pre-harvest stands is good on the cutblocks having retention; however, the diversity of tree species is lowered significantly because of the large number of cutblocks with no retention. The density of big CWD pieces is significantly lower on the harvested CWHws areas compared to the retention patches.

CWHws Consideration: Continue the good practice of maintaining similar densities of large snags in retention areas compared to natural stands. Increase the percentage of harvested cutblocks that have trees retained. This may be as simple as including, rather than excluding, adjacent treed "default" retention (e.g., riparian areas) and thus ensuring these areas are tracked and protected through the corporate systems (M. Moran, Kalum Forest District, pers. comm.). A continuous improvement opportunity is to retain wildlife tree patches with higher densities of large trees for the site, preferably with densities closer to pre-harvest conditions. Consider and manage for windthrow risk when designing retention areas.

Figure 3. Peace Forest District, trembling aspen retention. Photo credit: Jessica Amonson.

ENGELMANN SPRUCE–SUBALPINE FIR MOIST VERY COLD SUBZONE (ESSFmv) DISCUSSION

Retention was found on 84% of the sampled cutblocks, resulting in an overall average retention of 9.5% (Table 1). Though this was the lowest average percentage of the six predominant northern interior subzones, there was good representation of large trees with densities higher (257%) than might be expected from pre-harvest conditions as represented by the cruise baseline. Tree species diversity is lower in the FREP-sampled retention compared to the cruise baseline. Frost hazard and brush hazard are both high in the ESSFmv and protection of advanced regeneration will minimize impact from both hazards (J. Amonson, Peace Forest District, pers. comm.). Leaving an overstorey of dispersed retention can provide frost protection to seedlings, as noted for hardwood overstorey by McCulloch and Kabzems (2009) and Delong (1997). Leaving larger CWD may also provide opportunity for obstacle planting in high snowfall areas and offer some protection against frost damage.

ESSFmv Consideration: Continue practices of maintaining areas with good densities of large trees. A continuous improvement opportunity is to retain three or more tree species on most cutblocks, inclusive of deciduous trees (see example of deciduous retention in Figure 3). Maintain some level of retention in most cutblocks and retain a higher density of big CWD pieces in the harvested areas.

INTERIOR CEDAR–HEMLOCK MOIST COLD SUBZONE (ICHmc) DISCUSSION

Retention was found on 76% of the FREP-sampled cutblocks (Table 1). Despite the 24% of cutblocks with no retention, the overall average ICHmc retention is fairly high at 15.2%. However, the quality of the retention, particularly the density of large trees, at 34.2% of the average from the baseline, is the lowest of the six predominant subzones. Average windthrow was a relatively low 6.6%. The quantity

ICHmc Consideration: Continue good CWD management with similar amounts of big pieces of CWD within the harvested areas and retention patches and good potential CWD recruitment from the dispersed retention. A continuous improvement opportunity is to retain a higher percentage of wildlife tree patches with large trees for the site in densities comparable to pre-harvest conditions. Increase the percentage of harvested cutblocks that have trees retained.

and quality of CWD was good, with the highest percentage of baseline amounts for density of large pieces of CWD found in the six predominant northern interior subzones. In addition, the relatively high amount of dispersed retention (3.6% basal area equivalent), should contribute to future CWD, as well as current habitat for internal wildlife tree users.

Figure 4. Fort St. James Forest District, dispersed retention.

SUB-BOREAL SPRUCE DRY WARM SUBZONE (SBSdw) DISCUSSION

Average retention in the SBSdw is 14%, and retention is present on 92% of the FREP-sampled cutblocks (Table 1), the highest percentage of cutblocks with retention on the six predominant subzones. At 10%, windthrow is a potential concern if valuable wildlife tree attributes are being lost. The density of large snags is potentially low, but the density of large trees (live and dead ≥ 40 cm dbh) is representative of pre-harvest conditions. Tree species diversity is being maintained, and the presence of valuable wildlife tree species (aspen, cottonwood, birch, and Douglas-fir) is higher in the FREP-sampled retention compared to the baseline. Where Douglas-fir is maintained in the FREP-sampled cutblocks, it is in dispersed retention for 90% of the cutblocks and in patch retention for 60% of the cutblocks. The density of large CWD pieces in the harvest areas is 38% of that found in the retention patches. Recruitment of CWD will come from the average 3.9% of dispersed retention maintained within the cutblocks (see example of dispersed retention in Figure 4).

SBSdw Consideration: Continue having retention on more than 90% of the cutblocks, and maintaining retention areas with representative densities of large trees and the full diversity of tree species. Continue maintaining high-value wildlife trees such as aspen, cottonwood, birch, and fir. Consider the drought risk for Douglas-fir if left as dispersed retention, and increase the amount of fir maintained in retention patches. A continuous improvement opportunity is to increase the densities of large CWD pieces within the harvest areas. Windthrow management, such as patch orientation, will continue to be important in this subzone, although it is acknowledged that trees killed by the mountain pine beetle will eventually fall down.

Figure 5. Mackenzie Forest District, mountain pine beetle impact. Photo credit: Deepa Tolia.

SUB-BOREAL SPRUCE WET COOL SUBZONE (SBSwk) DISCUSSION

Average retention on the SBSwk is 15% and 75% of cutblocks had retention (Table 1). Average density of large snags was 33% of what was found in the cruise baseline, the lowest of the six predominant subzones. The timing of the mountain pine beetle infestation and the density of pine are likely large contributors to this number.

The apparently low snag retention should be considered along with the SBSwk baseline having the highest average density of snags at 73 large snags per hectare (see example, figure 5). For comparison, the ICHmc and SBSdw both have an average baseline density of 42 large snags per hectare. Average density of large snags in the SBSwk retention was therefore similar to the retention within the other predominant ecosystems. An emphasis of retention on live and likely non-pine trees is appropriate for mountain pine beetle salvage; however, the high ecological value of dead wood would support leaving some lower levels of dead pine (with large snags) on most salvage cutblocks.

Average windthrow was 12.6%. The density of big trees (≥ 40 cm dbh live or dead) is 87% of the cruise baseline (marginally significant difference). The density of big pieces of CWD in the harvested areas is 26% of what was found in the retention patches. Four percent of patches were located external and non-contiguous with the cutblock boundary.

SBSwk Consideration: Continue good mix of both patch and dispersed retention, and continue leaving large trees for the site on most cutblocks. Avoid the use of external non-contiguous retention patches for stand-level retention. A continuous improvement opportunity is to increase the density of large CWD on the harvested areas. Increase the percentage of cutblocks containing retention, even if low levels of dead pine. Windthrow management, such as patch orientation, will continue to be important in this subzone, although it is acknowledged that dead trees will eventually fall down.

SUMMARY

Various harvesting and retention outcomes are evident throughout the Northern Interior Forest Region. In the six predominant subzones reported on here, the average retention ranges from 9.5% in the ESSFmv to 17% in the CWHws. The retention quality indicators also vary greatly. For example, the FREP data collected in the ESSFmv and the SBSdw showed consistently high biodiversity quality (i.e., equivalent or higher than baseline) for two of the three tree indicators presented (large snags, large trees, and number of tree species). In comparison, the FREP data collected in the ICHmc and SBSwk subzones consistently showed lower biodiversity quality for all three tree biodiversity indicators. Mountain pine beetle mortality affects the large snag indicator the most, and maintenance of pre-harvest densities of large snags may not be appropriate in salvage areas. However, the absence of any large snags within a significant portion of the retention cutblock data is a concern. This is indicated by very low median numbers of large snags for the FREP-sampled retention cutblocks, and is seen in the BWBSmw, SBSdw, and SBSwk.

Even in areas of pure pine, some pine retention after salvage is recommended for habitat and biodiversity purposes (Bunnell et al. 2004).

Without knowledge of landscape-level retention levels and quality, the question of whether the actual retention (or a quality-weighted retention) is sufficient within a particular area or subzone can only be answered partially. However, 15% stand-level retention has been suggested as a basic amount for the habitat needs of less sensitive to harvesting forest-dwelling birds (Huggard and Bunnell 2007). This level, not considering any quality weighting, was obtained as an average in three of the predominant subzones.

A consistent weakness in most subzones is the low density of large CWD pieces. This is particularly an issue within the BWBSmw, ESSFmv, SBSdw, and SBSwk subzones. It is less of an issue in the CWHws or ICHmc. In the ICHmc in particular, higher densities of big CWD pieces (not significantly different than found within retention patches) and dispersed treed retention potentially providing CWD recruitment combine to give better CWD quality or potential quality.

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