Coastal Forest Region: Summary of Stand-level Biodiversity Sampling

FREP

Extension Note #21

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INTRODUCTION

The purpose of this extension note is to improve understanding of the 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. The key audience for this note is natural resource management professionals and managers. This analysis provides an overview of the Coastal Forest Region as a whole with a more detailed look at its predominant biogeoclimatic subzones. The data is from cutblocks harvested between 1997 and 2008 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 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.

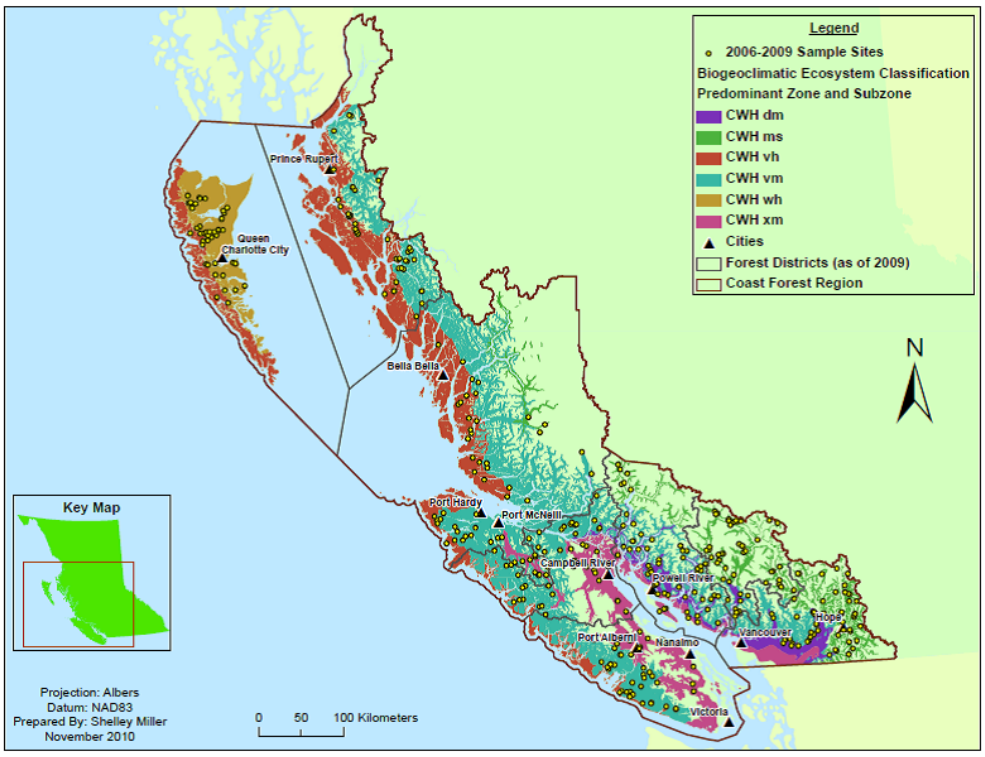

Figure 1. *FREP stand-level biodiversity assessment location and predominant subzones.*

The FREP Mission:
To be a world leader in resource stewardship monitoring and effectiveness evaluations; communicating science-based information to enhance the knowledge of resource professionals and inform balanced 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*

BRITISH COLUMBIA

GENERAL DESCRIPTION OF COASTAL FOREST REGION SAMPLE CUTBLOCKS:

- 405 cutblocks sampled
- 93% of cutblocks had retention (> 0.5% retention)
- 9006 hectares (ha) total gross area
- 15.5% (1399 ha) of patch (long-term) retention
- 7.3% (658 ha) of dispersed retention (basal area equivalent (BAE)[1])
- 22.8% average retention
- 34% of retention constrained[2]
- 18.4% of patches are greater than 2 ha
- Average of 4.7 ecological anchors/ha[3] of retention, patch or dispersed (range 0 – 203)
- Average of 7.6% windthrow in the 376 cutblocks with retention
- 36.8% of patches internal to cutblock boundaries; 62.2% on the edge of the cutblocks; and 3.6% external and non-contiguous to the cutblocks[4]
- Invasive plant species were found on 20% of the cutblocks.

1 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 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%. Since we do not have pre-harvest data, the basal area from retention patches on the same opening, or if no patches, the average basal area for all other retention patches in the same BEC subzone, are used for comparison. The actual area covered with dispersed retention was 2,235 hectares.

2 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.

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

4 This tally may include patches designated as temporary retention and likely to be harvested prior to rotation end.

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		Tree indicator average as percentage of average baseline[f]			CWD average in harvested areas as % of average in retention patches	
Subzone (sample size)	Average	Maximum	Total (%)	Patch (%)	Dispersed (BAE*) (%)	% 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[g]
CWHms (47)	21.3	137.2	32.9	18.3	14.6	93.6	6.4	33	66	1	17	42	100	59	88	167	80
CWHxm (35)	15.1	50.3	22.4	17.9	4.5	88.6	4.5	43	53	4	16	34	27	115	78	87	22
CWHdm (46)	19.7	127.8	19.1	11.6	7.5	95.6	5.6	46	52	2	16	30	62	91	80	112	27
CWHvm (138)	26.8	70.6	20.6	16.2	4.4	92	10.2	47	50	3	23	51	85	57	79	108	52
CWHwh (36)	22.3	54.4	15.1	15.1	0.0	94.4	10.6	18	73	8	28	42	56	60	91	141	31
CWHvh (52)	22.7	89.4	32.9	13.3	19.6	92.0	6.6	40	52	8	23	42	69	44	75	156	76

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 harvested cutblock, potentially allowing more movement of small animals and easier recruitment of understory species throughout the cutblock.

d The edge patches may merge with forest cover outside of the cutblock, giving larger forested patches (even if temporarily); edge patches often supply more linear retention from 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.

f The tree indicators presented are; large snags (dead trees ≥ 10 m tall and ≥ 30 cm diameter breast height (dbh)), large diameter trees (live and dead trees ≥ 70 cm dbh) and number of tree species found on the cutblock.

g Big CWD pieces are ≥ 20 cm diameter and ≥ 10 m long

COASTAL WESTERN HEMLOCK DRY MARITIME SUBZONE (CWHdm) DISCUSSION

The CWHdm subzone had retention within 96% of the sampled cutblocks, with an overall average retention of 19.1%. Average windthrow was 5.6%, and there was a good mixture of retention patch locations both internal to harvest boundary and on the edge, with two retention patches external and non-contiguous to the harvest boundary.

The average density of large snags in the FREP-sampled retention was 62% of the cruise baseline, with the major difference in the data distribution being a high percentage (66%) of the retention data with zero large snags. The average density of large trees was not significantly different than the baseline. The average number of tree species retained was also very similar to that found in the baseline. Volume of CWD on the harvested areas was similar to that found in the retention patches, though the density of big CWD pieces (as compared to the retention patches) is significantly lower than the baseline (27%). However, the average 7.5% dispersed retention will provide inputs of future CWD in the 33% of the FREP-sampled cutblocks that contained dispersed retention.

CWHdm 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 containing representative or higher densities of large trees and tree species. A continuous improvement opportunity is to increase the density of large snags retained, in particular by decreasing the numbers of cutblocks which have zero large snags. Increase the density of big CWD pieces left on cutblocks.

COASTAL WESTERN HEMLOCK MOIST SUBMARITIME SUBZONE (CWHms) DISCUSSION

The CWHms subzone had retention within 94% of the sampled cutblocks, with an overall average retention of 32.9%. Average windthrow was 6.4%. The average density of large snags in the FREP-sampled retention was similar to the cruise baseline, as was the overall density distribution of all the sampled cutblocks. The average density of large trees was 59% of the baseline average. The average number of tree species retained was very similar to that found in the baseline. Density of big CWD pieces (as compared to the retention patches) is fairly high, compared to other subzones, at 65% of what was found in the patch retention. The average 14.6% dispersed retention may also provide future inputs of CWD.

CWHms consideration

Continue choosing retention areas containing representative or higher densities of large snags and numbers of tree species. Continue maintenance of good current and potential future CWD, both in terms of volume and density of big pieces of CWD. A continuous improvement opportunity is to increase the retention density of large trees for the site (e.g. ≥ 70 cm dbh live or dead).

COASTAL WESTERN HEMLOCK VERY WET HYPERMARITIME SUBZONE (CWHvh) DISCUSSION

The CWHvh subzone had retention within 92% of the sampled cutblocks, with an overall average retention of 32.9%. Average windthrow was 6.6%. Eight percent of the retention patches are external and non-contiguous with the harvest boundary. This is the highest percentage of all the six predominant subzones. The average density of large snags in the FREP-sampled retention was 69% of baseline, with the major difference in distribution, being the higher percentage of the FREP cutblocks with zero large snags found, compared to the baseline cutblocks. The average density of large trees was 44% of the baseline. The average number of tree species retained was 75% of baseline. All three of these tree indicators were significantly lower in the FREP-sampled cutblock retention compared to the cruise baseline, though a portion of the decrease in tree species is likely due to differing sampling intensities in the two populations. The volume of CWD on the harvested areas was higher than in retention patches. Density of big CWD pieces (as compared to the retention patches) is high (compared to all the predominant subzones) and considered not significantly different at 76% of what was found in the patch retention (see figure 1). The average 19.6% dispersed retention may provide inputs of future CWD on the 29% of the blocks with dispersed retention.

CWHvh consideration

Overall retention is high in the CWHvh though retention quality could be improved, in particular for the density of large trees retained on site. CWD quantity and quality is high compared to the other subzones. There is also a large amount of dispersed retention, potentially providing for CWD recruitment in the future.

Figure 1: *North Island district, high densities of big CWD. Photo credit: Paul Barolet*

Figure 2: *South Island district, windthrow on edge of retention patch. Photo credit: Thomas Chen*

COASTAL WESTERN HEMLOCK VERY WET MARITIME SUBZONE (CWHvm) DISCUSSION

The CWHvm subzone had retention within 92% of the sampled cutblocks, with an overall average retention of 20.6%. Average windthrow was 10.2%, higher than most of the other predominant subzones (see figure 2). There is a good mix of both internal retention patches and retention patches on the edge of the harvest boundary, with three percent of the retention patches being located external and non-contiguous to the harvest cutblock. The average density of large snags in the FREP-sampled retention was 85% of baseline (not significantly different). The average density of large trees was low, at 57% of the baseline. The average number of tree species retained was not significantly different at 79% of baseline. Volume of CWD on the harvested areas was equivalent to that found in retention patches. Density of big CWD pieces is 54% of what was found in the patch retention.

CWHvm consideration

Continue good mixture of retention patches both internal and on the edge of cutblock, with few retention patches external and non-contiguous to the cutblock. Increase the density of large trees for the site within the cutblock retention.

COASTAL WESTERN HEMLOCK WET HYPERMARITIME SUBZONE (CWHwh) DISCUSSION

The CWHwh subzone had retention within 94% of the sampled cutblocks, with an overall average retention of 15.1%. Average windthrow was 10.6%, the highest of these six predominant coastal subzones. Eight percent of the retention patches are external and non-contiguous with the harvest boundary, this is the highest percentage of all the six predominant subzones, and there is also a much lower percentage of internal retention patches (18% of patches internal), compared to the other predominant subzones. The average density of large snags in the FREP-sampled retention was 56% of baseline. The average density of large trees (see figure 3) was 60% of the baseline. The average number of tree species retained was similar to the baseline. Volume of CWD on the harvested areas was higher than found in retention patches. Density of large CWD pieces in the harvest areas is low at 15% of what was found in the patch retention, and the absence of dispersed retention will minimize input of future CWD.

CWHwh consideration

Continue the good practise of maintaining the full range of tree species within retention. Look for retention opportunities that will increase densities of large snags and large trees retained on cutblocks. Decrease the use of retention patches that are external and non-contiguous to the cutblock boundary and increase the numbers of internal retention patches. Increase the density of big pieces of CWD maintained in the harvested areas of cutblocks.

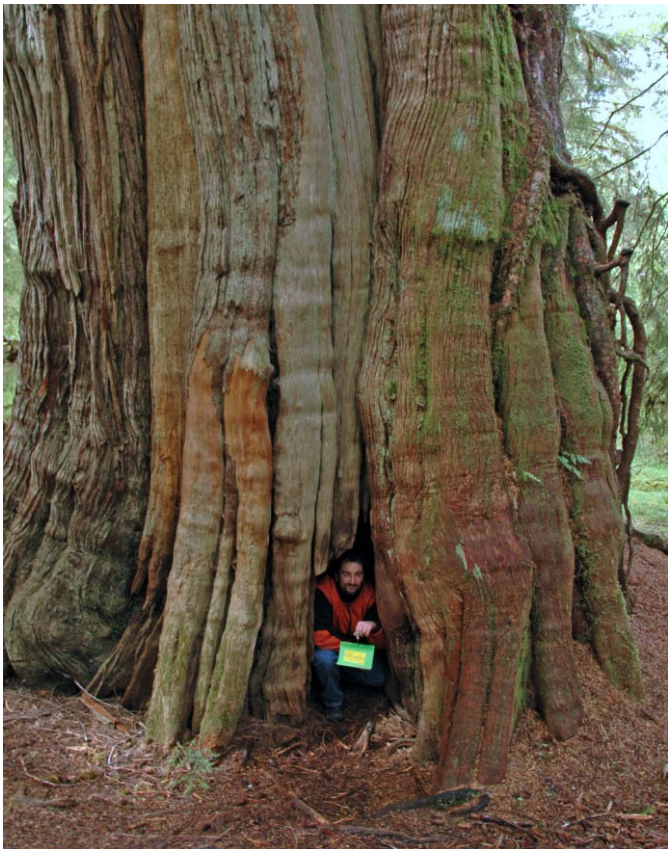

Figure 3: *Haida Gwaii district, large cedar tree. Photo credit Lloyd Davis*

COASTAL WESTERN HEMLOCK VERY DRY MARITIME SUBZONE (CWHxm) DISCUSSION

The CWHxm subzone had retention within 89% of the sampled cutblocks, with an overall average retention of 22.4%. Average windthrow was 4.5%, the lowest of these six predominant coastal subzones. The average density of large snags in the FREP-sampled retention was 27% of baseline. The density of large trees is similar to baseline. The number of tree species retained was 78% of the baseline (not significantly different). Volume of CWD on the harvested areas was similar to that found in retention patches. Density of large CWD pieces (as compared to the retention patches) is lowest of the six subzones at 11% of what was found in the patch retention, though the presence of dispersed retention on 51% of the cutblocks (overall average 4.5%) may provide a future input of CWD.

CWHxm consideration

Continue the good practise of maintaining retention areas with densities of large trees and numbers of tree species similar to the pre-harvest stands. Look for retention opportunities that will increase densities of large snags. Increase the density of big pieces of CWD maintained in the harvested areas of cutblocks.

SUMMARY

Various harvesting and retention outcomes occur throughout the Coastal Forest Region. In the six predominant subzones reported on here, the average retention ranges from 15.1% in the CWHwh to 32.9% in the CWHms and CWHvh. The retention quality indicators also vary greatly. For example, the FREP data collected in the Coastal Western Hemlock (CWH) dm, ms, and xm subzones showed consistently high biodiversity quality (i.e., equivalent or higher than baseline) for two of the three tree indicators presented (e.g. two of; large snags, large trees and number of tree species). In comparison, the FREP data collected in the CWHvh subzone consistently showed lower biodiversity quality for all three tree biodiversity indicators.

The question of whether the actual retention or a quality-weighted retention is sufficient within a particular area or subzone can only be partially answered without knowledge of landscape-level retention levels and quality. However, to provide basic levels of stand-level retention for habitat needs of some less-sensitive (to harvesting) forest-dwelling birds a 15% stand-level retention has been suggested (Huggard and Bunnell 2007). When considering the impact of quality (see discussion in FREP Report #30), this level is obtained as an average in five of the six predominant subzones. Without considering quality weighting, the 15% average is seen in all six predominant subzones.

Overall tree retention (patch and dispersed) and CWD total volume retention, is high in the CWHms and CWHvh subzones. Higher relative densities of big pieces of CWD are also seen in those two subzones, compared to other predominant subzones. CWD total volume in the harvested areas of the cutblocks was equal or higher than that found within retention patches for all the predominant subzones. There are low levels of big CWD pieces in the CWHdm, wh and xm, though there is opportunity for future CWD recruitment in the dm and xm with dispersed standing tree retention and higher levels of patch retention.

The FREP-sample for stand-level biodiversity is randomly chosen harvested cutblocks. This relates to the timber cruise baseline (for the tree indicators) which comes from pre-harvest cutblocks which have current digital cruise plot information. This methodology should allow for representative cutblocks for both baseline and FREP within a BEC subzone where sample size is sufficient (e.g. above 30 blocks). Future analysis is possible with improved baseline data, in particular if paired timber cruise data can be obtained.

REFERENCES

Huggard, D.J. and F.L. Bunnell. 2007. Stand-level retention and forest birds: A synthesis of studies. Centre for Applied Conservation Research, University of British Columbia, Vancouver, B.C.