

Post-harvest Coarse Woody Debris sampling
in the Fort St. James Forest District



Submitted to:

Canadian Forest Products Ltd.
Administration Center
5162 Northwood Pulpmill Road
Prince George, B.C.
Attention: **Janine Larmand**, RPF
Janine.Larmand@canfor.com

Submitted by:

Manning, Cooper, and Associates Ltd.
Northern Interior Office
#211-154 Quebec Street
Prince George, B.C. V2L 1W2
Tel: 250.562.7811
Contact: **Aaron Deans**
adeans@manningcooper.com

May 30, 2007

EXECUTIVE SUMMARY

A total of 27 CWD transects were surveyed within seven different cutblocks located throughout the Mossvale and lower Carrier–Operating areas of the Fort St. James Forest District (Supply Block C). All sample sites were within mesic SBSmk1 ecosystems. The average total volume (m^3/ha) was calculated for each site and compared to Indicator 23 for CWD and the natural range of CWD volume variability for mesic sites as reported in the Fort St. James SFMP (Version 3.4).

All sites sampled fell within the natural range of CWD variability defined for SBS mesic locations ($1.37\text{-}932.14 \text{ m}^3/\text{ha}$; FSJ SFMP 2006). In addition to the overall average total volume, which was $150.8 \text{ m}^3/\text{ha}$ (± 33.3), the average total volume for DBH between 7.5 – 30cm (m^3/ha) and volume of CWD pieces greater than 30 cm in diameter were summarized and compared to benchmark data collected within moist unharvested SBS stands throughout the Prince George TSA in 2006 (MCA 2007).

TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
TABLE OF CONTENTS.....	ii
LIST OF TABLES.....	iii
LIST OF FIGURES	iii
1. INTRODUCTION	1
1.1 Background.....	1
1.2 Objectives	1
2. STUDY AREA	2
2.1 Project Study Area	2
2.2 Biogeoclimatic Ecological Classification.....	2
3. METHODS	3
3.1 Sampling Design.....	3
3.2 Sample Methods.....	3
3.3 Data Analysis	5
4. RESULTS	6
5. DISCUSSION.....	6
6. CONCLUSION.....	6
7. LITERATURE CITED	7

LIST OF TABLES

Table 1. Natural levels and range of CWD volumes in unharvested SBS stands in BC forests....	1
Table 2. Cutblocks sampled during the 2007 CWD re-assessment in the Fort St. James FD.	3
Table 3. Sample site location details for each cutblock surveyed ^{*1}	4
Table 4. Calculated average total volumes \pm standard errors for all cutblocks surveyed.....	6

LIST OF FIGURES

Figure 1. The Prince George timber supply area.	2
--	---

1. INTRODUCTION

1.1 Background

As an integral component of the sustainable forest management planning process (FSJ SFMP Version 3.4, 2006), monitoring and reporting on Criteria & Indicators provides an opportunity for adaptive management techniques to be realized and developed in the forested landscape context. Indicator 23 of the Fort St. James Sustainable Forest Management Plan defines the goals and objectives with respect to the management of coarse woody debris (CWD).

Recognized as an important stand-level habitat element in forested landscapes, CWD provides for shelter and foraging substrate and as travel routes for amphibians, birds, small mammals and furbearers throughout their respective territories. CWD also provides a substrate for numerous species of invertebrates, fungi and lichen, as well as returning nutrients during decomposition to the forest floor (Lofroth 1998, Stevens 1997).

Indicator 23 addresses the Canadian Standards Association (CSA) parameters for maintaining and enhancing forest ecosystem condition and productivity among other Sustainable Forest Management objectives for Coarse Woody Debris. Indicator 23 states: '*Percent of audited cutblocks harvested where post harvest CWD levels are within the acceptable natural range of variability (as stated in m³/ha).*'

One goal of Indicator 23 is to maintain CWD volumes post-harvest within the natural range of variability 100 percent of the time. The intention of cutblock audits is to assess at least 50% of the cutblocks harvested during the reporting period. Results of each assessment will be compared to the benchmarks identified in the table below. In the FSJ FD the average volume of CWD in the Sub-Boreal Spruce (SBS) Zone is suggested to be 222.78 m³/ha on mesic site types and ranges from 1.4 – 932.1 m³/ha (Table 1).

Table 1. Natural levels and range of CWD volumes in unharvested SBS stands in BC forests.

BEC Zone	Moisture	Samples	Average Total Volume (m ³ /ha)	Range (m ³ /ha)
SBS	Mesic	954	222.78	1.37 - 932.14

Source: Adapted from the Fort St. James SFMP, Version 3.4, March 2006.

1.2 Objectives

The objective of this project was to assess and report the levels and qualities of CWD in stands harvested in the summer and winter of 2006. Specific project objectives are:

1. Conduct CWD sampling in 7 cutblocks harvested in the summer and winter of 2006 within the Mossvale and lower Carrier–Operating areas of the Fort St. James Forest District.
2. Compare CWD volume estimates to those defined as the natural range of variability for mesic stands in the Fort St. James Sustainable Forest Management Plan (Version 3.4).

3. METHODS

3.1 Sampling Design

Sampling design followed the Forest and Range Practices Act (FRPA) Resource Evaluation Program standards for Stand-level Biodiversity Monitoring (BC MoE 2006a) in combination with Monitoring and Reporting Procedures reported for Indicator 23 and the FSJ SFMP (2006). The FREP Protocol for Stand-level Biodiversity Monitoring (Version 2.0, April 28, 2006) and the Big Block Sampling addendum (June 28, 2006) for cutblocks greater than 100 ha in size (BC MoE 2006b) was used to determine the number of plots required within each of the seven cutblocks sampling areas (Densmore et al. 2005).

Since the majority of cutblocks sampled were smaller than 100 ha in size a sampling effort of three sites per cutblock was deemed adequate for CWD assessments in most blocks (Table 2). The one cutblock (CAR438) that was greater than 100 ha had a total of 9 sample sites; calculated using the Big Block Sampling addendum for determining the number of sample sites. The addendum states that the number of sample sites in harvest areas should be one per every 20 ha to a maximum of 15 plots (BC MoE 2006b).

Table 2. Cutblocks sampled during the 2007 CWD re-assessment in the Fort St. James FD.

Block	Season Harvested	License	Permit	Gross Area (ha)	# of Plots	BEC Zone	Moisture
MOS14A	Summer '06	A40873	B38	52.8	3	SBS	Mesic
CAR425	Summer '06	A40873	B34	57.3	3	SBS	Mesic
CAR446	Summer '06	A40873	B40	75.6	3	SBS	Mesic
CAR447	Summer '06	A40873	B40	67.9	3	SBS	Mesic
CAR438	Winter '06	A40873	B33	188.6	9	SBS	Mesic
CAR427	Winter '06	A40873	B37	45.2	3	SBS	Mesic
CAR444	Winter '06	A40873	B44	75.1	3	SBS	Mesic

3.2 Sample Methods

For each cutblock sampled candidate sites were identified and UTM coordinates estimated using operational maps prior to going into the field. Two additional candidates identified in all assessment areas facilitated surveyor avoidance of large burn piles or ephemeral water resulting from recent snow-melt (that may have occurred at selected sample site locations).

Post-harvest CWD sample sites were dispersed within the net area to be reforested (NAR) of blocks only. Roadside work areas were excluded from randomized candidate site selections. Using the FREP protocols a CWD line-transect (15 m) was established from each plot centre and the bearing was recorded. A second line transect of 15 m was then established at a 90° angle for the first. Data was recorded only for all pieces of CWD (>7.5 cm dbh) that were found to intersect the line transect.

Data collection for CWD included species, diameter, length, and decay class. Only diameter of pieces at the point of intersection was used in the line-transect equation to calculate volume

(quantity in m³/ha; Van Wagner 1968), however, length estimates are collected as a qualitative indicator of CWD – long pieces are generally better for habitat and decay at a slower rate. Although the FSJ SFMP Indicator 23 Monitoring Procedures states that all CWD pieces should be a minimum of 5 m in length, in this assessment, pieces <5 m in length that intersected the transect were also tallied.

Plot centres were randomly placed within cutblocks following FREP methodologies and using field operations and ecological unit maps provided by Canfor Ltd. Garmin 76 handheld Global Positioning System (GPS, Olathe KS) was used to record location data and UTM coordinates, elevation, and plot name was recorded at each sample site (BC MoE 2006a). Photographs originating from plot centre in all four cardinal directions were taken with a digital camera. Sample plot images are attached to this report. All CWD sampling occurred under snow free conditions.

Table 3. Sample site location details for each cutblock surveyed ^{*1}.

Site	Licence	BEC Subunit	UTM E	UTM N
CAR446-01	A40873	SBSmk1 01/100	466471	6027189
CAR446-04	A40873	SBSmk1 01/100	466824	6026991
CAR446-03	A40873	SBSmk1 01/100	466543	6027254
CAR438-02	A40873	SBSmk1 08/100	478653	6044155
CAR438-03	A40873	SBSmk1 05/100	478215	6044072
CAR438-04	A40873	SBSmk1 05/100	477624	6043557
CAR438-05	A40873	SBSmk1 05/100	478052	6043333
CAR438-06	A40873	SBSmk1 01/100	477694	6043834
CAR438-07	A40873	SBSmk1 05/100	478749	6043191
CAR438-08	A40873	SBSmk1 01/100	478175	6043662
CAR438-09	A40873	SBSmk1 01/100	478671	6043573
CAR438-10	A40873	SBSmk1 05/100	478630	6042977
CAR438-11	A40873	SBSmk1 01/100	478712	6043849
CAR444-01	A40873	SBSmk1 01/100	476477	6034577
CAR444-03	A40873	SBSmk1 01/100	476589	6034389
CAR444-04	A40873	SBSmk1 01/100	476031	6034615
MOS14A-01	A40873	SBSmk1 05/100	472997	6020597
MOS14A-02	A40873	SBSmk1 05/100	472358	6020582
MOS14A-03	A40873	SBSmk1 05/100	472726	6020800
CAR425-03	A40873	SBSmk1 01/08	462077	6027279
CAR425-04	A40873	SBSmk1 01/08	462129	6027611
CAR425-05	A40873	SBSmk1 01/08	462360	6027575
CAR427-02	A40873	SBSmk1 01/100	463548	6029036
CAR427-03	A40873	SBSmk1 05/100	463050	6028624
CAR427-05	A40873	SBSmk1 01/100	463259	6028780
CAR447-01	A40873	SBSmk1 01/100	468322	6027782
CAR447-04	A40873	SBSmk1 05/100	468535	6027463
CAR447-04	A40873	SBSmk1 05/100	468535	6027463
CAR447-05	A40873	SBSmk1 01/100	468311	6028044

^{*1} Scanned copies of field cards and raw data are attached to this report.

3.3 Data Analysis

All CWD from this re-assessment was entered into Microsoft Excel from field cards and summarized.

Volume of CWD (cubic metre per hectare, m³/ha.) was calculated using Van Wagner's (1968) equation for a site using the line-intersect method:

$$V = \frac{\pi^2 * \Sigma(d^2)}{8 * L}$$

Where: V is volume per unit area (m³/ha),
d is piece diameter at intersection (cm),
L is slope-corrected length of sample line (m).

Average total volume of CWD was calculated using the mean of all sample site volumes in each cutblock. Average volume by site was tallied into 3 different volume classes: total volume, 7.5 – 30 cm volume, and >30 cm volume. Pieces within the volume class >30 cm were considered 'large' as established in previous studies (e.g., Adams 2002; MCA 2007).

4. RESULTS

The combined average total volume of CWD for all seven cutblocks was found to be 150.8 m³/ha (± 33.3) and ranged from 80.6 m³/ha on CAR447 to 338.9 m³/ha on CAR446 (Table 4). The average total volume for pieces 7.5 – 30 cm in diameter ranged from 53.8 m³/ha to 264.5 m³/ha with an overall mean of 122.9 m³/ha (± 25.6). The mean volume of large (>30 cm dbh) CWD pieces in sites sampled was 27.9 m³/ha (± 8.6), with a high of 74.4 m³/ha (± 15.2) found in cutblock CAR446.

Table 4. Calculated average total volumes \pm standard errors for all cutblocks surveyed.

Site	# of Samples	Average Total CWD Volume (m ³ /ha \pm std. err.)	Average Total Volume for DBH 7.5 - 30cm (m ³ /ha \pm std. err.)	Average Total Volume for DBH > 30cm (m ³ /ha \pm std. err.)
MOS14A	3	99.74 \pm 8.1	99.74 \pm 8.1	0.00 \pm 0.0
CAR425	3	164.91 \pm 56.3	133.19 \pm 24.8	31.72 \pm 31.7
CAR446	3	338.93 \pm 66.8	264.55 \pm 54.9	74.38 \pm 15.2
CAR447	3	80.63 \pm 30.2	53.75 \pm 19.6	26.88 \pm 13.5
CAR438	9	136.46 \pm 16.0	112.87 \pm 14.9	23.59 \pm 8.1
CAR427	3	95.97 \pm 25.5	78.21 \pm 8.0	17.77 \pm 17.8
CAR444	3	138.89 \pm 22.0	118.04 \pm 3.6	20.85 \pm 20.8
Overall	27	150.79 \pm 33.3	122.91 \pm 25.6	27.88 \pm 8.6

5. DISCUSSION

All sites except CAR446 fell within the range determined in 2006 during the establishment of CWD benchmarks for the PG TSA (23.09 – 189.86 m³/ha; MCA 2007). The overall average volume was evidently lower than the average volume (222.78 m³/ha) for unharvested SBS stands in mesic site types (Table 1; FSJ SFMP 2006). However, the overall average volume appeared greater than benchmark volumes established for mesic SBS stands throughout the PG TSA in 2006 (107.8 m³/ha \pm 18.0; MCA 2007).

All cutblocks sampled during this re-assessment had volumes of large diameter pieces that were greater than CWD benchmarks (MCA 2007) for corresponding ecotypes, except for MOS14A, which may have had relatively fewer large diameter trees present on site prior to harvesting. Additionally, many pieces were found to be greater than 5 m in length and considerable amounts were longer than 15 m.

6. CONCLUSION

100% of cutblocks sampled in this study met the target level of CWD retention during forest operations as defined by Indicator 23 for CWD in the Fort St. James Sustainable Forest Management Plan (Version 3.4; 2006).

7. LITERATURE CITED

- Adams, I. 2002. Coarse woody debris in the East Kootenay region. Final Report for Tembec Industries, B.C. Division, Cranbrook, B.C.
- BC MoE 2006a. Protocol for Stand-level Biodiversity Monitoring: Steps for field data collection and administration. FRPA Resource Evaluation Program. BC Min. For. and BC Min. Water, Land and Air Protect. URL: [Indicators Biodiversity-Protocol for Stand-level Biodiversity Monitoring.pdf](#)
- BC MoE 2006b. Indicators Biodiversity Addendum for Stand-level Biodiversity Monitoring. FRPA Resource Evaluation Program. BC Min. For. and BC Min. Water, Land and Air Protect. URL: [Indicators Biodiversity-Addendum for Stand-level Biodiversity Monitoring 28-Jun-06.pdf](#)
- Densmore, N., R. Thompson and P. Bradford. 2005. Protocol for stand-level biodiversity monitoring: Steps for field data collection and administration. FRPA Resource Evaluation Program. BC Min. Forests, BC Min. Water, Land and Air Protection, and BC Min. Sustain. Resource Manage., Victoria, BC. June 2005.
- FSJ SFMP 2006. Fort St. James Sustainable Forest Management Plan, Version 3.4. March 2006. 199pp. Url: http://www.for.gov.bc.ca/ftp/TSN/external/!publish/EMS2/SFM/FSJ_SFMP.pdf
- Lofroth, E. 1998. The dead wood cycle. *In* Conservation biology principles for forested landscapes. J. Voller and S. Harrison (eds.). UBC Press, Vancouver, BC. pp. 185-214.
- Manning, Cooper and Associates Ltd. 2007. Establishing CWD Benchmarks in the Prince George Timber Supply Area. Forest Investment Account report prepared for Canadian Forest Products Ltd. 22pp.
- Meidinger, D., J. Pojar, and W.L. Harper. 1991. Chapter 14: Sub-boreal spruce (SBS) zone. Page 209-221 *In*: Meidinger, D. and J. Pojar. (Eds.) Ecosystems of British Columbia. B.C. Ministry of Forests. 330 pp.
- Stevens, V. 1997. The ecological role of coarse woody debris. Working Paper 30. Ministry of Forests Research Program. B.C. Ministry of Forests.
- Van Wagner, C.E. 1968. The line intersect method in forest fuel sampling. *Forest Science* 14(1): 20-26.