

DRAFT

Mule Deer Winter Range Harvest Assessments

Monitoring Study:

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Submitted:

February, 2006

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1. INTRODUCTION

In 2004 the Cariboo-Chilcotin Land Use Plan (CCLUP) Mule Deer Working Group prepared a mule deer winter range monitoring protocol (MDWG, 2004). This 'Monitoring Document' was borne out of the recognition that a sound monitoring program is required to ensure that forest management activities on mule deer winter ranges (MDWR) are being conducted in accordance with CCLUP guidance documents. The protocol focuses on monitoring six high priority indicators developed to indicate the quality of harvesting practices in relation to winter range habitat elements. Results of field monitoring surveys are then compared against objectives set out in the CCLUP Mule Deer Strategy.

This report presents results, discussion and recommendations of a field study using the monitoring protocol and conducted on 21 harvested sites within Cariboo-Chilcotin mule deer winter ranges.

2. STUDY SCOPE AND AREA:

CCLUP Mule Deer Winter Range (MDWR) guidance documents have been in place since 2000 (Dawson et. al., 2000; 2002). Most harvesting in mule deer winter ranges since then has targeted dead and dieing, mountain pine beetle (MPB) infested lodgepole pine. The scope of this study was to monitor and assess recent (since 2000) MPB harvesting in mule deer winter ranges and evaluate it against guidance of the Cariboo-Chilcotin Mule Deer Winter Range Strategy. This guidance covers all mule deer winter ranges in the 100 Mile House, Central Cariboo, Chilcotin, and Quesnel Timber Supply Areas (TSAs) as well as one winter range at the southern end of the Prince George TSA whose forests have historically been harvested by Quesnel-based forest licensees.

The general location of all sample sites is provided in the accompanying Timber Supply Area Maps in Appendix 1.

3. STUDY OBJECTIVES:

This study had three primary objectives:

- To determine whether MPB harvesting is occurring in a manner consistent with the Objectives set out in the *Management Plan for Shallow and Moderate Snowpack Zones* (Dec. 15, 2002) and guidance from the *Recommended Interim Management Guidelines for Mule Deer Winter Range* (Nov. 14, 2000);
- To prepare a report on the findings, and in particular, report on any indications harvests may be falling short of meeting the Objectives and guidance; and,
- If findings point to potential shortfalls:
 - a) provide recommendations for more focused, future assessments that could confirm the existence of the observed potential shortfalls;
 - b) provide recommendations (e.g. silvicultural or harvesting practices recommendations) that could in turn be used to provide informal feedback to licensees and agency personnel who are actively managing MDWR; and,
 - c) provide recommendations that might be used in refining Objectives and/or guidance.

4. METHODS:

This study was conducted using the methodology recommended by the Mule Deer Working Group in, *Habitat Monitoring for Shallow and Moderate Snow-pack Mule Deer Winter Ranges* (Monitoring Document) (MDWG, 2004).

4.1. Pre-field Phases:

Pre-field Information Collection

The first phase of the study was to develop a complete list of all blocks harvested on MDWR between Jan. 2001 and Sept. 2005 that had a lodgepole pine component of not less than 10% and which were harvested to control MPB or salvage MPB-infested timber.

Requests to the range of licensees as well as Ministry of Forests across the Cariboo Chilcotin region were made by telephone first, then followed up with written requests by email, and in most cases with an in-person office visit. Initially, it was thought that this process would be exhaustive and provide a complete list of harvesting activities in the region during the specified time-period. For three main reasons this was not to be the case:

- ◆ lack of response from some licensees despite repeated telephone calls and/or emails;
- ◆ inability of licensees to devote resources to fulfilling requests;
- ◆ harvesting information was not up to date or not kept in a form that allowed for straightforward inclusion in the study.

For those cases where licensees were unable to comply with the information requests their development plan amendment submissions or the Consolidated Development Plan Maps were reviewed at the MOF offices in Williams Lake and Quesnel respectively. The development plan amendments were a suitable option for identifying harvest sites since most MPB harvesting would not have been identified on original development plans and therefore would have been applied for individually as the harvesting was being planned. These licensees were later contacted with requests for block-specific information identified from the amendment files and maps.

For each cutblock meeting the above criteria, the following information was requested:

1. License i.d.;
2. Cutting permit and cutblock i.d.;
3. Gross block area;
4. block area within MDWR if different from the Gross area;
5. MDWR name;
6. BEC subzone; and
7. Pre-harvest stand composition.

The information provided by the various licensees was not always complete with respect to the seven requested variables.

Of the licensees who complied with the information requests, each had their own way of putting together a list. Those who used in-house forest management information systems (e.g. GENUS) and GIS were able to comply with these requests easiest and most completely.

Obtaining woodlot license harvest information was problematic. Due to the large number of individual licensees with woodlots on mule deer winter ranges the only practical way of obtaining data was through

each district’s woodlot forester. Furthermore, woodlot harvesting information varied significantly with respect to available details and identification of harvesting sites. No consolidated map with all the harvest information on it was available in any of the districts. Files are organized by woodlot license and most pertinent information is filed in the cutting permit approval documents; however the maps contained within these files range in detail from a simple boundary of the entire woodlot polygon to hand-drawn harvest site boundaries attached to a salvage harvesting permit or for non-salvage permits, more accurate GPSd block boundaries attached to completed site plans. The lack of detail on most cutting permit files is attributable to the dominance of recent harvesting occurring under salvage permit.

To identify potential sites for sampling, the woodlot forester for each district drew from his/her knowledge of harvesting activities during the specified time period and provided a list of potential sites. This was method of choice for two reasons: Suitable blocks for the study were identified in consultation with each district woodlot forester and the site plans or cutting permit documents were photocopied for preparing the master list and for later use in the study. In the Central Cariboo District, two sites were eventually chosen that were harvested under standard (non-salvage) permits and therefore had more detail available in the form of completed site plans, while in the Quesnel District salvage sites were chosen, which had minimal detail.

Licenses and agency representatives contacted to obtain information are listed in Table 1

Table 1: Contact List of Licensees and Agency Representatives

<p>100 Mile House Ainsworth Lumber Co. Weldwood of Canada Ltd. (now WFM) West Fraser Mills Ltd. (WFM) B.C. Timber Sales MOF Woodlot Forester</p>	<p>Chilcotin Forest District Min. of Environment - Ecosystem Biologist Min. of Forests – Tenures Officer</p>
<p>Central Cariboo Forest District U.B.C. Alex Fraser Research Forest Alkali Resource Management Corporation Likely-X’ Atsull Community Forest Riverside F. P. Ltd. (now Tolko Industries Ltd.) Lignum Ltd. (now Tolko Industries Ltd.) Tolko Industries Ltd. Weldwood of Canada Ltd. (now WFM) West Fraser Mills Ltd. BC Timber Sales MOF Woodlot Foresters</p>	<p>Quesnel Forest District Canfor Corporation (formerly Slocan F. P.) Tolko Industries Ltd. Weldwood of Canada Ltd. (now WFM) West Fraser Mills Ltd. BC Timber Sales Ministry of Environment Ecosystems Officer MOF Woodlot Forester</p>

Note: Listed licensees are those which responded to information requests

Stratification:

As per the terms of reference for the project, field sample sites were to represent a range of tenures, and licensees across the region and were to be stratified by ‘Snowpack Zone’ (Shallow/Moderate, Transition and Deep/Very Deep) and ‘Percent Pre-harvest Pine Composition’ (10-40%, 41-60%, 61-80%).

For ease of handling, all the collected data was initially compiled into three spreadsheets – one for each forest district. A regional biogeoclimatic map, the MDWR snowpack zone map, and a Central Cariboo Forest District woodlot/MDWR map were used to fill any information gaps pertaining to snowpack zones.

As the field sampling methodology required a minimum of 25 sample plots at a density of approximately 2 plots per hectare, a minimum cutblock size of 10 ha¹ was used for a block to be included in the sample site selection shortlist.

Blocks in the shortlist were then stratified by Snowpack Zone and Percent of Pine in the Pre-harvest Stand (three categories as mentioned above). The shortlist is provided herein as Appendix 2. A complete list of blocks (including blocks that did not make the shortlist) is provided as a digital attachment on the inside cover of this report.

Site Selection

Once all sites were stratified by Snowpack Zone and % pine composition, 18 sample sites were selected so to represent areas across the CCLUP region (representation in different districts) and provide representation across the various licensees and license types. Furthermore, the number of sample sites selected per strata was roughly chosen to be proportional to the total number of sites in each strata (proportional representation). Two alternate sites were selected in case access or sample suitability issues arose with any of the primary sites selected

As an addendum to the project, three additional woodlot sites in the Quesnel Forest District were added to the sampling program after sampling was underway. The pre-field data collection and field work phases were conducted by a sub-consultant using the same methodology.

Sample Site Information Collection

Once sites were selected, licensees and agencies were contacted and requested to provide pertinent site documentation such as silviculture prescriptions, site plans, skidding/harvesting maps, cutting permit documents, cruise information, silviculture reports, and access maps.

Preparation of Site-specific Sampling Plans:

Site plan, silviculture prescription or cutting permit maps were used as the base maps for creating field sampling maps. Long-term Objectives Maps available on the Ministry of Environment ftp site were cross-referenced for information on known locations of major topographic features. Field maps were prepared showing a grid of not less than 25 plots overlain onto the base maps. If topographical features (ridges or topographical breaks with slopes >15% from the apex) were noted on any maps or described in documentation, sampling grids were placed preferentially to overlay these features. Sampling transects were laid out on the base map in directions presumed to be perpendicular to prevailing skid trail direction. Plots were systematically distributed along transects to provide a sampling rate of approximately 2 plots per hectare.

¹ The exceptions to this rule were woodlots in the Quesnel Forest District. The majority of cutblocks in these woodlots were small (<10 ha) and there was little choice but to select a number of harvest units per woodlot to comprise the areas necessary for sampling 25 plots.

Field Sampling

The methodology for field sampling followed the recommendations of the Mule Deer Working Group (2004) for moderate intensity, reconnaissance level sampling.

The focus of the field surveys was to collect data relevant to the monitoring of six high priority indicators. The methods of data collection for each indicator are discussed one a time below. The indicators are associated with a number of objectives tied to five harvesting types (HOTs). These types are defined and the harvest regime and management constraints are described in detail in Dawson et al (2000 and 2002). All data were recorded onto standard field note paper. Plots that fell on non-productive ground (i.e. roads or landings or NPBr) were excluded from sampling and replaced with another plot in another suitable location along the transect. All plots measured 9.77m in radius.

INDICATOR 1: Skid Trail Area

Monitoring Document details two methods for estimating skid trail area. The method use during this project was the “line intercept” method wherein, the length of transect travelled across skid trails as a proportion of total transect length within the net area to be reforested, is determined and used as an estimate of the total block area occupied by skid trails. Initially, it was hoped that representative areas of the blocks surveyed could be chosen for these transects but this was not always possible since some blocks were far too large to conduct walkthrough surveys to decide where a representative area is. On some blocks, the objective of sampling areas possessing topographical features took precedence over sampling representative areas. These areas with features may or may not have been representative.

It was originally proposed to stratify any blocks that had significant differences in the skid trail character from one part of the block to the next. This turned out to be too complex and at times impractical (especially on large blocks) because most blocks had no information recorded about the location of skid trails.

INDICATOR 2: Skid Trail Locations

The location of skid trails in relation to significant topographical features was assessed in two ways. Firstly; with sampling grids overlain onto significant topographical features, any skid trails which ran parallel to and within 30m of the apex of a ridge or topographic break, and which were crossed by the transects, were recorded (length within 30m of feature and location). Secondly, any ridges or topographic breaks in the immediate vicinity of the grid were walked in order to determine if skid trails falling within the critical 30m distance were present. Lengths of any such skid trails paralleling the features were estimated and recorded.

INDICATORS 3 & 4: Non-target-Harvest and Damage

Non-target-harvest and damage surveys were conducted using the methods of the Mule Deer Working Group. The description below is taken from the Monitoring Document (Mule Deer Working Group 2004).

- A. *Select a portion of the block to sample of approximately 10 ha.*
- B. *Layout a grid of sampling transects perpendicular to the main direction of skid trails to include a plot density of approximately 2 plots per hectare. A minimum of 25 plots is recommended.*

- C. *Locate plot centres systematically along sampling transects. Sample all plots, except those that would include in-block roads and landings. Plots landing on skid trails created from previous or current harvest operations must be included in the sample.*
- D. *Record all live Douglas-fir >12.5cm breast height and the stump diameter (**inside bark**) of all Douglas-fir stumps greater than 20cm in plots with a radius of 9.77m. Record the height for each stump and record in **meters**. Different plot sizes can be used, if desired, but the relatively large 9.77m plot size is recommended to decrease to sampling variance. **Note that "old stumps" that were created before the current harvest are not to be recorded.***
- E. *Record any residual Douglas-fir stems >12.5cm DBH that are have bark and/or crown damage. Crown damage is defined as loss of 1/4 or more of the crown. Bark damage is defined as either loss of 1000cm² of bark or loss of bark from 1/3 the circumference of the tree.*

Additions to the above methodology were as follows:

Stumps that were harvested as pre-existing windthrow and residual windthrown stems were coded with B/D and recorded in the excel spreadsheets with the same code. To allow for estimation of total pre-harvest BA/ha and an expanded analysis of the results, all coniferous stems and stumps were measured using the methods described above. This additional deliverable was negotiated after the first day of field sampling. Consequently, the first block sampled (FLA 20017 - CP 09-02-12) only has Fd data recorded.

Plot centers were marked either with flagging or a GPS waypoint, or both.

INDICATOR 5: Harvest Distribution²

Assessment of harvest distribution was focused on answering two questions when a thinning from below harvest regime (Harvest Opportunity Type 4) was applied.

1. Is the harvest heavily concentrated adjacent to skid trails?, and
2. Is higher than average tree cover maintained on ridge tops and topographic breaks?

The first question was answered during the course of the survey while walking transects and noting the distribution of harvest in relation to skid trails.

Question 2 was answered by walking and viewing ridges and topographical breaks and noting relative cover amounts on these features in relation to adjacent areas.

INDICATOR 6: Douglas-fir Maintenance and Regeneration

Assessment of a stand's status regarding Douglas-fir maintenance and regeneration was focused on answering three questions:

1. For those sites that have been planted, are they being regenerated to Fd wherever ecologically suitable?;
2. Has harvesting created potential frost problems for Fd regeneration?, and
3. Has harvesting created a Fd windthrow risk because of size, location and orientation of canopy openings?

Question 1 was answered by noting, first, whether a site had been planted or not, and then second, by noting the regenerating species, whether they are natural or planted, their relative abundance within each

² Note: Only two blocks in the entire sample set were harvested under a Harvest Opportunity Type 4.

plot and the layers present within each plot. Observations along the transects between plots were also made and recorded

Answering questions 2 and 3 was a subjective process that was based on the surveyors' assessment of whether gaps created by harvesting resulted in frost or windthrow risk that could have been avoided had harvesting been conducted differently. This took into consideration the amount of pre-harvest Fd in the openings, whether windthrow was likely to occur regardless of harvest strategy and, for question 2, if possible, the pre-harvest species presence, abundance and distribution of underutilization-sized (<12.5 cm dbh) stems in the openings

Field Site Assessments

Field sampling on 18 of 21 sites was conducted between Sept. 26 and Oct. 19, 2005 by Mr. Chris Nowotny, R.P.Bio., R.P.F. and his assistant Lindsey Wood, F.I.T. Three woodlots in Quesnel were added to the project on a subcontract basis after the project was underway. These sites were sampled between Nov. 3 and 12, by Mr. Crispin Guppy, M.Sc., R.P.Bio. All surveys were conducted prior to snowfall due to the requirement to see and measure stumps.

Data Entry and Analysis

All non-Fd stump and residual stem measurement data were transcribed into a generic Microsoft Excel workbook. Stump diameters and heights were used as variables in a formula to calculate breast height diameters (dbh).

$$\text{Stump DBH} = (\text{DSIB} + 0.056984 * \text{DSIB} * (2.3 - \text{SH}) + ((0.712098 * \text{DSIB} * \text{LN}((\text{SH} + 1) / 2.3))))$$

where: DSIB = Diameter of Stump Inside Bark
and SH = Stump Height

This formula (taken from Omule and Kozak, 1989) is based on the analysis of lodgepole pine data but, for the purposes of this project's objectives, was considered a reasonable estimate to represent all coniferous non-Fd stump dbh's. DBH values were then used in a formula to calculate an estimate of the average BA/ha for non-Fd stems for each block.

All Douglas-fir stump and residual stem data as well as transect length data (skid trail crossing lengths and total transect lengths across the net area to be reforested) were transcribed into the Data Input Spreadsheet supplied by the contract monitor. This spreadsheet has a built in program that calculates 'Non-target Harvest and Damage' and when applicable, 'Proportion of Area Occupied by Skid Trails'.

5. RESULTS:

5.1. Pre-field Data Collection

479 sites harvested in mule deer winter ranges, most³ between January 2001 and August 2005 were initially identified as potential sites for sampling. District lists were developed using these sites. Of the original 479 sites only 162 or 34%, met all the criteria, or had sufficient information available, to be considered eligible for inclusion on the sampling shortlist. This shortlist is provide as Appendix 2. Most sites failed to be included because of their small size (<10ha) or lack of information on size. Some sites were excluded because they were outside of Known MDWR boundaries. A more detailed analysis of all 479 sites including total area harvested during the four year period was not practical and would not likely be very meaningful due to the considerable number of sites for which block size was not obtained (see discussion).

The process of collecting all harvest information from licensees was straightforward and occurred without too many unexpected obstacles, with the exception of the following significant ones:

1. licensees not responding to requests even after repeated attempts of contact;
2. licensees not willing to comply with requests because of lack of resources;
3. woodlot harvest information only kept in hardcopy format and reporting of some (salvage permits) harvesting is only required every three years. Apart from identifying the block size and target and reserve species, woodlot salvage permits typically have no additional information available about the stand. Most maps were hand-drawn;
4. licensees taking a long time to provide data, and in some cases, too long to incorporate data into master population list for use in selecting sites;
5. receiving data in various formats that required significant formatting and manipulation time;
6. pre-harvest stand information not being accurate, thereby resulting in the need to move sites to different strata after sampling was completed.

Reasons 1-3 above are why it is not possible in this study to provide an accurate estimate of total harvesting area in MDWRs during the specified time period.

Selection of sites to obtain a relatively representative sampling among licensees, license types, districts, and geographic area was difficult especially since the sites were also to be distributed amongst the 9 stratum combinations of 'snowpack zone' and 'pre-harvest pine percent composition'. The final sampling matrix shown below in Table 2 represents the culmination of a difficult process to balance as many of these variables as possible.

³ Some sites were identified from consolidated development plan maps made available at the Quesnel Forest District Office. Others were identified from Development Plan Application Submissions dated back to January 2000. The sites identified in this manner did not have harvest date information available with them. Attempts to obtain harvest information for a large number of these sites failed. The sites were likely to have been harvested since 2000 but some may have been harvested in 2000 or even slightly earlier.

Table 2: Matrix of Sample Sites by Snowpack Zone and Pre-harvest Stand Composition

Snowpack Zone	Pre-harvest Stand Composition (% PI by BA/Ha)		
	10-40	41-60	61-80
Moderate	LTC 42641: Blk 215: Knife Cr. (DCC)	FL A20020: CP 003-203-10-00: - McLeese Lk. (DCC)	FL A20001: CP 504-2: Lac la Hache N. (DOM)
	FL A20018: CP 268-398: W.L. Hawks Creek (DCC)	Woodlot 1696: CP A Blk 2: Jones (DCC)	
	FL A62076: CP 277-9: Meldrum (DCC)	FL A20019: CP 521-3: McLeese Lk. (DCC)	
	Woodlot 1052: CPZ -302,313, 321: Australian-Alix (DQU)		
Moderate /Transition		Woodlot 528: CPZ - K1&T: Australian-Alix (DQU)	
Transition	LTC 42502: Blk 131: B.V. North (DCC)	FL A20002: CP500-429: Timothy-Rail (DOM)	A20013: CP 42W-4: Blackwater (DQU)
	Woodlot 531:CPZ- 02-20,21,30: Narcosli Cr. (DQU)	Woodlot 805: CPZ - 3-14,15 & 4-10,11,12,13,14: Alix-Honeyburn (DQU)	Woodlot 533:CPZ Blk03-15A: Dragon-Australian (DQU)
	FL A20002 402-4: Needa Lk (DOM)		FL A20017: CP099-02-12: Horsefly River (DCC)
			FL A18172:FL CP 25-1 Blackwater (DQU)
Deep / V. Deep	TSL A64033:Blk 16: Little Lk. (DCC)	Woodlot 502:CP E Blk 1: Quesnel Forks (DCC)	K1L:CP B Blk002: West Arm (DCC)

Note: Each site is identified with the following information: License: Cutting permit and/or cut block i.d.: Mule Deer Winter Range i.d. and (Forest District). DCC= Central Cariboo District; DQU= Quesnel District; DOM=100 Mile House District

Seven (7) sites in the Quesnel Forest District, eleven (11) in the Central Cariboo Forest District (DCC) and three (3) in the 100 Mile House District (DOM) were sampled. These numbers represent 15%, 14% and 9% of eligible sites listed in the master shortlist in each district respectively. Very few blocks harvested for pine in MDWR were identified in the Chilcotin Forest District. Based on discussions with the ecosystems biologist at the Chilcotin Forest District, most recent harvesting (very little) had been Fd salvage harvesting. One suitable block was identified in the west Chilcotin but was not chosen for sampling.

Eight (8) sites in the Moderate Snowpack Zone (SPZ); one (1) site straddling the Moderate and Transition SPZs; nine (9) sites in the Transition SPZ; and three (3) sites in the Deep/V. Deep SPZ were sampled. These numbers represent 15% 20%, 12% and 23% respectively of all eligible sites by snowpack zone.

All nine strata were represented in the sampling; however the number of sites per stratum varied. The selection process attempted to balance the numbers in proportion to the numbers of total eligible sites for

each stratum in the shortlist. Some sites making it onto the shortlist were subsequently excluded because of insufficient forest cover or pre-harvest species information.

5.2. Field Surveys:

Appendix 3 presents a summary table of all results from the field surveys. The table summarizes for all blocks, the information provided on ‘Block Monitoring Summary’ Sheets and the ‘Short and Detailed (statistical) Summary’ sheets. These are included as Appendix 4. Also in Appendix 4 are the block sampling maps for each site. Blocks are arranged by Snowpack Zone (Moderate to Deep/V. Deep) and increasing Pine % strata. Some of these results have been extracted and presented in the relevant sections discussed below. Where they have not, the reader is referred to Appendices 3 and 4.

INDICATOR 1: Proportion of Net Area to be Reforested (N.A.R.) Occupied by Skid Trails:

This indicator is applicable to blocks on which types 4 or 5 harvesting have been implemented, or type 3 if the pre-harvest Fd basal area (BA) was >60% of total block BA. Only six of the 21 blocks surveyed met the criteria for analysis under this indicator.

Table 3: Harvest and Skid Trail Statistics for Selected Applicable Blocks

Licensee/Block i.d.	BA/Ha of Fd (>12.5cm) Harvested	Proportion of Total Fd (>12.5cm) Harvested	Proportion of Fd (22.5 - 37.5 cm dbh) Harvested & Damaged	Proportion of Fd (>37.5 cm dbh) Harvested & Damaged	Pre-harvest Fd % from survey/cruise	Is Skid Trail Area >15% of N.A.R.? (skid trail%)	Comments
FL A62076 CP 277-9 (Buckskin Rd.)	0.75	3.95%	13.07%	2.31%	71	N (14%)	
Woodlot 1052- CPZ - 302, 313, 321 (Quesnel)	11.04	58.74%	67.54%	16.84%	81	N (2%)	random skidding prevailed across the block; should have been trailed
LTC 42502 Blk. 131	10.33	32.47%	35.35%	20.79%	62/67	N (8%)	proportion of original skid trails probably obscured by repeated entries into stand for windthrow salvage
FL A20002; CP 402-4	10.91	40.54%	62.78%	47.70%	85	N (~0-1%)	Block mostly cable harvested; where ground-based harvesting occurred, random skidding prevailed.
Woodlot 531 CP B - 02-20,21,30	10.23	47.35%	44.16%	53.74%	63	N (13%)	Random harvesting and skidding to salvage blowdown may have covered up some original skid trails
TSL A64033-Blk. 16	3.25	12.07%	42.19%	9.68%	71	N (12%)	

Of the six blocks, one (FLA20002 - CP 402-4) was predominantly cable-logged and therefore had very few if any skid trails made. For this reason, this block technically achieved the target. On moderate to gently sloped ground, skidding was random rather than trailed. Random skidding had the effect of creating clearcut gaps. Rather than measuring skid trails on this block, the survey measured the proportion of the N.A.R. occupied by the cable-harvested strip cuts and the random-skidding clearcut patches. The strip cuts functioned similarly to skid trails in that they were corridors used to transport cut trees to the processing and loading areas. The proportion of NAR occupied by these areas was 46% and the stand's pre-harvest Fd BA was 85% of total BA. Therefore a large amount of Fd was taken off this block. The silviculture prescription identified the block as having sustained significant ice damage and that a Douglas-fir trap tree program had been undertaken to contain a potential Douglas-fir bark beetle expansion from the damaged timber. The prescription also stated that green-attacked Fd trees would be harvested. An amendment to the original prescription has been prepared by the licensee but was not made available to this study.

Skid trails on the five other blocks occupied less than 15% of the NAR but for reasons explained below some possible concerns with skidding area may exist.

On Woodlot 531 there were three harvest units on which a combination of trail development and random skidding was used. Alone, the trails only occupied 13% of the area, but an accurate picture of the original trail pattern and density was somewhat obscured by windthrow salvage harvesting that has occurred subsequent to initial stand entry. Based on the observed amount of blowdown harvested, and the relatively uniform distribution of Fd in the units, it appears that the area originally occupied by skid trails probably exceeded 15%.

One of the three harvest units surveyed in this woodlot was characterized by very complex ground (steep and frequent parallel gulleys/ridges), which provided limited skid trailing options. In general, the licensee seemed to place trails where they were required to access the lodgepole pine.

Estimated skid trail percentage on Woodlot 1052 was 2%; however this was only so low because random skidding prevailed across the two harvest units. Given the high percentage of pre-harvest merchantable Fd on the block (81%), as well as inferred high amounts of underutilization Fd this block should have been trailed.

Block 131 (LTC 42502) was harvested under a type 3 and 4 harvesting opportunity type in a stand that had approximately 67% of its pre-harvest BA in Fd. Although skid trails did not occupy more than 15% of the block (only 8% as measured by the survey), there were two or three significant openings that were clearcut (or nearly so) either during the initial harvest entry or as a result of subsequent windthrow salvage harvesting. Original skid trails in the gaps have been obscured by this recent harvesting; however the level of skid trail development on this block is not likely a concern.

INDICATOR 2: Skid Trail Locations:

Monitoring of this indicator focused on identifying incidences of skid trails⁴ running parallel to and being situated within 30m of the apex of topographic breaks or ridges with slopes of 15% or greater. The results are summarized below in Table 4:

⁴ The indicator is intended to monitor skid trails only but instances were noted during the survey where random skidding along ridges and breaks potentially warranted the same concerns as if skid trails had been developed. Therefore, any features with random skidding within 30m were also noted in the survey.

Table 4: Incidences of skid trails or random skidding adjacent to ridges and breaks

Were skid Trails located within 30m of topographic break or ridge (slope >15%)	Number of Blocks
N/A (blocks without ridges or breaks)	5
Y (minor features or not likely a concern)	8
Y (possible concern)	8
N	0
Total Number of Blocks	21

Incidences of skid trails or random skids situated adjacent to topographic features were identified on 16 of 21 blocks; however not all instances were considered to be of significant concern. Five of the 21 blocks were featureless and therefore had no concerns respecting this indicator.

In eight blocks (FLA20018, A20019, A62076, WL1052, FLA20001, LTC42502, WL531 & K1L) skid trails or random skidding were noted adjacent to features but the features were either so minor (e.g. shallow stream gulleys) and/or formed such a minor part of the block that concern was not considered warranted. These blocks were situated in all three snowpack zones.

In another eight blocks (FLA20002 CP500-429, FLA18172, FLA20013, WL533, FLA20017, WL805, TSLA64033 & WL502) concerns with the placement of skid trails or random skids relative to ridges or breaks were noted. Comments for each are provided below. All eight of these blocks had pre-harvest pine percentages greater than 40% and were situated within the Transition or Deep/V.Deep snowpack zones.

On FLA20002 CP 500-429 the small area of the block characterized by a topographic break was dominated by random skidding. The forest cover in the vicinity of the break as indicated by the survey was predominantly non-fir.

The FLA18172 block (CP 25-1) is situated on level terraced ground having two plateaus separated by a wide, flat valley. The breaks of this valley along each plateau have been harvested and skidded at random. The result has been the removal of most of the mature tree cover. The block's pre-harvest basal area was composed of 34% Fd as indicated by the survey. Whether random skidding removed understorey layers that could have provided some cover to mule deer using the ridges could not be determined.

The FLA20013 block (CP 42W-4) has one significant gully running through it at its southwest end. Random skidding prevailed through this area. Consequently, most of the tree cover on the ridges of the gully has been removed. The status of understorey layers on the ridges prior to harvest was unclear from the survey.

The WL533 (CP Z) block has a major gully running through the centre of the block. The block was clearcut. Random skidding was used almost exclusively except in one area where skidding was concentrated to move wood across the gully. The random skidding has removed all the tree cover from the breaks of the gully including any understorey layers that may have been present. Pre-harvest merchantable Fd BA was only 16% of the total BA so there may not have been much opportunity to reserve mature trees along the this gully.

The FLA20017 block (CP 099-02-12) has one area with several topographic features. Skid trails here (area between plots 1 and 13) are mostly perpendicular to the slope except for two notable instances measuring approximately 200-250 m in length. One section runs along the top of the ridge (NW-SE) south of the WTP and the other runs at the base of the slope through plot 4. From the surveyor's perspective there was no apparent necessity for the placement of these trails in those locations.

In harvest unit 3-14 of Woodlot 805 a lightly used skid trail was noted within 20m of the top of a major west-facing slope.

The TSL A64033 block (block 16) is characterized by moderately steep slopes, ridges, gullies and topographic breaks. Seven trails were noted within 30m of such features. The opportunities for placement of some of these trails in different locations away from these features are constrained by the close spacing of some of the gullies (i.e. less than 60m) as well as the steepness of the terrain that prevents sideslope trailing perpendicular to the features.

In woodlot 502, topography is highly variable with ridges and breaks present as well as gently sloped ground. Three instances of skid trails or random skidding were noted within 20m of the ridges or breaks.

INDICATOR 3A: Non-Target Harvest or Damage:

INDICATOR 3A: Types 2 & 3 Harvest:

The silviculture prescriptions or site plans⁵ for most blocks made references to reserving Fd at varying levels and for a variety of reasons (see Appendix 5 – Summary of retention information prescribed in SPs and site plans; and Attachment 1 – copy of prescriptions); however, only four of the 21 blocks (two UBC Research Forest blocks – LTC 42641 & LTC 42502, and CP 268-398 and CP 277-9) made any mention of Fd retention targets with respect to the MDWR strategy objectives. Of these four, only the two UBC blocks discussed harvesting with respect to harvest opportunity types. Based on the objective of harvesting beetle infested lodgepole pine and the survey-indicated proportion of Fd in each block, all blocks (aside from the UBC blocks) were by default harvested under Type 2 or 3 opportunity with the two UBC blocks (LTCs) also being harvested under Type 4.

All Moderate SPZ blocks had more than 40% pre-harvest Fd (by BA) in them and therefore were considered Type 3 harvest opportunities. In the Transition and Deep/V. Deep SPZ both type 2 and 3 opportunities occurred.

Figure 1 shows the proportion of 'Harvest and Damaged' Fd on each block. Two categories of stem sizes are shown: 22.5-37.5 cm dbh and >37.5cm. The survey targets for each are <20% and <10% respectively.

Only three blocks met the survey⁶ targets for trees > 22.5cm dbh (i.e. both categories in Figure 1). These blocks were Woodlot 1696, FLA62076, and Woodlot 805. Partial targets were met on five additional blocks. LTC42641 Blk 215, FL A20018 CP 268-398, and FLA20020 CP 003-203-10-00 met targets for trees measuring between 22.5 cm and 37.5 cm dbh while CP504-2 (FLA20001) and Block 16 (TSLA64033) met the target for trees greater than 37.5cm.

⁵ All blocks except woodlots harvested under exemption (MPB harvesting) had silviculture prescriptions or site plans in place.

⁶ Survey targets are higher than MDWR strategy targets by 5%. For example, if the MDWR strategy target is for $\leq 5\%$ harvest or damage then the survey target is $\leq 10\%$.

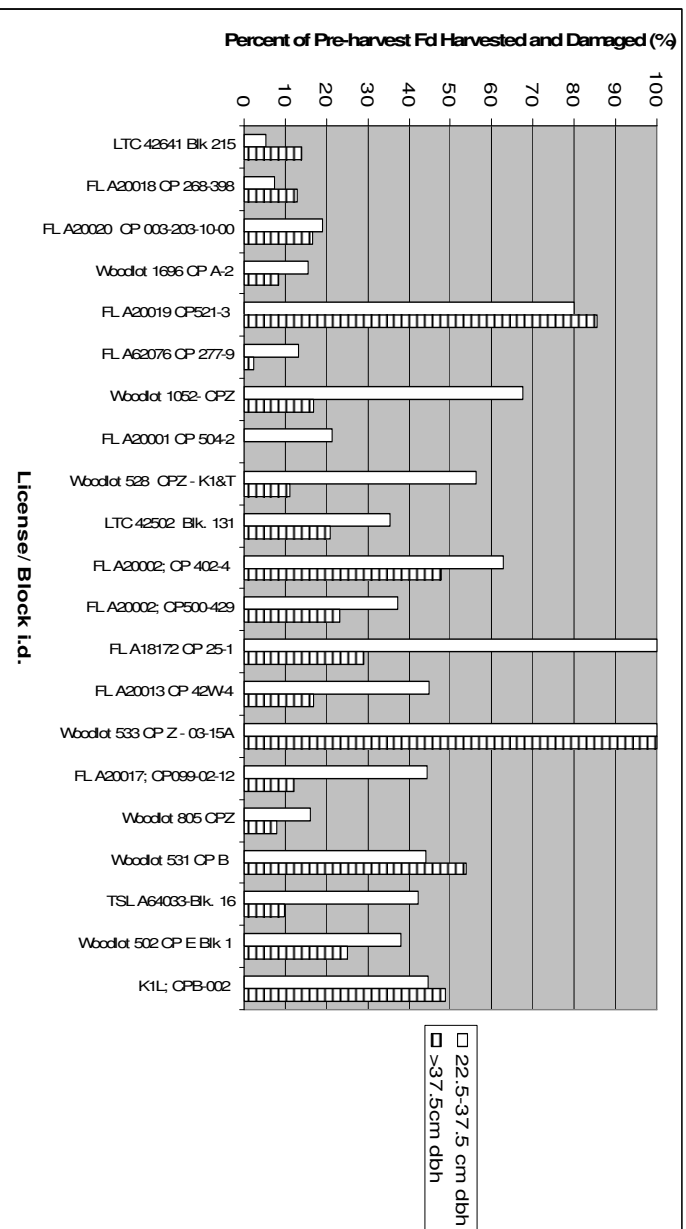


Figure 1 : Percent of pre-harvest Fd basal area harvested or Damaged for each block Surveyed

Figure 1 also shows that there was a wide range of Fd harvest levels across the blocks. In terms of percent harvested, the highest level was seen on WL 533 (+99%-clearcut) but this block had a low Fd composition to begin with (only 16% of stand) and did not represent the largest harvest in terms of m²/ha. The largest BA/ha harvest occurred on FL A20019 CP 521-3 as seen in Figure 2.

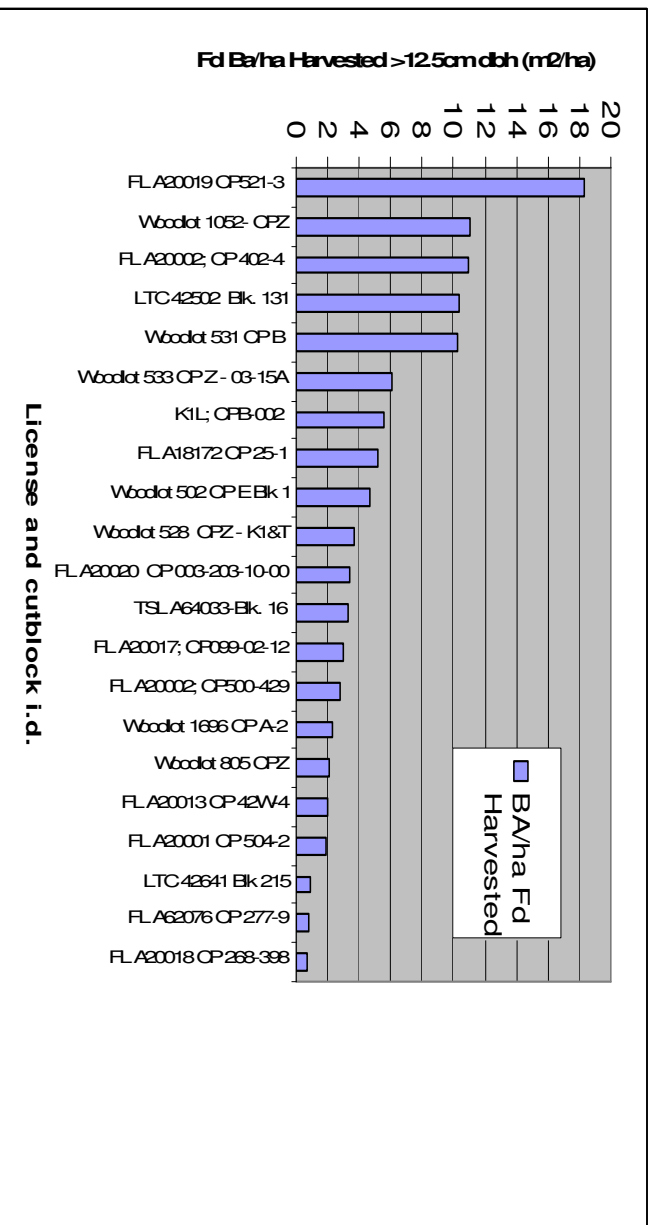


Figure 2: Basal Area/ha of Fd Harvested and Damaged for Each Block

INDICATOR 3b: Type 4 Harvest:

The survey indicated that Block 215 (LTC42641) met the survey's Type 4 target for 'Harvest and Damage' of Fd >37.5 cm dbh but that Block 131 (LTC42502) did not. It should be cautioned, however, that this indication may not be accurate due to the Type 4 harvest only applying to two of three strata in the block while the survey results are based on data from plots in all three strata. Furthermore, this block (131) was originally harvested in 2001 and has had windthrow salvage operations conducted in each year thereafter. Estimating the amount of windthrow harvesting that has occurred over 4 years is not likely to be very accurate because it is not always simple to identify older windthrown harvested stumps.

INDICATOR 4: Residual Douglas-fir Basal Area Targets (Type 4 Harvest):

This indicator only applies to two blocks – LTC 42641 Blk 215 and LTC 42502 Blk 131. Neither of these blocks' silviculture prescriptions specified type 4 thinning BA targets; however, in relation to the MDWR strategy target of retaining at least 75% of all merchantable Fd BA both blocks achieved the survey targets of not less than 10% below the strategy target. Block 215 exceeded the retention target by 24% (11.1 m² vs a target of 9 m²), while block 131 met the target at 10% below the strategy target 21.5m²/ha vs a target of 23.8m²/ha)

INDICATOR 5: Harvest Distribution (Type 4 Harvest):

For those areas of the two blocks which type 4 harvesting applied, heavy concentrations of harvesting adjacent to skid trails were not noted. This was a somewhat difficult indicator to monitor on both blocks because of the uncertainty associated with knowing which areas of each block were under a Type 4 harvesting regime.

Under this indicator, monitoring of tree cover on ridges and topographic breaks is required. In block 131, the breaks of the gulley were harvested to varying degrees depending on the level of lodgepole pine present. On the tops of the breaks, pine was removed where pine was present leaving lower cover than adjacent areas heavier to Fd. On the slopes of the gulley, some thinning did occur. In general, the slopes of the gulley maintained a higher tree cover than the flats because of a lower pre-harvest PI composition. Block 215 was a flat block and did not have any features on it.

INDICATOR 6: Douglas-fir Maintenance and Regeneration

Indicator 6a: Has Fd been planted wherever ecologically suitable?:

Table 5: Block tally of Fd plantings on ecologically suitable sites

Categories of Planting Characteristics	Block Count
Not Planted: Blocks are NSR (not stocked)	11 (still to be planted)
Not Planted: Blocks are SR (stocked)	4
Planted: Blocks largely stocked with multi-layer Fd & other species – <i>fill planted to Fd wherever ecologically suitable</i>	1
Planted: Blocks largely stocked with multi-layer Fd & Sx – <i>fill planted with Pl & Sx where Fd was ecologically suitable</i>	1
Planted: NSR Blocks <i>planted to Fd wherever ecologically suitable</i>	4

At the time of survey, fifteen blocks had not been planted. Eleven were still to be planted, while four appeared to be naturally stocked (with the exception of some small gaps) with multi-layered Fd, Sx and deciduous species.

Of the seven planted blocks, two were predominantly stocked with natural multi-layered Fd and minor Sx but fill planting had been conducted along skid trails, small gaps and wet areas. One of these blocks, woodlot 1696, was planted with Pl and Sx in the wet sites and cold-air collecting openings. Natural ingress of Fd seedlings is expected across the block. CP 504-2 (FLA20001) was also planted to Pl and Sx, along skid trails, but not only on wet and low lying sites. While it is still a concern that Fd was not planted on all ecologically suitable sites, the concern is lessened by the fact that the site is still stocked by multi-layered Fd and Sx and that natural Fd ingress is likely to occur across the block.

The remaining four blocks varied considerably in the proportions of each block ecologically suitable for regenerating Fd. CP 521-3 was essentially clearcut and as it is dominated by level to gently-sloped terrain, the entire clearcut area is likely unsuitable for regenerating Fd. Pl and Sx were planted across the block. In the other three blocks, a mixture of Fd, Pl and Sx was planted, with Fd being planted on the ecologically suitable sites. The areas of each block that were clearcut, or nearly so, were deemed to be ecologically unsuitable at this time for re-establishing Fd. Whether an immature tree cover was present prior to harvest that should have been protected to keep the sites ecologically suited to regenerating Fd was not clear from this survey.

INDICATOR 6b: Has harvesting created potential frost problems for regenerating Fd?:

Results of this indicator can be quite subjective relying heavily on the knowledge and experience of the surveyor(s) with the influence of specific variables on frost. Three main variables were used in determining whether potential frost problems could arise as a result of harvesting. These were: presence/absence of overhead cover, terrain character (slope and aspect), and slope position. The results are summarized in Table 6.

Table 6: Block tally of harvesting-induced frost problems for Fd regeneration

Has Harvesting created potential frost problems for regenerating Fd?	Block Count
Y	7
N	10
? (not from removal of mature Fd but possibly from removal of understorey)	4

Of the seven blocks expected to have Fd regeneration problems caused by harvesting, one would likely be a result of high mature Fd removal due to repeated blowdown harvesting (LTC 42502 block 131); two blocks (FLA20002 CP500-429 and Woodlot 805) would likely result from the removal of an abundant understorey that would have provided frost protection; and four blocks (FLA20019 CP521-3; WL1052; WL528 & K1L CPB-002) would likely result from a combination of excessive mature Fd re-

moval during initial harvest and removal of a protective understorey.

Ten blocks are not expected to have frost-related Fd-regeneration problems. Some of the blocks had a sufficient protective overstorey remaining after harvest (mature and/or immature) and some blocks were positioned on terrain that was predominantly frost shedding.

For four blocks (FLA18172 CP 25-1; FLA20013 CP42W-4; WL 533; & FLA20017 CP003-99-02-12) survey results left the answer to this frost question unanswered. Each block had low (<34%) pre-harvest Fd cover so that the level of mature Fd harvest was relatively inconsequential to Fd regeneration except from the standpoint that an overhead seed source would have been removed. If on these blocks harvesting removed an abundant protective understorey layer, then the frost protection afforded by this removal would be significant. Unfortunately, the survey was not able to determine the pre-harvest stand condition with respect to presence of understorey layers.

INDICATOR 6c: Has harvesting created potential windthrow problems?:

Eight blocks out of the total of 21 surveyed were deemed to have potential harvesting-related windthrow problems. Seven of these were found to have experienced one or more windthrow events subsequent to initial entry into the stands. These windthrow events are attributable in large part to the natural windthrow susceptibility of trees growing on gentle or level terrain underlain by fine wet soils but also to specific stand characteristics. Patchy distributions of Fd can result in small stand openings after harvest, which promote windthrow within and along the edges of these gaps. This appears to be the likely reason for much of the windthrow noted in Blk 131 (LTC 42502) and some of the windthrow noted in WL502 (CPE blk 1). On blocks with low (<40%) pre-harvest Fd levels (i.e. FLA18172 CP 25-1, FLA20019 CP521-3), the creation of large openings from MPB harvesting increases the susceptibility of the remaining few dispersed or clumped Fd within the large opening or even in the adjacent mature stand. On three blocks (WL531, WL528 and K1L CPB-002), the windthrow may have been caused by simply over-harvesting the mature Fd during the initial entry. When this occurs the high pre-harvest Fd BA is reduced thereby compromising the residual stand's ability to resist windthrow.

One recently harvested block (WL1052) has not shown evidence of windthrow to date but because of the excessive harvest of mature Fd (41% of Fd BA with dbh >12.5cm), this stand's windthrow susceptibility is also deemed to have been compromised.

6. DISCUSSION AND RECOMMENDATIONS:

Monitoring Protocol:

1. A shortlist of 162 eligible sites for sampling was developed from a total of 479 identified sites harvested in MDWR between January 2001 and August 2005. Most of the 479 sites failed to make the shortlist because of their insufficient block size (<10ha) or lack of available block size information. The lack of available information was generally due to a lack of or slow response (information received after sampling sites were selected), or an unwillingness or inability to devote resources to the information requests. Out of the 162 shortlisted sites, 18 were selected to represent nine strata combinations of 'Snowpack Zone' and 'Pre-harvest Pine Composition Category'. Some sites that made the shortlist were excluded from selection because of insufficient information on pre-harvest forest cover. Three additional Quesnel district woodlot sites, selected by a subcontractor were added to the project as an addendum to the original contract.

The nine designated strata were unequally represented by the sample sites chosen. A more even representation of samples across the strata was initially targeted; however this did not occur for a number of reasons. First and foremost, as was expected, certain strata had a greater number of eligible sites to choose from. Consequently, a weighted rather than equal representation was chosen. Secondly, some sites were chosen to represent one strata (based on licensee provided information), and were subsequently moved to another strata because of inaccurate stand composition information. These inaccuracies stemmed mostly from information based on recce-type stand composition surveys. This type of information was relied upon for salvage blocks for which cruise information was not available and provincial forest cover data was not provided with other block information. Cruise information was only made available for six of 21 blocks (29%). Despite the unequal representation, the study's effectiveness did not appear compromised, as results in general did not seem to be strata-related.

Recommendation: Consideration should be given to ways of increasing the number of, and improving, licensee responses. One way would be by modifying the information request procedure. A more effective (i.e. complete and timely) way of obtaining the information might be for the initial data request to be made in a formal letter written by a representative of the Ministry of Environment (perhaps a member of the MDWR Committee) detailing the information being requested and the objective of the project. Such a process would likely give the project a higher profile and compel more licensees to submit information, or submit it in a timely fashion.

2. The field assessment portion of this project was budgeted to consume approximately 60% of the budget. It is estimated that collection of non-Fd data likely increased the amount of time in the field by approximately 20%. The data entry stage approximately doubled in time and the analysis time probably quadrupled.

Recommendation: It would be very useful to prepare non-Fd data entry input sheets and associated programs for calculating BA and 'harvest and damage' statistics for each species as well as various combinations of species combined. These combinations would facilitate efficient and meaningful comparisons of 'harvest and damage' survey statistics against prescribed retention targets for both Fd and non-Fd species separately or together.

Recommendation: If limited budgets are an issue, and to ensure that an appropriate amount of time can be allocated to data entry and analysis, it would be useful to manipulate this current project's data to examine how results and their accuracy are affected by reducing the number of plots per

block. Alternatively, the monitoring document could incorporate some specifications around plot size or a target number of trees and stumps (data points) per plot. If the strength of analysis can be maintained at a relatively high level at a reduced plot/block level, this would free up time for post-field stages or allow for some additional field time to conduct useful walkthroughs of other parts of larger blocks or portions that were not covered by the transects to assess regeneration, skid trail locations, etc.

Highlights of the survey's significant findings are summarized below for discussion purposes.

3. The amount of pre-harvest Douglas-fir on the sampled blocks ranged from a low of 16% to a high of 85% of total pre-harvest stand basal area. Reporting of this statistic was made possible by measuring all conifer stumps and standing trees found in the plots – an element of the survey methodology not specified in the monitoring document. These measurements allowed for the calculation of total stand BA and determination of whether Indicator 1 (% of net area to be reforested occupied by skid trail) was applicable to each stand (indicator only applies to stands with >60% of the pre-harvest basal area in Fd).

If future monitoring has a Compliance and Enforcement (C&E) goal, more detailed investigations of some blocks would require the measurement of both Fd and non-Fd species to allow for comparison against prescribed retention of both Fd and non-Fd species.

Furthermore, for future monitoring focused on C&E, sites should probably be chosen for which cruise data is available. Comparison of monitoring results against cruise information helps to determine whether results of the monitoring survey are typical of the whole block, especially if the blocks are considerably larger than the survey area.

Recommendation: Incorporate measurement of non-Fd stumps into monitoring protocol document. Suggest calculating total retention and retention by species to facilitate determination of whether harvesting of Fd and non-Fd species achieved prescribed targets as well as monitoring survey targets.

Recommendation: 'Harvest and damage' results should be evaluated carefully when plots overlap more than one standards unit (SU), particularly if the SUs have markedly different retention targets or pre-harvest basal areas of Fd. If the number of plots placed in a small SU having low Fd retention targets is disproportionately high, indicated high harvest levels could be greatly exaggerated relative to prescribed targets..

4. Windthrow harvesting during or subsequent to initial harvest entry should be considered as a subgroup of harvested trees and differentiated from harvest of standing stems. This differentiation could prove useful in evaluating windthrow prevalence or patterns.

Recommendation: Modify the Fd plot data spreadsheet to allow for entry of windthrown stem data (i.e. similar to damage code) and to enable analysis of windthrown stems separately from standing stems.

5. The amount of all merchantable residual Fd (>12.5cm dbh) among all the blocks ranged from a low of 0.44% to a high of 96%. The average was 67.60% while the median was just over 72%.

The amount of all merchantable Fd harvested ranged from a low of 0.7m²/ha to a high of 18.4 m²/ha.

'Harvest and Damage' Targets for Type 2 &/or 3 harvesting were only achieved on six of 21 blocks for Fd measuring 22.5cm - 37.5 cm dbh, and only on five blocks for Fd measuring >37.5 cm dbh.

Harvest and Damage targets for both categories of tree size (>22.5cm dbh) were only achieved on three blocks.

All blocks having features as defined in MDWR strategy documents were skid trailed or random skidded in a manner counter to the strategy's objectives for maintaining winter range values (i.e. parallel to and within 30m of feature apexes).

Six blocks were assessed for the proportion of area occupied by skid trails. Although all six blocks achieved the survey target of 'trails occupying less than 15% of the net area to be reforested', there may be some concern with skidding in general on three of these blocks due to the prevalence of random skidding in situations that warranted trailing or where re-entry into the stand for blowdown salvage was required, in which case, original skid trail patterns and widths could not be measured.

At the time of survey, only six sites had been planted. All but one had been planted to Fd wherever ecologically suitable. Regenerating fir on many of the sites that had not yet been planted may prove to be difficult due to the reduced ecological suitability of sites opened up by excessive harvest of mature Fd, damage of immature Fd, and/or the creation of large gaps in areas originally dominated by non-Fd species.

Together with the observations that; 1) prescriptions (SPs) are typically not tailored to consider and implement MDWR strategy objectives, and 2) harvesting typically proceeds without any level of detailed harvest planning to manage MDWR values, these results clearly identify a shortfall in stand-level harvest planning by licensees in general. They also likely point to an additional shortfall – a disconnect between the historical harvest approval process when SPs were submitted for approval and the prescription/harvesting implementation process. Approved SPs were not required to provide detail of management strategies but the licensees were (and still are under the new site plan regime) expected to adhere to the principles of the MDWR strategy objectives. With a lack of detail in the prescriptions, logging supervisors not familiar with strategy guidance, might not recognize opportunities or requirements for specific strategies to meet objectives.

Furthermore, now that site plans, having replaced silviculture prescriptions, are not submitted to the MOF for approval, there is no check in place for ensuring that MDWR values are managed for in accordance with the MDWR strategy guidance. This is some cause for concern in the short term until licensees switch to operating under Forest Stewardship Plans legislated by the Forest and Range Practices Act. Under Forest Stewardship Plans, legal objectives surrounding MDWR management will be specified.

Recommendation: Deliver district information/training sessions about the MDWR strategy guidance and licensee obligations for managing MDWR values during cutblock planning and harvesting. In general, the licensee community (planning and harvesting foresters and supervisors) and independent foresters signing site plans would stand to benefit greatly from information / training sessions delivered by agency personnel explaining the guidance in place and how it fits into the legal framework governing harvest activities on MDWRs. The sessions could also provide participants with recent update information (i.e. adjusted MDWR lines) and discuss broad (i.e. MDWR-level) planning objectives as well.

6. Due to the broad scope of the current survey, results did not point to any particular licensee, group of licensees, or license types as causing greater concern with their management practices over any others. However, four of five sampled woodlots that were harvested under salvage permits had generally poor results. There may be a perception among woodlot licensees that MDWR strategy

guidance restrictions are not applicable to harvesting issued under salvage permit. As stated earlier, these salvage permits allow harvesting without requiring silviculture prescriptions or site plans. It is conceivable therefore, that planning and harvesting could be carried out by non-technical individuals who are unfamiliar, or even unaware, of the MDWR strategy guidance. In contrast, under a prescription or site plan a cutblock proposed for harvesting has, by law, been reviewed and signed-off by a registered professional forester.

Recommendation: Some consideration should be given to communicating with woodlot licensees, either through district information sessions as mentioned above or through district woodlot foresters, about their continued obligations to manage for MDWR values while harvesting under salvage permit exemption.

Recommendation: In order to determine whether salvage harvesting in woodlots is or isn't more of a problem than non-salvage permit harvesting, future monitoring programs could focus specifically on these types of permits.

Potential Strategy Guidance Improvement:

Recommendation for improving strategy guidance regarding cutblock areas occupied by skid trails: In the mule deer winter strategy management plan for Shallow and Moderate Snowpack Zones, the target of achieving 10% or less skid trail development in the net area to be reforested applies only to stands with more than 60% of the BA in Fd. Consideration should be given to modifying this target to somehow require or incorporate consideration of the pre-harvest immature Fd as well. The 60% (or some other threshold level, if deemed more appropriate) should apply to mature Fd basal area but the implication of the objective as it is now stated is that regardless of how much immature Fd is present on a block, higher levels of skid trails or random skidding are allowed as long as mature Fd composes <60% of the basal area. The problem with this is that at increasingly lower pre-harvest Fd levels (<60%), post-harvest stand structure increasingly resembles a clearcut because of the tendency towards random harvesting and skidding. This is the case unless effort is made to protect understorey Fd layers through trailing. This is an important point because low pre-harvest Fd composition stands that are randomly harvested and skidded make some sites, especially those that are level to gently-sloped, ecologically unsuitable for re-establishing Fd if the majority of cover is removed.

This study has shown that the newly developed monitoring protocol is an effective tool for identifying how harvesting in MDWR may be meeting or falling short of meeting strategy objectives and guidance. In addition, the report identifies ways of possibly improving the protocol, improving harvest management practices through delivery of information/training sessions, and potentially improving MDWR strategy guidance.

7. REFERENCES:

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APPENDIX 1:

**TIMBER SUPPLY AREA MAPS SHOWING
GENERAL LOCATION OF SAMPLE SITES**

APPENDIX 2: SHORTLIST OF HARVESTING SITES FROM WHICH SAMPLE SITES WERE CHOSEN

Block & Location Information							Pre-harvest PI Composition					FC or Stand Comp. Info from Licensees	
Snowpack Zone	District	Cutting Permit	Blk. No.	License	Blk. Area	Area in MDWR	MDWR i.d.	<10%	10-40%	41-60%	61-80%		>80%
Shallow	Chilcotin	904	5	FL A55906	72.00		Big Creek						X
	Chilcotin	904	4	FL A55906	133.00		Big Creek						X
Shallow/Moderate sites are those which straddle the boundary													
Shallow/Moderate	100 Mile		1	TSL A62648	32.50	29.91	Loon Creek			X?	X?		PIFd 7314-13
Moderate	Cent. Car.		209	LTC 42641	40.80		Knife Cr.		X				16%PI, 73%Fd, 14%Sx, 7%Dc
	Cent. Car.		202	LTC 42641	32.30		Knife Cr.		X				16%PI, 59%Fd, 18%Sx, 7%Dc
	Cent. Car.		213	LTC 42641	26.70		Knife Cr.		X				19%PI, 39%Fd, 23%Sx, 19%Dc
	Cent. Car.		214	LTC 42641	16.10		Knife Cr.		X				25%PI, 35%Fd, 24%Sx, 16%Dc
	Cent. Car.		215	LTC 42641	30.90		Knife Cr.		X				29%PI, 42%Fd, 18%Sx, 11%Dc
	Cent. Car.		216	LTC 42641	41.60		Knife Cr.		X				25%PI, 73%Fd, 2%Sx
	Cent. Car.		206	LTC 42641	42.40		Knife Cr.		X				20%PI, 80%Fd
	Cent. Car.	268	14	FL A20018	10.60		W.L.-Hawks Cr.		X				PIF831 (33% PI 60%F 7%Sx)
	Cent. Car.	268	398	FL A20018	20.00		W.L.-Hawks Cr.		X				35%PI 20%Sx35%F
	Cent. Car.	277	2	FL A20018	45.30		Meldrum Cr.		X				4.8% Fd by Vol (~70% Fd)
	Quesnel		1	TSL A71577	61.88		Dragon Australian		X				FD6PL2S1.5AT0.56405-18.5
	Cent. Car.		1	FL A72022			Hawks Cr. S		X?	X?			FD6PL47316-16.4
	Cent. Car.		2	FL A72294			McCleese Lake		X?	X?			PL6FD47315-15.4
	Cent. Car.		1	FL A72294			McCleese Lake		X?	X?			PL6FD47316-15.4
	Cent. Car.		3	FL A72294			McCleese Lake		X?	X?			PL6FD47315-15.4
	Cent. Car.	487	180	FL A20018	26.00		Knife Cr			?			FP(A)4270
	Cent. Car.	487	253	FL A20018	19.00		Knife Cr			?			PI(F)5281
	Cent. Car.		207	LTC 42641	34.80		Knife Cr.		X				42%PI, 48%Fd, 13%Sx, 7%Dc
	Cent. Car.	268	367	FL A20018	20.00		W.L.-Hawks Cr.		X				45%PI 55%F
	Cent. Car.	3	204-10-00	FL A20020	131.00		McLeese Lk			X			
	Cent. Car.	3	203-10-00	FL A20020	27.00		McLeese Lk			X			
	Chilcotin	998	1	FL A20019	52.70		Mosley Cr. (?)		X				FdPI 832
	100 Mile	225	002	FL A20002	46.19		Horse Lake			X			PIFd
	Cent. Car.	A	2	WL 1696	14.2		Jones			X			
	Cent. Car.	277	10	FL A20018	16.20		Meldrum Cr.			X?	X?		2.3% Fd by Vol (40% Fd)
	100 Mile		1	TSL A58070	62.90	20.28	Watch Lake North			X?	X?		PI(A)Fd 6316-17
	100 Mile		MH307	TSL A59149	18.90		Lac La Hache North			X?	X?		PIFdAt 5317-16
	Cent. Car.	521	1	FL A20019	15.90		McLeese Lk.			X?			FP(S) 731 (walkthrough)
	Cent. Car.	521	3	FL A20019	52.80		McLeese Lk.			X?			PFSAt 731 (walkthrough)
	Cent. Car.	268	203	FL A20018	12.10		W.L.-Hawks Cr.			X?			FP1410
	Cent. Car.	277	3	FL A20018	16.70		Meldrum Cr.			X?			4.2%Fd by Vol (~55% Fd)
	Cent. Car.	277	9	FL A62076	74.90		Meldrum Cr.			X?			2.2% Fd by Vol (55% Fd)
	100 Mile	561	4	FL A20001	33.95		111 Mile - Forest Grove			X?			PIF?
	100 Mile	225	002	FL A20002	46.19		Horse Lake			X?			PIFd
	100 Mile	504	2	FL A20001	51.37		Lac La Hache North			X ?	X		Fd35PI30S20At15
	100 Mile	449	004	FL A20002	35.70		Lac La Hache North				X		P65+At25+
	100 Mile	561	3	FL A20001	23.09		111 Mile - Forest Grove				X		PI(75)Fd15(A)T
	100 Mile	432	001	FL A20002	53.86		Lac La Hache North				X		P75+F10+At10+
	100 Mile		MH525	TSL A74892	35.80	31.25	Watch Lake North				X?	X?	PI(SxA) 5315-19
	Cent. Car.	009	04-4C-01	FL A20019	25.80		Gaspard						?
	Cent. Car.	60H	WDF142	FL A20019	29.20		Farwell					X	P631 (>80%)
	Cent. Car.	283	351	FL A20018	19.20	12.90	Bull Mtn.					X	>80%PI (4.5ha WTP)
	Cent. Car.	277	4	FL A20018	14.20		Meldrum Cr.						3.2% Fd by Vol
	Cent. Car.	277	5	FL A20018	10.30		Meldrum Cr.						0% Fd by Vol
	Cent. Car.	03A	185	FL A20018	15.30		Knife Cr.						?
	Cent. Car.	3	202-10-00	FL A20020	13.00		McLeese Lk					X	
	Cent. Car.	632	1	FL A20020	44.00		Hances Timber						?
	Cent. Car.		8	FL A72294			McCleese Lake					X	PL104307-19
	Chilcotin	904	3	FL A55906	19.00		Big Creek	X					
	Chilcotin	904	2	FL A55906	56.00		Big Creek	X					
	100 Mile	504	1	FL A20001	53.58		Lac La Hache North					X	PI(85+)
	100 Mile	503	3	FL A20001	14.51		Lac La Hache North					X	PI(85-90)
Moderate/Transition sites are those which straddle the boundary													
Moderate/Transition	100 Mile	449	004	FL A20002	35.70		Lac La Hache North				X		P65+At25+
	100 Mile	928	2	FL A20001	13.53		111 Mile - Forest Grove				X?	X?	PI(FdAt)?
	100 Mile		1	TSL A51959	24.30	20.80	Watch Lake North				X?	X?	PI(A)Sx 5316-19
	Quesnel	Z	EX 02-1	WL 527	2.25		Australian-Alix						?
	Quesnel	Z	EX 02-5	WL 527	3.75		Australian-Alix						?
	Quesnel	Z	K1	WL 528	6.1		Australian-Alix						?
	Quesnel	Z	Y1	WL 528	6.5		Australian-Alix						?

Block & Location Information								Pre-harvest PI Composition					FC or Stand Comp. Info from Licensees
Snowpack Zone	District	Cutting Permit	Blk. No.	License	Blk. Area	Area in MDWR	MDWR i.d.	<10%	10-40%	41-60%	61-80%	>80%	
Transition	Cent. Car.		91B	LTC 42502	20.50		B.V. North	X	UBC/MOF Research Plots			9% PI, 91%Fd	
	Cent. Car.	003	99-9-17	FL A20017	35.81	32.88	Skelton		X	X		P40F35At25	
	100 Mile	402	004	FL A20002	27.80		Needa Lake North	X?	X?			F60+P?	
	Cent. Car.		131	LTC 42502	19.20		B.V. North		X			26%PI, 64%Fd, 7%Sx, 3%Dc	
	Cent. Car.		124	LTC 42502	21.00		B.V. North		X			31%PI, 57%Fd, 6%Sx, 3%Bl, 3%Dc	
	Cent. Car.		126	LTC 42502	26.50		B.V. North		X			27%PI, 32%Fd, 35%Sx, 7%Dc	
	Cent. Car.		142	LTC 42502	24.80		B.V. North		X			25%PI, 51%Fd, 18%Sx, 7%Dc	
	Cent. Car.	002	98-12	FL A20017	81.60		B.V. North		X			F50S30(P)	
	Cent. Car.	083	BUX004	FL A20017	76.68	10.12	B.V. North		X			F70P20(S)	
	Cent. Car.	270	2	FL A20017	23.39	15.93	B.V. North		X			F50P25+	
	Cent. Car.	599	SKE008	FL A20017	19.49		Skelton		X			F60+P35+	
	Cent. Car.	65	1	FL A20017	18.02	13.14	B.V. North		X		X	F45P40(AtS)	
	100 Mile	538	2	FL A20001	143.43		Drewry Lake North		X			P140Fd40Sx	
	100 Mile	550	3	FL A20001	18.80		111 Mile - Forest Grove		X			P140Fd20	
	100 Mile	225	005	FL A20002	31.07		Horse Lake		X			F37+P26+	
	100 Mile	385	006	FL A20002	23.36		Horse Lake		X			F60+P8+	
	100 Mile	425	004	FL A20002	20.30		Timothy - Rail		X			F70+P25+	
	Quesnel	Z-EX03-1	02-30	WL 531	8.7		Narcosli		X				
	Quesnel	Z-EX03-1	02-20	WL 531	4.3		Narcosli		X				
	Quesnel	Z-EX03-1	02-21	WL 531	2.3		Narcosli		X				
	100 Mile	928	1	FL A20001	16.14		111 Mile - Forest Grove		X	X?		Fd(P1?)?	
	100 Mile		A	TSL A71593	31.30		Buffalo Creek		X?	X?		FdPI 7215-11	
	100 Mile	500	429	FL A20002	13.15		Timothy - Rail		X		X?	P60+F?	
	100 Mile		MH524	TSL A74891	23.80	15.04	Canim Lake West		X			PIFd 6317-17	
	Cent. Car.		135	LTC 42502	30.70		B.V. North		X			53%PI, 40%Fd, 6%Sx, 1%Dc	
	Cent. Car.	002	98-11	FL A20017	367.19	272.11	B.V. North		X			P45F41(S)	
	Cent. Car.	002	99-10	FL A20017	53.47	39.09	B.V. North		X			P50+F30+S15+	
	Cent. Car.	003	01-9-30	FL A20017	11.84		Skelton		X			P55F45	
	Cent. Car.	61	1	FL A20017	66.95	27.56	B.V. North		X			P40+F30+S20+	
	Cent. Car.	63	1	FL A20017	43.90		B.V. North		X			F5P5	
	Quesnel	25	25 1	FL A18172	18.32		Westroad South		X				
	100 Mile	550	1	FL A20001	33.41		111 Mile - Forest Grove		X			PI50Fd10(SxAt)	
	100 Mile	550	4	FL A20001	15.34		111 Mile - Forest Grove		X			PI45Sx35 (Fd?)	
	100 Mile	550	5	FL A20001	39.68		111 Mile - Forest Grove		X			PI(50)Fd15	
	100 Mile	238	001	FL A20002	12.06		Needa Lake North		X			P60+F20+	
	100 Mile	402	005	FL A20002	35.24		Needa Lake North		X			P50+F15+	
	Cent. Car.	099	02-12	FL A20017	20.04		Horsefly R.				X	70% PI by Vol. from SP	
	Cent. Car.	002	99-02	FL A20017	66.00		B.V. North			X		P40F40S20	
	Cent. Car.	003	202-10-00	FL A20017	20.50		Mcleese Lk.?			X		P60F40	
	Cent. Car.	64	1	FL A20017	22.38		B.V. North			X		P60F20+	
	Cent. Car.	003	99-9-15	FL A20017	10.13		Skelton				X	P60F25	
	Quesnel	42W	42W-4	FL A20013	51.38		Westroad South				X	51%PI24%Sx19%Fd	
	Quesnel	804	1	FL A51220	27.00		James Mtn.			X		65% PI 45%Sx 29%Fd	
	100 Mile	550	2	FL A20001	29.32		111 Mile - Forest Grove			X		PI75(FdAt)	
	100 Mile	227	003	FL A20002	37.86		Drewry Lake North			X		P70+F?	
	100 Mile		B	TSL A71593	28.60		Buffalo Creek			X		PI(At) 5214-13	
	Quesnel	Z	03-15B	WL 533	7.9		Dragon - Australian			X			
	Quesnel	Z	03-15A	WL 533	11		Dragon - Australian			X			
	100 Mile	452	003	FL A20002	13.80		Buffalo Creek			X?	X?	P80+F?	
	100 Mile		MH331	TSL A61158	50.00		Horse Lake			X?	X?	PI(At) 6316-17	
	100 Mile		1	TSL A68194	42.50		The Lakes			X?	X?	PI(Sx) 5416-23	
	Cent. Car.	002	00-506	FL A20017	13.56		B.V. North	X				F90+(P)	
	Cent. Car.	084	BUX009	FL A20017	58.70	16.87	B.V. North				X	P85+(FAI)	
	Cent. Car.	599	02-14	FL A20017	23.30		Skelton				X	P	
	Cent. Car.	700	SKE004	FL A20017	49.98	43.64	Skelton					P80+(F)	
	Cent. Car.		1	TSL A62311	75.60		Rose Lake	X				FD105206-14	
	Quesnel	858	4	FL A20013	17.67		Upper Quesnel					?	
	Quesnel	911	911-20a	FL A20013	39.47		Upper Quesnel					?	
	Quesnel	875	GER01	FL A20013	12.87		Geremi					?	
	Quesnel	911	26	FL A20013	12.35		Geremi					?	
	Quesnel	99	99 33A-G	FL A18172	52.32		Westroad South					?	
	Quesnel	99	99 42T&Y	FL A18172	12.08		Westroad South					?	
	Quesnel	99	99_B00B 1A-1E	FL A18172	24.16		Westroad South					?	
	Quesnel	912	912-7	FL A20013	51.19		Westroad South					?	
	Quesnel	5	29(A-C)	TFL 52	17.50		Lower Quesnel					?	
	Quesnel		03-27	TSL A70688	12.00		Dragon - Australian					?	
	100 Mile	503	1	FL A20001	51.00		Lac La Hache North				X	PI(98)Fd(2)	
	100 Mile	503	2	FL A20001	35.49		Lac La Hache North				X	PI(96)Fd(4)	

Block & Location Information							Pre-harvest PI Composition					FC or Stand Comp. Info from Licensees		
Snowpack Zone	District	Cutting Permit	Blk. No.	License	Bik. Area	Area in MDWR	MDWR I.d.	<10%	10-40%	41-60%	61-80%		>80%	
Transition cont'd.	100 Mile	503	5	FL A20001	17.40		Lac La Hache North					X	PI(80?)	
	100 Mile	503	6	FL A20001	20.00		Lac La Hache North					X	PI(>90)	
	100 Mile	550	6	FL A20001	28.40		111 Mile - Forest Grove					X	PI(85-95)	
	100 Mile	227	001	FL A20002	51.34		Drewry Lake North					X	P82+	
	100 Mile	227	002	FL A20002	30.70		Drewry Lake North					X	P86+F?	
	Quesnel	Z	03-25	WL 533	3		Dragon - Australian							?
	Quesnel	Y	EX04-1-11	WL 561	4.4		Baker Cr.?							?
	Quesnel	Y	EX04-1-8	WL 561	3.1		Baker Cr.?							?
	Quesnel	Y	EX04-1-10	WL 561	7.2		Baker Cr.?							?
	Quesnel	Z	EX03-1	WL 562	2.7		Baker Creek							?
Quesnel	Z	EX03-5	WL 562	3.4		Baker Creek							?	
Deep/V. Dp.	Cent. Car.	Z	103	K1L	15.00		West Arm			X				
	Cent. Car.	Z	203	K1L	14.00		West Arm			X				
	Cent. Car.	Z	303	K1L	15.00		West Arm			X				
	Cent. Car.	Z	604	K1L	38.50		West Arm			X				
	Cent. Car.	B	002	K1L	33.00		West Arm					X		
	Cent. Car.	D	001	K1L	91.00		West Arm					X		
	Cent. Car.	Z	1004	K1L	11.00		Likely			X				
	Cent. Car.			FL A64705	15.40		Little Lake						X	PL8FD1S0.5AT0.57416-22
	Cent. Car.		16	FL A64033	23.30		Little Lake		X					FD6PL2S1AT17416-21
	Cent. Car.			FL A70942	12.70		Little Lake							EP9FD0.5AT0.55318-21
100 Mile	411	1	FL A20001	16.95		Canim Lake North					X			
Quesnel	Z	03-21	WL 1633	1		Lower Quesnel							?	
Cent. Car.	E	1	WL 502	51.2		Quesnel Forks				X				
Unconfirmed	Cent. Car.	1	1	FL A65106	53.30		?			X?	X?		PL6AT3FD16314-16	
	Cent. Car.		2	FL A71030	58.00		Mackin-Buckskin			X?	X?		PL6AT3FD16314-15.9	
	Quesnel		2	TSL A73389	14.23		Upper Quesnel				X		PL8AT1S0.5FD0.56315-19	
	Quesnel		1-2	TSL A69213	33.08		Upper Quesnel		X				AT4PL3FD2S16414-20.8	
	Quesnel		2	TSL A51444	64.58		Upper Quesnel					X	PL9FD16316-19.9	
	Quesnel		1	TSL A68689	40.07		West Road South					X	PL9FD15316-19.2	
	Quesnel	Z	03-22	WL 1633	4.5		Lower Quesnel							?

APPENDIX 3:

SUMMARY TABLE OF RESULTS

Snowpack Zone	Licensee/Block i.d.	Total pre-harvest Fd BA/ha from survey	Total pre-harvest Fd BA from cruise	% Total Residual Fd (>12.5cm) BA/ha from survey	% Harvest & damage Fd (22.5 - 37.5 cm dbh)	% Harvest & Damage Fd (>37.5 cm)	Total BA/ha from survey	Total BA/ha from cruise	% Difference in Total BA/ha between survey and cruise	SSO	Harvest Opportunity Type(s) (%Fd from survey/cruise)	Skid Trail % > 15% of N.A.R.?	Do Skid Trail Sections Run within 30m of ridge or break? (R=rand)om; T= trails	Monitoring Summary Concerns?						
														Did Non-target Harvest or Damage exceed target maximums?		Was post-harvest BA more than 10% below retention target? (Type 4 Harvesting)	Harvest Distribution concerns?	Maintenance & Regeneration		
														Type 2/3	Type 4			Has Fd been planted wherever ecologically possible? (Y, N, NP)	Potential Frost Problems resulting from harvesting?	Potential Windthrow resulting from harvesting?
Moderate	LTC 42641 Blk 215 (Knife Cr.)	12	11.4	92.83%	5.35	14.02	24.97	27.68	9.79	Low	3, 4 (43/46)	n/a	n/a	Y	N	N	N	NP	N	N
	FL A20018 CP 268-398 (Whiskey Cr.)	10.70		93.43%	7.51	12.86	24.57	-	-	Low	3 (42)	n/a	Y (T)	Y	n/a	n/a	n/a	NP (stocked)	N	N
	FL A20020 CP 003-203-10-00 (Soda Cr.)	25.10	14.67	86.63%	19.00	16.62	32.96	27.51	-19.80	Mod	3 (54)	n/a	n/a	Y	n/a	n/a	n/a	NP (stocked)	N	N
	Woodlot 1696 CP A-2 (150 Mile House)	16.30	14.80	85.67%	15.69	8.34	28.05	30.40	7.72	Mod	3 (51)	n/a	n/a	N	n/a	n/a	n/a	Y	N	N
	FL A20019 CP521-3 (Sheridan Cr.)	22.2		17.32%	79.99	85.53	39.92	-	-	Low	3 (54/25)	n/a	Y (R)	Y	n/a	n/a	n/a	Y	Y	Y
	FL A62076 CP 277-9 (Buckskin Rd.)	19		96.05%	13.07	2.31	25.97	23.92	-8.54	Mod	3 (71)	N	Y (T)	N	n/a	n/a	n/a	NP (stocked)	N	N
	Woodlot 1052- CPZ - 302, 313, 321 (Quesnel)	18.8		41.26%	67.54	16.84	26.96	-	-	Mod	3 (81)	N	Y (T)	Y	n/a	n/a	n/a	NP	Y	Y
	FL A20001 CP 504-2 (Lac la Hache N.)	11.4		83.56%	21.29	0.00	25.43	-	-	Low	3 (42)	n/a	Y (T)	Y	n/a	n/a	n/a	N (fill plant)	N	N
Mod/ Trans.	Woodlot 528 CPZ - K1&T (Quesnel)	11.8		69.01%	56.10	11.16	28.76	-	-	Mod	3 (53)	n/a	n/a	Y	n/a	n/a	n/a	NP	Y	Y

Snowpack Zone	Licensee/Block i.d.	Total pre-harvest Fd BA/ha from survey	Total pre-harvest Fd BA from cruise	% Total Residual Fd (>12.5cm) BA/ha from survey	% Harvest & damage Fd (22.5 - 37.5 cm dbh)	% Harvest & Damage Fd (>37.5 cm)	Total BA/ha from survey	Total BA/ha from cruise	% Difference in Total BA/ha between survey and cruise	SSO	Harvest Opportunity Type(s) (%Fd from survey/cruise)	Monitoring Summary Concerns?								
												Skid Trail % >15% of N.A.R.?	Do Skid Trail Sections Run within 30m of ridge or break? (R=rand/om; T= trails)	Did Non-target Harvest or Damage exceed target maximums?	Was post-harvest BA more than 10% below retention target? (Type 4 Harvesting)	Harvest Distribution concerns?	Maintenance & Regeneration			
Transition												Type 2/3	Type 4			Has Fd been planted wherever ecologically possible? (Y, N, NP)	Potential Frost Problems resulting from harvesting?	Potential Windthrow resulting from harvesting?		
	LTC 42502 Bk. 131 (Beaver Valley N.)	31.8	37.80	67.53%	35.35	20.79	49.43	55.80	11.41	Mod	(2),3,4 (62/67)	N	Y (T)	Y	Y	N	N	Y	Y	Y
	FL A20002; CP 402-4 (Needa Lk)	26.9		59.46%	62.78	47.70	31.97	-	-	Mod	3 (85)	Y/N	n/a	Y	n/a	n/a	n/a	NP	N	N
	FL A20002; CP500-429 (Timothy-Rail)	10.3		72.82%	37.10	23.25	31.41	-	-	Mod	2 (32)	n/a	Y (R)	Y	n/a	n/a	n/a	NP	Y	N
	FL A18172 CP 25-1 (Blackwater)	9.2		44.02%	100.00	28.99	25.33	-	-	High	2 (34)	n/a	Y (R)	Y	n/a	n/a	n/a	Y	?	Y
	FL A20013 CP 42W-4 (Blackwater)	7.10		72.29%	44.76	16.96	29.45	-	-	High	2 (22)	n/a	Y (R)	Y	n/a	n/a	n/a	NP	?	N
	Woodlot 533 CP Z - 03-15A (Quesnel)	6.14		0.44%	100.00	100.00	34.77	-	-	Mod	2 (16)	n/a	Y (R)	Y	n/a	n/a	n/a	NP	?	N
	FL A20017; CP099-02-12 (Sucker Lk.)	14.19		78.94%	44.26	12.25	NM	-	-	High	2 (?/~20?)	n/a	Y (T)	Y	n/a	n/a	n/a	Y	?	N
	Woodlot 805 CPZ - 3-14,15, 4-10,11,12,13,14 (Quesnel)	16.9		87.90%	16.18	7.95	28.08	-	-	Mod	3 (57)	n/a	Y (R)	N	n/a	n/a	n/a	NP	Y	Y
	Woodlot 531 CP B - 02-20,21,30 (Narcosli Cr.)	21.6		52.65%	44.16	53.74	28.76	-	-	Mod	3 (63)	N	Y (T)	Y	n/a	n/a	n/a	NP	N	Y (02-20&21)

APPENDIX 4:

SUMMARY FORMS, SUMMARY DATA
SHEETS AND BLOCK SAMPLING MAPS

**APPENDIX 5: SUMMARY OF SILVICULTURE PRESCRIPTION/
SITE PLAN RETENTION STATEMENTS AND
TARGETS**

Appendix 5: Harvest and Retention Target Statements and Explanatory Comments

Block i.d.	Statements taken from SP and qualifying remarks
FL A20001: CP 504-2	SUs1&2: Reserve fir, spruce, aspen and balsam. Protect fir and spruce under CU and regeneration; Stand Composition Goals after harvest = 8.7 m ² /ha Fd (128.6 sph); 1.3m ² /ha Sx (21.4 sph), 0.1m ² /ha Bl (1.8sph); and 1 m ² /ha At (19.7 sph). Harvest of up to 10% of these species allowed for in SP
FL A18172: CP 25-1	Seven windfirm clumps of Douglas-fir vets (51 trees in total) marked in field to be retained throughout the block. Fd >60cm will be retained throughout the block where operationally feasible. Fd <20cm dbh will be retained in groups to the greatest extent possible
FL A20013: CP 42W-4	Within the portion of the block that is in MDWR, retain Fd to the fullest extent possible except for the roadside work areas within 50m from the edge of the road.
FL A20019: CP521-3	Two SUS in block (2&3). This block's dominant SU is SU 3. SU 3: "Due to the low distribution of fir (25%) in this SU and inevitability of blowdown this SU will be clearcut". SU 2: "All Fd is reserved". Planned Residual BA/Ha = 30-35m ² /ha.
FL A62076: CP 277-9	2.7m ² /ha of Fd <27.5cm dbh to be retained; 8.1m ² /ha of Fd >27.5cm dbh to be retained; 80% of Sx and deciduous to be retained (0.7m ² /ha).
FL A 20017: CP99-02-12	Fd and deciduous will be retained across the block. Up to 10% of leave trees, not including those required for development and roadside harvesting may be removed for safety or because of damage during harvesting. Any leave trees that blow down may be harvested which will reduce the number of trees left on site.
LTC 42641: Blk 215	Residual stand to have 15-19m ² /ha of leave trees >12.5cm dbh
FL A20002: CP 402-4	Due to various statements about damage and pests and the treatments to deal with the damage and pests, the loose targets in SP are not measurable
FL A20002: CP 500-429	Protect merchantable Fd where feasible. Protect fir, and spruce regen where feasible
Woodlot 1696 CP A-2	Fd and poplar intended residual BA = 17m ² /ha
LTC 42502 Blk 131	Retain and regenerate Fd and promote clumpy spacing. 3 SUs compose block. In the dominant SU: harvest a max. of 10% of Fd and preserve all >37.5 cm dbh
Woodlot 502: CP E Blk 1	Retain Fd, Hw, and deciduous along with some grade 5 PI Sx, and Bl. Residual BA planned = 12.7m ² /ha (+/- 179 trees per ha). Level of retention: " A minimum of 4 trees per hectare on the average over the entire block"
FL A64033 Blk 16	removal of only PI which composes <10% of stand
K1L: CP B Blk 2	reserve all Fd in SU 1. Not <8m ² /ha of Fd to be retained
FL A20020 CP 003-203-10-00	Uneven-aged single tree selection. Harvest Fd (Sx) only to facilitate roads, landings and trails
FL A20018 CP 268-398	Reserve Fd, Sx, and At. 80% of Fd<27.5cm dbh=3.4m ² /ha; and 95% of Fd>27.5cm dbh = 6.1m ² /ha to be retained.

Note: The above statements represent the extent of retention and post-harvest stand structure goal statements taken from the silviculture prescriptions or site plans for each block. Five woodlots harvested under CP Z exemptions (including WL 531 CPB blocks) did not have silviculture prescriptions prepared but the cutting permits each recognized that Fd was to be retained.