TFL 48
Change Monitoring Inventory
Sample Plan

Prepared for

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1. INTRODUCTION

1.1 BACKGROUND

Canadian Forest Products Ltd. Chetwynd Division (Canfor) is implementing a Change Monitoring Inventory (CMI) program in a continued effort to improve management of the forest resources of Tree Farm License (TFL) 48. Canfor achieved registration under the CSA sustainable forest management (SFM) system for TFL 48 in 2000. Canfor completed a Vegetation Resources Inventory (VRI) in 2000, with statistical adjustment in 2003 using the Phase II ground measurements. Canfor also explored opportunities for a site productivity program to develop improved site index information for TFL 48.

The volume in most post-harvest-regenerated (PHR) stands is projected to be higher than natural stands on the same sites. Increased projected yields exert upward pressure on forecasted timber supply, thus it is important that the G&Y of these stands is closely monitored to ensure this growth is achieved on the landbase.

The CMI program complements other programs as it help track G&Y attributes for the SFM plan, provides a broad-level check of G&Y attributes to identify potential problems with the G&Y model predictions, provides information for other internal management functions such as fiber allocation, and helps develop more accurate managed stand yield tables for the next timber supply review.

1.2 PROGRAM GOALS & OBJECTIVES

Canfor's goal for the CMI program is to monitor and track changes in key G&Y attributes over time in PHR stands on the TFL. The key attributes include volume, mean annual increment, site index, top height, and species composition. The intent is that the data from this G&Y monitoring program will be used to compare the predicted and actual productivity of PHR stands to support future timber supply analyses and SFM plans.

The objectives to achieve that goal are to:

1. Design a CMI sampling program that meets Canfor's goals and that is sufficiently flexible to address potential future changes in conditions, funding, and program objectives.
2. Install CMI ground plots at the establishment year.
3. Install new CMI ground plots and re-measure existing plots in the future re-measurement year as determined by this sample plan, available funding, and information needs at the time.
4. Analyze the data periodically to support future timber supply analyses on the TFL.

1.3 SAMPLE PLAN OBJECTIVES

The objective of this sample plan is to guide Canfor in the initial installation of CMI plots on the TFL and in future installation and remeasurements. This report will also provide information needed in the future statistical analyses of the CMI data.

1.4 TERMS OF REFERENCE

J.S. Thrower & Associates Ltd (JST) completed this CMI sample plan for Canfor on TFL 48. Don Rosen, *RPF* is the project leader for Canfor. René de Jong, *RPF* (JST) is the project manager, and Jim Thrower, *RPF*, PhD is the project advisor.

2. SAMPLE DESIGN

2.1 OVERVIEW

The key features of the sample design are:

1. Sample points are located on a 2,000 m grid based on NAD 83 UTM coordinates.
2. Plots are established at these sample grid points and located in PHR stands older than 15 years of age since harvest.
3. Plots are 11.28 m radius (400 m^2) circular plots as per the Ministry of Forests and Range (MOFR) CMI standards.[1]
4. Plot re-measurement and installation of new plots will be done on a 10-year interval.

2.2 TARGET POPULATION

The target population for the CMI program is all PHR stands[2] in the TFL. All species (including conifer and deciduous) and silviculture systems (including clearcut and shelterwood) are in the target population. A minimum age of 15 years is required to ensure that establishment plots have measurable merchantable volumes. Therefore, for the purposes of CMI plot establishment the target population is represented by PHR stands at least 15 years of age.[3] These stands are approximately 7% of the entire vegetated treed landbase (Appendix II and Appendix III).[4]

2.3 PLOT LOCATION

The CMI plots will be located in the target population on a 2,000 m grid based on NAD 83 UTM coordinates (evenly divisible by 2,000).[5] The advantage of locating plots on a grid instead of randomly is the convenience of locating sample points in the future. Statistical properties of the systematic samples and difference from random samples are known and can be addressed in future data analyses and reporting.

2.4 ESTABLISHMENT SAMPLE SIZE

The 2,000 m grid results in 60 grid points within the target population (Appendix IV). Additional grid points will only be excluded if a permanent road[6] has subsequently been established over a grid point. No exclusion will be made for grid points that fall within riparian management areas.[7]

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[1] Ministry of Agriculture and Land (previously Sustainable Resource Management (MSRM)) - National Forest Inventory BC Change Monitoring Procedures for Provincial and National Reporting ver. 1.4 March 2005. http://srmwww.gov.bc.ca/vri/standards/#cmi.

[2] All harvested cutblocks from Canfor's spatial cutblock coverage were used to define PHR stands. Digital coverage was provided by Don Rosen August 18, 2005.

[3] Stand age is based on the years between the harvest year from Canfor's spatial cutblock coverage relative to 2005.

[4] The spatial coverage for TFL 48 was based on the vegetated treed portion of the VRI inventory. This same spatial coverage was used for the recent VRI phase 2 adjustment project completed by JST in March 2005. For this CMI program, unadjusted attributes were used.

[5] Possible grid sizes ranged from 1,000 m to 2,000 m in increments of 200 m. The 2,000 m grid was agreed to following discussion of sample sizes and future recruitment rates using the different grid size options. In addition, grid sizes were divisible by 200 m to ensure consistency with Canfor's enhanced survey methods used in Ft. St. John. (per. comm. with Don Rosen June 29, 2005).

[6] Permanent roads include mainlines and mainline right-of-ways, and in-block permanent access structures. These exclusions ensure consistency with THLB netdown assumptions.

The large sample size of CMI plots will enable post-stratification of the data for analysis at the establishment phase. Post stratification is of value to assess attribute differences between strata such as species types.

2.5 PLOT DESIGN

The plot design is based on MOFR-approved CMI standards (Figure 1). The main plot is 400 m^2 (11.28 m radius) where all trees greater than 4 cm diameter at breast-height (DBH) are measured and tagged. Trees between 4 and 9 cm are measured and tagged in the small-tree plot (100 m^2, 5.64 m radius), and all trees taller than 30 cm but less than 4 cm DBH are measured and tallied by species in the regeneration plot (19.6 m^2, 2.50 m radius).

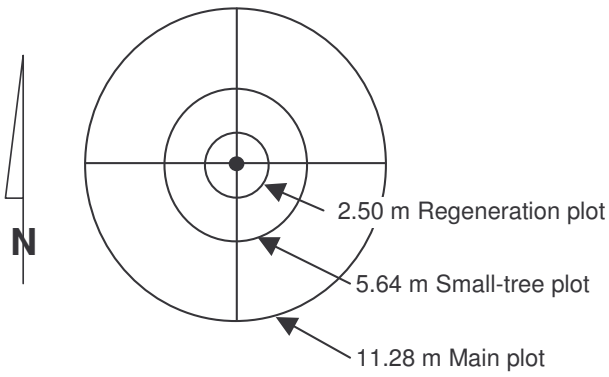

Figure 1. CMI sample plot.

2.6 PLOT MEASUREMENTS

The majority of CMI field procedures will be followed for this project, with the exception of modifications discussed below. These are also summarized in Appendix I.

2.6.1 Coarse Woody Debris

The 2005 CMI Standards will not be followed. Instead, the 2002 CMI standards[8] for CWD transects will be followed, where 2 X 24m transects are established, and only CWD data collected (ie., SWD not included).

2.6.2 Range Data

Shrub transect data will not be collected.
Standard forage production clipping plots will be collected along each CWD transect.

2.6.3 Ecology Data

Complete ecological data will be collected during establishment phase by a certified ecology sampler.

2.6.4 Top Height / Site Trees

There will be no change from standards in the way top height trees ('T' trees) are measured. For leading and secondary species ('L' and 'S' trees), the age and height of the largest diameter, dominant or co-dominant tree of every species present in each plot quadrant will be measured. This ensures the data for both the leading and second species are collected, plus it provides additional valuable data to examine site index relationships between species.[9]

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[7] While these areas represent the current state of these older PHR stands, the need for their inclusion may change in the future, as current management practice is to exclude the RRZ, and portions of the RMZ from the net area to be reforested.

[8] MSRM CMI Ground sampling procedures for the provincial CMI program. March 29, 2002. Ver. 1.2.

[9] Collection of this information supports the need to localize site index conversion equations, an issue previously raised by government in other related projects.

2.6.5 Other Height Trees

Other potential site trees will also be identified where the largest diameter tree is deemed unsuitable as a site tree. This includes provision for stepping-down the DBH list until a suitable site tree is identified. Such trees will be recorded as 'O' trees. While these trees will not be used in the CMI compilation program, their collection will ensure a site index estimation is taken for every plot, which would not otherwise be collected under CMI standards.

2.6.6 Tree Tagging

Blue tree tags are affixed at breast height rather than at stump. This simplifies installation and re-measurement without making the plot unduly visible.

2.6.7 Portion of Plots Outside Target Population

If a portion of a plot overlaps with an adjacent stand outside the target population (eg., mature / old growth) then site trees will be sampled from each stand type.[10] A drawing of the plot will be used to estimate the target population boundary line, and will be based on the 1:5,000 sample package maps.

2.7 QUALITY CONTROL

Third-party quality assurance will be completed and follow current Ministry standards[11].

2.8 DATA ENTRY

Data will be recorded on field cards and checked each night during the field sampling phase. Once field sampling is completed, data entry will use TIMVEG, the data entry software supported by MOFR.

2.9 DATA COMPILATION

Data will be compiled using the MOFR CMI data compiler.[12]

2.10 ANALYSIS AND INTERPRETATION

Data analysis is not a part of this project, however, an establishment report will be completed that describes the sample design, plot installation methods, and some basic summaries of the compiled measurements.

2.11 RE-MEASUREMENT SCHEDULE

Canfor will base its CMI re-measurement on a 10-year cycle to be consistent with Canfor's PSP re-measurement cycle.[13] The re-measurement period can be shortened if desired to be consistent with 5-year management plan cycle. Re-measurements will provide new information to check the PHR yield curves for each subsequent timber supply analysis. The recruitment rate of new CMI plots entering the minimum 15 year threshold age will be approximately 42 CMI plots over each ten-year period, based on the 2,000 m grid size.

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[10] Although we are interested primarily with PHR stands, suitable site trees originating from adjacent older stands outside the target population should also be measured (email from V. Sundstrom, MSRM, October 2, 2003).

[11] MSRM Change Monitoring Inventory – Ground Sampling Quality Assurance Standards ver. 1.1 March 29, 2002.

[12] This publicly available software was originally written by MSRM to compile both VRI and CMI data, and has been updated to June 27, 2002.

[13] per. comm. with Don Rosen June 23, 2005.

2.12 FUTURE MODIFICATIONS

Future modifications to the CMI program may include:

1) **Changes to sample intensity**
   Sampling intensity can be decreased or increased in the future as more plots are located in PHR stands. The number of plots in the CMI program will increase as more natural stands are harvested, regenerated, and reach 15 years of age. At some point in the future, the cost of the program may become too high and Canfor may want to reduce costs. This can be done by randomly dropping some plots in older PHR stands where the comfort on predicting stand yield is higher.

2) **Decreasing measurement period**
   A five-year measurement period is convenient because it corresponds to the MP schedule and would provide monitoring results sooner. However, this would substantially increase the CMI program costs.

3) **Re-defining the Target Population**
   Post-stratification of the CMI plots in the future may identify a need to concentrate on just a subset of the data (eg., specific species), and thereby reduce or remove CMI plots occurring in other strata types. Existing stands may have been harvested under varying historical standards, and some may be considered for future exclusion (eg, CMI plots located within riparian management zones may be excluded if the THLB netdown process also excluded these areas).

4) **Establishing linkages with other programs**
   Extend the CMI program to mature stands and possibly have links to VRI Phase II ground sampling.

   Provide a link with silviculture surveys designed to monitor the first 15 years of post-harvest.

5) **Combine with other CMI data**
   Utilize other previously collected CMI data from similar sites to increase statistical confidence of analyses.

6) **Adding other information**
   New tree measurements can be added to the CMI program at any time in the future. For example, measurements of branch size, tree taper, or wood quality could be included in the next measurement cycle. This would provide the same representative sample, but change estimates could not be computed until two or more measurements of the same attribute were taken. Future additions could also include more detailed ecological descriptions.

APPENDIX I – SAMPLING METHODS VARIANCE FROM CMI STANDARDS

For the most part, MOFR Monitoring procedures should be followed to establish the plots. This appendix outlines proposed changes to these procedures (by VRI / CMI card number) for consideration for use on TFL 48. It should be noted that any change may require modification of the CMI compilation procedures.

Header Card (CH – card 1)

Plot number – There are four spaces to enter a plot number on this card. It is recommended that plot numbers incorporate the UTM coordinates of the plot to ensure unique plot numbers over time. This also allows for easy location of the plot. A plot number based on UTM coordinates could be recorded in the notes section. A sequential plot number (for plots established in any given year) could be entered in the plot sample # field. This information along with the date of establishment will be stored in the database, allowing plot XXXX-XXXX to be cross-referenced as the Yth plot established in year Z.

Compass Card (CP – card 2)

Complete following 2005 CMI standards.

Cluster Layout Card (CL – card 3)

Complete following 2005 CMI standards.

If plot boundary overlaps with adjacent polygon outside target population (eg., mature / old growth stand, permanent road), map portion of plot outside target population using plot detail map. Reference the boundary line from the sample package map (based on ortho image X forest cover).

Range Sampling Shrub Transect 1 (RS – card 4)
Range Sampling Shrub Transect 2 (RT – card 5)

Do not sample shrub transects.

Sample standard forage production clipping plots along each CWD transect.

Coarse Woody Debris Transect 1 (EW – card 6)
Coarse Woody Debris Transect 2 (EC – card 7)

Do not follow 2005 CMI standards.

Follow 2002 CMI standards, where 2 X 24m CWD transects are established, and only CWD is sampled (ie., SWD not included).

Tree Details (TD – card 8)

Complete following 2005 CMI standards.

Tags will be nailed at breast height. Tagging sector (1-8) will be recorded in column S1 of Card 8.

Where the plot boundary overlaps with adjacent stand outside target population, then identify trees outside the target population in column S2 of card 8 (I=in, O=out).

Tree Loss Indicators (TL – card 9)

Complete and enter following CMI procedures with the exception of stem mapping.

Small Tree, Stump and Site Tree Data (TS – card 10)

Top height tree - measured as per 2005 CMI standards.

Leading and second species - not pre-determined, instead, potential site trees are measured from each species in each 11.28 m radius quadrant. Record as 'S' tree. Where the plot boundary overlaps with adjacent stand outside target population and the 'S' tree is determined outside the target population, then two 'S' trees are measured (one from the stand outside target population and one from PHR stand inside target population).

Other site trees - Additional potential site trees are measured from the next largest DBH tree of each conifer species in each 11.28 m quad, if the largest DBH tree is deemed unsuitable for site index. Record as 'O' tree. Note that these trees are not used as part of the CMI compilation procedures.
Where plot boundary overlaps with adjacent mature / old growth stand, do not sample 'O' tree from the adjacent older stand.

Auxiliary Plot Card (TA – card 11)

Not used.

Ecological Description 1 (EP – card 12)
Ecological Description 2 (ED – card 13)

Complete following 2005 CMI standards.

Tree and Shrub Layers (ET – card 14)

Complete following 2005 CMI standards except use the 11.28 m radius plot was instead of a 10.0 m radius plot.

Herb and Moss Layers (EH – card 15)

Complete following 2005 CMI standards.

Succession Interpretations (EO – card 16)

Complete following 2005 CMI standards.

APPENDIX II – TFL 48 LANDBASE

Canfor's TFL 48 covers approximately 643,000 ha, of which 565,000 ha (88%) are vegetated treed (Table 1). White spruce (Sw), Lodgepole pine (Pl) and subalpine fir (Bl) account for 83% of all leading species in the productive forest of the TFL (Table 2). Approximately 10% of the area is covered by stands up to 40 years of age, while 50% of the area is 121 years and older.

Table 1. TFL 48 area distribution.

Landbase	Area (ha)	(%)
Entire Landbase	643,238	100
Non-vegetated treed	76,701	12
Vegetated tree portion	564,761	88

Table 2. TFL 48 Area distribution by leading species and age class.[14]

	Age Class										Total	
Spp	0	1	2	3	4	5	6	7	8	9	(ha)	(%)
AC		1,973	910	1,895	2,171	3,195	5,600	3,026	2,868	8	*21,647*	*4%*
AT	19	4,730	4,768	8,724	10,241	15,035	14,267	7,470	932		*66,186*	*12%*
BL	1	5,373	2,187	8,502	4,075	15,527	13,218	18,960	50,283	3,564	*121,691*	*22%*
EP		240	378	1,051	867	445	260	103			*3,344*	*1%*
LT		6	34	150	67	129	64	13	64		*527*	*0%*
PL	289	6,888	3,757	14,257	9,797	22,747	30,059	34,305	41,409	171	*163,679*	*29%*
SW	1,008	18,614	2,291	6,350	3,439	12,632	15,167	26,515	68,593	26,021	*180,630*	*32%*
SB		3	311	926	354	903	1,041	1,115	2,360	44	*7,057*	*1%*
Total	*1,317*	*37,828*	*14,635*	*41,856*	*31,012*	*70,614*	*79,676*	*91,507*	*166,509*	*29,808*	*564,761*	*100%*
	0%	*7%*	*3%*	*7%*	*5%*	*13%*	*14%*	*16%*	*29%*	*5%*	*100%*	

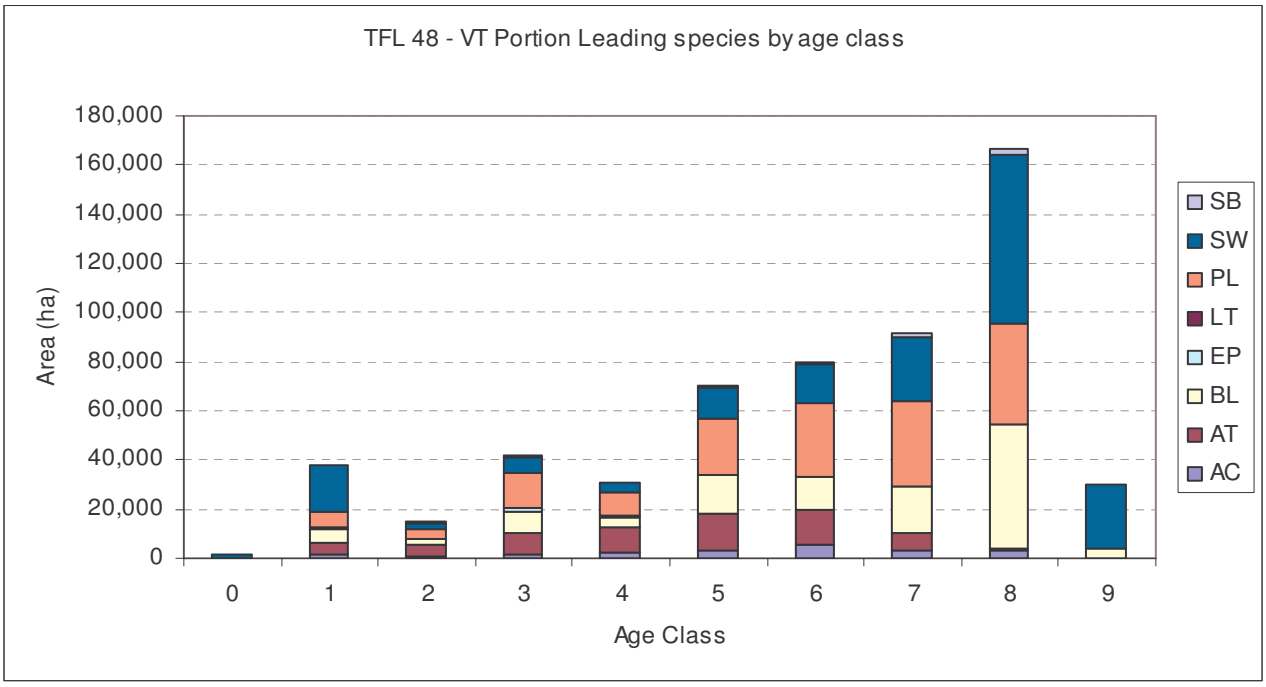

Figure 2. TFL 48 Vegetated treed area distribution by leading species and age class.

[14] Age class attributes are projected in the inventory file to the year 2004.

APPENDIX III – AREA DISTRIBUTION OF PHR STANDS

Table 3. TFL 48 Area distribution by leading inventory species and age[15] (ha).

Age range	Leading Inventory Species								*Total*	*%*
	Blank	AC	AT	EP	BL	PL	SW	SB		
0 – 4	603	252	1,306	1	578	2,045	6,155	131	*11,072*	*22%*
5 – 9	627	620	1,542	9	1,837	1,751	4,259	53	*10,697*	*21%*
10 – 14	501	341	690	4	2,292	442	2,736	3	*7,009*	*14%*
15 - 19	577	213	1,033	23	1,430	2,005	3,465		*8,746*	*17%*
20 – 24	346	519	458	36	1,014	1,179	2,371		*5,923*	*12%*
25 – 29	318	140	324	349	1,079	560	2,416	7	*5,192*	*10%*
30 – 34	34	95	219		17	72	739		*1,176*	*2%*
35 - 39	5				132	52	112		*301*	*1%*
40 – 44	1				10	23	17		*51*	*0%*
45 – 49	3		18			19	215		*254*	*1%*
Total	*3,014*	*2,180*	*5,589*	*422*	*8,389*	*8,148*	*22,485*	*195*	*50,422*	*100%*
%	*6%*	*4%*	*11%*	*1%*	*17%*	*16%*	*45%*	*0%*	*100%*	

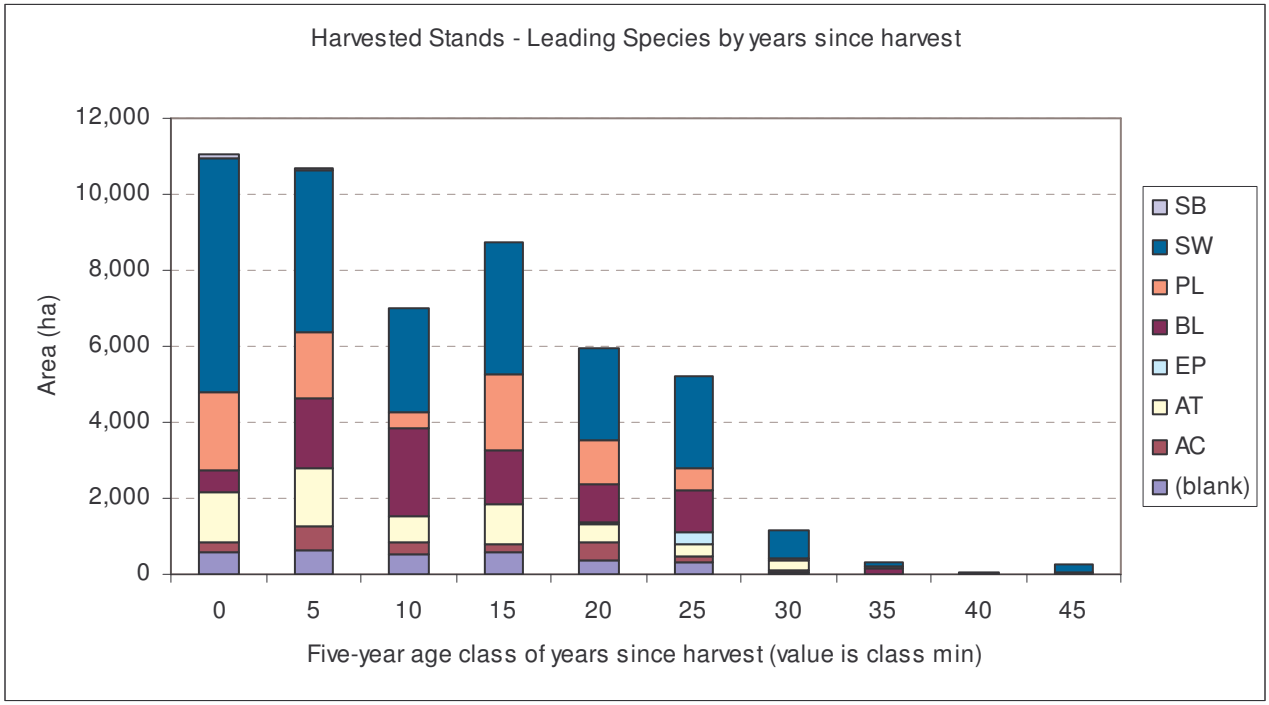

Figure 3. TFL 48 Area distribution of harvested stands by species and age.

[15] Age class for harvested stands is based on the number of years since harvest start date, relative to 2005.

APPENDIX IV – TFL 48 CMI ESTABLISHMENT SAMPLE LIST

The following sample list is based on a 2,000 m grid size for all possible sample points located on PHR stands that are at least 15 years from the date of harvest (relative to 2005). No assessment has yet been made whether any grid point should be excluded (eg., located on mainline roads or mainline right of ways, safety).

Grid (m)	Plot number	Mapsheet	Polygon	VRI Population type	UTM Easting	UTM Northing	Species 1	Species 2	Species 1 %	Species 2 %	Harvest year	Harvest age	Inventory age
2,000	1	093O087	1853	Young	524000	6190000	PL	SW	61	19	1986	19	16
2,000	2	093P052	2508	Young	582000	6158000	SW	AC	63	13	1989	16	14
2,000	3	093O050	2296	Young	560000	6142000	BL	SW	80	20	1977	28	19
2,000	4	094B008	1656	Young	534000	6216000	AC	SX	40	20	1990	15	11
2,000	5	094B008	1652	Young	536000	6216000	PL	SX	50	30	1989	16	11
2,000	6	093P021	1851	Young	564000	6128000	SW	PL	47	35	1985	20	12
2,000	7	093P052	2584	Young	580000	6156000	PL	SW	69	28	1986	19	15
2,000	8	094B009	860	Young	542000	6212000	SW	AC	37	26	1985	20	15
2,000	9	093O098	1639	Young	530000	6204000	BL	SW	60	30	1987	18	16
2,000	10	093O077	1630	Young	520000	6180000	SW	BL	50	30	1990	15	12
2,000	11	093O099	1611	Young	540000	6204000	AC	SW	30	28	1980	25	9
2,000	12	094B008	1771	Young	530000	6212000	SW	BL	44	23	1984	21	16
2,000	13	093P043	1844	Young	592000	6148000	SW	AT	54	41	1989	16	14
2,000	14	093I093	1445	Young	598000	6092000	SW	BL	56	43	1987	18	15
2,000	15	093P052	2627	Young	576000	6156000	PL	SW	91	7	1985	20	15
2,000	16	093O089	1535	Non-VT	544000	6194000					1972	33	
2,000	17	093O089	1644	Young	548000	6192000	PL	AC	94	6	1985	20	18
2,000	18	093P043	1803	Young	592000	6150000	AT	SW	60	20	1990	15	13
2,000	19	093O049	2083	Young	540000	6142000	BL	SX	60	40	1989	16	14
2,000	20	093P015	1540	Young	618000	6110000	SW	AC	64	19	1986	19	14
2,000	21	093O089	573	Young	548000	6190000	SW	AC	30	30	1986	19	17
2,000	22	093O099	1737	Young	540000	6198000	SW	AC	43	27	1986	19	15
2,000	23	093O099	1628	Young	540000	6202000	PL	AT	72	15	1984	21	19
2,000	24	093O077	1585	Young	514000	6182000	SW		100	0	1990	15	8
2,000	25	093O049	400	Non-VT	542000	6140000	BL	SW	80	20	1984	21	21
2,000	26	094B018	1191	Young	534000	6228000	SW	BL	46	38	1983	22	19
2,000	27	093P051	2411	Young	572000	6154000	BL	SW	50	30	1983	22	22
2,000	28	093P014	939	Young	612000	6114000	SW	AC	50	30	1988	17	12
2,000	29	093O097	1970	Young	524000	6196000	SW	BL	55	20	1985	20	18
2,000	30	093O098	1724	Young	534000	6198000	SW	BL	40	30	1983	22	14
2,000	31	093O029	1262	Young	550000	6122000	BL	SX	74	26	1990	15	13
2,000	32	093O020	1583	Shelter	560000	6114000	BL	SX	60	40	1978	27	86
2,000	33	093P052	2438	Young	578000	6160000	PL	SW	61	25	1986	19	15
2,000	34	093P042	760	Target	576000	6146000	SW	PL	70	20	1978	27	182
2,000	35	093O089	1702	Young	550000	6190000	AC	SW	50	43	1974	31	28

Grid (m)	Plot number	Mapsheet	Polygon	VRI Population type	UTM Easting	UTM Northing	Species 1	Species 2	Species 1 %	Species 2 %	Harvest year	Harvest age	Inventory age
2,000	36	093O050	2264	Young	558000	6144000	BL	SX	80	20	1979	26	24
2,000	37	093P004	1997	Non-VT	612000	6104000					1976	29	
2,000	38	093P033	1065	Young	600000	6136000	PL	BL	70	20	1990	15	14
2,000	39	093P092	915	Young	582000	6200000	SW	AT	70	20	1975	30	17
2,000	40	093P004	1957	Target	614000	6106000	SW	PL	50	40	1957	48	40
2,000	41	093O039	1722	Young	548000	6138000	SW	BL	60	40	1983	22	15
2,000	42	093O039	1735	Young	548000	6136000	SW	BL	70	30	1983	22	16
2,000	43	093O099	1842	Young	546000	6196000	PL	SW	49	29	1979	26	25
2,000	44	093O099	1745	Young	542000	6198000	PL	SW	58	29	1984	21	17
2,000	45	093O089	1636	Young	546000	6192000	PL	SW	64	23	1980	25	17
2,000	46	093P084	1318	Young	604000	6190000	EP	AT	42	21	1977	28	24
2,000	47	093P053	1611	Young	592000	6160000	SW	AT	50	20	1988	17	15
2,000	48	093O089	363	Young	542000	6192000	PL	SX	50	30	1986	19	14
2,000	49	093P014	943	Young	614000	6112000	PL	AC	50	30	1988	17	15
2,000	50	093O059	2290	Young	546000	6160000	PL	SX	80	11	1990	15	14
2,000	51	093O076	1026	Young	512000	6182000	PL	SX	60	30	1990	15	11
2,000	52	093O089	1696	Young	540000	6190000	PL	SW	80	10	1986	19	15
2,000	53	093O089	1710	Young	546000	6190000	PL	SW	43	28	1979	26	18
2,000	54	093P053	1579	Young	592000	6162000	SW	PL	70	20	1981	24	20
2,000	55	094B040	115	Young	550000	6242000	SW		100	0	1981	24	19
2,000	56	094B009	834	Young	538000	6214000	PL	SW	45	36	1986	19	16
2,000	57	093I094	1686	Young	610000	6092000	PL	AT	80	10	1990	15	13
2,000	58	094B009	904	Young	542000	6210000	SW	AC	70	24	1979	26	20
2,000	59	093O089	1509	Young	546000	6194000	AT	SW	48	23	1971	34	19
2,000	60	093P031	2841	Young	566000	6130000	SW	BL	50	30	1985	20	15

APPENDIX V – TFL 48 CMI 10-YEAR RE-CRUITMENT SAMPLE LIST

The following sample list is based on a 2,000 m grid size for all possible recruitment sample points in ten year's time, located on stands between 5 and 14 years of age (relative to 2005). No assessment has yet been made whether any grid point should be excluded (eg., located on mainline roads or mainline right of ways, safety).

Grid (m)	Plot number	Mapsheet	Polygon	VRI Population type	UTM Easting	UTM Northing	Species 1	Species 2	Species 1 %	Species 2 %	Harvest year	Harvest age	Inventory age
2000	1	093O086	1021	Young	510000	6192000	BL	SX	50	50	1993	12	8
2000	2	093O059	2359	Young	550000	6152000	SW	BL	90	10	1999	6	4
2000	3	093P092	964	Young	578000	6198000	SW	PL	50	30	1994	11	12
2000	4	093P042	2139	Young	588000	6148000	SW	AT	80	10	1996	9	8
2000	5	093O060	2532	Young	560000	6152000	SW	PL	70	20	1997	8	6
2000	6	093P051	1526	Target	570000	6154000	PL	SW	55	45	1996	9	131
2000	7	093I083	220	Target	600000	6082000	BL	SW	70	30	1999	6	172
2000	8	093O098	1669	Young	530000	6200000	BL	SX	20	8	1998	7	1
2000	9	093O099	1827	Young	538000	6196000	SW	BL	60	20	1996	9	7
2000	10	094B018	1247	Young	528000	6220000	AT	EP	50	30	1995	10	10
2000	11	093O029	1236	Shelter	548000	6124000	BL	SX	90	10	1998	7	43
2000	12	093P092	844	Non-VT	582000	6198000					1992	13	
2000	13	093O097	1836	Young	520000	6206000	AT	PL	50	40	1999	6	4
2000	14	093P052	1573	Target	582000	6154000	SW	AC	85	5	1996	9	156
2000	15	093P051	2496	Young	570000	6152000	BL	SX	60	30	1996	9	7
2000	16	093O060	2526	Non-VT	562000	6152000					1998	7	
2000	17	093I095	637	Target	618000	6090000	SW	ACT	90	10	1996	9	191
2000	18	093P085	687	Young	618000	6188000	SW		15	0	2000	5	3
2000	19	093P033	1080	Young	590000	6136000	SW	BL	50	40	1997	8	5
2000	20	093P042	2197	Young	584000	6142000	AT	AC	90	10	1999	6	5
2000	21	093I093	1470	Young	596000	6090000	SW	BL	60	40	1996	9	1
2000	22	093I084	1247	Young	606000	6082000	SW	BL	70	30	1993	12	8
2000	23	094B018	1002	Non-VT	530000	6218000					1991	14	
2000	24	093P032	1788	Non-VT	580000	6136000					1992	13	
2000	25	093O040	2453	Shelter	562000	6136000	BL	SX	60	40	1999	6	77
2000	26	093P084	1397	Young	602000	6186000	SW	PL	60	30	1997	8	7
2000	27	094B009	242	Non-VT	538000	6210000					1992	13	
2000	28	093P075	455	Young	614000	6182000	AC	AT	40	23	2000	5	1
2000	29	093I094	1710	Young	608000	6090000	SW	BL	60	30	1992	13	9
2000	30	093I094	1739	Young	606000	6088000	BL	SX	70	30	1993	12	6
2000	31	093P075	405	Young	614000	6184000	AC	AT	63	21	2000	5	6
2000	32	093P074	889	Young	602000	6184000	SW	AC	70	20	1997	8	7
2000	33	093O099	853	Target	544000	6196000	SW	PL	50	30	1999	6	158
2000	34	093O087	1823	Young	514000	6194000	SW	BL	80	20	1993	12	11
2000	35	093P085	748	Young	614000	6186000	AC	SX	39	38	2000	5	1

Grid (m)	Plot number	Mapsheet	Polygon	VRI Population type	UTM Easting	UTM Northing	Species 1	Species 2	Species 1 %	Species 2 %	Harvest year	Harvest age	Inventory age
2000	36	093O060	2258	Young	562000	6160000	SW	PL	60	40	1998	7	6
2000	37	093O060	2519	Young	556000	6152000	SW	BL	59	41	2000	5	3
2000	38	093P022	1103	Young	580000	6124000	BL	PL	50	30	1991	14	10
2000	39	093P032	1896	Young	582000	6138000	AT		100	0	1991	14	10
2000	40	093I083	407	Shelter	598000	6082000	BL	SX	70	30	1999	6	38
2000	41	093O097	1869	Young	522000	6204000	PL	BL	50	30	1997	8	6
2000	42	093P092	1030	Young	582000	6196000	SW	AC	50	30	1991	14	12

APPENDIX VI – ESTABLISHMENT SAMPLE LIST SPECIES DISTRIBUTION

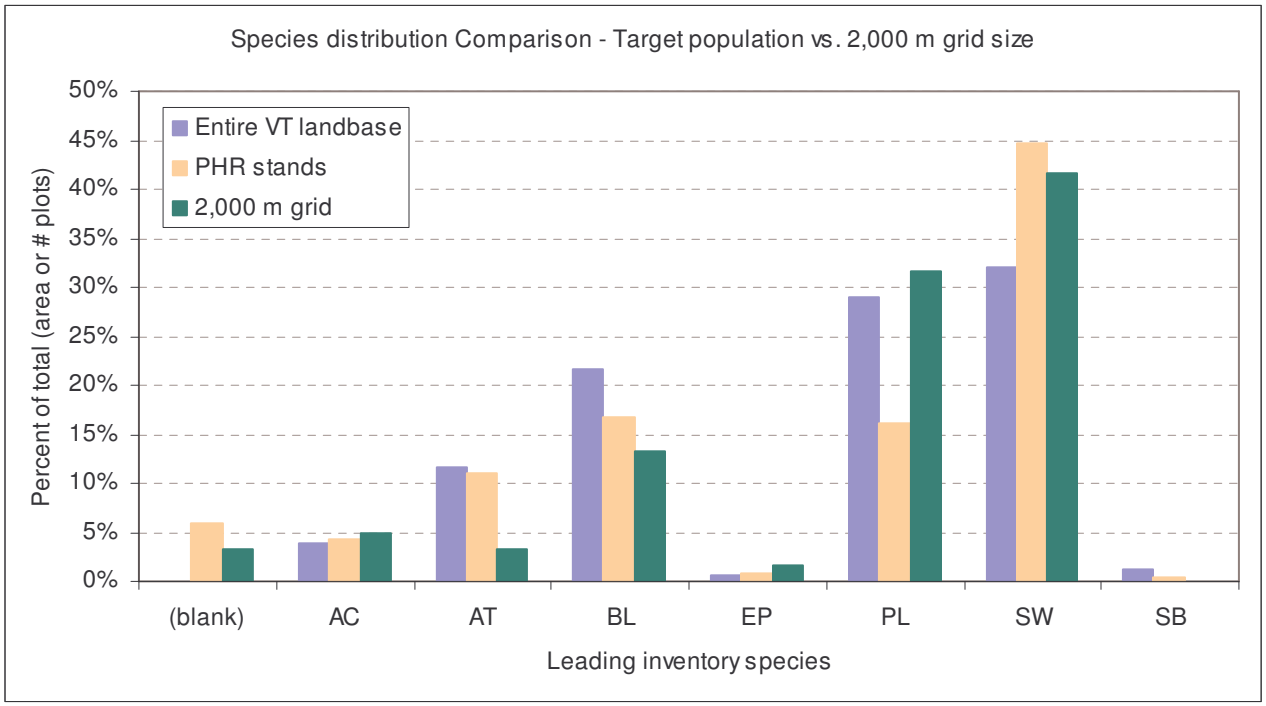

Figure 4. TFL 48 Comparison of species distribution between entire PFLB, PHR stands, and sample points based on a 2,000 m grid.

APPENDIX VII – CMI ALTERNATE SAMPLING OPTIONS

A range of grid sizes were assessed to evaluate the species distribution, current establishment sample sizes, and recruitment rates. Note that sample sizes are based on spatial grid overlays, and costs are estimated at $2,500 / plot (sample plan + establishment) and $1,250 / plot (re-measurement). Shaded cells include the chosen grid size for TFL 48.

Grid based sample sizes						Year 0 cost		Year 10 cost			
Grid (m)	establishment age range	recruitment age range	Grid area representation (ha / plot)	Establishment sample size – spatial grid (# plots)	10yr recruitment sample size – spatial grid (# plots)	Total # plots	Total cost	Total # plots	Establishment cost	Re-measurement cost	Total cost
1000	15-44	5-14	100	218	162	218	***$545,000***	380	405,000	273,000	***$678,000***
1200	15-44	5-14	144	158	103	158	***$395,000***	261	258,000	198,000	***$456,000***
1400	15-44	5-14	196	103	87	103	***$258,000***	190	218,000	129,000	***$347,000***
1600	15-44	5-14	256	89	69	89	***$223,000***	158	173,000	111,000	***$284,000***
1800	15-44	5-14	324	87	54	87	***$218,000***	141	135,000	109,000	***$244,000***
2000	15-44	5-14	400	60	40	60	***$150,000***	100	100,000	75,000	***$175,000***