Statistical Adjustment of Dense Lodgepole Pine Polygons in the Boundary Forest District

Prepared for

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Executive Summary

Total yield estimates in the Forest Inventory Production (FIP) files were not significantly different from ground-sample estimates in dense lodgepole pine (Pl) polygons in the Boundary Timber Supply Area (TSA) or Tree Farm License (TFL) 8. The ground sample estimates indicated that age in the FIP inventory was relatively reliable, and that height and site index were under-estimated.

The adjusted inventory for the TSA and the TFL should be used in the next timber supply review. The adjusted site index of existing stands probably under-estimates the potential site index of future post-harvest regenerated (PHR) stands because of height-growth repression. A method should be developed to provide more accurate estimates of potential site index for these stands.

Average diameter and piece-size distributions were estimated from the ground-sample clusters, but not at the polygon level. Analysis of the sawlog component suggested that about one third of the dense Pl polygons currently meet the minimum sawlog size (0.1 m^3 piece size for Pl, 0.2 m^3 for other species).

The total area of dense Pl polygons dropped by 60% in the Boundary TSA and 40% in TFL 8 after adjustment. However, the sample did not provide information about how much area from the remainder of the TSA and TFL should be included as dense Pl. Consequently, the true area of dense Pl polygons in the Boundary Forest District is unknown.

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1. INTRODUCTION

1.1 TERMS OF REFERENCE

This is the final report for the project "Statistical Adjustment of Dense Lodgepole Pine Polygons in the Boundary Forest District." Pope and Talbot Ltd. contracted J.S. Thrower & Associates Ltd. to statistically adjust the inventory attributes in dense lodgepole pine (Pl) polygons in the Boundary Forest District. Geoff Bekker, *RPF* was the contact person for this project.

1.2 BACKGROUND

The Boundary Forest District, located in the southeast portion of the province, consists of the Boundary Timber Supply Area (TSA) and Pope & Talbot's Tree Farm License (TFL) 8 (Figure 1). The TSA contains 578,118 ha; 311,321 ha are in the timber harvesting landbase (THLB) with an Annual Allowable Cut (AAC) of 700,000 m^3. The total area of the TFL is 77,664 ha with a 64,658 ha THLB and an AAC of 145,000 m^3.

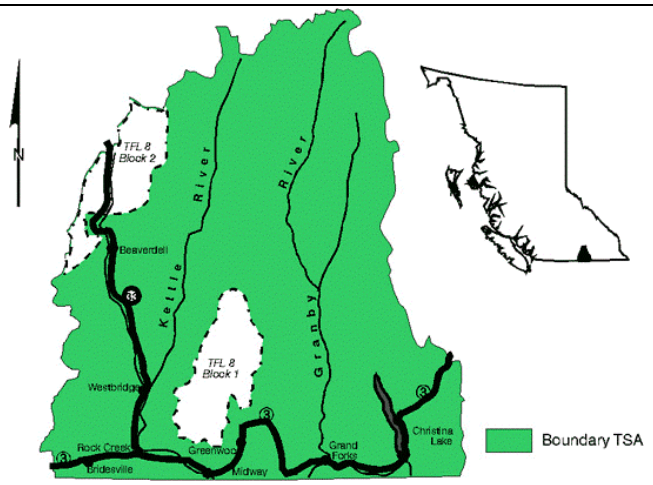

Figure 1. Map of the Boundary Forest District.

Dense Pl stand types make up roughly 15% of the THLB in the Boundary Forest District. These areas present an opportunity to increase future timber supplies, as many of these stands are currently immature.[1] Furthermore, changing technologies and growing demand for special wood products has created interest in the value of these stands. Consequently, the Ministry of Forests (MOF) has decided to adjust inventories to improve the accuracy of dense Pl stand attributes in the database.[2]

1.3 OBJECTIVES

The objectives of this project were to:

1. *Analyze data collected in the Phase II Vegetation Resources Inventory (VRI) Timber Emphasis Plots and adjust the FIP file inventory of dense Pl stand types in the Boundary Forest District.*[3]
2. *Develop estimates of area, volume, and location of dense Pl stands in the Boundary Forest District.*
3. *Recommend how the results of this analysis can be incorporated into the timber supply review.*

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[1] AAC Rationale for the Boundary TSA, 1995.

[2] Boundary Forest District Dense Pine Management Inventory Plan. Unpublished Report, Ministry of Forests, Resources Inventory Branch, July 31, 1998. 22 p.

[3] We included the Boundary Timber Supply Area and TFL 8 in our definition of the Boundary Forest District.

2. METHODS

2.1 OVERVIEW

This section defines the dense Pl populations adjusted using data from the VRI Timber Emphasis Plot ground samples, shows how the populations were weighted to account for different selection probabilities in the TSA and TFL, and describes the analysis (ratio-of-mean, geometric mean regression). Average volume/ha was compared by species, management unit (TSA, TFL), and utilization (12.5-cm, 17.5-cm). Average frequency distributions by diameter and piece-size classes were also estimated.

2.2 SAMPLE POPULATION

The population of interest was all dense Pl polygons in the Boundary TSA and TFL 8. Dense Pl polygons were defined by inventory type group, age, height, stocking, and site classes (Table 1). The population was stratified into the TFL, productive TSA area, and parks and non-productive TSA area (Table 2).

Table 1. Definition of dense Pl population in the Boundary Forest District.

Inventory Type Group	Age Class	Height Class	Stocking Class	Site Class
28-31	Any	Any	4	Any
28-31	3	1	0	P
28-31	3	2	0	P
28-31	4	2	0	P
28-31	Any	Any	3	Any

Table 2. Populations of interest.

Stratum	Population			Sample		Adjustment
	No. Polygons	Area		No. Clusters		
TFL 8	1,128	10,494	18%	15	10%	Yes
TSA-Productive	1,704	38,727	64%	131	83%	Yes
TSA-Parks & NP	600	10,818	18%	11	7%	No
Total	*3,432*	*60,039*	*100%*	*157*	*100%*	

The sampled and adjusted populations were not exactly the same although the difference was probably negligible and thus the populations were assumed the same. The difference was addressed by reconstructing the population database.[4]

Fifteen samples were located in the TFL and 150 in the TSA. The TSA sample was systematically selected (with random start) from an unsorted list, and the TFL sample was selected from a sorted list (by age, height, and site classes). However, five samples selected in the TSA were not established,[5] and three sample clusters were dropped because they were not part of the reconstructed TSA population. These eight dropped plots probably create a statistical bias; however, the magnitude is probably small. This potential bias is ignored in this project. The 11 clusters located in parks and non-productive areas in the TSA were not included in the adjustment.

[4] The difference likely resulted from logging and North American Datum shift.

[5] One could not be located on the mapsheets, one was dropped for safety, two were considered too small, and one was dropped for an unknown reason.

The resulting sample included 131 plots in the productive land in the TSA and 15 plots in the TFL. Ground sampling used *Timber Emphasis Plots*, which use the same five-point cluster as the VRI.

Sample plot clusters were weighted to account for the sample selection probabilities in the TSA and TFL.

$$\text{TSA:} \quad w = \frac{38{,}726.5\,\text{ha}}{131\ \text{samples}} = 295.6\,\text{ha/sample}$$

$$\text{TFL:} \quad w = \frac{10{,}494.4\,\text{ha}}{15\ \text{samples}} = 699.6\,\text{ha/sample}$$

Thus, the relative weight of samples from the TFL was approximately 2.367 (699.6/295.6), while plots from the TSA had a relative weight of 1.0.

2.3 ANALYSIS

2.3.1 Audit and Descriptive Statistics

The MOF Resources Inventory Branch compiled the data with net volumes based on the MOF loss-factor. The average volume/ha from the ground sample was compared to the inventory database using similar techniques to inventory audits. Audit statistics were calculated by species and management unit (TSA, TFL), and by 12.5 cm+ and 17.5 cm+ utilization. Average frequency distribution was compiled by 0.1-m^3 piece-size class and by 5-cm diameter at breast height (DBH) class. A polygon-level piece-size or diameter distribution could not be derived since these attributes are not available in the inventory database.

2.3.2 Statistical Adjustments

The inventory database was adjusted using the Fraser TSA method:[6]

1) adjust height and age;
2) derive site index based on unadjusted leading species and adjusted height and age;
3) use VDYP to generate volume based on the adjusted site index and adjusted age; and
4) use ground sample data to adjust VDYP volume.

The TFL and TSA were adjusted separately as they are considered independent in timber supply analysis. Attributes in TFL 8 were adjusted using a ratio-of-means method because of the small number of plots. The TSA was adjusted using geometric mean regression (GMR) which allows better apportioning of total volume among polygons than the ratio-of-means.

The combined population (TFL & TSA) also was adjusted using GMR and should only be used for common TFL/TSA management approaches to address the dense Pl issue in the District.

[6] Ministry of Forests. Fraser TSA: File adjustment project. File adjustment recommendations. MOF ORCS 13300-20TSAADJMT, April 15, 1997. 10 p.

3. RESULTS

3.1 INVENTORY AUDIT

3.1.1 Comparison by Species

The FIP files slightly under-estimated (about 5.3%) the ground-sample volume at 12.5-cm+ utilization, but the difference was not statistically significant (Table 3, Figure 2). Thirteen species were present in the inventory; however, five [balsam (Bl), Douglas-fir (Fdi), Pl, larch (Lw), and spruce (Sx)] represented 99% of total volume. Pl, the dominant component, was over-estimated by about 33% (31 m^3/ha), and the other four were under-estimated. The statistics and pattern of over- and under-estimation were similar at 17.5-cm utilization (Table 4, Figure 3).

Table 3. Audit statistics by species (12.5-cm utilization).

Species	FIP Files (n=146)			Ground Data (n=146)			Difference	
	Average (m^3/ha)	Std Err (m^3/ha)	95% CI (m^3/ha)	Average (m^3/ha)	Std Err (m^3/ha)	95% CI (m^3/ha)	t-value	p-value
Bl	1.5	0.5	[0.4, 2.6]	11.1	2.3	[6.5, 15.7]	-4.012	0.000*
Fdi	1.0	0.4	[0.1, 1.9]	13.5	2.1	[9.4, 17.6]	-5.946	0.000*
Lw	6.7	1.0	[4.7, 8.7]	13.4	2.1	[9.2, 17.6]	-2.855	0.005*
Pl	121.5	5.1	[111.3, 131.7]	90.2	5.9	[78.6, 101.8]	4.017	0.000*
Sx	1.6	0.7	[0.3, 2.9]	8.6	1.8	[5.0, 12.2]	-3.645	0.000*
Others	0.3	0.3	[0.0, 0.9]	2.9	0.9	[1.2, 4.6]	-2.856	
All	*132.6*	*5.0*	*[122.7, 142.5]*	*139.7*	*7.2*	*[125.4, 154.0]*	*-0.808*	*0.420*

* statistically different at 99%.

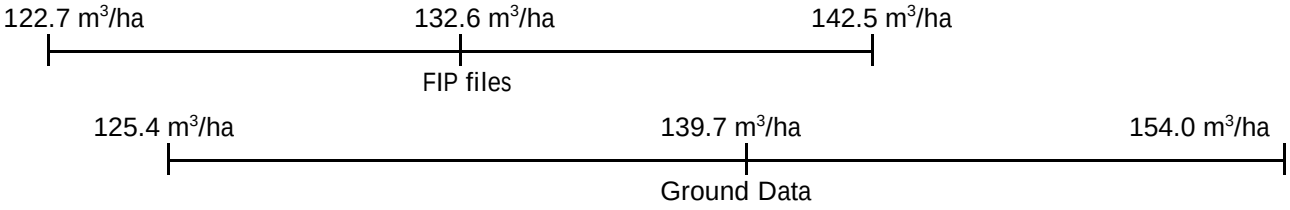

Figure 2. Confidence intervals for the Boundary Forest District (12.5-cm utilization).

Table 4. Audit statistics by species (17.5-cm utilization).

Species	FIP Files (n=146)			Ground Data (n=146)			Difference	
	Average (m^3/ha)	Std Err (m^3/ha)	95% CI (m^3/ha)	Average (m^3/ha)	Std Err (m^3/ha)	95% CI (m^3/ha)	t-value	p-value
Bl	1.2	0.5	[0.3, 2.1]	7.9	2.0	[3.9, 11.9]	-3.256	0.001*
Fdi	0.7	0.4	[0, 1.4]	12.2	1.9	[8.4, 16]	-5.905	0.000*
Lw	4.4	0.7	[3, 5.8]	10.6	1.6	[7.4, 13.8]	-3.507	0.001*
Pl	86.7	4.1	[78.5, 94.9]	60.3	4.9	[50.7, 69.9]	4.128	0.000*
Sx	1.2	0.6	[0.1, 2.3]	7.1	1.5	[4.1, 10.1]	-3.616	0.000*
Others	0.2	0.2	[0, 0.5]	2.4	0.8	[0.9, 3.9]	-2.789	
All	*94.4*	*4.1*	*[86.3, 102.5]*	*100.4*	*6.3*	*[87.9, 112.9]*	*-0.796*	*0.426*

* statistically different at 99%.

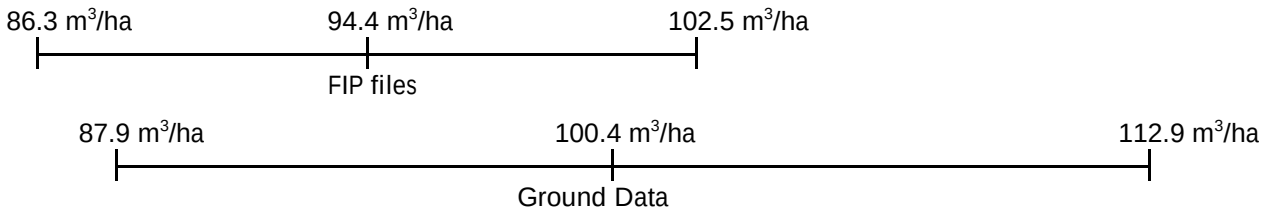

Figure 3. Confidence intervals for the Boundary Forest District (17.5-cm utilization).

3.1.2 Comparison by Management Unit

The average volume/ha in the TSA and TFL inventories were not significantly different from the ground samples. Volume in the FIP files was under-estimated by about 4% in the TSA and 16% in the TFL at 12.5-cm utilization (Table 5, Figures 4 and 5), and by about 6% in the TSA and 19% in the TFL at 17.5-cm utilization (Table 6, Figures 6 and 7).

Table 5. Audit statistics by management unit (12.5-cm utilization).

Stratum	N	FIP Files			Ground Data			Difference	
		Average (m^3/ha)	Std Err (m^3/ha)	95% CI (m^3/ha)	Average (m^3/ha)	Std Err (m^3/ha)	95% CI (m^3/ha)	t-value	p-value
TSA	131	132.8	5.3	[122.3, 143.3]	137.8	7.0	[124.0, 151.6]	-0.569	0.570
TFL	15	126.8	13.5	[97.8, 155.8]	146.8	29.0	[84.6, 209.0]	-0.625	0.542
All	*146*	*132.6*	*5.0*	*[122.7, 142.5]*	*139.7*	*7.2*	*[125.4, 154.0]*	*-0.808*	*0.420*

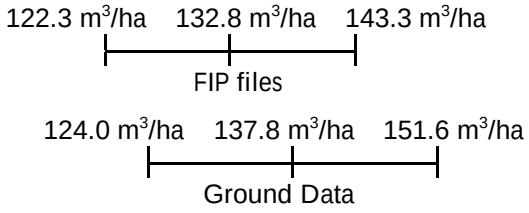

Figure 4. Confidence intervals for the TSA (12.5-cm utilization).

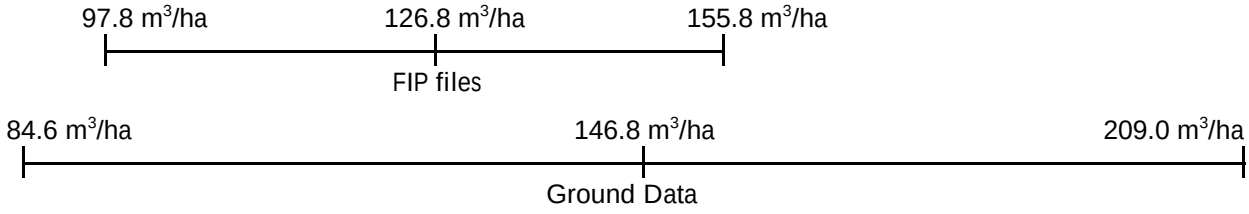

Figure 5. Confidence intervals for TFL 8 (12.5-cm utilization).

Table 6. Audit statistics by management unit (17.5-cm utilization).

Stratum	N	FIP Files			Ground Data			Difference	
		Average (m^3/ha)	Std Err (m^3/ha)	95% CI (m^3/ha)	Average (m^3/ha)	Std Err (m^3/ha)	95% CI (m^3/ha)	t-value	p-value
TSA	131	94.8	4.4	[86.1, 103.5]	100.5	6.4	[87.8, 113.2]	-0.734	0.464
TFL	15	83.9	11.6	[59.0, 108.8]	100.2	23.2	[50.4, 150.0]	-0.628	0.541
All	*146*	*94.4*	*4.1*	*[86.3, 102.5]*	*100.4*	*6.3*	*[87.9, 112.9]*	*-0.796*	*0.426*

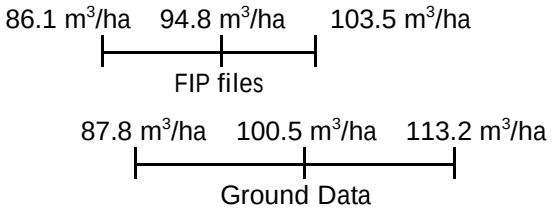

Figure 6. Confidence intervals for the TSA (17.5-cm utilization).

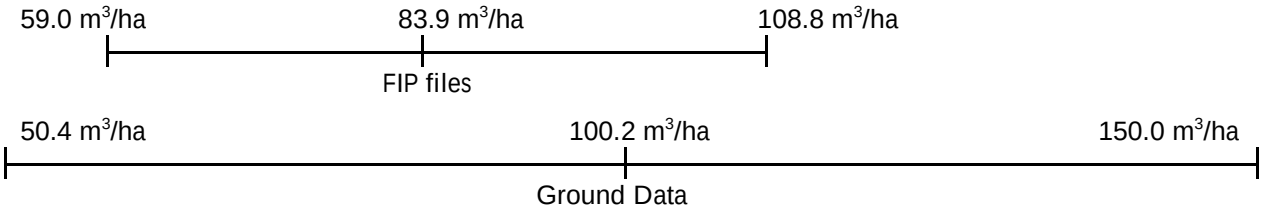

Figure 7. Confidence intervals for TFL 8 (17.5-cm utilization).

3.1.3 Comparison by Polygon

The average difference in volume in each polygon was calculated by subtracting the ground-sample estimate from the FIP estimate. The FIP volume estimates were reliable at both utilization levels in the TSA and TFL (Tables 7 and 8). Although comparisons by polygon usually employ paired observation, and VRI sample plot clusters were not designed for this purpose, the method provides useful information about the accuracy of the inventory.

Table 7. Volume statistics compared by polygon (12.5-cm utilization).

Stratum	N	Average Difference (m^3/ha)	Std Err (m^3/ha)	95% CI (m^3/ha)	t-value	p-value
TSA	131	-11.0	7.7	[-26.3, 4.3]	-1.422	0.157
TFL	15	1.0	24.7	[-51.9, 54.0]	0.041	0.968
All	*146*	*-10.6*	*7.3*	*[-25.1, 3.9]*	*-1.443*	*0.151*

Table 8. Volume statistics compared by polygon (17.5-cm utilization).

Stratum	N	Average Difference (m^3/ha)	Std Err (m^3/ha)	95% CI (m^3/ha)	t-value	p-value
TSA	131	0.3	6.9	[-13.4, 13.9]	0.039	0.969
TFL	15	6.7	22.3	[-41.2, 54.6]	0.299	0.770
All	*146*	*0.5*	*6.6*	*[-12.5, 13.4]*	*0.074*	*0.941*

3.2 GROUND DATA ANALYSIS

3.2.1 Diameter Distribution

The diameter distributions on the TFL and the TSA were very similar (Figure 8). There was an average of 2,289 trees/ha for the entire Forest District (4 cm+ utilization). About two thirds of the stems (1,491stems/ha) were under 12.5-cm DBH, and about 15% (356 stems/ha) had a DBH greater than 17.5 cm.

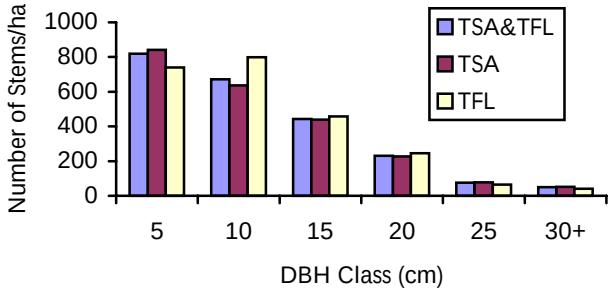

Figure 8. Distribution of stems by 5-cm diameter class.

3.2.2 Piece Size Distribution

The piece size distribution was also similar on the TFL and the TSA (Figure 9). The average volume per tree (4 cm+ utilization) was 0.066 m^3. About 80% of the stems (1,809 stems/ha) were less than 0.1 m^3/tree (net merchantable volume), and about 10% (216 stems/ha) had a volume greater than 0.2 m^3.

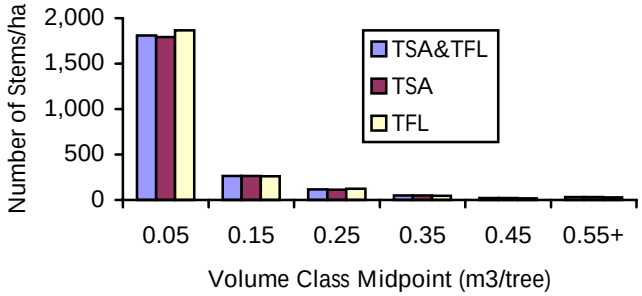

Figure 9. Distribution of stems by 0.1-m^3 piece size.

3.3 SAWLOG COMPONENT

Sample plot clusters containing sawlog-sized trees were identified by minimum DBH of 12.5 cm for Pl-leading and 17.5 cm for other leading species, or by minimum piece size of 0.1 m^3 for Pl-leading and 0.2 m^3 for other leading species.

The proportion of sample plot clusters meeting the minimum sawlog size was calculated by landscape unit (Table 9). About 44% of the sample-plot clusters met the minimum average DBH and about 35% met the average piece size. There was no apparent difference among landscape

units. Therefore, roughly one third of all dense Pl polygons can be assumed to contain sawlog-size trees.

Table 9. Proportion of clusters meeting minimum sawlog size.

				Definition	
Landscape Unit	N (Pl)	N (Others)	N (Total)	DBH	Piece Size
B1	9	1	10	40.0%	30.0%
B2	1	0	1	0.0%	0.0%
B3	5	2	7	57.1%	42.9%
B4	1	0	1	100.0%	100.0%
B5	24	9	33	36.4%	24.2%
B6	21	12	33	39.4%	42.4%
B7	0	1	1	0.0%	100.0%
B8	6	0	6	33.3%	16.7%
B9	3	4	7	42.9%	28.6%
B10	10	7	17	58.8%	29.4%
B11	11	4	15	53.3%	60.0%
TFL 8	12	3	15	46.7%	26.7%
Total	*103*	*43*	*146*	*43.8%*	*34.9%*

3.4 SPECIES COMPOSITION

Species composition was not adjusted for this project; however, about 30% of the sample plot clusters were leading in species other than Pl (Table 10). Adjusting species composition might be necessary if dense Pl polygons are defined via leading species or inventory type group.

Table 10. Distribution of leading species in the sample.

	TSA		TFL		All	
Species	N		N		N	
Bl	10	7.6%	1	6.7%	11	7.5%
Ep	1	0.8%	0	0.0%	1	0.7%
Fdi	16	12.2%	0	0.0%	16	11.0%
Lw	11	8.4%	1	6.7%	12	8.2%
Pl	91	69.5%	12	80.0%	103	70.5%
Sx	2	1.5%	1	6.7%	3	2.1%
Total	*131*	*100.0%*	*15*	*100.0%*	*146*	*100.0%*

3.5 ADJUSTMENT STATISTICS

The correlation between photo-interpreted attributes and ground-sampled estimates was generally very good (between 50% and 65%), except for the volume component between 12.5 and 17.5 cm (Table 11). Mean adjustment ratios for height, age, and site index ranged from 0-15% and 15-25% for volumes (Table 12).

VDYP (based on adjusted height and age) generated higher volumes than currently in the FIP files. For example, for the whole population, VDYP generated 176.3 m^3/ha (12.5-cm utilization) for the sample average, and the corresponding FIP file volume was 132.6 m^3/ha (Table 5), an increase of almost one third.

The mean annual increment (MAI) for the dense Pl stand population was about 1.9 m^3/ha/yr after adjustment (12.5-cm utilization). The MAI was slightly higher on the TFL than on the TSA (2.1 vs. 1.8 m^3/ha/yr). The MAI for the dense Pl population is comparable to the average MAI derived from the AAC.

Table 11. Adjustment statistics.

Stratum	Attribute	N	Grnd Smpl Avg	Adjustment Slope	Correlation Coefficient	FIP file Pop'n Avg	FIP file Sample Avg	Adjusted Avg
TSA	Height (m)	111	18.0	1.291	54%	16.3	16.0	18.4
	Age (yrs)	111	77.7	1.343	66%	76.6	74.5	80.6
	Volume (12.5 cm+, m^3/ha)	131	138.1[a]	-	-	166.9	163.1	142.5
	Volume (17.5 cm+, m^3/ha)	131	100.5	0.956	32%	127.9	124.7	103.6
	Volume(12.5-17.5 cm, m^3/ha)	131	37.6	2.092	12%	39.0	38.3	38.9
TFL	Height (m)	15	19.0	1.176	66%	17.7	16.1	20.8
	Age (yrs)	15	84.2	0.980	65%	88.6	85.9	86.9
	Volume (12.5 cm+, m^3/ha)	15	146.8	-	-	213.4	167.0	185.9
	Volume (17.5 cm+, m^3/ha)	15	100.2	0.829	47%	163.8	120.8	135.8
	Volume(12.5-17.5 cm, m^3/ha)	15	46.6	1.009	75%	49.7	46.2	50.1
All	Height (m)	126	18.2	1.236	56%	16.6	16.1	18.9
	Age (yrs)	126	79.3	1.022	63%	79.2	77.2	81.3
	Volume (12.5 cm+, m^3/ha)	146	139.9	-	-	176.3	163.1	155.9
	Volume (17.5 cm+, m^3/ha)	146	100.4	1.077	35%	134.7	122.9	113.2
	Volume(12.5-17.5 cm, m^3/ha)	146	39.5	2.235	25%	41.7	40.2	42.8

[a] This number does not match Table 5 because in six clusters, the 17.5-cm utilization estimate was greater than the 12.5-cm utilization estimate. For these six, the difference was set to zero before adjustment.

Table 12. Adjustment impact on the current inventory.

Stratum	Attribute	Current FIP Estimate	Adjusted Estimate	Absolute Difference	Ratio of Means
TSA	Height (m)	16.3	18.4	2.1	1.129
	Age (yrs)	80.6	76.6	4.0	1.052
	Site Index (m)	13.8	15.4	1.6	1.116
	Volume (12.5 cm+, m^3/ha)	122.4	142.5	20.1	1.164
	Volume (17.5 cm+, m^3/ha)	86.9	103.6	16.7	1.192
TFL	Height (m)	17.7	20.8	3.1	1.175
	Age (yrs)	88.6	86.9	-1.7	0.981
	Site Index (m)	14.2	17.2	3.0	1.211
	Volume (12.5 cm+, m^3/ha)	150.1	185.9	35.8	1.239
	Volume (17.5 cm+, m^3/ha)	106.6	135.8	50.4	1.274
All	Height (m)	16.6	18.9	2.3	1.139
	Age (yrs)	79.2	81.3	2.1	1.027
	Site Index (m)	13.9	15.8	1.9	1.137
	Volume (12.5 cm+, m^3/ha)	128.3	155.9	26.1	1.215
	Volume (17.5 cm+, m^3/ha)	91.1	113.2	20.5	1.243

3.6 ESTIMATES OF AREA AND VOLUME OF DENSE LODGEPOLE PINE STANDS

The definition for dense Pl stands was applied to the adjusted inventory database, which was then recompiled (Table 13). The population of dense Pl stands dropped about 60% on the TSA and 40% on the TFL after adjustment. However, it is very likely that polygons not currently labeled dense Pl would become part of the dense Pl population if the statistical adjustment were done on the entire Forest District. Adjusting species composition would also impact the dense Pl population. Without this information, it is very difficult to estimate the exact area and volume of dense Pl stands.

Table 13. Population change after adjustment.

Stratum		N	Area (ha)	Volume (12.5-cm utilization) (m^3)	Volume (17.5-cm utilization) (m^3)
TSA	Before adjustment	1,704	38,726	5,519,819	4,011,845
	After adjustment	721	15,918	2,196,919	1,532,899
	Change	983	22,809	3,322,899	2,478,947
	Change(%)	57.7%	58.9%	60.2%	61.8%
TFL	Before adjustment	1,128	10,494	1,951,055	1,425,191
	After adjustment	682	6,020	1,143,977	836,518
	Change	446	4,474	807,079	588,673
	Change(%)	39.5%	42.6%	41.4%	41.3%
All	Before adjustment	2,832	49,221	7,675,504	5,569,610
	After adjustment	1,546	24,083	3,618,035	2,528,786
	Change	1286	25,137	4,057,469	3,040,825
	Change(%)	45.4%	51.1%	52.9%	54.6%

4. DISCUSSION

4.1 OVERVIEW

This section describes several issues that we consider important, but that are not directly referred to in the project objectives (Section 1.3). Recommendations are provided to address some of these issues.

4.2 NON-RESPONSE

About 6% of the TSA sample-plot clusters (eight of 139) were dropped from the sample and not used in the adjustment process for various reasons. Statistical literature refers to this as non-response, which very likely causes statistical bias. Methods exist to handle non-response in forest surveys, for example, matching a non-response cluster with another similar cluster. The MOF should implement a strategy to deal with this type of non-response.

4.3 SPECIES COMPOSITION

Species composition was not adjusted; however, about 30% of the clusters were not Pl-leading. Consequently, the use of unadjusted species composition (from photo-interpretation) to define dense Pl stands could be misleading. A safer approach would be to base dense Pl stand definition on a minimum proportion of Pl. Non Pl-leading stands also could be included in this population. Species composition plays a major role in site index and volume estimation and should be adjusted for the next timber supply review.

4.4 PREDICTING IMPACT ON THE TIMBER SUPPLY ANALYSIS

The adjusted inventory is statistically unbiased for overall polygon volume, and should be used in the next timber supply review. The impact of the adjusted inventory on the timber supply would require a sensitivity analysis using different scenarios, which was beyond the scope of this project.

5. SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY

The main findings in this report were:

- Diameter and piece size distributions in dense Pl polygons in the Boundary TSA and TFL 8 are similar.
- The accuracy of the inventory database versus the ground sample was similar for the TSA and TFL.
- Total yield in the inventory can be considered reliable, although the Pl component was overestimated.
- Age was relatively reliable, while height and site index were less reliable.

5.2 RECOMMENDATIONS

Timber supply analysis on the TFL and the TSA strata are independent; thus, information from one should not be used to adjust the other. The difference between the combined (TSA-TFL) adjustment and the adjustment by stratum is too small to justify tracking two different adjusted populations. Therefore, the adjusted populations by stratum should be used, even if a common management approach is taken for dense Pl polygons. We recommend:

The adjusted inventory for the TSA and TFL strata be used separately in timber supply analyses.

Average diameter and piece-size distributions were estimated for the entire sample but not at the polygon level. Information about diameter distribution at the polygon level would help decisions about harvesting for specialty wood products. Few stands currently contain sawlog-sized trees; however, these stands could be used for other purposes if diameter distribution or log population was known. Therefore, we recommend:

The MOF investigate methods to obtain diameter and piece-size distributions at the polygon level.

The population of dense Pl stands dropped about 60% on the TSA and 40% on the TFL when the dense Pl polygon definition was applied to the adjusted inventory. However, the sample did not provide information about how much area from the remainder of the TSA and TFL should be included as dense Pl. Consequently, the true area of dense Pl polygons is unknown. Thus, we recommend:

Statistical adjustment should be done on the entire Forest District.

Statistical adjustment can correct information about standing volume; however, the important issue in dense Pl polygons is the impact of height-growth repression on estimates of potential site index. Methods exist to obtain more reliable site index estimates for future crops of trees, and should be evaluated for potential use in the next timber supply review. We recommend:

The MOF evaluate site index estimation methods to predict site index in future post-harvest regenerated stands.

Additional recommendations from the discussion (Section 4):

The MOF should implement a strategy to deal with non-response.

Species composition should be adjusted for in the next timber supply review.