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**Tree Farm Licence 15  
Vegetation Resources Inventory  
Statistical Adjustment**

*Prepared for*

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## Executive Summary

In 1997, Weyerhaeuser Company (Weyco) began implementing a Vegetation Resources Inventory (VRI) on Tree Farm Licence (TFL) 15. This initiative will update the forest cover inventory for the TFL to current Ministry of Sustainable Resource Management (MSRM) inventory standards.

Weyco initially completed the Phase I in 1997 and updated the dataset in March 2003. In 2000 and 2001, 74 Phase II plots were established in the vegetated treed (VT) portion of the TFL. This report documents the statistical adjustment of the VT area of the TFL based on Phase I and Phase II data.

Following adjustment, site index increased approximately 8% in young (21 to 80 years) stands in the wet-belt, and approximately 4% overall.

The net merchantable volume used in Timber Supply Review (TSR) decreased approximately 9% on average. The volume adjustment was different for lodgepole pine (PI) and non-PI leading stands. In PI-leading stands, net merchantable volume increased by approximately 1%. In non-PI leading stands, net merchantable volume decreased by approximately 18%.

The achieved 95% sampling error for net merchantable volume was 18%, and was 3% higher than what is normally accepted by the MSRM for TSR. However, given the forest inventory challenges on TFL 15, it is likely that the MSRM will accept a higher sampling error.



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## 1. INTRODUCTION

### 1.1 BACKGROUND

In 1997, Weyerhaeuser Company (Weyco) began implementing a Vegetation Resources Inventory (VRI) on Tree Farm Licence (TFL) 15. The VRI program includes the following four phases (Figure 1):

1. Phase I (unadjusted inventory data) – Attributes of all polygons are estimated using photo-interpretation;
2. Phase II (ground plot data) – Measurements are taken from randomly located ground samples;
3. Net Volume Adjustment Factor (NVAF) Sampling – Random trees are selected for stem-analysis studies to develop adjustment ratios to correct taper and decay estimation bias; and
4. Adjustment Phase – The Phase I estimates are adjusted using the NVAF corrected Phase II ground samples to give an adjusted unbiased estimate of forest inventory attributes. The final product is an adjusted VRI database.

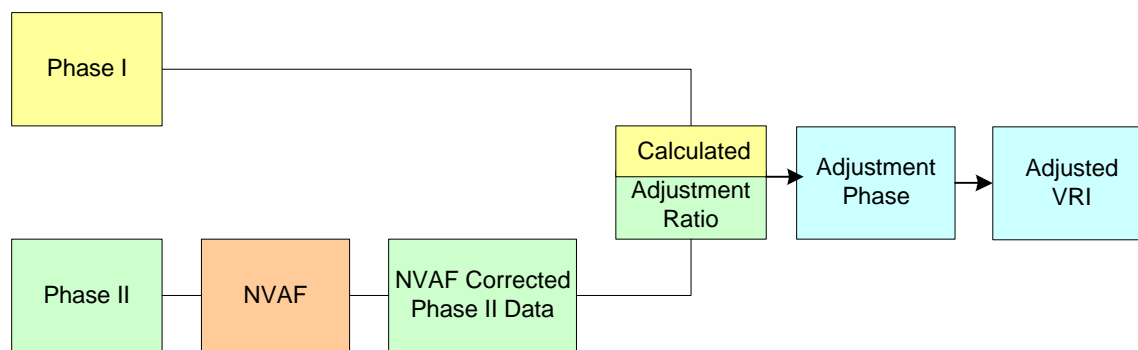


Figure 1. VRI program.

Timberline Forest Inventory Consultants Ltd. (TFIC) first updated the TFL Forest Inventory Planning (FIP) inventory to the Ministry of Sustainable Resource Management (MSRM) VRI Phase I photo-interpretation standards in 1997. However, Weyco recognized that some forest cover polygons in the dry-belt portion of the TFL might be too heterogeneous to provide accurate information. Thus, Weyco requested that TFIC revise the Phase I dry-belt forest cover polygons to create smaller, more homogenous polygons. The revised Phase I was completed in March 2003. Phase II ground sampling was completed in 2000 and 2001 and was based on the original Phase I. NVAF sampling was not completed on the TFL. The next step in the TFL 15 VRI program is to complete the statistical adjustment.

### 1.2 PHASE II PROJECT OBJECTIVES

The objectives of the Phase II were to:

- Install a sufficient number of VRI plots in the Vegetated Treed (VT) portion of the TFL to achieve a targeted sampling error of  $\pm 10\%$  (95% probability).
- Install a sufficient number of VRI plots to check the overall volume accuracy in polygons 61 years and older in the timber harvesting land base (THLB).

### **1.3 REPORT OBJECTIVES**

The report objectives were to:

- Provide descriptive statistics for the unadjusted inventory (Phase I);
- Provide descriptive statistics for the ground sampling data (Phase II); and
- Adjust inventory attributes as necessary (Adjustment Phase).

### **1.4 TERMS OF REFERENCE**

J.S. Thrower & Associates Ltd. (JST) completed this VRI statistical adjustment for Ed Collen, *RPF* Weyco. Guillaume Thérien, *PhD* (JST) was the project manager. This report was prepared for Weyco's internal use and may not present all the information required by the MSRM and the Ministry of Forests (MOF) before Timber Supply Review (TSR).



## 2. PROJECT DATA

### 2.1 LAND BASE

TFL 15 is located in south central BC in the Okanagan, near the towns of Okanagan Falls and Penticton (Figure 2). The entire TFL is 48,447 ha and the THLB represents 39,653 ha (82% of the TFL). The VT portion represents 42,197 ha (87% of the TFL and covers 35,536 ha (90%) of the THLB (Table 1).

Table 1. TFL 15 land base statistics.

Land Classification	Non-THLB	THLB	Total	
			(ha)	(%)
Non Vegetated	288	1,340	1,629	3
Vegetated Non-Treed	1,845	2,777	4,622	10
Vegetated Treed	6,661	35,536	42,197	87
<i>Total (ha)</i>	<i>8,794</i>	<i>39,653</i>	<i>48,447</i>	<i>100</i>
<i>(%)</i>	<i>18</i>	<i>82</i>		

The different land bases used for sampling (2000) and statistical adjustment (2003) were compared to determine the impact of land base modifications. This comparison showed that only 43,565 ha (90% of the TFL) had the same land classification code in both inventories (shaded areas in Table 2). Following discussion with the MSRM, we decided that the 2000 land classification would be used to define the VT land base.<sup>1</sup> The adjusted land base was therefore 46,500 ha (96% of the TFL).

Table 2. Land classification comparison between the 2000 and 2003 TFL 15 inventories.

Land Classification	2000		Total
	Non-VT	VT	
2003 Non-VT	1,658	4,593	6,250
2003 VT	289	41,907	42,197
<i>Total</i>	<i>1,947</i>	<i>46,500</i>	<i>48,447</i>

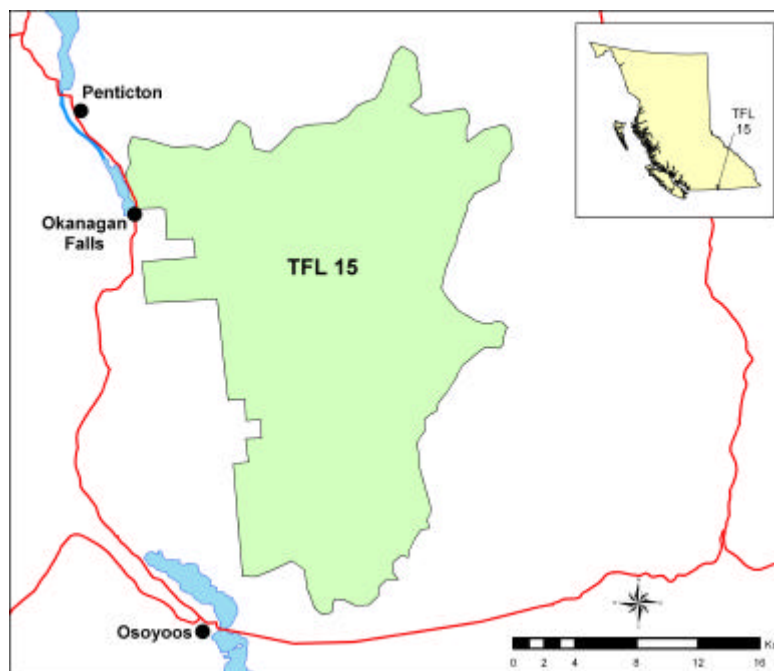


Figure 2. TFL 15 location.

<sup>1</sup> Sam Otukol, *PhD RPF* (MSRM – Terrestrial Inventory Branch), personal communication, April 1, 2003

## 2.2 PHASE I (UNADJUSTED INVENTORY DATA)

Approximately 55% of the VT population was in the THLB mature age classes (61 years and older).<sup>2</sup> In the mature THLB area, average height was approximately 21 m, average age 122 years, average site index 14 m, and average volume<sup>3</sup> was 175 m<sup>3</sup>/ha (12.5 cm utilization) and 150 m<sup>3</sup>/ha (17.5 cm utilization) (Table 3). Almost 90% of the standing volume was located in the THLB mature area.

Table 3. Unadjusted inventory statistics for the TFL 15 VT population.

THLB	Maturity Class	Area		Height (m)	Age (yrs)	Site Index (m)	Volume – 12.5 cm			Volume – 17.5 cm		
		(ha)	(%)				(m <sup>3</sup> /ha)	('000 m <sup>3</sup> )	(%)	(m <sup>3</sup> /ha)	('000 m <sup>3</sup> )	(%)
Yes	Mature	25,699	55	21.2	121.6	14.2	166.5	4,279	87	144.0	3,701	88
	Immature	12,538	27	4.0	16.4	11.4	6.6	83	2	4.3	54	1
No	All	8,263	18	15.7	112.3	11.0	69.3	573	12	54.3	449	11
All	All	46,500		15.6	91.6	12.9	106.1	4,934	100	90.4	4,204	100

## 2.3 PHASE II (GROUND PLOT DATA)

### 2.3.1 Sample Selection and Weight

Samples were selected in four batches of 25, 10, 10, and 30 plots, respectively. In the first three batches plots were selected from the VT population. In the fourth batch, plots were selected from the THLB population to increase the sampling intensity in this area. Prior to selecting the samples in the fourth batch, the THLB was stratified by biogeoclimatic (BGC) zone and maturity class (mature and immature [0 to 60 years]). The sample size in each stratum in the fourth batch was selected to ensure that the 64 samples in the THLB would have the same selection probability, and therefore the same sampling weight (Table 4). Since sample selection was less intensive in the VT outside the THLB, the relative weight of the 11 plots in that stratum is slightly more important.

Table 4. Sampling weight for plots in the THLB and in the VT area outside the THLB.

Stratum	Sample Size	Area (ha)	Area/Plot	Relative Weight
THLB	64	38,237	597.5	1.000
VT Non-THLB	11	8,263	751.2	1.257
All	75	46,500	620.0	

### 2.3.2 Data Compilation

Prior to compilation, the Phase II ground plot locations were overlaid on the revised Phase I to determine whether the auxiliary plots were still in the same forest cover polygon as the integrated plot centre. Thirty auxiliary plots from 21 clusters were dropped because they were no longer in the sampled polygon. Nine auxiliary plots in six clusters that were not measured because they were outside of the original sampled polygon were now inside the revised sampled polygon. The missing information from these nine plots will create a slight bias; however, we assume that the bias is negligible.

JST compiled all data using the MSRM VRI compiler. Plots from the first batch were compiled following the regular VRI data compilation procedures. In the last three batches of plots (50 plots), ground sampling procedures were modified: total tree height was measured on all trees. In a regular VRI data compilation, whole-stem volume for trees in auxiliary plots is estimated from a regression using trees from the full measured plots. In the last three batches of plots, whole-stem volume for trees in auxiliary plots

<sup>2</sup> The inventory was projected to January 2003 before adjustment.

<sup>3</sup> Inventory volumes in this report were net merchantable volume generated using *VDYP version 6.6d*.

was estimated using the same procedure as for full measured plots. The ground sampling enhancement used for the last 50 plots provided more precise whole-stem volume estimation for these plots.

### 2.3.3 Data Summary

One of the 75 selected plots could not be installed for safety reasons, and was not replaced. Because the leading species on the plot did not match the leading species on the polygon label, heights were not measured on eight plots, age was not collected on seven plots, and a valid site index could not be computed on 12 plots. The average ground height for the VT population was approximately 16 m, average age was 80 years, average site index 15 m, and average volumes<sup>4</sup> were 105 m<sup>3</sup>/ha (12.5 cm utilization) and 70 m<sup>3</sup>/ha (17.5 cm utilization) (Table 5 and Table 6).

Table 5. Phase II ground height, age, and site index statistics for the TFL 15 VT population.

THLB	Maturity Class	Sample Size	Height (m)		Age (yrs)		Site Index (m)	
			Avg.	95% CI	Avg.	95% CI	Avg.	95% CI
Yes	Mature	42	19.2	[18.0, 20.4]	89.5	[ 77.4, 101.7]	15.4	[14.5, 16.3]
	Immature	21	10.7	[ 7.3, 14.1]	55.1	[ 28.4, 81.8]	17.8	[16.3, 19.2]
No	All	11	13.9	[ 9.1, 18.7]	75.9	[ 49.5, 102.2]	13.0	[ 9.8, 16.2]
<i>All</i>	<i>All</i>	74	16.3	[14.7, 17.8]	78.7	[ 68.1, 89.2]	15.5	[14.6, 16.3]

Note: CI = confidence interval.

Table 6. Phase II ground volume sampling statistics for the TFL 15 VT population.

THLB	Maturity Class	Sample Size	Volume – 12.5 cm (m <sup>3</sup> /ha)		Volume – 17.5 cm (m <sup>3</sup> /ha)	
			Avg.	95% CI	Avg.	95% CI
Yes	Mature	42	139.4	[111.6, 167.2]	87.9	[ 62.8, 113.0]
	Immature	21	52.1	[ 19.9, 84.4]	40.8	[ 14.6, 67.0]
No	All	11	86.9	[ 33.2, 140.5]	53.5	[ 19.9, 87.0]
<i>All</i>	<i>All</i>	74	106.1	[ 85.2, 127.1]	68.9	[ 52.1, 85.7]

<sup>4</sup> Ground and adjusted volumes in this report are whole-stem volume less tops, stumps, cruiser-called decay, waste, and breakage. The cruiser-called decay was uncorrected for NVAF.

### 3. METHODS

#### 3.1 NET VOLUME ADJUSTMENT FACTOR (NVAF) SAMPLING

The NVAF sampling was not included in Phase II, and therefore the ground volume was not corrected. Anecdotal evidence suggests that using an NVAF ratio of 1.0 may introduce a bias of between 0 and 5% in net merchantable volume. As of April 2002, MSRM has determined that a fully compliant VRI includes localized net volume adjustment factors.

#### 3.2 STATISTICAL ADJUSTMENT

The statistical adjustment followed MSRM attribute adjustment procedures.<sup>5</sup> The MSRM adjustment process assumes the unadjusted (Phase I) inventory volume is biased because of two sources of error:

1. An attribute bias associated with the photo-interpreted height and age; and
2. A model bias inherent in the growth and yield model used to estimate volume (*VDYP version 6.6d*).

The statistical adjustment procedure is a two-step process (Figure 3) that corrects both sources of error. In the first step, Phase I height and age bias are corrected using an adjustment ratio calculated from the Phase I data (unadjusted inventory data) and the Phase II data (ground plot data). An attribute-adjusted volume is then calculated using adjusted height and age with *VDYP*.

In the second step, an adjustment ratio is calculated from the attribute-adjusted volume and the Phase II (ground plot data) volume, and this ratio is used to correct the model bias in the attribute-adjusted volume.

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<sup>5</sup> Ministry of Sustainable Resource Management. 2002. Vegetation resources inventory attribute adjustment procedures. Draft Version 4.4. 37 pp.

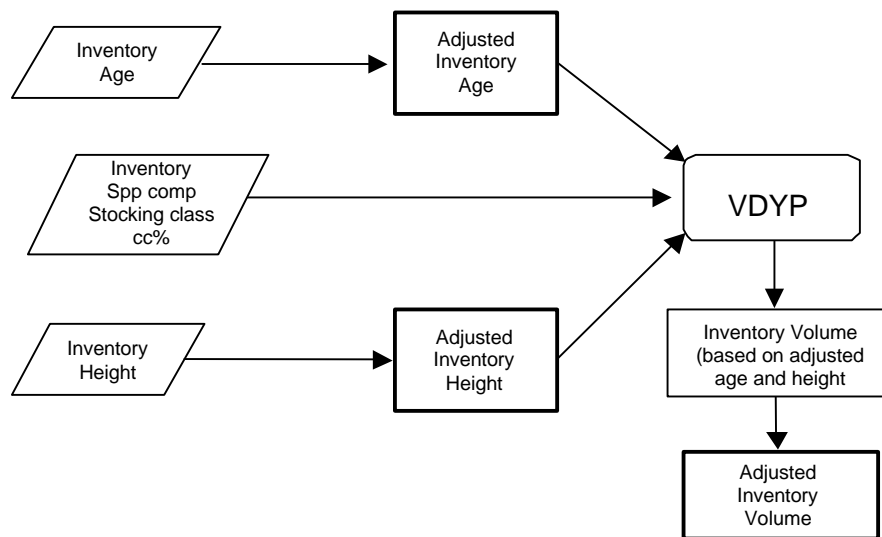


Figure 3. VRI statistical adjustment process.<sup>5</sup>

### 3.3 POST SAMPLING STRATIFICATION

Stratification is a sampling technique that can improve the precision of population estimates; hence, stratification was explored in this project. In this case, post-stratification (when stratification is done after sampling is complete) was used with different attributes. The impact of post-stratification based on leading species, BGC zone, stocking class, polygon layers, vertical complexity of the main layer, tree cover pattern of the main layer, age, and site index was tested. For height and age estimates, species and species rank stratifications were also tested, while stratification based on utilization level was tested for volume.

## 4. RESULTS AND DISCUSSION

### 4.1 HEIGHT AND AGE ADJUSTMENT

Stocking class and polygon layers were significant stratification variables. Three strata were created prior to adjustment: stocking class 0 and one layer (0-Single), stocking class 0 and more than one layer (0-Many) and stocking class different from 0 (Non 0). Stocking Class 0 means undisturbed immature stands. Stocking class different from 0 includes mature and disturbed stands.

Three points in the 0-Many stratum appeared to be outliers. The ground observations for these points were most likely from residual trees. After consultation with the MSRM, it was decided to exclude these points from the ratio estimation for height and age. The ratio of means (ROM) method was used to estimate the adjustment ratios in all strata.

The ratio adjustments for both height and age was close to 1.0 in the immature single-layered (0-Single) stratum, greater than 1.0 in the immature, multi-layered (0-Many) stratum, and less than 1.0 in the mature and disturbed (Non 0) stratum (Table 7). In general, the height observations were closer to their predictions than the age observations (Figure 4). Therefore, the height estimates tended to be more precise than the age estimates.

Table 7. Height and age adjustment for the TFL 15 VT population.

Attribute	Stratum	Population		Sample			Ratio	Adjusted Population	
		Area (ha)	Avg.	Size	Grd. Avg.	Inv. Avg.		Avg.	95% CI
Height (m)	0-Single	12,432	16.3	25	17.0	16.1	1.056	17.2	[15.4, 19.0]
	0-Many	16,524	7.8	22	12.8	9.3	1.384	10.7	[8.2, 13.3]
	Non 0	17,544	22.5	19	19.1	23.3	0.818	18.4	[15.4, 21.5]
Age (yrs)	0-Single	12,432	72.0	25	70.3	74.1	0.948	68.3	[58.8, 77.8]
	0-Many	16,524	33.8	23	62.0	37.8	1.638	55.4	[36.5, 74.4]
	Non 0	17,544	159.8	19	108.7	160.7	0.676	108.0	[72.6, 143.5]

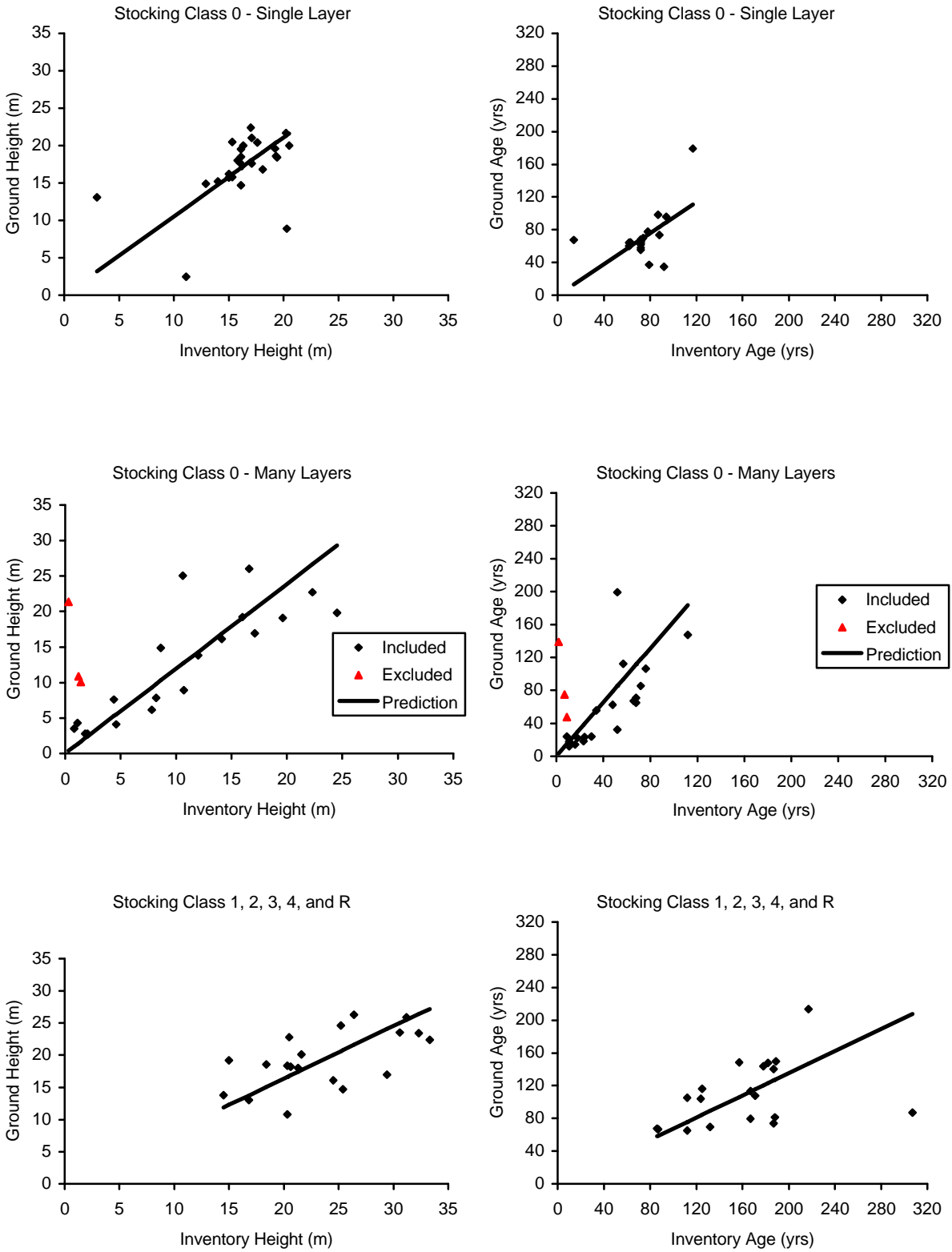


Figure 4. Height and age adjustment scattergrams.

## 4.2 SITE INDEX ADJUSTMENT

Site index was not directly adjusted but derived from adjusted height and age using the site index software *SINDEX version 1.21*. The new derived site index estimates will be used for natural stands (age class 2 and above), while managed stands (age class 1 stands) will continue using the site index estimates obtained from the Site Index Adjustment (SIA) project completed on TFL 15 in 2001.<sup>6</sup>

In this project, site index increased 6% on average following height and age adjustment in PI stands (Table 8). The PI site index increase was about 10% in age classes 2 to 4. In age classes 8 and 9, site index for all species tended to decrease. However, site index estimates in these age classes are often not important since timber supply analysis usually assumes no growth in these stands and the site index is not assigned to regenerated stands.<sup>7</sup> The overall average site index increase was 4%.

Table 8. Site index (m) statistics for the TFL 15 VT population, age class 2 and above.

Age Class	Area (ha)	PI			Area (ha)	Fd			Area (ha)	Others		
		Unadj.	Adj.	Diff (%)		Unadj.	Adj.	Diff (%)		Unadj.	Adj.	Diff (%)
2	1,404	15.7	17.5	+11	468	15.4	16.3	+5	471	15.6	17.5	+12
3	537	15.5	16.8	+8	504	16.1	16.8	+5	226	14.2	15.0	+6
4	10,331	13.6	15.0	+10	1,702	15.5	16.2	+5	1,502	16.1	17.2	+7
5	1,812	11.4	12.0	+5	919	14.2	14.9	+5	631	15.0	15.9	+7
6	1,236	13.0	12.9	-1	783	13.6	14.9	+10	488	13.8	14.6	+6
7	1,664	12.4	12.2	-2	243	15.0	15.3	+2	549	14.1	15.1	+7
8	1,662	12.7	11.6	-9	3,135	14.6	14.3	-2	4,787	11.7	11.8	+1
9	115	10.5	10.0	-4	626	14.8	14.0	-5	711	11.8	11.0	-7
<i>All</i>	<i>18,762</i>	<i>13.4</i>	<i>14.2</i>	<i>+6</i>	<i>8,378</i>	<i>14.8</i>	<i>15.1</i>	<i>+2</i>	<i>9,364</i>	<i>13.1</i>	<i>13.6</i>	<i>+3</i>

## 4.3 ATTRIBUTE-ADJUSTED VOLUME

After adjusting for height and age, volume decreased 4% (12.5 cm utilization level) and 2% (17.5 cm utilization level) (Table 9). This means that the photo-interpreted bias in height and age was responsible for a small over-estimation of the volume. As

mentioned in Section 3.2, however, the attribute-adjusted volumes have not been corrected for the model bias. The volumes of interest are discussed in the next section.

Table 9. Unadjusted and attribute-adjusted volumes for the TFL 15 VT population.

THLB	Maturity Class	Volume – 12.5 cm (m <sup>3</sup> /ha)			Volume – 17.5 cm (m <sup>3</sup> /ha)		
		Unadj.	Attr. Adj.	Diff (%)	Unadj.	Attr. Adj.	Diff (%)
Yes	Mature	166.5	157.4	-5%	144.0	136.4	-5%
	Immature	7.1	9.5	35%	4.3	7.6	77%
No	All	70.2	78.1	11%	54.3	63.2	16%
<i>All</i>	<i>All</i>	<i>108.1</i>	<i>103.4</i>	<i>-4%</i>	<i>90.4</i>	<i>88.6</i>	<i>-2%</i>

Note: Attr. Adj = attribute-adjusted volume.

<sup>6</sup> J.S. Thrower & Associates Ltd. 2001. Potential site index estimates for the major commercial tree species on TFL 15 - Version 2.0. November 9, 2001. Unpublished Report. Project No. WCF-082-020. 16 pp.

<sup>7</sup> Site index in a regenerated stand can be obtained from the SIA project rather than using site index from the previous stand.



#### 4.4 VOLUME ADJUSTMENT

As mentioned in Section 3.3, different variables were tested for post-stratification. No stratification variable could improve the statistical model for the 12.5 cm utilization level volume, but leading species was a significant stratification variable for the 17.5 cm utilization level volume. Two strata were therefore created for the 17.5 cm volume: PI-leading stands and Other stands.

The ROM method was used to fit the adjustment ratios. For the 12.5 cm utilization level, the adjustment ratio was slightly less than 1.0 (Table 10, Figure 5). The adjustment ratio for the 17.5 cm utilization level was approximately 0.65 for PI-leading stands and 0.93 for Others species (Table 10, Figure 6). The 95% sampling error (E%) was relatively higher for the 17.5 cm than for the 12.5 cm utilization level volume.

Table 10. Volume adjustment statistics for the TFL 15 VT population.

Utilization Level (cm)	Leading Spp.	Population		Sample				Adjusted Population		
		Area (ha)	Attr. Vol. (m <sup>3</sup> /ha)	Size	Grd. Vol. (m <sup>3</sup> /ha)	Attr. Vol. (m <sup>3</sup> /ha)	ROM	Volume (m <sup>3</sup> /ha)	95% E %	95% CI
12.5	All	45,639	103.4	74	106.1	107.9	0.983	101.7	16.6	[84.8, 118.6]
17.5	PI	26,536	68.1	43	57.3	88.8	0.645	44.0	41.3	[25.8, 62.1]
	Others	19,103	115.9	31	84.7	91.0	0.930	107.8	32.6	[72.6, 143.0]

Note : Attr. Vol.=attribute-adjusted volume. Grd. Vol.=ground volume.

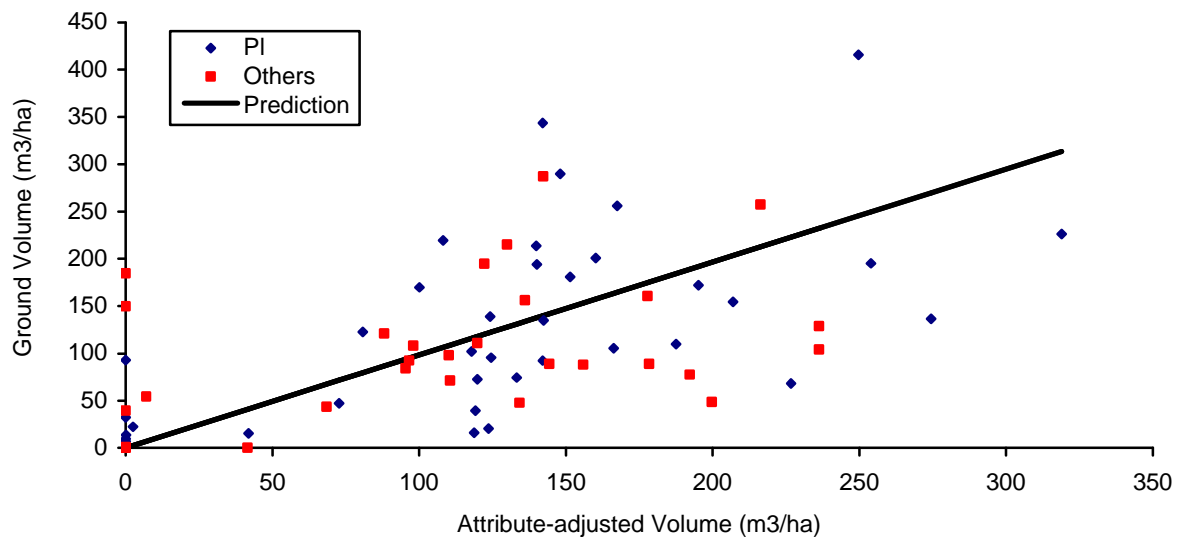


Figure 5. Ground versus attribute-adjusted volume (12.5 cm utilization level).

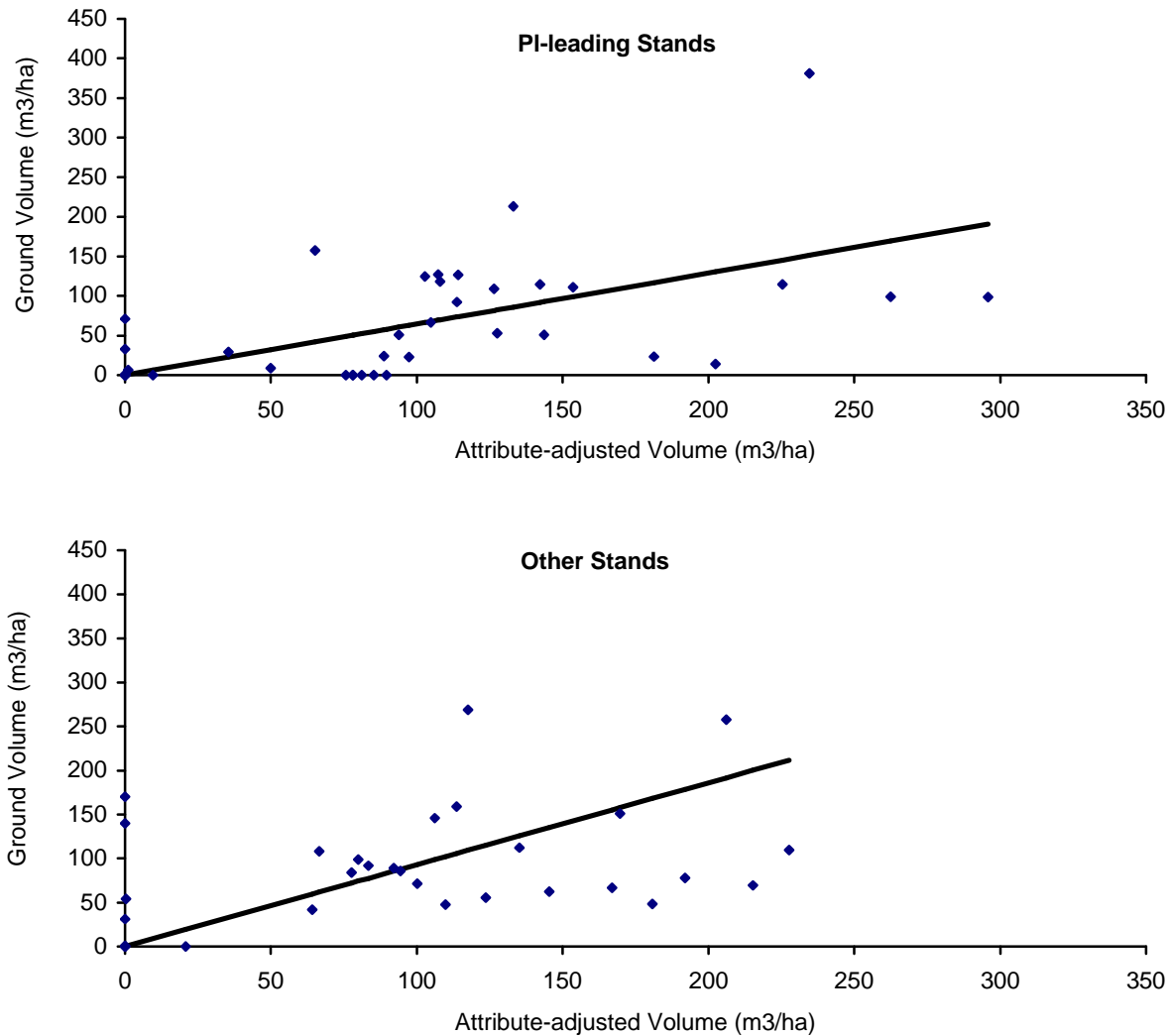


Figure 6. Ground versus attribute-adjusted volume (17.5 cm utilization level).

For TSR purposes, PI-leading stands use a 12.5 cm utilization level and Other stands use 17.5 cm utilization limit. Based on these limits, the unadjusted volume decreased by about 9% following adjustment (Table 11). The average THLB volume was 100.3 m<sup>3</sup>/ha.

Table 11. TSR volume statistics for the TFL 15 THLB population.

Leading Spp	Area (ha)	Unadj. Vol. (m <sup>3</sup> /ha)	Adj. Vol. (m <sup>3</sup> /ha)	Diff. (%)	95% E%
PI	22,346	88.2	88.8	1	17
Others	15,891	142.4	116.4	-18	33
<b>Total</b>	<b>38,237</b>	<b>110.7</b>	<b>100.3</b>	<b>-9</b>	<b>18</b>

The overall 95% sampling error was 18%, which means that the targeted sampling error was not achieved; however, the sampling error was reasonably close to the MSRM precision standard of 15% for TSR. Results of this statistical adjustment should be reviewed with the MSRM. Given the TFL’s highly variable stand conditions and its small area and volumes, it is likely that the MSRM will accept the adjusted inventory with a higher sampling error than the standard.

#### 4.5 ADJUSTED INVENTORY

For reporting purposes, the adjusted VRI was divided into the following strata:

1. Non-THLB
2. THLB – Dry-belt (Douglas-fir or larch-leading stands in the PP or IDF BGC zones).
3. THLB – Wet-Belt – Managed stands (between 0 and 20 years, using adjusted age).
4. THLB – Wet-Belt – Young stands (between 21 and 80 years, using adjusted age).
5. THLB – Wet-Belt – Old stands (between 81 and 140 years, using adjusted age).
6. THLB – Wet-Belt – Over-mature stands (over 140 years, using adjusted age).

The adjusted inventory results from the Non-THLB and from the Managed stands are not critical since the inventory attributes from these two strata will likely not be used in a timber supply analysis for TFL 15.

The adjustment in site index is most important in the Young stands and in the Dry-belt area since site index adjustment in these two strata can influence the long-term harvest flow in a timber supply analysis. Site index increased approximately 8% in Young stands and 10% in the Dry-belt area (Table 12).

Table 12. Site index adjustment statistics for the TFL 15 VT population.

THLB	Land Type	Age Class	Species Group	Area (ha)	Unadj. (m)	Adj. (m)	Difference (%)
No	N/A	All	PI	4,145	11.1	11.9	7%
		All	Others	3,960	11.3	12.1	7%
		All	Total	8,106	11.2	12.0	7%
Yes	Dry-belt	All	Others	8,813	15.5	17.0	10%
		Wet-belt 0-20	PI	6,139	15.6	18.6	19%
			Others	270	16.8	35.7	113%
	Total		6,409	15.7	19.8	27%	
	21-80	PI	10,082	14.0	15.1	7%	
		Others	759	15.1	16.6	10%	
		Total	10,841	14.1	15.2	8%	
	81-140	PI	3,575	13.7	13.9	2%	
		Others	2,730	14.0	14.3	2%	
		Total	6,305	13.8	14.1	2%	
	141+	PI	558	13.2	12.4	-6%	
		Others	1,880	11.9	11.6	-3%	
Total		2,438	12.2	11.8	-3%		

Volume/ha and total volume are most important in the Dry-belt and in the Wet-belt Old and Over-mature areas since most of the upcoming harvesting will occur in these strata. In PI-leading stands in these strata, volume increased by an average of 9% (12% in Old and -3% in Over-mature) (Table 13). In the non-PI leading stands however, volume decreased by

Table 13. Volume adjustment statistics for the TFL 15 VT population.

THLB	Land Type	Age Class	Species Group	Area (ha)	Volume/ha (m <sup>3</sup> /ha)		Total Volume (m <sup>3</sup> )		
					Unadj.	Adj.	Unadj.	Adj.	Diff (%)
No	N/A	All	PI	4,145	71.5	68.8	299	288	-4
		All	Others	3,960	64.4	74.0	256	302	+15
		All	Total	8,106	68.0	71.4	555	590	+5
Yes	Dry-belt	All	Others	8,813	129.6	109.0	1,174	987	-16
		Wet-belt 0-20	PI	6,139	0.1	0.0	1	0	-64
			Others	270	0.1	0.0	0	0	0
	Total		6,409	0.1	0.0	1	0	-68	
	21-80	PI	10,082	121.2	115.9	1,221	1,168	-4	
		Others	759	75.7	57.2	57	43	-24	
		Total	10,841	118.0	111.8	1,279	1,212	-5	
	81-140	PI	3,575	173.7	194.1	621	694	+12	
		Others	2,730	209.0	160.8	571	439	-23	
		Total	6,305	189.0	179.7	1,191	1,133	-5	
	141+	PI	558	226.5	219.4	126	122	-3	
		Others	1,880	245.4	202.5	461	381	-17	
Total		2,438	241.1	206.4	588	503	-14		

approximately 19% on average. The overall change in volume for all species in these three strata was approximately 11%.

## 5. CONCLUSIONS

The statistically adjusted VRI database provides the most accurate inventory available for TFL 15. Therefore, we recommend that

*Weyerhaeuser use the adjusted VRI for operational purposes on TFL 15.*

The 95% sampling error recommended by the MSRM for TSR was not achieved in this project. However, given the small area and the low average adjusted volume observed in TFL 15, the achieved 95% sampling error (18%) is the best available information and should provide the Chief Forester with the necessary confidence in the TFL inventory. Therefore, we recommend that

*Weyerhaeuser seek approval from the MSRM and MOF to use this dataset in the next TSR.*