TFL 55

VEGETATION RESOURCES INVENTORY

STATISTICAL ADJUSTMENT

TIMBERLINE FOREST INVENTORY CONSULTANTS LTD.

Prepared for:

Louisiana Pacific

Prepared by:

Timberline Forest Inventory Consultants Ltd.

Kelowna, B.C.

Project Number: 7051008

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Timberline
Forest Inventory Consultants

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Malakwa Division
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Attention: Fernando Cocciolo, R.P.F.
Area Forest Manager

Reference: *TFL 55 VRI Statistical Adjustment*

Please accept this final report for the above-mentioned project.

It has been our pleasure working with you.

Yours truly,
TIMBERLINE FOREST INVENTORY CONSULTANTS LTD.

Kelly Sherman, R.P.F.
Kelowna Branch Manager

EXECUTIVE SUMMARY

Louisiana Pacific has completed a Vegetation Resources Inventory for Tree Farm Licence 55. The Phase 2 adjustment has been completed by Timberline Forest Inventory Consultants and this report details the methodology used.

The Phase 2 adjustment for the TFL 55 VRI was carried out using methods detailed in *VRI Procedures and Standards for Data Analysis, Attribute Adjustment and Implementation of Adjustment in the Corporate database* (MoF 2004).

Table I shows the weighted ratios that have been used to adjust each of the strata. The adjustments have only been applied to stands over the age 40.

Table I Phase 2 Adjustment

Stratum	Height	Age	Volume
Balsam	1.1151	0.8097	1.0677
Cedar	0.9827	1.0062	1.3673
Hemlock	0.9033	1.4425	1.2636
Other	0.9827	1.1917	1.3673
Spruce	0.9766	0.8164	1.0274

Table II shows the inventory statistics after the adjustment for stands over the age 40.

Table II Adjusted Inventory Statistics

Strata	Area (ha)	Height (m)	Age (yrs)	Site Index (m)	Volume 2003 m^3/ha
Spruce	8,972	31.2	180.0	16.1	364.1
Balsam	3,477	23.6	140.8	13.5	236.5
Cedar	4,583	34.7	275.1	16.1	661.3
Hemlock	5,801	28.0	248.4	11.2	478.7
Other	2,225	27.8	158.2	16.5	373.0
Total	**25,058**	**29.8**	**205.9**	**14.6**	**428.1**

Table III shows the percent change in the inventory statistics after the adjustment.

Table III Adjusted versus Unadjusted Inventory Statistics

Strata	Area (ha)	Height (m)	Age (yrs)	Site Index (m)	Volume 2003 m^3/ha
Spruce	8,972	-2.33%	-17.08%	8.67%	-1.85%
Balsam	3,477	11.49%	-19.02%	28.61%	19.83%
Cedar	4,583	-1.73%	0.00%	-1.76%	33.69%
Hemlock	5,801	-9.65%	18.36%	-23.93%	11.79%
Other	2,225	-1.24%	33.32%	-12.09%	29.25%
Total	**25,058**	**-1.90%**	**-1.54%**	**0.14%**	**13.58%**

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1.0 INTRODUCTION

Tree Farm Licence (TFL) 55 is located in the Selkirk Mountains between the Revelstoke Reservoir and Kinbasket Lake. The TFL is approximately 93,000 hectares with 45,000 hectares of productive forest and 19,782 hectares of timber harvesting landbase according to Management Plan No. 3 (Sterling Wood Group, June 2000). A comprehensive vegetation inventory commenced in 2002, based on a Chief Forester's recommendation in the 1996. Atticus Resources Consulting carried out the Phase 1 VRI, which was completed by 2002. Atticus also did the Phase 2 sampling plan and the Phase II ground sampling in the fall and early winter of 2002. This project compiles the ground sampling data and statistically adjusts the vegetation inventory. This project represents one of several projects that are being completed prior to Management Plan No. 4, which is due in April 2005.

1.1 Objectives

The main objective of the Phase 2 inventory adjustment is to statistically adjust Phase 1 inventory age, height and resulting VDYP generated volume. Age and height are estimated using air photos and contain an interpretation bias. Volume generated using VDYP contains a volume bias because, which result from:

1. VDYP estimates decay waste and breakage using FIZ and PSYU which are "averaged" values (note: this bias can be removed by calculating a volume adjust factor from the Net Volume Adjustment Factor sampling collected during the ground portion of Phase 2); and
2. Additional model error associated with taper equations, local fit and the many other variables used to estimate volume (note: these biases can be removed by adjusting the VDYP volume with the ground volumes).

2.0 DESCRIPTION OF THE DATA

This section details the vegetation resources inventory data set and the ground sample information used to perform the adjustments.

2.1 Vegetation Resources Inventory (VRI) Landbase

TFL 55 encompasses 92,700 hectares of land with 54,444 hectares classified vegetated treed. The remaining 38,000 hectares is broken down between vegetated non-treed and non-vegetated (See Table 1).

Table 1 TFL 55 Vegetation Netdown

Landbase Description	Area (ha)	Percent
Vegetated Treed	54,444	59%
Vegetated Non-Treed	32,884	35%
Non-Treed	5,372	6%
Total	**92,700**	100%

The vegetated treed inventory was further broken down into strata for ground sampling based upon species within the operable landbase. Of the 54,444 ha of vegetated treed land only 26,646 ha were within or touching the operability line. See Table 2.

Table 2 Broad Strata Summary

Species	Area (ha)	Percent
Spruce	9,593	36.0%
Balsam	3,725	14.0%
Cedar	4,745	17.8%
Hemlock	5,937	22.3%
Other	2,646	9.9%
TOTAL	**26,646**	**100.0%**

Once the strata were defined, the standards required that each of the strata be further separated in sub-strata, based on volume. However, in this case volume had not yet been assigned to the inventory file (assigned separately by the MSRM). In discussions between Atticus and the Ministry it was decided that the photo interpreted attribute basal area would be used for sub-stratification. The target was less than 15 substrata overall with a maximum of three substrata (low to high basal area) per main species strata. (Atticus, 2003) Table 3 illustrates the final strata and sub-strata used.

Table 3 Final Strata, Sub-Strata Summary

Strata	Sub-strata	Area (ha)	Percent	# Plots
Spruce	Spruce1	2,730	28.5%	9
	Spruce2	3,165	33.0%	10
	Spruce3	3,699	38.5%	12
Total Spruce		**9,593**	**100.0%**	**31**
Balsam	Balsam1	1,755	47.1%	6
	Balsam2	1,969	52.9%	6
Total Balsam		**3,725**	**100.0%**	**12**
Cedar	Cedar1	900	19.0%	3
	Cedar2	1,778	37.5%	6
	Cedar3	2,066	43.5%	6
Total Cedar		**4,745**	**100.0%**	**15**
Hemlock	Hemlock1	1,371	23.1%	4
	Hemlock2	2,108	35.5%	7
	Hemlock3	2,458	41.4%	8
Total Hemlock		**5,937**	**100.0%**	**19**
Other	Other	2,646	100.0%	8
Total Other		**2,646**	**100.0%**	**8**
Grand TOTAL		**26,646**		**85**

2.2 Unadjusted Inventory

The unadjusted inventory contained an average stand height of 29.4 meters, age of 199.9 years, site index of 15.8 meters, volume at 12.5 cm dbh utilization level of 368.8 m^3/ha and volume at 17.5 cm of 358.5 m^3/ha. There is a difference in total area of 248 ha between Atticus' summaries and Timberline Forest Inventory Consultants summaries. This is due to recently harvested blocks that were "erased" from the inventory when the depletions were cut in by the Ministry. This will not affect the results of this analysis. The population was obtained by selecting only those vegetated treed stands that were within or touched the operability line and were greater than 40 years old. See Table 4.

Table 4 Unadjusted Inventory Statistics

Strata	Area (ha)	Height (m)	Age (yrs)	Site Index (m)	Volume 12.5 m^3/ha	Volume 17.5 m^3/ha
Spruce	8,972	32.0	217.1	14.8	371.0	362.0
Balsam	3,477	21.1	173.9	10.5	197.3	182.6
Cedar	4,583	35.3	275.1	16.4	494.6	488.8
Hemlock	5,801	31.0	209.9	14.7	428.2	417.0
Other	2,225	28.2	118.6	18.7	288.6	273.7
Total	**25,058**	**30.5**	**211.3**	**14.8**	**375.4**	**365.2**

*Area Weighted Averages

2.3 Ground Plot Data

Table 5 shows a summary of Inventory and ground data for each of the Phase 2 ground plots.

Table 5 Phase 2 Ground Plots Summary Table

Phase 2						Phase 1					BEC	elevation
Sample Number	Sub-statum	SP1	Age	Ht	Vol	SP1	SP2	Age	HT	Vol		
1	Spruce1	SXW	33	11	17	SX	BL	25	6	0	ICHvk1	1261
2	Spruce1	SXW	28	8	3	SX	CW	24	6	0	ICHvk1	1096
3	Spruce1	SX	25	9	18	SX	BL	156	21	164	ICHvk1	1349
4	Spruce1	SE	138	39	465	SE	BL	236	36	150	ICHvk1	.
5	Spruce1	SX	165	31	378	SE	BL	246	35	421	ICHvk1	.
6	Spruce1	SE	154	42	252	SE	BL	271	40	449	ICHvk1	.
7	Spruce1	SXW	194	34	224	SE	BL	246	35	375	ICHvk1	.
8	Spruce1	SXW	173	40	506	SE	BL	266	39	454	ICHvk1	1232
9	Spruce1	SXW	150	36	398	SE	CW	206	33	440	ICHvk1	.
10	Spruce2	BL	182	20	366	SE	BL	146	25	298	ESSFwc2	.
11	Spruce2	HM	325	26	369	SE	BL	246	28	310	ESSFvc-	1641
12	Spruce2	SXW	222	33	441	SE	BL	256	29	316	ESSFvc-	.
13	Spruce2	BL	221	29	379	SE	BL	226	28	340	ESSFvc-	1721
17	Spruce2	SXW	264	35	355	SE	BL	236	34	368	ESSFvc-	1537
18	Spruce2	SE	189	38	368	SE		186	38	470	ICHvk1	.
19	Spruce2	HM	283		384	SE	BL	266	33	380	ESSFvc-	1549
31	Spruce3	HW	102	16	95	SE	CW	106	28	382	ESSFvc-	.
14	Spruce2	HM	196	25	413	SE	BL	246	28	294	ESSFvc-	.
15	Spruce2	BL	145	31	353	SE	BL	156	23	284	ESSFvc-	.
16	Spruce2	SXW	213	41	267	SE	BL	266	35	392	ICHvk1	.
20	Spruce3	SE	264	42	440	SE	HW	256	35	508	ESSFvc-	.

Phase 2						Phase 1						
Sample Number	**Sub-statum**	**SP1**	**Age**	**Ht**	**Vol**	**SP1**	**SP2**	**Age**	**HT**	**Vol**	**BEC**	**elevation**
21	Spruce3	SX	203	37	602	SE	BL	236	40	411	ICHvk1	.
22	Spruce3	SXW	264		372	SE	BL	306	34	391	ESSFvc-	.
23	Spruce3	BL	140	25	313	SE	BL	206	30	385	ICHvk1	1162
25	Spruce3	FDI	106	25	244	SE	PL	106	28	326	ICHvk1	1240
26	Spruce3	FDI	91	30	230	SE	PL	106	28	326	ICHvk1	.
27	Spruce3	SXW	122	34	557	SE	BL	226	36	466	ICHvk1	.
28	Spruce3	SXW	139	28	335	SE	HW	276	35	433	ICHvk1	.
29	Spruce3	SXW	101	28	439	SE	FDI	106	28	320	ESSFvc-	.
30	Spruce3	FDI	107	23	139	SE	HW	156	33	492	ICHvk1	.
32	Balsam1	HM	143	4	0	BL		36	4	0	ESSFvc-	.
42	Balsam2	BL	160	24	269	BL	SE	156	26	266	ESSFvv-	1823
33	Balsam1	SXW	21	5	0	SX	BL	146	23	208	ICHvk1	.
34	Balsam1	BL	87	18	55	BL	SE	96	16	119	ESSFvc-	.
35	Balsam1	BL	86	18	177	BL	SE	106	14	87	ESSFvc-	1875
36	Balsam1	BL	133	24	311	BL	SE	226	23	208	ESSFvc-	.
37	Balsam1	BL	164	27	92	BL	SE	186	25	266	ESSFvc-	1878
38	Balsam2	BL	197	20	203	BL	SE	176	25	190	ESSFvc-	1682
39	Balsam2	BL	97	17	78	BL	SE	206	20	181	ESSFvc-	1999
40	Balsam2	BL	168	24	240	BL	SE	236	28	291	ESSFvc-	.
41	Balsam2	SE	62	22	175	BL	HW	116	10	30	ESSFvc-	.
43	Balsam2	BL	166	25	526	BL	SE	156	26	266	ESSFwc2	1400
44	Cedar1	SE	123	32	280	CW	AC	86	20	152	ICHvk1	.
45	Cedar1	SXW	83	21	52	CW	SE	106	22	232	ICHwk1	722
46	Cedar1	CW			1017	CW	SE	306	35	501	ICHvk1	1115
47	Cedar2	HW	142	30	247	CW	HW	206	33	385	ICHvk1	960
49	Cedar2	HW	251	30	353	CW	HW	256	33	452	ICHvk1	.
50	Cedar2	CW	354	33	734	CW	HW	306	37	535	ICHvk1	.
51	Cedar2	CW	179	38	1179	CW	HW	306	36	523	ICHvk1	697
52	Cedar2	CW	254	32	603	CW	HW	256	33	504	ICHvk1	910
53	Cedar3	HW	281	37	610	CW	HW	281	38	503	ICHvk1	.
54	Cedar3	HW	198	28	566	CW	SE	256	33	479	ICHvk1	1062
55	Cedar3	CW	213	38	301	CW	HW	256	35	544	ICHvk1	744
56	Cedar3	CW	404	32	801	CW	HW	256	35	530	ICHvk1	1245
57	Cedar3	CW	522		1121	CW	HW	331	39	550	ICHvk1	1146
58	Cedar3	CW	252	40	563	CW	HW	381	41	569	ICHvk1	798
59	Hemlock1	FDI	20	5	0	HW	FDI	26	8	1	ICHvk1	756
61	Hemlock1	HM	274	18	477	HM	BL	236	25	331	ESSFvc-	1852
62	Hemlock1	HM	367		407	HW	SE	271	33	473	ESSFvc-	1670
63	Hemlock2	HW	200	32	472	HW	CW	126	25	311	ICHvk1	.
64	Hemlock2	HW	298		287	HW	SE	236	32	494	ICHvk1	.
65	Hemlock2	FDI	107	28	433	HW	CW	106	29	341	ICHvk1	1109

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		Phase 2				Phase 1						
Sample Number	**Sub-statum**	**SP1**	**Age**	**Ht**	**Vol**	**SP1**	**SP2**	**Age**	**HT**	**Vol**	**BEC**	**elevation**
66	Hemlock2	HM	257	27	439	H	SE	271	35	513	ESSFvc-	.
67	Hemlock2	SXW	63	21	226	HW	CW	136	33	409	ICHvk1	.
68	Hemlock2	CW			810	HW	CW	381	52	581	ICHvk1	.
69	Hemlock2	CW	301	30	701	HW	CW	206	30	375	ICHvk1	.
70	Hemlock3	CW	134	35	532	HW	CW	256	38	532	ICHvk1	.
71	Hemlock3	CW			386	HW	CW	186	32	466	ICHvk1	856
72	Hemlock3	HW	240	24	434	HW	CW	146	25	354	ICHvk1	643
73	Hemlock3	CW	584	41	237	HW	CW	306	37	523	ICHvk1	.
74	Hemlock3	HW	381	23	411	HW	CW	281	35	514	ICHvk1	957
75	Hemlock3	HW	281	37	573	HW	CW	236	34	474	ICHvk1	860
76	Hemlock3	HW	309	34	800	HW	CW	256	35	493	ICHvk1	.
77	Hemlock3	HW	186	42	1089	HM	SE	276	37	592	ICHvk1	1326
79	Other	AC	44	22	81	AC		56	18	26	ICHvk1	792
81	Other	FDI	112	27	434	FDI	EP	96	25	189	ICHwk1	947
82	Other	HW	239	29	190	FD	HW	146	30	337	ICHvk1	.
83	Other	BL	90	27	602	FDI	SE	106	28	360	ESSFvc-	1491
84	Other	HW	237	22	516	FD	HW	146	32	369	ICHvk1	.
85	Other	CW	244		669	FDI	SE	126	33	444	ICHwk1	661

3.0 METHODS

The Phase 2 adjustment for the TFL 55 VRI was carried out using methods detailed in *VRI Procedures and Standards for Data Analysis, Attribute Adjustment and Implementation of Adjustment in the Corporate database* (MOF 2004).

3.1 Compilation and Net Volume Adjustment Factors

JS Thrower and Associates compiled the Phase 2 ground data and calculated the net volume adjustment factors (NVAF). There were 63 trees sampled, which were distributed as shown in Table 6.

Table 6 Sample size for NVAF

Stratum	Sample Size
Dead	4
Immature	10
Mature-C	12
Mature-H	12
Mature-Others	25

Note: The cedar and hemlock were combined for sampling and then post stratified.

3.2 Statistical Adjustment

The adjustment process was carried out following Section 4 of the *VRI Procedures and Standards for Data Analysis, Attribute Adjustment and Implementation of Adjustment in the Corporate Database* (MOF 2004).

The process involves first determining appropriate adjustment ratios for the age and height. Then using VDYP the adjusted volume is calculated. The adjusted volume is then compared to the Phase 2 ground volumes to determine and appropriate volume adjustment ratio.

3.3 Post Stratification

There was a considerable amount of 'gaming' done to find appropriate post stratification. Variables such as age, biogeoclimatic zones, height and site index were all considered for stratification. Through gaming it was found that none of the variables considered for post stratification improved the relationships.

No post stratification was done except that Cedar and Douglas-fir have been combined for the volume and height adjustments. There were only 5 plots in Douglas-fir stands and they were very similar to the cedar stands in terms of volumes and heights. For the age adjustment they have been adjusted separately because they are distinctly different (i.e. age adjustment for cedar is 1.006 and Douglas-fir is 1.443). Sam Otukol of the Ministry of Forests stated that it is preferable to use the same strata for age, height and volume adjustments; however he agreed that this was an exception.

3.4 Calculating Adjustment Factors

The method used for adjustment factors is the ratio of means (ROM) for all three adjustments; specifically age, height and volume. The observations were weighted appropriately because the selection probabilities were unequal amongst the sub strata.

4.0 ADJUSTMENT RESULTS

4.1 Net Volume Adjustment Factors

The NVAF ratios are shown on Table 7.

Table 7 NVAF Ratios and Sampling Error

Stratum	Sample Size	Avg. NVAF Volume (m3)	Avg. VRI Volume (m3)	NVAF Ratio	95% Sampling Error (Absolute)	CV
Dead	4	2.9613	2.1418	1.291	0.604	29.4
Immature	10	0.2881	0.2919	0.987	0.063	8.9
Mature-C	12	6.7724	7.6007	0.858	0.138	25.2
Mature-H	12	2.0007	1.9594	1.049	0.111	16.7
Mature-Others	25	3.8241	3.6243	1.021	0.064	15.1

The NVAF factors have been approved by Will Smith. It was suggested that LP Canada consider destructively sampling about eight more tree to bring the sampling error in cedar and hemlock to 10%. Using the original strata, which combined cedar and hemlock, the sampling error was less than 10%. However, the difference in NVAF between cedar and hemlock (6.7724 versus 2.0007) was too large to ignore, so the strata was split.

4.2 Age Adjustment

Table 8 shows the weighted ratio of means for the age adjustment for each of the strata.

Table 8 Age Adjustment Ratios

Stratum	Age Adjustment Ratio
Balsam	0.8097
Cedar	1.0062
Douglas-fir	1.4425
Hemlock	1.1917
Spruce	0.8164

The method used for weighting the adjustment ratios has been shown in Table 9.

Table 9 Determining Area weighted Adjustment Ratio for Age (Spruce Stratum)

Phase 2 Sample	Substratum		Age		# of plots	Weight *	Ratio **	Ratio * area
	Name	area	Phase 2	Phase 1				
9	Spruce1	2730.1	150	206	7	390	0.73	283.99
4			138	236		390	0.58	228.06
5			165	246		390	0.67	261.59
7			194	246		390	0.79	307.57
8			173	266		390	0.65	253.66
6			154	271		390	0.57	221.63
3			25	156		390	0.16	62.50
10	Spruce2	3164.7	182	146	10	316	1.25	394.50
15			145	156		316	0.93	294.15
18			189	186		316	1.02	321.57
13			221	226		316	0.98	309.47
17			264	236		316	1.12	354.02
11			325	246		316	1.32	418.10
14			196	246		316	0.80	252.15
12			222	256		316	0.87	274.44
19			283	266		316	1.06	336.70
16			213	266		316	0.80	253.41
31	Spruce3	3698.6	102	106	11	336	0.96	323.55
25			106	106		336	1.00	336.24
26			91	106		336	0.86	288.66
29			101	106		336	0.95	320.38
30			107	156		336	0.69	230.62
23			140	206		336	0.68	228.51
27			122	226		336	0.54	181.51
21			203	236		336	0.86	289.22
20			264	256		336	1.03	346.74
28			139	276		336	0.50	169.34
22			264	306		336	0.86	290.09
Accumulative sum						**9593**		**7832.366766**
Weighted Adjustment ratio (7832.3668 / 9593)								**0.816432836**

* Weight is the area in each substratum divided by the number of plots in that substratum.
* Ratio is Phase 2 age divided by Phase 1 age.

A regression was used to analyse the relationship between the Phase 1 and Phase 2 inventory age (See Figure 1).

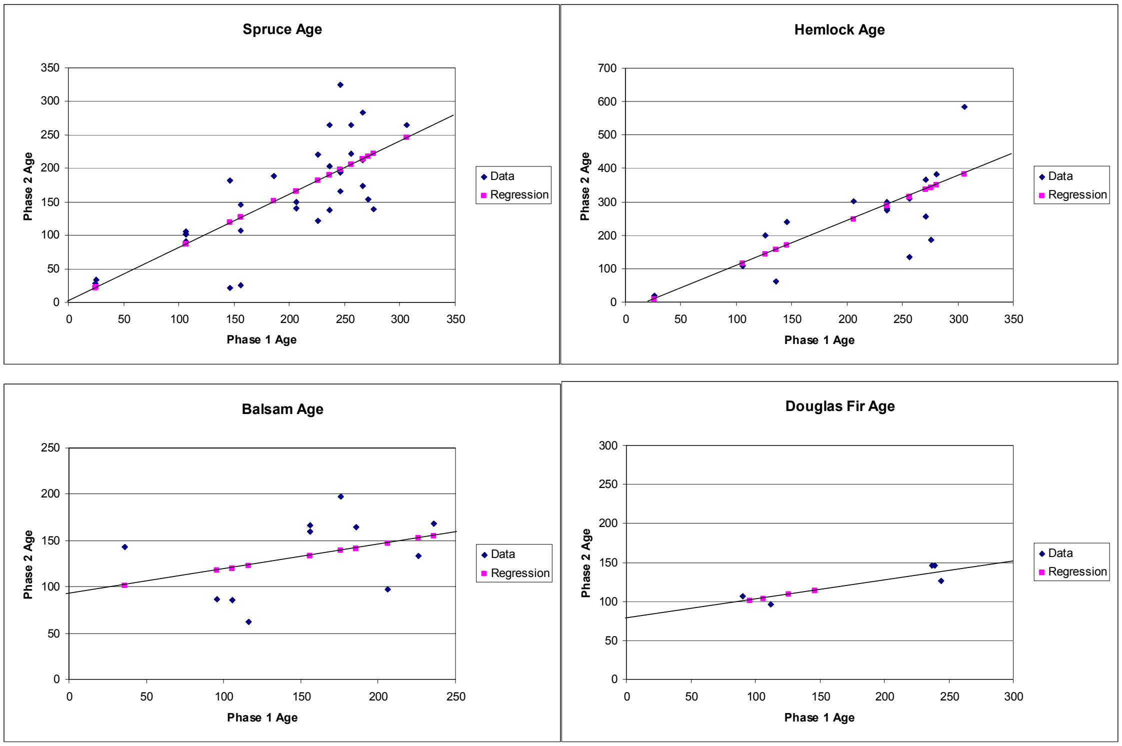

Figure 1 Phase 1 versus Phase 2 age

There were several tests done to see if there differences between the Phase 1 and Phase 2 ages. Table 10 shows the ratio of means and the difference of means, both weighted and non-weighted for each of the strata. The table also includes the result of a series of t-test used to see if the differences were significant.

Table 10 Statistics for each of the strata (species) for age adjustment

Species		**Balsam**	**Cedar**	**Fd**	**Hemlock**	**Spruce**
Weighted Ratio Adjustment		0.8097	1.0062	1.4425	1.1917	0.8164
Unweighted Ratio Adjustment		0.8114	1.003	1.4425	1.1834	0.8295
Weighted Difference Adjustment		-34	-2	60	45	-41
Unweighted Difference Adjustment		-34	-2	60	43	-38
Are they Significantly Different (0.95)	Ratio different than 1	Yes	No	No	No	Yes
	Means	Yes	No	No	No	Yes
	Weighted Means	Yes	No	No	No	Yes
Weighted Means (0.90)		Yes	No	Yes	Yes	Yes

Table 10 shows that we can be 90% confident that the means are significantly different for balsam, Douglas-fir, hemlock and spruce. For cedar the Phase 1 and Phase 2 ages are on average the same.

4.3 Height Adjustment

Table 11 shows the weighted ratio of means for the height adjustment for each of the strata.

Table 11 Height Adjustment Ratios

Stratum	Age Adjustment Ratio
Balsam	1.1151
Cedar/Douglas-fir	0.9827
Hemlock	0.9033
Spruce	0.9766

The method used for the weighted adjustment is the same as that used for the age adjustment (See Table 9).

A regression was used to analyse the relationship between the Phase 1 and Phase 2 inventory height (See Figure 2).

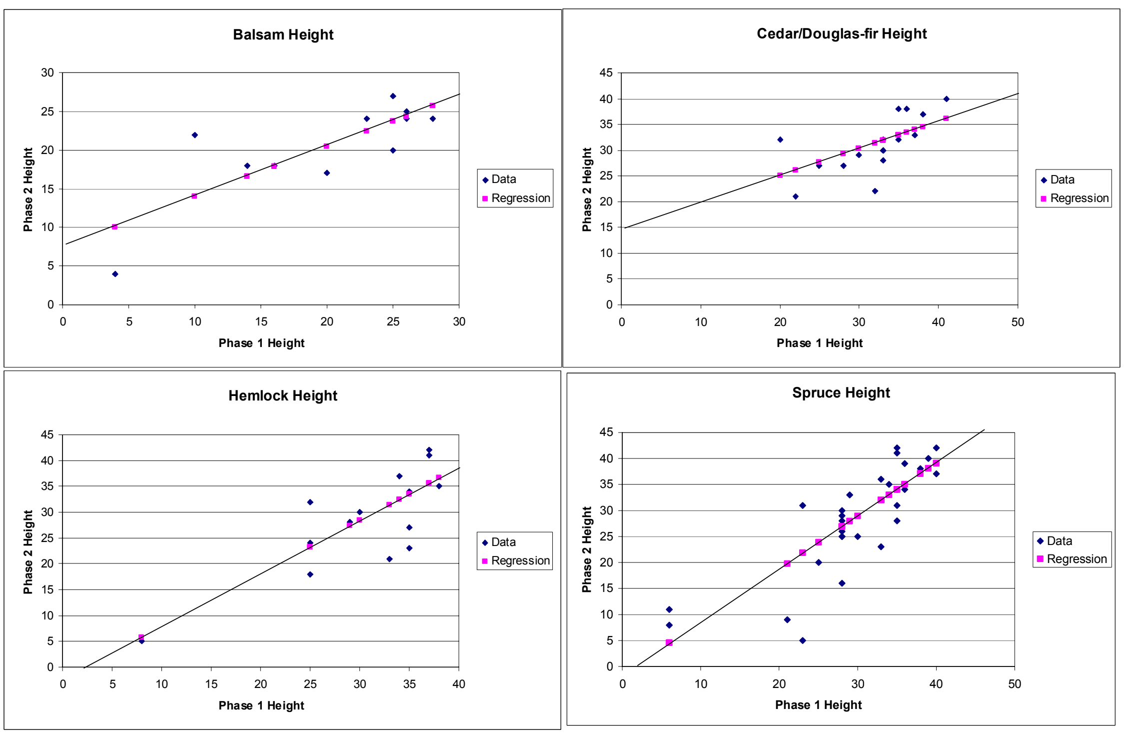

Figure 2 Phase 1 versus Phase 2 height

There were several tests done to see if there differences between the Phase 1 and Phase 2 heights. Table 12 shows the ratio of means and the difference of means, both weighted and non-weighted for each of the strata. The table also includes the result of a series of t-test used to see if the differences were significant.

Table 12 Statistics for each of the strata (species) for height adjustment

Species		Balsam	Cedar/Fd	Hemlock	Spruce
Weighted Ratio Adjustment		1.1151	0.9827	0.9033	0.9766
Unweighted Ratio Adjustment		1.1126	0.9866	0.9396	0.9754
Weighted Difference Adjustment		0.8	-1.1	-2.9	-0.7
Unweighted Difference Adjustment		0.6	-0.9	-2.0	-0.8
Are they Significantly Different (0.90)	Ratio different than 1	No	No	No	No
	Means	No	No	No	No
	Weighted Means	No	No	No	No

Figure 3 shows that there is no statistical evidence that there are any differences between the heights of the Phase 1 and Phase 2 ground heights. Although there are no significant differences shown between the interpreted heights and the ground heights the Ministry of Forests (MoF) Resource Inventory Committee (RIC) still wants the heights to be adjusted. While I disagree with this in concept, I respect the Ministries intent to have consistency across the province.

4.4 Volume Adjustment

Using the adjusted age and height as inputs a new volume was calculated with VDYP. This new volume is compared to Phase 2 volume to determine the volume adjustment factor, which is simply a ratio of means between the Phase 2 and adjusted Phase 1 volume (See Table 13).

Table 13 Volume Adjustment Ratios

Stratum	Volume Adjustment Ratio
Balsam	1.0677
Cedar/Douglas-fir	1.3673
Hemlock	1.2636
Spruce	1.0274

There were t-tests done to test if the ratios were significantly different than 1, which is another way of testing if the means are statistically different. The Cedar/Douglas-fir and Hemlock strata proved to be significantly different, but the spruce and balsam strata were not.

5.0 SUMMARY

5.1 Standard Error

Table 14 shows the standard error for each of the strata, which were calculated by Sam Otukol of the Ministry of Forests. As per ministry standards, the standard error was calculated using the weighted ratios for the volume adjustment. The standard error for height and ages was determined without including the weighting.

Table 14 Standard Error

Stratum	Height	Age	Volume
Balsam	22.9	27.9	47.5
Cedar	7.4	21.2	26.7
Hemlock	10.4	18.6	22.1
Other	22.3	36.7	48.1
Spruce	6.7	11.3	16.0
All strata	**4.4**	**8.2**	**10.6**

5.2 Adjustment Summary

Table 15 shows the weighted adjustments that have been applied to the inventory.

Table 15 Adjustment

Stratum	Height	Age	Volume
Balsam	1.1151	0.8097	1.0677
Cedar	0.9827	1.0062	1.3673
Hemlock	0.9033	1.4425	1.2636
Other	0.9827	1.1917	1.3673
Spruce	0.9766	0.8164	1.0274

The adjustments have been applied to all stands in the strata that are over 40 years old.

5.3 Adjusted Inventory

Table 16 shows the inventory statistics after the adjustment for stands over the age 40.

Table 16 Adjusted Inventory Statistics

Strata	Area (ha)	Height (m)	Age (yrs)	Site Index (m)	Volume 2003 m^3/ha
Spruce	8,972	31.2	180.0	16.1	364.1
Balsam	3,477	23.6	140.8	13.5	236.5
Cedar	4,583	34.7	275.1	16.1	661.3
Hemlock	5,801	28.0	248.4	11.2	478.7
Other	2,225	27.8	158.2	16.5	373.0
Total	**25,058**	**29.8**	**205.9**	**14.6**	**428.1**

Table 17 shows the percent change in the inventory statistics after the adjustment.

Table 17 Adjusted versus Unadjusted Inventory Statistics

Strata	Area (ha)	Height (m)	Age (yrs)	Site Index (m)	Volume 2003 m^3/ha
Spruce	8,972	-2.33%	-17.08%	8.67%	-1.85%
Balsam	3,477	11.49%	-19.02%	28.61%	19.83%
Cedar	4,583	-1.73%	0.00%	-1.76%	33.69%
Hemlock	5,801	-9.65%	18.36%	-23.93%	11.79%
Other	2,225	-1.24%	33.32%	-12.09%	29.25%
Total	**25,058**	**-1.90%**	**-1.54%**	**0.14%**	**13.58%**

6.0 DISCUSSION

This section addresses the impact of the volume adjustment.

6.1 Age, Height, and Site Index

On average the age, height, and site index have remained almost unchanged. Height decreased 1.9 %, age decreased 1.54 % and site index increased 0.14%. The adjustments applied to specific stratum were much more significant but on average the changes were minimal.

The site index is an indirect adjustment in that it is recalculated using VDYP following the age and height adjustment.

6.2 Volume Adjustment

The net increase in the total volume of the inventory is 13.58%. There is a slight decrease in spruce, but a significant increase for all other species. The largest volume increase is found in the Cedar and Douglas-fir stands, where there are increases in the magnitude of 30%.

6.3 Implications

The increase in volume from the Phase 2 VRI adjustment is expected to introduce upward pressure on the short and mid term timber supply of TFL 55.

7.0 REFERENCES

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