Trouble-shooting for Tree-level Models

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EXECUTIVE SUMMARY

In response to direct requests from Members, a project to trouble-shoot the reliability of tree-level models for the prediction of diameter and height growth, and probability of survival, was initiated in 2004. The intent was for members to identify any reservations about any particular model(s), and to then, investigate the circumstances (e.g., mortality in Southland, basal area in Gisborne, MTH in CLAYS).

Only one dataset was provided for this project. Peter Oliver, City Forests, provided inventory runs from Southland, where he used SGM3 as a calibration against ITGM. This was done as there was no pre-harvest data available for the mid-rotation inventories to be compared against.

It was noted that generally there was poorer correlation with all variables on the more difficult higher altitude sites. It was felt that more site information for each inventory was required before any conclusions could be made.

Because the models are very different they could be expected to produce different results and on average they were quite reasonable. More data was required to continue with the project, in particular where inventory plots had been revisited (ie. two sets of actual data at different ages on the same site).

Trouble-shooting for Tree-level Models

Introduction

In response to direct requests from Members, a project to trouble-shoot the reliability of tree-level models for the prediction of diameter and height growth, and probability of survival, was initiated in 2004. The intent was for members to identify any reservations about any particular model(s), and to then, investigate the circumstances (e.g., mortality in Southland, basal area in Gisborne, MTH in CLAYS).

In the past, validations of models were done using PSP data, but it was felt it would also be useful for members to use their own data to carry out validations of ITGM, and then, provide feedback to Forest Research on where bugs occurred or improvements were needed.

To date, only Peter Oliver, City Forests, has provided some inventory runs from Southland, where he used SGM3 as a calibration against ITGM. This was done as there was no pre-harvest data available for the mid-rotation inventories to be compared against. (It was pointed out that small inventory plots (1-3 trees) would not give a sensible result in ITGM. The model works as individual trees grown within a 'normally' stocked stand and does not recognise isolated, or edge trees growing apart from the stand).

Data

Mid-rotation inventories were carried out at age 23 years by City Forests Ltd in Dunedin. The inventories covered three forests (Flagstaff, Tokoiti and Waipori) over 10 compartments from the Southland region (Table 1). Peter Oliver provided summary data of the inventories to the Cooperative to analyse. The data was summarised at age 23 then grown forward to an arbitrary age of 30 years, using both SGM3 and ITGM growth models implemented in YTGEN.

- SGM3 referred to the use of a growth function where the results of applying individual tree functions are adjusted to ensure that stand state variables are those projected by the stand growth model (SGM3)
- ITGM referred to the use of the Southland individual tree growth model with the revised survival function.

The summary output showed the overall actual stand summary (age23) and product mix by Log Grade as well as the overall predicted stand summary (age 30) and product mix by Log Grade.

Table 1.

Inventory ID	**Age**	**Mean SI by Forest**	**Mean Alt by Forest**	**No Plots**	**No Strata**	**Appendix of data analysis**
Flag1031	23	27	257 med	5	1	1
Flag3*	23	"	"	21	2	2
Toko601	23	30	95 low	19	2	3
Toko901#	23	"	"	27	1	4
Waip0101	23	23	438 high	13	1	5
Waip0302	23	"	"	21	1	6
Waip0802	23	"	"	15	1	7
Waip1302	23	"	"	6	1	8
Waip24012	23	"	"	34	1	9
Waip3912#	23	"	"	10	1	10

* Best result
# Worst results

Methods and Results

For each inventory plot, the difference at age 30 of the predicted values for the stand parameters was calculated (Appendices 1- 10), with the average difference and range for each inventory. The percentage error (SGM3-ITGM)/SGM3) for stocking, MTH, BA, standing tree (TSV) and recoverable tree volume (TRV), and each of the log grade products was also calculated for each inventory. The codes by Log Grade are as follows:

L1L2	large branch <14
P1	pruned >40
P2	pruned > V20
Rest	Pulp
S1S2	small branch >6
S3L3	small and large branch

The results of the projected product mix using ITGM did not differ significantly from the SGM3 runs. However MTH, BA and Volume projections were different enough to be of concern. Noting that despite a higher rate of projected mortality, ITGM still predicts a greater overall BA. The results from YTGEN generally showed ITGM over-predicting when compared to SGM3 (Table 2) except for stocking, but this could be an artefact of the probability of survival equations not being implemented properly in YTGEN yet. The height results predicted the best, which was in contrast to expectations.

Table 2

Inventory	% ERROR=(SGM3-ITGM)/SGM3				
	BA	MTH	SPH	TSV	TRV
FLAG1031	-6	1	4	-3	-3
FLAG3	-2	1	8	0	0
TOKO601	-6	0	1	-5	-5
TOKO901	-5	1	3	-4	-21
WAIP0101	-4	-2	4	-5	-5
WAIP0302	-5	-1	5	-5	-5
WAIP0802	-5	-1	5	-5	-5
WAIP1302	-2	-2	9	-3	-3
WAIP24012	-2	-3	10	-4	-5
WAIP3912	-4	-4	4	-7	-7
Min	-6	-4	1	-7	-21
Max	-2	1	10	0	0
Mean	-4	-1	5	-4	-6

The inventory in Flagstaff Forest, Cpt 3, showed the best results (ie. the least error) for the total trees variables (BA, MTH etc.), as shown in Table 2 (mean error 2.2%). Tokoiti Cmpt 9.01, showed the worst results overall for the total tree variables (Table 2), with mean error of 6.8%. In contrast this site showed the second to best results for the average log grade %error (Table 3) Waipoua, Cmpt 39.12 showed the second to worst results for the average log grade %error (Table 3) and was the worst over all values with a mean %error of 7.8%.

Table 3

Inventory	Log Grade % Error (SGM3-ITGM)					
	P1	P2	S1S2	L1L2	S3L3	Rest
FLAG1031	-24	-4	-5	-5	16	7
FLAG3	-23	3	-2	-5	18	5
TOKO601	-6	-7	-3	-8	8	-1
TOKO901	-5	-6	-4	-5	13	-3
WAIP0101	-21	-1	-9	-7	22	-3
WAIP0302	-20	-5	-8	-5	13	-4
WAIP0802	-5	-9	-7	-4	11	-3
WAIP1302	na	na	-7	-7	11	2
WAIP24012	na	na	-11	-8	18	-1
WAIP3912	-5	-5	-20	-9	17	-6
Min	-24	-9	-2	-4	8	-6
Max	-5	3	-20	-9	22	7
Mean	-14	-4	-8	-6	15	-1

Table 4 shows the range of results for the best and worst inventories in Flagstaff, Waipoua and Tokoiti Forests.

Table 4

Best Inventory		SPH	MTH	BA	TSVol	No. Plots
FLAG3	Average	8	1	-2	0	21
	Min	*0*	*0*	*-11*	*-8*	
	Max	*18*	*2*	*6*	*8*	
Worst Inventories		**SPH**	**MTH**	**BA**	**TSVol**	**No. Plots**
WAIP3912	Average	4	-4	-4	-7	10
	Min	*1*	*-5*	*-7*	*-9*	
	Max	*10*	*-2*	*-1*	*-4*	
TOKO901	Average	3	1	-5	-4	27
	Min	*-1*	*-1*	*-22*	*1*	
	Max	*9*	*2*	*-1*	*-19*	

A more in-depth look at the best and worse inventories could also be useful, particularly with respect to environmental variables (such as elevation, aspect and genetics). This cannot be carried out at present as this data is not available.

Conclusions

The results (Table 2) showed the greatest difference in prediction with stocking and the least difference with MTH. The stocking results may be because of the overestimation of mortality in the SGM3 model.

It was noted that generally there was poorer correlation with all variables on the more difficult higher altitude sites. It was felt that more site information for each inventory was required before any conclusions could be made.

Because the models are very different they could be expected to produce different results and on average they were quite reasonable. More data was required to continue with the project, in particular where inventory plots had been revisited (ie. two sets of actual data at different ages on the same site).

Volume Predictions at Age 30 years APPENDIX 1

Flagstaff Forest, Cpt 103.1

	Code	SGM3 Volume (m3)	ITGM Volume (m3)	% Error
Log Grade	break	45.0	47.3	-5%
	stump	17.0	17.7	-4%
	top	7.4	6.8	8%
	waste	23.8	25.3	-6%
	L1L2	29.6	31.2	-5%
	P1	36.0	44.7	-24%
	P2	129.9	135.7	-4%
	Rest	57.2	53.4	7%
	S1S2	359.4	378.8	-5%
	S3L3	58.0	48.8	16%
	TRV	670.1	692.5	-3%
Stand Value	SPH	380.2	366.5	4%
	MTH	36.0	35.6	1%
	BA	64.0	67.6	-6%
	TSV	763.3	789.5	-3%

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
SGM3	Plot 1	360.7	36.1	69.1	813.0
SGM3	Plot 2	385.5	35.1	64.1	748.7
SGM3	Plot 3	337.1	37.2	63.6	773.2
SGM3	Plot 4	408.8	36.0	60.8	753.1
SGM3	Plot 5	408.7	35.7	62.6	728.7
ITGM	Plot 1	328.0	35.8	70.9	822.8
ITGM	Plot 2	375.5	34.8	68.0	780.3
ITGM	Plot 3	331.6	36.6	67.2	798.1
ITGM	Plot 4	397.8	35.5	65.1	786.9
ITGM	Plot 5	399.6	35.3	66.7	759.5
Diff SG-IT	Plot 1	32.70	0.30	-1.80	-9.80
Diff SG-IT	Plot 2	10.00	0.30	-3.90	-31.60
Diff SG-IT	Plot 3	5.50	0.60	-3.60	-24.90
Diff SG-IT	Plot 4	11.00	0.50	-4.30	-33.80
Diff SG-IT	Plot 5	9.10	0.40	-4.10	-30.80
Average Diff		**13.66**	**0.42**	**-3.54**	**-26.18**
Range in value	Min	5.50	0.30	-4.30	-33.80
	Max	32.70	0.60	-1.80	-9.80

Volume Predictions at Age 30 years APPENDIX 2

Flagstaff Forest, Cpt 3.1

	Type	SGMC Volume (m3)	ITGM Volume (m3)	% Error
Log Grade	break	56.1	57.1	-2%
	stump	17.4	17.5	-1%
	top	7.7	6.7	13%
	waste	48.4	48.1	1%
	L1L2	71.6	75.1	-5%
	P1	37.3	45.9	-23%
	P2	61.8	59.9	3%
	Rest	109.9	104.5	5%
	S1S2	318.0	323.0	-2%
	S3L3	52.8	43.3	18%
	TRV	651.4	651.4	0%
Stand Value	SPH	390.0	359.2	8%
	MTH	37.1	36.6	1%
	BA	66.1	67.2	-2%
	TSV	782.2	781.9	0%

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
SGM3	Plota 1	383.4	36.4	72.0	851.0
SGM3	Plota 2	314.9	35.3	60.9	686.4
SGM3	Plota 3	546.0	35.3	75.5	881.5
SGM3	Plota 4	477.1	35.8	71.0	812.1
SGM3	Plota 5	291.6	36.2	51.9	609.6
SGM3	Plota 6	521.8	35.9	77.5	906.8
SGM3	Plota 7	267.3	36.0	57.4	669.9
SGM3	Plota 8	123.1	36.6	45.7	516.4
SGM3	Plota 9	384.3	35.5	69.9	811.7
SGM3	Plota 10	361.8	35.7	61.5	706.2
SGM3	Plota 11	477.0	35.5	73.2	850.5
SGM3	Plotb 1	450.4	38.3	74.4	920.8
SGM3	Plotb 2	631.2	37.1	84.6	1023.2
SGM3	Plotb 3	451.8	38.6	66.5	815.4
SGM3	Plotb 4	312.6	39.1	61.4	759.8
SGM3	Plotb 5	561.1	38.9	81.9	1001.8
SGM3	Plotb 6	313.4	38.3	59.0	713.9
SGM3	Plotb 7	243.7	38.0	45.8	518.3
SGM3	Plotb 8	383.5	37.7	64.2	753.6
SGM3	Plotb 9	289.6	39.0	57.5	688.5
SGM3	Plotb 10	403.4	39.1	75.3	927.8
ITGM	Plota 1	357.7	36.0	73.2	850.6
ITGM	Plota 2	307.2	35.2	64.6	720.6
ITGM	Plota 3	468.8	35.1	73.9	854.8
ITGM	Plota 4	442.5	35.5	71.3	806.2
ITGM	Plota 5	282.9	35.9	56.0	646.0
ITGM	Plota 6	426.6	35.6	75.5	872.6
ITGM	Plota 7	263.1	35.8	61.3	706.3
ITGM	Plota 8	123.0	36.7	48.6	546.9

Flagstaff Forest, Cpt 3.1

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
ITGM	Plota 9	350.9	35.4	70.7	814.3
ITGM	Plota 10	348.5	35.3	65.2	734.5
ITGM	Plota 11	443.6	35.2	73.9	846.0
ITGM	Plotb 1	415.7	37.6	74.3	898.2
ITGM	Plotb 2	575.6	36.2	81.4	962.3
ITGM	Plotb 3	398.9	37.9	66.7	801.6
ITGM	Plotb 4	301.5	38.5	63.7	769.7
ITGM	Plotb 5	472.3	38.2	76.6	920.9
ITGM	Plotb 6	297.5	37.6	62.4	736.7
ITGM	Plotb 7	241.9	37.3	50.7	559.1
ITGM	Plotb 8	374.5	37.1	67.1	769.6
ITGM	Plotb 9	281.1	38.4	60.3	705.9
ITGM	Plotb 10	370.2	38.5	74.2	897.4
Diff SG-IT	Plota 1	25.7	0.4	-1.2	0.4
Diff SG-IT	Plota 2	7.7	0.1	-3.7	-34.2
Diff SG-IT	Plota 3	77.2	0.2	1.6	26.7
Diff SG-IT	Plota 4	34.6	0.3	-0.3	5.9
Diff SG-IT	Plota 5	8.7	0.3	-4.1	-36.4
Diff SG-IT	Plota 6	18%	0.3	2.0	34.2
Diff SG-IT	Plota 7	4.2	0.2	-3.9	-36.4
Diff SG-IT	Plota 8	0%	0%	-2.9	-30.5
Diff SG-IT	Plota 9	33.4	0.1	-0.8	-2.6
Diff SG-IT	Plota 10	13.3	0.4	-3.7	-28.3
Diff SG-IT	Plota 11	33.4	0.3	-0.7	4.5
Diff SG-IT	Plotb 1	34.7	0.7	0.1	22.6
Diff SG-IT	Plotb 2	55.6	2%	3.2	60.9
Diff SG-IT	Plotb 3	52.9	0.7	-0.2	13.8
Diff SG-IT	Plotb 4	11.1	0.6	-2.3	-9.9
Diff SG-IT	Plotb 5	88.8	0.7	0.1	0.1
Diff SG-IT	Plotb 6	15.9	0.7	-3.4	-22.8
Diff SG-IT	Plotb 7	1.8	0.7	-0.1	-0.1
Diff SG-IT	Plotb 8	9.0	0.6	-2.9	-16.0
Diff SG-IT	Plotb 9	8.5	0.6	-2.8	-17.4
Diff SG-IT	Plotb 10	33.2	0.6	1.1	30.4
Average Diff		**26.2**	**0.4**	**-1.2**	**-1.7**
Range in value	Min	0.0	0.0	-4.1	-36.4
	Max	88.8	0.7	3.2	60.9

Volume Predictions at Age 30 years APPENDIX 3

Tokoiti Forest, Cpt 6.1

	Code	SGMC Volume (m3)	ITGM Volume (m3)	% Error
Log Grade	break	42.9	45.5	-6%
	stump	14.4	15.1	-5%
	top	4.2	4.0	5%
	waste	34.6	36.3	-5%
	L1L2	243.2	261.7	-8%
	P1	45.5	48.1	-6%
	P2	103.8	111.0	-7%
	Rest	42.1	42.7	-1%
	S1S2	62.1	64.0	-3%
	S3L3	31.5	29.0	8%
	TRV	528.1	556.5	-5%
Stand Value	SPH	227.1	223.8	1%
	MTH	35.7	35.7	0%
	BA	56.5	60.0	-6%
	TSV	624.2	657.5	-5%

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
SGM3	Plota 1	181.6	36.1	58.2	663.1
SGM3	Plota 2	250.0	34.8	65.8	745.8
SGM3	Plota 3	167.9	36.3	55.2	593.9
SGM3	Plota 4	181.9	35.7	51.5	588.8
SGM3	Plota 5	209.8	35.4	48.8	558.6
SGM3	Plota 6	236.2	36.0	61.6	705.2
SGM3	Plota 7	222.9	35.8	58.1	657.5
SGM3	Plota 8	250.3	35.7	57.6	656.7
SGM3	Plota 9	168.1	35.8	51.3	512.4
SGM3	Plota 10	167.6	36.6	60.4	686.8
SGM3	Plotb 1	154.5	36.3	41.9	483.1
SGM3	Plotb 2	237.4	34.2	52.8	537.9
SGM3	Plotb 3	209.3	36.2	54.3	618.3
SGM3	Plotb 4	263.6	35.6	62.4	658.1
SGM3	Plotb 5	250.4	35.4	57.4	638.9
SGM3	Plotb 6	250.6	35.3	55.4	541.0
SGM3	Plotb 7	290.7	35.4	64.9	740.1
SGM3	Plotb 8	400.2	34.2	60.3	640.3
SGM3	Plotb 9	222.7	36.9	55.8	633.7
ITGM	Plota 1	179.4	36.3	61.0	693.9
ITGM	Plota 2	240.1	35.1	67.8	769.7
ITGM	Plota 3	165.9	36.5	58.0	623.1
ITGM	Plota 4	181.7	35.8	55.6	630.4
ITGM	Plota 5	209.2	35.4	53.3	603.6
ITGM	Plota 6	232.4	36.0	64.7	734.8
ITGM	Plota 7	218.9	35.8	61.3	689.8

Volume Predictions at Age 30 years APPENDIX 3 cont.

Tokoiti Forest, Cpt 6.1

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
ITGM	Plota 8	244.4	35.7	61.0	690.2
ITGM	Plota 9	168.0	35.9	54.9	546.4
ITGM	Plota 10	165.9	36.7	62.9	714.7
ITGM	Plotb 1	155.3	36.2	46.3	526.2
ITGM	Plotb 2	236.1	34.3	57.5	580.8
ITGM	Plotb 3	208.6	36.0	58.3	655.9
ITGM	Plotb 4	256.4	35.7	64.9	680.9
ITGM	Plotb 5	247.9	35.3	61.3	675.6
ITGM	Plotb 6	246.4	35.2	59.0	570.6
ITGM	Plotb 7	284.6	35.3	68.0	767.3
ITGM	Plotb 8	390.2	34.0	64.5	673.4
ITGM	Plotb 9	221.0	36.6	59.4	665.0
Diff SG-IT	Plota 1	2.2	-0.2	-2.8	-30.8
Diff SG-IT	Plota 2	9.9	-0.3	-2.0	-23.9
Diff SG-IT	Plota 3	2.0	-0.2	-2.8	-29.2
Diff SG-IT	Plota 4	0.2	-0.1	-4.1	-41.6
Diff SG-IT	Plota 5	0.6	0.0	-4.5	-45.0
Diff SG-IT	Plota 6	3.8	0.0	-3.1	-29.6
Diff SG-IT	Plota 7	4.0	0.0	-3.2	-32.3
Diff SG-IT	Plota 8	5.9	0.0	-3.4	-33.5
Diff SG-IT	Plota 9	0.1	-0.1	-3.6	-34.0
Diff SG-IT	Plota 10	1.7	-0.1	-2.5	-27.9
Diff SG-IT	Plotb 1	-0.8	0.1	-4.4	-43.1
Diff SG-IT	Plotb 2	1.3	-0.1	-4.7	-42.9
Diff SG-IT	Plotb 3	0.7	0.2	-4.0	-37.6
Diff SG-IT	Plotb 4	7.2	-0.1	-2.5	-22.8
Diff SG-IT	Plotb 5	2.5	0.1	-3.9	-36.7
Diff SG-IT	Plotb 6	4.2	0.1	-3.6	-29.6
Diff SG-IT	Plotb 7	6.1	0.1	-3.1	-27.2
Diff SG-IT	Plotb 8	10.0	0.2	-4.2	-33.1
Diff SG-IT	Plotb 9	1.7	0.3	-3.6	-31.3
Average Diff		**3.3**	**0.0**	**-3.5**	**-33.3**
Range	Min	-0.8	-0.3	-4.7	-45.0
	Max	10.0	0.3	-2.0	-22.8

Volume Predictions at Age 30 years

APPENDIX 4

Tokoiti Forest, Cpt 9.1

	Code	SGM3 Volume (m3)	ITGM Volume (m3)	Diff SG-IT
Log Grade	break	45.4	47.4	-4%
	stump	13.9	14.5	-4%
	top	4.1	3.8	7%
	waste	47.2	48.7	-3%
	L1L2	59.8	62.7	-5%
	P1	49.4	51.9	-5%
	P2	56.0	59.4	-6%
	Rest	112.1	115.6	-3%
	S1S2	249.7	260.9	-4%
	S3L3	17.4	15.2	13%
	TRV	544.5	656.8	-21%
Stand Value	SPH	216.8	210.6	3%
	MTH	37.7	37.4	1%
	BA	54.6	57.5	-5%
	TSV	655.1	680.1	-4%

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
SGM3	Plot 1	195.4	37.8	52.9	632.3
SGM3	Plot 2	171.1	38.0	56.2	675.6
SGM3	Plot 3	170.8	38.2	62.9	768.7
SGM3	Plot 4	183.0	38.1	59.1	744.5
SGM3	Plot 5	135.4	37.5	41.1	490.8
SGM3	Plot 6	135.1	38.1	48.6	584.4
SGM3	Plot 7	255.4	38.1	51.5	624.0
SGM3	Plot 8	123.7	36.7	26.8	310.2
SGM3	Plot 9	243.6	37.5	51.3	646.7
SGM3	Plot 10	195.1	37.9	58.2	677.8
SGM3	Plot 11	135.3	36.2	48.8	559.5
SGM3	Plot 12	171.1	38.0	56.9	689.8
SGM3	Plot 13	348.4	37.4	70.0	860.8
SGM3	Plot 14	254.3	38.4	62.3	768.9
SGM3	Plot 15	230.6	37.8	63.6	769.8
SGM3	Plot 16	147.2	38.1	49.6	599.7
SGM3	Plot 17	407.0	37.2	70.3	855.4
SGM3	Plot 18	524.2	36.6	67.4	795.6
SGM3	Plot 19	171.9	37.2	42.3	496.4
SGM3	Plot 20	159.3	37.9	49.9	601.6
SGM3	Plot 21	123.0	37.5	47.6	532.7
SGM3	Plot 22	195.1	37.9	57.0	692.6
SGM3	Plot 23	268.1	37.1	46.6	538.2
SGM3	Plot 24	219.2	38.7	52.6	656.4
SGM3	Plot 25	348.3	37.6	69.8	858.2
SGM3	Plot 26	206.6	38.1	66.4	766.6
SGM3	Plot 27	135.3	37.5	44.3	489.3
ITGM	Plot 1	195.6	37.4	56.8	667.0
ITGM	Plot 2	170.0	38.2	59.0	708.5
ITGM	Plot 3	168.7	38.1	64.9	787.2
ITGM	Plot 4	181.3	37.9	61.6	767.9
ITGM	Plot 5	135.7	37.3	44.8	527.3
ITGM	Plot 6	135.3	37.9	51.6	613.4

Volume Predictions at Age 30 years APPENDIX 4 cont.

Tokoiti Forest, Cpt 9.1

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
ITGM	Plot 7	253.8	37.5	55.6	659.2
ITGM	Plot 8	124.5	36.1	32.8	369.2
ITGM	Plot 9	240.6	37.1	55.3	682.5
ITGM	Plot 10	193.4	37.6	61.1	702.9
ITGM	Plot 11	135.3	36.3	51.8	592.3
ITGM	Plot 12	169.9	37.9	59.5	715.1
ITGM	Plot 13	328.1	37.0	71.7	863.8
ITGM	Plot 14	244.6	38.0	64.6	783.4
ITGM	Plot 15	214.7	37.6	65.1	779.5
ITGM	Plot 16	145.9	38.0	52.3	626.0
ITGM	Plot 17	379.9	36.7	71.7	854.7
ITGM	Plot 18	478.5	36.0	68.5	791.9
ITGM	Plot 19	172.5	36.9	46.8	539.2
ITGM	Plot 20	159.5	37.6	53.2	633.8
ITGM	Plot 21	123.1	37.5	50.3	559.9
ITGM	Plot 22	193.7	37.6	60.0	719.0
ITGM	Plot 23	267.6	36.6	51.9	584.2
ITGM	Plot 24	219.4	38.1	56.7	689.7
ITGM	Plot 25	321.9	37.2	70.8	855.5
ITGM	Plot 26	202.7	37.9	68.2	780.6
ITGM	Plot 27	130.0	37.5	46.6	510.2
Diff SG-IT	Plot 1	-0.2	0.4	-3.9	-34.7
Diff SG-IT	Plot 2	1.1	-0.2	-2.8	-32.9
Diff SG-IT	Plot 3	2.1	0.1	-2.0	-18.5
Diff SG-IT	Plot 4	1.7	0.2	-2.5	-23.4
Diff SG-IT	Plot 5	-0.3	0.2	-3.7	-36.5
Diff SG-IT	Plot 6	-0.2	0.2	-3.0	-29.0
Diff SG-IT	Plot 7	1.6	0.6	-4.1	-35.2
Diff SG-IT	Plot 8	-0.8	0.6	-6.0	-59.0
Diff SG-IT	Plot 9	3.0	0.4	-4.0	-35.8
Diff SG-IT	Plot 10	1.7	0.3	-2.9	-25.1
Diff SG-IT	Plot 11	0.0	-0.1	-3.0	-32.8
Diff SG-IT	Plot 12	1.2	0.1	-2.6	-25.3
Diff SG-IT	Plot 13	20.3	0.4	-1.7	-3.0
Diff SG-IT	Plot 14	9.7	0.4	-2.3	-14.5
Diff SG-IT	Plot 15	15.9	0.2	-1.5	-9.7
Diff SG-IT	Plot 16	1.3	0.1	-2.7	-26.3
Diff SG-IT	Plot 17	27.1	0.5	-1.4	0.7
Diff SG-IT	Plot 18	45.7	0.6	-1.1	3.7
Diff SG-IT	Plot 19	-0.6	0.3	-4.5	-42.8
Diff SG-IT	Plot 20	-0.2	0.3	-3.3	-32.2
Diff SG-IT	Plot 21	-0.1	0.0	-2.7	-27.2
Diff SG-IT	Plot 22	1.4	0.3	-3.0	-26.4
Diff SG-IT	Plot 23	0.5	0.5	-5.3	-46.0
Diff SG-IT	Plot 24	-0.2	0.6	-4.1	-33.3
Diff SG-IT	Plot 25	26.4	0.4	-1.0	2.7
Diff SG-IT	Plot 26	3.9	0.2	-1.8	-14.0
Diff SG-IT	Plot 27	5.3	0.0	-2.3	-20.9
Average Diff		**6.2**	**0.3**	**-2.9**	**-25.1**
Range	Min	-0.8	-0.2	-6.0	-59.0
	Max	45.7	0.6	-1.0	3.7

Volume Predictions at Age 30 years

APPENDIX 5

Waipori Forest, Cpt 1.1

	Code	SGM3 Volume (m3)	ITGM Volume (m3)	% Error
Log Grade	break	43.1	46.1	-7%
	stump	16.2	16.8	-4%
	top	7.4	7.0	5%
	waste	76.2	80.7	-6%
	L1L2	42.0	45.1	-7%
	P1	12.8	15.5	-21%
	P2	38.5	38.9	-1%
	Rest	169.5	174.6	-3%
	S1S2	214.6	233.2	-9%
	S3L3	20.6	16.0	22%
	TRV	497.9	523.3	-5%
Stand Value	SPH	303.4	290.8	4%
	MTH	32.0	32.6	-2%
	BA	63.1	65.9	-4%
	TSV	640.9	673.8	-5%

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
SGM3	Plot 1	292.9	31.5	62.1	594.4
SGM3	Plot 2	355.7	32.2	69.4	684.9
SGM3	Plot 3	292.8	31.9	64.9	618.8
SGM3	Plot 4	229.3	31.9	45.8	483.1
SGM3	Plot 5	387.7	31.7	70.1	716.0
SGM3	Plot 6	212.7	31.6	55.1	564.3
SGM3	Plot 7	355.8	32.0	69.5	718.2
SGM3	Plot 8	324.4	32.4	63.6	650.9
SGM3	Plot 9	371.2	32.2	72.7	756.4
SGM3	Plot 10	308.3	32.1	67.0	709.9
SGM3	Plot 11	308.8	32.1	61.2	611.4
SGM3	Plot 12	292.3	33.1	62.0	636.5
SGM3	Plot 13	212.6	31.9	57.0	586.9
ITGM	Plot 1	283.5	32.2	65.0	629.2
ITGM	Plot 2	339.0	32.7	71.1	708.4
ITGM	Plot 3	284.2	32.5	68.0	651.5
ITGM	Plot 4	221.8	32.3	50.3	532.8
ITGM	Plot 5	369.0	32.5	72.1	747.3
ITGM	Plot 6	202.0	32.4	58.3	606.6
ITGM	Plot 7	336.8	32.5	71.3	741.3
ITGM	Plot 8	304.9	32.7	66.7	681.5
ITGM	Plot 9	347.4	32.7	73.6	770.0
ITGM	Plot 10	297.1	32.7	69.5	742.6
ITGM	Plot 11	301.8	32.4	64.9	948.5
ITGM	Plot 12	284.2	33.5	65.1	669.6
ITGM	Plot 13	208.7	32.7	60.3	630.7

Volume Predictions at Age 30 years APPENDIX 5 cont.

Waipori Forest, Cpt 1.1

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
Diff SG-IT	Plot 1	9.4	-0.7	-2.9	-34.8
Diff SG-IT	Plot 2	16.7	-0.5	-1.7	-23.5
Diff SG-IT	Plot 3	8.6	-0.6	-3.1	-32.7
Diff SG-IT	Plot 4	7.5	-0.4	-4.5	-49.7
Diff SG-IT	Plot 5	18.7	-0.8	-2.0	-31.3
Diff SG-IT	Plot 6	10.7	-0.8	-3.2	-42.3
Diff SG-IT	Plot 7	19.0	-0.5	-1.8	-23.1
Diff SG-IT	Plot 8	19.5	-0.3	-3.1	-30.6
Diff SG-IT	Plot 9	23.8	-0.5	-0.9	-13.6
Diff SG-IT	Plot 10	11.2	-0.6	-2.5	-32.7
Diff SG-IT	Plot 11	7.0	-0.3	-3.7	-337.1
Diff SG-IT	Plot 12	8.1	-0.4	-3.1	-33.1
Diff SG-IT	Plot 13	3.9	-0.8	-3.3	-43.8
Average Diff		**12.6**	**-0.6**	**-2.8**	**-56.0**
Range	Min	3.9	-0.8	-4.5	-337.1
	Max	23.8	-0.3	-0.9	-13.6

Volume Predictions at Age 30 years APPENDIX 6

Waipori Forest, Cpt 3.2

	Code	SGMC Volume (m3)	ITGM Volume (m3)	% Error
Log Grade	break	35.5	38.1	-7%
	stump	15.2	15.8	-4%
	top	6.1	5.7	7%
	waste	71.0	75.2	-6%
	L1L2	27.0	28.4	-5%
	P1	12.7	15.2	-20%
	P2	45.5	47.9	-5%
	Rest	160.9	166.6	-4%
	S1S2	185.3	199.8	-8%
	S3L3	18.6	16.2	13%
	TRV	449.9	473.9	-5%
Stand Value	SPH	310.4	294.8	5%
	MTH	32.1	32.5	-1%
	BA	58.6	61.4	-5%
	TSV	577.8	608.7	-5%

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
SGMC	Plot 1	254.6	32.3	53.6	498.2
SGMC	Plot 2	254.0	33.1	59.7	597.2
SGMC	Plot 3	424.8	32.1	74.2	736.9
SGMC	Plot 4	292.8	32.4	59.4	611.7
SGMC	Plot 5	331.4	31.8	58.6	576.9
SGMC	Plot 6	406.5	32.2	68.5	699.5
SGMC	Plot 7	311.5	32.4	64.4	594.7
SGMC	Plot 8	254.1	33.3	57.3	551.8
SGMC	Plot 9	388.2	31.4	66.7	630.3
SGMC	Plot 10	235.4	31.8	53.1	521.4
SGMC	Plot 11	408.4	30.6	60.9	597.1
SGMC	Plot 12	79.6	30.0	22.6	211.0
SGMC	Plot 13	368.9	32.1	65.3	642.1
SGMC	Plot 14	368.9	31.8	67.4	678.0
SGMC	Plot 15	197.1	31.2	43.2	444.7
SGMC	Plot 16	426.0	31.9	65.6	636.2
SGMC	Plot 17	157.8	33.5	42.4	446.1
SGMC	Plot 18	236.1	31.4	43.0	370.1
SGMC	Plot 19	273.7	32.8	55.4	528.3
SGMC	Plot 20	368.2	32.9	67.6	698.5
SGMC	Plot 21	479.8	32.5	81.7	862.5

Waipori Forest, Cpt 3.2

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
ITGM	Plot 1	252.1	32.7	57.8	537.9
ITGM	Plot 2	248.8	33.5	62.8	631.8
ITGM	Plot 3	397.7	32.4	74.9	745.6
ITGM	Plot 4	286.9	32.8	63.0	651.6
ITGM	Plot 5	304.2	32.3	61.8	611.8
ITGM	Plot 6	371.7	32.5	69.8	717.8
ITGM	Plot 7	302.0	32.8	67.3	622.3
ITGM	Plot 8	244.2	33.7	60.2	583.6
ITGM	Plot 9	375.0	31.8	69.6	661.0
ITGM	Plot 10	233.8	32.3	57.4	567.9
ITGM	Plot 11	378.0	31.1	63.5	631.7
ITGM	Plot 12	79.9	30.8	27.3	260.2
ITGM	Plot 13	343.4	32.5	67.8	671.8
ITGM	Plot 14	350.2	32.2	70.0	706.5
ITGM	Plot 15	197.0	31.8	48.1	498.2
ITGM	Plot 16	395.0	32.3	67.4	656.6
ITGM	Plot 17	155.2	33.9	45.6	488.1
ITGM	Plot 18	233.6	31.9	47.5	410.7
ITGM	Plot 19	259.7	33.2	58.1	558.8
ITGM	Plot 20	351.5	33.1	69.5	721.0
ITGM	Plot 21	430.2	32.7	80.2	848.0
Diff SG-IT	Plot 1	2.5	-0.4	-4.2	-39.7
Diff SG-IT	Plot 2	5.2	-0.4	-3.1	-34.6
Diff SG-IT	Plot 3	27.1	-0.3	-0.7	-8.7
Diff SG-IT	Plot 4	5.9	-0.4	-3.6	-39.9
Diff SG-IT	Plot 5	27.2	-0.5	-3.2	-34.9
Diff SG-IT	Plot 6	34.8	-0.3	-1.3	-18.3
Diff SG-IT	Plot 7	9.5	-0.4	-2.9	-27.6
Diff SG-IT	Plot 8	9.9	-0.4	-2.9	-31.8
Diff SG-IT	Plot 9	13.2	-0.4	-2.9	-30.7
Diff SG-IT	Plot 10	1.6	-0.5	-4.3	-46.5
Diff SG-IT	Plot 11	30.4	-0.5	-2.6	-34.6
Diff SG-IT	Plot 12	-0.3	-0.8	-4.7	-49.2
Diff SG-IT	Plot 13	25.5	-0.4	-2.5	-29.7
Diff SG-IT	Plot 14	18.7	-0.4	-2.6	-28.5
Diff SG-IT	Plot 15	0.1	-0.6	-4.9	-53.5
Diff SG-IT	Plot 16	31.0	-0.4	-1.8	-20.4
Diff SG-IT	Plot 17	2.6	-0.4	-3.2	-42.0
Diff SG-IT	Plot 18	2.5	-0.5	-4.5	-40.6
Diff SG-IT	Plot 19	14.0	-0.4	-2.7	-30.5
Diff SG-IT	Plot 20	16.7	-0.2	-1.9	-22.5
Diff SG-IT	Plot 21	49.6	-0.2	1.5	14.5
Average Diff		**15.6**	**-0.4**	**-2.8**	**-30.9**
Range	Min	-0.3	-0.8	-4.9	-53.5
	Max	49.6	-0.2	1.5	14.5

Waipori Forest, Cpt 8.2

	Code	SGMC Volume (m3)	ITGM Volume (m3)	Diff SG-IT
Log Grade	break	39.0	41.4	-6%
	stump	15.8	16.4	-4%
	top	6.0	5.5	8%
	waste	77.6	80.5	-4%
	L1L2	17.3	18.0	-4%
	P1	8.4	8.8	-5%
	P2	36.3	39.6	-9%
	Rest	173.0	177.9	-3%
	S1S2	231.7	248.6	-7%
	S3L3	23.0	20.4	11%
	TRV	489.7	513.3	-5%
Stand Value	SPH	56.8	63.0	-11%
	MTH	32.9	32.9	0%
	BA	292.8	325.4	-11%
	TSV	584.2	647.0	-11%

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
SGMC	Plot 1	339.3	33.0	71.5	786.2
SGMC	Plot 2	196.6	34.1	44.8	498.8
SGMC	Plot 3	414.5	30.5	52.2	503.3
SGMC	Plot 4	268.1	34.0	60.3	607.8
SGMC	Plot 5	292.8	32.2	60.4	614.0
SGMC	Plot 6	291.8	33.7	66.3	697.3
SGMC	Plot 7	387.3	32.4	71.2	753.8
SGMC	Plot 8	340.4	32.7	61.9	636.9
SGMC	Plot 9	385.6	34.1	74.7	778.2
SGMC	Plot 10	268.6	33.3	57.9	573.9
SGMC	Plot 11	245.3	32.2	49.3	492.2
SGMC	Plot 12	293.2	32.1	55.3	540.2
SGMC	Plot 13	412.8	31.8	59.3	594.4
SGMC	Plot 14	340.4	33.5	57.7	604.9
SGMC	Plot 15	505.0	32.4	72.8	749.2
ITGM	Plot 1	316.8	33.3	72.7	802.3
ITGM	Plot 2	186.8	34.3	48.2	529.4
ITGM	Plot 3	403.1	30.8	57.3	552.0
ITGM	Plot 4	244.4	34.3	62.3	631.4
ITGM	Plot 5	286.9	32.6	64.0	653.9
ITGM	Plot 6	278.5	34.0	34.0	723.0
ITGM	Plot 7	371.3	32.6	32.6	777.0
ITGM	Plot 8	331.5	32.9	65.3	673.3
ITGM	Plot 9	355.4	34.4	74.1	774.6
ITGM	Plot 10	261.9	33.6	61.2	607.9
ITGM	Plot 11	244.7	32.5	54.1	540.0
ITGM	Plot 12	286.3	32.4	59.6	580.3
ITGM	Plot 13	372.3	32.1	62.0	625.4
ITGM	Plot 14	325.4	33.5	61.2	637.0
ITGM	Plot 15	455.7	32.6	72.5	750.7

Waipori Forest, Cpt 8.2

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
Diff SG-IT	Plot 1	22.5	-0.3	-1.2	-16.1
Diff SG-IT	Plot 2	9.8	-0.2	-3.4	-30.6
Diff SG-IT	Plot 3	11.4	-0.3	-5.1	-48.7
Diff SG-IT	Plot 4	23.7	-0.3	-2.0	-23.6
Diff SG-IT	Plot 5	5.9	-0.4	-3.6	-39.9
Diff SG-IT	Plot 6	13.3	-0.3	32.3	-25.7
Diff SG-IT	Plot 7	16.0	-0.2	38.6	-23.2
Diff SG-IT	Plot 8	8.9	-0.2	-3.4	-36.4
Diff SG-IT	Plot 9	30.2	-0.3	0.6	3.6
Diff SG-IT	Plot 10	6.7	-0.3	-3.3	-34.0
Diff SG-IT	Plot 11	0.6	-0.3	-4.8	-47.8
Diff SG-IT	Plot 12	6.9	-0.3	-4.3	-40.1
Diff SG-IT	Plot 13	40.5	-0.3	-2.7	-31.0
Diff SG-IT	Plot 14	15.0	0.0	-3.5	-32.1
Diff SG-IT	Plot 15	49.3	-0.2	0.3	-1.5
Average Diff		**17.4**	**-0.3**	**2.3**	**-28.5**
Range in value	Min	0.6	-0.4	-5.1	-48.7
	Max	49.3	0.0	38.6	3.6

Volume Predictions at Age 30 years APPENDIX 8

Waipoa Forest, Cpt 13.2

	Type	SGMC Volume (m3)	ITGM Volume (m3)	Diff SG-IT
Log Grade	break	37.9	39.4	-4%
	stump	17.5	17.7	-1%
	top	8.2	7.4	10%
	waste	64.7	64.3	1%
	L1L2	100.1	107.2	-7%
	P1	0.0	0.0	
	P2	0.0	0.0	
	Rest	142.4	138.9	2%
	S1S2	250.1	268.0	-7%
	S3L3	35.5	31.5	11%
	TRV	528.1	545.6	-3%
Stand Value	SPH	396.2	360.4	9%
	MTH	31.9	32.4	-2%
	BA	67.3	68.4	-2%
	TSV	656.5	674.4	-3%

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
SGMC	Plot 1	235.3	31.6	52.9	537.4
SGMC	Plot 2	482.6	30.7	69.3	640.0
SGMC	Plot 3	330.2	32.3	65.7	561.1
SGMC	Plot 4	573.6	31.6	78.6	793.4
SGMC	Plot 5	482.9	31.2	64.7	626.7
SGMC	Plot 6	348.8	32.5	69.5	699.0
SGMC	Plot 7	386.5	33.1	67.2	701.4
SGMC	Plot 8	329.6	32.5	70.5	692.5
ITGM	Plot 1	229.0	32.4	56.1	581.9
ITGM	Plot 2	445.1	31.1	71.1	661.5
ITGM	Plot 3	294.1	32.90	67.20	577.90
ITGM	Plot 4	500.5	32.00	76.40	779.70
ITGM	Plot 5	448.5	31.70	66.40	649.10
ITGM	Plot 6	313.7	33.00	70.60	720.00
ITGM	Plot 7	360.5	33.20	69.00	721.60
ITGM	Plot 8	291.4	33.20	70.30	703.00
Diff SG-IT	Plot 1	6.3	-0.80	-3.20	-44.50
Diff SG-IT	Plot 2	37.5	-0.40	-1.80	-21.50
Diff SG-IT	Plot 3	36.1	-0.60	-1.50	-16.80
Diff SG-IT	Plot 4	73.1	-0.40	2.20	13.70
Diff SG-IT	Plot 5	34.4	-0.50	-1.70	-22.40
Diff SG-IT	Plot 6	35.1	-0.50	-1.10	-21.00
Diff SG-IT	Plot 7	26.0	-0.10	-1.80	-20.20
Diff SG-IT	Plot 8	38.2	-0.70	0.20	-10.50
Average Diff		**35.8**	**-0.50**	**-1.09**	**-17.90**
Range in value	Min	6.3	-0.80	-3.20	-44.50
	Max	73.1	-0.10	2.20	13.70

Volume Predictions at Age 30 years APPENDIX 9

Waipoa Forest, Cpt 24.12

	Type	SGMC Volume (m3)	ITGM Volume (m3)	Diff SG-IT
Log Grade	break	28.8	30.7	-7%
	stump	17.5	17.6	-1%
	top	6.4	5.8	9%
	waste	57.3	58.6	-2%
	L1L2	119.6	129.7	-8%
	P1	0.0	0.0	
	P2	0.0	0.0	
	Rest	148.2	149.0	-1%
	S1S2	156.4	173.3	-11%
	S3L3	32.3	26.4	18%
	TRV	456.5	478.4	-5%
Stand Value	SPH	440.6	396.2	10%
	MTH	28.6	29.6	-3%
	BA	66.4	67.5	-2%
	TSV	566.5	591.1	-4%

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
SGMC	Plot 1	458.6	29.3	80.7	711.3
SGMC	Plot 2	388.3	30.0	68.9	613.7
SGMC	Plot 3	221.9	29.1	40.5	326.6
SGMC	Plot 4	413.9	28.2	63.0	525.6
SGMC	Plot 5	622.6	28.5	88.0	766.7
SGMC	Plot 6	529.8	28.2	85.1	793.3
SGMC	Plot 7	389.1	29.5	64.0	525.0
SGMC	Plot 8	460.2	29.1	69.5	568.7
SGMC	Plot 9	366.4	28.4	56.7	479.4
SGMC	Plot 10	342.7	28.4	52.5	485.2
SGMC	Plot 11	553.9	28.9	76.7	676.2
SGMC	Plot 12	393.3	26.5	39.1	305.6
SGMC	Plot 13	762.9	28.4	84.6	706.0
SGMC	Plot 14	506.0	29.4	78.5	689.5
SGMC	Plot 15	415.0	27.4	58.2	462.9
SGMC	Plot 16	574.9	29.9	82.8	732.5
SGMC	Plot 17	645.3	28.7	89.3	767.4
SGMC	Plot 18	390.9	28.0	54.2	365.8
SGMC	Plot 19	173.2	28.2	34.3	275.8
SGMC	Plot 20	411.6	29.4	76.6	649.4
SGMC	Plot 21	365.8	28.5	63.1	541.2
SGMC	Plot 22	414.0	27.9	63.8	510.7
SGMC	Plot 23	318.1	28.7	56.4	411.3
SGMC	Plot 24	509.3	27.9	66.1	579.6
SGMC	Plot 25	625.3	28.4	74.7	676.2
SGMC	Plot 26	552.4	29.3	82.1	682.4
SGMC	Plot 27	529.8	28.5	82.9	741.7
SGMC	Plot 28	197.8	27.8	36.5	318.1
SGMC	Plot 29	269.4	29.0	60.3	527.8
SGMC	Plot 30	506.5	28.9	78.3	678.1

Volume Predictions at Age 30 years APPENDIX 9 cont.

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
SGMC	Plot 31	270.0	28.8	52.1	495.1
SGMC	Plot 32	459.8	29.3	70.9	605.2
SGMC	Plot 33	671.1	28.2	81.3	663.7
SGMC	Plot 34	270.4	28.6	45.7	401.8
ITGM	Plot 1	392.5	30.4	78.5	718.0
ITGM	Plot 2	352.5	30.8	71.0	643.9
ITGM	Plot 3	221.5	30.0	46.1	376.1
ITGM	Plot 4	375.5	29.3	65.6	559.8
ITGM	Plot 5	526.6	29.5	83.1	743.3
ITGM	Plot 6	443.3	29.4	81.7	787.5
ITGM	Plot 7	373.3	30.3	67.2	559.5
ITGM	Plot 8	426.3	30.2	70.5	597.2
ITGM	Plot 9	349.2	29.4	60.5	524.6
ITGM	Plot 10	328.6	29.4	56.9	539.7
ITGM	Plot 11	486.2	29.8	75.8	687.7
ITGM	Plot 12	390.9	27.3	46.5	367.3
ITGM	Plot 13	639.2	29.3	79.4	682.8
ITGM	Plot 14	440.9	30.3	76.9	697.0
ITGM	Plot 15	392.8	28.7	61.7	502.2
ITGM	Plot 16	480.5	30.7	79.4	727.2
ITGM	Plot 17	477.6	29.9	82.2	740.3
ITGM	Plot 18	371.7	29.0	58.6	401.4
ITGM	Plot 19	173.2	29.3	39.7	327.7
ITGM	Plot 20	373.2	30.6	76.2	669.4
ITGM	Plot 21	350.2	29.5	66.3	583.9
ITGM	Plot 22	393.6	29.0	67.0	549.9
ITGM	Plot 23	308.4	29.8	60.5	450.3
ITGM	Plot 24	484.2	28.8	69.3	622.4
ITGM	Plot 25	571.0	29.1	75.1	691.0
ITGM	Plot 26	481.9	30.2	79.2	680.7
ITGM	Plot 27	459.8	29.6	80.3	739.8
ITGM	Plot 28	198.3	28.8	42.7	379.5
ITGM	Plot 29	264.5	30.1	64.5	577.3
ITGM	Plot 30	425.4	30.0	76.3	679.3
ITGM	Plot 31	266.2	29.9	56.7	554.8
ITGM	Plot 32	427.5	30.2	72.0	633.5
ITGM	Plot 33	581.1	29.1	78.5	661.9
ITGM	Plot 34	244.1	30.0	48.1	442.0

Volume Predictions at Age 30 years APPENDIX 9 cont.

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
Diff SG-IT	Plot 1	66.1	-1.1	2.2	-6.7
Diff SG-IT	Plot 2	35.8	-0.8	-2.1	-30.2
Diff SG-IT	Plot 3	0.4	-0.9	-5.6	-49.5
Diff SG-IT	Plot 4	38.4	-1.1	-2.6	-34.2
Diff SG-IT	Plot 5	96.0	-1.0	4.9	23.4
Diff SG-IT	Plot 6	86.5	-1.2	3.4	5.8
Diff SG-IT	Plot 7	15.8	-0.8	-3.2	-34.5
Diff SG-IT	Plot 8	33.9	-1.1	-1.0	-28.5
Diff SG-IT	Plot 9	17.2	-1.0	-3.8	-45.2
Diff SG-IT	Plot 10	14.1	-1.0	-4.4	-54.5
Diff SG-IT	Plot 11	67.7	-0.9	0.9	-11.5
Diff SG-IT	Plot 12	2.4	-0.8	-7.4	-61.7
Diff SG-IT	Plot 13	123.7	-0.9	5.2	23.2
Diff SG-IT	Plot 14	65.1	-0.9	1.6	-7.5
Diff SG-IT	Plot 15	22.2	-1.3	-3.5	-39.3
Diff SG-IT	Plot 16	94.4	-0.8	3.4	5.3
Diff SG-IT	Plot 17	167.7	-1.2	7.1	27.1
Diff SG-IT	Plot 18	19.2	-1.0	-4.4	-35.6
Diff SG-IT	Plot 19	0.0	-1.1	-5.4	-51.9
Diff SG-IT	Plot 20	38.4	-1.2	0.4	-20.0
Diff SG-IT	Plot 21	15.6	-1.0	-3.2	-42.7
Diff SG-IT	Plot 22	20.4	-1.1	-3.2	-39.2
Diff SG-IT	Plot 23	9.7	-1.1	-4.1	-39.0
Diff SG-IT	Plot 24	25.1	-0.9	-3.2	-42.8
Diff SG-IT	Plot 25	54.3	-0.7	-0.4	-14.8
Diff SG-IT	Plot 26	70.5	-0.9	2.9	1.7
Diff SG-IT	Plot 27	70.0	-1.1	2.6	1.9
Diff SG-IT	Plot 28	-0.5	-1.0	-6.2	-61.4
Diff SG-IT	Plot 29	4.9	-1.1	-4.2	-49.5
Diff SG-IT	Plot 30	81.1	-1.1	2.0	-1.2
Diff SG-IT	Plot 31	3.8	-1.1	-4.6	-59.7
Diff SG-IT	Plot 32	32.3	-0.9	-1.1	-28.3
Diff SG-IT	Plot 33	90.0	-0.9	2.8	1.8
Diff SG-IT	Plot 34	26.3	-1.4	-2.4	-40.2
Average Diff		**44.4**	**-1.0**	**-1.1**	**-24.7**
Range in value	Min	-0.5	-1.4	-7.4	-61.7
	Max	167.7	-0.7	7.1	27.1

Volume Predictions at Age 30 years APPENDIX 10

Waipoa Forest, Cpt 39.12

	Type	SGMC Volume (m3)	ITGM Volume (m3)	Diff SG-IT
Log Grade	break	31.1	33.6	-8%
	stump	15.2	15.7	-3%
	top	4.0	3.9	3%
	waste	45.4	47.2	-4%
	L1L2	230.2	249.8	-9%
	P1	16.2	17.0	-5%
	P2	34.7	36.3	-5%
	Rest	132.8	141.4	-6%
	S1S2	10.5	12.6	-20%
	S3L3	12.5	10.4	17%
	TRV	436.9	467.5	-7%
Stand Value	SPH	214.2	205.3	4%
	MTH	31.0	32.2	-4%
	BA	61.1	63.6	-4%
	TSV	532.6	567.8	-7%

Model	Name	Stems/ha	Top Height (m)	Basal Area (m2/ha)	Volume (m3/ha)
SGMC	Plot 1	168.8	30.2	57.6	470.7
SGMC	Plot 2	196.3	30.7	62.3	549
SGMC	Plot 3	182.7	31.1	53.4	431.5
SGMC	Plot 4	196.6	30.9	54.0	415.8
SGMC	Plot 5	237.7	30.8	64.0	540.3
SGMC	Plot 6	237.2	31.5	70.8	642.7
SGMC	Plot 7	224.0	31.1	59.8	533.8
SGMC	Plot 8	251.6	31.3	58.8	547.4
SGMC	Plot 9	251.0	31.3	69.8	625.4
SGMC	Plot 10	196.2	31.4	60.8	569.4
ITGM	Plot 1	161.6	31.8	59.7	509.4
ITGM	Plot 2	190.4	32.0	64.7	587.4
ITGM	Plot 3	180.4	32.2	56.8	469.5
ITGM	Plot 4	193.6	31.9	57.6	452.0
ITGM	Plot 5	227.9	31.9	66.3	573.4
ITGM	Plot 6	224.4	32.6	71.9	668.9
ITGM	Plot 7	208.1	32.2	62.3	568.1
ITGM	Plot 8	247.1	32.0	62.6	590.2
ITGM	Plot 9	227.0	32.5	70.3	649.3
ITGM	Plot 10	192.2	32.5	63.6	610.1
Diff SG-IT	Plot 1	4.3	-5.3	-3.6	-8.2
Diff SG-IT	Plot 2	3.0	-4.2	-3.9	-7.0
Diff SG-IT	Plot 3	1.3	-3.5	-6.4	-8.8
Diff SG-IT	Plot 4	1.5	-3.2	-6.7	-8.7
Diff SG-IT	Plot 5	4.1	-3.6	-3.6	-6.1
Diff SG-IT	Plot 6	5.4	-3.5	-1.6	-4.1
Diff SG-IT	Plot 7	7.1	-3.5	-4.2	-6.4
Diff SG-IT	Plot 8	1.8	-2.2	-6.5	-7.8
Diff SG-IT	Plot 9	9.6	-3.8	-0.7	-3.8
Diff SG-IT	Plot 10	2.0	-3.5	-4.6	-7.1
Average Diff		**4.0**	**-3.6**	**-4.2**	**-6.8**
Range in value	Min	1.3	-5.3	-6.7	-8.8
	Max	9.6	-2.2	-0.7	-3.8