TFL 35 – JAMIESON BLOCK
GROWTH AND YIELD MONITORING
SECOND MEASUREMENT RESULTS
FINAL REPORT

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Project Number: WCK-099

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File number WCK-099

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Attention: Jamie Skinner, *RPF*

Reference: TFL 35 Growth and Yield Monitoring – 2nd Measurement Results

Please accept this final report for the project "TFL 35 Growth and Yield Monitoring – 2nd Measurement Results".

If you have any questions regarding the information contained in this report, please contact either Dan Turner, *RPF*, project manager (Kamloops office) or René de Jong, *RFP*, analyst (Victoria office).

Yours truly,
TIMBERLINE NATURAL RESOURCE GROUP LTD.

Dan Turner, *RPF*
Project Manager

EXECUTIVE SUMMARY

This report documents the second measurement analysis results of a pilot growth and yield monitoring program located in Weyerhaeuser Company Limited's Tree Farm License (TFL) 35 Jamieson Block near Kamloops, BC. This report also documents the first time this new MoFR approved monitoring design has been analyzed using repeated measurement. Sixty-five (65) plots were originally established in post-harvest regenerated stands across the TFL using a 1.0 km grid between 2000 and 2001. These plots were revisited in 2006 following two recent major events that have impacted the TFL: the 2003 McLure wildfire, and the ongoing mountain pine beetle epidemic.

The analyses showed that the net merchantable volume at the end of the second measurement (for those monitoring plots assessed as managed) is over two times higher than predicted volumes. The net annual growth rate is also about 2.5 times faster. This suggests that Weyerhaeuser's management plan assumptions are conservatively underestimating the true volume and growth rate on TFL 35, even with the volume losses attributed to the 2003 McLure wildfire.

However, since some of the older harvested stands contain an overstory residual component, there is concern that residual trees may be inflating volumes when compared against management plan assumptions. There are also live Pli trees recently infested by the MPB on the TFL. The potential combined impact of removing residual trees together with MPB infested trees (as well as the 2003 McLure wildfire) is that the resulting net merchantable ground volume is only 1.2 times greater than predicted volumes, and the resulting net growth rate is lower than predicted. This may be of concern when evaluating management plan assumptions.

The site index of the ground plots at the second measurement were closer to predicted estimates for all species, compared to the first measurement. This suggests that potential site index estimates originating from the previous site index adjustment project appropriately reflect current site productivity conditions. Overall, the ground based leading species proportion is very similar to the inventory leading species at the time of the second measurement.

Recommendations for future work include:

- Data should be further analysed to evaluate the mountain pine beetle impact to assist Weyco in its management plans for the TFL.
- There should be further effort to better quantify the residual stand component, considering the impact it may have on the analysis.
- Recognition of different historical harvest methods on the TFL should be considered when assigning managed stand yield tables vs. natural stand yield tables.
- Older monitoring plots should be reviewed for continued remeasurement, as they may no longer reflect current management practises.
- Inventory ages need to be rationalized for those stands with a known harvest history.
- Weyco should consider the option to use electronic data loggers at subsequent plot remeasurements.
- The repeated tree branch data collected should be analyzed to further improve the understanding of wood quality in these post-harvest regenerated stands.

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1.0 INTRODUCTION

1.1 Background

Weyerhaeuser Company Limited (Weyco) established a growth and yield (G&Y) monitoring program on Tree Farm License (TFL) 35 Jamieson Block near Kamloops, BC. A total of 65 monitoring plots were installed between 2000 (20) and 2001 (45),[1,2] which formed a representative sample of all Post Harvest Regenerated (PHR) stands between 15 and 40 years of age (as of January 1, 2001). These plots were remeasured in the fall of 2006, and an additional 8 new monitoring plots were also established.

During the period between the first and second measurements, two major natural events occurred on the TFL, which are now incorporated into the monitoring program. They include the 2003 McLure wildfire, and the ongoing mountain pine beetle (MPB) epidemic.

1.2 Monitoring Objective

The primary objective of the G&Y monitoring program is to monitor the change in volume, site index, top height, and species composition in PHR stands, and to compare these data with predicted values of the same attributes used in timber supply analysis. The goal is to develop a high level of confidence in the accuracy and precision of timber supply analysis projections.

1.3 Report Objectives

The objectives of this report are to:

1) Compile the ground data from both first and second measurements, and compare data between measurements.

2) Compare ground results of volume, site index, age, and species composition, against management plan assumptions for those stands where monitoring plots are located.

1.4 Terms of Reference

This project was completed by Timberline Natural Resource Group (TNR). The Weyco project team included Jamie Skinner, *RPF* (project leader), and Sean Curry, *RPF* (Management Plan [MP] 9 data package support). The TNR project team included Dan Turner, *RPF* (project manager), René de Jong, *RPF* (project analyst, report writing), Scott MacKinnon, *FIT* (field operations manager), and Eleanor McWilliams, *MSc, RPF* (technical support).

[1] J.S. Thrower & Associates Ltd. 2001. TFL 35 Growth and Yield Monitoring Pilot Project: Year end report. Contract report to Weyerhaeuser Company Limited. Kamloops, BC. March 30, 2001. 19 pp.

[2] J.S. Thrower & Associates Ltd. 2002. TFL 35 Growth and Yield Monitoring Pilot Project: An example analysis of 1st measurement results. Report to Weyerhaeuser Company Limited, Kamloops, BC. March 22, 2002.

2.0 SAMPLING DESIGN

2.1 Target Population

The original target population included all PHR stands between 15 and 40 years of age (as defined in the forest cover inventory) at the time of project establishment in 2000. The intent was to include harvested stands with some measurable volume (ie., at least 15 years of age), dating back to about 1960. The original target population covered approximately 18% of the 36,445 ha TFL, as summarized in the first measurement analysis report.[2]

In 2006, the target population was modified to include all stands in the TFL that were in Weyco's harvest history spatial coverage and at least 18 years of age.[3]

2.2 Sample Population

The sample plots are located on a 1.0 km square grid using NAD 83 UTM coordinates evenly divisible by 1,000. The 1.0 km grid gives an approximate sample intensity of one plot for each 100 ha of PHR stand area. Sixty-five (65) plots were established for this pilot project: 20 in the 2000 field season and 45 in the 2001 field season. In 2006, and additional 8 plots were also established.

2.3 Sample Plot Design

The monitoring plots are 400 m^2 circular plots with two nested subplots. The design and plot measurements are largely consistent with Ministry of Forests and Range (MoFR) Change Monitoring Inventory (CMI) plot design standards.[4] Additional documentation on the sampling design and variances to data collection standards can be found in the first measurement analysis report.[2]

[3] This revised target population definition was made by Weyco staff in June 2006. It differed from the original definition as it used a spatial coverage of harvest history as opposed to projected inventory age.

[4] The DBH tagging limit at first measurement was reduced by Weyco down to 4.0 cm in the 11.28 m plot and 1.3 m tall in the 5.64 m plot. The second measurement tagging limit was increased to 9.0 cm in the 11.28 m plot and 4 cm tall in the 5.64. The second measurement is consistent with current MoFR CMI standards.

3.0 DATA MANAGEMENT

3.1 Plot Data Compilation

All second measurement plus newly established plot data were entered in the MoFR data entry program TIMVEG.[5] Individual tree data were compiled by TNR using the VRI[6] / CMI compiler previously developed by the MoFR. First measurement tree data were previously compiled by the MoFR in 2002.[7] Plot level summaries for volume, site index, and species distribution were recompiled using custom programs developed by TNR.

3.1.1 Error Checking

Individual tree level comparisons were made between first and second measurements, and included checks for abnormal changes in diameter, height, live / dead status, and species labeling. While the majority of anomalies were corrected through repeated field card reviews, a few anomalies could not be resolved. A summary of suspect tree measurements (out of a total of over 3,600 trees) included:

1. There were a total of 72 trees that were either alive (52) or dead (20) at first measurement but missing at second measurement. We assumed these trees were either burned from the 2003 wildfire,[8] and / or had died and fallen between measurements. All missing trees were assumed to be CWD and therefore assigned zero volume at second measurement.
2. There were 18 trees with species label differences between measurements, and the majority of differences were between Bl and Sx. These discrepancies were left unchanged.
3. There were 10 trees that had a DBH increase of greater than 10 cm over the 5-6 year measurement period. These differences were left unchanged.
4. There were 52 trees that shrank in DBH at the second measurement. Seventeen (17) of these trees were dead at the first measurement, and can be attributed to expected bark loss. Of the live trees, the average DBH reduction was about 1cm. These differences were left unchanged.
5. There were five Bl site trees identified at second measurement as unsuitable for site index (ie., defined as veterans), and yet were previously suitable for site index at first measurement. These trees ranged in total age from 101 to 141 years. For this analysis, these trees were redefined as unsuitable for site index at both first and second measurements.

3.1.2 Merchantable Volume

Plot data were compiled using similar standards as for managed stand yield tables (MSYTs). This included a minimum DBH utilization limit of 12.5 cm for Pli and 17.5 cm for other species.

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[5] TIMVEG is the standard data entry software for all VRI / CMI plot data, version updated to July 27, 2005.

[6] Vegetation Resources Inventory Compiler has been updated to July 27, 2002.

[7] In 2002, the VRI / CMI compiler was not yet available for general use, and could only be run by MoFR staff (formerly MSRM).

[8] 40 of the missing trees were located in plots identified as partially burned in the 2003 wildfire.

Net merchantable volume was based on reduction from whole stem volume[9] which included 10 cm top diameter, 30 cm stump height, and applicable decay and waste loss factors.[10] As well, only the conifer component was included in the plot volume summaries.

Net merchantable volume was grouped as live or dead at the first measurement, and as live, dead, mortality, or ingrowth at the second measurement.

3.1.3 Ingrowth

Ingrowth was identified as those trees that exceeded the utilization limits at the second measurement, but which were less than the utilization limits at first measurement.

3.1.4 Mortality

Dead trees at first measurement were tracked separately from mortality, with the latter being trees alive at first measurement and dead at second measurement.

3.1.5 Periodic Annual Increment

Net periodic annual increment (PAI) was computed as the live growth plus ingrowth minus mortality. Since the measurement interval ranged from 5 to 6 years depending on the plot establishment year (i.e., 2000 and 2001), PAIs were first computed individually for each plot, and then averaged across all plots.

3.2 Inventory Data and Yield Tables

3.2.1 Inventory Coverage

The base forest cover inventory used in this analysis originated from the first measurement analysis, and included all inventory attributes for each 1 km grid point within the target population projected to 1999.[11] Additional updates applied to Weyco's inventory between 1999 and 2001 and which were used in the first measurement analysis report were also applied here.[12]

3.2.2 Managed Stand Yield Tables

The same Management Plan (MP) #9 MSYTs used in the first measurement analysis were also used for this second measurement analysis.[13] These MSYTs were produced with TIPSY where possible and VDYP in all other cases, using the 1999 version of the inventory.[14] MSYTs were assigned to each monitoring plot grid point by Weyco, based on the intersected mapstand ID for each forest cover polygon (Table 1).

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[9] Whole stem volumes computed in MoFR's VRI / CMI compiler use Kozak's 1994 BGC zone-based volume taper equations.

[10] Volume reduction to account for decay, waste and breakage were minimal in these young stands.

[11] From database created by JST in 2002 for the project establishment phase. Refer to table '1KM GRID AUG 4, 2000', located in the 'WCK-075 TFL 35 GY MONITORING DATA 2002 APRIL.DB1' database. The inventory data attributes were projected to 1999.

[12] This included updates to projected inventory age between the 1999 and 2001 inventory for samples 8960 (from 82 to 21 years) and sample 9057 (from 9 to 21 years). The one exception (sample 8951), which was reclassified in 2001 as NSR, was kept in this analysis using the 1999 inventory age of 25 years.

[13] Telephone conversation with S. Curry 23 February 2007, confirming that MP#9 MSYTs should be used for this analysis.

[14] Curry, Sean. 2000. Weyerhaeuser Timber Supply Analysis information package for Management Plan #9 on TFL 35. December 29, 2000 Revision.

Table 1. MSYT source data files originating from the first measurement analysis.

Filename	Description
REGEN_CURVES_FROM SEAN_2002JAN25_RJ.XLS	Individual MSYT names, curve source, and volumes by 10 yr increments, with linear interpolation for annual volumes.
MONITORING DETAIL_FROM SEAN_2002FEB14.XLS	Lookup table to link MSYTs to each plot by Mapstand ID.[15]

3.3 Revised Sample Size

3.3.1 Impact of McLure Fire

There were originally 65 monitoring plots established between 2000 and 2001. The McLure wildfire of 2003 impacted the TFL and consumed or partially consumed 7 monitoring plots. Of these 7 plots, 2 were completely burned and were subsequently site prepped for planting by Weyco and the inventory age was changed to zero. The remaining 5 plots were impacted to varying levels, but were assessed by Weyco as still containing a viable regenerated stand component and the inventory age was not changed. Hence, the 2 completely burned plots were removed from the sample population, reducing the number of remeasured plots from 65 to 63.

3.3.2 TIPSY vs. VDYP Curves

While the majority of MSYTs assigned to these monitoring plots were TIPSY-based, VDYP yield tables were assigned to six monitoring plots. Due to differences in curve shape and MP assumptions between TIPSY and VDYP, all analyses were stratified by yield table source.

3.3.3 New 2006 Plots

In 2006, an additional eight plots were established using the modified target population definition to cover all grid points that had a harvest history. When compared to projected inventory age, however, seven of the eight new plots were in 48 – 110 year old stands, while one new plot was 21 years old. The eight new plots were not analysed at this time, since only remeasured plot data were used to compare against MP assumptions.

3.3.4 Sample Size Used in Analysis

For simplicity of comparing change, only those plots present at both first and second measurements were compared against the MP assumptions for volume, site index, age, and species proportion. Therefore, the revised sample size used in this comparative analysis was 63 plots.

[15] One plot (sample # 8951) was missing a MSYT link from the first measurement analysis. Followup discussions with S.Curry (February 26, 2007) enabled this plot to be assigned an appropriate existing MSYT.

4.0 ANALYSIS METHODS

4.1 Volume Comparisons

4.1.1 All Live Trees

Live net merchantable plot volumes at each measurement as well as net PAIs were compared against MSYT projected volumes, using the inventory age adjusted from 1999 to the year of plot establishment or remeasurement. Average volume and 95% confidence intervals were computed at each measurement.

4.1.2 Excluding Residual Stand Component

A number of older PHR stands included a residual component which reflected past IU / retention harvesting practices. This residual component was not accounted for in the development of the regenerated yield curves, the assumption was made that the stands were 100% regenerated trees. It is possible that the residual component is resulting in higher volumes at younger ages than would be expected in 100% regenerated stands, it is also possible that the residual component may result in less volume than expected at older stand ages. Therefore, we attempted to identify and remove this residual component as a separate evaluation. The intent was that volumes without a residual component may more closely reflect the assumptions used to develop MSYTs for managed stands. We approximated the 'residual trees' in the data by assessing age and crown class data from all site trees collected at either first or second measurement. If the tree was classed as a veteran, or if the breast height age exceeded 55 years old at the time of plot establishment in 2000, then the tree was classified as a 'residual', and its volume was removed. In reality this will likely result in an underestimation of the regenerated volumes as these volumes would be expected to be higher if regenerated trees had been able to occupy the growing space currently occupied by residuals.

4.1.3 Excluding Mountain Pine Beetle Infested Trees

With the current MPB epidemic, a separate evaluation of MPB impact was also assessed. All live Pli trees that were identified as having any MPB related damage in 2006 were re-classified as dead. Remaining live volumes were then compared against MSYT projections.

4.2 Site Index Comparisons

Site index (SI) was recomputed (outside the VRI / CMI compiler) at each measurement for all site trees assessed as having suitable age and height criteria for SI. This was to ensure that consistent SI equations were used at both first and second measurements. Suitability for site index was assessed independently at each measurement. This means the average SI estimated from a given plot may not be from the same group of trees between first and second measurement.

SI calculations were based on the MoFR's Site Tools program.[16] For all species (except interior spruce), the MoFR recommended growth intercept (GI) and SI equations were used. While the plot field cards included a mix of both Englemann spruce (Se) and hybrid spruce (Sx) labeling,

[16] Site Tools version 3.3 software available from: http://www.for.gov.bc.ca/hre/software/download.htm

and the inventory classified all interior spruce as Se, we used only the white spruce (Sw) based GI and SI equations and not Se.[17]

Actual SI estimates were averaged for all site trees in each monitoring plot by species. Estimated SI from the MSYTs originated from a previous SI adjustment project completed on the TFL.[18] Potential SI estimates were provided for each monitoring plot grid point for each Pli, Fd, Sx, and Bl.[19] Plot based SI estimates were then compared against average potential SI estimates for each species, at both first and second measurements.

4.3 Age Comparison

A subset of the site tree data was used to compare total age[20] from the ground samples against projected inventory ages. Only those site tree species that were suitable for age and that matched the leading species in the inventory label were compared for each plot. The average total age and standard errors were computed by species, based on the second measurement data.

4.4 Species Comparison

The species proportion in each plot (for all species including conifer and deciduous) was computed based on tree basal area. The leading species of each plot (as determined by highest basal area) was then compared against the inventory leading species, and a cross-table matrix (based on number of plots) was created for both first and second measurements.

[17] GI equations are more accurate than SI equations at the very young tree ages, and are only available for Sw, but not Se.

[18] J.S. Thrower and Associates Ltd. 2000. Site index adjustments using BEC classification on TFL 35. Contract report to Weyerhaeuser Company Limited. Kamloops, BC. February 22, 2000. 25 pp.

[19] From database created by JST in 2002 for the project establishment phase. Refer to table 'SITE TREE SUMMARY', located within database 'WCK-075 TFL 35 GY MONITORING DATA 2002 APRIL.DB1'.

[20] Total age is estimated from breast height age using SiteTool's "years to breast height" equations for each species.

5.0 RESULTS

5.1 Plot Level Volume Summary

The total net merchantable volume (live and dead) across all 63 monitoring plots increased from about 34 m^3/ha at first measurement[21] to 47 m^3/ha at second measurement (Table 2, Figure 1). At second measurement, about 13% of the volume was classified as alive but attacked to some degree by the MPB. About 14% of the volume at measurement 2 originated from ingrowth trees exceeding the minimum utilization limits at the second measurement. Almost 1/3 of the volume at second measurement was also attributed to the residual stand component (as defined in this analysis). Mortality between measurements was about 2% of the total merchantable volume.

Table 2. Net merchantable volume breakdown of monitoring plots by measurement.

		Measurement 1		Measurement 2	
		Merch Vol (m^3/ha)	% of Total	Merch Vol (m^3/ha)	% of Total
Live	Regen	18.0	54%	17.4	37%
	MPB Attack	0.0	0%	6.3	13%
	Ingrowth	0.0	0%	6.5	14%
	Residuals	14.3	42%	14.8	31%
Total Live		***32.3***	***96%***	***45.1***	***95%***
Dead	Dead	1.2	4%	1.2	3%
	Mortality	0.0	0%	1.0	2%
Total Dead		***1.2***	***4%***	***2.2***	***5%***
Total (l+d)		***33.5***	***100%***	***47.4***	***100%***

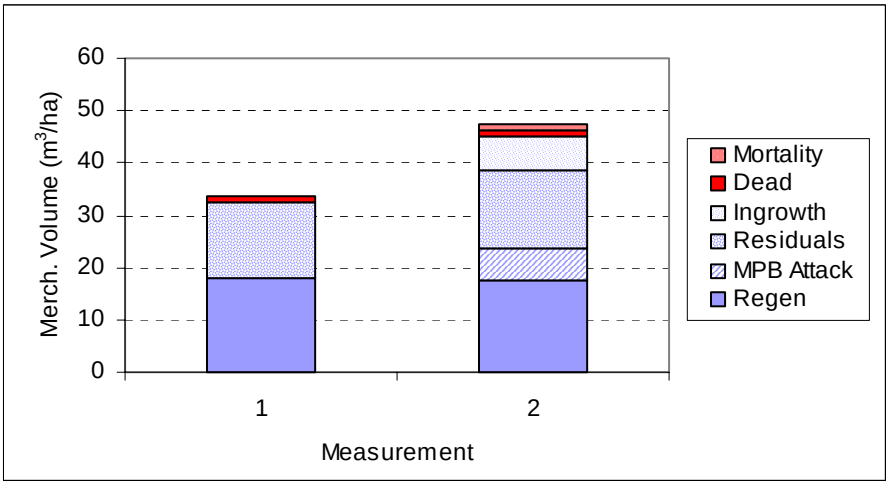


Figure 1. Net merchantable volume breakdown by measurement.

[21] This differs slightly from the first measurement analysis report, because only 63 plots (instead of 65) were compared, plus first measurement compilation was to a 17.5 cm utilization limit for all species.

5.2 Comparing Net Merchantable Volume

The net merchantable volume (all live trees) from the ground samples was significantly greater than the predicted volume for those plots that were assigned TIPSY MSYTs (Table 3, Figure 2, Figure 3, Figure 4). Ground volumes were three times greater at first measurement, and over two times greater at second measurement.

However, the estimated 'residual stand component' from the TIPSY ground samples comprised about 33% of the live ground volume, and the MPB impacted trees comprised a further 14%. With the removal of both residual trees and MPB impacted trees, the live ground volume was reduced by 47%, leaving approximately 1.2 times more volume than predicted at second measurement.

For all the VDYP assigned plots, predicted merchantable volume was greater than ground volumes, but this difference was not significant[22] (Table 3, Figure 4).

Table 3. Merchantable volume of ground and predicted estimates, at each measurement. Ground volumes summarized for all stems vs. the regenerated stand component, both without and with expected MPB mortality, stratified by yield table source (TIPSY vs. VDYP).

Msmt #	Volume Source	n	Ratio (Ground/pred)	Merch Vol (m^3/ha)	Std Err. (m^3/ha)	Lower 95% (m^3/ha)	Upper 95% (m^3/ha)
TIPSY Assigned Yield Tables							
1	Ground : all live trees	57	3.0	35.4	7.2	21.1	49.8
	Ground : no residuals	57	1.7	19.7	4.2	11.3	28.2
	Ground : no MPB	57	3.0	35.4	7.2	21.1	49.8
	Ground : no residuals, no MPB	57	1.7	19.7	4.2	11.3	28.2
	Predicted	57		11.7	4.3	3.2	20.3
2	Ground : all live trees	57	2.3	49.3	7.3	34.6	63.9
	Ground : no residuals	57	1.6	33.0	4.9	23.2	42.8
	Ground : no MPB	57	2.0	42.3	7.5	27.3	57.4
	Ground : no residuals, no MPB	57	1.2	26.1	4.8	16.4	35.7
	Predicted	57		21.1	6.2	8.6	33.5
VDYP Assigned Yield Tables							
1	Ground : all stems	6	0.3	2.6	1.0	0.1	5.1
	Ground : no residuals	6	0.2	1.7	1.1	-0.9	4.3
	Ground : no MPB	6	0.3	2.6	1.0	0.1	5.1
	Ground : no residuals, no MPB	6	0.2	1.7	1.1	-0.9	4.3
	Predicted	6		7.7	7.6	-11.0	26.4
2	Ground : all stems	6	0.5	5.9	2.5	-0.2	12.1
	Ground : no residuals	6	0.4	4.8	2.7	-1.8	11.4
	Ground : no MPB	6	0.5	5.5	2.5	-0.7	11.7
	Ground : no residuals, no MPB	6	0.4	4.3	2.8	-2.5	11.2
	Predicted	6		12.0	11.7	-16.8	40.7

[22] Significance is determined at the 95% level of confidence.

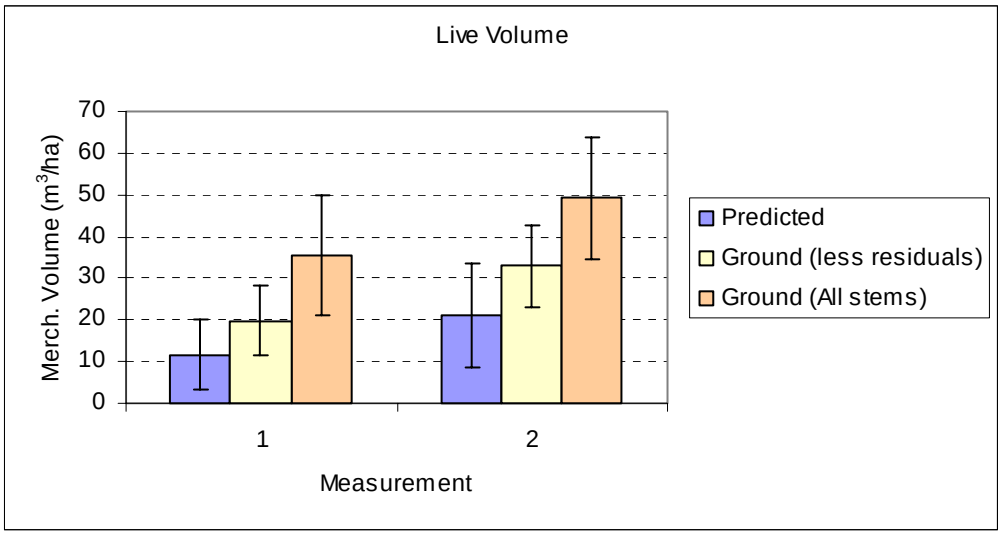


Figure 2. Comparison of ground vs. predicted live merchantable volumes for the subset of plots assigned to TIPSY curves. Means and 95% confidence bars displayed by measurement.

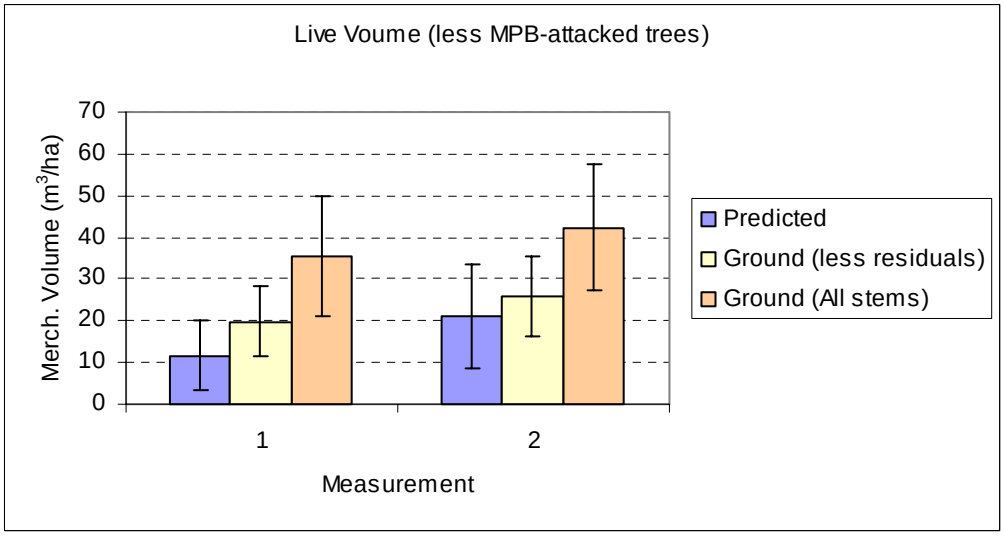


Figure 3. Comparison of ground vs. predicted merchantable live volume (minus MPB attacked trees) for the subset of plots assigned to TIPSY curves. Means and 95% confidence bars displayed by measurement.

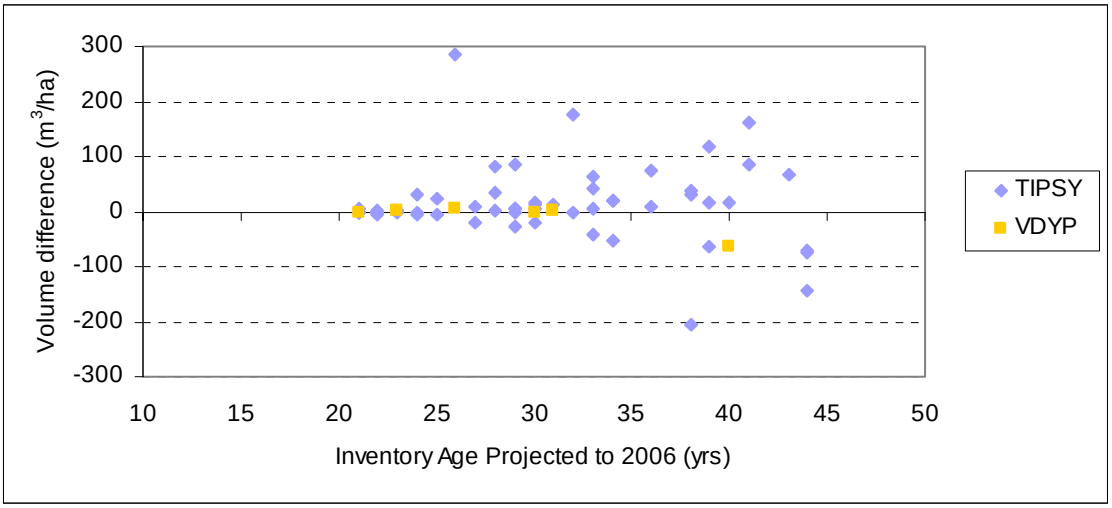


Figure 4. Comparison of live merchantable volume differences, by inventory age. Volume difference is based on live ground volume of all stems minus predicted volume for each plot, plotted against projected inventory age, and separated by yield table source.

5.3 Comparing Periodic Annual Increment

The net PAI from the ground samples averaged 2.6 m^3/ha/yr, compared to a predicted value of 1.8 m^3/ha/yr for those plots assigned to TIPSY yield curves (Table 4, Figure 5).

The estimated 'residual stand component' comprised about 0.1 m^3/ha/yr of the PAI, while the MPB impacted trees comprised a further 1.4 m^3/ha/yr. With the removal of both residual trees and MPB impacted trees, the net PAI was reduced to 1.1 m^3/ha/yr, which was below (but not significantly different from) the predicted growth rate of 1.8 m3/ha/yr.

For all the VDYP assigned plots, the ground PAI was less than predicted, but these differences were not significant.

A total of seven plots had negative PAI. A range of sources contributed to lower volumes at second measurement and included MPB mortality (2 plots), death of residual overstory (3 plots), and fire (2 plots).

Table 4. Five-year PAI for ground and predicted estimates, stratified by yield table source (TIPSY vs. VDYP).

Msmt #	Volume Source	n	Ratio (ground/pred)	PAI (m^3/ha/yr)	Std Err. (m^3/ha/yr)	Lower 95% (m^3/ha/yr)	Upper 95% (m^3/ha/yr)
TIPSY Assigned Yield Tables							
	Ground : all live trees	57	1.40	2.58	0.48	1.63	3.53
	Ground : no residuals	57	1.35	2.49	0.43	1.62	3.36
	Ground : no MPB	57	0.66	1.21	0.51	0.18	2.24
	Ground : no residuals, no MPB	57	0.61	1.12	0.46	0.20	2.03
	Predicted	57		1.84	0.43	0.99	2.69
VDYP Assigned Tables							
	Ground : all stems	6	0.71	0.61	0.55	-0.72	1.94
	Ground : no residuals	6	0.65	0.56	0.55	-0.79	1.91
	Ground : no MPB	6	0.60	0.52	0.56	-0.85	1.89
	Ground : no residuals, no MPB	6	0.54	0.47	0.57	-0.92	1.86
	Predicted	6		0.86	0.82	-1.14	2.87

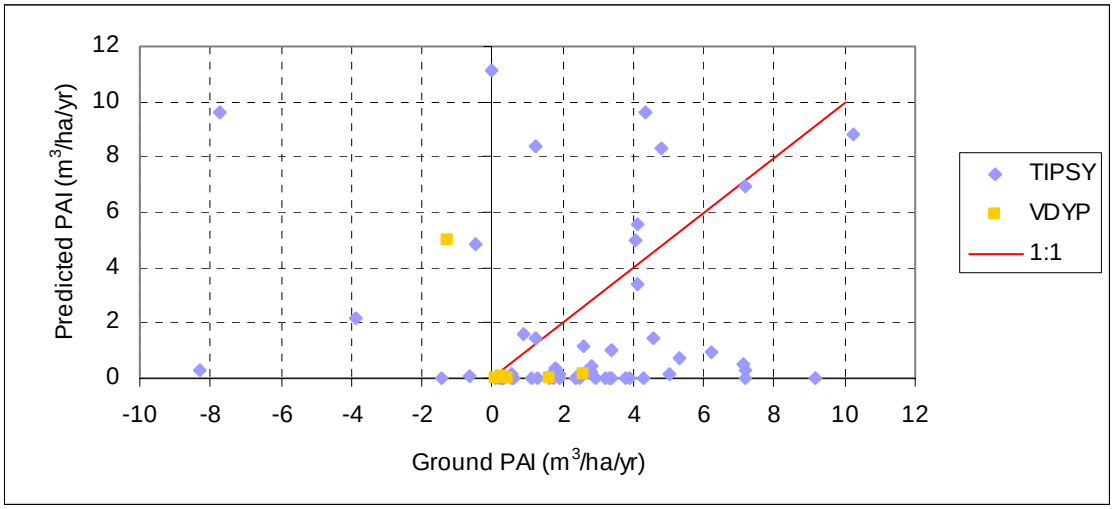


Figure 5. Comparison of predicted vs. ground periodic annual increment, for each plot, and separated by yield table source.

5.4 Comparing Site Index

For the species with predicted SIA estimates (Bl, Fd, Pli, and Se), the average ground measured SI from all site trees was closer to predicted estimates at the second measurement, compared to the first measurement (Table 5, Figure 6). For all species (except Fd), the second measurement ground SI was higher than at first measurement. For all species (except Bl), the difference between ground SI and predicted SI was less than 0.4m.

Site index suitability was assessed independently at each measurement, which meant that the cohort of site trees could change between measurements. A total of 20% of Pli, 34% of Se, 48% of Bl, and 56% of Fd site trees that were suitable at the second measurement were previously assessed as unsuitable for site index at the first measurement.

Table 5. Site index estimates by species, for ground samples at first and second measurements versus predicted site index from SIA project. Only those plots are included where ground site tree data exists for a given species at each measurement.

Species	SI Ground @ 1st Msmt			SI Ground @ 2nd Msmt			SI Predicted @ 2nd Msmt		
	Mean (m)	n	SE (m)	Mean (m)	n	SE (m)	Mean (m)	n	SE (m)
BL	17.8	44	0.6	18.0	42	0.4	19.6	42	0.3
FD	20.9	9	1.2	20.7	10	1.4	20.1	10	0.4
PLI	20.0	45	0.3	20.4	43	0.2	20.5	43	0.2
SE	20.3	41	0.6	21.0	39	0.5	21.2	39	0.3

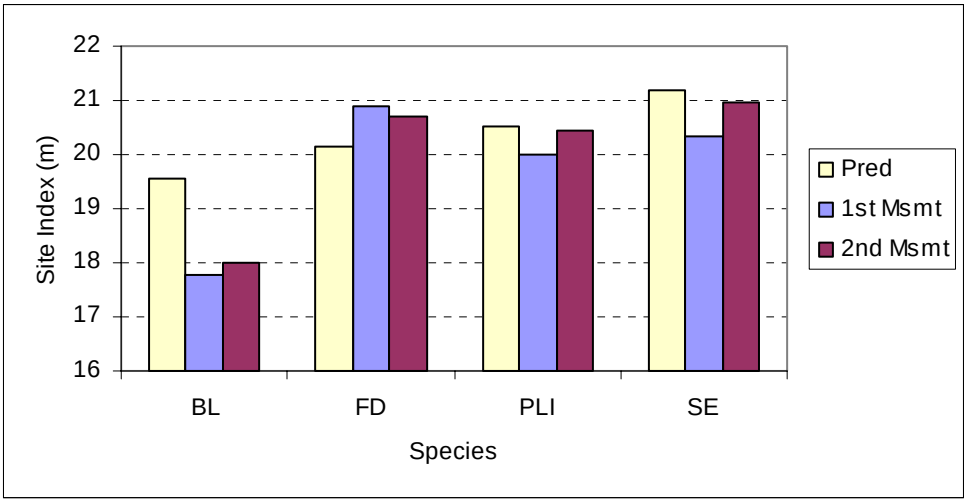


Figure 6. Site index estimates by species, for ground samples at first and second measurements versus predicted site index from SIA project. Only a subset of plots are compared where ground site tree data exists for a given species.

5.5 Comparing Age

The ground-based total age of the site trees that matched the leading species from the inventory was on average younger than the projected inventory age for Pli leading stands, and older for Bl (Table 6, Figure 7). The youngest trees were Pli (<20 years old) and the oldest Bl (>80 years old).

Table 6. Average total age by species for ground samples at 2nd measurement vs. projected inventory age. Only the ages of those species defined as leading in the inventory (and age-suitable from the ground plots) were compared.

Species	Ground Total Age @ 2nd Msmt			Predicted Total Age @ 2nd Msmt		
	Mean (m)	n	SE (m)	Mean (m)	n	SE (m)
BL	47	11	6	31	13	2
FD	39	3	4	33	3	4
PLI	25	27	1	29	30	1
SX	31	16	2	32	16	1

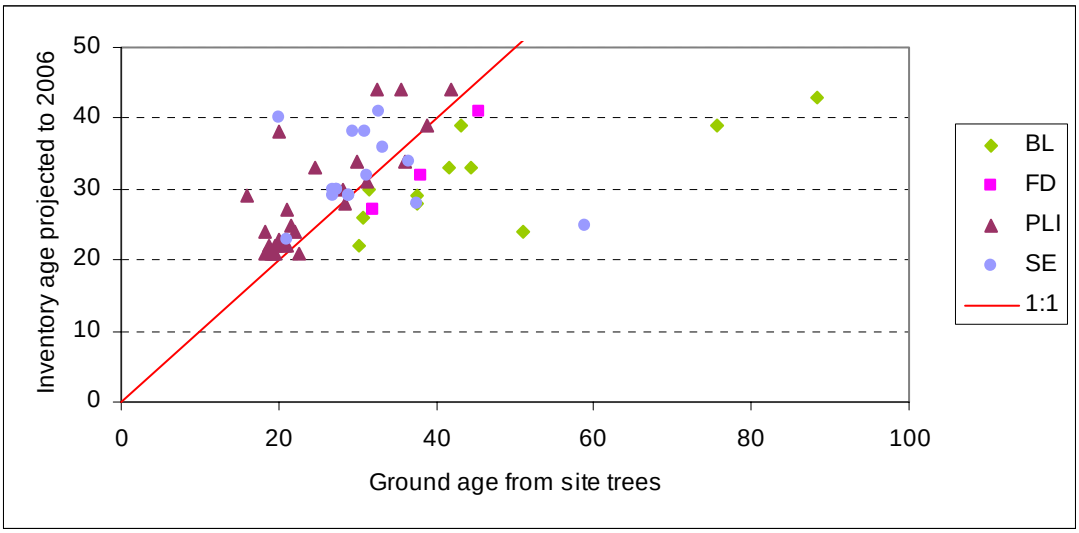


Figure 7. Comparison of total age (by species) vs. projected inventory age at the second measurement. Only the ages of those species defined as leading in the inventory (and age-suitable from the ground plots) were compared.

5.6 Comparing Species Composition

The percentage of plots with the same leading species between ground samples and forest cover inventory was 38% at the first measurement, and 57% at the second measurement (Table 7, Table 8).[23] This increase is attributed to Pli leading stands, where the majority of these stands had zero volume at first measurement, but exceeded minimum utilization limits at second measurement.

Overall, the ground based leading species proportion is very similar to the inventory leading species at the time of the second measurement, with almost half of the plots leading to Pli (Figure 8). The inventory also appears to underestimate Bl leading stands and overestimate Se leading stands, relative to the leading species proportion at the second measurement.

Table 7. Matrix table of number of plots by leading species, for ground measurements vs. forest cover inventory label, at first measurement. "*Blank*" species are those plots with zero merchantable volume.

1st Measurement	Inventory						
	AT	BL	FD	PLI	SE	***Total***	*%*
AC		1				***1***	*2%*
AT				1		***1***	*2%*
BL		8	2	2	8	***20***	*32%*
FD	1		1	2		***4***	*6%*
PLI				14	4	***18***	*29%*
SE		2		2	1	***5***	*8%*
(blank)		2		9	3	***14***	*22%*
Total	***1***	***13***	***3***	***30***	***16***	***63***	*100%*
%	*2%*	*21%*	*5%*	*48%*	*25%*	*100%*	

Table 8. Matrix table of number of plots by leading species, for ground measurements vs. forest cover inventory label, at second measurement. "*Blank*" species are those plots with zero merchantable volume.

2nd Measurement	Inventory						
	AT	BL	FD	PLI	SE	***Total***	*%*
AC		1				***1***	*2%*
AT				1		***1***	*2%*
BL		8		1	9	***18***	*29%*
FD	1		1	2		***4***	*6%*
PLI		2		24	4	***30***	*48%*
SE		2	1	1	3	***7***	*11%*
(blank)			1	1		***2***	*3%*
Total	***1***	***13***	***3***	***30***	***16***	***63***	***100%***
%	*2%*	*21%*	*5%*	*48%*	*25%*	*100%*	

[23] Note that establishment results presented here differ from the first measurement analysis report, because species proportion is now based on the basal area of trees above the minimum utilization limit, as opposed to the percentage of the total number of stems.

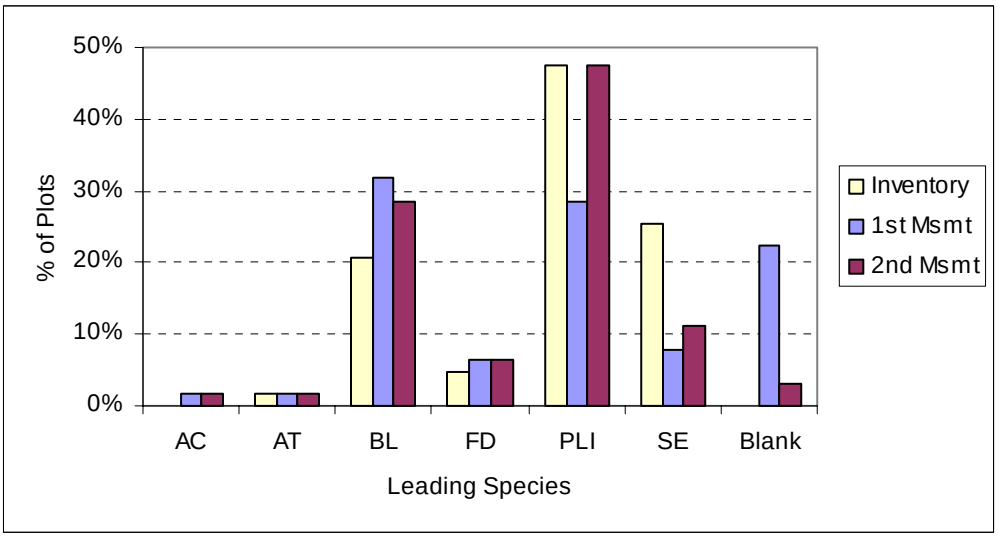


Figure 8. Comparison of site tree total age (by species) vs. projected inventory age.

6.0 CONCLUSIONS

The primary conclusions related to the CMI second measurement results are:

1) The average net merchantable volume at the end of the second measurement for those monitoring plots assigned TIPSY MSYTs (57 out of 63 plots) is over two times higher than predicted volumes (49 m^3/ha vs. 21 m^3/ha). The net annual growth rate is also about 2.5 times faster. This suggests that MP #9 assumptions are conservatively underestimating the true volume and growth rate on TFL 35, even with the volume losses attributed to the 2003 McLure wildfire.

2) Some of the older harvested stands contain an overstory residual component making them different from newly regenerated stands. Therefore caution must be exercised in extrapolating the results documented in point 1 above to newly regenerating stands. There is the possibility that residual trees may be inflating volumes when compared to the TIPSY MSYTs which do not include a residual component After removing the residual stand component (approximated in this analysis), the average net merchantable volume is reduced by over 16 m^3/ha, but is still higher than the predicted volumes. However, the regenerated trees PAI is less than predicted in TIPSY. In reality, this impact may be partially offset by the expectation of increased growth from the regeneration component if the regenerated trees fully occupied the growing space currently occupied by the residuals.

3) There are live Pli trees recently infested by the MPB on the TFL. After assuming these infested trees are dead, the net merchantable volume (for those plots assigned TIPSY MSYTs) is reduced by 7 m^3/ha.

4) The average site index of the ground plots increased at the second measurement for Pli, Sx, and Bl, and decreased for Fd relative to the first measurement, but in all cases were closer to the predicted estimates. This suggests that potential site index estimates originating from the previous SIA project appropriately reflect current site productivity conditions.

5) Total stand age is generally lower than projected inventory age for Pli leading stands, and higher than projected inventory ages for Bl.

6) Overall, the ground based leading species proportion is very similar to the inventory leading species at the time of the second measurement, with almost half of the plots leading to Pli.

7.0 RECOMMENDATIONS

The primary recommendations related to the CMI second measurement results are:

1) The data should be further analysed to evaluate the MPB impact and assist Weyco in its management plans for the TFL. MPB impact could be compared against specific stand attributes including species percentage, volume, site index, and diameter and height distributions.

2) Considering the potential impact of including / excluding the residual stand component when comparing against MP assumptions, further examination should be made to better define this subgroup of trees. This may include further review of the diameter distribution of each plot, review of additional tree detail collected on field cards (which were not currently used by the MoFR data entry software), as well as follow-up field visits to better identify such trees.

3) Consideration should be given to further stratify the plot data into different historical harvest methods (e.g., older IU / retention harvesting vs. current clearcutting). This may include a re-assessment of previously assigned inventory ages, as well as possible re-assignment of yield tables (e.g., TIPSY vs. VDYP).

4) Weyco should rationalize inventory ages that are projected in their stands together with the rank and layer definitions that have been used, specifically for those stands with a known harvest history.

5) When considering subsequent plot remeasurement, Weyco should consider the option to use electronic data loggers, which may enable more direct comparison with previously recorded measurements. The intent is that errors may be more efficiently captured and corrected in the field, as opposed to added project costs from error checking and data cleaning with post processed data. However, this may only be of benefit with concurrent improvements to the presently available data entry software TIMVEG.

6) The repeated tree branch data that were collected from these plots have not yet been analyzed. These data should also be analyzed to further improve the understanding of wood quality in these post-harvest regenerated stands.

8.0 APPENDIX I – PLOT ATTRIBUTES

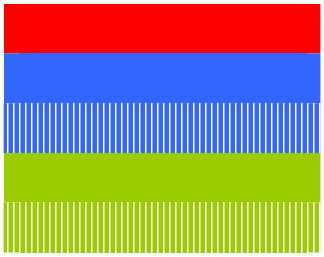
Sample #	Establishment year	Plot status	Species Label			Merchantable volume (m^3/ha)				Site index (m)				Total age (years)		
			1st measurement	2nd measurement	Forest cover inventory	Plot all stems msmt 1	Plot all stems msmt 2	MSYT msmt 1	MSYT msmt 2	Leading inventory species	Plot SI msmt 1	Plot SI msmt 2	Predicted SI	Site tree age msmt 1	Site tree age msmt 2	Inventory age - msmt 2
8144	2001	ACTIVE		PLI100	SE90BL10	0	1	0	0	SE	25.5	24.5	20.7	16	21	23
8145	2000	ACTIVE	BL72SE19PLI9	BL70SE19PLI11	BL60SE30PLI10	16	28	0	1	BL	18.1	16.2	18.7	30	44	39
8146	2001	ACTIVE	PLI100	PLI100	PLI60SE30BL10	35	60	0	1	PLI	20.5	21.3	19.2	23	29	28
8160	2001	ACTIVE		PLI100	PLI90BL10	0	1	0	0	PLI	17.0	17.6	18.8	15	20	22
8166	2001	ACTIVE		PLI100	PLI98BL1SE1	0	8	0	0	PLI	19.3	19.8	18.9	15	18	21
8245	2006	New		BL65SE35	SE60BL30PLI10	0	48			SE		21.4	22.5		31	48
8260	2000	ACTIVE		PLI100	PLI100	0	3	0	1	PLI	19.8	20.2	18.8	13	20	22
8261	2001	ACTIVE		PLI100	BL90PLI10	0	0	0	0	BL	17.2	18.0	17.3	23	32	30
8345	2000	ACTIVE	PLI66SE34	PLI74SE26	SE83PLI17	7	25	0	0	SE	23.4	22.5	22.7	19	30	29
8352	2006	New		PLI87BL13	PLI70BL20SE10	0	15			PLI		22.0	21.5		20	20
8367	2001	ACTIVE		PLI100	PLI100	0	13	0	6	PLI	20.0	20.7	19.4	13	19	22
8443	2001	ACTIVE	BL86PLI14	BL78PLI12SE10	SE100	18	32	0	2	SE			22.9			40
8445	2001	ACTIVE	BL78SE22	BL83SE17	SE70PLI20BL10	24	33	0	0	SE	21.1	13.3	19.7	19	59	25
8446	2001	ACTIVE	BL100	BL84SE8AT7	BL80SE18PLI1FD1	63	82	0	0	BL	18.9	20.7	21.4	34	42	33
8447	2006	New		BL90SE10	BL77SE23	0	170			BL		17.5	21.1		63	63
8453	2001	ACTIVE		PLI100	PLI60BL20AT10SE10	0	6	0	7	PLI	20.2	21.3	21.4	14	19	24
8456	2001	ACTIVE	PLI100	PLI100	PLI70AT10BL10SE10	3	16	0	1	PLI	19.3	19.8	18.8	16	19	23
8459	2001	ACTIVE		PLI100	PLI90AT10	0	2	0	0	PLI	19.3	19.6	19.0	14	19	21
8460	2000	ACTIVE		PLI100	BL44PLI40SE10AT6	0	1	0	0	BL	17.2	15.9	19.1	24	32	22
8461	2001	ACTIVE	PLI100	PLI95BL5	PLI66BL22SE12	15	51	23	58	PLI	20.4	22.2	22.0	19	24	33
8463	2000	ACTIVE	BL100	BL95SE5	BL80SE20	42	67	0	0	BL	7.8		21.7	63		33
8464	2001	ACTIVE	BL39SE22XC21PLI19	BL46PLI28SE26	SE54BL30PLI16	41	50	0	1	SE	20.0	21.0	20.2	24	30	38
8543	2000	ACTIVE		PLI100	PLI80AT10EP10	0	10	0	0	PLI	21.8	22.4	21.9	13	20	21
8548	2001	ACTIVE	SE100	SE100	SE80BL10AC10	5	8	0	0	SE	20.2	21.0	20.2	23	28	29
8549	2000	ACTIVE	BL100	BL53FD26SE21	SE70BL20FD10	3	10	0	0	SE	17.5	15.7	17.5	32	40	28
8559	2001	ACTIVE	BL87SE13	BL77SE23	SE67BL33	32	46	1	2	SE	21.5	24.2	15.9	22	31	38
8561	2000	ACTIVE	PLI62BL23SE15	PLI49SE30BL20	PLI60SE30BL10	53	78	8	41	PLI	15.7	16.6	19.8	26	31	31
8565	2001	ACTIVE	PLI100	PLI100	PLI78BL12SE10	4	31	0	4	PLI	19.7	21.6	21.8	17	21	22
8566	2000	ACTIVE		SE65AC26PLI9	SE80BL10PLI10	0	15	0	0	SE	20.7	21.5	20.2	24	30	32
8567	2001	ACTIVE	PLI56BL25SE19	PLI44SE37BL18	PLI60SE40	24	41	1	6	PLI	17.7	18.5	19.0	31	36	34
8571	2000	ACTIVE		PLI88SE12	PLI79BL14SE7	0	15	0	0	PLI	19.7	20.8	19.0	14	20	22
8654	2001	ACTIVE	AC73BL27	AC62PLI22BL16	BL40SE30FD10PLI10	3	9	0	0	BL	12.1		20.5	26		23
8656	2000	ACTIVE	SE39PLI34BL27	PLI54BL19SE18AC9	PLI90BL10	5	21	0	1	PLI	19.3	20.2	21.0	16	23	21
8657	2001	ACTIVE	BL58PLI23SE19	BL68PLI18SE14	PLI50BL40SE10	86	154	110	158	PLI	20.6	20.8	21.8	32	35	44
8658	2000	ACTIVE	SE73PLI19BL7	SE67PLI20BL13	BL60SE20PLI20	82	137	0	0	BL	19.7	19.8	17.1	32	38	28
8659	2001	ACTIVE	PLI57SE37BL5	PLI48SE35BL16	PLI70BL20SE10	84	45	110	158	PLI	19.6	20.9	22.3	26	33	44
8663	2000	ACTIVE	PLI50SE31BL19	PLI39SE37BL24	SE90PLI10	19	38	0	0	SE	22.3	22.7	22.3	29	35	34
8665	2001	ACTIVE	BL95SE5	BL91SE9	SE60BL40	92	123	2	7	SE	22.7	24.9	22.9	26	30	41

Sample #	Establishment year	Plot status	Species Label			Merchantable volume (m^3/ha)				Site index (m)				Total age (years)		
			1st measurement	2nd measurement	Forest cover inventory	Plot all stems msmt 1	Plot all stems msmt 2	MSYT msmt 1	MSYT msmt 2	Leading inventory species	Plot SI msmt 1	Plot SI msmt 2	Predicted SI	Site tree age msmt 1	Site tree age msmt 2	Inventory age - msmt 2
8668	2001	ACTIVE	PLI87BL13	PLI89BL11	PLI70SE30	45	96	66	110	PLI	19.9	20.0	21.8	32	39	39
8669	2001	ACTIVE	PLI100	PLI100	PLI70SE20BL10	16	38	110	158	PLI	15.3	17.8	22.3	36	42	44
8750	2001	ACTIVE	PLI100	PLI100	PLI80FD10SE10	5	28	0	7	PLI	21.5	22.9	21.6	17	22	24
8752	2001	ACTIVE	PLI100	PLI100	PLI85FD15	19	43	29	70	PLI	19.8	21.8	19.8	23	30	34
8763	2001	ACTIVE	SE60BL40	SE52BL48	PLI50SE30BL20	94	100	41	83	PLI			22.0			36
8767	2001	ACTIVE	BL85AT9XC6	BL81AT14XC5	BL100	118	153	0	0	BL	16.9	14.6	18.5	53	81	39
8768	2001	ACTIVE	PLI100	PLI84SE16	SE91PLI5BL4	15	35	0	0	SE	23.7	25.2	22.3	21	28	30
8770	2001	ACTIVE	PLI100	PLI100	PLI90SE10	2	22	4	21	PLI	20.3	21.1	19.8	16	21	27
8853	2001	ACTIVE	BL54SE43FD3	SE47BL44FD9	FD82SE15PLI3	164	122	0	2	FD	18.6		21.2	40		41
8860	2000	ACTIVE	BL89SE11	BL83SE17	BL52SE41FD7	84	104	0	0	BL	18.7	19.4	21.1	28	37	29
8865	2001	ACTIVE		BL100	SE70BL10CW10FD10	0	2	0	0	SE	18.4	19.1	21.4	20	27	29
8866	2000	ACTIVE	BL75SE25	BL72SE28	SE80BL20	76	120	0	2	SE	23.4	22.4	20.9	24	31	36
8867	2001	ACTIVE	SE52BL32CW16	SE52BL32CW16	BL89SE11	32	35	0	0	BL	10.7	14.9	21.7	44	51	24
8868	2006	New		BL96FD4	BL90SE10	0	120			BL		40.4	17.1		30	53
8869	2000	ACTIVE	BL90SE10	BL89SE11	BL70SE30	71	113	0	3	BL	13.5	13.8	21.1	77	83	43
8870	2001	Burn_in	PLI51AC49	PLI57AC43	PLI80BL20	1	6	0	8	PLI	20.7	19.8	20.3	16	22	25
8951	2000	ACTIVE	FD61SE23EP8BL7	FD59SE25EP9BL8	FD80SE20	176	172	0	0	FD		16.3	18.8		38	32
8953	2001	ACTIVE	FD100	FD100	AT50PLI30FD20	2	3	0	0							
8958	2006	New		BL72SE28	BL100	0	80			BL		18.1	19.5		66	56
8959	2006	New		BL89PLI7SE3	BL90SE10	0	88			BL		17.2	20.8		58	66
8960	2001	ACTIVE	BL78PLI22	BL60PLI40	BL90SE10	4	6	0	0	BL	14.5	16.1	20.8	31	31	26
8963	2001	ACTIVE	PLI85BL15	PLI67BL18FD8SE7	PLI80BL10SE10	14	34	8	33	PLI	19.4	20.9	21.8	23	28	30
8964	2001	ACTIVE	BL65FD19SE17	BL36SE32FD25PLI7	SE60PLI20FD20	12	28	0	0	SE	21.7	22.8	22.3	16	27	30
8965	2001	ACTIVE	PLI52BL48	SE46PLI34BL20	SE60PLI20BL10AT10	7	19	0	0	SE	25.8	22.7	21.5	19	27	30
9054	2001	ACTIVE	AT89PLI11	AT86PLI7EP6	PLI30AT30SE20FD20	6	0	46	71	PLI	28.2		22.0	32		40
9055	2000	ACTIVE	BL100	BL69FD17PLI14	BL40FD30AT20SE10	7	18	0	0	BL	17.8	17.1	16.5	32	44	33
9057	2001	ACTIVE	FD98BL2	FD98BL2	PLI96BL4	297	278	1	12	PLI			20.8			26
9068	2001	Burn_out	FD63BL20PLI17		FD73BL27	43	0			FD	23.1		18.8	39		6
9157	2006	New		BL55FD31PLI14	BL50FD30SE20	0	12			BL		19.8	21.1		40	108
9158	2006	New		PLI100	BL40FD40SE10AT10	0	21			BL		21.8	17.1		26	109
9164	2000	Burn_in	BL54FD46		FD60PLI20BL10AT10	9	0	0	0	FD	19.7		21.2	25		27
9166	2001	Burn_in		PLI100	PLI60FD30BL10	0	9	0	2	PLI	22.1	21.6	21.8	14	19	21
9170	2000	Burn_out	BL82SE18		PLI60SE20BL20	19	0			PLI			21.9			1
9264	2001	Burn_in	BL52FD48		PLI60BL20FD10SE10	2	0	7	31	PLI	19.1	16.5	21.8	15	16	29
9266	2001	Burn_in	FD100	FD84EP16	PLI70FD20SE10	0	0	148	204	PLI	22.1	21.7	21.8	15	20	38

Status : Active = Original plots from establishment, remeasured in 2006
New = New 2006 plot established in 2006
Burn-in = Remeasured plots from establishment impacted by wildfire
Burn-out = Plots consumed by wildfire, dropped from project

9.0 APPENDIX II – PLOT AND MSYT VOLUME GRAPHS

The following graphs illustrate the MSYT's assigned to each monitoring sample point by Weyco for MP #9. In addition, individual plot merchantable volumes are plotted for first and second measurements against projected inventory age, identified as follows:



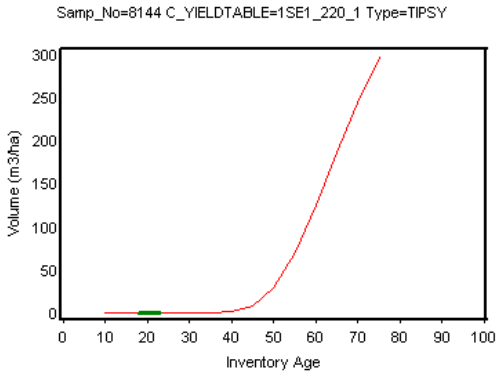
MSYT assigned to each monitoring plot

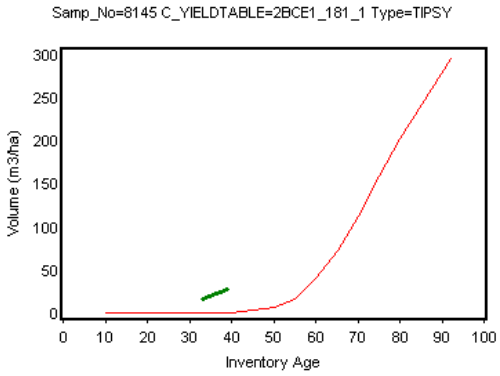
Live merch volume of all stems

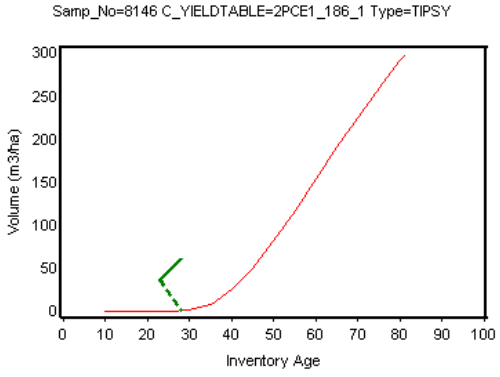
Live merch volume, minus resid component

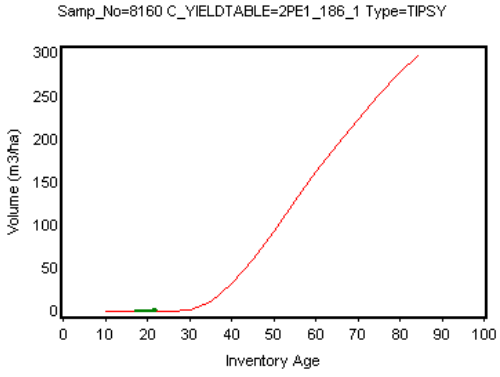
Live merch volume, minus MPB attacked trees.

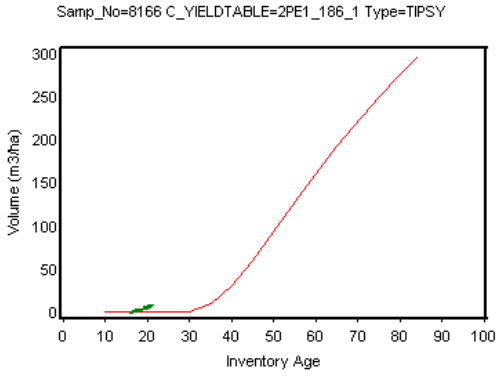
Live merch volume, minus resid component and MPB attacked trees

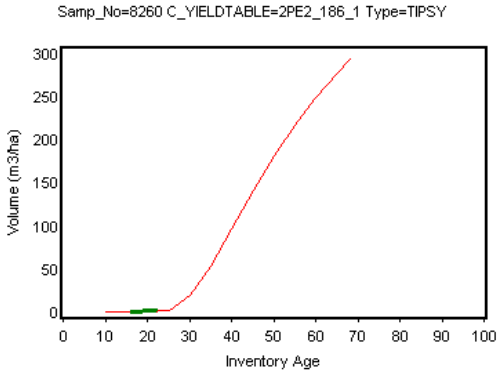

Samp_No=8144 C_YIELDTABLE=1SE1_220_1 Type=TIPSY
Volume (m3/ha)
Inventory Age

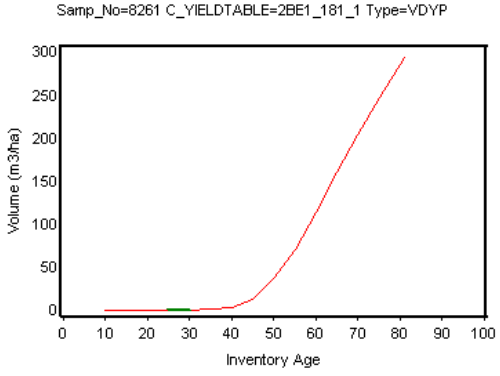

Samp_No=8145 C_YIELDTABLE=2BCE1_181_1 Type=TIPSY
Volume (m3/ha)
Inventory Age

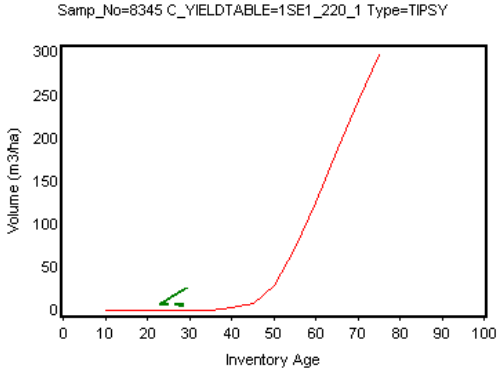

Samp_No=8146 C_YIELDTABLE=2PCE1_186_1 Type=TIPSY
Volume (m3/ha)
Inventory Age


Samp_No=8160 C_YIELDTABLE=2PE1_186_1 Type=TIPSY
Volume (m3/ha)
Inventory Age

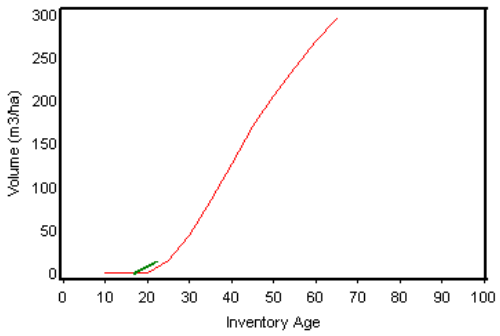

Samp_No=8166 C_YIELDTABLE=2PE1_186_1 Type=TIPSY
Volume (m3/ha)
Inventory Age


Samp_No=8260 C_YIELDTABLE=2PE2_186_1 Type=TIPSY
Volume (m3/ha)
Inventory Age

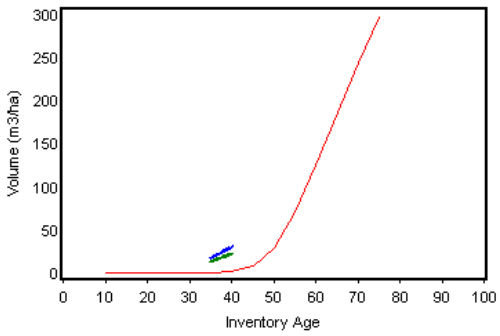

Samp_No=8261 C_YIELDTABLE=2BE1_181_1 Type=VDYP
Volume (m3/ha)
Inventory Age


Samp_No=8345 C_YIELDTABLE=1SE1_220_1 Type=TIPSY
Volume (m3/ha)
Inventory Age

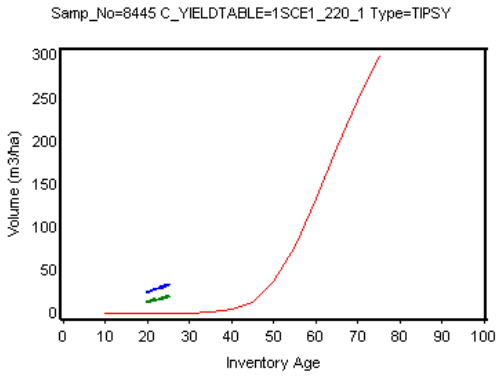
Samp_No=8367 C_YIELDTABLE=2_p_18 Type=TIPSY



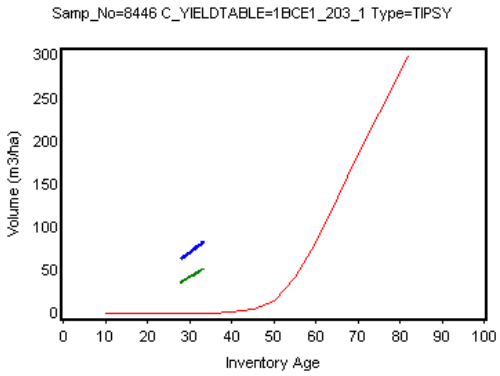
Samp_No=8443 C_YIELDTABLE=1SE1_220_1 Type=TIPSY



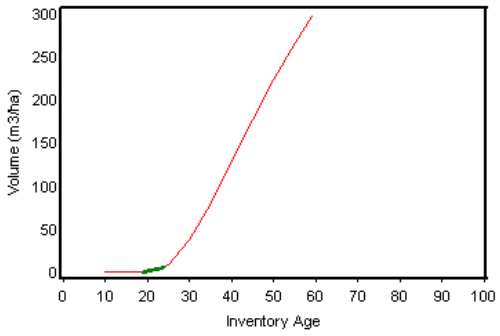
Samp_No=8445 C_YIELDTABLE=1SCE1_220_1 Type=TIPSY



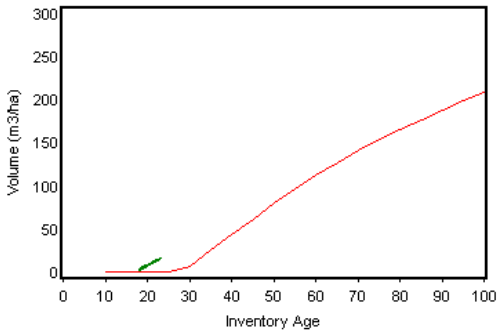
Samp_No=8446 C_YIELDTABLE=1BCE1_203_1 Type=TIPSY



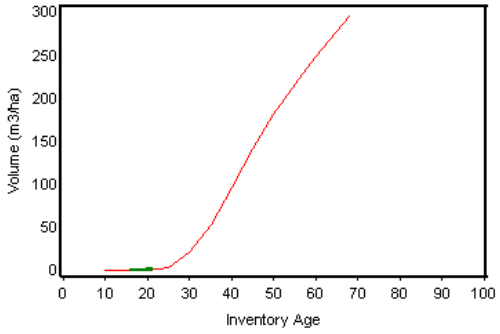
Samp_No=8453 C_YIELDTABLE=1PCE2_215_1 Type=TIPSY



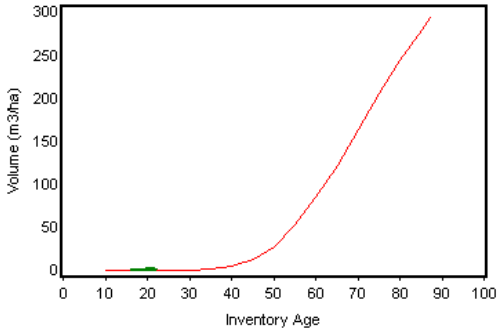
Samp_No=8456 C_YIELDTABLE=2PDE2_186_1 Type=VDYP



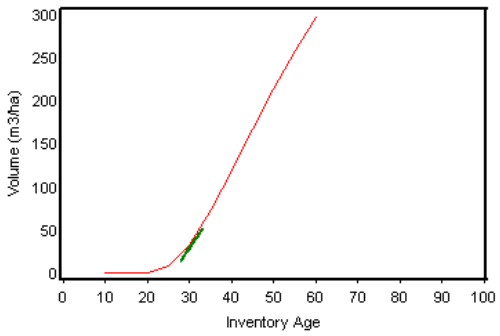
Samp_No=8459 C_YIELDTABLE=2PE2_186_1 Type=TIPSY



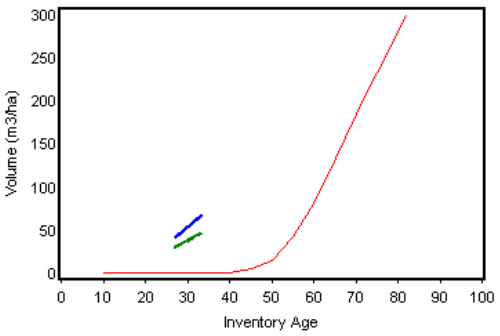
Samp_No=8460 C_YIELDTABLE=2BCE2_181_1 Type=TIPSY



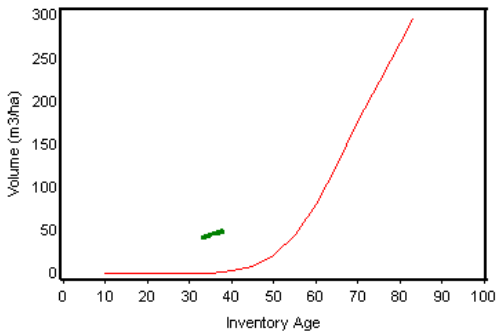
Samp_No=8461 C_YIELDTABLE=1PCE1_215_1 Type=TIPSY



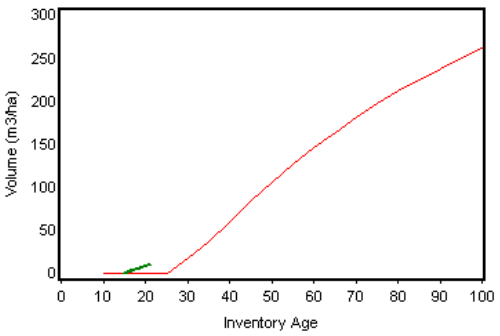
Samp_No=8463 C_YIELDTABLE=1BCE1_203_1 Type=TIPSY



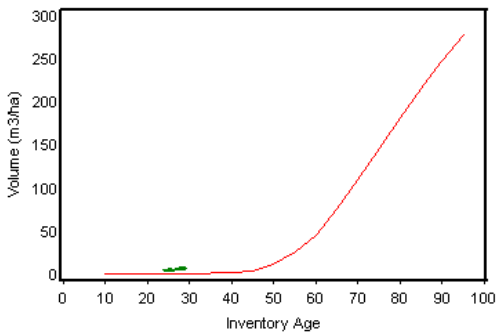
Samp_No=8464 C_YIELDTABLE=2SCE1_197_1 Type=TIPSY



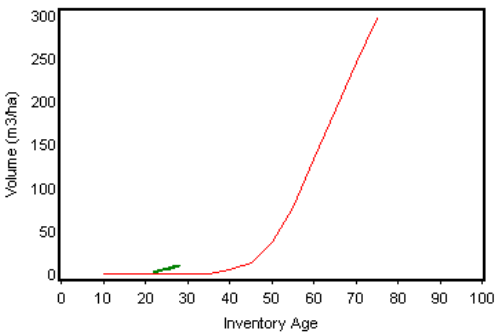
Samp_No=8543 C_YIELDTABLE=1PDV_205_1 Type=VDYP



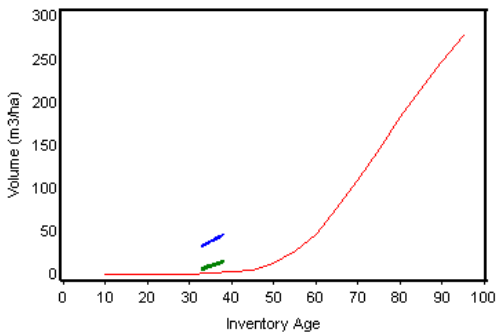
Samp_No=8548 C_YIELDTABLE=3SCE1_155_1 Type=TIPSY



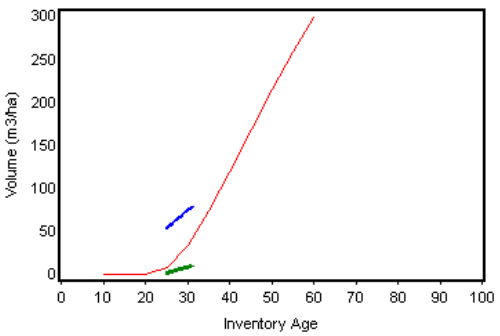
Samp_No=8549 C_YIELDTABLE=1SCE1_220_1 Type=TIPSY



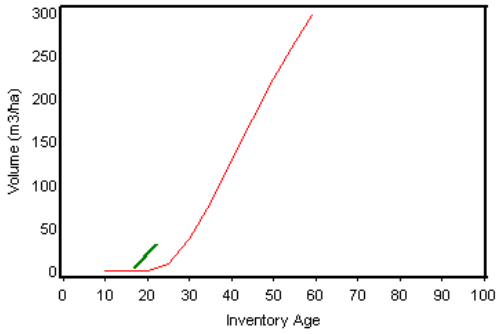
Samp_No=8559 C_YIELDTABLE=3SCE1_155_1 Type=TIPSY



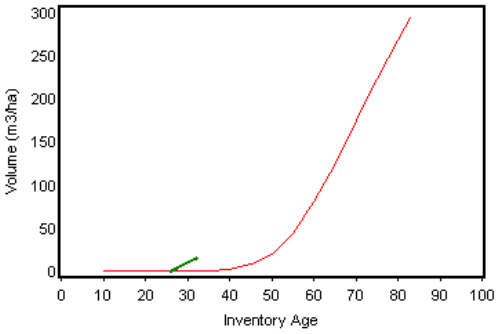
Samp_No=8561 C_YIELDTABLE=1PCE1_215_1 Type=TIPSY



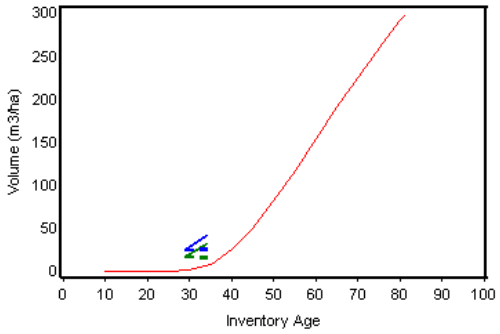
Samp_No=8565 C_YIELDTABLE=1PCE2_215_1 Type=TIPSY



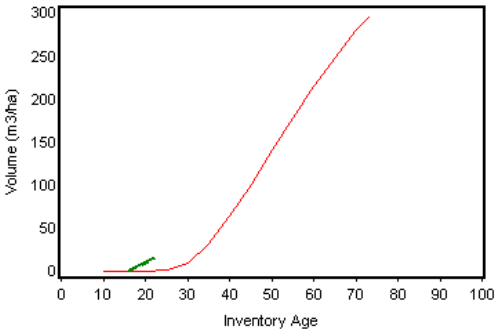
Samp_No=8566 C_YIELDTABLE=2SCE1_197_1 Type=TIPSY



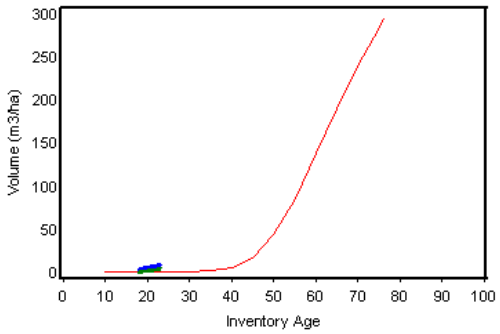
Samp_No=8567 C_YIELDTABLE=2PCE1_186_1 Type=TIPSY



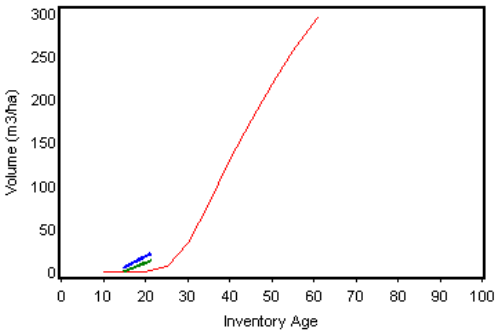
Samp_No=8571 C_YIELDTABLE=2PCE2_186_1 Type=TIPSY



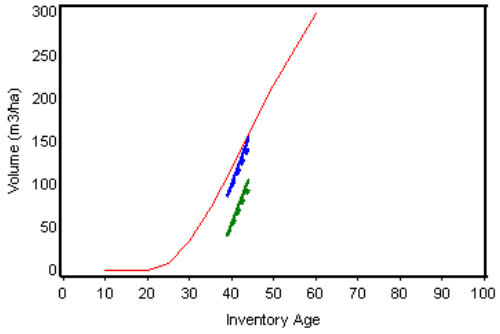
Samp_No=8654 C_YIELDTABLE=1BCE2_203_1 Type=TIPSY



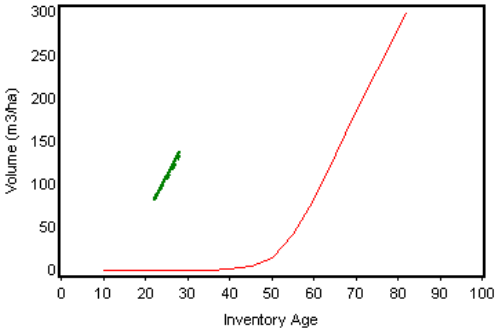
Samp_No=8656 C_YIELDTABLE=1PE1_215_1 Type=TIPSY



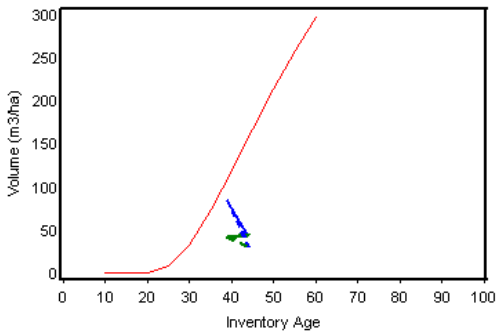
Samp_No=8657 C_YIELDTABLE=1PCE1_215_1 Type=TIPSY



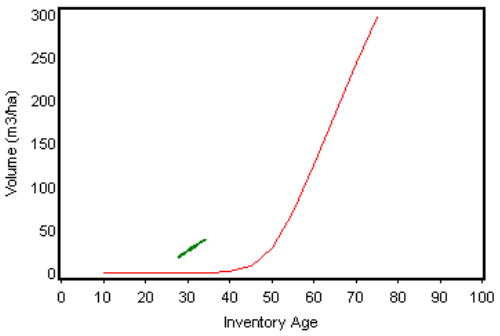
Samp_No=8658 C_YIELDTABLE=1BCE1_203_1 Type=TIPSY



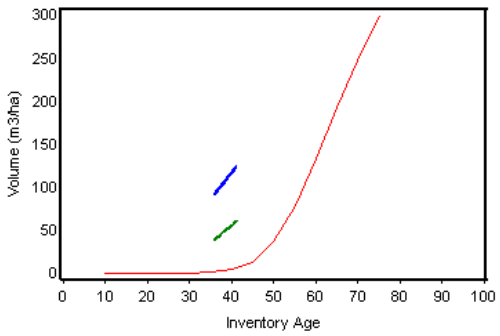
Samp_No=8659 C_YIELDTABLE=1PCE1_215_1 Type=TIPSY



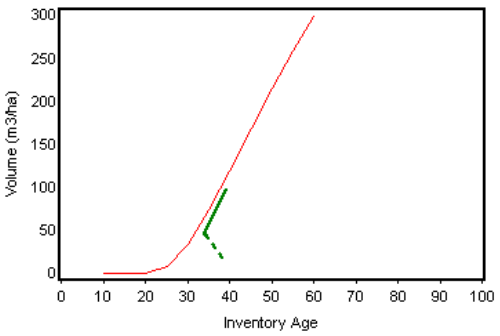
Samp_No=8663 C_YIELDTABLE=1SE1_220_1 Type=TIPSY



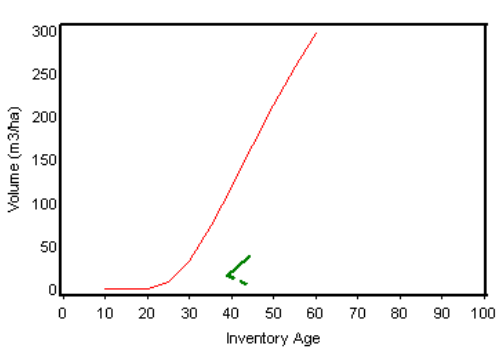
Samp_No=8665 C_YIELDTABLE=1SCE1_220_1 Type=TIPSY



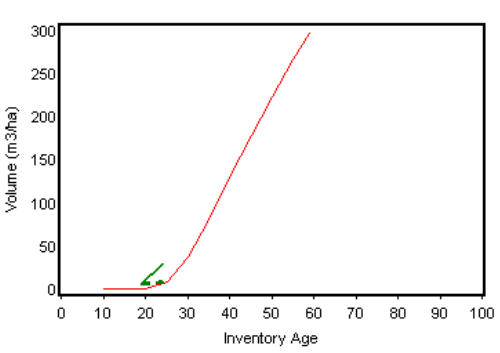
Samp_No=8668 C_YIELDTABLE=1PCE1_215_1 Type=TIPSY



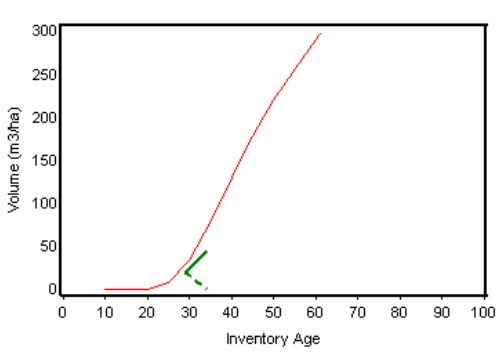
Samp_No=8669 C_YIELDTABLE=1PCE1_215_1 Type=TIPSY



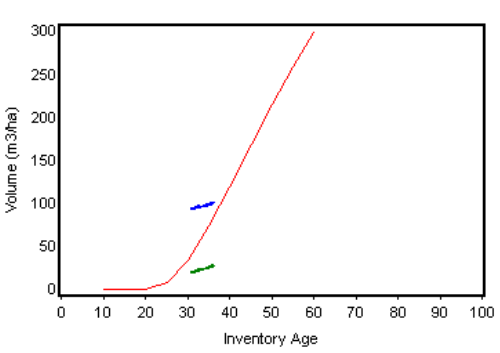
Samp_No=8750 C_YIELDTABLE=1PCE2_215_1 Type=TIPSY

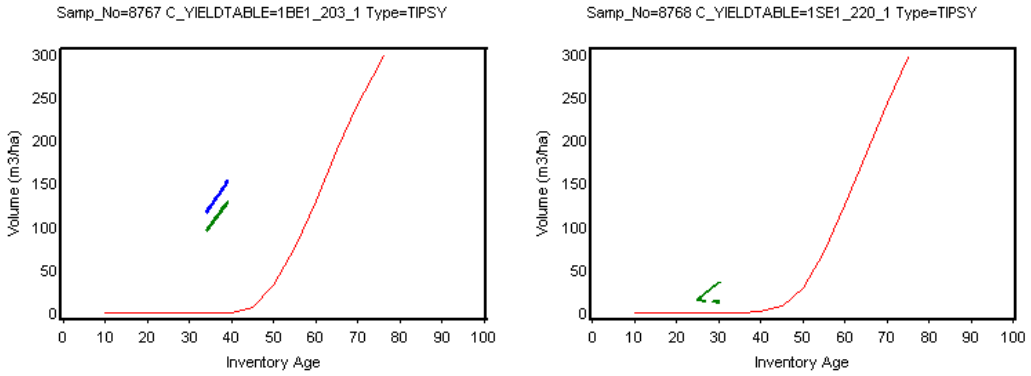


Samp_No=8752 C_YIELDTABLE=1PE1_215_1 Type=TIPSY

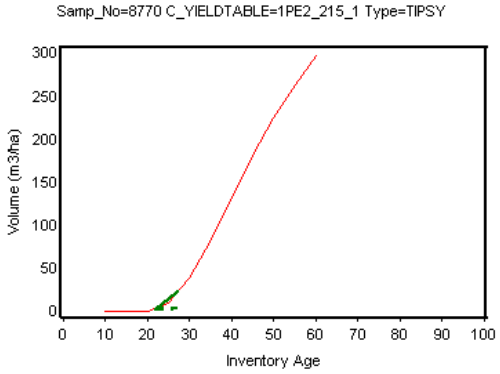


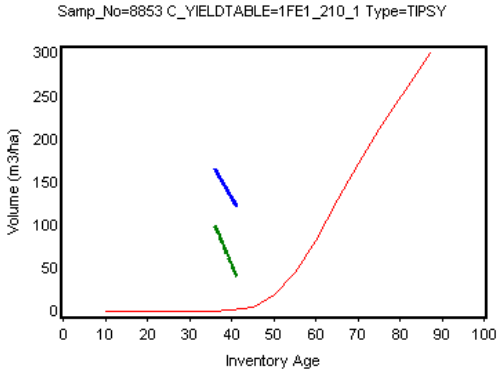
Samp_No=8763 C_YIELDTABLE=1PCE1_215_1 Type=TIPSY

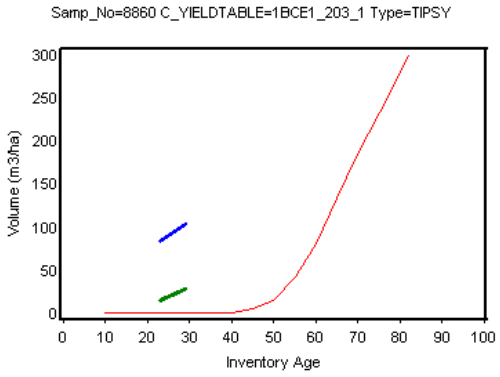


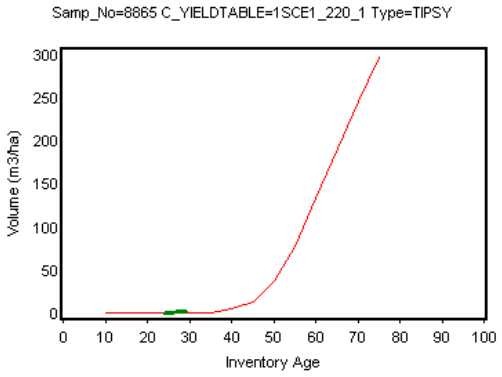

Samp_No=8767 C_YIELDTABLE=1BE1_203_1 Type=TIPSY
Volume (m3/ha)
Inventory Age

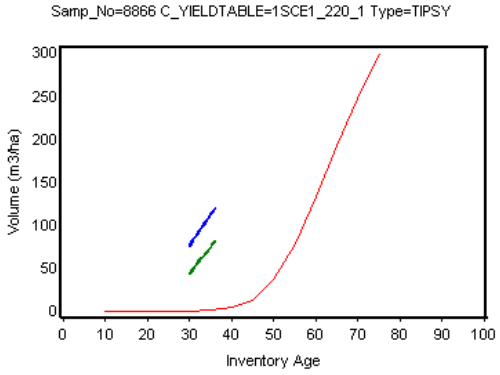
Samp_No=8768 C_YIELDTABLE=1SE1_220_1 Type=TIPSY
Volume (m3/ha)
Inventory Age

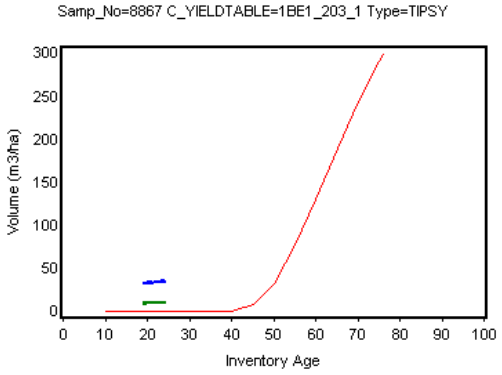

Samp_No=8770 C_YIELDTABLE=1PE2_215_1 Type=TIPSY
Volume (m3/ha)
Inventory Age


Samp_No=8853 C_YIELDTABLE=1FE1_210_1 Type=TIPSY
Volume (m3/ha)
Inventory Age

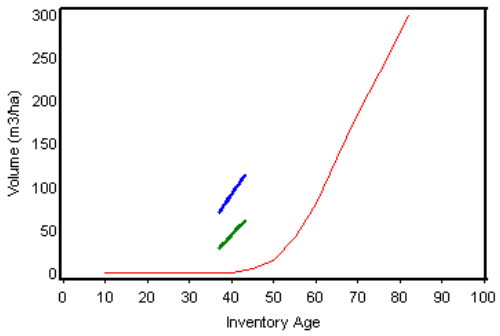

Samp_No=8860 C_YIELDTABLE=1BCE1_203_1 Type=TIPSY
Volume (m3/ha)
Inventory Age


Samp_No=8865 C_YIELDTABLE=1SCE1_220_1 Type=TIPSY
Volume (m3/ha)
Inventory Age

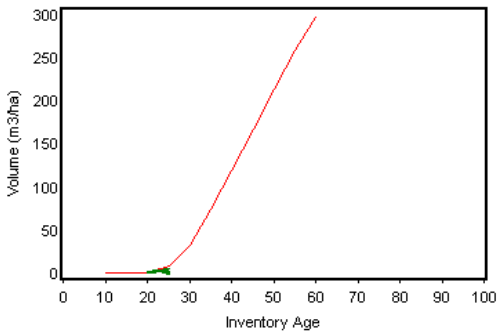

Samp_No=8866 C_YIELDTABLE=1SCE1_220_1 Type=TIPSY
Volume (m3/ha)
Inventory Age


Samp_No=8867 C_YIELDTABLE=1BE1_203_1 Type=TIPSY
Volume (m3/ha)
Inventory Age

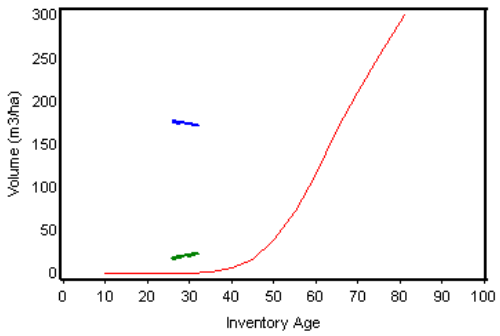
Samp_No=8869 C_YIELDTABLE=1BCE1_203_1 Type=TIPSY



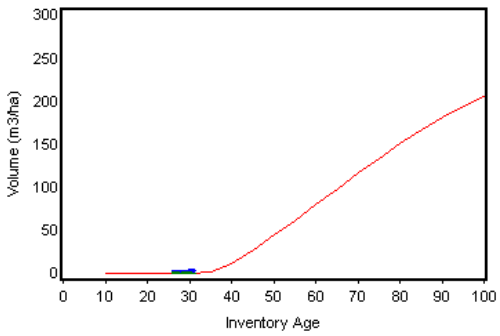
Samp_No=8870 C_YIELDTABLE=1PCE1_215_1 Type=TIPSY



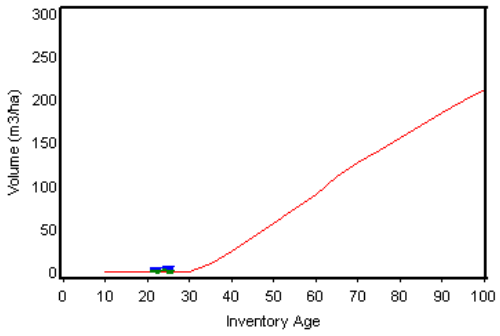
Samp_No=8951 C_YIELDTABLE=1FCE1_210_1 Type=TIPSY



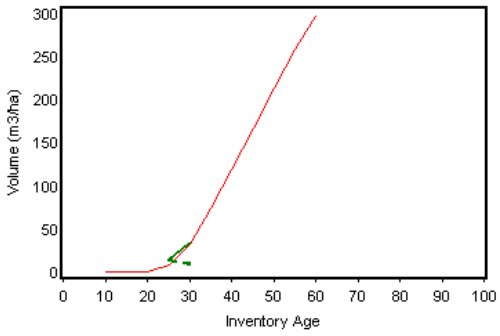
Samp_No=8953 C_YIELDTABLE=1DV_182_1 Type=VDYP



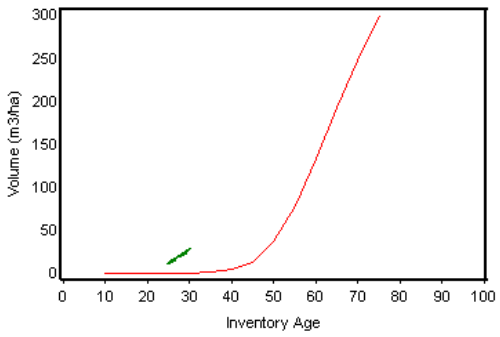
Samp_No=8960 C_YIELDTABLE=1BV_145_1 Type=VDYP



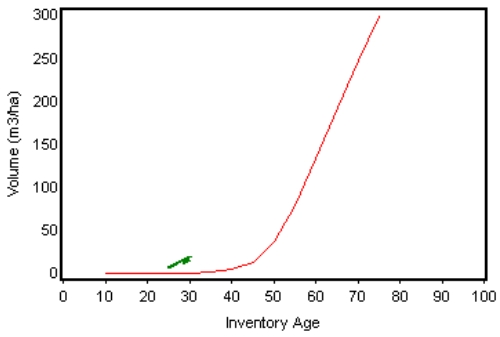
Samp_No=8963 C_YIELDTABLE=1PCE1_215_1 Type=TIPSY



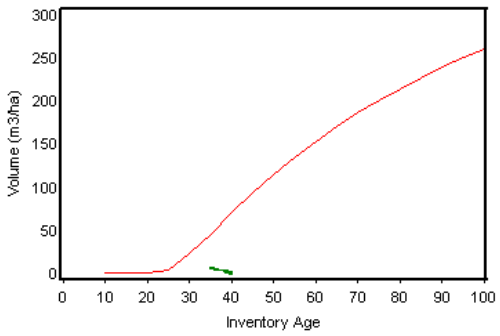
Samp_No=8964 C_YIELDTABLE=1SCE1_220_1 Type=TIPSY



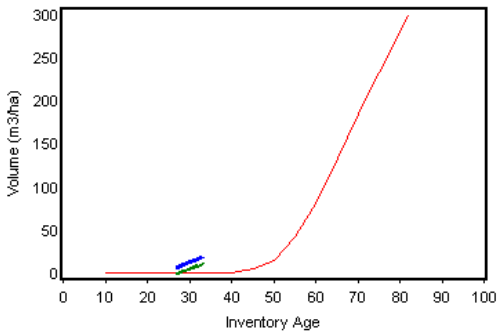
Samp_No=8965 C_YIELDTABLE=1SCE1_220_1 Type=TIPSY



Samp_No=9054 C_YIELDTABLE=1PDE1_215_1 Type=VDYP



Samp_No=9055 C_YIELDTABLE=1BCE1_203_1 Type=TIPSY



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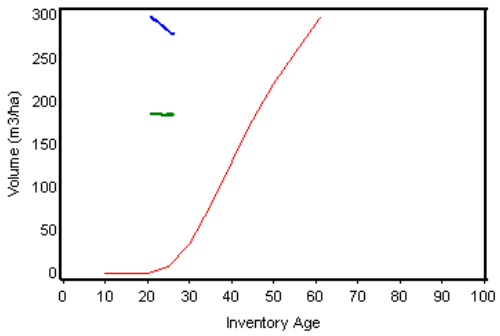

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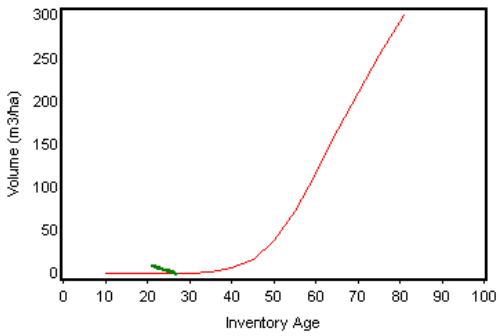

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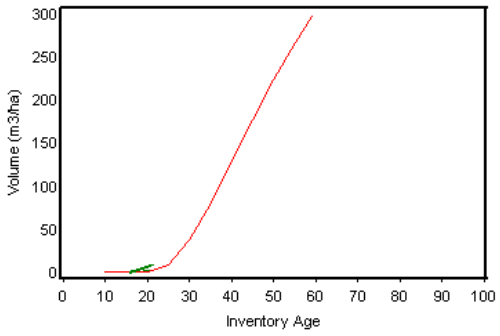

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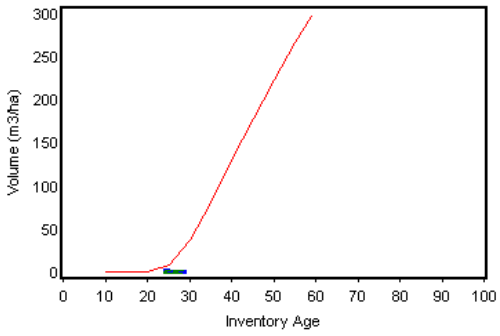

Samp_No=9266 C_YIELDTABLE=1_PI_Plant_21 Type=TIPSY