TASS III ver. 4.0.9

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A Quick-start Tutorial
using two demonstration regimes

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BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development

https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/growth-and-yield-modelling

Table of Contents

Introduction

TASS III is the third generation of the Tree And Stand Simulator (TASS), a biologically oriented, spatially explicit (distance dependent), individual tree, growth and yield model. Version 4.0.9 is its first public release and it's available to download here. It currently simulates two interior tree species, in pure and mixed stands:

Lodgepole pine, *Pinus contorta var. latifolia*
White spruce, *Picea glauca*

This document provides a brief, quick-start overview, followed by a short demonstration simulating two stand silviculture regimes. Similar information can be found in TASS III HELP. Beginning at the "Getting Started" HELP page, users can follow links to additional information, as needed.

Before exploring TASS III on your own, we encourage you to read the following Quick Start section (5 short pages!) to familiarize yourself with the basics. For those preferring a more structured approach, this document concludes with a step-by-step demonstration preparing, simulating, and plotting two silviculture regimes.

Please forward questions and feedback to: Mario.diLucca@gov.bc.ca

Important Caveats

Despite years of development and testing, there are bound to be glitches in a program of this size and complexity. Given the number of potential permeations and combinations, there is no practical way to test them all. Nor are there data to validate them all. The model will continue to evolve with further research and development and valued user feedback.

Please download and review the TASS III Use Policy here.

This current version is limited to two interior species, white spruce and lodgepole pine. The new, improved growth models for these two species have also been incorporated in TASS II and TIPSY. We plan on adding two coastal species, Douglas-fir and western hemlock, next.

TASS III Quick-Start Guide

Background

The central focus of TASS is the prediction of silvicultural treatment response through the modelling of individual tree crown dynamics and its linkage to bole growth and wood quality. TASS simulates the growth of individual trees and stands in three dimensions. This focus on crown dynamics makes TASS particularly well suited for predicting response to treatments such as espacement, fertilization, pruning, pre-commercial and commercial thinning.

Prior to TASS III, TASS was largely limited to single species, even-age (single cohort) stands due to simplifying assumptions regarding light, i.e., overtopped foliage did not survive in the vertical shadow of neighboring trees. Before TASS III, the model also had no public user interface. Instead, TIPSY (Table Interpolation Program for Stand Yields) was created in 1991 to enable operational users to access yield tables pre-generated with second-generation TASS II. TIPSY will likely remain the operational mainstay during the early stages of TASS III development. TIPSY produces product-based yields for 12 species, and like TASS II, it is suitable primarily for even-age, single-species stands.

Key Concept: The addition of dynamic light modelling to TASS III enables simulation of more complex stand structures than earlier TASS versions (including TIPSY), albeit currently just for two interior species.

TASS III Windows© Interface

Users experienced with other growth and yield programs, including TIPSY, will notice many differences in the TASS III Windows© interface (Figure 1). These differences support the unique individual-tree, spatially-explicit architecture of TASS III, which models growth based on the spatial location of every tree and associated crown competition. This makes TASS III a powerful tool for modelling the response to silvicultural treatments, through their unique effects on crown development and ultimately bole increment.

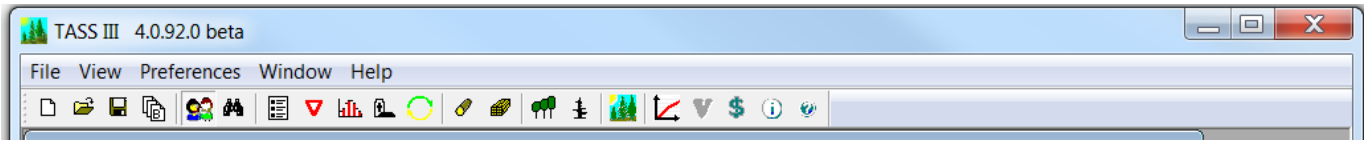


Figure 1: At the top of the TASS III interface is a standard **Main Menu**[1] with a row of **Tool Bar** icons below it. These provide access to the standard **File** commands (e.g., New, Open, Save, etc) and the various **Outputs** produced by TASS III.

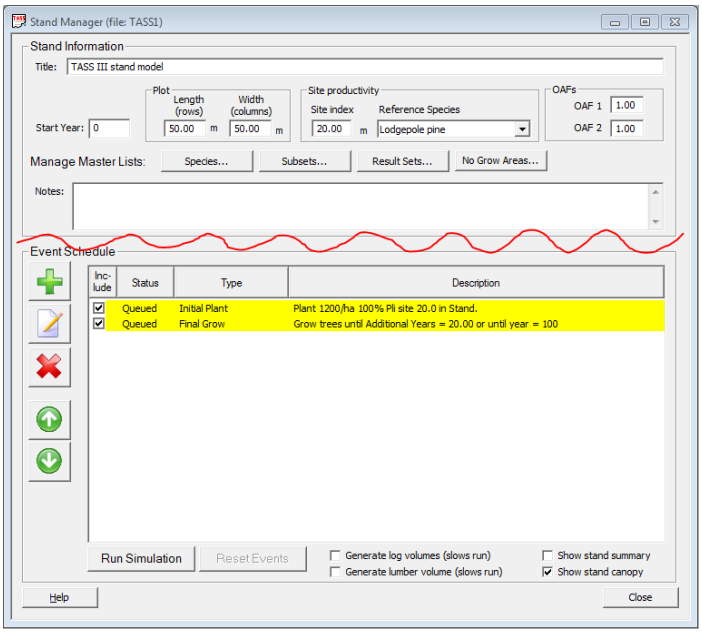
The **File - Save** command (Figure 1) saves all the **Stand Manager** settings to a TASS III stand file **(.t3d)**. Opening an existing **.t3d file** repopulates the **Stand Manager** settings.

[1] **Bold** text identifies a TASS III component by name. Refer to **Help** for more information.

TASS III includes an extensive **Help** function, which provides context-sensitive **Help** through the keyboard F1 key or the **Help** buttons found on each form. Users will find answers to most questions there. Key concepts are highlighted throughout.

Stand Manager form

The **Stand Manager** form (Figure 2) is the interactive simulation control centre. It provides central access to <u>all</u> settings for configuring and simulating a stand management regime. The form is initially populated with defaults that can all be edited. TASS III also has a non-interactive **Batch Processing** feature (refer to **Help**).



<u>Figure 2:</u> The **Stand Manager** form is visually divided into two main sections: **Stand Information** (top) and **Event Schedule** (bottom). The **Notes** box in the middle provides space for documenting modelling assumptions, etc (optional).

Stand Information

The **Stand Information** section of the **Stand Manager** form defines **Plot** dimensions, **Site Productivity**, Operational Adjustment Factors (**OAFs**) and other settings common to a simulation, or series of simulations. Refer to **Help** for more information on these settings.

Key Concepts:

- TASS III simulates the growth of <u>every individual tree</u> within the defined fixed-area, hereafter referred to interchangeably as the **Plot** or *stand*.
- Simulation (computer processing) time increases proportional to the total number of trees in the **Plot**, which is a function of both **Plot** size and tree density (trees/ha). Users can adjust either of these to obtain acceptable simulation times.
- TASS III eliminates **Plot** edge-effects, thereby making plot buffers unnecessary. Tree crowns along each edge grow into the opposite side of the plot and compete with the trees there.

"Crown wrap" is visible in the **Crown Display** window. Note that within plot edge-effects along internal gaps and openings are simulated directly by TASS III.

Master Lists, Stand Information

Key Concept: The **Master Lists** concept referenced in the **Stand Information** area (Figure 2) will be new to many users. Users are encouraged to become familiar with these flexible and powerful features, and their various applications, before simulating complex scenarios. Refer to **Help** for more information. A brief overview of the four master lists follows (Figures 3-6):

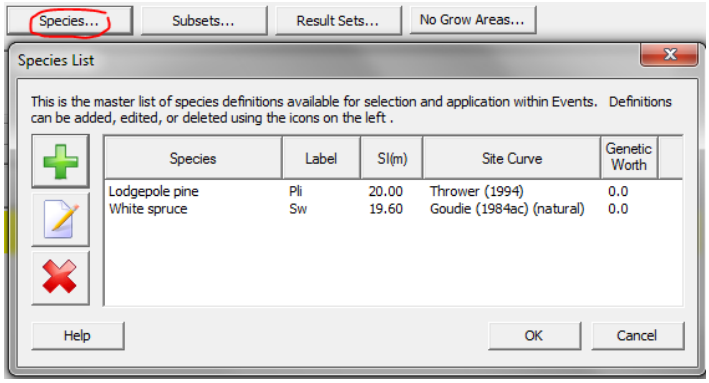


Figure 3: The **Species List** form displays the species master list. Each entry represents a unique **Species Definition,** which are created and edited using the three icons on the left. Each **Species Definition** has a unique **Site Index** and **Genetic Worth** assigned to it, allowing more than one definition per species. **Species Definitions** are used in the design of both **Plant** and **Natural Regeneration Events,** and in species **Subsets**.

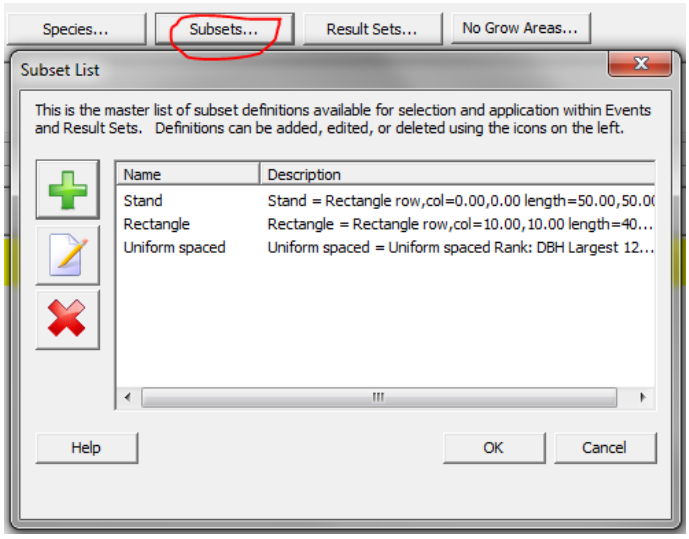


Figure 4: The **Subset List** form displays the **Subset** master list. Each entry represents a unique **Subset Definition,** which is created and edited using the three icons on the left. Each **Subset Definition** defines a unique selection (subset) of trees within the plot. **Subsets** can be area-based or attribute-based. The (whole) **Stand** subset is always present as the default. **Subsets** are

powerful tools for defining various populations of trees within **Events** and **Results Sets.** Multiple **Subsets** can be combined within both these applications to produce **Nested Subsets**, according to established rules found in **Help**.

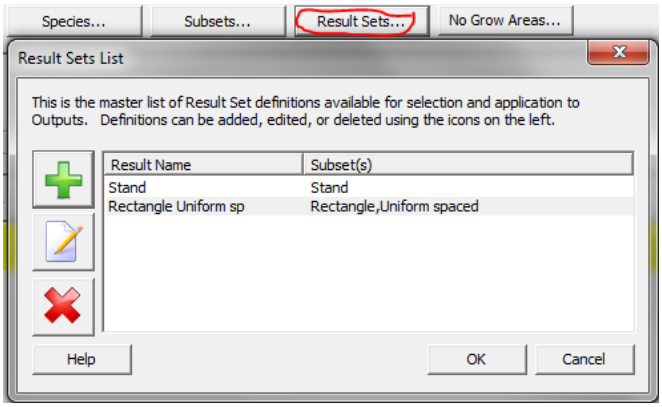


Figure 5: The **Result Sets List** form displays the **Result Sets** master list. Each entry represents a unique **Result Set Definition,** which are created and edited using the three icons on the left. Each **Result Set Definition** defines a unique combination of **Subsets** used to define populations of trees reported on by the various **Outputs**. The (whole) **Stand** Results Set is always present as the default.

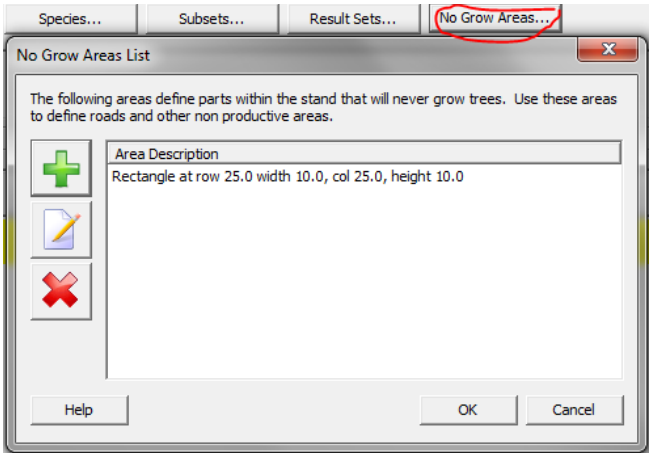


Figure 6: The **No Grow Areas List** form displays the **No Grow Areas** master list. **No Grow Areas** define areas within the plot that do not support tree growth. Regeneration **Events** ignore these areas. Each entry represents a unique **No Grow Area Definition,** which are created and edited using the three icons on the left.

Event Schedule

The **Event Schedule** is the bottom half of the **Stand Manager** form (Figure 1). It supports configuring, editing, and simulating a series of **Events** defining a stand management regime. **Events** are listed in chronological order within the **Event Table**. The five (5) buttons on the left are used to add, edit, delete, and move **Events** within the list.

Key Concept: Check boxes in the first column are used to activate and de-activate each **Event** before a simulation run. This enables the user to add alternative **Events** to the **Event Schedule** and (de)activate them individually for comparison runs, i.e., one **Event Schedule** can be used to document and compare multiple treatment options for the same stand. The remaining columns provide information about each **Event**.

Note the first two **Events** highlighted in yellow (Figure 1). These are permanent **Events** that cannot be moved or deleted, but they can be edited. They define the initial stand establishment **Event** and the Final **Grow Event**. Numerous options for stand establishment and other silviculture treatments are detailed in the **Event** section within **Help**.

Directly below the **Event Table** are the **Run Simulation** and **Reset Events** buttons (Figure 1). These control computer processing of the simulation. After completing a simulation run, click the **Reset Events** button to enable **Event Table** editing and/or re-running of the simulation.

To the right of the **Reset Events** button are four check boxes. Generation of **Log** and **Lumber** volumes slows run time considerably. Leaving the boxes unchecked is recommended unless **Log** or **Lumber** volumes are needed (e.g., economic analyses with FAN$IER). Select **Stand Summary** and/or **Canopy Display** in order to monitor simulation progress and to confirm **Events** perform as intended.

Events

TASS III provides eight (8) types of **Events;** each one can be scheduled multiple times in a regime. These include three (3) types of regeneration **Events**, including **Plant** and **Natural Regeneration**. The **Cut/Leave Event**, in combination with **Subsets**, provides a powerful tool for defining many types of thinning and harvesting activities. A **Fertilize Event** is also included. **Pause Events** pause the simulation allowing the user to examine and/or adjust the simulation at that point.

Outputs

Once a regime simulation has been run to the user's satisfaction, TASS III can produce 13 types of **Outputs**, including 9 types of tables (e.g., yield, logs, lumber, etc), 3 different graphics displays, plus **Exports** to **FAN$IER** (economic analysis), and **PLOTSY** (data plotting). The **Toolbar** contains icons for many of these **Outputs** (Figure 1).

Two Demonstration Regimes

The following two regimes were designed to demonstrate a few key features of **TASS III**. This demonstration compares thinned and unthinned regimes for the same stand, with additional help from the graphing program, **PLOTSY**, which is integrated with **TASS III**.

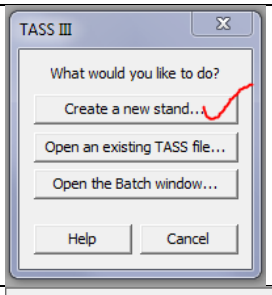
NOTE: The thinned regime will be configured first so that the unthinned regime can be simulated by simply unchecking (turning off) the thinning event.

Stand Information	**Thinned Regime (w/ PCT)**	**Unthinned Regime (w/o PCT)**
Start Year	0	Same, unless noted otherwise.
Plot size	50m x 50m	
Site Productivity (bare ground site index)	20m, lodgepole pine	
Operational Adjustment Factors	OAF1=0.85; OAF2=0.95 (standard Ministry defaults)	
Event Schedule		
Initial Plant Event		
Species	White spruce	
Site Index	19.6m (auto-predicted based on pine site productivity)	
Genetic Worth	15%	
Seedling specs	1-yr old, 13 cm	
Planting density (trees/ha)	1600	
Planting spatial pattern	Square with 0.25m variation	
Post-plant Grow Event	Grow until stand age = 2 (ingress delay)	
Natural Regen (Ingress) Event		
Species	Lodgepole pine (natural, no genetic gain)	
Site Index	20m	
Trees/ha (total)	6000	
Distributed over	5 years max	
Calculated temporal distribution	Poisson; lambda=3.2	
Spatial Distribution	Clumped; 70/ha; var=8.0	
Grow Event	Grow until top ht = 6m (defines timing of thinning)	
Cut/Leave Event Pre-commercial Thinning	CUT all trees <5m tall (no intended silvicultural significance)	None (Turn off Event)
Grow Event	Grow until stand age = 50;	

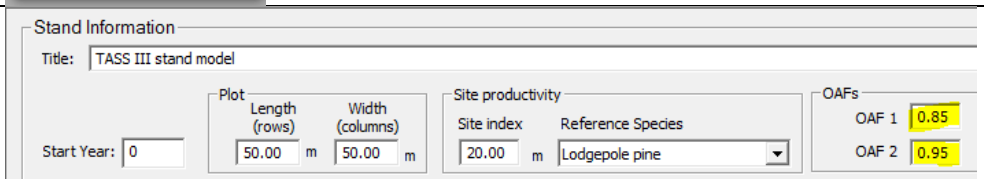
Configuring TASS III

Note the following screen capture images may be from an earlier version. Defaults and results may differ slightly.

1. Launch TASS III and select "Create a new stand" to open the **Stand Manager** form.

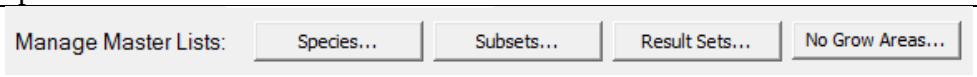


2. Note the **Stand Information** defaults that need to be changed (i.e., OAFs).



Users edit existing **Stand Manager** defaults to reflect their own regime specifications.

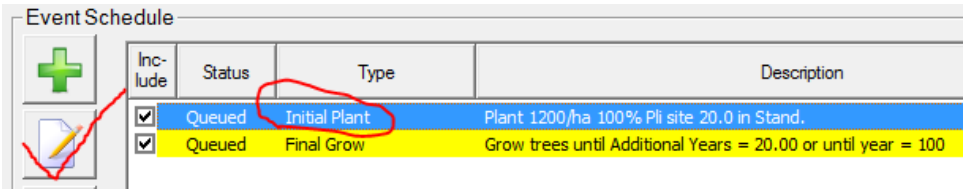
3. Note and consider the four **Master Lists**.



Only **Species** and **Subsets** are affected by the two **Regimes.** These will be altered later within the associated **Events**. **Regime** descriptions imply that only the default **Result Set** (Stand) will be needed for reporting results, and no **No Grow Areas** were specified.

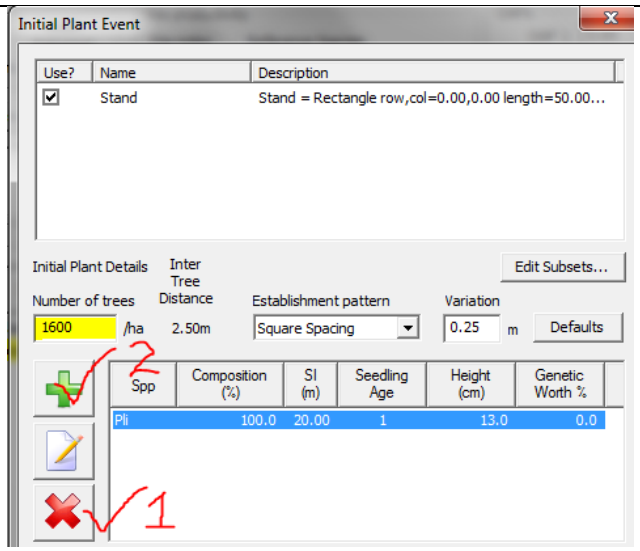
4. Move down to the **Event Schedule** and examine the **Initial Stand Establishment Event**, i.e., the first "yellow" **Event.**

   Select the first **Event** and click the **Edit** button on the left. Choose **Edit Initial Plant** from the Edit Menu to open the **Initial Plant Event** form.



Note that defaults for this **Event** already reflect the correct regen method (planting), but the specifics will need to be edited.

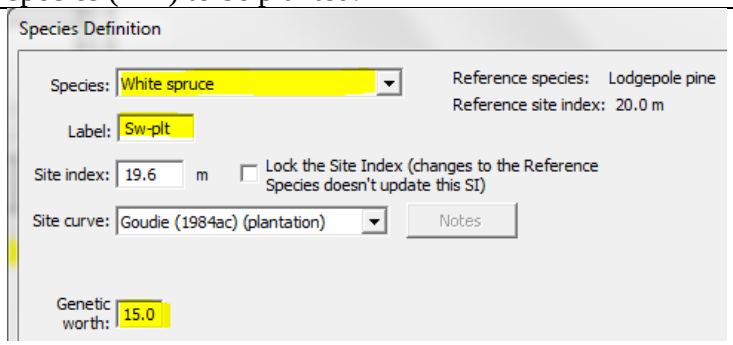
5. On the **Initial Plant Event** form, change the number of trees to 1600 then select and delete the default Pli definition. Lastly, click the Add button to open the **Species List** form. Click Add to then open the **Species Definition** form.



At the top, notice the default **Subset** (Stand) is already listed and selected for use. This means the **Event** will plant the entire plot, as intended.

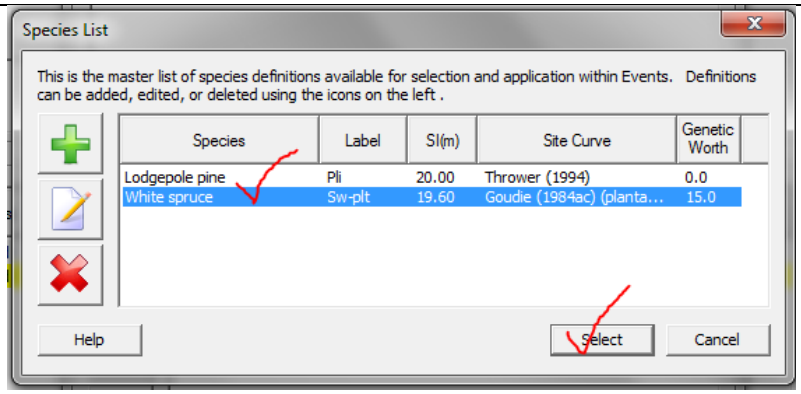
At the bottom, is the table of the associated **Species Definitions**, i.e., the species (mix) to be planted.

6. On the **Species Definition** form, change the **Species, Label** and **Genetic Worth** and then click **OK** to view the updated **Species List**.

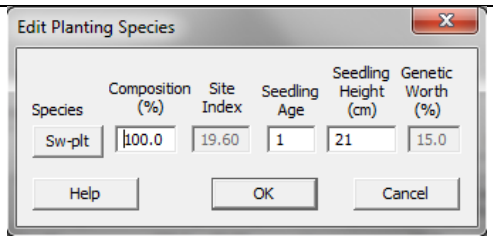
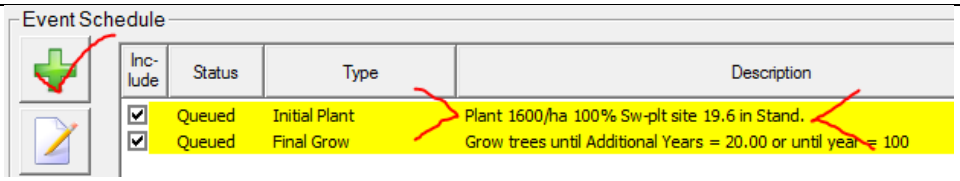
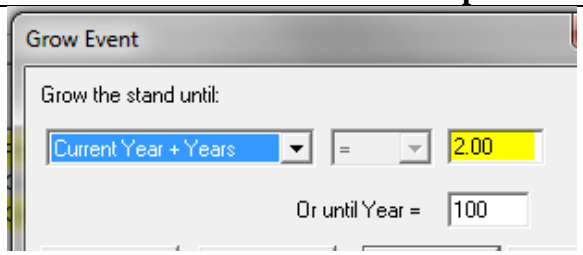
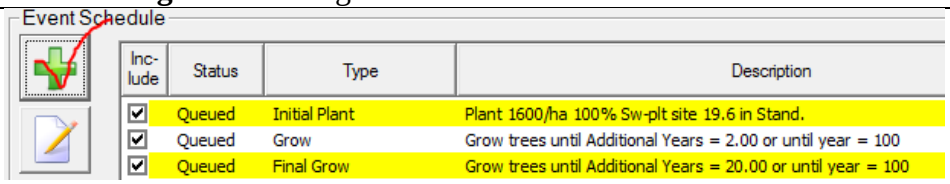
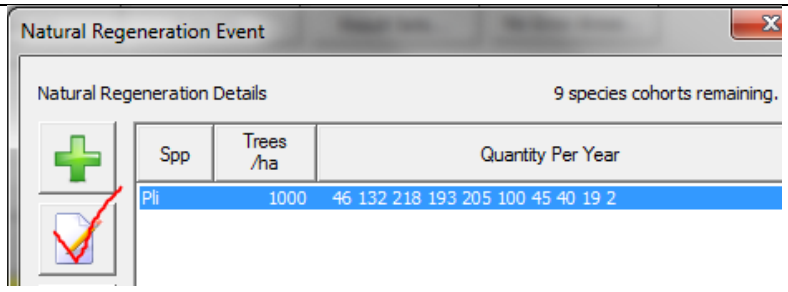


Note the spruce Site Index is automatically adjusted based on pine site productivity. The **Label** helps to differentiate multiple species definitions.

7. On the **Species List** form, select (click) the new spruce definition and click the **Select** button to view the **Edit Planting Species** form.

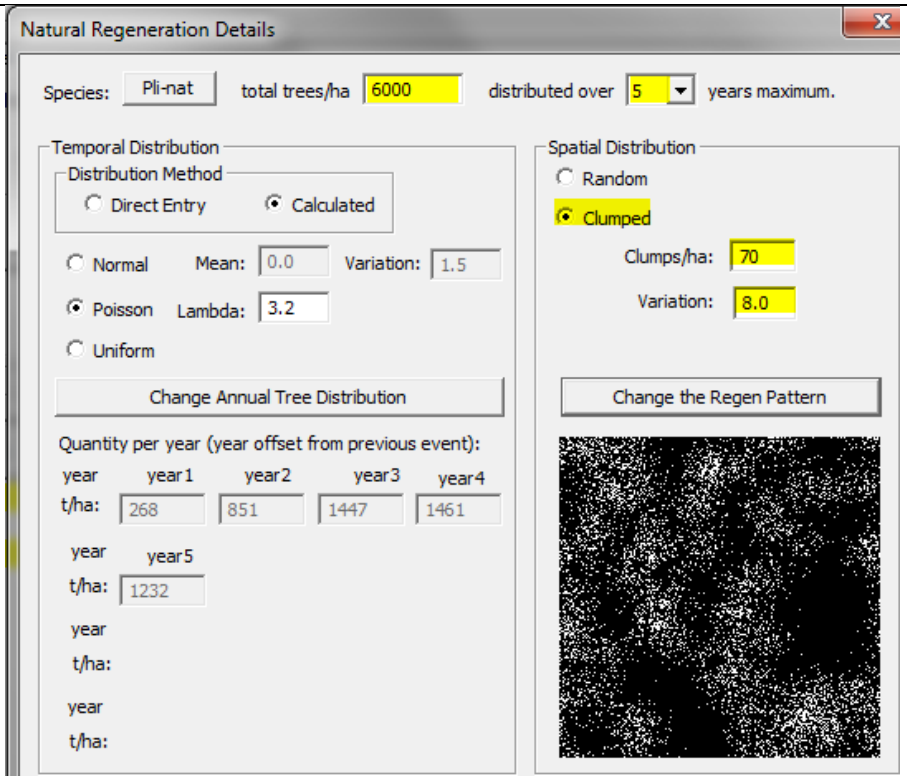


This new **Species Definition** will also appear in the **Species Master List** making it available for use in other **Events**.

8. In this case, there are no changes to the **Edit Planting Species** form. Click **OK** twice to return to the **Event Schedule** on the **Stand Manager** form.	 Note that species **Composition** and **Seedling Age** and **Height** are not part of the **Species Definition**. They are defined within each **Plant Event**.
9. Next, click the **Add Event** button and select **Grow** to open the **Grow Event** form.	 Note the **Initial Plant** event **Description** now reflects the previous edits.
10. Change **Current Year + Years** to 2.0 and click **OK** to return to the **Event Schedule**.	 Note this represents the expected delay until the onset of the next **Event, Natural Regeneration** ingress.
11. Next, click the **Add** button on the left and select **Natural Regeneration** from the pop-up **Event** menu.	 Note, new events are automatically inserted just before the yellow **Final Grow Event**. Use the up and down arrow buttons to reposition events if needed.
12. Select (click) the default Pli species cohort and then click the **Edit** button to open the **Natural Regeneration Details** form.	 A **Natural Regeneration Event** may contain definitions for up to 10 species cohorts. Natural regeneration is always applied to the entire plot.

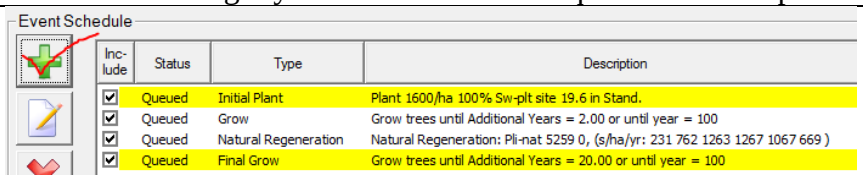
13. Change the highlighted settings then click **Change Annual Tree Distribution** to register the changes. Then click **OK** twice to return to the **Event Schedule**.

    Optionally, to change the **Species label** (Pli-nat), click the **Species** button.



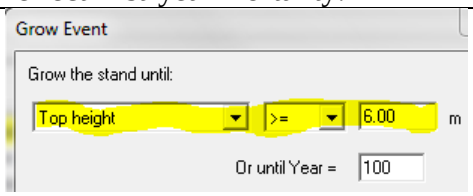
Note, clicking either **Change** button multiple times cycles through additional random **Age and Spatial Distribution** patterns for the same parameters. Yields will be slightly different for each unique distribution pattern.

14. Click the **Add** button and select **Grow** from the pop-up **Event** menu.



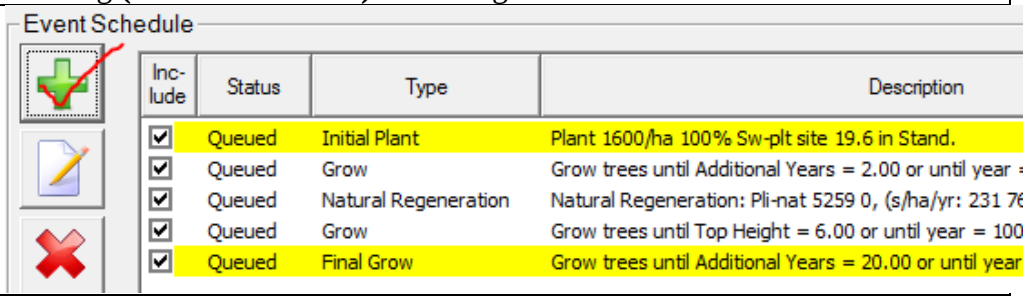
Note, reduced tree numbers in the **Natural Regeneration** event description reflect first-year mortality.

15. Change the **Grow Event** definition as noted and click **OK**.

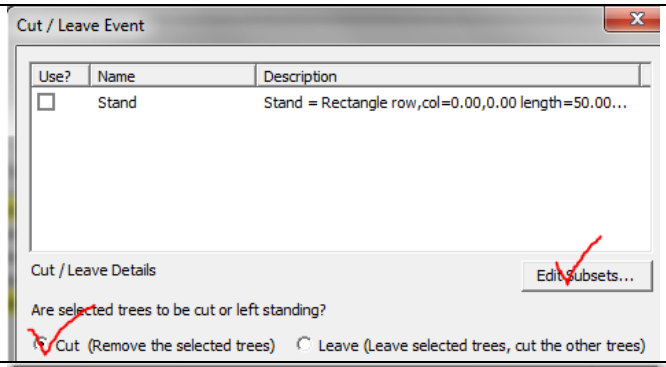


These parameters reflect the timing specified for the pre-commercial thinning **(Cut/Leave Event)** in this regime.

16. Click the add button and select **Cut/Leave** from the pop-up **Event** menu.



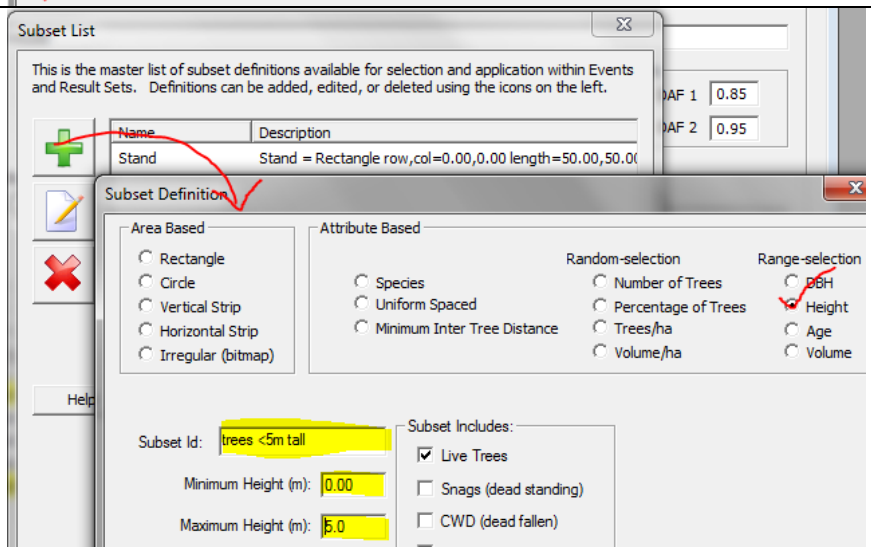
17. Select the **Cut** option then click the **Edit Subsets** button to open the **Subset Master List** form.



A **Subset** must be defined to select the trees meeting the thinning (cut) criteria.

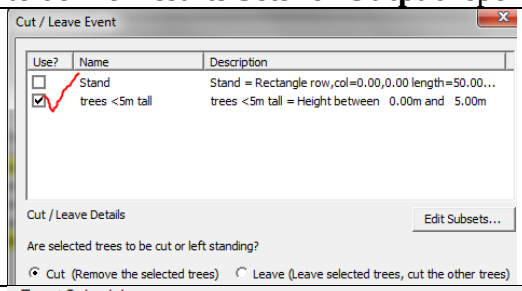
The **Cut** option cuts all the trees defined by the **Subset**.

18. Click the Add button to open the **Subset Definition** form. Select the **Height range** option and edit the highlighted settings. Then click **OK** twice to return to the **Cut/Leave Event** form.



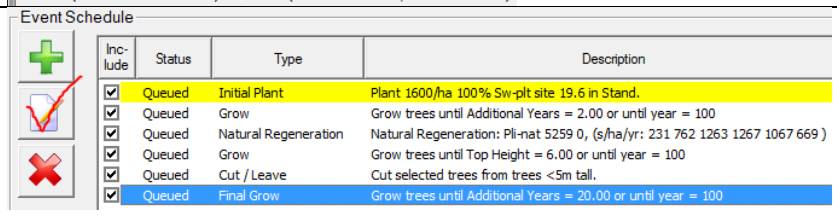
The **Subset ID** provides a unique name for this **Subset** for later reference. Also note the many other **Subsets** options available. **Subsets** are a powerful tool for mimicking silviculture treatments in **TASS III**. They are also used to define **Results Sets** for **Output** reporting.

19. Select only the new **Subset** then click **OK** to return to the **Event Schedule**.

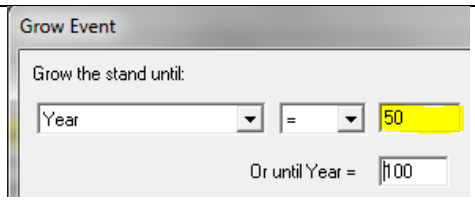


This completes the definition of the **Cut/Leave Event**.

20. Select the **Final Grow Event** and click the **Edit** button to open the **Grow Event** settings.

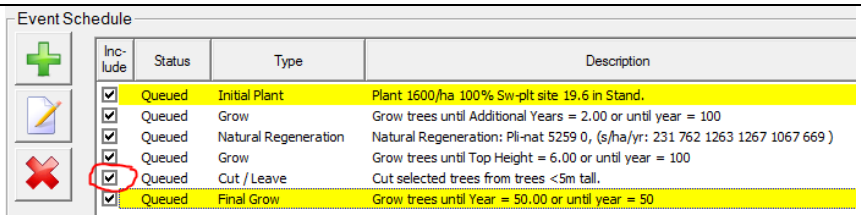


21. Change the grow parameters to **Year = 50** and click OK to return to **Stand Manager**.



Final Grow Event parameters are set to meet or exceed the anticipated rotation length or desired reporting period.

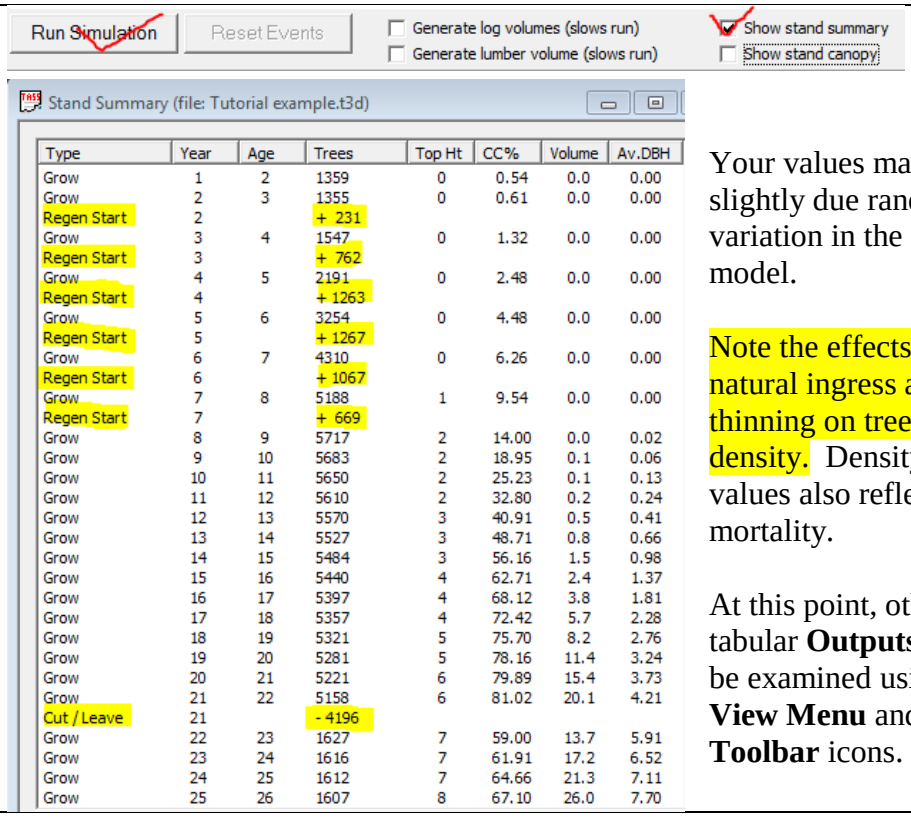
22. This completes the **Event Schedule** for the demo.



Note, with all the **Include** boxes checked, this **Event Schedule** will simulate the thinned **Regime**. By unchecking the **Cut/Leave Event**, the schedule can be re-run to simulate the unthinned **Regime**.

23. Check **Show stand summary** and uncheck **Show stand canopy**, then click **Run Simulation** to simulate the thinned regime….

24. After the simulation completes, to graph the results click **View** in **Main Menu** and select **Export to PLOTSY**.

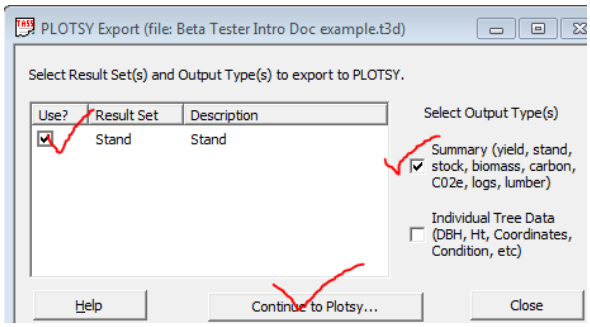
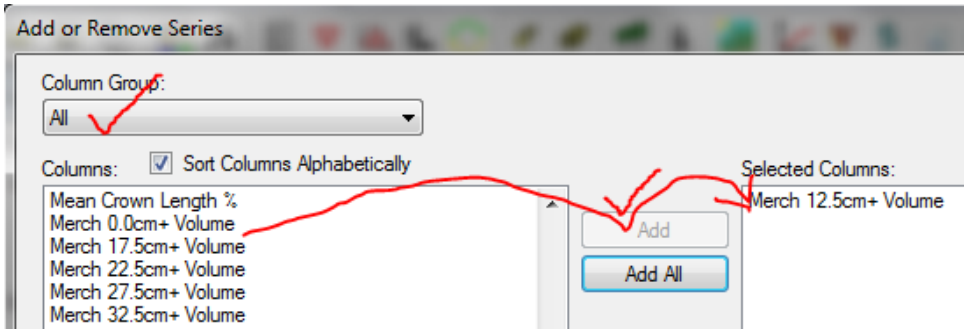
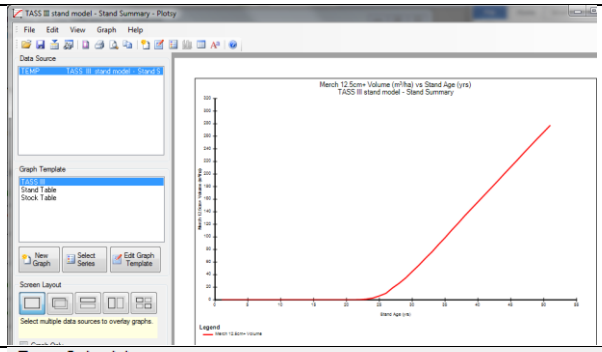
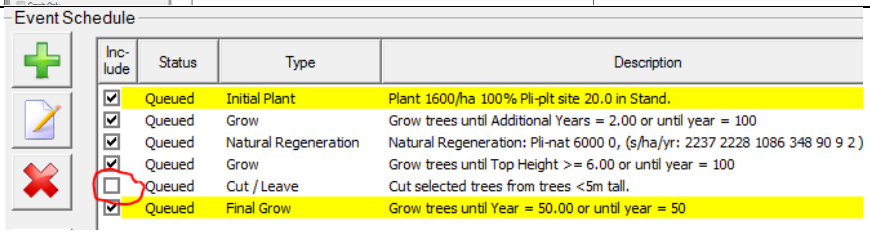


Type	Year	Age	Trees	Top Ht	CC%	Volume	Av.DBH
Grow	1	2	1359	0	0.54	0.0	0.00
Grow	2	3	1355	0	0.61	0.0	0.00
Regen Start	2		+ 231				
Grow	3	4	1547	0	1.32	0.0	0.00
Regen Start	3		+ 762				
Grow	4	5	2191	0	2.48	0.0	0.00
Regen Start	4		+ 1263				
Grow	5	6	3254	0	4.48	0.0	0.00
Regen Start	5		+ 1267				
Grow	6	7	4310	0	6.26	0.0	0.00
Regen Start	6		+ 1067				
Grow	7	8	5188	1	9.54	0.0	0.00
Regen Start	7		+ 669				
Grow	8	9	5717	2	14.00	0.0	0.02
Grow	9	10	5683	2	18.95	0.1	0.06
Grow	10	11	5650	2	25.23	0.1	0.13
Grow	11	12	5610	2	32.80	0.2	0.24
Grow	12	13	5570	3	40.91	0.5	0.41
Grow	13	14	5527	3	48.71	0.8	0.66
Grow	14	15	5484	3	56.16	1.5	0.98
Grow	15	16	5440	4	62.71	2.4	1.37
Grow	16	17	5397	4	68.12	3.8	1.81
Grow	17	18	5357	4	72.42	5.7	2.28
Grow	18	19	5321	5	75.70	8.2	2.76
Grow	19	20	5281	5	78.16	11.4	3.24
Grow	20	21	5221	6	79.89	15.4	3.73
Grow	21	22	5158	6	81.02	20.1	4.21
Cut / Leave	21		- 4196				
Grow	22	23	1627	7	59.00	13.7	5.91
Grow	23	24	1616	7	61.91	17.2	6.52
Grow	24	25	1612	7	64.66	21.3	7.11
Grow	25	26	1607	8	67.10	26.0	7.70

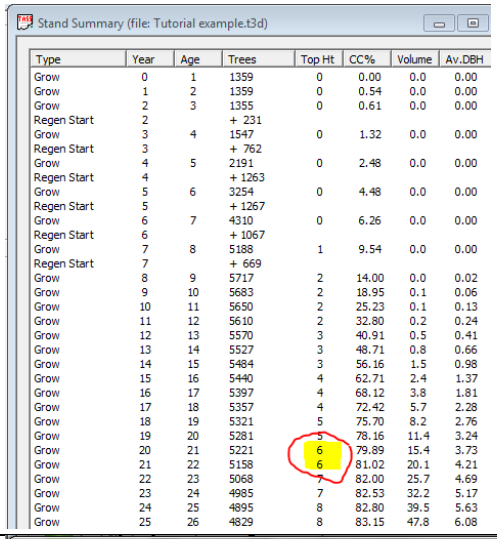
Your values may vary slightly due random variation in the model.

Note the effects of natural ingress and thinning on tree density. Density values also reflect mortality.

At this point, other tabular **Outputs** can be examined using the **View Menu** and **Toolbar** icons.

25. Select the default **Stand Result Set** and select **Summary Output** to be sent to **PLOTSY**. Then click **Continue to Plotsy…** to open **Plotsy's Add or Remove Series** form.	 This sends stand-level (per-hectare) results to **PLOTSY** for plotting. You may continue to **PLOTSY** without Log and Lumber data.
26. Scroll down the variable list on the left and select **Merch 12.5cm+ Volume** then click the **Add** button in the middle to move the variable over to the list on the right. Then click OK to view the graph in **PLOTSY**.	
27. After viewing the graph, leave **PLOTSY** open and return to **TASS III**.	
28. Below the **Event Schedule**, click **Reset Events**. Then uncheck the **Cut/Leave Event.**	 Note, the **Event Schedule** is now configured for the unthinned regime.

29. Again, check **Show stand summary** and uncheck **Show stand canopy**, then click **Run Simulation**. Wait for the simulation to complete, then click **View** in TASS III's **Main Menu** and select **Export to PLOTSY**.



Type	Year	Age	Trees	Top Ht	CC%	Volume	Av.DBH
Grow	0	1	1359	0	0.00	0.0	0.00
Grow	1	2	1359	0	0.54	0.0	0.00
Grow	2	3	1355	0	0.61	0.0	0.00
Regen Start	2		+ 231				
Grow	3	4	1547	0	1.32	0.0	0.00
Regen Start	3		+ 762				
Grow	4	5	2191	0	2.48	0.0	0.00
Regen Start	4		+ 1263				
Grow	5	6	3254	0	4.48	0.0	0.00
Regen Start	5		+ 1267				
Grow	6	7	4310	0	6.26	0.0	0.00
Regen Start	6		+ 1067				
Grow	7	8	5188	1	9.54	0.0	0.00
Regen Start	7		+ 669				
Grow	8	9	5717	2	14.00	0.0	0.02
Grow	9	10	5683	2	18.95	0.1	0.06
Grow	10	11	5650	2	25.23	0.1	0.13
Grow	11	12	5610	2	32.80	0.2	0.24
Grow	12	13	5570	3	40.91	0.5	0.41
Grow	13	14	5527	3	48.71	0.8	0.66
Grow	14	15	5484	3	56.16	1.5	0.98
Grow	15	16	5440	4	62.71	2.4	1.37
Grow	16	17	5397	4	68.12	3.8	1.81
Grow	17	18	5357	4	72.42	5.7	2.28
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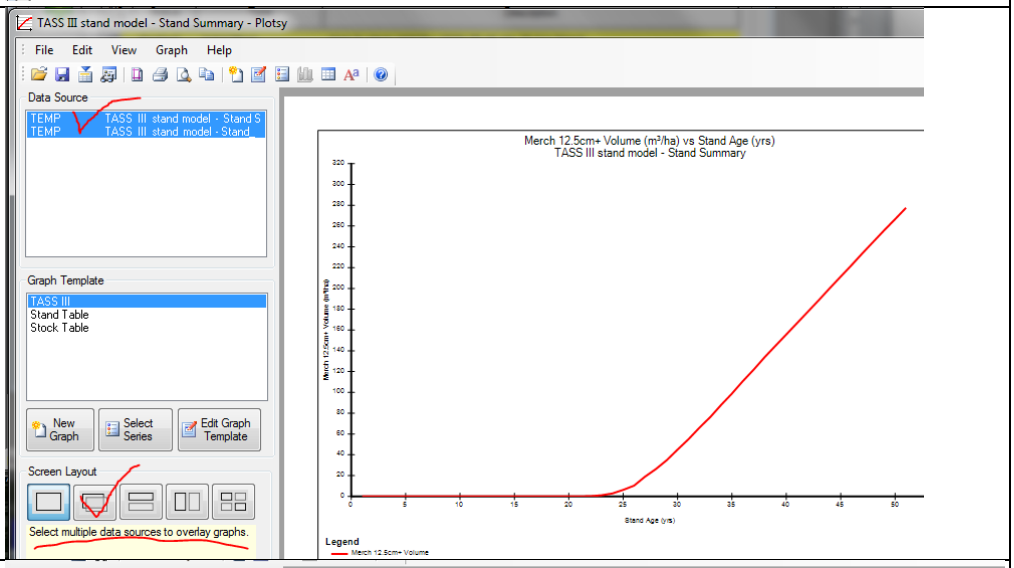
Grow	19	20	5281	5	78.16	11.4	3.24
Grow	20	21	5221	6	79.89	15.4	3.73
Grow	21	22	5158	6	81.02	20.1	4.21
Grow	22	23	5068	7	82.00	25.7	4.69
Grow	23	24	4985	7	82.53	32.2	5.17
Grow	24	25	4895	8	82.80	39.5	5.63
Grow	25	26	4829	8	83.15	47.8	6.08

Note, there was no thinning at 6m this time.

This run also took nearly twice as long due to the larger number of trees being simulated without the thinning.

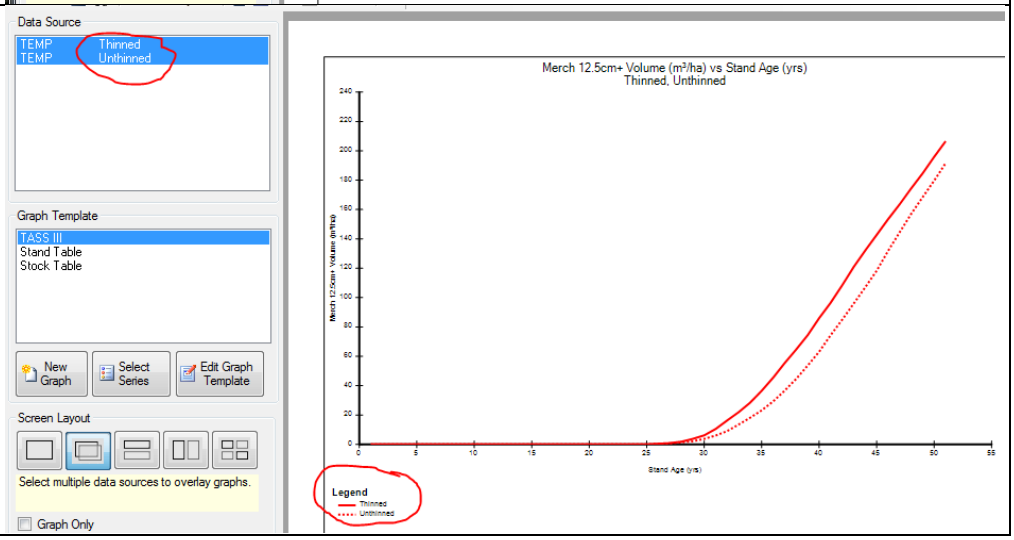
30. Repeat steps 25 & 26 to produce another graph in **PLOTSY**.

Next, select (highlight) both **Data Sources** and click the indicated **Screen Layout** button to overlay both regimes on the same graph.



31. In the graph to the right, the solid line is the thinned, and the dotted line is unthinned.

Line labels can be renamed by right-clicking the individual **Data Source** listings.



The File-Save commands in TASS III and PLOTSY save the settings used to (re)create the simulations and graphs. TASS III and PLOTSY settings are saved as **.T3D** and **.GPH** files, respectively.

Conclusion

This concludes this brief overview and demonstration of **TASS III**. We encourage you to further explore the interface on your own, as time allows. Your valued feedback will help us improve **TASS III**. Thank you.