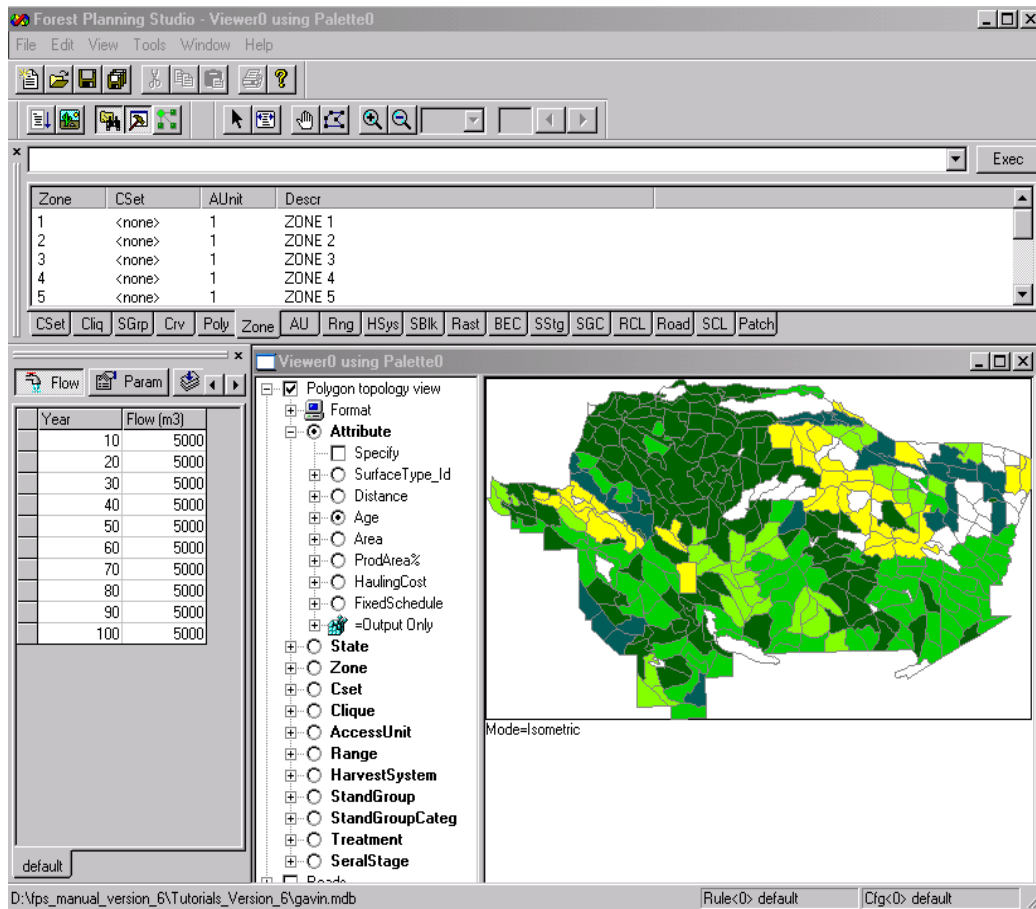# FPS Tutorials 1 - 8

FOREST PLANNING STUDIO
ATLAS 6.0.2.0
TUTORIAL MANUAL

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Introduction

This manual provides some basic examples of the Forest Planning Studio (FPS) – Atlas Program. These tutorials are nested and hierarchical so that each tutorial prepares the user for the next. More specific and detailed explanations of FPS are available in the FPS-ATLAS manual. The manual and the FPS program are available at no cost on the FRST 424 website of the ATLAS FTP site.

Downloading FPS-ATALS from the FRST 424 Web Page (Recommended)

i. System Requirements

FPS requires the following software and system specifications.
- Windows 2000, Windows XP, or later
- Microsoft Access 2000 or later

ii. Connect to the FRST 424 webpage at UBC http://sfmtutorials.forestry.ubc.ca/fps-atlas . Choose the Modelling tab and select ATLAS Model Documentation and Tutorials.

iii. Under the heading FPS-ATLAS FILES, download "*FPS-ATLAS Install Program Files (Zipped)*" to a temporary folder (e.g. D:\tmp) This download is named *Giz May 06.zip*

Note: Do not place this file way down in the folder structure (e.g. C:\mystuff\junk\morejunk\junkagain\...\etc.). However do NOT put this file on your desktop (this will sometimes cause it to be unable to run).

iv. Unzip this file using the unzip to folder option and you will get the following structure:
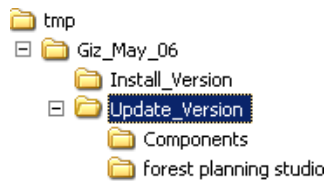
v. Open the *Install_Version* folder and run **Setup.exe** to install FPS. It will install the program in the folder *Program Files(x86)\Forest Planning Studio* and a subfolder called *Components.*

vi. Now move to the *Update_Version* folder. Copy the files in the subfolders (*Components* and *Forest Planning Studio)* and overwrite the files in the corresponding folders found in *Programs Files(x86)\Forest Planning Studio\Components.*

vii. From the webpage (http://sfmtutorials.forestry.ubc.ca/fps-atlas), download *FPS-ATLAS Tutorial Database (Gavin 2009)* to a working folder on your hard drive. This downloads the file *Gavin 2009.zip*. Unzip this file and you will have the *Gavin_2009.mdb.* You can open this file type in FPS.

viii. Start FPS (it is under the Forestry Applications Menu as Forest Planning Studio). A pop-up window will appear prompting you to *Select Palette Database.* Navigate to *Program Files(x86)/Forest Planning Studio* and select the file *Palette.mdb.* Close the program and then restart it. FPS will now use this palette file each time it is opened.

ix. The final set in setting up FPS-ATLAS is creating a file to be used as the default directory. In your C-drive create a folder called *atlas*, under this folder create a subfolder called *runs*. This will allow you to conduct many different simulations in FPS without filling your hard drives with extra unneeded information. You will be given further instructions on this in the following tutorials.

The file *Gavin_2009.mdb* is a Microsoft Access database of the Gavin Lake area of the Alex Fraser Research Forest (AFRF) and is used in these training tutorials.

The file *Palette.mdb* is a Microsoft Access database that controls the viewing options within FPS-ATLAS (e.g. map colors and legends). If the palette location is not set FPS-ATLAS will not be able to correctly show the map. If FPS is unable to render the map always check that the palette location is set. This can be done by going to *tools* and then *choose palette location.* Every time you change the palette location you will have to restart the program.

Starting FPS-ATLAS on the UBC Forestry Lab Computers

i. On your User drive, create a folder called *atlas*, and under *atlas* create another folder called *runs* (eg. U:\atlas\runs).

ii. From the webpage (http://sfmtutorials.forestry.ubc.ca/fps-atlas), download *FPS-ATLAS Tutorial Database (Gavin 2009)* to a working folder on your hard drive. This downloads the file *Gavin 2009.zip*. Unzip this file and you will have the *Gavin_2009.mdb*. You can open this file type in FPS.

iii. Start FPS (it is under the Forestry Applications Menu as Forest Planning Studio). Under tools, choose palette location. Select the file *Palette.mdb* in U:\atlas. Close the program and then restart it. FPS will now use this palette file each time it is opened (you will have to do this the first time you run FPS on a different computer in the lab).

iv. The final set in setting up FPS-ATLAS is creating a file to be used as the default directory. In your C-drive create a folder called *atlas*, under this folder create a subfolder called *runs*. This will allow you to conduct many different simulations in FPS without filling your hard drives with extra unneeded information. You will be given further instructions on this in the following tutorials.

The file *Gavin_2009.mdb* is a Microsoft Access database for the Gavin lake block of the Alex Fraser Research Forest and is used in the training tutorials.

The file *Palette.mdb* is a Microsoft Access database that controls the viewing options within FPS-ATLAS (e.g. map colors and legends). If the palette location is not set FPS-ATLAS will not be able to correctly show the map. If FPS is unable to render the map always check that the palette location is set. This can be done by going to *tools* and then *choose palette location.* Every time you change the palette location you will have to restart the program.

Tutorial 1. Open a Database for Work with FPS

1.1 Create a working file

FFP Automatically saves changes to the *.mdb* file as you work. The advantage of this design is that current edits are never lost, the disadvantage is that the original file is not retained. It is therefore important that create and work off a working file rather than the original.

    1.1.1.   In *Windows Explorer* create a folder named *atlas* to save your FPS work into (this may have been completed during the installation steps). Save (or move) the file *Gavin_2009.mdb* to this folder. To create a working file, make a copy of *Gavin_2009.mdb* and rename is *GavinTut.mdb*. **Note:** It is important to always retain an unedited copy of the original database. This is true for these tutorials and any other work done in FPS.

    1.1.2.   To back-up your work at the end of each tutorial, zip the working file (eg. *GavinTut.zip*). You can continue to work from *GavinTut.mdb*, but if for some reason you need a back-up, just unzip the *GavinTut.zip* file.

1.2 Open Forest Planning Studio

    1.2.1.   You will likely need to create a shortcut on your desktop to *FPS.exe*. *FPS.exe* is located in *C:\Program Files\ Forest Planning Studio*. Once the shortcut is established, double click on the shortcut to open the FPS Program.

    1.2.2.   If you are prompted to to *Select Palette Database.* Navigate to *Program Files(x86)/Forest Planning Studio* and select the file *Palette.mdb.* Close the program and then restart it. FPS will now use this palette file each time it is opened. This step may have been completed in the installation steps.

    1.2.3.   The FPS window should appear as shown below.
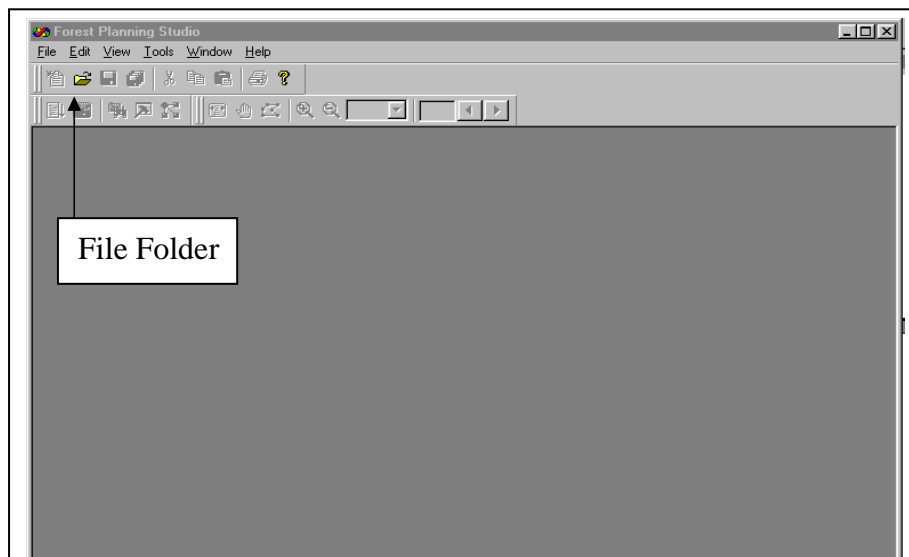
Figure 1: FPS opening window.

1.3 Load an Existing FPS Database

1.3.1. Click on the *File* menu and select *Open*.

1.3.2. Browse for the file *GavinTut.mdb* and open it.
Note: You will not have all the files shown in the below image.
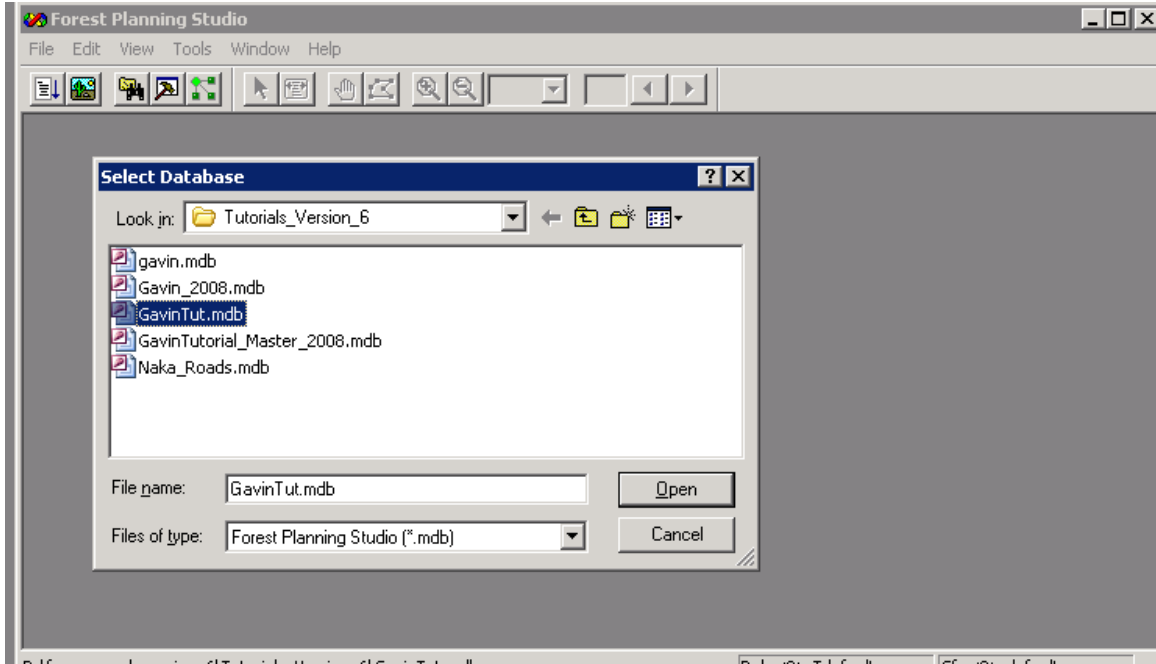
Figure 2: Selecting a database to open

1.3.3. Below is a description of the FPS toolbar icons. These toolbars are used regularly so it is helpful to become familiar with the icon names and functions. If you hover your mouse above and icon the name will appear. FPS likes to put the word *Toggle* in front of some names. These have been removed from the below diagram and will not be used when referencing an icon.
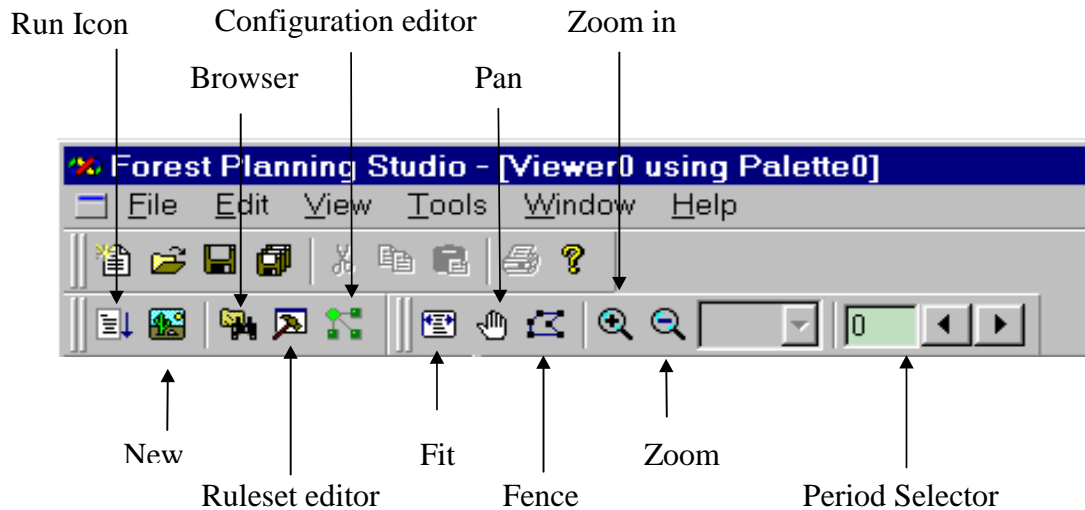
Figure 3: FPS toolbar icons, layout and names.

1.4 Managing the Ruleset, Browser and Configuration windows.

Once you have opened a database you will find three windows open within FPS. The default location of these windows is:

- Browser: Right hand side of the screen
- Ruleset: Right hand side of the screen
- Configuration: at the bottom of the screen

These windows can be moved where ever you like. To dock a window to a different location, just drag and drop to the desired location.

Note: You should only have these windows open when you need them, instead use the Toolbar icons to open and close them as needed (Figure 3). Try to not maximize these windows. Maximizing will tend to cover up the other windows that you have neglected to close. This often ends with results seemingly not showing up when in fact they are being hidden. In FPS it is easiest to keep your workspace clean to prevent problems.

1.4.1. Close and open the Browser, Ruleset and configuration windows using the Toolbar icon until you are sure you know the different icon and windows apart.

1.5 Viewing a Map of the Database

1.5.1. To view a map of the database, click on the *New Viewer* icon (Figure 3) (it looks like a little cactus in the desert).
Note: Do not maximize the Viewer window. Maximizing the window will tend to cover up other windows that you have neglected to close, resulting in a mess that will come back to bite you. Always close the Viewer window when it is not needed.

The information presented in the *Viewer* depends on the *Viewer* settings from the settings used in the previous FPS session.
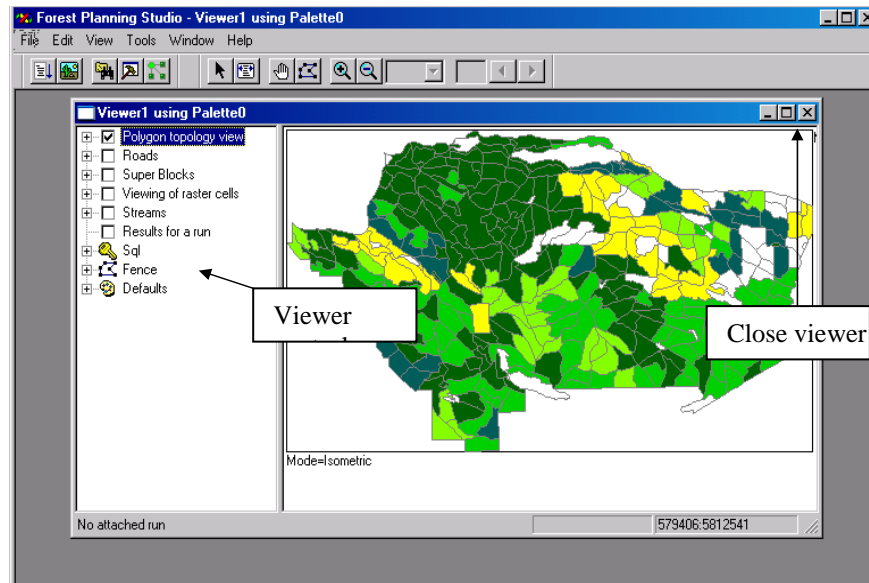
Figure 4: FPS viewer window

1.5.2   Check the current settings. These are indicated by checkmarks in the *Viewer Control* that is located on the left side of the viewer window.

1.5.3   In the *Viewer Control*, click on the box adjacent to the *Polygon topology view* (this box should now be checked, and you should be able to see the outline of the different polygons).

1.5.4   Expand the *Polygon topology view* by clicking the + to the left of the checkbox. Continue to select, by clicking the radio buttons.

1.5.5   Click the *Attribute* radio button. Expand the *Attribute* tab and find the sub-attribute *Age* and click the radio button. The *Map Viewer* should now be displaying the age-class of each polygon. **Note:** The colors that are used automatically are controlled by the palette file that was selected earlier. A different palette file may have different colors.

Continue exploring different views that are available in the *Viewer* until you are comfortable navigating through the *Viewer control* and you start to understand what data is available to view.

Note: This database does not have roads, superblock, raster cells, or streams. Trying to view these features will not change the image in the *Viewer*.

1.5.6   Close the *Viewer* by clicking the **X** at the top right corner of the viewer.

End of tutorial 1.

Tutorial 2. Harvest Simulation

FPS simulates spatially explicit harvest scenarios based on target harvest levels and harvest priorities (found in the *Flow & Parameters* tab in the *Ruleset* window). And user-defined harvest constraints (found in the *Cset* tab in the *Browser* window).

This tutorial describes the first of these two basic procedures (i.e. *Flows & Parameters*).

2.1 Schedule a Harvest Flow

2.1.1.   Open the *Ruleset* window. The *Ruleset* window should appear (Figure 5).

Rulesets contain user-defined harvest flow targets and run parameters such as harvest priorities for age or distance and switches for superblocks. It also provides an interface to set criteria for edge and interior forest calculations. Different *Rulesets* can be created and saved. Each *Ruleset* is tabbed at the bottom. In the figure below only, the default *Ruleset* is shown. We will be creating new *Ruleset* in this and the following tutorials.

1.1.2   Create a new *Ruleset*. Right-click inside the *Ruleset* window and select *New Rule Set* from the drop-down menu.
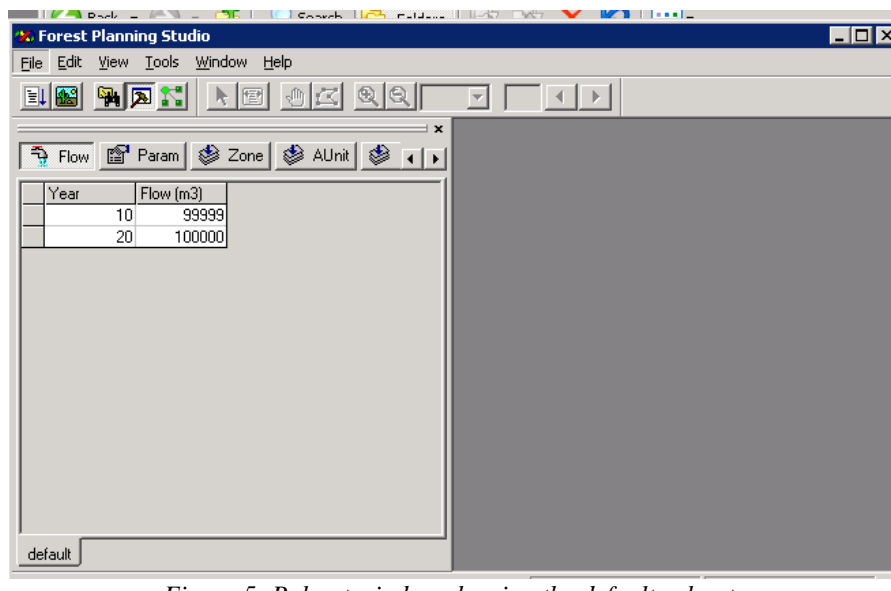
Figure 5: Ruleset window showing the default ruleset.

1.1.3   The *Forest Planning Studio – Create new Record* window should appear (Figure 6).

1.1.4   Enter the name *Crash* in the *Description* and *Abbrev* boxes. Select OK to save the new *Ruleset.* **Note:** The name entered in *Description* box is the long name of what you are calling the *Ruleset.* What is entered into the *Abbrev* box is what appears as the tab at the bottom of the *Ruleset* window. For this reason, the *Abbrev* box has a small character limit.
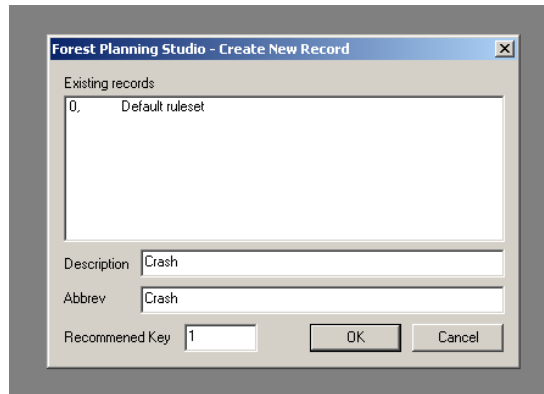
Figure 6: Box for creating a new Ruleset

2.1.5   In the *Viewer* window ensure that the *Crash* tab is selected.

2.1.6   Select the *Flow* tab from the *Ruleset* window.

2.1.7   Highlight the *Year* or *Flow* box within the *Flow* window with the cursor. While the box is highlighted depress the *Ctrl + Down arrow* to create a row.
         Note: Once a row has been created it cannot be deleted.

2.1.8   In the first row of the *Flows* tab enter *Year* 10 and a *Flow* of 200 000m^3.
         Note: The value entered into the *Flow* column represents the total volume that FPS will attempt to harvest during the time period. For example with this set up FPS will attempt to harvest 200 000m^3 in the first 10 years of harvesting.
         It is also important to understand that FPS will always harvest the *Flow* amount in the last year of the period. This is important in understanding how FPS assigns ages to the harvested polygon.

2.1.9   With the cursor in the *Ruleset* window, right-click and select the *Configure Flows* option. This will bring up the *Configure Planning Horizon* window (Figure 7).
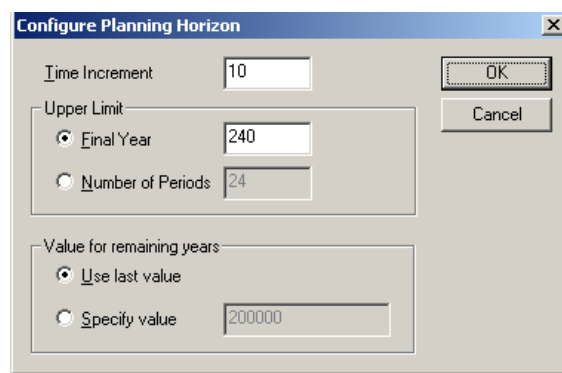
Figure 7: Configure Planning Horizon window used to configure the flows over the length of a planning horizon.

2.1.10   In the *Time Increment* box, enter 10 (if not already displayed). By setting the value to 10 FPS will try to harvest the *Flow* amount every ten years. If you wanted to understand the amount that could be harvested every year you could set this value to 1 and adjust the flows accordingly.

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However, since most landscape level plans work on large time scales 10 is typically a good starting number.

2.1.11   To finish setting up the *Configure Planning Horizon* window set a *Final Year* of 240 and click the radio button to *Use last Value* to fill in the *Flows* of 200 000m^3. These values tell FPS how long the planning horizon will be and how much to attempt to harvest during each period.

2.1.12   Click OK. The *Year* and *Flow* should now be filled in for the entire planning horizon.

2.1.13   Select the *Parameters (Param)* tab. Set:

- *Default extra sort* to 0-none
- *Default sort* to 1-Age
- Leave the boxes unmarked
- *Edge Contrast* as 6-old scraps and 1-regen/shrub
- *Edge Depth* to 100m
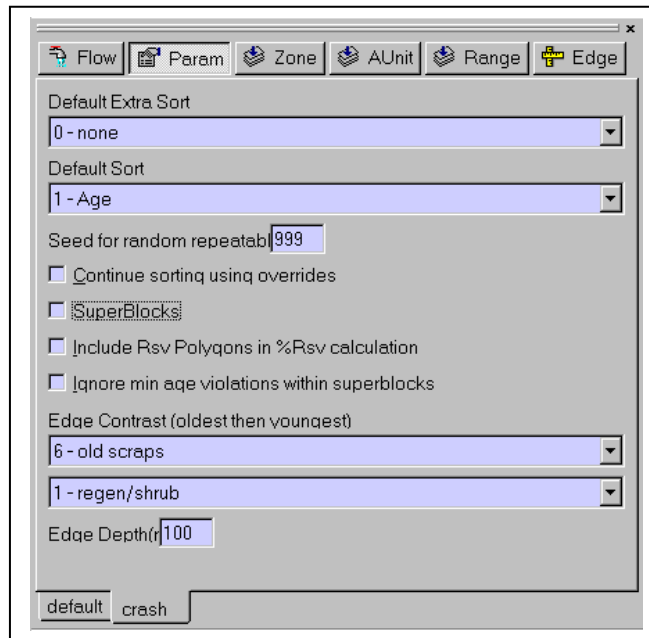
Figure 8: Example setting in the parameter window for crash ruleset.

2.1.14   Check that the remaining tabs in the *Ruleset* window (i.e. *Zone, AUnit, Range, Edge*) are empty. The exception is the *AgeClass* tab which will have values, leave these as is.

2.1.15   Close the *Ruleset* window by toggling it off with the *Toolbar* or by clicking the x in the top right corner.

2.2 Module Configuration

The *Configurations* window contains the modules that will be run during each planning period. Think of the modules as the information that FPS will be able to supply after a harvesting simulation has been run. There are numerous modules that can be added, but adding more modules increases computing time and power needed. Therefor only include the modules that are necessary.

2.2.1 Edit the Configurations

2.2.1.1 Select the *Configuration* icon. The default *Configuration* window should be similar to Figure 9. The check marks indicate the modules that are active. To activate or deactivate a module, uncheck the box to the left of the module names. Any changes made are automatically saved.
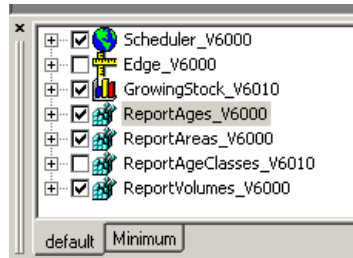
Figure 9:Configuration window with active and inactive module shown

2.2.2 Create a new Configuration

2.2.2.1 With the cursor within the *Configuration* window, right-click and select *New Configuration* from the drop-down menu.

2.2.2.2 Enter *Minimum* in the *Description* and *Abbreviation (Abbrev)* windows. Select OK. The *Minimum* Configuration should appear as a tab at the bottom of the *Configuration* window.

2.2.2.3 Ensure that the *Minimum* tab is selected.

2.2.2.4 With the cursor in the *Minimum* configuration window right-click. From the drop-down menu select *Append*. The *Select FPS Components to add to the current configuration* window should appear as in Figure 10.
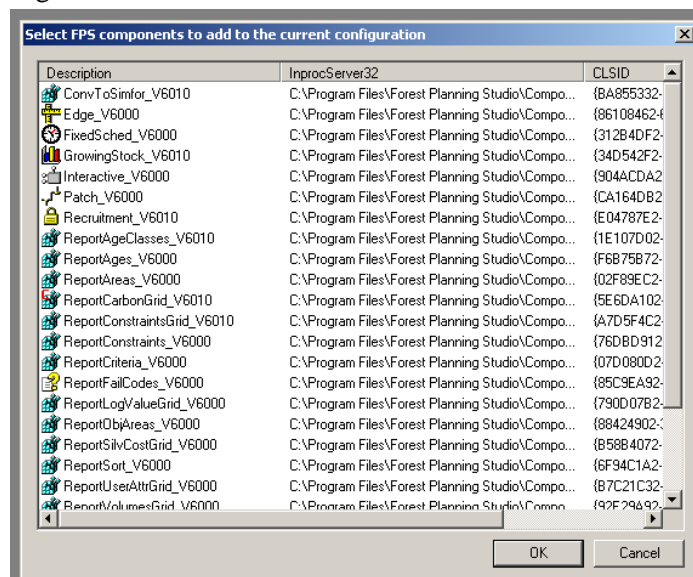
Figure 10: FPS components to add to current configuration window

2.2.2.5 Highlight the *Scheduler_V6000* module with a left-click. Select OK. The *Scheduler_V6000* module should now be displayed in the *Minimum* configuration window. Repeat this step to include:
- *Report Ages*
- *Report Areas*
- *Report Volumes*
- *Report Growing stock*

Note: Multiple modules can be added at once by holding the *Ctrl* key while selecting additional modules.

2.2.2.6 You may now close the *Configuration* window.

2.3   Apply a Treatment

We are now going to apply a clearcut treatment to *Stand Groups:*
- *1-Fir*
- *2-PL/S*
- *3-Decid.*

2.3.1   From the *Toolbar* select the *Browser* icon.

2.3.2   Select the *SGrp* tab at the bottom. There will be all 6 stand groups in the database shown here. The *Browser* window should appear as shown in Figure 11.
Note: Other databases may have many more stand groups. But all stand groups will always be shown here.
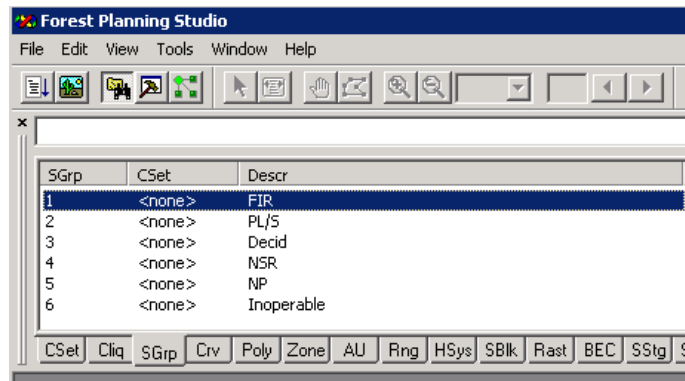
Figure 11: Browser window showing the stand groups in the database

2.3.3   Select stand group *1-Fir* by double clicking. The *Stand Group(1)* box will appear.
Note: the 1 in this window's heading denotes number designated to the stand group in the *SGrp* column.
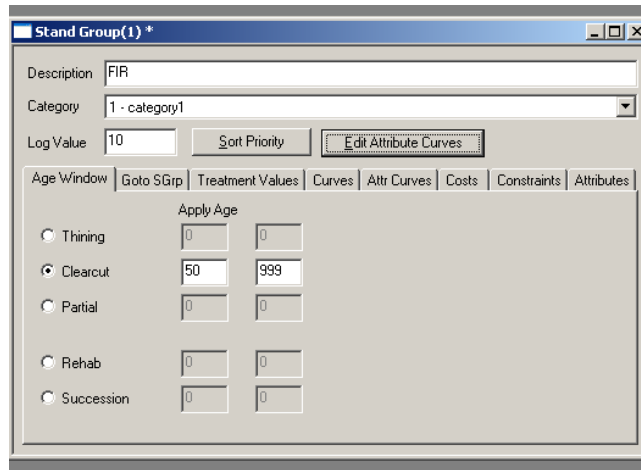
*Figure 12: Stand group window where different treatments
may be added to each stand group.*

2.3.4   Click the *Clearcut* treatment radio button.

2.3.5   Enter a Minimum value of 50 and a Maximum value of 999. These values define the minimum
and maximum ages when the treatment is allowed. In this case any polygon that is Fir and older
than 50 years old will be available for harvesting.

2.3.6   Close the *Stand Group (1)* window by clicking the x in the top right corner.

2.3.7   Accept the changes to Stand group 1-Fir.
Note: The Stand Group windows will be used again extensively in upcoming tutorials and
reviewed in detail in tutorial 7.

2.3.8   Repeat steps 2.3.3 through 2.3.7 for stand groups 2-Pl/S and 3-Decid.

2.3.9   Close the *Browser* window.

2.4 Initiate a Run

2.4.1   To initiate a run, click the *Run* icon in the *Toolbar*. A window the same as Figure 13 should
appear.
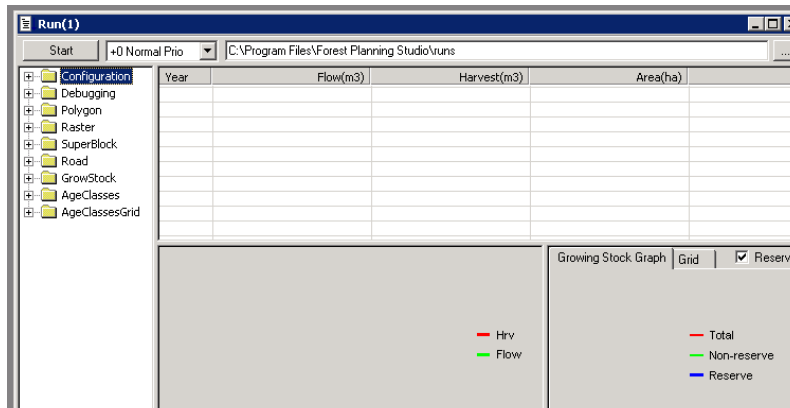
Figure 13: Run window

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2.4.2   Click the *Start* button.

The simulation should have produced a harvest schedule of *Flow, Harvest* and *Area* values similar to Figure 14. Understanding Figure 14 takes a little explaining. The *year* column denotes the year of harvesting and the *Flow* column is the target flows. These two columns are the user inputs assigned is step 2.1. The *Harvest* column shows how close FPS was able to get those targets flows (it the actual amount that FPS is harvesting in each time period) and the *Area* column shows the hectares harvested to get that volume.

Notice that the *Flow* target are achieved through the first 18 planning periods (first 180 years) but decline raidly beyond that point.

 Figure 14 also shows a graphic representation of how well FPS was able to achieve the targets in the bottom right corner. This graph is simply the *Year* on the x-axis, *Volume* on the y-axis and has the *Flow* (green) and *Harvest* (Red) from the spreadsheet directly above. This figure allows the user to easily see if the *Flow* was achievable and to identify large dips or drops in the harvestable amount of wood.

The final graphic in Figure 14 is the Growing Stock located in the bottom left corner. Growing Stock is a measured as the total volume, regardless of age (i.e. merchantable and non-merchantable). The growing stock is divided into two parts: Reserve (this is not harvestable and will be discussed in later tutorials) (Blue) and the Non-Reserve (available for harvest) (Green). These two parts are summed to form the total (Red). It is important to notice how the growing stock and the harvesting levels are related. The drop and eventual leveling of the Non-reserve growing stock corresponds with the crash in the harvest volumes. This occurs because there isn't sufficient timber available for harvest to support the target *Flow*.
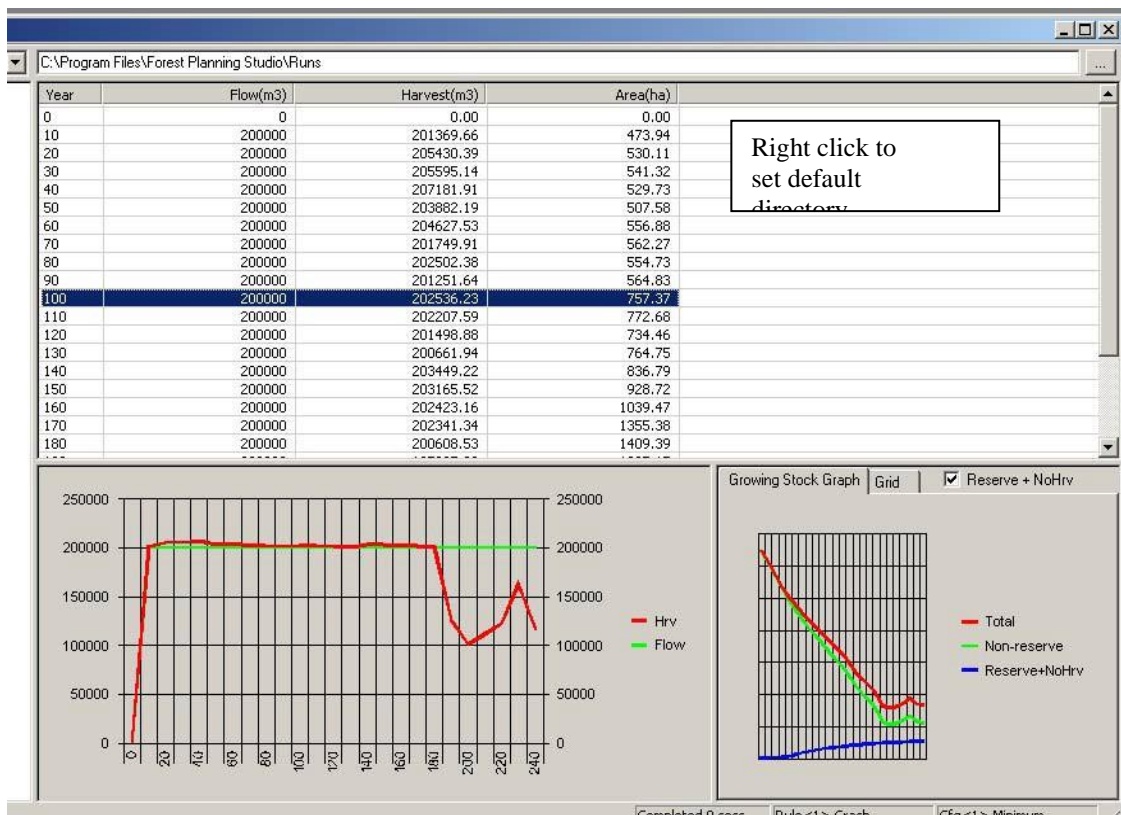
Figure 14: Outputs from starting a harvest run in FPS.

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The results from *Runs* are saved automatically, in Figure 14 they are being saved to *C:\Program Files\Forest Planning Studio\runs*.

Note: If a default folder is not created and set up every run will produce a new folder. This is both confusing and waste space on your computer.

> 2.4.3 Set a new default directory by changing the save location at the top of the *Run* window. Click the … button next to the save location and browse to the folder *runs* that was created in the installation step ix (if you missed this step please go back and create these folders).
>
> 2.4.4 Once the save location has been saved right-click anywhere in the *Run* window and select *Save Directory as Default.*

Now all output files will go to this location. Each run conducted will overwrite the files from the previous run. This is okay because previous runs can be easily replicated. Additionally, this saves space on the hard drive. This is especially important if you are working off a laptop or your computer has limited storage.

> 2.4.5 To view the results of a run in more detail, double click on a value in the *Year* column and select *Polygon* from the down-down menu.

This will bring up a table (Figure 15) allowing you to see the attributes of each polygon for each period in the harvesting simulation. Using the arrows next to the *Period* box (top left), cycles through the planning periods. This allows for the observation of how the attributes of each polygon change over the planning horizon

Figure 15: Detailed results about each polygon after running a simulation.

> 2.4.6 To view the results from a run spatial in the *Map Viewer* open the *Map Viewer* window.
>
> 2.4.7 Highlight any *Year* in the *Run* window, click, drag and then drop this value into the *Map Viewer* window. The *Period Selector* (Figure 3) should become activated.
>
> 2.4.8 In the *Viewer* legend, click on the box adjacent to the *Polygon topology* view to expand the legend. Expand both the *Attributes* and *Age* categories and ensure that the radio buttons next to each is checked. The *Map Viewer* should now be displaying the age-classes of each polygon (Figure 16). The legend showing which color corresponds to each age-class should also be displayed in the *Viewer Control* legend.
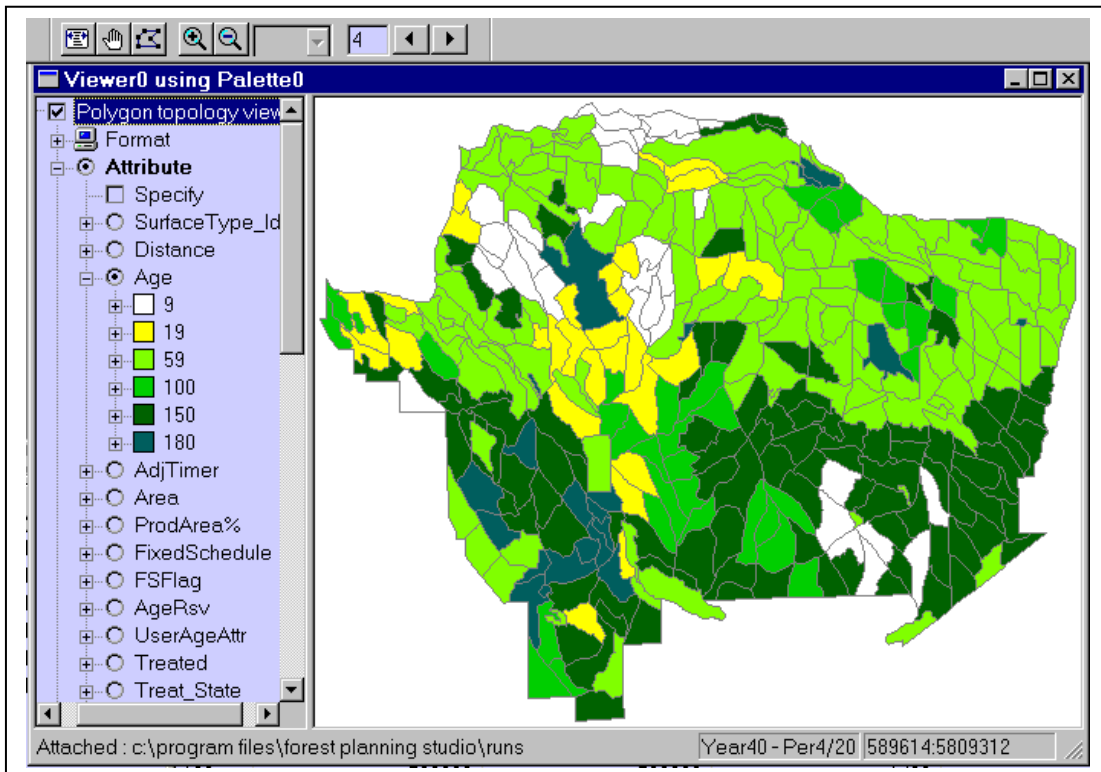
Figure 16: Map viewer showing the ages of polygons at age 40.

2.4.9   Use the *Period Selector* to cycle through the different periods in the planning horizon to observe how the polygons age.

It is possible to display the ages (in numbers) on each polygon by expanding the *Format* tree at the top of the *Viewer Control.* Next expand the tree next to *Text* and select *Value* (Figure 17).
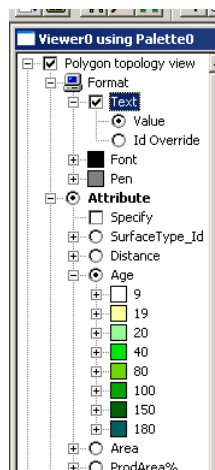
Figure 17: Viewer control tree showing how to get
age values as text on the Map Viewer.

2.5 Find the Maximum Harvest Volume

In previous example, the *Flow* targets were not achieved throughout the entire planning horizon (Figure 14). This section the *Flows* will be modified so that the target is met in all periods. There is an infinite number of ways of doing this, so guidelines are needed.

In this scenario we want to maximize the harvest in the early periods and gradually drop down to a sustained yield. Further, the drop in harvest from one period to the next cannot exceed 10% and the *Harvest Volume* is to never drop below the target *Flows*.
Note: the *Flows* could also be called the long run sustained yield (LRSY).

    2.5.1   Create another *RuleSet* named *Conv + LRSY*
              Note: When FPS creates a new *RuleSet* it will automatically be assigned a number. These numbers are assigned in sequence so this new *RuleSet* will be assigned number 2.

Note: When a new *RuleSet* is created **none** of the parameters of the previous *RuleSet* is transferred in to the new one. The desired parameters must be entered for each new *RuleSet*.

    2.5.2   Set up this new *RuleSet* to be the same as the previous *RuleSet* (*Crash*). This includes setting the values in the *Parameters* tab, setting *SGrp* 1-Fir, 2-PL/S and 3-Decid to clearcut starting at age 50.

The harvest *Flows* in Table 1 were derived by trial and error and represent one possible solution to the above restrictions to the harvest schedule. Trial and error was done by playing with the first 3-5 periods until the worked and then moved on to the later periods. The first periods were then readjusted until a solution was found.

Table 1: One example of Flows that reach the constraints outline in section 2.5

Year	Flow(m3)	Harvest(m3)	Area
10	200,000	201,370	474
20	195,000	195,815	505
30	190,000	199,048	523
40	188,000	188,438	482
50	186,000	187,776	463
60	185,000	191,146	495
70	185,000	190,846	529
80	185,000	187,986	504
90	185,000	185,790	496
100	185,000	186,147	561
110	185,000	190,441	671
120	185,000	191,200	686
130	185,000	191,506	641
140	185,000	186,805	644
150	185,000	188,667	672
160	185,000	189,600	726
170	185,000	188,482	753
180	185,000	186,657	826
190	185,000	189,527	958
200	185,000	185,553	899
210	185,000	188,004	927
220	185,000	187,193	1,043
230	185,000	185,709	1,204
240	185,000	185,868	1,624

2.5.3   In order to understand the trial and error process, try to find a different solution than the one in the Table 1.

Note: Setting harvest flows to the nearest 1000m^3 is sufficient for this tutorial. Although there may be other situations where the *Flows* need to be more specific.

2.5.4   Set the *Flows* in *Conv + LRSY* to match Table 1.

2.5.5   *Run* the model. The results should be similar to those in Figure 18.
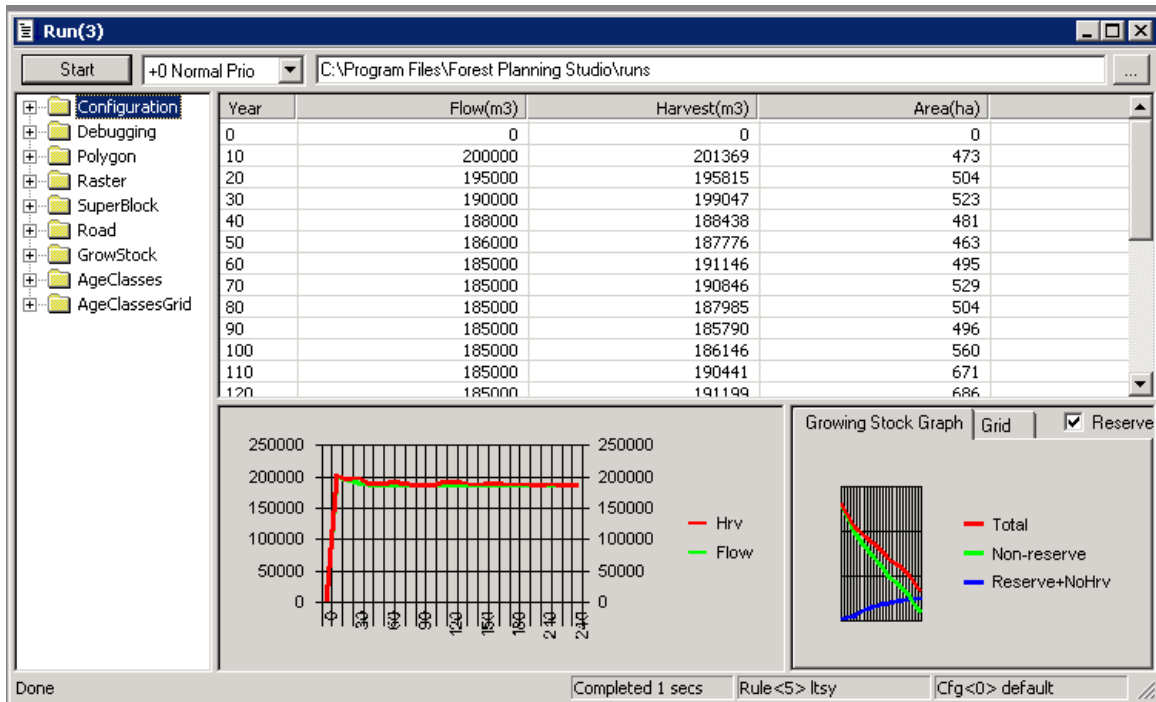
Figure 18: Results from running a Maximum harvest scenario in FPS.

Note: The growing stock graph is very similar to the previous harvesting simulation (Figure 14). They are decreasing rapidly, but have not hit the bottom.

2.5.6   Change the *Flows* so that the simulation runs for another 100 years at 185 000m^3/decade (e.g. years 240-340 at 185 000m^3/decade).

Question:
What happens in this new simulation?
How does this result relate to the growing stock graph from the previous simulation (Figure 18).

Alternate Solution to Maximum Harvesting Scenario

Figure 19 is an alternate solution to the scenario outlined in section 2.5 following the same objectives (maximize early harvest, maximum of 10% between periods and always harvest more than the target flows). This solution was run for 340 years (not 240) and the LRSY is lower over the 340 years than the previous solution.

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Run(6)

Start | +0 Normal Prio | C:\Program Files\Forest Planning Studio\Runs

- Configuration
- Debugging
- Polygon
- Raster
- SuperBlock
- Road
- GrowStock

Year	Flow(m3)	Harvest(m3)	Area(ha)
0	0	0.00	0.00
10	260000	262713.09	835.05
20	250000	252811.41	834.19
30	240000	249127.42	846.21
40	230000	233084.91	1011.38
50	220000	221436.03	753.91
60	210000	215762.88	1171.97
70	200000	200116.06	1118.15
80	120000	121463.25	935.47
90	120000	127661.73	1077.21
100	120000	121379.57	848.32
110	120000	120488.59	1141.55
120	120000	121565.90	1101.90
130	120000	122244.30	1021.14
140	120000	124414.78	1107.29
150	120000	123782.71	913.65
160	120000	120488.59	1141.55
170	120000	120349.10	1101.90

Growing Stock Graph | Grid | ☑ Reserve + NoHrv

— Hrv
— Flow

— Total
— Non-re
— Reser

Done | Completed 1 secs | Rule<4> Alt Thurs Constr Cfg<1> Minim

Figure 19: Alternate solution to maximize harvest scenario over a 340 year planning horizon.

Note: The growing stock declines sharply at first and then at a slower rate. Ideally to prove that a *Flow* is really sustainable into future (and past the planning horizon) the grown stock should level. This gives more confidence that the LTSY has really been identified.

2.6 Calculating the LTSY vs Results from FPS (Supplemental)

This supplemental section links some basic conversion concepts to the harvest simulation with FPS.

Table 2 should the area (ha) in the Timber Harvest Landbase (THLB) and the Non-Timber Harvest Landbase (NTHLB) by age class.
Note: This data was gotten from the database (*Gavin_2009.mdb*) by doing an external query. Conducting external queries is not covered in these tutorials.

Table 2: Area in the THLB and the NTHLB by age class.

AgeCls	THLB	N-THLB
0-20	938.7	434.1
21-40	83.7	61.3
41-60	462.7	0.0
61-80	1,235.7	0.0
81-100	317.4	0.0
101-120	1,670.4	3.5
121-140	503.0	32.8
141-160	30.4	1.6
161-180	85.6	16.3
181-200	46.7	0.0
201-220	125.1	0.0
240+	260.6	0.0
Total	5,760.1	549.6

The information in Table 2 has been turned into a chart (Figure 20) to help show the differences between the THLB and NTHLB.

Initial Age-Class

Figure 20: Initial age class distribution and areas in the THLB and NTHLB.

An external query of the database shows that *Stand Groups* 1-Fir, 2-PL/S, and 3-Decid have *4005, 817 and 938 ha* in the THLB, respectively. If these are to be harvested at age *50 years*, the volume/ha cut is 118, 88 and 78 m3/ha, respectively. Therefore, our estimate of LTSY is 12,353 m3/yr or 123,530 m3/decade.

StandGroup_Id	SumOfArea (ha)	Ha/yr	m3/ha@ age 50	LTSY m3/yr
1	4,005.3	80.11	118	9,453
2	817.2	16.34	88	1,438
3	937.6	18.75	78	1,463
Total	5,760.1			12,353

Notice how close the value 123 530m³/decade is to the LTSY found in the alternate solution to Maximum harvest scenario is (planning horizon of 340).

2.7 Extreme Departure (Supplemental)

Another good starting point is to see how the forest behaves with an extreme departure scenario. An extreme departure scenario is where you set to model to harvest everything as soon as it is available. This is done by setting the harvest *Flow* higher than can ever be achieved (e.g. 2 000 000m³/decade). Figure 21 shows an example of what happens to the harvest amount when the *Flows* are set to 2 000 000m³/decade.

2.7.1 Create a new *RuleSet* called Max_Departure with these flows and *Age* as the harvest priority. Because of the initial age class distribution, there are still some stands that are harvested in between each 50 year peak.
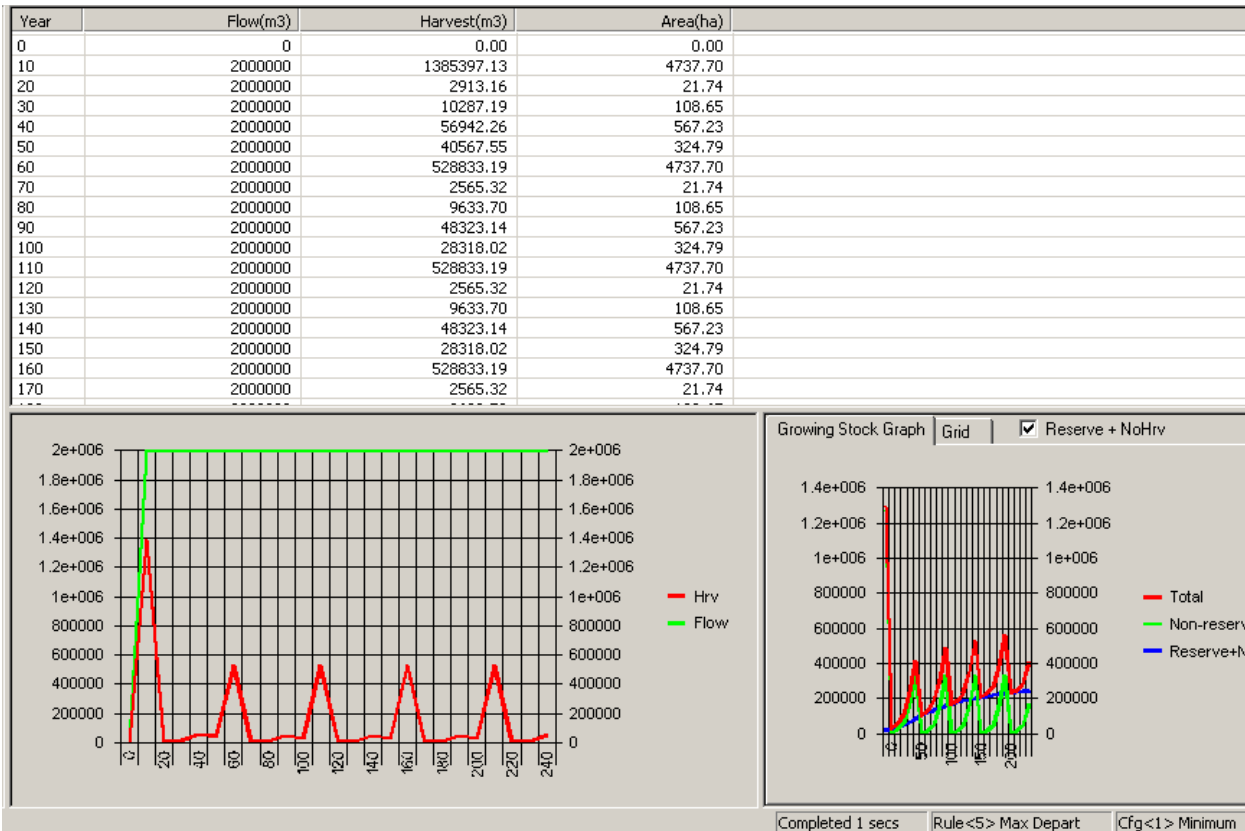
Year	Flow(m3)	Harvest(m3)	Area(ha)
0	0	0.00	0.00
10	2000000	1385397.13	4737.70
20	2000000	2913.16	21.74
30	2000000	10287.19	108.65
40	2000000	56942.26	567.23
50	2000000	40567.55	324.79
60	2000000	528833.19	4737.70
70	2000000	2565.32	21.74
80	2000000	9633.70	108.65
90	2000000	48323.14	567.23
100	2000000	28318.02	324.79
110	2000000	528833.19	4737.70
120	2000000	2565.32	21.74
130	2000000	9633.70	108.65
140	2000000	48323.14	567.23
150	2000000	28318.02	324.79
160	2000000	528833.19	4737.70
170	2000000	2565.32	21.74

Figure 21: Extreme departure scenario

Note: The growing stock is the inverse of the harvest. In periods of high harvest, the growing stock rapidly declines and in periods of low harvest, the growing stock increases rapidly.

At this point you should have the four *RuleSets* shown in figure 22.
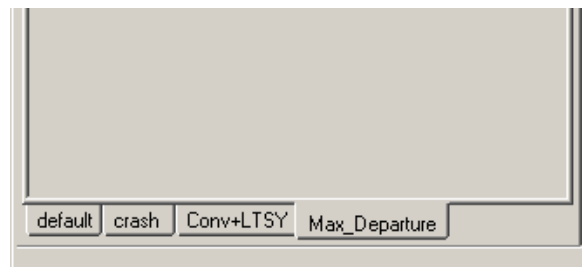
Figure 22: All of the RuleSets to have at the completion of Tutorial 2

If you want to re-run a pervious harvest scenario (*RuleSet*) just select the appropriate *RuleSet* tab in the *RuleSet Editor* window and run the model. This is how FPS allows us to create and compare multiple harvest scenarios from one database. This is also the reason why we do not need to save the output files every time we run the model.
Accessing other outputs and the output files will be discussed in a later tutorial.

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End of Tutorial 2

At this point you should exit FPS and zip your database (*GavinTut.zip*). This will be your backup in case you make a serious error in subsequent tutorials. Zipping the database a regular intervals is you best back up method.

Tutorial 3. Constraints and Harvest Parameters

Open the *GavinTut.mdb* database that was used at the end of Tutorial 2.

To model with FPS it is necessary to define the constraints (*CSets*) that will affect the harvesting scenario. In tutorial 2 harvesting was scheduled without any constraints. However, in practice there are always estate and therefore it is necessary to define and apply a number of different *CSets*.

Further, one of the real values of forest-estate modeling is the opportunity to observe the consequences of various scenarios. Therefore, a variety of different *CSets* are create an applied to each area within the forest landbase.

This tutorial describes the basic procedures necessary to define these constraints.

3.1 Create a Constraint Set (*Cset*)

A *Constraint Set* (*CSet*) is a collection of management objectives that imposes restrictions on the ability for FPS to harvest polygons. FPS allows a number of *Constraints* to be identified and applies as a single set: The *Constraint Set*.

3.1.1   Select *File*, then *New*, then highlight *Constraint Set*, and the OK to accept the selection.

The *New Constraint Set* window should appear.

3.1.2   Check the *Disable Harvesting?* box. In the *Description* box type: *No Harvest.*

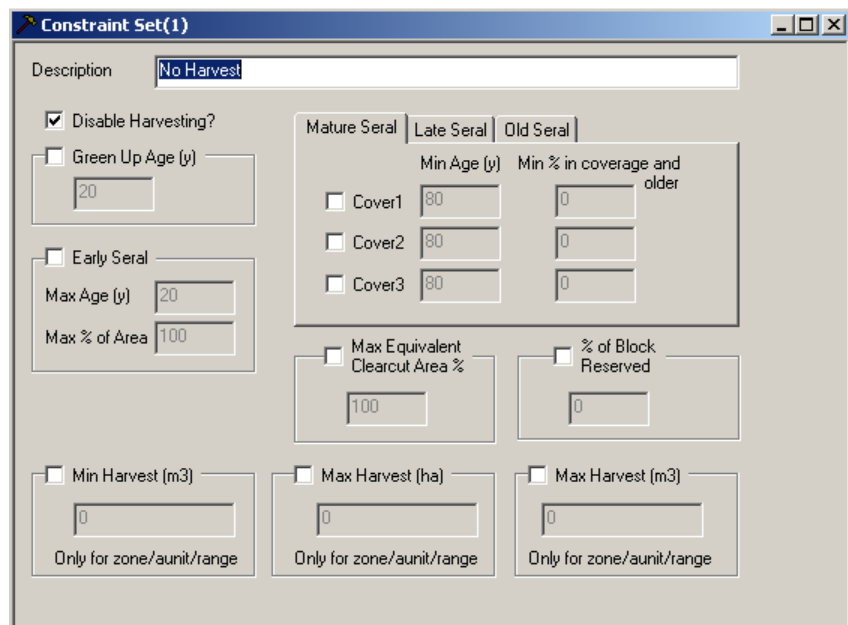The *Constraint Set* box should match Figure 23.

Figure 23: Constraint Set box set up to disable harvesting

3.1.3   To save the *No Harvest* constraint set, close the *New Constraint Set* window and accept the changes.

3.1.4   Select the *Browser* button, the *Browser* window should appear.

3.1.5   Select the *CSet* tab at the bottom of the *Browser* window. You will see the *No Harvest* Cset listed (Figure 24).
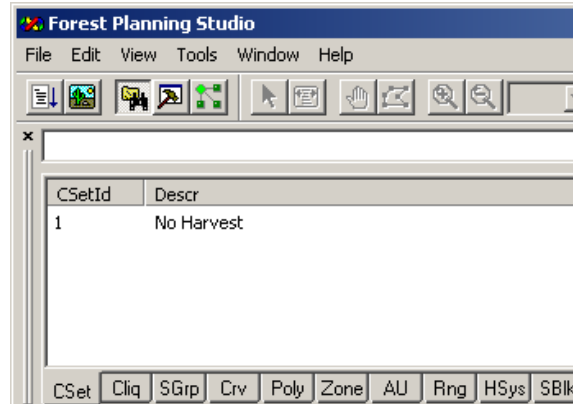**Note:** You may have to click the *Exec* icon or press *F5* key to refresh the window.

Figure 24: No Harvest CSet in the Browser window.

3.1.6   Now make a new *RuleSet* called *Conv+LTSY+RSV*.

3.1.7   Copy the *Flows* from the *RuleSet Conv+LTSY* and paste them into the new *RuleSet Conv+LTSY+RSV*.

3.1.8   Ensure that the harvest priority is set to Age in this new *RuleSet*.

These steps are the first steps in creating a new *RuleSet* that will use the *Flows* from *Conv+LTSY,* but it will be linked to the *No Harvest* constraint. *CSets* must be linked to a *RuleSet* to be active.

3.1.9   Close the *RuleSet* Window.

3.2 Apply the No Harvest Constraint Set (*Cset*)

Now that the *No Harvest* Cset has been defined it is necessary to apply it to a spatial unit. In FPS spatial units are:
- Cliques
- Zones
- Access Units
- Ranges

In this tutorial we will adding the *No Harvest* constraint on to a *Zone. CSets* can be added onto existing zones (or spatial units) or new zones (or spatial units).

3.2.1   Create a new *Zone,* select: *File, New, Zone, OK.* This will bring up the *New Zone* window (Figure 25).

3.2.2   Type *Reserve Zone* into the *Description.*
Note: This database already has two zones (Zone 1 – THLB and Zone 2 – NTHLB). This is why the new zone appears as zone 3.
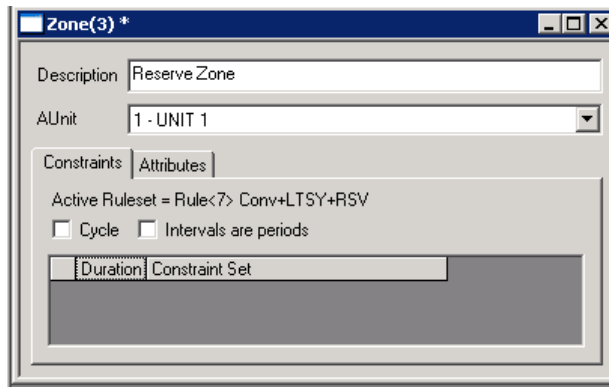
Figure 25: Creating a new Zone

3.2.3   Close the *New Zone* window and accept the changes.
Note: it is important to understand that even though a new zone has been created with have not assigned any polygons to be allocated into this zone yet. Polygons will be assigned to this zone in step 3.3.

3.2.4   In the *Browser* window, open the *Zone* tab. Double click on the *Reserve Zone* to open the *Zone* window.

3.2.5   Ensure that the *Constraints* tab is selected in the *Zone* window.

3.2.6   Click on *Duration* and then press *Ctrl + Down arrow*. This will create a new row and a drop down list of *Csets* (including the *No Harvest* constraint that was created in step 3.1) should appear (Figure 26).
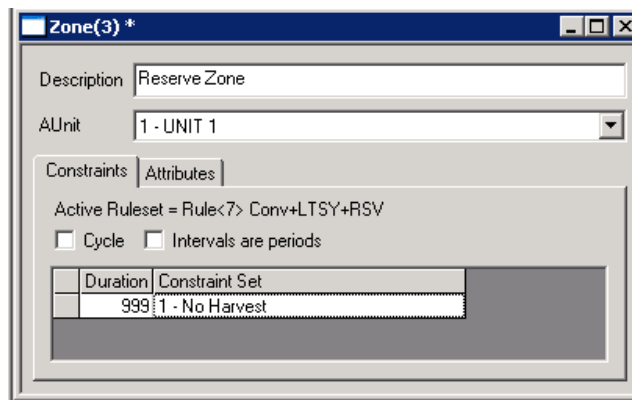
Figure 26: Adding a constraint onto a Zone

3.2.7   Select *No Harvest* from the list of *Csets*. This will apply this constraint to the *Reserve Zone*. As a default this constraint will be applied for 999 years.
Note: Although only one constraint is currently being applied. It is possible to have many constraints running for different times on each zone. This is important because it allows for complexity to be added to the model.

3.2.8   Accept the changes.

3.3 Define the Reserve Zone Spatially

This section will be defining the spatial unit that was created in step 3.2. The *Reserve Zone* has been created an a *No Harvest* constraint has been applied, now it is necessary to add polygons into this zone.

3.3.1   In the *Viewer Legend*, expand the *Polygon topology view* by pressing the + beside it. And the select *Zone* from the expanded list.

3.3.2   Expand the *Id* to view the *Zone* legend. *Reserve Zone* should be in this list.
Note: If the reserve zone is not visible you need to refresh the window by going to *Window* then *Refresh*, or by pressing F5. If the reserve zone is still not visible it was not created correctly and repeat the previous steps.

Polygons are the basic spatial element in FPS and can be assigned to different spatial units through a fencing operation, polygon edits or an SQL operation. This example will show a how to assign polygons with a fencing operation.

3.3.3   On the *Toolbar*, press the *Fence* icon (Figure 3). The cursor can now be used to "digitize" around polygons (i.e. fence) that you want to select in the *Viewer*.
Note: if any portion of a polygon is contained within the fence it will select the entire polygon.

3.3.4   Select the polygons located in the south-west portion of the map by drawing a fence around them (Figure 27) vertexes can be created through clicking. When you want to close the fence right-click.
Note: the polygon selection does not need to be perfect. However, any changes will cause there to be differences between your results and those provided in the tutorial. For this reason try to be as accurate as possible.
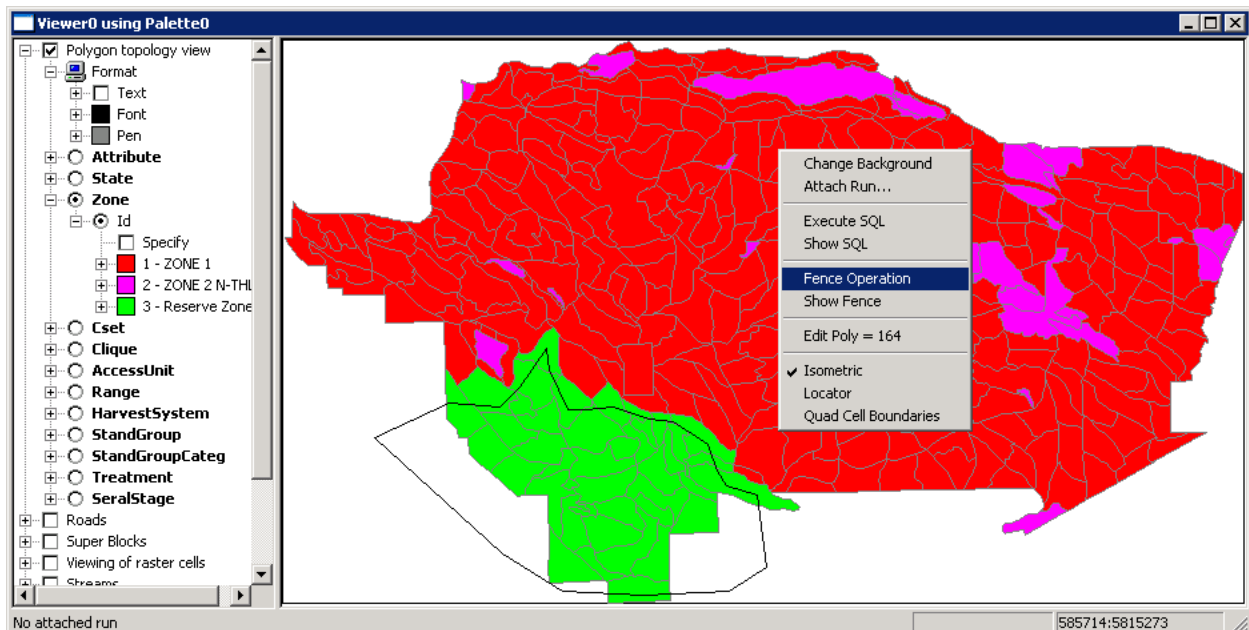

Figure 27: Fencing operation

3.3.5   With the cursor located anywhere in the *Viewer*, right click and select *Fence operation*. A dialogue box listing all of the selected polygons should appear (Figure 28).
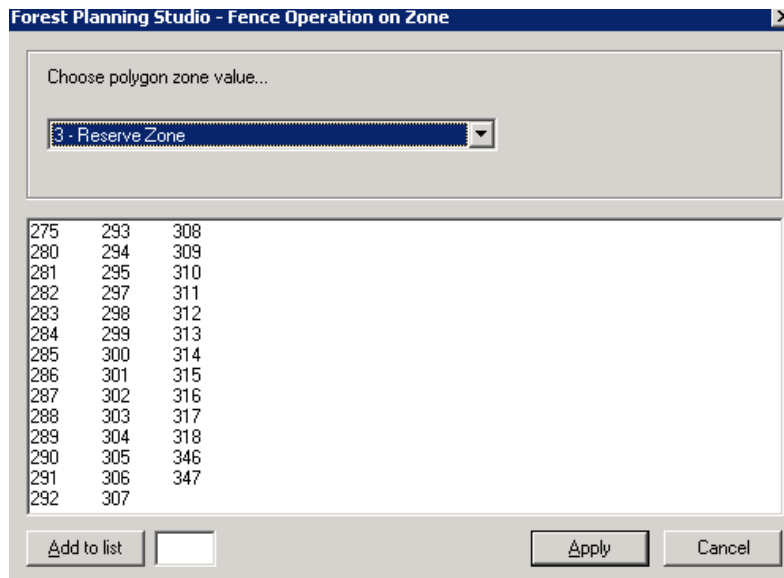
Figure 28: Dialogue box of the polygons selected during the fence operation.

This list can now be edited. Polygons can be added by typing in the polygon number and selecting *Add*, and polygons can be removed by highlighting the polygon number and pressing the *Delete* key on the keyboard.

3.3.6   Edit your list so that only those polygons listed below are included in your list.

3.3.7   In the *Fence Operation* window, select *3- Reserve Zone* from the drop down menu under *Choose polygon zone value*.

3.3.8   Click the apply button and answer *yes* on the next dialogue box.

Reserve Zone and its *No Harvest Cset* are now applies spatially and visible on the *Map Viewer.*

3.3.9   In the Viewer, select *Zone,* and you will now see the new reserve zone.
          Note: If you are unable to see it you may need to change the color it is being shown in. To do this right click on the colored icon next to the reserve zone and select edit. Change the color to something different.

Double checking that this new zone has the correct constraints can be done in the *Browser* window.

3.3.10   Select the *Zone* tab in the *Browser* window. The *Reserve Zone* should be visible and should have *Cset* 1 (No Harvest) applied (figure 29).

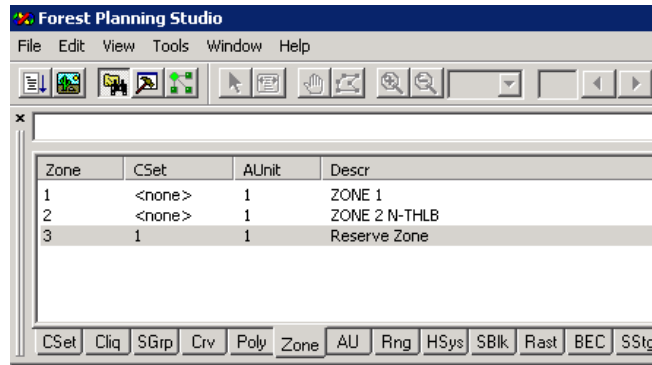3.3.11   Close the *Browser* window.

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Figure 29: Confirming that the constraints are applied to the correct zone.

3.4 Run the Scenario

Make sure that you are still in the Conv+LTSY+RSV RuleSet. FPS will now include the No Harvest Constraint for the Reserve Zone.

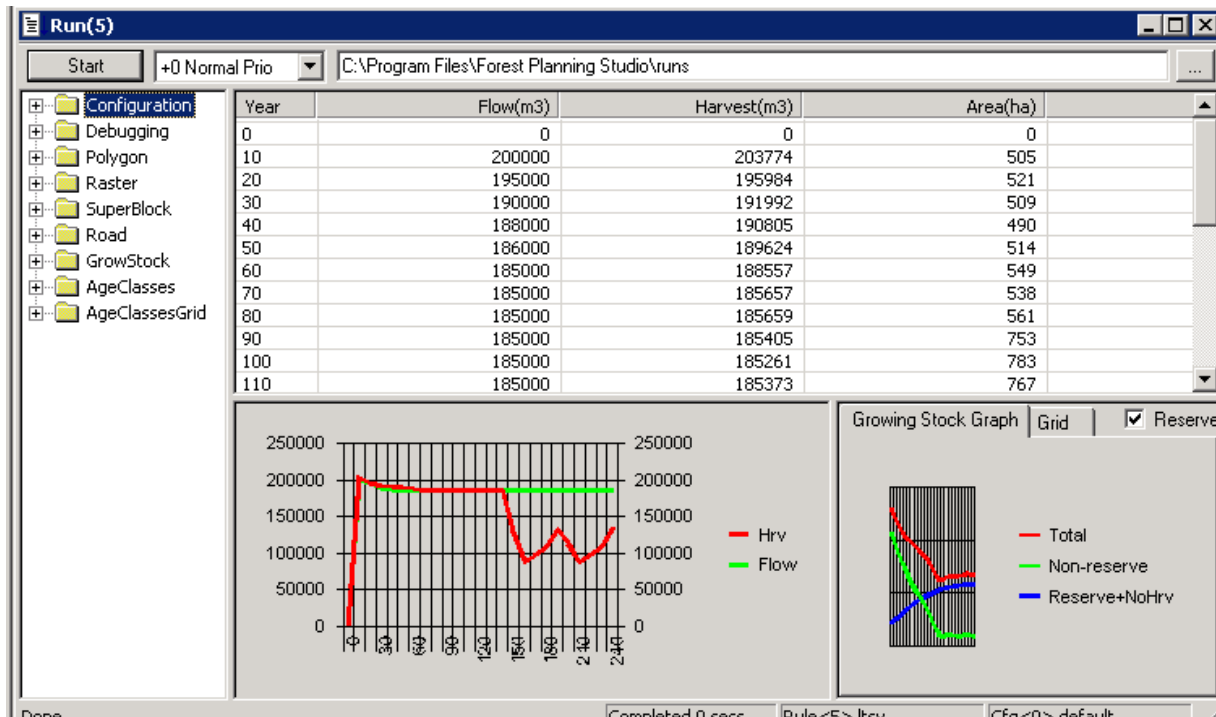3.4.1   Click the *Run* button. The harvest schedule should match figure 30.

Figure 30: Harvest schedule with a no harvest constraint on a reserve zone.

3.4.2   Open the Viewer and ensure that the polygons in the Reserve Zone are never harvested (they all grow older).

3.4.3   Now create a new *Ruleset* called *NewFlow+RSV*.

3.4.4   Be sure to set *Age* as the harvest priority and apply the *No Harvest CSet* to *the Reserve Zone*
        Note: recall that *Csets* are not automatically transferred to the new *Ruleset*. They must be manually linked each time a new *Ruleset* is create.

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3.4.5   Add the flow targets show in figure 31.

Note: the easiest way to do this is to copy the flows from the *Conv_LTSY+RSV Ruleset* and paste them into the new *Ruleset*.

The new harvest flows have been adjusted downwards to reflect the loss of the THLB caused by the reserve zone. This was done through trial and error (i.e. iteration) until the harvest flow objectives were met (transition to new LTSY).
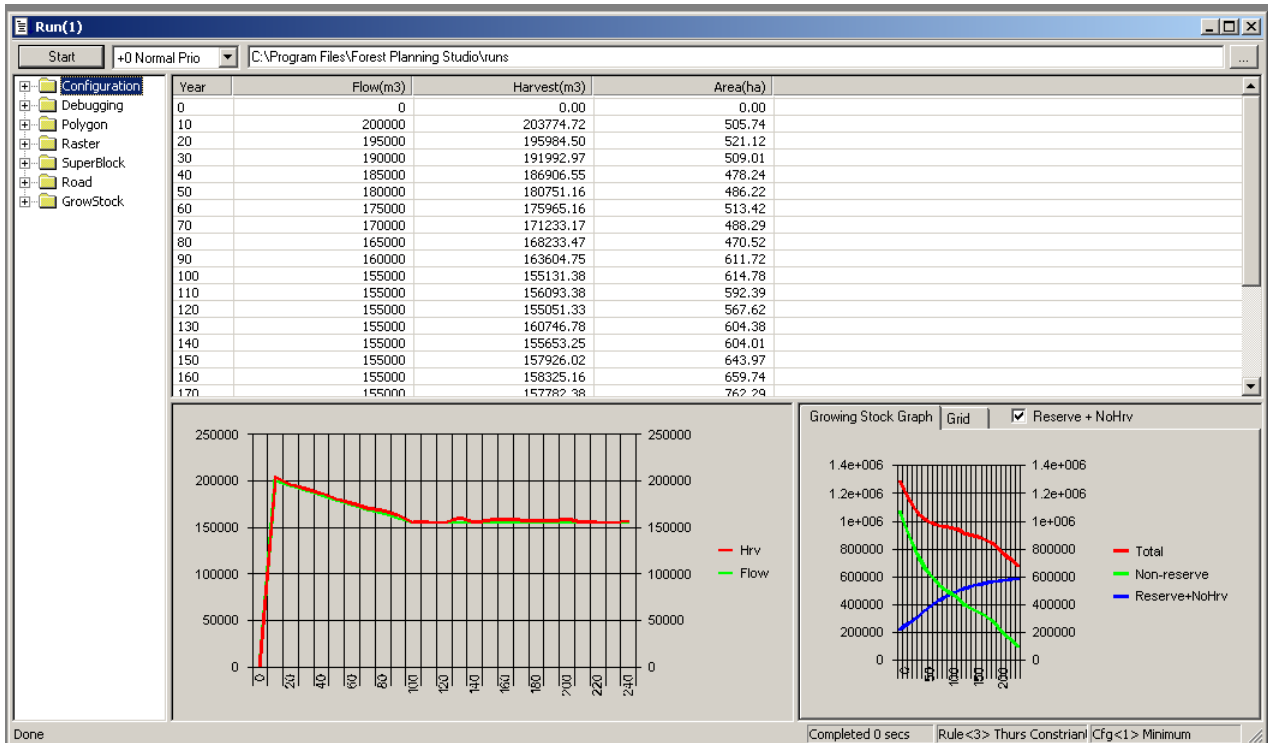
3.4.6   Close the *Ruleset* window.

Figure 31: Adjusted flows to account for the remove of the reserve zone from the THLB.

Notice the growing stock in figure 31. What happens if you run the simulation for 340 years?

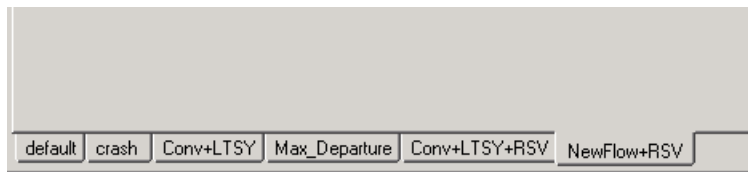3.4.7   Ensure that you currently have the *Rulesets* from figure 32 in your model.

Figure 32: Rulesets to have used by the end of tutorial 3.

3.5 Edit the Colour Palette

The following sets outline how to edit the color palette of the *Reserve zone* (or any other legend item).

First Method:

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3.5.1   Click on the colour box next to the components that you would like to change. A colour box will pop up on your screen and you can choose the colour you want.

3.5.2   Select *OK* to apply the changes.

Second Method:

3.5.3   Alternatively, right-click the components title.

3.5.4   Select *Edit*

3.5.5   Then select the colour and apply as in method 1.

We hope you are wondering what is going on with Zone 2 (N-THLB) and why we don't have a *No Harvest Cset* applied to it. The answer is that the polygons within this zone are permanently reserved using the *State* field (RSV) in the polygon window. There are a number of ways to reserve polygons from harvest, and this is one of them. You can observe the state field in the *Viewer Control* by clicking on the State button

End of Tutorial 3

Be sure to exit FPS and zip the database as a backup

Tutorial 4. Apply an Adjacency Constraint

Constraints can be applied at various spatial scales and FPS can accommodate these variations through its hierarchy of the spatial units. There are 4 mandatory spatial units:

- *Range*
- *Access Unit*
- *Zone*
- *Polygon*

In tutorial 3 the *No Harvest Cset* was applied to a *Zone*. This tutorial illustrates how different spatial constraints can be applied at various scales.

4.1 Create an Adjacency Constraint

4.1.1   Create a new *Ruleset* called *RSV+Adjacency*.

4.1.2   Set the harvest priority to *Age* and copy/paste the flows from the *Ruleset NewFlow+RSV*.

4.1.3   Open the *Zone* tab in the *Browser* window.

4.1.4   Double click on *Reserve Zone*, and add the *No Harvest Cset*. Save the *Zone.*

4.1.5   Using the menu *File\New\Constraint Set,* to create a new *Cset* that imposes a 20-year adjacency constraints (figure 33).

Figure 33: Creating an adjacency constraint.

4.1.6   In the *Description* box, enter *20-yr adjacency*. Check the *Green Up Age (y)* box and enter 20 in the box below it.

4.1.7   Save the *Cset* by closing and saving changes.

Applying the *20-yr adjacency* constraint to *Access Unit 1*.

4.1.8   Open the *Browser* and select the *Access Unit (AU)* tab. There should be a single *Access Unit (AUnit1)* listed and it should not have any *Csets* applied.

4.1.9   Double click on *AUnit1* to open it.

4.1.10   On the *constraints* tab, highlight *Duration* or *Constraint Set* and depress the *Ctrl + Down arrow* keys at the same time to add a new row.

4.1.11   Select the *20-yr adjacency Cset*.
            Note: The *20-year adjacency CSet* may not be immediately listed. If another *CSet* is listed double click on that *CSet* and a drop down menu should produce the *20-year adjacency CSet*.

4.1.12   Close the *AUnit1* window and accept the changes.

4.2 Run the Simulation

Figure 34 shows the harvest results from the *RSV+Adjacency Ruleset.*

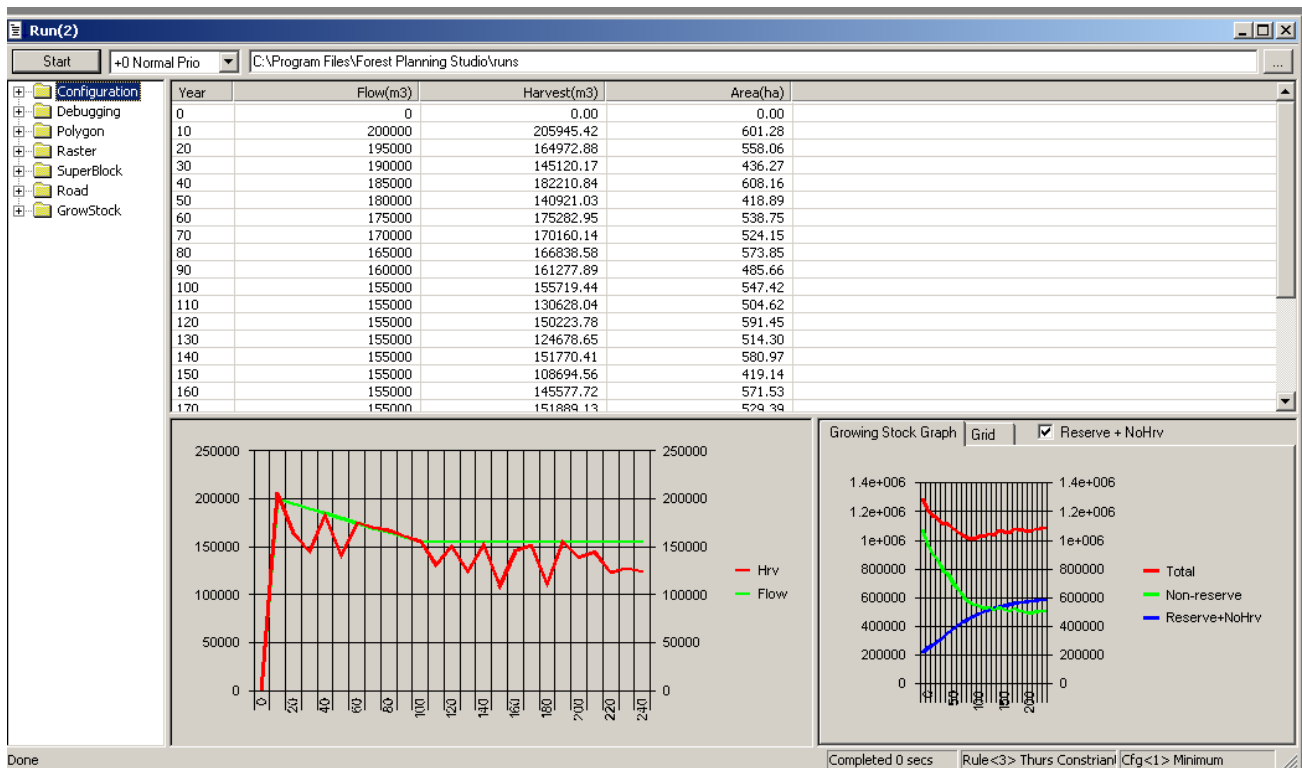*Figure 34: Harvest results from Ruleset RSV+Adjacency.*

Note: the "saw-tooth" pattern of the harvest (peak at ~20 years apart) is because of the 20-yr adjacency constraint. This is a classic pattern that develops when adjacency constraints are applied and the model struggles to meet the harvest flow targets.

4.2.1   Modify the *Flows* in the *Ruleset RSV+Adjacency* to match those in figure 35.

Note: These *Flows* are just one solution to smooth out harvest levels throughout the planning horizon. They were derived by trial and error and accommodate the adjacency constraint by reducing the LTSY.
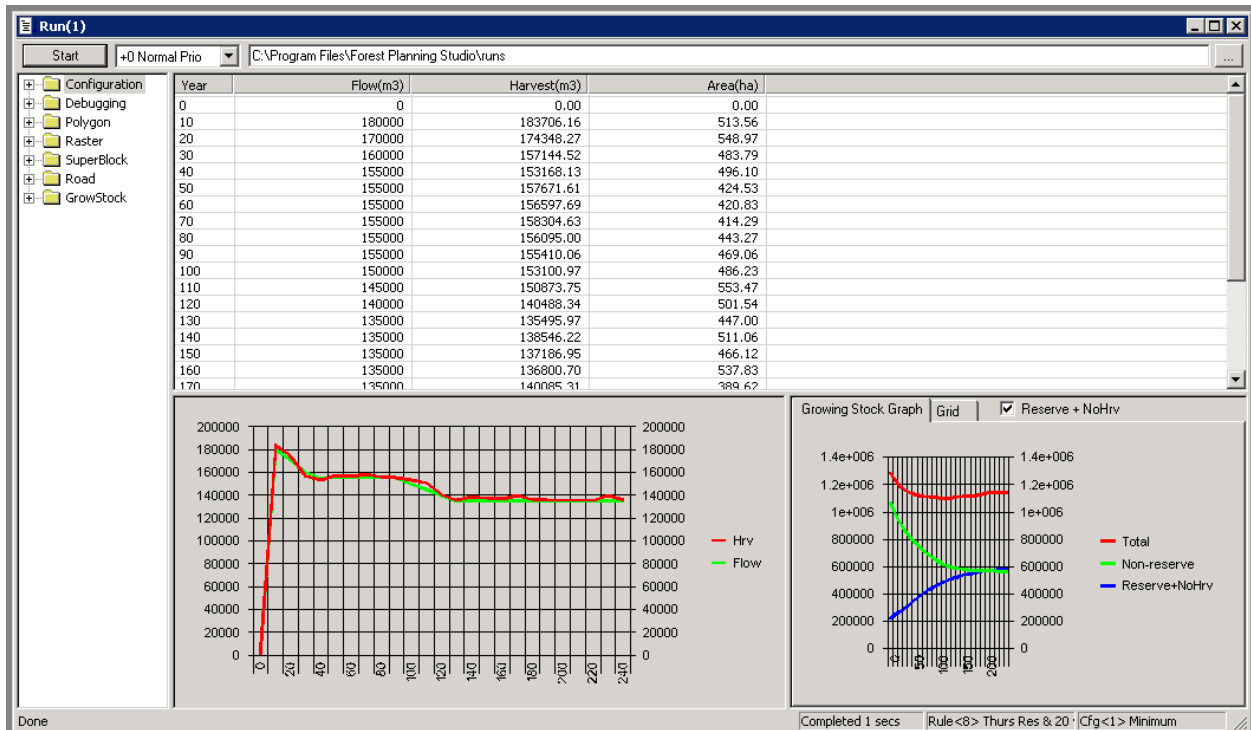

Figure 35: Flows to remove the "saw-tooth" caused by adjacency constraint.

Note: The harvest and growing stocks have stabilized in the long-term. This gives us more confidence in the LTSY estimate than found in the previous runs.

End of Tutorial 4.

Be sure to exit FPS and zip the database as a backup.

Tutorial 5. Schedule with Sorts

In the previous tutorials, polygons were scheduled for harvest using the oldest-first (*Age*) priority. This was set manually in the *Default Sort* drop down menu located in the *Parameters (Param)* window of the *Ruleset Editor*. This procedure assumes that all polygons within the forest estate are currently and continually accessible, or that accessibility is irrelevant.

If access is important, a more realistic harvest simulation can be achieved by quieting stands according to their proximity to a mill, although this is also a simplification of operations complexity. The distance to the mill is determined during the preparations of the database.

This tutorial resets the *Default Sort* to illustrate the consequences of queuing polygons based on the minimum distance to the mill priority. In new *Rulesets* the *Distance* priority is typically the default.

To view the distance to the mill for each polygon in the Gavin Lake database, use the *Viewer control* and select *Polygon topology, Attribute* and *Distance*. Notice the distance radiates from two different road systems that access the area.

Note: Harvests schedules can be further defined by applying the *Default Extra Sort*, although this is not discussed in this tutorial.

5.1 Select the Reserve & Adjacency Rule Set

5.1.1   Create a new *Ruleset* called *Dist+RSV+Adjacency.*

5.1.2   Copy the *Flows* from the *Ruleset RSV+Adjacency*

5.1.3   Apply the same *Csets* that were applied under the previous *Rulesets* (no harvest on the reserve zone and 20-yr adjacency on *AUnit1*.

5.1.4   Close the *Browser*.

5.2 Reset the Default Sort

5.2.1   In the *Parameters* tab, from the *Default Sort* dropdown menu select *0-Distance*.

5.2.2   Save the changes to the *Ruleset* by closing the *Ruleset Editor*.

5.3 Run the Simulation

Figure 36 shows the harvest volumes for *Dist+RSV+Adjacency Ruleset* sorted by *Distance*
Note: The *Flows* have not been adjusted to smooth out the harvest levels.
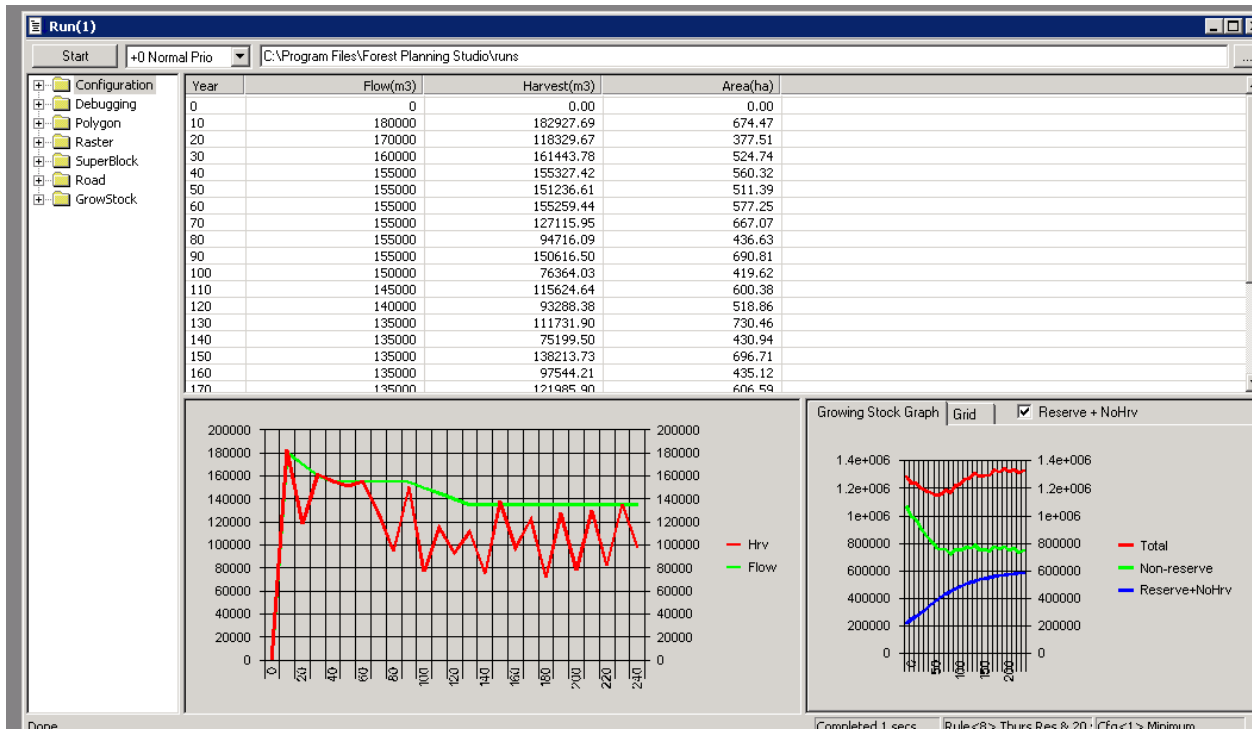
Figure 36:Harvest volumes when Distance is harvest priority.

5.3.1   Create a new *Ruleset* called *SmoothDist+RSV+Adjacency*.

5.3.2   Find the maximum harvest volume that meets the objectives (maximize early harvest, maximum of 10% decline in LTSY between each period).
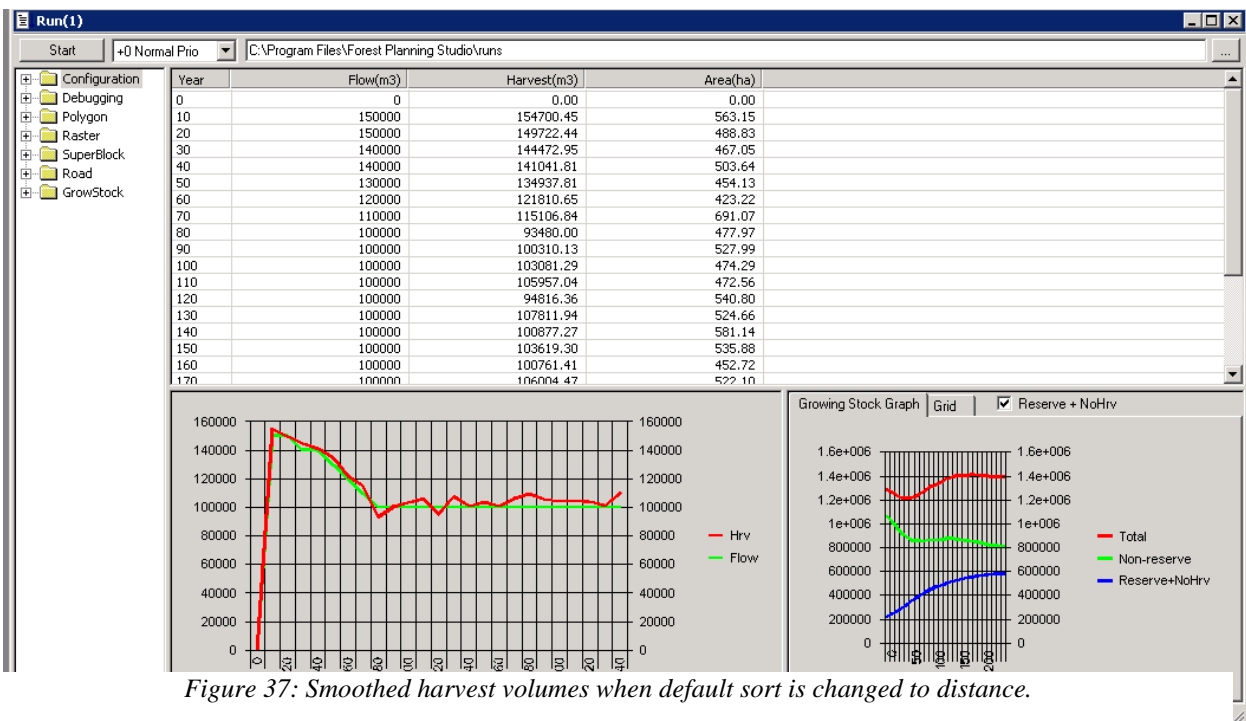
Figure 37 shows one possible solution.

Figure 37: Smoothed harvest volumes when default sort is changed to distance.

5.3.3   Open the *Map Viewer* and observe the harvest schedule in the *Viewer*.
         Note: the pattern tends to radiate out from access points at the NW and NE portions of the forest estate.

5.4 Random Harvest Priority/Sort

5.4.1   Create a new *Ruleset* called *Rand+RSV+Adjacency*.

5.4.2   Copy and paste the flows from the *Ruleset Dist+RSV+Adjacency*.

5.4.3   Apply the same *Csets* that were applied under the previous *Ruleset* (no harvest on the reserve zone and 20-yr adjacency on *AUnit1*).

5.4.4   In the *Parameters* tab, from the *Default Sort* dropdown menu select *2-Random*.

5.5 Run the Simulation

Figure 38 shows the harvest simulation for the *Rand+RSV+Adjacency Ruleset* sorted by *Random*. These flows have not been smoothed like *SmoothDist+RSV+Adjacency*.
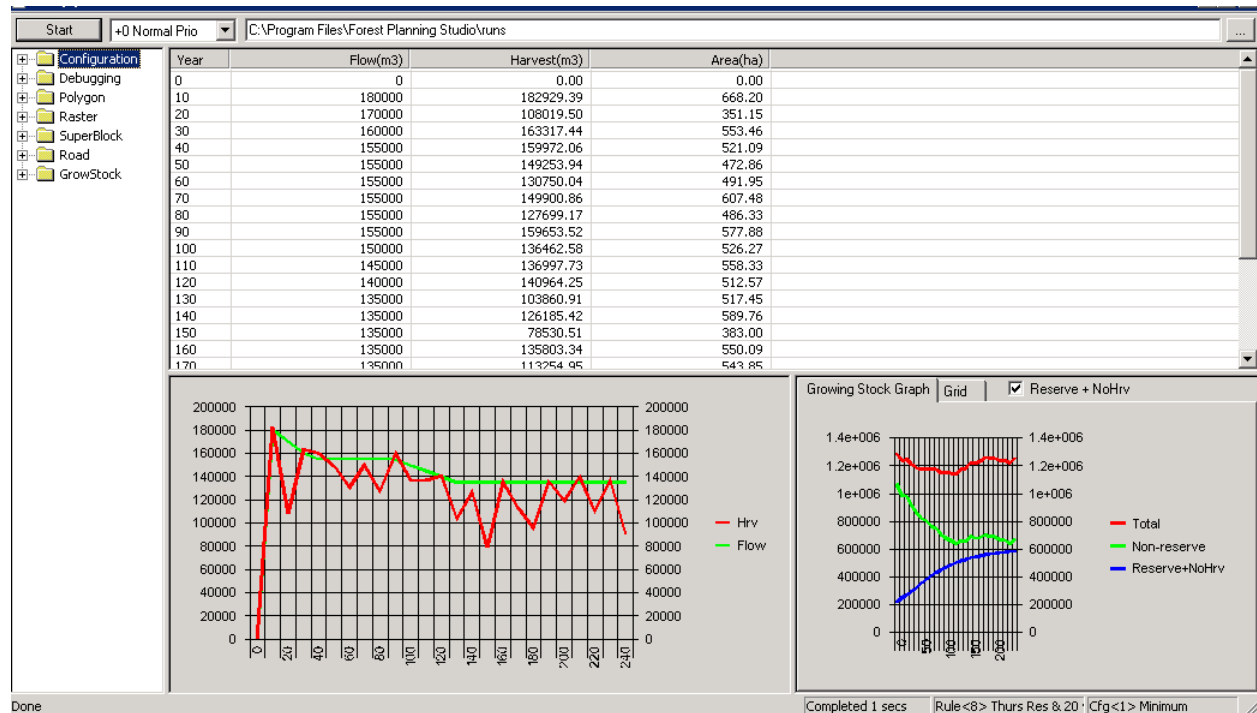

Figure 38: Harvest volumes from using the default sort of random.

Try running the simulation 5-6 times. Each time will provide a different solution. This is handy for estimating variation in the harvest schedule.

5.5.1   Change the *Flows* until you meet the desired objectives (no harvest on the reserve zone and 20-yr adjacency on *AUnit1*).

End of Tutorial 5.
Be sure to exit FPS and zip the database as a backup

Tutorial 6. Schedule Long Rotations

FPS models' long rotation lengths at the stand level through the *Stand Group* settings for minimum harvest age.

In this tutorial we will be changing the minimum of harvest age of a stand group, and since stand groups are independent of the *Ruleset* (unlike *Csets*) you can't replicate previous runs that unse a minimum harvest age of 50 years. However, in subsequent tutorials the minimum harvest age will be put back to its original value. It is important to remember the minimum harvest age used in each *Ruleset*.

If changes to *Stand Groups* become substantial (lots of work to reverse) it may be better to make a new working copy of the database so that the original runs are preserved in the original database.

6.1 Long Rotations

6.1.1   Create a new *Ruleset* called *Long Rotation*.

6.1.2   Copy and paste the flows from *Dist+RSV+Adjacency* and in to *Long Rotation.*

6.1.3   Add the 20-yr adjacency *Cset* to *AUnit1* and the no harvest *Cset* to the reserve zone.

6.1.4   Additionally, ensure that the default sort is set to *Distance.*

6.1.5   From the *Browser* window select the *SGrp* tab.

6.1.6   Select *SGrp 1 – FIR* by double clicking on it. The *Stand Group 1-FIR* window shown in figure 39 should appear.
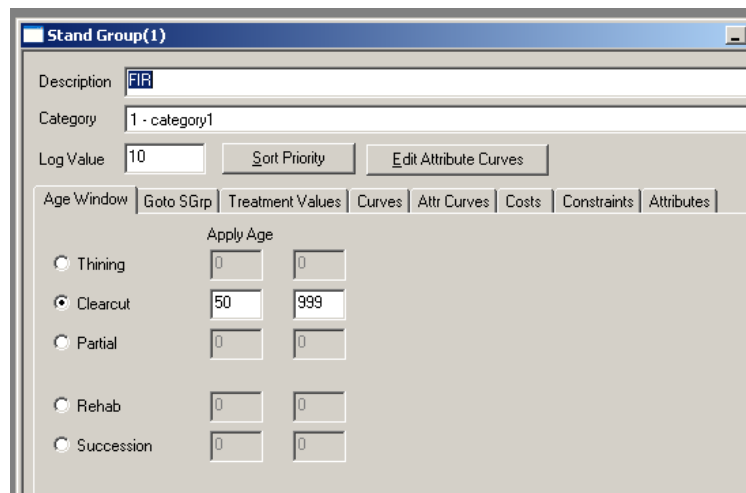

Figure 39: Stand group window used in long rotations

6.1.7   Select the *Age window*. *Clearcut* should be highlighted.

6.1.8   Reset the minimum harvest age to *180* years.

6.1.9   Select the *Goto SGrp* tab and again *Clearcut* should be selected.

6.1.10   Open the dropdown menu adjacent to the *Clearcut* treatment and select *<myself>*

With this setting all stands within *Stand Group 1-FIR* will be harvested between the ages of 180 and 999 years. Once harvested these stands will "regrow"/return to *Stand Group 1-FIR* (starting at age 0). For the same treatment in the next rotation.
Note: It is this setting that you would change if you wanted to "replant" with something different. You would select a different *Goto Stand Group.*

6.1.11   Close the *Stand Group 1-FIR* window and accept the changes.

6.2 Run the Simulation

Figure 40 shows the harvest simulation for *Long Rotation* sorted by *Distance* with a minimum harvest age of 180 years in *Stand Group 1-FIR* type stands.
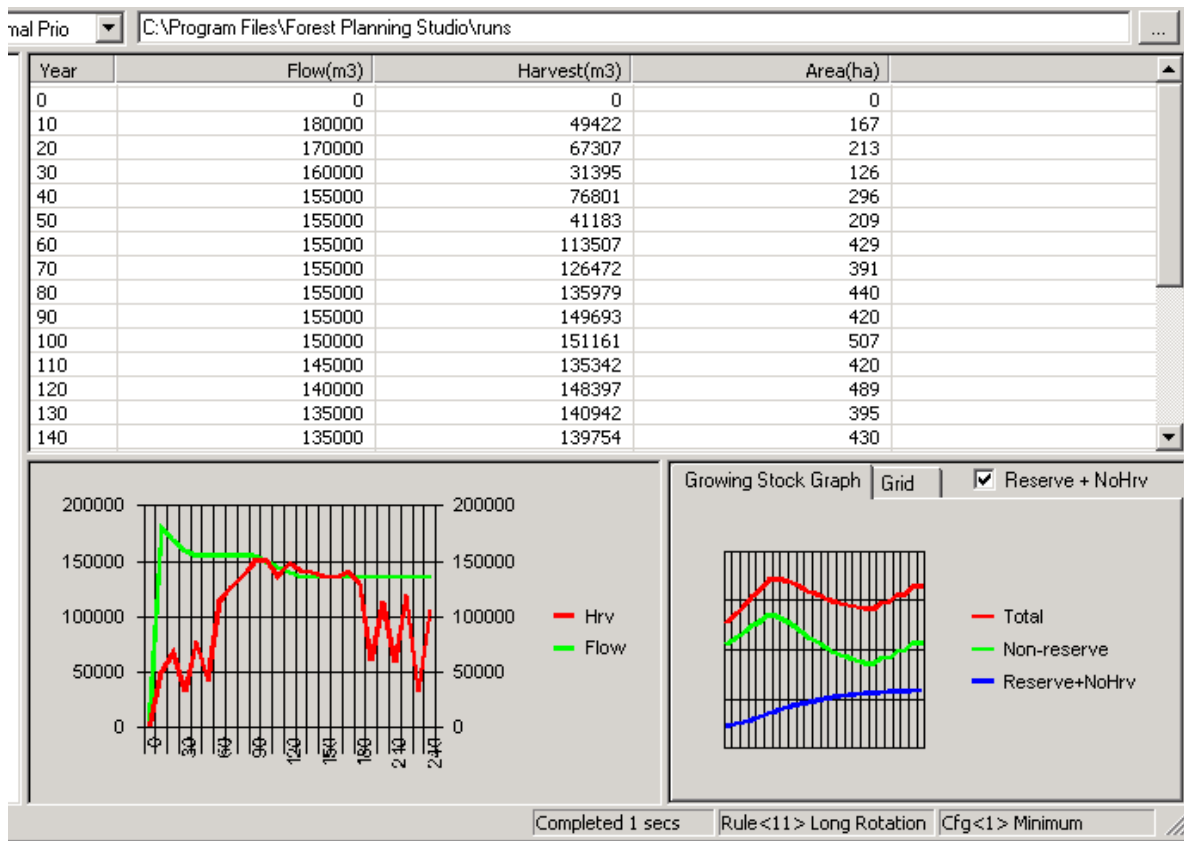

Figure 40: Results of the Long Rotation Ruleset.

6.2.1   Create a new *Ruleset* called *Long Rotations 2* (Set: Sort = distance and the same *Csets* as above).

6.2.2   Find a *Flow* that smooth out the peaks and valleys in the harvest volumes in the simulation.
Note: It will have the harvest level in the first 50 years than in the remaining periods. Watch your growing stock to see if long term harvest can be increase of if they need to decrease. No answer is provided for this exercise.

End of Tutorial 6.
Be sure to exit FPS and zip the database as a backup

Tutorial 7. Set Minimum Levels of Old Forest

In FPS another method of maintaining portions of old forest within forest estates is to define (ages) and set minimum portions of the estate as old forests.

7.1 Create the Minimum Old Seral Constraint

7.1.1 Create a new *Ruleset* called *Minimum Old Seral* by copying the flows from *Dist+RSV+Adjacency* and set the *Distance* sort.

7.1.2 Check that the minimum and maximum harvest ages should be 50 and 999 years, respectively.

7.1.3 Update the *No harvest Cset* on the Reserve zone and set the *20-yr adjacency Cset* on *AUnit1*.

7.1.4 Use the procedures described in Tutorial 3 to create a *Cset* named *Minimum Old Seral*.

7.1.5 In the *Cset* window, select the *Old Seral* tab and check *Cover 1* box. The *Min Age (y)* and *Min% in coverage and older* boxes should become highlighted.

7.1.6 Enter a minimum age of *180* and a minimum percent coverage of 20% as shown in Figure 41.
7.1.7 Close the *Cset* window and accept the changes.

Figure 41: Creating the Old Seral Cset.

7.2 Apply the *Cset*

7.2.1 Apply the *Minimum Old Seral Cset* to *Stand Group 1-FIR*
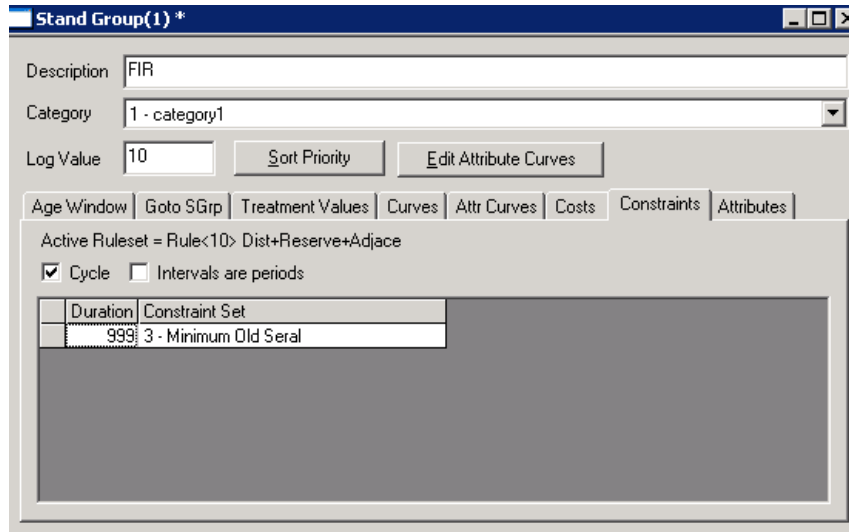
Figure 42: Applying the Minimum Old Seral constraint to FIR stand group

7.3 Run the Simulation

Figure 43 shows the results of the harvest volume using the *Minimum Old Seral Ruleset.*
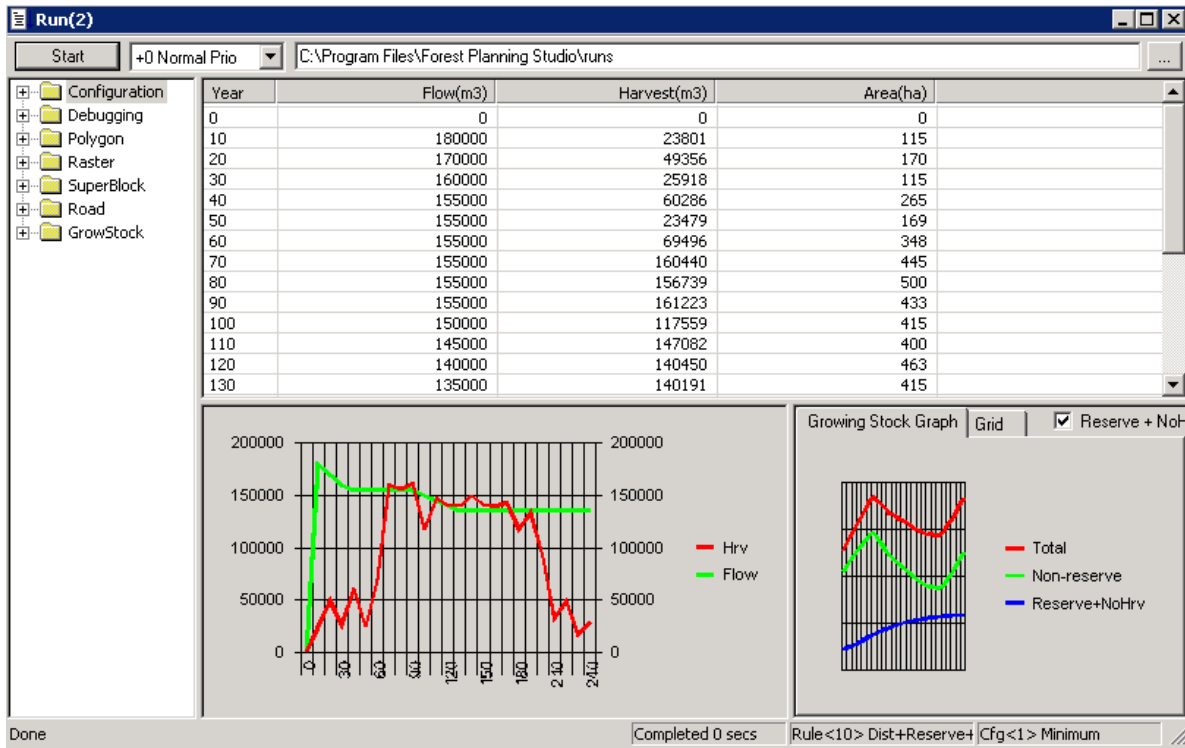

Figure 43: Harvest simulation when applying a minimum old seral stage constraint.

7.4 Understanding how FPS is applying this *Ruleset* and constraint.

7.4.1   With the *Viewer* control set to *Polygon topology, Attributes,* and *Age* check the *Map Viewer* to see that 20% of the forest appears as 180-years or greater.

Another way to check these results (and other results) is to generate text files.

7.4.1   Append the *Configuration* window to have the *ReportConstraintsGrid*.

7.4.2   When the *Run* window is open, expand the tree structure under *Constraint Grid* and check the boxes as shown in figure 44.
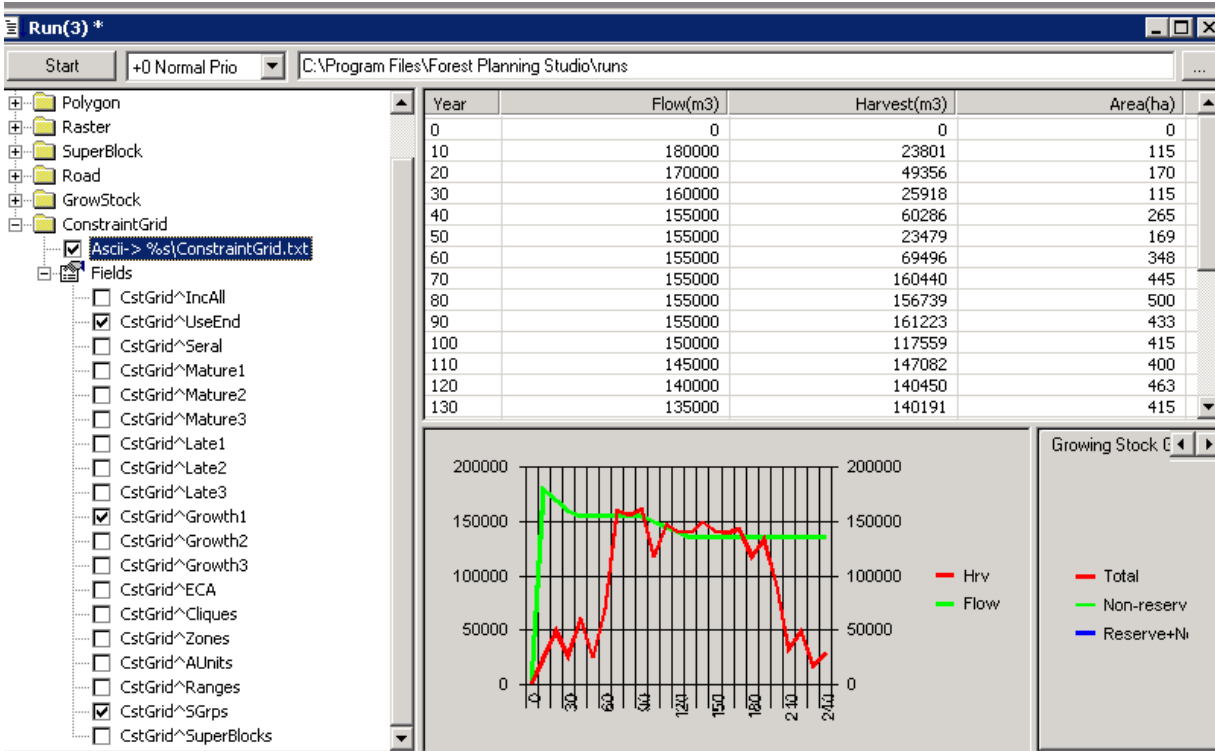

Figure 44: Producing text files showing the constraints applied on to different stand groups.

7.4.3   After the run is made, double click on *ConstraintsGrid.txt.* This will open the test fule with Notepad.
Note: this file reports targets and achieved values for all constraints and spatial units that were selected with the checked boxes. Subsequent runs will include the *constraints.txt.* file provided that the module is included in the *configuration window* and the appropriate boxes are checked in the *run* window.
Note: Other Modules, such as *ReportVolumesGrid* can be appended to the *configuration* window to produce similar test files. These files can easily be imported or copied into a spreadsheet for analysis and graphing.

Figure 45 shows the *Constraint Grid* report. The first column is the period, followed by each stand group. For stand group 1- Fir, the minimum old seral was 20% and this target value appears just before period 0. The following rows show the percentage of 180+ year old stands (by area) in each period. The minimum taget of 20% isn't reached until period 7 (41.78%), so no harvesting of stand group 1 – Fir occurred before

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this period. The last few periods are very close to 20%, suggesting the constraint is also binding during these periods.

Figure 45: Text file produced of the constraints on the Minimum Old Seral ruleset

7.4.4   Try smoothing out the harvest flows to get a more desirable harvest schedule. For a starting point try 40 000 for years 10-60 and 110 000 for years 70-240.

End of Tutorial 7.

Be sure to exit FPS and zip the database as a backup

Tutorial 8. Schedule Partial Cut Harvest

Up till this point, clearcutting has been the only silviculture system considered. FPS can apply five basic treatments to polygons. Three of these treatments (thinning, clearcut, and partial cut). Generate harvest volumes while two treatments (succession and rehabilitation) do not. There is important difference in how FPS applies theses various treatments and this tutorial applies a partial cut harvest as an example of how silviculture treatments can be simulated.

8.1 Setting up the Dataset

In this tutorial will be making substantial changes to the stand groups you will need to make a copy of the *GavinTut.mdb* to be used for this tutorial

   8.1.1   Rename this tutorial *GavinTut2.mdb.*

   8.1.2   Open the *Ruleset* window.

 Delete all *Rulesets* except *Minimum Old Seral*.

   8.1.3   To delete a *Ruleset*, click on its tab and then right click anywhere in the *Ruleset* window.

   8.1.4   Select *Delete Ruleset* from the drop down menu.

   8.1.5   Now, create a new *Ruleset* named *Partial Cut* and ensure that *Distance* is set as the default sort.

   8.1.6   Copy the *Flows* from the *Ruleset Minimum Old Seral*.

   8.1.7   In the *Browser*, apply the *No Harvest Cset* to the *Reserve zone* and the *20-yr adjacency Cset* to *AUnit1.*

8.2 Create a Partial Cut Stand Group

Stand groups are used to describe the silviculture treatments that are applied to polygons. Stand groups are linked to the volume-age curves.

   8.2.1   Select *File,* then *New,* then *Stand Group*. The New Stand Group window in Figure 46 should appear.
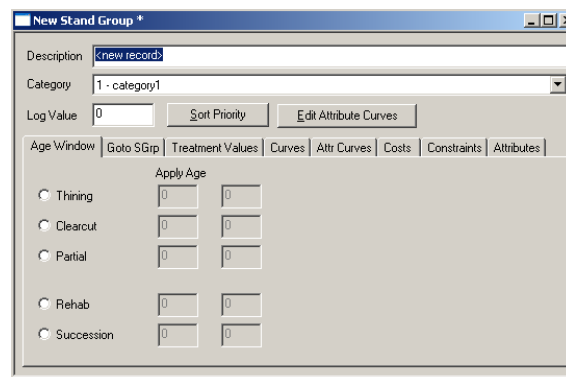

Figure 46: Creating a new stand group.

8.2.2   Name the new stand group *Partial Cut*.

8.2.3   Select the *Age Window*.
         Note: Notice the five silviculture treatment options available.

8.2.4   Select *Partial* cut treatment.

8.2.5   Set a *Minimum* of *180* and a *Maximum* of *999* (Figure 47).
         Note: These age limits are to ensure that the partial cut is applied within a period that is
         consistent with the associated *Yield Curve*. A more detailed description is provided in tutorial
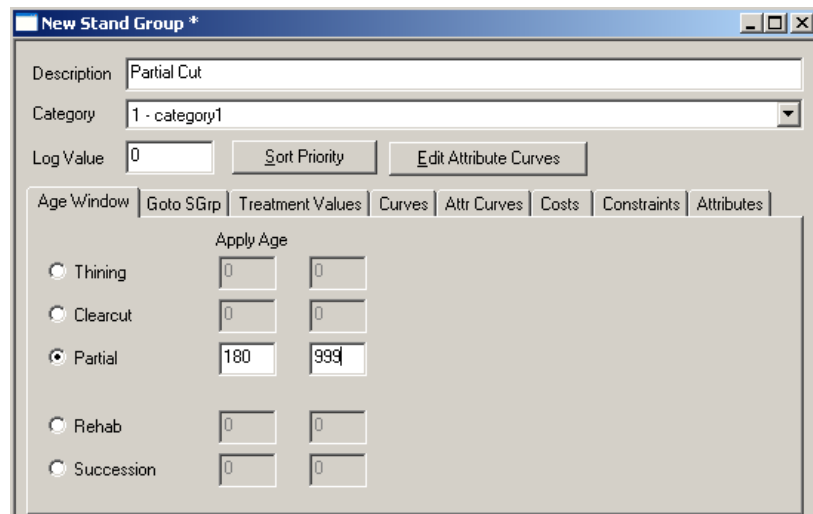   9.

Figure 47: Creating a new stand group

8.2.6   Select the *Goto SGrp* tab.
         Note: Notice the five treatments and that the treatment *Partial* should already be selected.

8.2.7   Ensure that the box to the right of *Partial* says *<myself>*. This indicates that after a polygon
         has been harvested it will be returned to the same *Stand Group* (i.e. it will *Goto* the *Partial
         Cut* stand group).

8.2.8   Select the *treatment* tab.
         Note: there are three conditions, each associated with a treatment.

8.2.9   Set the *Residual Growing Stock* to *351* m3/ha (figure 48). *Partial Cut* stands may now be
         harvested so long as a residual growing stock of 351 m3/ha is retained.
         Note: This level of residual growing stock is based on an arbitrary objective of maintaining
         mule deer winter range. Guidelines indicate that 70% and 90% of growing stock should be
         maintained in partial harvests within mule deer winter range. The lower bounds being
         appropriate when there is a high portion of suitable winter habitat within the planning area.

To be more specific about how FPS applies partial cuts, in this example, if a polygon is 180 years or older,
it is harvested down to the *Residual Growing Stock* of 351m^3/ha as set in the *Treatment Values* tab. After
harvest, the new stand age is set to the age where the *Residual Growing Stock* occurs on the Volume/Age
curve. In this example it a volume of 351m^3/ha is age 130. In this example, every 50 years 74m^3/ha is
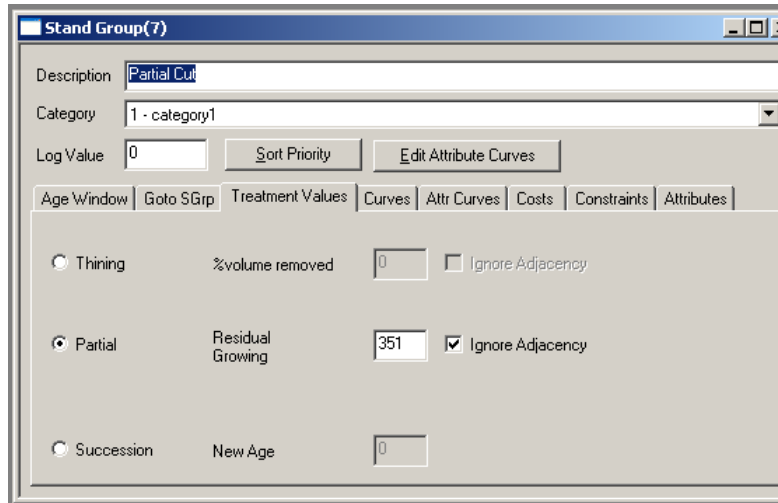harvested, and the age of polygons cycle between 180 and 130 years.

Figure 48: Setting the residual growing stock in a partial cut harvest.

8.2.10   Check the *Ignore Adjacency* box.

8.2.11   Select the *Curves* tab. Notice there are two options; *Age* (volume age curve) and *CCE* (clearcut equivalency).

8.2.12   Click on the drop down arrow at the right of the *Age* box and select *Partial Cut Curve*.

8.2.13   Leave the *CCE* box blank.

8.2.14   Select the *Constraints* tab. Ensure that there are no constraints selected for this Stand Group

8.2.15   Close and accept the new *Partial Cut* Stand Group.

8.3 Partial Cut in the First Rotation

The *Partial Cut* stand group and *Partial cut* growth & yield curves describe the management regime for partially cut stands. Currently there are no partially cut stands. Confirmation of this can be seen if you open the *Viewer* and expand *Polygon topology* in the *Viewer Control* and selecting *Stand Group*. After expanding the legend, the *partial cut* stand group should be listed in the legend but no polygons will identified in the *Map Viewer.*

To apply partial cuts to the desired polygons, their stand groups must be changed to the *Partial Cut* stand group just created or their existing stand group needs to be edited to apply a partial cut. In this example the existing stand group (*Stand group 1-FIR*) will be changed to a partial cut system.

Polygons can be changed individually or through Stand Group edits (individual polygon changes will be discussed more in tutorial 10, fencing and edits are discussed in tutorial 11). In this tutorial the changes will be applied to all *Stand Group 1- FIR*

8.3.1   From the *Browser* window select the *SGrp* tab.

8.3.2   Select *SGrp 1-FIR* with a double click.

8.3.3   Select the *Age window*. The *Stand Group 1- FIR* should appear as shown in figure 49.
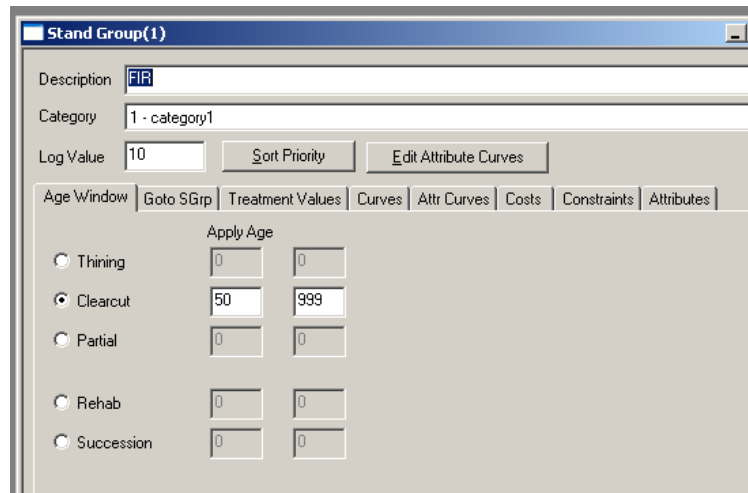

Figure 49: stand group window to allow for changes in silviculture system.

8.3.4   Select *Partial* and set the *Minimum* to 180 and the *Maximum* to 999.

8.3.5   Select the *Goto SGrp* window.

8.3.6   From the drop down menu select *<partial cut>*.

Now after each Stand Group 1 – FIR stand is partial-cut, the stand will become part of the *Partial Cut* stand group and will grow and yield volume according to the *Partial Cut* growth and yield curve. All future harvests will be partial cuts according to the *Partial Cut* stand group.

8.3.7   Right clicking on the *Partial Cut* stand group in the *GoTo SGrp* window will open this stand group.

8.3.8   Check that the *values* tab shows the *Residual Growing Stock* is $351m^3/ha$ and that the *Ignore Adjacency* box is checked.

8.3.9   Close the partial cut window.

8.3.10   On the FIR stand group. Select the *Treatment Value* tab.

8.3.11   Enter 351 as the residual growing stock and check the *Ignore adjacency* box.

8.3.12   Select the *Curves* tab and in the *Age* box select the *Partial Cut* curve. Leave the *CCE* box blank.

8.3.13   Close the stand group window and accept the changes.

8.4 Run the Simulation

After the simulation is complete confirm that *Stand Group 1- FIR* was replaced by the *Partial Cut* stand group. Scroll through the various planning periods within the *Map Viewer* as described in earlier tutorials.

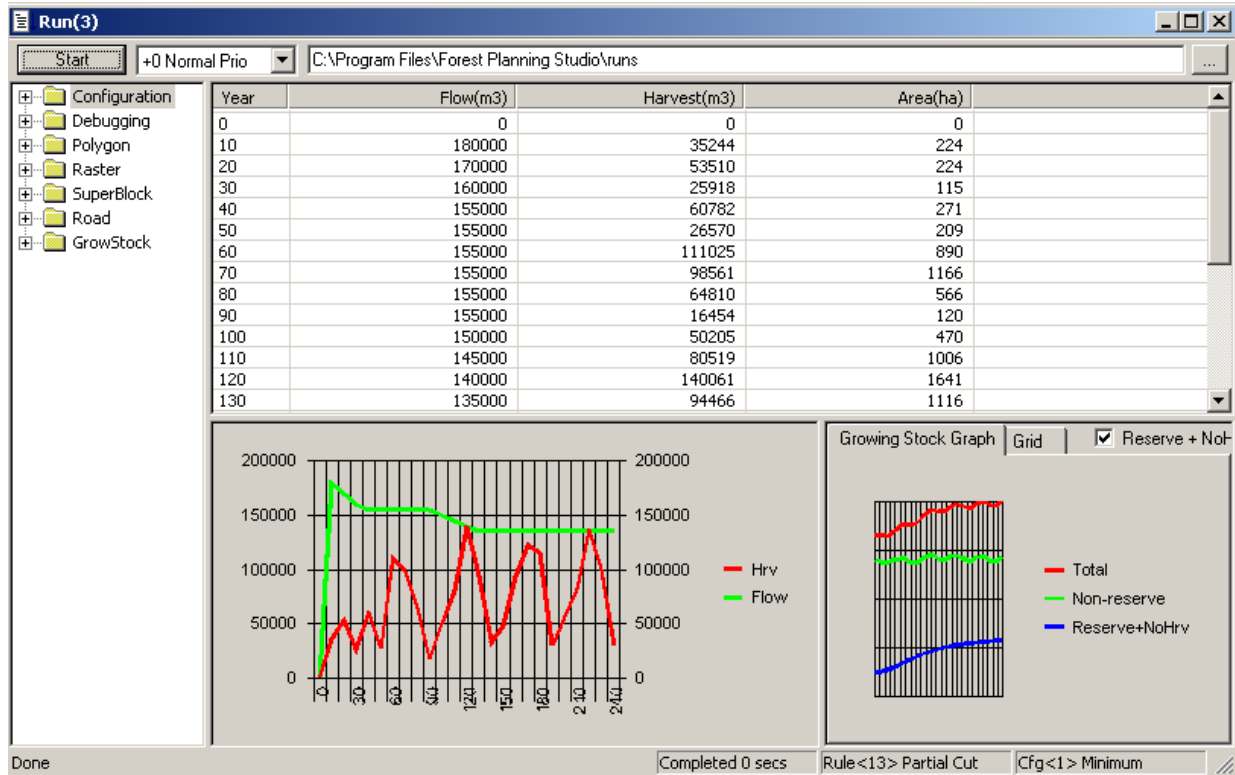The results from the *Partial Cut* rule set are shown in figure 50.

Figure 50: Harvest simulation for FIR Partial cutting.

To confirm that the model is running correctly:

8.4.1 Open the *Viewer* and drag the run into it.
8.4.2 Select *Stand Group* in the *Viewer Control* and cycle through the periods.

You should see that Stand Group 1-FIR is converted to the Partial Cut stand group.

8.4.3 Select *Attributes – Output Only – Treat_State*

Now as you cycle through the periods you can observe which polygons are clear cut, partially cut and those that continue to grow undisturbed.

8.4.4 Select *Attribute – Age* in the *Viewer Control* and expand the format tree (near the top of the *Viewer control* and check the *Text* box.

Now as you cycle through the periods you will see that when stands to be partially cut reach 180 old the age is reset to 130.

8.4.5 Create a new *Ruleset* named *Partial Cut Flow* (with the same sorts and Csets as *Partial Cut*) and smooth out the harvest volumes.
Note: you will need to start low and take a few steps to achieve a LTSY.

End of Tutorial 8.
Be sure to exit FPS and zip the database as a backup