

Tutorial 9. Construct a Yield Curve

In the previous tutorial the *Partial Cut* curve estimating growth and yield was provided. This estimate was derived by modifying even-aged-stand curves to the partial cut (uneven-age-stands) based on the proportion of volume cut. For stands that are evenly proportioned to different age-classes, a single curve is sufficient. Where the proportions of age-classes change (such as the period when a stand is being converted from even-aged to uneven-aged) a more complicated series of yield curves is necessary. With FPS this requires a series of stand groups because each stand group is associated with only a single yield curve.

Outputs from stand-level yield models such as TIPSYP, VDYP and FORECAST, or single-tree based models such as TASS can be imported into FPS. This tutorial provides a simple example of how to create a growth and yield curve (*volume/age*). This procedure can also be used to create *EVA (CCE)* or *UserAttr/Age curves*.

9.1 Create a New Curve

- 8.1.1 Select *File*, then *New*, then *Curve*, and finally *OK* to accept. The *New Curve* window should appear.
- 8.1.2 Name the curve *Partial Cut 2*.
- 8.1.3 Select the *Properties* tab. The *Curve* window should look similar to that shown in figure 51.

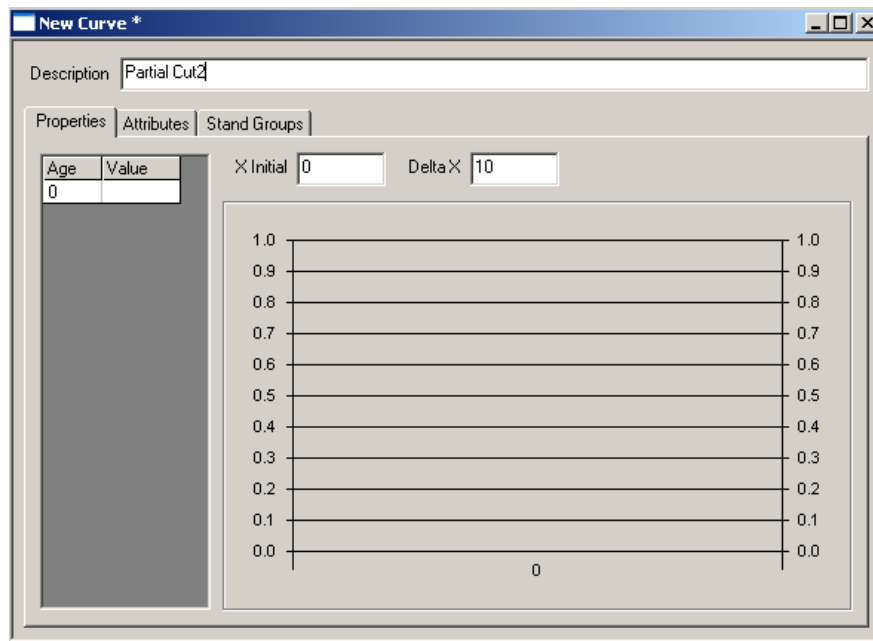


Figure 1: New curve window.

- 8.1.4 Enter an *X initial* of 130 years.
- 8.1.5 Highlight the *Age* or *Value* box and then push *Ctrl+down arrow* to create new rows. Create 17 rows with intervals (Delta) of 10 years (default).
Note: Each yield value needs to be entered manually.

By default, each click should add a single 10-year interval (delta x default is 10 although any integer value can be applied. For example, Equivalent Clearcut Area (ECA) curves often use 1, 3, or 5-year intervals).

9.2 Calculating the Yield Values

First it is important to understand how FPS describes partially cut stands. After each partial cut stand age reverts to the age which corresponds with the age at which the volume of *Residual Growing Stock* can be found on the yield curve (this is different from *Thinning* where the stand retains its pre-cut age). The *Partial Cut* curve is an even-aged stand up to 180 years. At 180 years the volume is 438m³/ha.

The objective in this scenario is to obtain habitat for mule deer winter range, by maintaining 80% of the original stand. This means we want to maintain a *residual growing stock* of 351m³/ha (438m³/ha * 0.8 = 351m³/ha). For this reason, the *Minimum Age* for harvest is set to 180 years.

After age 180, the curve reverts to age 130 to (best) represent the remaining volume of 351m³/ha (which is 355m³/ha occurring at age 130). The *Residual growing stock* is grown at a rate appropriate for the original stand. The New Growing stock (regenerated) is grown at the rate of a newly regenerated stand. The volume calculation used to create the *Partial Cut Curve* (used in the previous tutorials and later in this tutorial) is shown in the supplementary document *PartialCut_Tables* under the tab *Partial Cuts*

This document can be found at http://frst-558.sites.olt.ubc.ca/files/2019/01/PartialCut_Tables.xlsx or on the MSFM 558 webpage under the Modeling Module tab.

To run partial cuts using multiple curves three new curves need to be created. These will be called: *Partial Cut2*, *Partial Cut3* and *Partial Cut4*.

- 9.2.1 Construct a new yield curve called *Partial Cut2*. Use the values in the [PartialCut Tables](#) under the *partial cut* tab that are shaded orange for the ages and volumes.
- 9.2.2 Construct a new yield curve called *Partial Cut3*. Use the values in the [PartialCut Tables](#) under the *partial cut* tab that are shaded green for the ages and volumes.
- 9.2.3 Construct a new yield curve called *Partial Cut4*. Use the values in the [PartialCut Tables](#) under the *partial cut* tab that are shaded yellow for the ages and volumes.

In the *PartialCut_Tables* document the column highlighted in blue shows the values that were entered into the *Partial Cut* curve created in Tutorial 8.

The Partial Cut curve is shown in Figure 52.

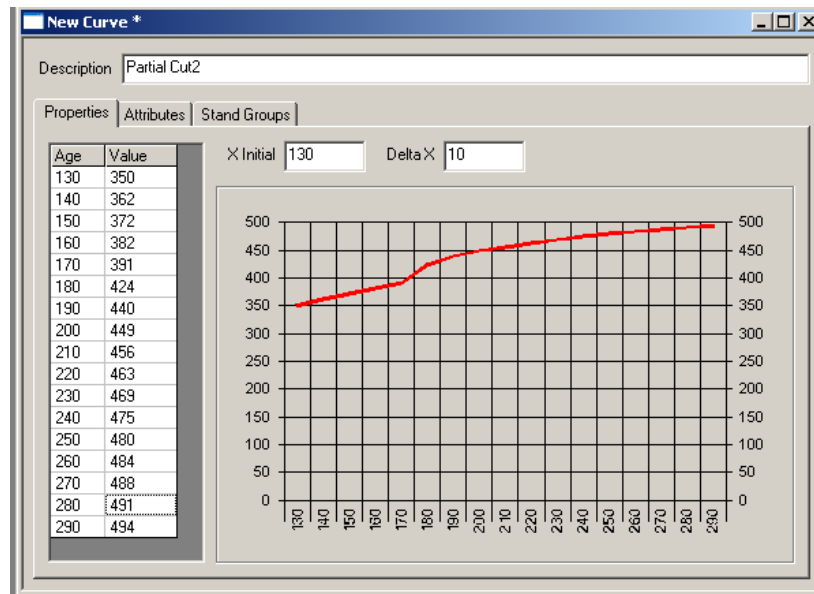


Figure 2: Partial Cut2 curve.

These curves all have the same volumes and are being used to illustrate that partial cutting can be modeled in FPS using multiple curves. This allows for a variety of factors to be accounted for in a partial cut. Two examples are as follows.

1. You may want your partial cut system to only run for a certain number of cycles before clear cutting. This could be done by setting the final curve and stand group to go to a clear cut vs continuing onto another partial cut curve.
2. You could consider a positive growth response of residual trees in partial cut curves. An example of this can be seen in [PartialCut Tables](#) under the tab *Partial Cuts with Response*. By editing the value in the orange box you can change the growth response in terms of proportional volume gain or loss. Changes in the volume curves could also be derived from programs like TIPS Y or Prognosis. This could be done if (for example) different proportions of multiple tree species have to be accounted for after a partial cut.

9.2.4 Create three new *Stand Groups* (*Partial Cut2*, *Partial Cut3*, and *Partial Cut4*) and assign the appropriate *Yield Curve* to each.

9.2.5 Use the same values as used for the *Partial Cut* Stand Group for your *Treatment Values* in all new curves.

9.2.6 In the *GoTo SGrp* tab of the *Partial Cut* stand group, select <*Partial Cut2*>.

9.2.7 In the *Age Windows* for *Partial Cut2*, *Partial Cut3* and *Partial Cut4*, set the *Minimum age* to **210** years to ensure the desired 80% retention is maintained.

9.2.8 For *Stand Group* **Partial Cut2** the *GoTo* window should be set to **Partial Cut3**.

9.2.9 For *Stand Group Partial Cut3* the *GoTo* window should be set to **Partial Cut4**

9.2.10 For *Stand Group Partial Cut4* the *GoTo* window should be set to **<myself> Error!**
Reference source not found.

9.3 Run the Simulation

9.3.1 Use your *Partial Cut Ruleset* to generate a harvest schedule.

9.3.2 Extend the modelling timeframe to 340 years to allow the model to cycle through all of the partial cutting stands groups.

You will notice that the harvest flows have to be reduced in the long term to ensure sustainable harvests in the long-term. You should observe the stand groups and ages in the Viewer to confirm that the model is working correctly. With a bit of tinkering on your flows, you should get a smooth harvest schedule.

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

Tutorial 10. Edit Individual Polygons

10.1 FPS Internal Database Queries

- 10.1.1 In the *Viewer control* select *Polygon Topology view* and then select *Stand Group* and expand the *Stand group* legend.
- 10.1.2 Locate the pointer on the *Map Viewer* and right click. A drop down menu will appear, then select *Execute SQL*.
- 10.1.3 *The Forest Planning Studio – Select Polygons* window should appear. To find polygon number 156 enter the number after the equal sign. Select *Execute*. Polygon 156 should appear in the lower box of the window as in figure 52.

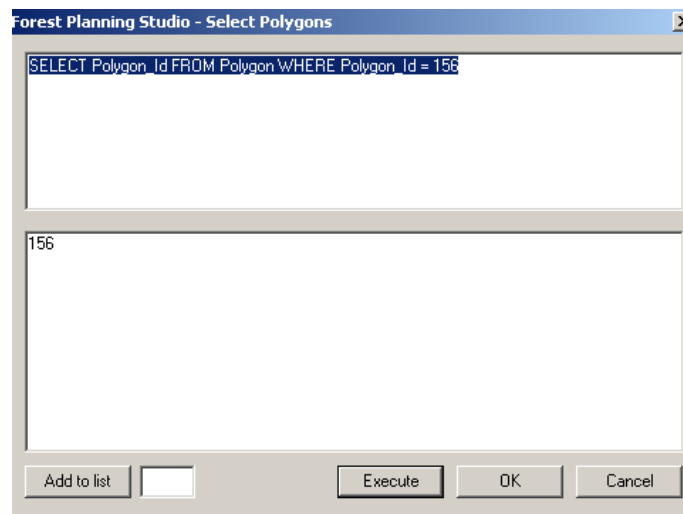


Figure 3: Select Polygon window

- 10.1.4 Select *OK* to view, on the *Map Viewer*, Polygon 156 should be highlighted on the *Map Viewer*.

10.2 Edit Polygons

- 10.2.1 Locate the pointer on Polygon 156 and with the right button on the mouse single click
- 10.2.2 From the drop down menu select *Edit Poly = 156* as shown in Figure 53.
- 10.2.3 Select the *Properties* tab with the left mouse button. Polygon (156) window should appear. **Note:** the *Stand Group* displayed is 1- FIR (figure 54). Explore the other tabs.

The screenshot shows a window titled "Polygon(156)" with a description field containing "093A042_156". Below the description are several tabs: Properties, Cliques, Attributes, Adjacency, FixedSch, Rasters, and Roads. The Properties tab is active, displaying a grid of fields:

Age	182	Zone	1 - ZONE 1
Distance	7054.69	Stand Group	1 - FIR
Area	29.57	Harvest System	1 - GROUND
LabelX	586378	State	1 - WLD - never been
LabelY	5813609	Super Block	<input type="checkbox"/> 0

Figure 4: Information about polygon 156

10.2.4 Polygon 156 is classified as Stand Group 1 – FIR in this database.

10.2.5 To edit the Stand Group open the drop-down menu, a complete list of Stand Groups should appear.

10.2.6 Select *Partial Cut4* and close the *Polygon (156)* window to accept the changes.

10.2.7 To confirm these changes were made repeat steps 10.2.1 – 10.2.3 to view the Stand Group.

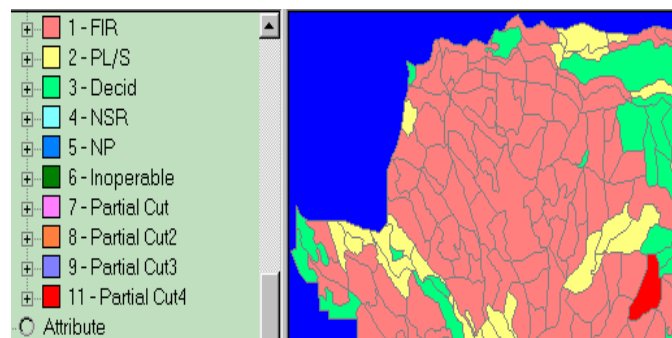


Figure 5: map viewer showing that polygon 156 is a different stand group

To observe the change on the Map Viewer it is often necessary to close the existing view and open another view.

End of Tutorial 10.

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

Tutorial 11. Edit by Fencing Polygons

11.1 Query the Database

11.1.1 In the Viewer control, select Stand Groups. In the Viewer right click for the drop-down menu and select Execute SQL.

11.1.2 To find all polygons within Stand Group 1 – FIR type the command exactly as shown below.

11.1.3 Select Execute

All polygons within the Stand Group 1 should be listed as shown below.

11.1.4 Select *OK* to view the query.

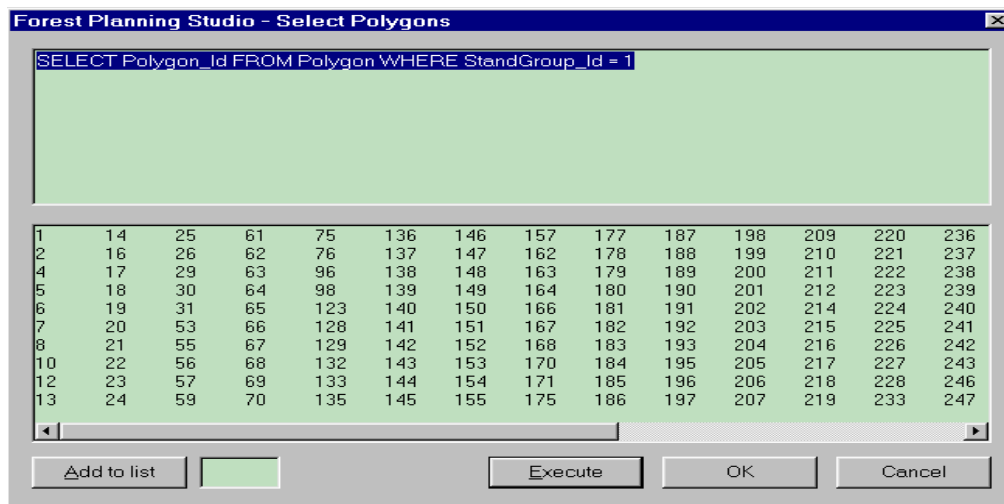


Figure 6: Polygons queried with an SQL code

11.2 Fence the Queried Polygons

11.2.1 From the *Map Viewer* drop-down menu select *Fence Operation*.

11.2.2 The queried polygons should be listed in the *Fence Operation* window.

11.2.3 From drop-down menu select *Partial Cut4* (figure 56).

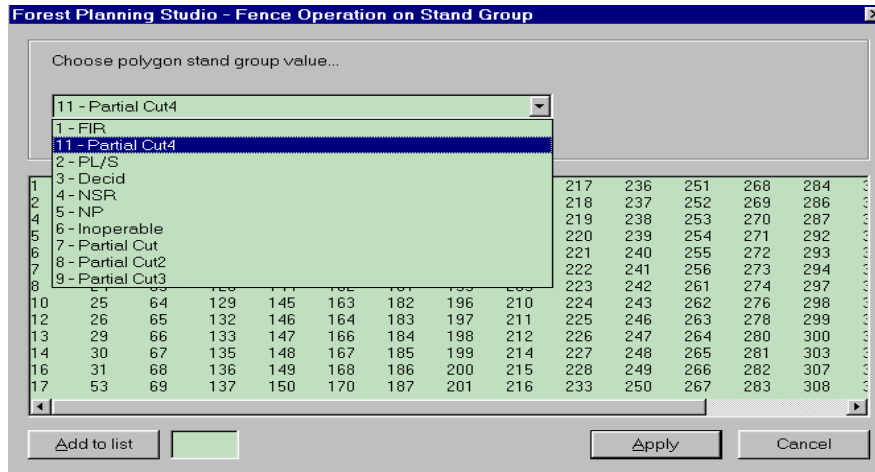


Figure 7: Changing the stand groups of selected polygons.

11.2.4 Select *Apply* and *Yes* to Execute the update.

Those polygons have now been edited into the *Partial Cut4 Stand Group*. Refresh the *Map Viewer* to confirm that these changes were made.

Now we will return the *Partial Cut4* polygons to *Stand Group 1 – FIR*. To do this, just repeat the above steps but first select all the *Partial Cut4* stand groups (# 10 or 11, depending on your database) and change them back to *Stand Group 1- FIR*.

Refresh the *Map Viewer* to confirm that these changes were made (the changes are necessary for the next tutorial).

End of Tutorial 11.

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

Tutorial 12. Apply a Commercial Thinning

The objective of this tutorial is to learn how FPS models commercial thinning. A query will be used to identify *FIR* stands eligible for commercial thinning. These stands will be commercially *Thinned* (51% volume removal) at 70 years, with a final *Clearcut* harvest at 150 years. To do this, two *new Stand Groups* and a *new Age-Volume Curve* will be created and then selected *FIR* stands will be assigned to these new Stand Groups. Continue using the GavinTut_2.mdb database.

12.1 Create a Volume-Age Curve for *Thinned Fir* Stands

12.1.1 Create a new volume-age curve called *Thinned Fir*

The *Thinned Fir* curve is similar to the original FD stand, except the volumes are reduced by 100m³/ha, as shown in figure 57. At age 70, 51% of the volume is removed (100m³/ha/195m³/ha = approximately 51%).

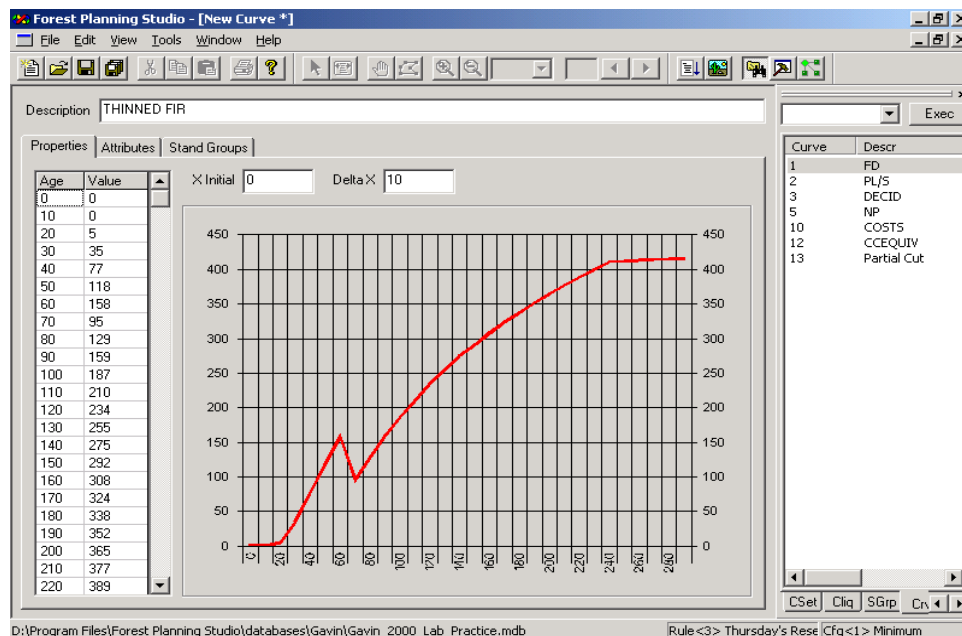


Figure 8: thinned fir volume age curve

12.1.2 Save and close the new *Thinned Fir* Curve.

12.2 Create Two New Stand Groups

12.2.1 Create a *Stand Group* named *Thinned Fir* and a *Stand Group* named *Young Fir*.

12.2.2 Open the *Young Fir* *Stand Group*.

12.2.3 In the *Age* window, select *Thinning* and assign a *Minimum* of 70 and a *Maximum* of 100.

12.2.4 In the *GoTo SGrp* tab, select *Thinning* and *Thinned Fir*.

12.2.5 In the *Treatment Values* tab, select *Thinning* and enter 51%.

12.2.6 In the *Curves* tab select *Age* and the *FD* curve.

12.2.7 *Save* and close the *Young Fir* Stand Group.

12.2.8 Open the *Thinned Fir* Stand Group.

12.2.9 In the *Age* window, select *Clearcut* and assign a *Minimum* of 150 and a *Maximum* of 999.

12.2.10 In the *GoTo SGrp* tab select *Young Fir*.

12.2.11 In the *Curves* tab, within the *Age* box, select the newly created *Thinned Fir* curve.

12.2.12 *Save* and close the *Thinned Fir* Stand Group.

12.3 Identify Stands Eligible for Commercial Thinning

12.3.1 Open the *Map Viewer* and select the *Stand Group* from the *Viewer Control*.

12.3.2 Right mouse click within the *Map Viewer* to open the drop-down menu.