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Advanced Topics in Customizing Management and Output using the Event Monitor

Training Guide

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Material and Programs

To successfully learn this material you will need to have access to the Essential FVS Users Guide (EFVS), the Fire and Fuels Extension Users Guide (FFE) and the FVS Variant Overviews documents. These documents are available on the FVS website.

This training document contains advanced FVS topics that are an extension of the Forest Management Service Center (FMSC) sponsored regional FVS training sessions; and therefore, assumes you have a working knowledge of FVS and the Suppose interface. This training guide has been designed for use with software and data outlined below. Participants using other software versions may obtain slightly different results from what is presented in this guide.

FVS Setup Package compiled on 10/18/2011.

Session 1- Creating Custom Output Variables

Introduction

In the Regional FVS training course, you defined simple custom variables using the **Model Outputs > Event Monitor (EM) Compute Variables** windows. In this course you will expand on that knowledge by learning how to compute complex custom variables through writing complex expressions utilizing the Event Monitor's (EM) conditional scheduling, pre-defined variables and functions, and interactions with databases. Before you begin the exercises you may need to review how to create custom output variables in Suppose. See exercise 1-3 in the Regional Training Guide for a step by step guide on creating custom variables in Suppose.

The EM model output options used in the regional training course are directly linked to the **COMPUTE** keyword. The following discussion describes the **COMPUTE** keyword.

The **COMPUTE** keyword allows the user to define single or multiple variables expressed as mathematical expressions containing constants, operators, EM variables, EM functions, and variables previously defined using the **COMPUTE** keyword. Tables 5-2 and 5-3 of the Essential FVS Users Guide (EFVS) contains the constants, operators, EM variables, and EM functions that may be used in expressions. Variables may be computed for all cycles, a single cycle, or conditionally using the EM conditional logic.

The following segment illustrates how to use the **COMPUTE** keyword to calculate the trees per acre of Douglas-fir and the percentage of Douglas-fir in the stand in 2012.

```
....|....|....|....|
Compute         2012
DF_TPA = SPMCDBH(1,DF,0)
DF_PCNT = (DF_TPA/BTPA)*100
End
```

1) The **COMPUTE** keyword begins in the first column of the keyword record and is followed by a timing option right justified in the first field of the keyword (columns 11-20). In the above example, the variables will be computed in 2012. A zero in column 20 would have FVS calculate the variables every cycle.

2) Each variable to be calculated is contained in a supplemental record (new line) following the **COMPUTE** keyword. Each supplemental record contains a user-defined variable name on the left of the equal sign, and a value or expression on the right of the equal sign. In this example, two variables are being calculated (DF_TPA and DF_PCNT). DF_TPA is being set to the trees per acre of Douglas-fir in the stand using the EM function SpMcDBH. DF_PCNT is being set to the percent of Douglas-fir in the stand by dividing DF_TPA by the stand trees per acre (EM variable BTPA) and multiplying by 100. Both variables are being computed at the beginning of the cycle prior to management activities.

3) The list of variables is complete when FVS reads the **END** keyword.

COMPUTE keyword expressions may contain a combination of EM variables and functions and predetermined user-defined variables. For instance, if you want to compute the trees per acre of Douglas-fir and ponderosa pine in a stand, you could add two SpMcDBH functions together (TPA_DFPP variable below). Another commonly used technique is to use variables and functions within functions. In the variable TPA>70% below, the DBHDist function is used to identify the lower end diameter for computing trees per acre using the SpMcDBH function. SpMcDBH(1,All,0,DBHDist(3,4)) would return the trees per acre of all trees greater than or equal to the diameter of the 70th percentile tree in the stand. Many addfiles in use today use these techniques in computing specialized variables.

```
....|....|....|....|
Compute         2012
TPA_DFPP = SPMCDBH(1,DF,0) + SPMCDBH(1,DF,0)
TPA>70% = SPMCDBH(1,0,0,DBHDist(3,4),999,0,999,0,0)
End
```

The **COMPUTE** keyword follows specific formatting. The following guidelines are followed:

- Variable names must not be longer than eight characters.
- Variable names may not be names found in Tables 5-2 and 5-3 of EFVS, may not be FVS species codes, and may not include an ampersand (&).
- Resulting variables may represent beginning of cycle values, harvested values, or after-harvest values.
- Each supplemental record (variable expression) may be up to 2000 characters, of which only 150 may appear on a given line. Additional lines may be used in a single expression by using an ampersand (&) at the end of the line to indicate that the expression is continued on the next line.
- Up to 199 user-defined variables may be calculated in a single stand simulation.

Results of the calculations are reported in the Activity Summary Section of the Summary Statistics Table found in the main output file. Additionally, the results may be viewed using the Compute Post Processors or may be sent to an output database/spreadsheet using the Database Extension.

Exercise 1-1 – Creating Custom Output Variables, Part 1

Many stand variables that are important to track in analyses are not provided for in basic FVS output; however, they may be calculated using the **COMPUTE** keyword. For instance, if wildlife habitat is defined using the number of ponderosa pine snags between 10 and 20 inches dbh, the **COMPUTE** keyword can be used to compute a variable that provides the number of ponderosa pine snags between 10 and 20 inches dbh. The wildlife habitat could then be rated by creating a rating scale where 1-3 ponderosa pine snags are considered poor habitat (habitat score = 1), 3-7 is considered adequate habitat (habitat score = 2), and >7 is considered ideal habitat (habitat score = 3).

In this exercise, the habitat of a fictional wildlife creature called the American Catmar will be determined by creating four complex custom variables that describe the habitat needs of the species. The **COMPUTE** keyword will be used to calculate the variables for a single stand. At the end of the exercise the quality of the habitat over a 100-year period will be rated.

Background Information

This set of exercises is based on the habitat requirements of the fictional North American Marauding Squirrel Cat, colloquially called the American Catmar. The American Catmar is a small mammalian creature seldom seen; however, it is found throughout moist forests in North America. It resembles a pine marten but is most often confused with the gray squirrel due to its slow spiraling accents into tree tops when approached. This trait is due to its left legs being 10-20% shorter than its right legs. This attribute almost led to its extinction following even-aged regeneration harvests where Catmars, when threatened, would circle endlessly. Hunters and predators quickly learned to stay put and wait for the Catmar to return.

Renowned wildlife biologist, I. M. Alyer, studied the American Catmar for over 20 years. His research yielded much needed information on the life history of this species. He specifically developed habitat requirements for resting and foraging activities as well as attributes of successful regress (escape) routes. Alyer found that Catmars use their enormous “beaverlike” front teeth and jaws to excavate woodpecker cavities and to build dens and nests in large live/dead trees. These large teeth also benefit their foraging abilities when prey (squirrels, moles, and mice) are scarce. He observed Catmars eating the twigs and leaves located in the tree crowns as a supplement to their unsteady diet of prey. Finally, Alyer found that tree density and downed woody debris (DWD) coverage played a significant role in their safety. Due to their slow surface speeds, the American Catmar needs readily accessible escape routes into the canopy of the stand (i.e. many small trees).

The American Catmar is listed as a sensitive species; and as such, forest managers need a way to assess the suitability of forests to meet the habitat requirements of this

species. In this training guide, the research results of Alyer will be used to compute custom FVS variables which describe the quality of American Catmar habitat. These variables will then be used to create a custom FVS stand suitability index for American Catmars.

The following stand attributes describe the American Catmar habitat:

1. Trees per acre of both live and dead trees greater than or equal to 20 inches in DBH – used to identify resting habitat
2. Crown biomass of the 50th percentile trees as defined by merchantable volume – used to identify foraging habitat
3. Trees per acre of live trees less than or equal to 30 feet in height – used to identify regress habitat
4. Percent cover of downed wood greater than three inches in DBH – used to indentify hiding and regress habitat

Custom variables need to be created in order to calculate the stand attributes listed above. Using the operators and pre-defined functions in Table 5-3 of the EFVS, write expressions for the four custom variables:

1. _Tpa20p =
2. _CrBio =
3. _TpaMid =
4. _PCDW3p =

Running the Simulation

1) Start Suppose by double-clicking the Suppose icon on your desktop.
2) Make sure that **no previous simulation** is in memory. The title bar should say *new file* if the memory is clear. If a previous simulation is in memory, click **File > New**.
3) Click on the File menu and select “Select Locations File”.
4) In the Open dialog box, navigate to “C:\Fvsdata\Regional-Training” and open the **Suppose.loc** file.

Step 1
Adding the stand to the simulation.

5) If the **Select Simulation Stands** window does not open, click on the “**Select Stands**” button on the main page.
   a. In the large “Locations” box select “Regional Training.”
   b. In the large “Groups” box select “Variant=WC.”

   c. In the large “Stands” box select “**060305402956**”.
   d. At the bottom left corner, click the “**Add 1 Stand**” button.
6) Click on the “**Close**” button.

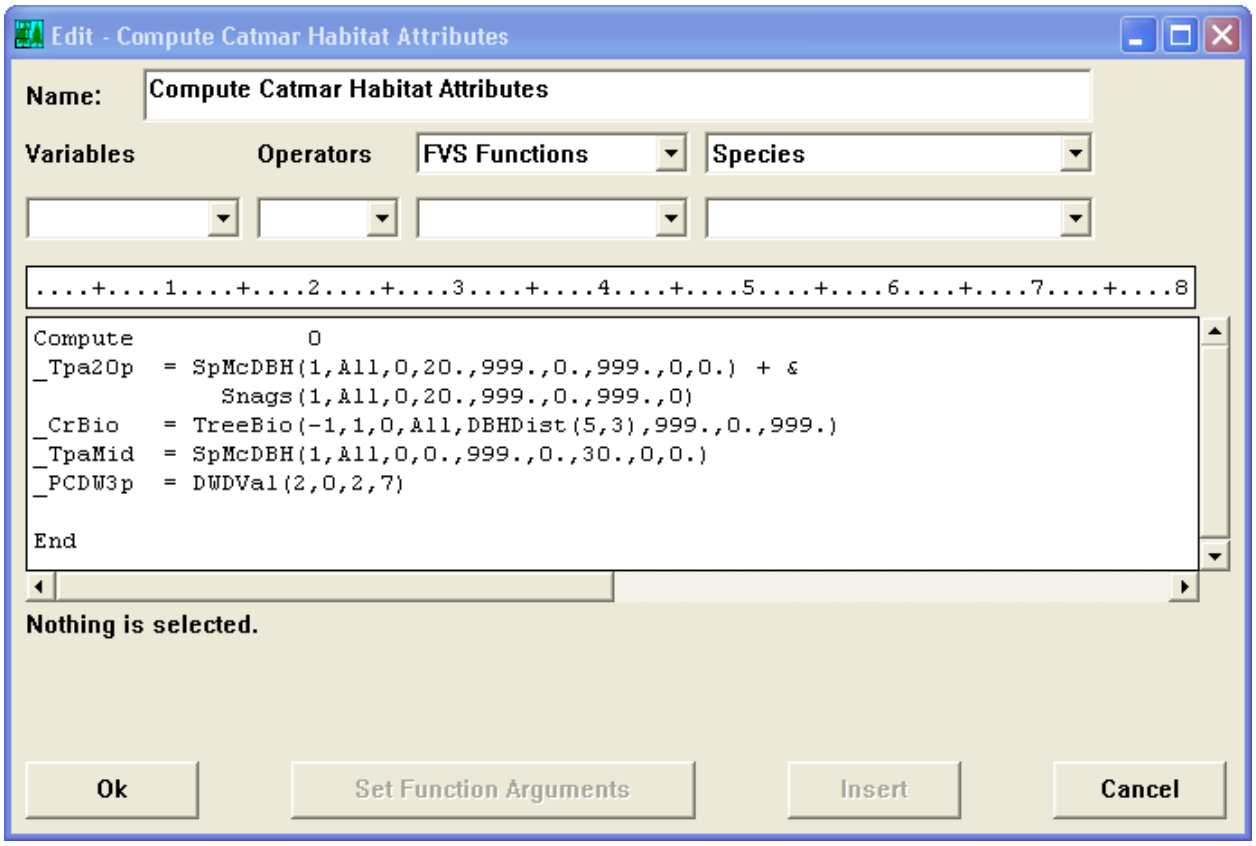
Step 2
Changing the time scale.

7) Click on the “**Set Time Scale**” button.
   a. Change the common starting year from 2006 to 2012.
   b. Change the common ending year to 2112.
8) Click on the “**Ok**” button.

Note: This will grow the stand from 2006 to 2012 before growing the stand cycle by cycle.

Step 3
Adding the compute variables.

9) Click on the “**Add Keywords**” button.
10) Select **Base FVS system > Input/Output Controls > Compute**.
11) Click on the “**Accept**” button.
12) In the **Compute** window do the following:
   a. Change the name to “**Compute Catmar Habitat Attributes”.**
   b. Change the “Schedule by Year/Cycle” field to a “0”.
   c. Click on the “**Use Parms**” button.
   d. Click on the “**Proceed**” button.
   e. Enter the expressions created for the four custom variables between the Compute line and the End line.
13) Click on the “**Ok**” button.
14) Click on the “**Close**” button to close the **Use FVS Keywords** window.



*Note: Entering a 0 in the "Schedule by Year/Cycle" input box provides the compute variables for all cycles. The dropdown menu below the FVS Functions dropdown menu provides access to predefined functions. If a predefined function is selected use the "**Set Function Arguments**" button to access the options available for the functions' arguments. Placing the cursor between the Compute line and the End line and clicking on the "**Insert**" button will place the selected function and its corresponding selected arguments in the **Compute** window. The Event Monitor (EM) Compute Variables can also be accessed using the Select Outputs button.*

Step 4
Creating the outputs.

15) Click on the "**Select Outputs**" button.
16) Select **Fire and Fuels Extension (FFE) Reports > Select Fire and Fuels Reports**.
    a. Leave all boxes checked (default option).
17) Click on the "**Ok**" button.
18) Click on the "**Close**" button to close the **Model Outputs** window.

Note: Some of the four custom variables included functions found in the Fire and Fuels Extension to the Forest Vegetation Simulator (FFE-FVS). In order to access these

functions the FFE-FVS must be turned on. To turn FFE-FVS on, an FFE-FVS keyword must be added to the simulation which is why the Fire and Fuels Reports were selected.

Step 5
Selecting the post processors.

19) Click on the "**Select Post Processors**" button.
    a. Highlight the "View the Main Output file using system editor" post processor.
    b. Click on the "**Include**" button.
    c. Highlight the "Compute1 – Table of Compute Variables (with headers)" post processor.
    d. Click on the "**Include**" button.
20) Click on the "**Close**" button to close the **Select Post Processors** window.

Note: Many of the post processors require output be created before it can be processed, one of the exceptions is "View the Main Output file using system editor" post processor. To know which output to create for a post processor, read the ***Desicription/Notes*** *section in the Select Post Processor window.*

Final Step
Running the simulation.

21) Click on the "**Run Simulation**" button.
22) Name the keyword file **Custom1-1.key.**
23) Click on the "**Save**" button.
24) Click on the "**Run**" button.

Note: Check the main output file for errors associated with your compute expressions. If an expression has a recognized problem, FVS will insert a FVS12 error after the expression in the Options Selected by Input section of the main output file. In addition, look in the Activity Summary to see that the Activity Disposition says "DONE IN <YEAR>" for each custom variable. If the disposition says "NOT DONE", then you have an error in your expression. If your custom variables are not computed, correct your expressions in Suppose. A screen capture of the ***Compute*** *expressions is located in the Answer Guide. Once you are satisfied that your expressions are functioning properly, rerun the simulation, close the output file.*

Questions

Answer the questions below using the Compute post processor output.

Use the table below to describe the habitat score of each habitat category in 2012, 2042, 2072, and 2112.

Habitat Category	Stand Attribute	No Habitat (score=0)	Poor Habitat (score=1)	Moderate Habitat (score=2)	Ideal Habitat (score=3)
Resting	Large Trees (_Tpa20p)	< 5	5 – 15	15 – 25	≥ 25
Foraging	Crown Biomass (_CrBio)	< 7.5	7.5 – 12.5	12.5 – 17.5	≥ 17.5
Regress Routes	TPA in Midstory (_TpaMid)	<100	100 – 200	200 – 300	≥ 300
Hiding/Regress Cover	Percent Cover of DWD (_PCDW3p)	<5 or ≥ 30	5 – 10 or 25 – 30	10 – 15 or 20 – 25	15 – 20

Fill in the table with your results.

Year	Resting Score	Foraging Score	Regress Score	Hiding/Regress Cover Score
2012				
2042				
2072				
2102				

Exercise 1-2 – Rating the Quality of Stand Attributes

In the previous exercise, custom output variables were computed to describe American Catmar habitat. From these custom variables, the quality of various types of habitat, resting, foraging, and regress/hiding habitat were rated using a table. This exercise will build on the previous exercise by using FVS to rate the resting, foraging, and regress/hiding habitat. The rating scale will use the scale found in the table in Exercise 1-1.

Background Information

One method to calculate score values is to use a series of conditional **COMPUTE keywords** for each possible score. FVS does not contain If-Then-Else options; rather each possibility must be created using exclusive **If-Then-Endif** options. An example using the resting score for the American Catmar habitat would be as follows:

```
If                  0
_Tpa20p LT 5
Then
Compute             0
RestScor = 0
End
Endif

If                  0
_Tpa20p GE 5 and _Tpa20p LT 15
Then
Compute             0
RestScor = 1
End
Endif

If                  0
_Tpa20p GE 15 and _Tpa20p LT 25
Then
Compute             0
RestScor = 2
End
Endif
```

```
If                  0
_Tpa20p GE 25
Then
Compute             0
RestScor = 3
End
```

Note: Using multiple conditional statements can take up memory in FVS and may fill up the storage area of the Event Monitor. This can result in the occurrence of FVS17 and FVS18 errors and may in turn cause the variables not to be calculated.

A second option is to use a single **COMPUTE** keyword with an expression containing the **LinInt** (linear interpolation) function, a pre-defined event monitor variable.

The LinInt function is a powerful and versatile function which linearly interpolates between two points graphed using x and y coordinates. The general form is shown below, where (x_1, y_1),(x_2, y_2), . . . ,(x_n, y_n) define points using x and y coordinates and X is some arbitrary value along the x-axis.

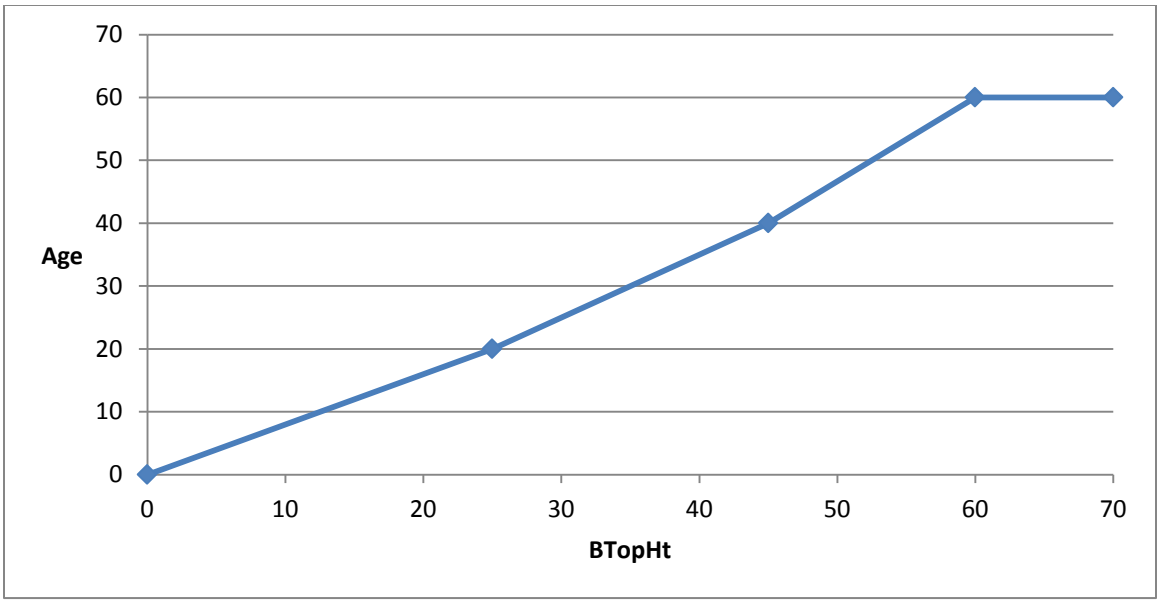
LinInt (X, x_1, $x_{2,...,}$ x_n, y_1, $y_{2,...,}$ y_n)

The function returns the appropriate value along the Y-axis derived from linear interpolation. The line is defined by connecting the points (x_i,y_i) listed in the arguments of the LinInt function. Note that x_1 through x_n must be in ascending sequence (however, two consecutive x_i values can be the same). If X is less than or equal to x_1, then **LinInt** returns the value of y_1, and if X is greater than or equal to x_n, **LinInt** returns the value of y_n. For example, the function **LinInt** (BADBH,5,5,0,1) would return 0 if the QMD is less than 5 inches and a 1 if the QMD was greater than or equal to 5 inches.

At least 2 points must be provided, all arguments must be defined, and the total number of arguments must be an odd number. If any of these conditions are violated, the result of **LinInt** is undefined. The maximum number of allowable points depends on the specific use within an expression and may vary by computer installation. In any case, up to 20 points should be permissible. This function does not have a set number of arguments; values for the arguments are required since there are no default values.

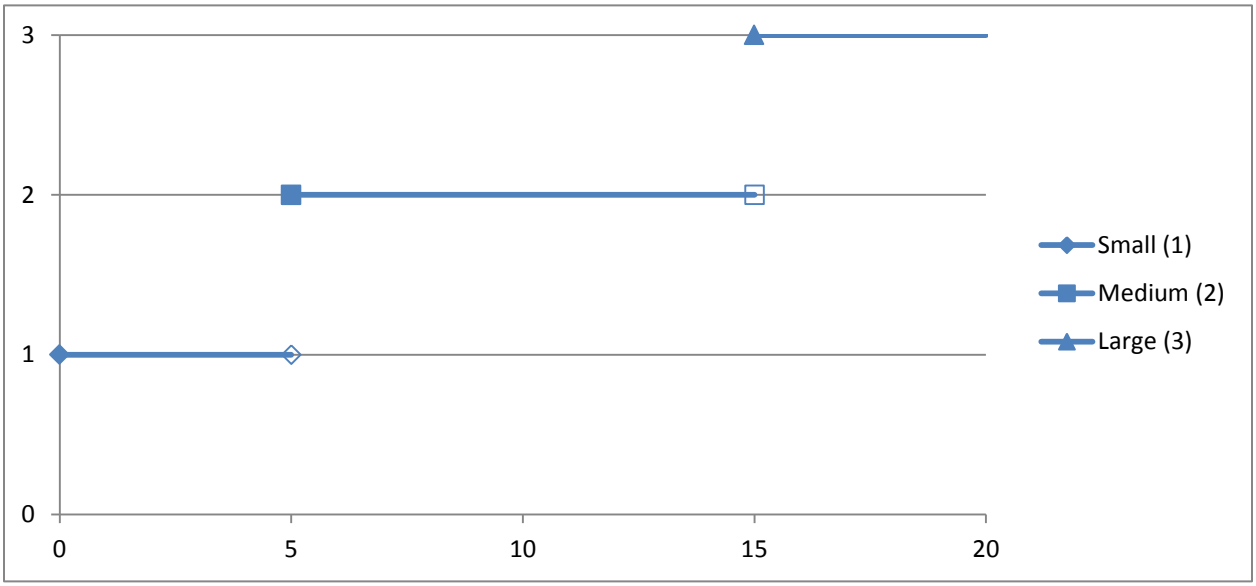
Here are two examples of how the **LinInt** function can be used to calculate a **COMPUTE** variable.

In the first example, the linear relationship between the age of the stand and stand height is examined within the **LinInt** function. The first argument of the **LinInt** function is the X variable (stand height); in this example the stand height will be estimated using the EM variable **BTopHt**. The individual x_i,y_i data points will be listed as the remaining arguments for the **LinInt** function such that the individual x_i's (stand heights) are listed before the individual y_i's (stand age for a given stand height). The **LinInt** function will then be used to compute the age of the stand for each cycle.



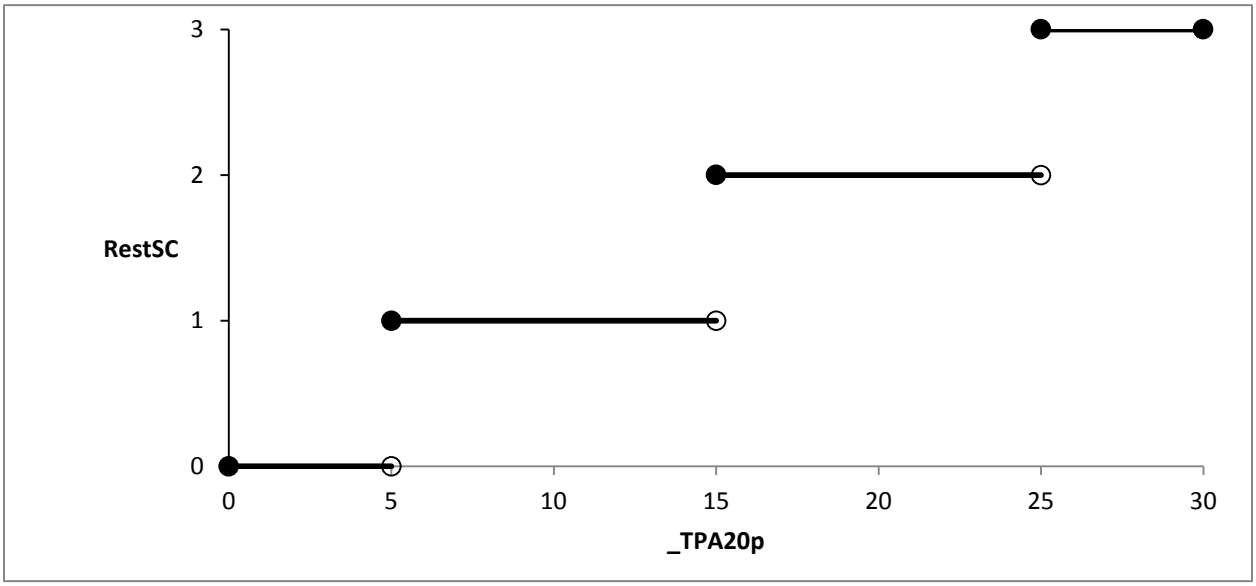

```
Compute            0
StandAge = Lininit(BTopHt,0,25,45,60,0,20,40,60)
End
```

In the second example, the **LinInt** function is used to estimate stand size (small, medium, or large) from quadratic mean diameter of the stand; this is referred to as a step-wise or trigger function. The x_i, y_i arguments of the **LinInt** function are set such that if the stand diameter (**BaDBH**) is less than 5, the size class is set to small (SizCls=1); if the stand diameter is greater than or equal to 5 and less than 15, the size class is set to medium (SizCls =2); and If the stand diameter is greater than or equal to 15, the size class is set to large (SizCls =3).



```
Compute            0
SizCls = Linint(BaDBH,5,5,15,15,1,2,2,3)
End
```

For this exercise, the step-wise **LinInt** function will be used to rate the four habitat variables. The following logic provides an example of how the LinInt function can be used to calculate the resting score for the American Catmar:




```
Compute              0
RestSc  = LinInt(_Tpa20p,5,5,15,15,25,25,0,1,1,2,2,3)
End
```

Using the table in the previous exercise, write expressions to compute the four habitat scores: resting, foraging, regress, and hiding cover.

RestSc = LinInt(_Tpa20p,5,5,15,15,25,25,0,1,1,2,2,3)

ForagSc =

RegrsSc =

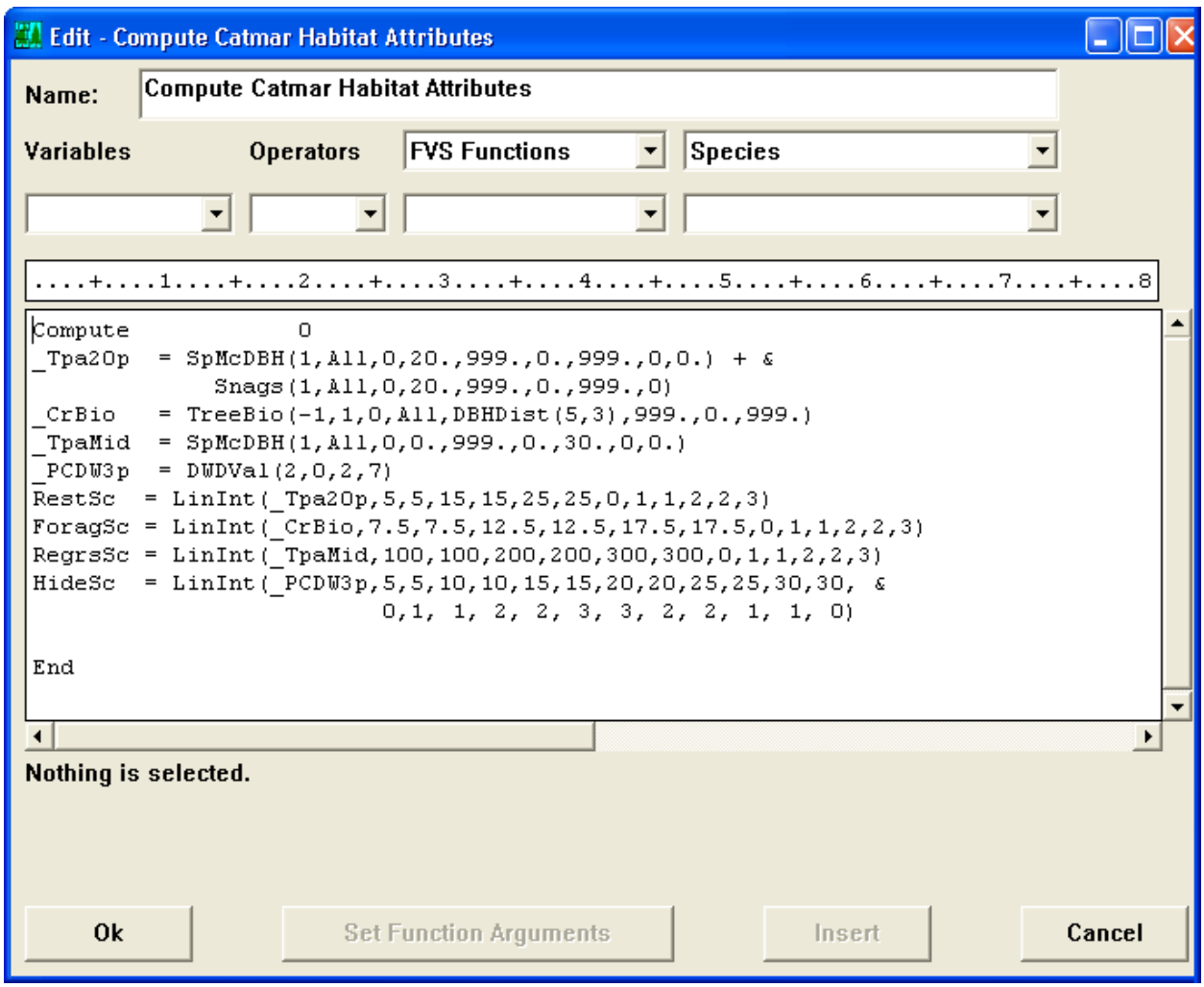
HideSc =

Running the Simulation

1) Make sure that **Exercise 1-1** is open. If the exercise is not open, open **Exercise 1-1** by selecting Open from the File dropdown tab and opening **Custom1-1.key**.

Step 1
Adding additional compute variables.

2) In the "Simulation file contents" window of Suppose, double click on the "**Compute Catmar Habitat Attributes**" option.
3) Enter the expressions created for the four habitat scores after the existing equations and between the Compute and End line.
4) Click on the "**Ok**" button.



Final Step
Running the simulation.

5) Click on the "**Run Simulation**" button.
6) Click on the "**Save As**" button.
7) Name the keyword file **Custom1-2.key.**
8) Click on the "**Save**" button.
9) Click on the "**Run**" button.

Questions

Fill in the table with your results.

Year	Resting Score	Foraging Score	Regress Score	Hiding/Regress Cover Score
2012				
2042				
2072				
2102				

Do these results match what you wrote down in the previous exercise? If not, check both exercises for errors.

Exercise 1-3 – Creating Custom Output Variables, Part 2

In the previous examples, custom variables were calculated based on stand attributes computed during a simulation. In addition, compute variable equations may contain variables in an auxiliary database using a Database Extension (DB-FVS) – Event Monitor (EM) connection.

DB-FVS supports connections between databases and the EM. This interaction can occur for any cycle where an EM's **COMPUTE** keyword is processed. At any time during the simulation DB-FVS keywords can be used in conjunction with SQL statements to connect to an existing database and select data from that database. The **SQLIN** keyword initiates this process and allows the user to use SQL statements within the EM. The user controls at what time during the simulation the SQL statements are executed.

Using the **SQL SELECT** statement will produce a new table. The column names from the resultant table will be compared to the names of any user-defined variables within the EM. For any matching variable, the value found in the last row of the result table is used to set the value of Event Monitor variable. For example, if a user-defined variable called BATARG is created using the **COMPUTE** keyword and the resultant table created from the SQL statement contains a column called BATARG, the value found in the last row of the BATARG column from the resultant table will be assigned to the user-defined **COMPUTE** variable. BATARG could then be used in conditional statements and expressions.

When the SQL statement is a Select statement meant to set the value of an Event Monitor variable, the variables must be defined prior to executing the query. Event Monitor variables are defined (but not given values) simply by using them in logical expressions, compute expressions, or by using parameters on keywords. This exercise uses the **SQLIN** keyword to select a value from the FVS_StandInit table in your input database and uses it to create a user-defined variable.

Background Information

Wildlife biologist I. M. Alyer recently identified that moisture regime index is a solid predictor for identifying forest stands capable of supporting American Catmar populations. Moisture regimes range from 0 to 4 and are reported in the MOISTURE field for stands on the Gifford-Pinchot forest (603) in your training database. The MOISTURE value will be used to create another user-defined variable which reports whether or not the forest is capable of supporting American Catmar habitat. MOISTURE values less than 2.5 are considered incapable of supporting populations, whereas values greater than or equal to 2.5 can support viable populations.

In this exercise, the EM-DB extension linkage will be used to compute a variable that reports the suitability of the forest stand to support a viable population of American

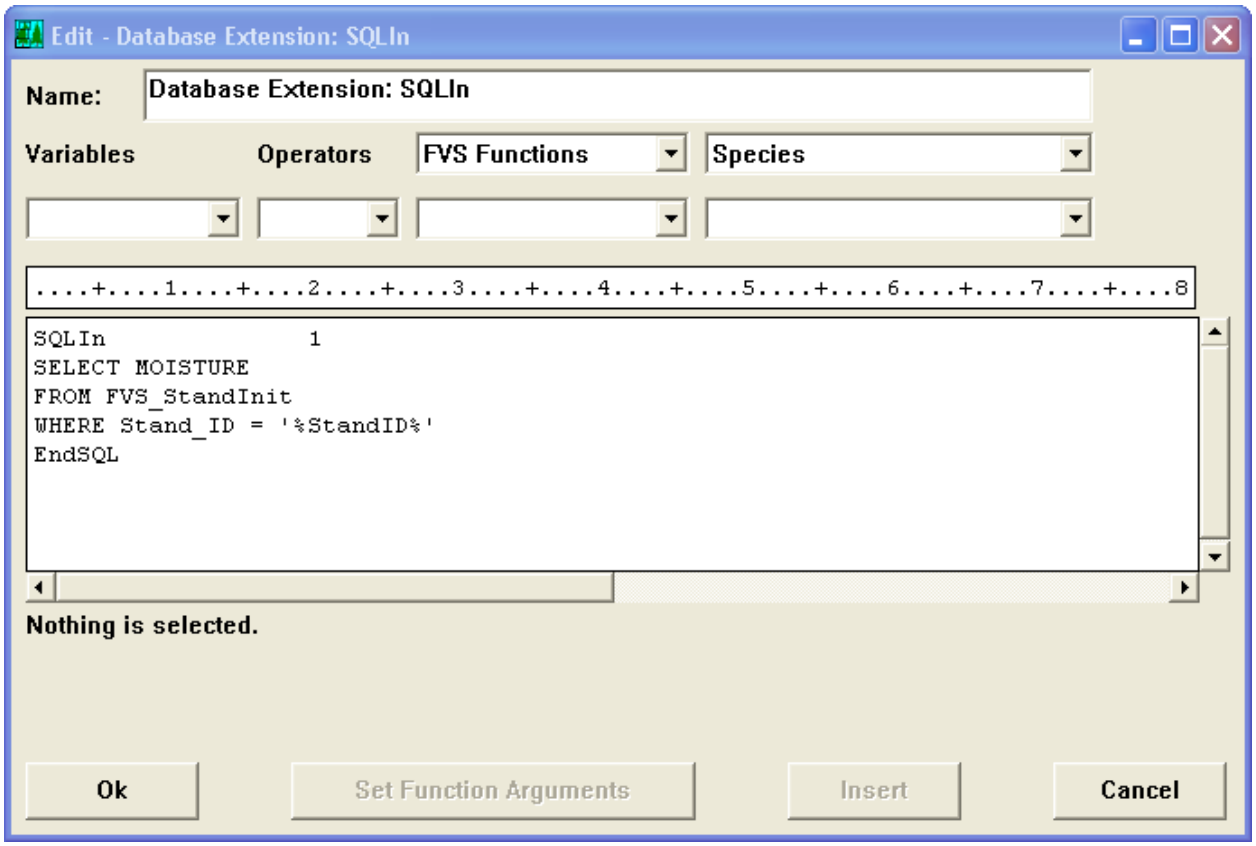
Catmar. Suitability scores of 0 will represent an unsuitable stand; suitability scores of 1 will represent a suitable stand.

Running the Simulation

1) Make sure that **Custom1-2.key** is the open simulation file. If the exercise is not open, open Exercise 1-2 by selecting Open from the File dropdown tab and opening **Custom1-2.key**.

Step 1
Opening the database extension.

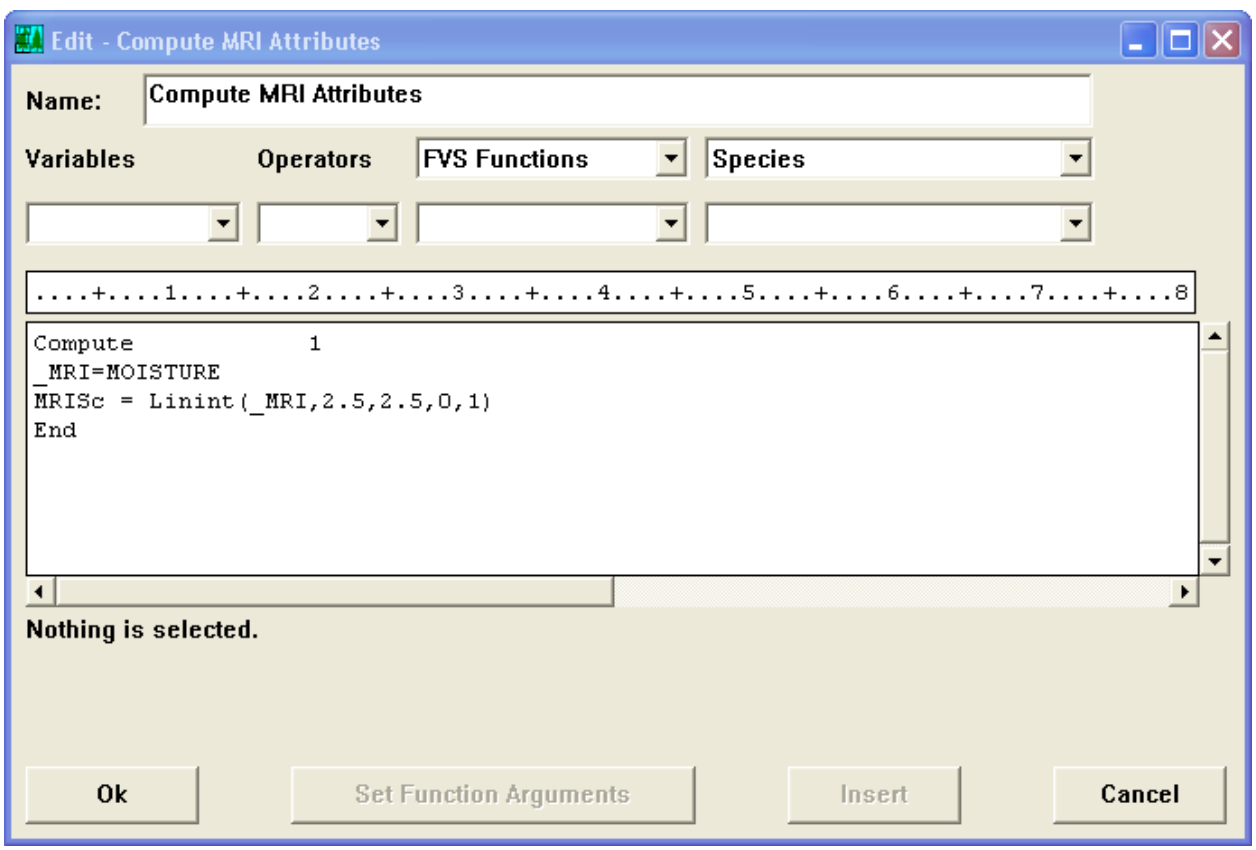
2) Click on the "**Add Keywords**" button.
3) Select **Database Extension > All Keywords > SQLIn**.
4) Click on the "**Accept**" button.
   a. Change the "Schedule by Year/Cycle" field to a "1".
   b. Click on the "**Use Parms**" button.
   c. Click on the "**Proceed**" button.
   d. Change the SQL statement to select the "MOISTURE" variable from the FVS_StandInit table where the current Stand_ID equals '%StandID%'.
5) Click on the "**Ok**" button.



Note: The quotes listed in 7d) are needed in the SQL code. When the first field is left blank, the statement is executed immediately upon being read by the program. When a value is entered in the first field, the statement is considered an FVS activity and scheduled to be executed during the year or cycle indicated. Like any other FVS activity, an SQLIN statement can be scheduled upon a condition using the ***IF-THEN-ENDIF*** *construct supported by the EM.*

Step 2
Computing the variables of interest.

6) Select **Base FVS System > All Keywords > Compute**.
   a. Change the name to "**Compute MRI Attributes"**
   b. Change the "Schedule by Year/Cycle" field to a "1".
   c. Click on the "**Use Parms**" button.
   d. Click on the "**Proceed**" button.
   e. Enter the following expressions between the Compute line and the End line:
      _MRI=MOISTURE
      MRISc = Linint(_MRI,2.5,2.5,0,1)
7) Click on the "**Ok**" button.
8) Click on the "**Close**" button to close the **Use FVS Keywords** window.



Final Step
Running the simulation.

9) Click on the "**Run Simulation**" button.
10) Click on the "**Save As**" button.
11) Name the keyword file **Custom1-3.key.**
12) Click on the "**Save**" button.
13) Click on the "**Run**" button.

Questions

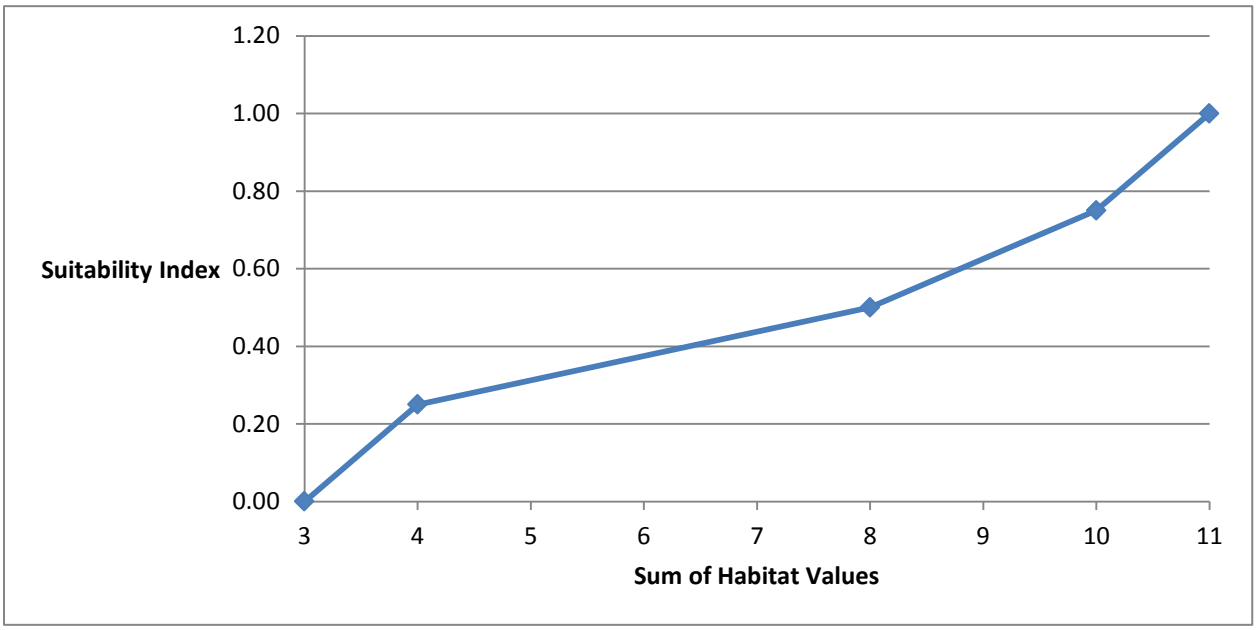
Check the main output file to make sure the new custom moisture variables were calculated. Close the main output file. The Compute post processor will open and you will see the two new moisture variables calculated in the first cycle. Since these variables do not change during a simulation, there is no need to calculate them every cycle. Once calculated they remain in memory for future use during the simulation. The compute variables were calculated then every cycle.

What are the MRI and MRI score for this stand: _____ _____

Exercise 1-4 – Creating a Habitat Suitability Index

In this exercise, an American Catmar suitability index (CatMrIdx) will be computed based on the habitat scores computed in the previous examples. Stands that have a MRI value greater than 2.5 are considered suitable habitat (MRISc = 1) for the American Catmar. If a stand meets this criterion, the suitability index is equal to the sum of the habitat scores using the following guidelines:

Sum of Habitat Values	Suitability Index
<3	0.00
4	0.25
8	0.50
10	0.75
>11	1.00



Once the habitat suitability index has been determined, the American Catmar suitability index will be calculated for all stands (not bareground) identified in the Western Cascades variant (group code = “Variant=WC) region. The information will then be used to fill in the table below. There are no new methods being presented in this example.

Stand ID	2012	2052	2112
060305402956			
060305402995			
060305403015			
060305403020			
060305403030			
060305403055			
Average Value			

Hint: you will need to use conditional COMPUTE keywords or use double LININTs in a single COMPUTE keyword to calculate the American Catmar suitability index (CatMrIdx).

Extra credit:

Reorganize the custom variables so that you use less than 5 custom variables in your calculations.

Session 2- Scheduling Management Activities Based on Conditions

Introduction

In the Regional FVS training course, you were introduced to the concept of scheduling management activities based upon a condition. Thinning may be called for if the stand is too dense, or a prescribed burn may be implemented only if certain conditions are met. The Event Monitor feature of FVS allows the user to specify a set of condition that must occur or thresholds that must be met. The user can then specify a set of management activities for the model to simulate when that condition occurs. The Event Monitor can evaluate expressions both prior to and after thinning requests. For more information on conditionally scheduling activities see section 5.5 in the Essential FVS guide.

In this course you will expand on the knowledge learned from the regional training to: schedule multiple events dependent upon a condition, scheduling a random event, scheduling based upon if-then-else conditions, and addition conditions to the Condition Library.

Exercise 2-1 – Conditionally Scheduling Multiple Management Activities

The scheduling of management activities is often dependent upon other management activities. In this exercise, the conditional scheduling option in FVS will be explored for multiple management activities. Conditional scheduling may be used when you want an activity to occur based on stand attributes and other considerations as opposed to scheduling an activity at a specified time. In this exercise a thin from below will be performed when the stand basal area reaches 100. One year after thin, a prescribed fire will be performed and one year after the fire, natural regeneration will be added to the simulation.

Running the Simulation

1) Start Suppose by double-clicking the Suppose icon on your desktop.
2) Make sure that **no previous simulation** is in memory. The title bar should say *new file* if the memory is clear. If a previous simulation is in memory, click **File > New**.
3) Click the File menu and select "Select Locations File".
4) In the Open dialog box, navigate to "C:\Fvsdata\Regional-Training" and open the **Suppose.loc** file.

Step 1
Adding the stand to the simulation.

5) If the **Select Simulation Stands** window does not open, click on the "**Select Stands**" button on the main page.
    a. In the large "Locations" box select "Regional Training."
    b. In the large "Groups" box select "Variant=WC."
    c. In the large "Stands" box select "**06035402995**".
    d. At the bottom left corner, click the "**Add 1 Stand**" button.
6) Click the "**Close**" button.

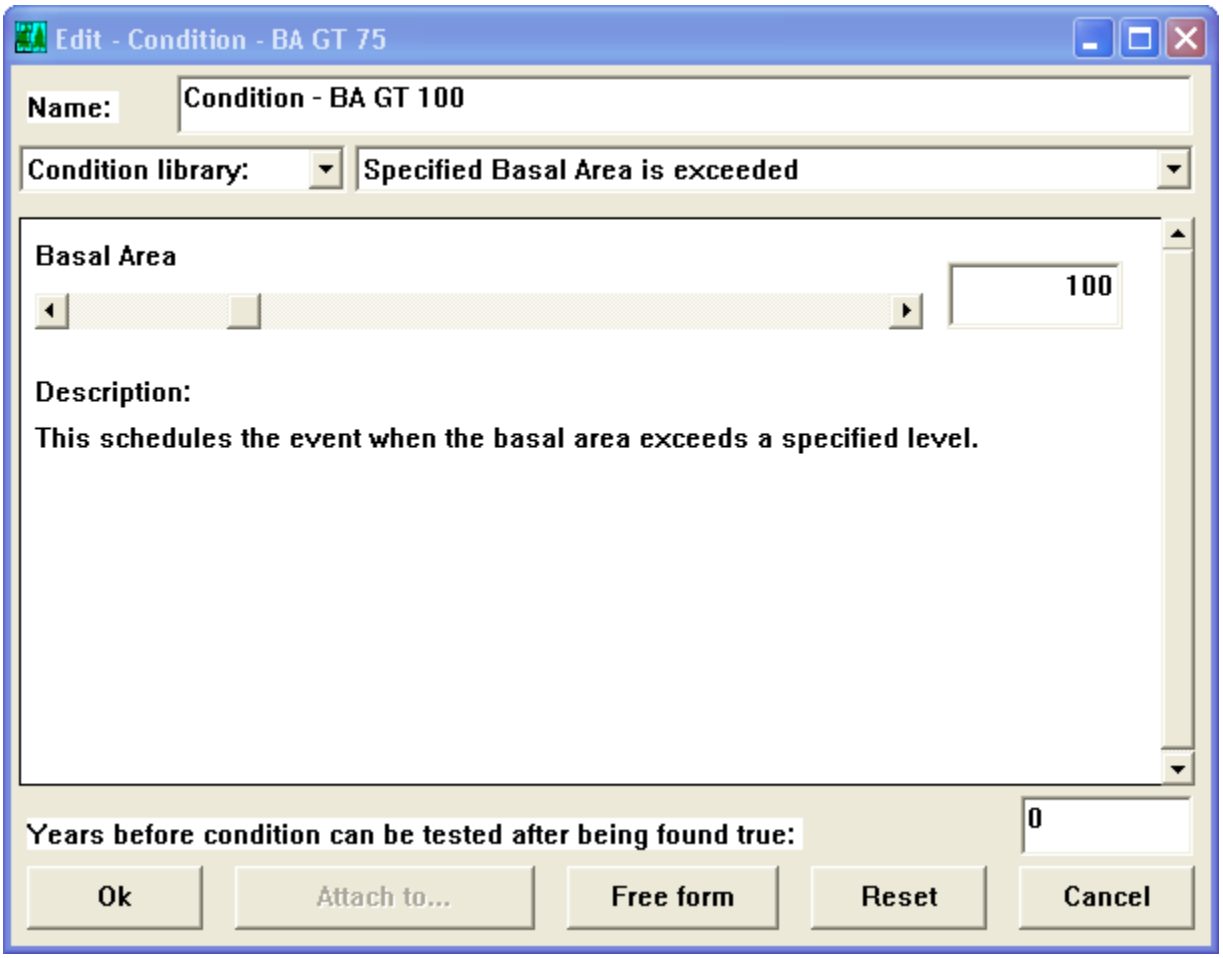
Step 2
Changing the time scale.

7) Click on the "**Set Time Scale**" button.
    a. Change the common starting year from 2006 to 2012.
    b. Change the common ending year to 2072.
8) Click on the "**Ok**" button.

Note: This will grow the stand from 2006 to 2012 before growing the stand cycle by cycle.

Step 3
Defining the management actions and conditions.

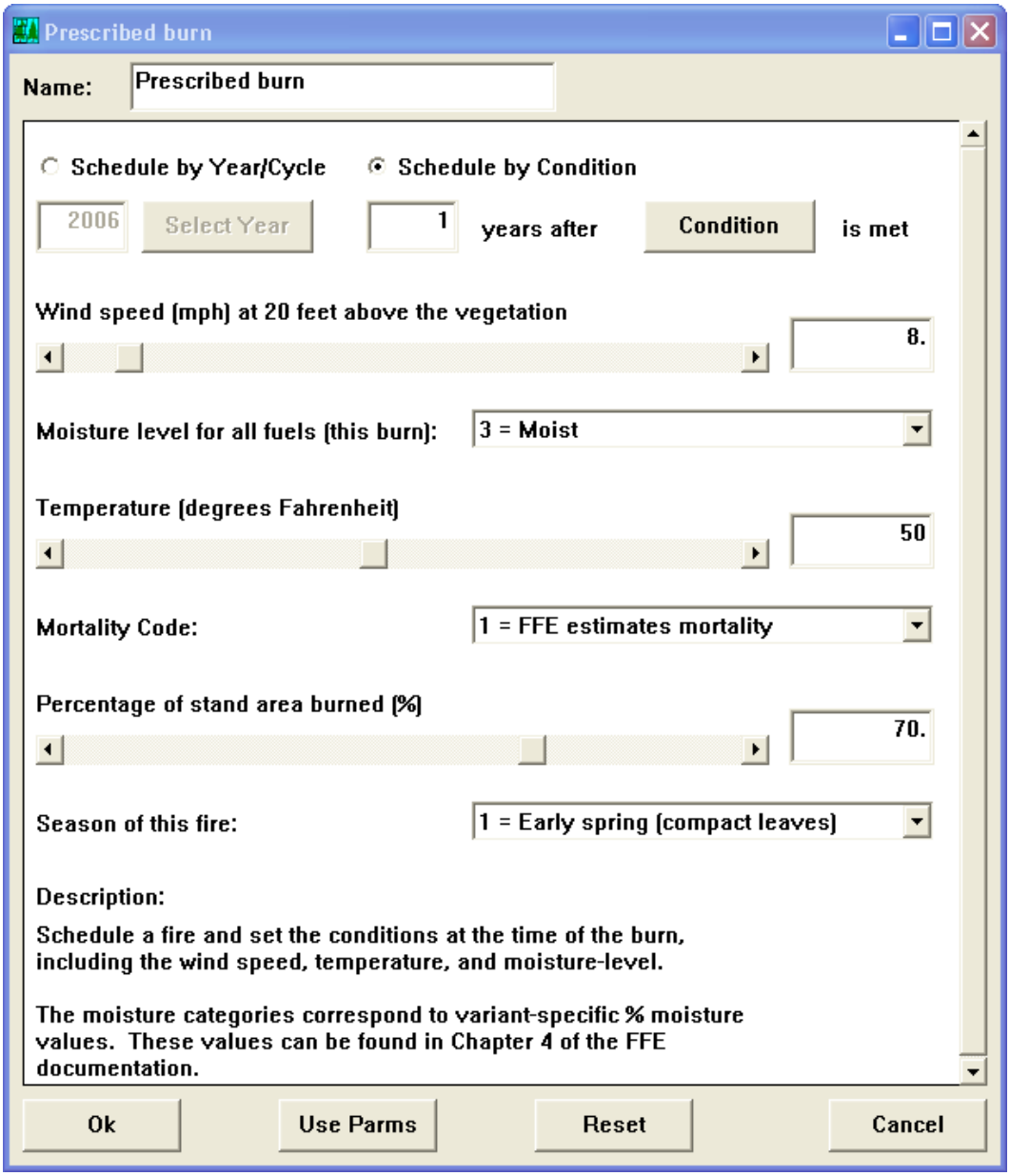
9) Click on the "**Select Management**" button.
10) Select **Thinning & Pruning Operations > Thin from below**.
    a. Enter the residual density in terms of basal area: 60.
    b. Click the small radio button to the left of "Schedule by Condition".
    c. Click the "**Condition**" button.
    d. Click the down arrow on the drop box to the right of the Condition Library.
    e. Select the condition "Specified Basal Area is exceeded."
    f. Set the basal area to "100".
    g. Change the "Years before condition can be tested after being found true:" to 0.
    h. Change the name of the condition to "Condition – BA GT 100".



11) Click on the "**Ok**" button to close the **Condition** window.
12) Click on the "**Ok**" button to close the **Thin from Below** window.

Note: The condition library contains a list of useful predefined conditions. Exercise 2-4 explains how to create a customized library of conditions.

13) Select **Fuel Treatments > Prescribed burn**.
    a. Change the moisture level to “3 = Moist”.
    b. Change the temperature to “50”.
    c. Click the small radio button to the left of “Schedule by Condition”.
    d. Change the “years after” field set to “1”.
    e. Click on the “**Condition**” button.
    f. Click on the “**Attach to…**” button.
    g. Select the Condition – BA GT 100 condition and click “**Ok**”.
14) Click on the “**Ok**” button to close the **Prescribed burn** window.



15) Select **Planting & Natural Regeneration > Plant/Natural with Partial Estab Model**.

a. Leave sprouting turned on. This will automatically add sprouts from the sprouting species into the simulation.
b. Change the Planting/Natural done to “0” year(s) after the date of disturbance.
c. Select the radio button to the left of the “Natural” keyword.
d. Enter the parameters for the first species:

Species .....Western hemlock
Trees/acre 50
Percent survival.....100
Ave. height 2.0

Shade code .....Uniform distribution
Leave all other fields set to default values.

e. Click on the "**Another Plant/Natural**" button.
f. Enter the parameters for the second species:

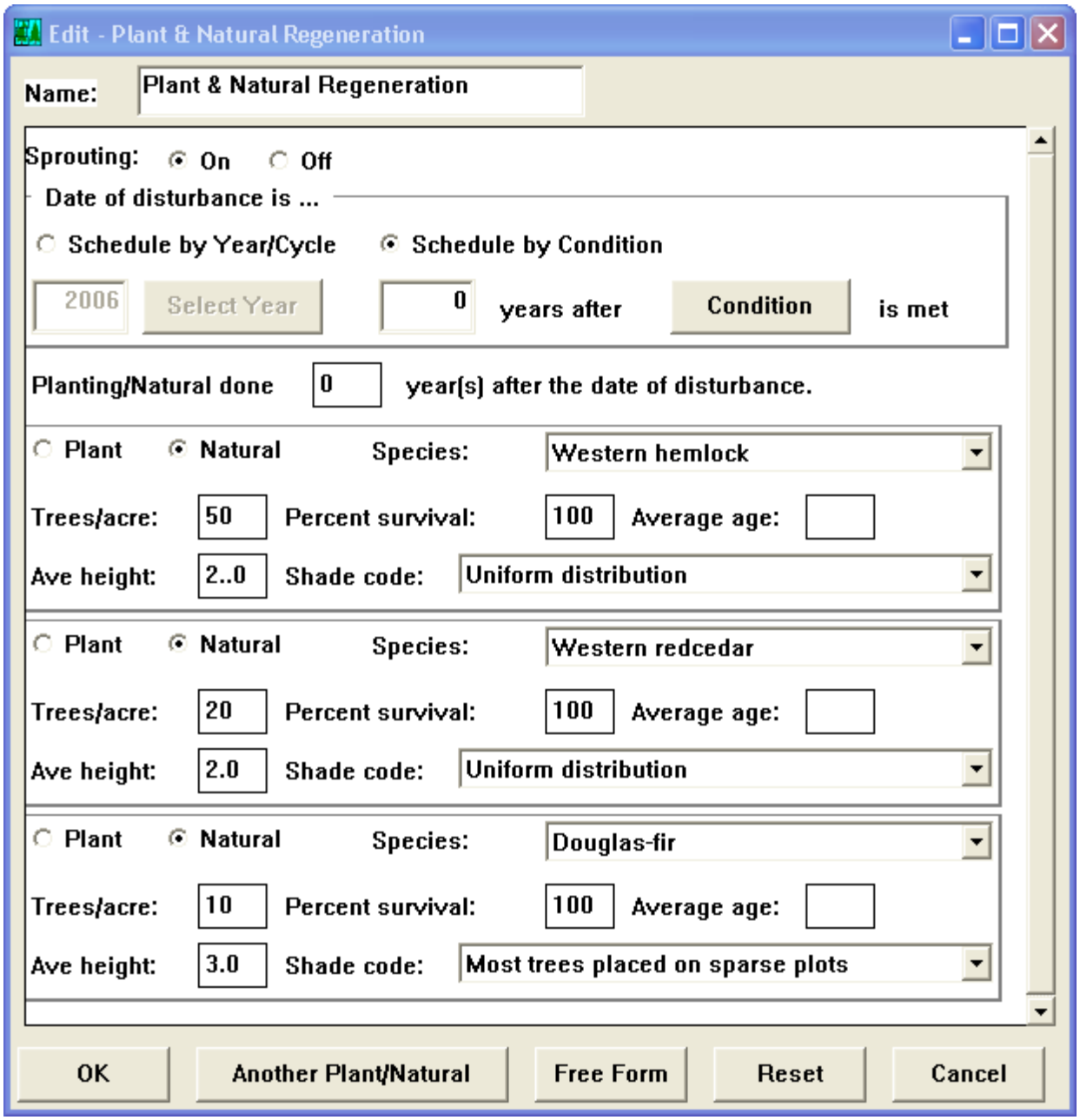
Type .....Natural
Species .....Western redcedar
Trees/acre 20
Percent survival.....100
Ave. height 2.0
Shade code .....Uniform distribution
Leave all other fields set to default values.

g. Click on the "**Another Plant/Natural**" button.
h. Enter the parameters for the third species:

Type .....Natural
Species .....Douglas-fir
Trees/acre 10
Percent survival.....100
Ave. height 3.0
Shade code .....Most trees placed on sparse plots
Leave all other fields set to default values.

i. Click the small radio button to the left of "Schedule by Condition".
j. Change the "years after" field to 2.
k. Click on the "**Condition**" button.
l. Click on the "**Attach to…**" button.
m. Select the Condition – BA GT 75 condition and click "**Ok**".

16) Click on the "**Ok**" button to close the **Planting and Natural Regeneration** window.
17) Click on the "**Close**" button to close the **Management Actions** window.



Note: Management actions may be attached to the same conditions. In this example the same condition (when stand basal area reaches 75) prompts thinning of the stand to a residual basal area of 60 followed by a prescribed burn and the addition of regeneration. Be warned, If for some reason the thinning does not occur (perhaps the residual target cannot be met), the prescribed burn and the addition of regeneration will still occur. In addition, only fire and regeneration keywords operate in the middle of a cycle. Adding other management activities in the middle of a cycle will cause the management activity to occur at the beginning of the cycle, unless a new cycle boundary is added to the simulation.

Step 4
Selecting the Post Processors.

18) Click on the "**Select Post Processors**" button.
19) Highlight the "View the Main Output file using system editor" post processor.
20) Click on the "**Include**" button.
21) Click on the "**Close**" button to close the **Select Post Processors** window.

Note: Many of the post processors require output be created before it can be processed, one of the exceptions is "View the Main Output file using system editor" post processor. To know which output to create for a post processor, read the ***Desicription/Notes*** *section in the Select Post Processor window.*

Final Step
Running the simulation.

22) Click on the "**Run Simulation**" button.
23) Name the keyword file **Conditional2-1.key**.
24) Click on the "**Save**" button.
25) Click on the "**Run**" button.

Questions

Scroll through the *Input Summary Table - Options Selected by Input* section of the main output file. What FVS keywords were added to the simulation to perform the conditional thinning, prescribed burn, and natural regeneration?

From the *Summary Statistics Table,* how many times was the stand thinned? Did the stand get thinned every time basal area exceeded 100?

From the *Activity Summary*, when did the natural regeneration get entered into the simulation?

Extra Credit

Adjust the simulation run so that you have a minimum waiting time of 40 years between thinning events and so that thinning does not occur in cycle 1. *Hint: you will have to use the free form editor to adjust the code.*

Extra Extra Credit

Adjust the simulation run so that you base the conditional thinning on basal area in trees greater than 5” DBH.

Exercise 2-2 – Conditionally Scheduling Based on a Random Event

Often random events such as fire or insect outbreaks need to be modeled. In this exercise, a stand replacing fire will be randomly scheduled. Two years after the fire regeneration of lodgepole pine will be added to the stand.

Running the Simulation

Step 1
Adding the stand to the simulation.

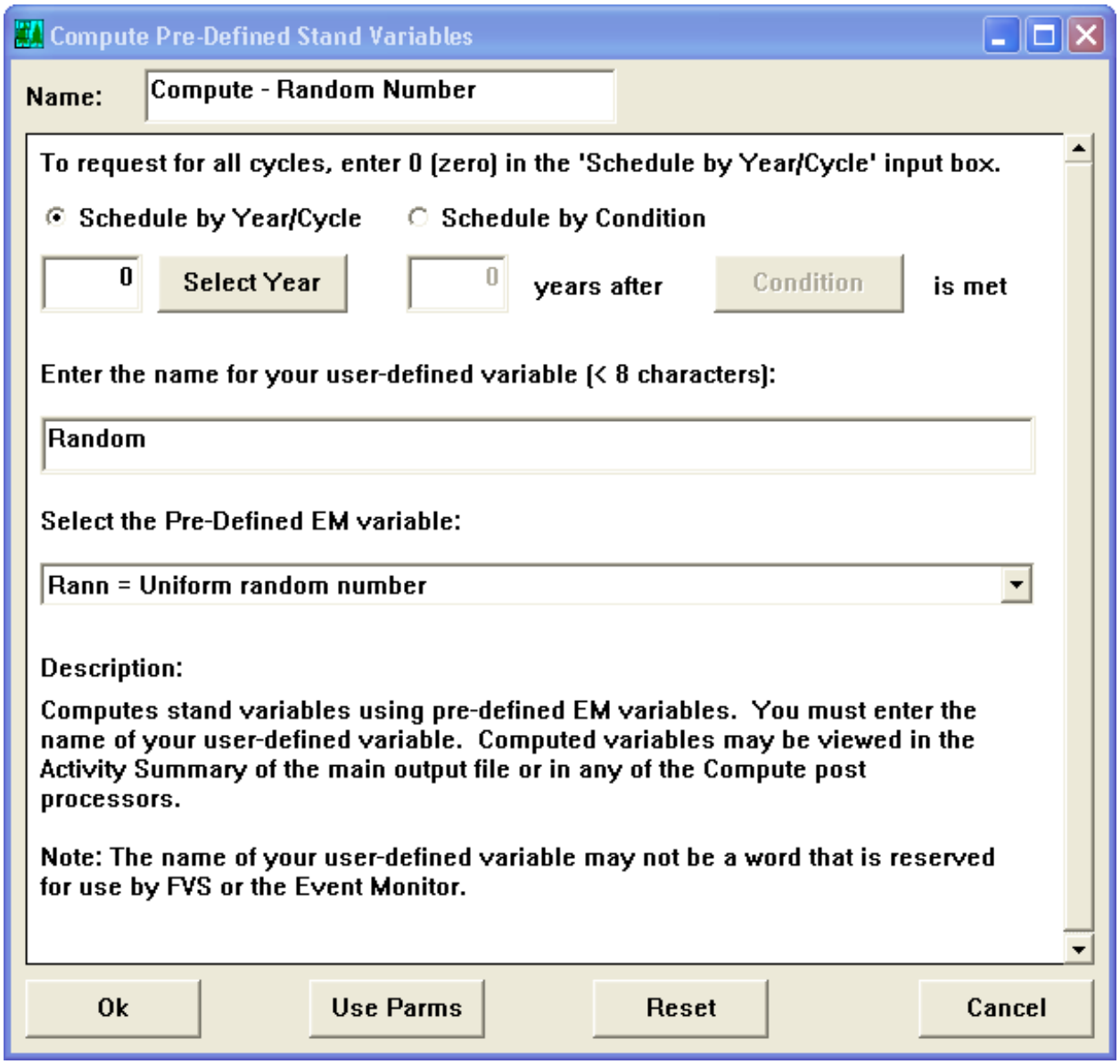
1) Make sure that **no previous simulation** is in memory. The title bar should say *new file* if the memory is clear. If a previous simulation is in memory, click **File > New**.
2) Click on the "**Select Stands**" button on the main page.
    a. In the large "Locations" box select "Regional Training."
    b. In the large "Groups" box select "Variant=WC."
    c. In the large "Stands" box select "**060305402995**".
    d. At the bottom left corner, click the "**Add 1 Stand**" button.
3) Click on the "**Close**" button.

Step 2
Changing the time scale.

4) Click on the "**Set Time Scale**" button.
    a. Change the common starting year from 2006 to 2012.
    b. Change the common ending year to 2042.
5) Click on the "**Ok**" button.

Step 3
Creating a random number using Event Monitor Compute Variables.

6) Click on the "**Select Outputs**" button.
7) Select **Event Monitor (EM) Compute Variables > Compute Pre-Defined Stand Variables**
    a. Change the name to "Compute – Random Number".
    b. Change the Schedule Year to "0".
    c. Enter the variable name to be "Random".
    d. Use the drop down tab to select "Rann = Uniform random number".
8) Click on the "**Ok**" button.
9) Click on the "**Close**" button to close the **Model Outputs** window.



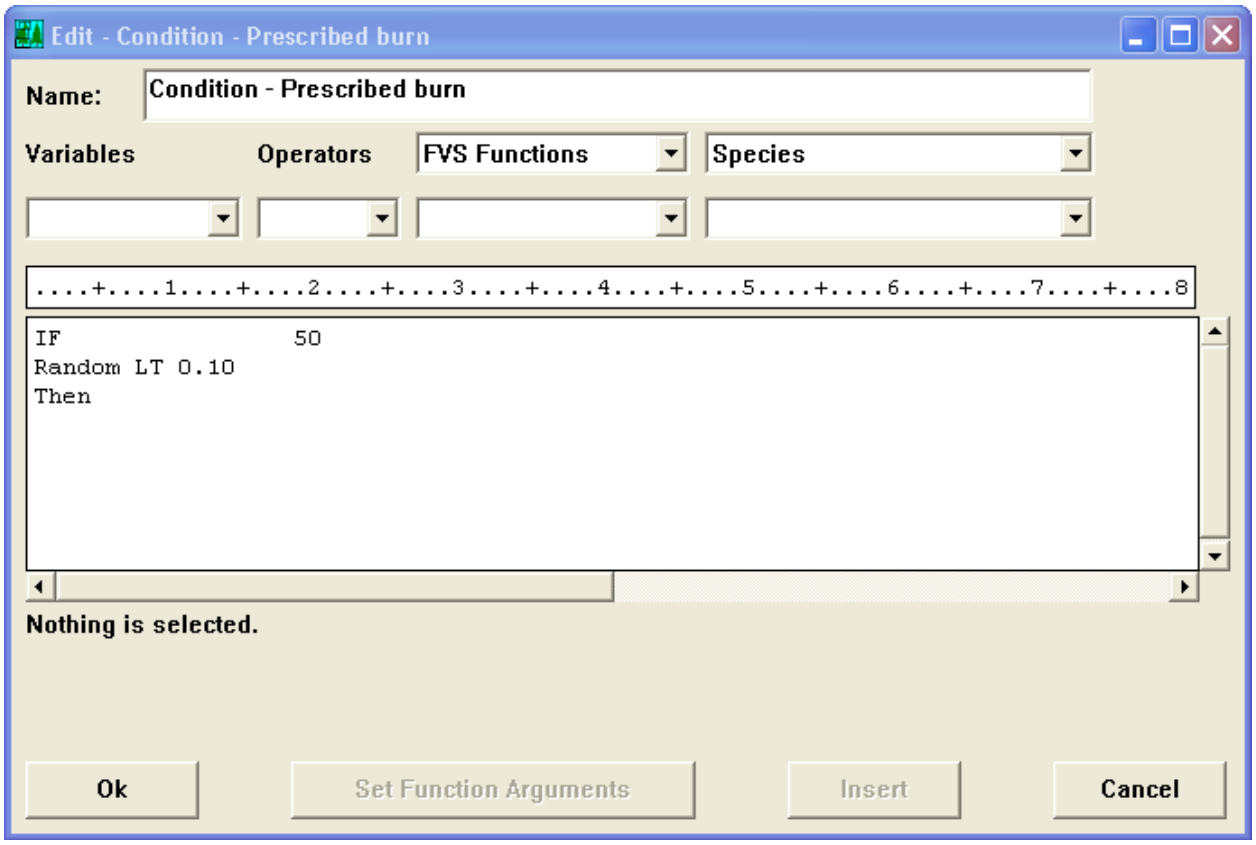
Note: For more information on using pre-defined event monitor variables see section 5.5.2.2 in the Essential FVS guide.

Step 4
Defining the management actions and conditions.

10) Click on the "**Select Management**" button.
11) Select **Fuel Treatments > Prescribed burn.**
    a. Change the moisture level to 1 = Very Dry.
    b. Change the wind speed to 50.
    c. Change the percentage of the stand area burned to 100.

d. Click on the small radio button to the left of “Schedule by Condition”.
e. Click on the “**Condition**” button.
f. Click on the “**Free form**” button.
g. Click on the “**Proceed**” button.
h. Change the name to “Condition – Random”.
i. Enter the conditional statement “Random LT 0.10” expressions between the IF line and the Then line.
j. Change the 0 located after the IF statement to 50.

12) Click on the “**Ok**” button.
13) Click on the “**Ok**” button to close the **Prescribed burn** window.



Note: The condition statement will cause a prescribed burn to occur if the random number is less than 0.10. By inserting the value of 50 within the IF statement constrains the fire from occurring within 50 years following a fire. The number 50 needs to be in the exact location as shown in the figure to work correctly.

14) Select **Planting & Natural Regeneration > Plant/Natural with Partial Estab Model**.
a. Turn off sprouting.
b. Change the Planting/Natural done to “2” year(s) after the date of disturbance.

c. Select the radio button to the left of the “Natural” keyword.
d. Enter the parameters for lodgepole pine:

Type .....Natural
Species .....Douglas-fir
Trees/acre.....700
Percent survival.....70
Ave. height 3.0
Shade code .....Uniform distribution
Leave all other fields set to default values

e. Click the small radio button to the left of “Schedule by Condition”.
f. Click on the “**Condition”** button.
g. Click on the “**Attach to…**” button.
h. Select the Condition – Random condition and click “**Ok**”.

15) Click on the “**Ok**” button to close the **Planting and Natural Regeneration** window.
16) Click on the “**Close**” button to close the **Management Actions** window.

Step 5
Selecting the Post Processors.

17) Click on the “**Select Post Processors**” button.
18) Highlight the “Compute1 – Table of Compute Variables (with headers)” post processor.
19) Click on the “**Include**” button.
20) Highlight the “View the Main Output file using system editor” post processor.
21) Click on the “**Include**” button.
22) Click on the “**Close**” button to close the “Select Post Processors” window.

*Note: to use the “Compute1 – Table of Compute Variables (with headers)” post processor, event monitor variables must be created first. See the Description/Notes section in the **Select Post Processors** window for more detailed information.*

Final Step
Running the simulation.

23) Click on the “**Run Simulation**” button.
24) Name the keyword file **Conditional2-2.key**.
25) Click on the “**Save**” button.
26) Click on the “**Run**” button.

Questions

The Table of Computed Variables will open. In which years is the random number greater than 0.90?

Close the Table of Computed Variables. The main output file will open. Scroll through the *Input Summary Table - Options Selected by Input* section of the main output file. Did the conditional statement appear?

Scroll through the *Activity Summary Table*. Did a fire occur? If so, in what year? What random number caused the fire to occur? Did regeneration occur 2 years after the fire?

Extra Credit

Run the simulation again. Did you obtain the same results? Use the RANNSeed keyword to change the random number generator and change the results.

Note: entering a value of 0 for the RANNSeed keyword will cause FVS to produce different results for each run.

Extra Extra Credit

For the years 2012, 2022, and 2032, create a distribution for the likelihood of a catastrophic fire to occur.

Note: This will require running the exercise (or the stand) multiple times (say 100) and exporting the compute variable "Random" to Microsoft Excel. From there a pivot chart can be created using 0.10 classes for the random number.

Exercise 2-3 – Scheduling Alternative Management Activities Based Upon a Condition

Perhaps interest lies in creating a condition as an indicator between selecting different management activities. For example if the basal area of a stand is at least 225 square feet per acre, less regeneration needs to be modeled than if the stand basal area is less than 225. While condition statements offer great flexibility in scheduling management activities, the use of an **If-Then-Else** statement is not an option in FVS. As such, each condition needs to be modeled separately as an **If-Then** statement.

Running the Simulation

Step 1
Adding the stand to the simulation.

1) Make sure that **no previous simulation** is in memory. The title bar should say *new file* if the memory is clear. If a previous simulation is in memory, click **File > New**.
2) Click on the "**Select Stands**" button on the main page.
    a. In the large "Locations" box select "Regional Training."
    b. In the large "Groups" box select "Variant=WC."
    c. In the large "Stands" box select "**060305402995**".
    d. At the bottom left corner, click the "**Add 1 Stand**" button.
3) Click on the "**Close**" button.

Step 2
Changing the time scale.

4) Click on the "**Set Time Scale**" button.
    a. Change the common starting year from 2006 to 2012.
    b. Change the common ending year to 2072.
5) Click on the "**Ok**" button.

Step 3
Defining the management actions and conditions.

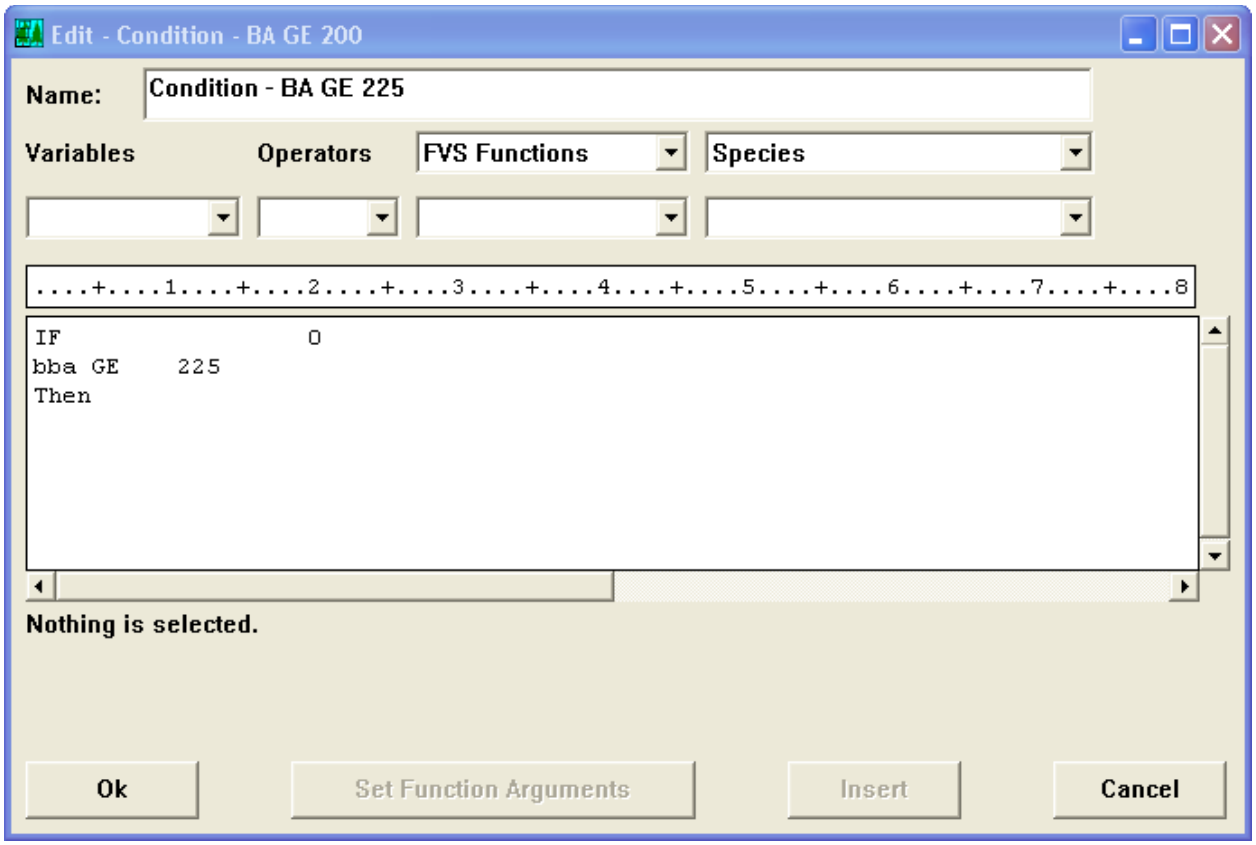
6) Click on the "**Select Management**" button.
7) Select **Thinning & Pruning Operations > Thin from below**.
    a. Enter the residual density in terms of basal area: 100.
8) Click on the "**Ok**" button to close the **Thin from Below** window.
9) Select **Planting & Natural Regeneration > Plant/Natural with Partial Establishment Model**.
    a. Select the radio button to the left of the "Natural" keyword.
    b. Enter the parameters for lodgepole pine:

        Species .....Douglas-fir

Trees/acre 10
Percent survival.....100
Ave. height 2.0
Shade code .....Most trees placed on sparse plots
Leave all other fields set to default values

c. Click the small radio button to the left of “Schedule by Condition”.
d. Click on the “**Condition**” button.
e. Change the name of the condition to “Condition – BA GE 225”.
f. Click the down arrow on the drop box to the right of the Condition Library.
g. Select the condition “Specified Basal Area is exceeded.”
h. Set the basal area to 225.
i. Set the years before the condition can be tested after being true to 0.
j. Click on the “**Free form**” button.
k. Click Proceed.
l. Change “gt” to “GE”.

10) Click on the “**Ok**” button.
11) Click on the “**Ok**” button to close the **Planting and Natural Regeneration** window.



*Note: Using the “**Free forms**” button opens the code behind the scenes which can then be edited. In this example the conditional statement automatically specifies greater*

than and was changed to greater than or equal to. The drop down tabs can be used to select mathematical operators and functions which can then be used within the conditional statements.

12) Select **Planting & Natural Regeneration > Plant/Natural with Partial Establishment Model**.
    a. Select the radio button to the left of the "Natural" keyword.
    b. Enter the parameters for lodgepole pine:

       Species .....Douglas-fir
       Trees/acre.....30
       Percent survival.....100
       Ave. height 3.0
       Shade code .....Most trees placed on sparse plots
       Leave all other fields set to default values

    c. Click the small radio button to the left of "Schedule by Condition".
    d. Click on the "**Condition"** button.
    e. Change the name of the condition to "Condition – BA LT 225".
    f. Click the down arrow on the drop box to the right of the Condition Library.
    g. Select the condition "Specified Basal Area is exceeded."
    h. Set the basal area to 225.
    i. Change the Years before condition can be tested after being found true to 0.
    j. Click on the "**Free form**" button.
    k. Click on the "**Proceed**" button.
    l. Change Change "gt" to "LT".
    m. Click on the "**Ok**" button.
13) Click on the "**Ok**" button to close the **Planting and Natural Regeneration** window.
14) Click the "**Close**" button to close the **Management Actions** window.

Step 4
Selecting the Post Processors.

15) Click on the "**Select Post Processors**" button.
16) Highlight the "View the Main Output file using system editor" post processor.
17) Click on the "**Include**" button.
18) Click on "**Close**" to close the **Select Post Processors** window.

Final Step
Running the simulation.

19) Click on the "**Run Simulation**" button.
20) Name the keyword file **Conditional2-3.key**.
21) Click on the "**Save**" button.
22) Click on the "**Run**" button.

Questions

From the *Summary Statistics Table,* in what year did the basal area first exceed 225?

From the *Regeneration Summary Tables*, how many Douglas-fir seedlings were added into the simulation for each cycle?

Extra Credit

Set up a simulation such that in the year 2012 if the quadratic mean exceeds 7” a thin from above to a basal area of 75 is performed else a then from below to a basal area of 100 and a prescribed burn is performed.

Exercise 2-4 – Customized Library of Condition Statements

It may be useful to create a library of conditions that are used often. For this exercise a library of different conditions will be created using a thinning event. These conditions will then be applied to Exercise 2-1.

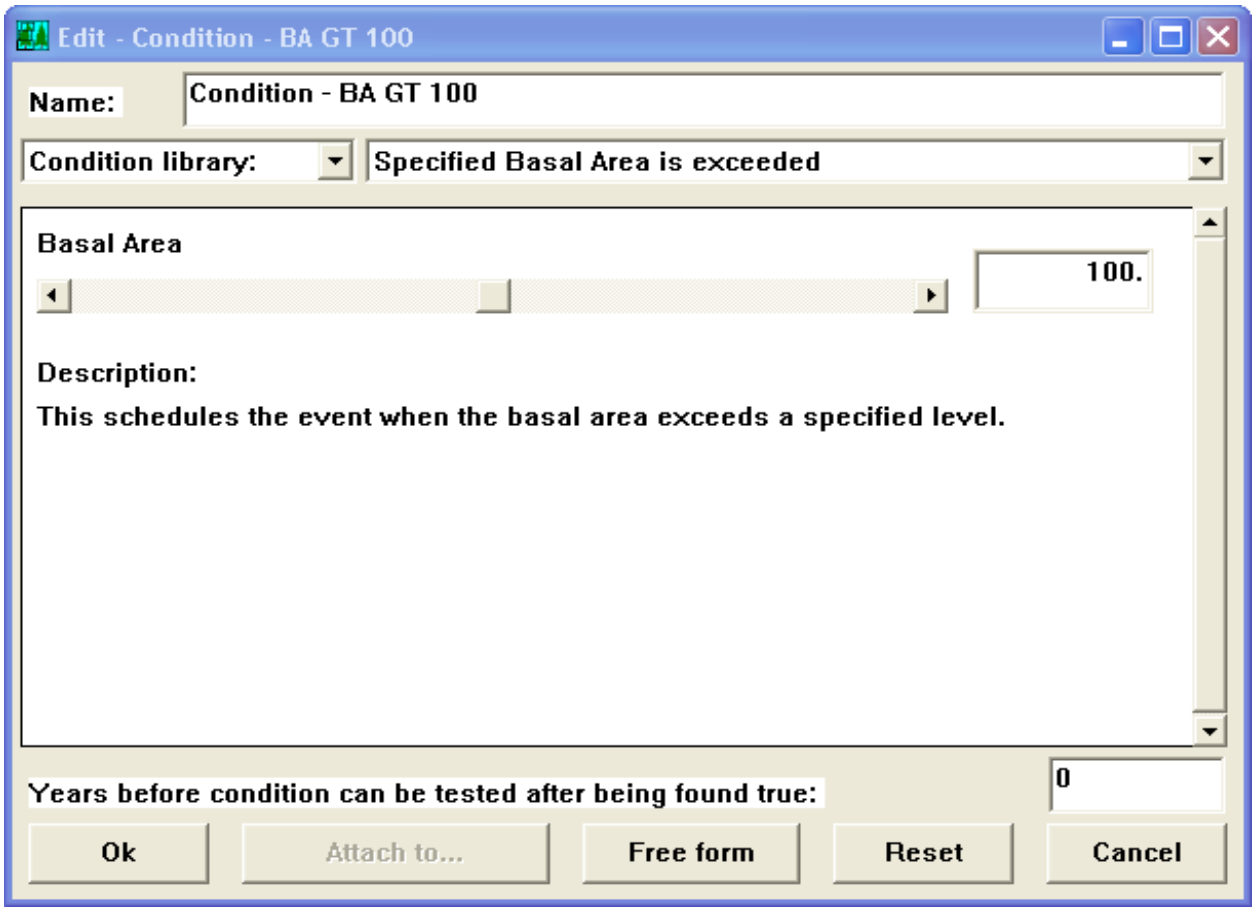
Running the Simulation

1) Make sure that **no previous simulation** is in memory.
2) From the Preferences drop down tab, select "Suppose Preferences".
3) Change the default variant to "wc".
4) Click the "Apply" button.
5) Click the "Close" button.
6) Click **File > New**.

Note: there is no need to select a stand for this exercise. Changing the default variant to wc ensures that the condition library will be created for the wc variant. The condition library should not be used with stands from another variant. If a stand is selected from another variant prior to adding a condition to the library of conditions, the variant will change and the condition will be attached to that variant only.

Step 1
Creating a condition.

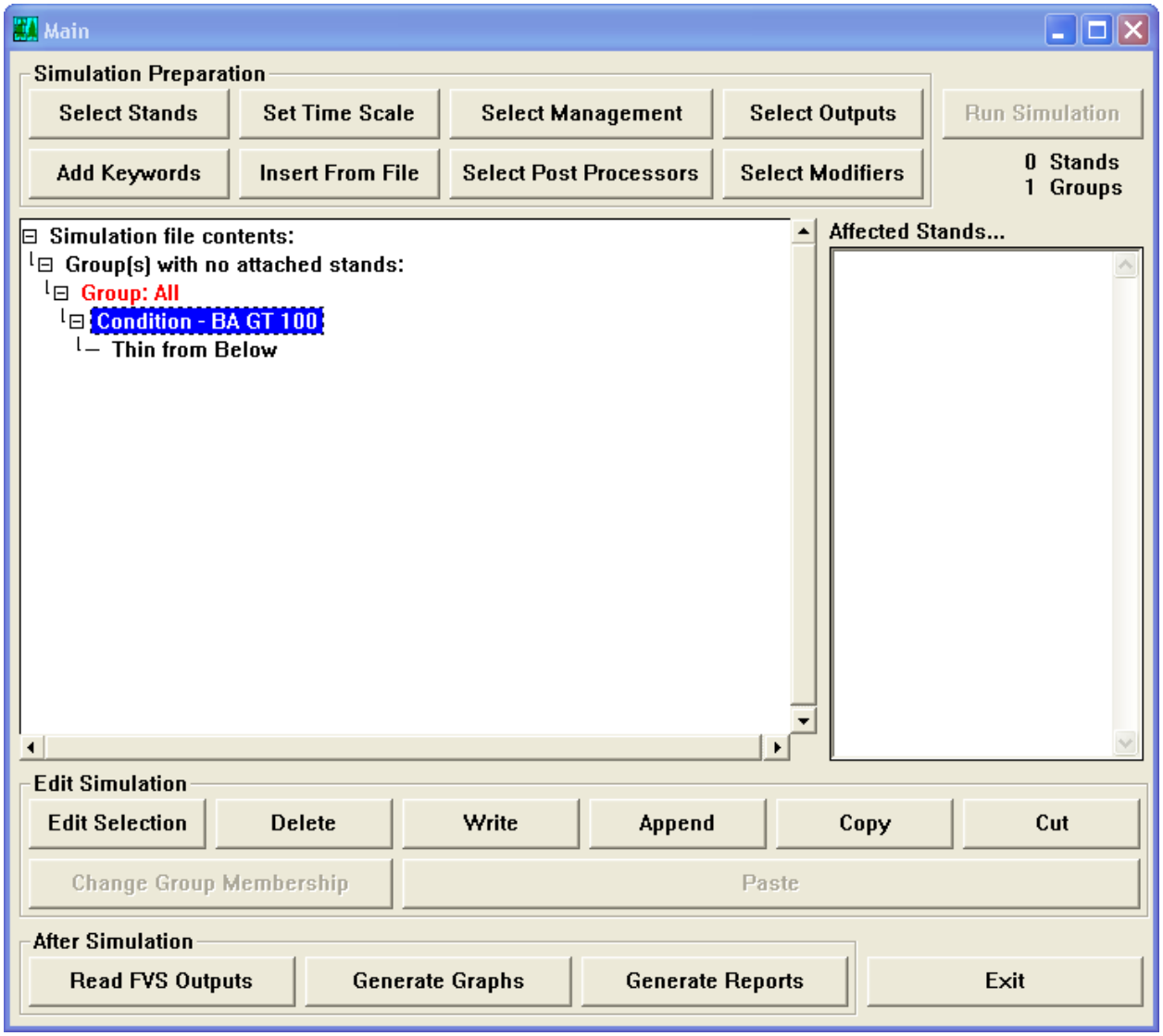
7) Click on the "**Select Management**" button
8) Select **Thinning & Pruning Operations > Thin from below**.
    a. Click the small radio button to the left of "Schedule by Condition".
    b. Click on Condition.
    c. Change the name of the condition to Condition – BA GT 100.
    d. Click the down arrow on the drop box to the right of the Condition Library.
    e. Select the condition "Specified Basal Area is exceeded."
    f. Enter 100.
    g. Set the basal area to 100.
    h. Change the "Years before condition can be tested after being found true:" to 0.
9) Click the "**Ok**" button.
10) Click the "**Ok**" button to close the **Thin from below** window.
11) Click the "Close" button to close the **Management Actions** window.



Note: This process created a condition for when the basal area is greater than 100 and the years before the condition can be tested after found being true equal to 0.

Step 2
Saving the condition to a file.

12) In the **Main** window, highlight Condition – BA GT 100.
13) Click on the "**Write**" button.
14) Save the file as **condlib.kcp**.

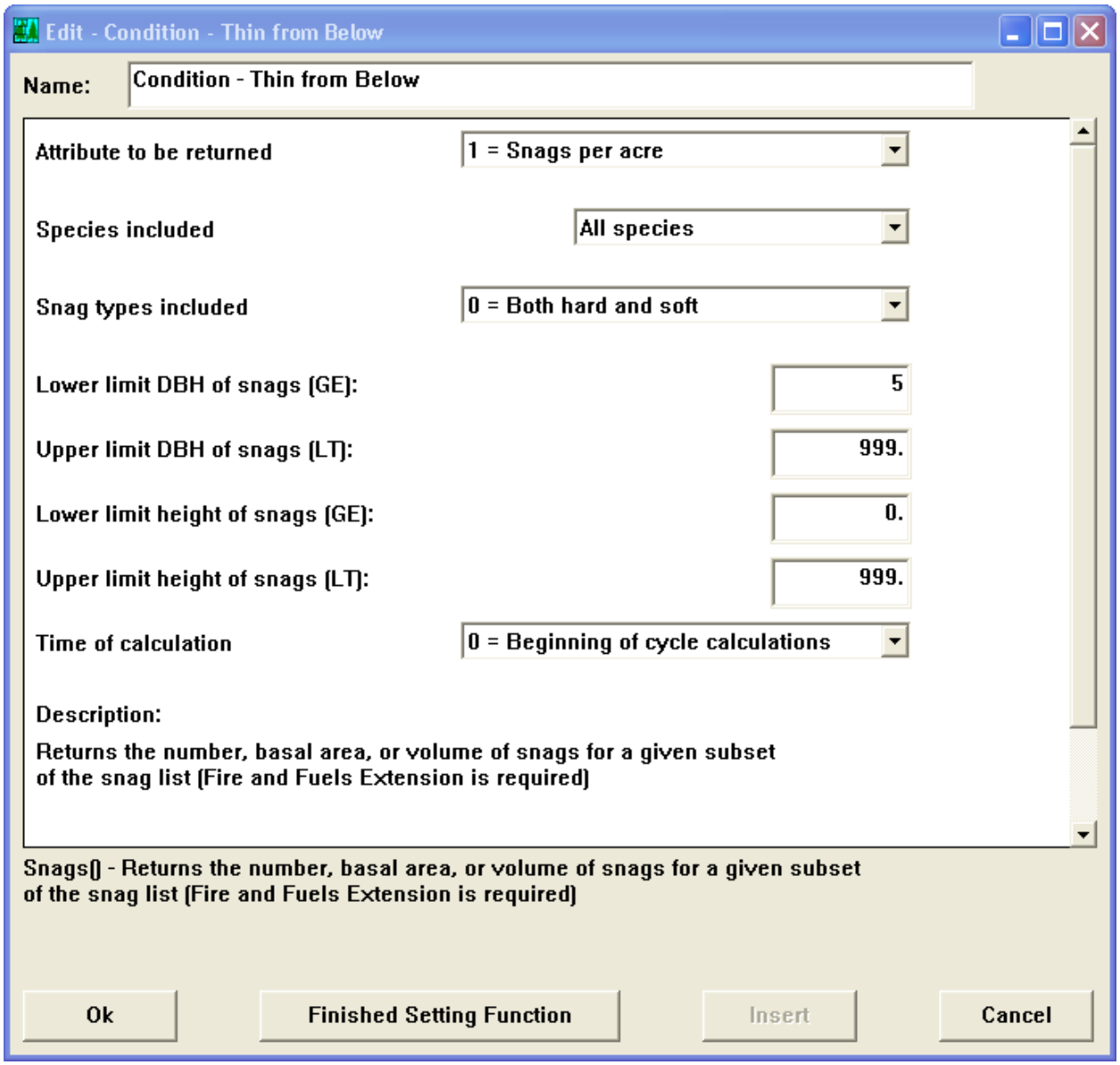


Note: The file condlib.kcp is a special file that Suppose uses to hold user-defined condition statements. This file did not exist until it was just created above.

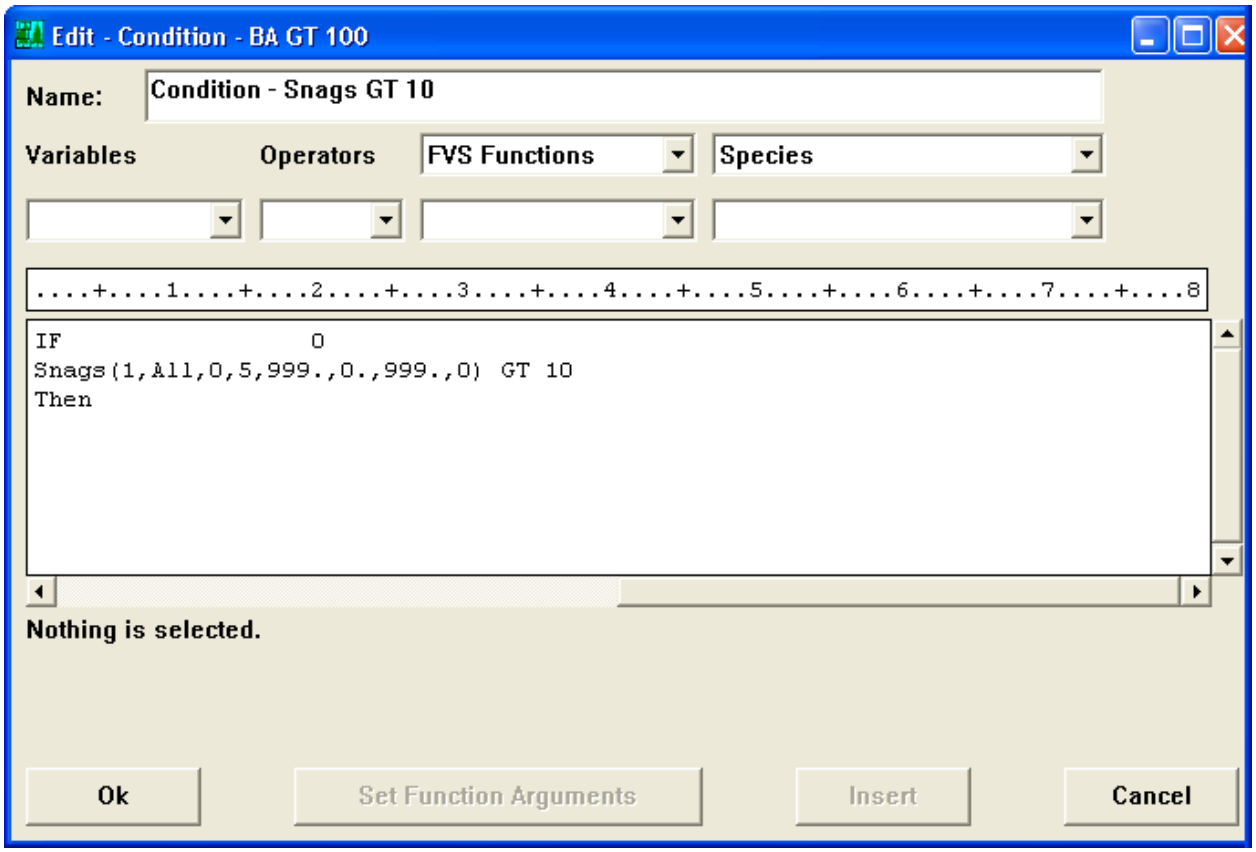
Step 3
Adding conditions to the file.

15) Open the Thin from Below management action by double clicking on it in the "Main" window.
    a. Click on Condition.
    b. Click on the "**Free form**" button.
    c. Click on the "**Proceed**" button.
    d. From the drop down tab beneath the FVS Functions select the Snags() function.

e. Click on the "**Set Function Arguments**" button.
f. Change the lower limit DBH to 5.
g. Leave all other fields set to default values



h. Click on the "**Ok**" button.
i. Click on the "**Yes**" button.
j. Delete the equation in between the IF and Then statements.
k. Click on the "**Insert**" button.
l. After the Snags equation type GT 10.
m. Change the name of the condition to Condition – Snags GT 10.



16) Click the "**Ok**" button.
17) Click the "**Ok**" button to close the **Thin from below** window.
18) In the **Main** window, highlight Condition – Snags GT 10.
19) Click on the "**Append**" button.
20) Select the **condlib.kcp file**
21) Click "open".

Note: The new condition has now been added to your library. The "Free form" button allows access to the predefined equations found within FVS. It can also be used in conjunction with user-defined event monitor variables.

Step 4
Opening a previous simulation.

22) Make sure that **no previous simulation** is in memory. The title bar should say *new file* if the memory is clear. If a previous simulation is in memory, click **File > New**.
23) Open Exercise 2-1 by selecting Open from the File dropdown tab and opening **Conditional2-1.key**.

Step 5
Adding the condition.

24) In the **Main** window, double -click the Thin from Below management action.
25) Click on the "**Condition**" button.
    a. Change the dropdown tab which currently says Condition library: to Your Conditions:.
    b. Select Condition – BA GT 100 using the dropdown tab next to Your conditions:.
    c. Click the "**Ok**" button.
26) Click "**Ok**" button to close the **Thin from Below** window.

Final Step
Running the simulation.

27) Click on the "**Run Simulation**" button.
28) Click on the "**Save As**" button.
29) Name the keyword file **Conditional2-4.key**.
30) Click on the "**Save**" button.
31) Click on the "**Run**" button.

Questions

Extra Credit

Include the following condition statements in your library:

1- Basal area at the beginning of a cycle is less than 100 square feet per acre
2- Trees per acre at least 15 inches in DBH at the beginning of a cycle is greater than 50
3- Quadratic mean diameter for trees 10 inches in DBH or larger at the beginning of a cycle is greater than 20 inches.

Session 3- Advanced Management Activities

Introduction

Often when creating thinning prescriptions they are more complex than just thinning to a specific target. More often than not you have to exclude certain trees from thinning based on their particular characteristics. For example you may not want to thin trees of a particular species or diameter. These exercises will help you create more complex management using the PARMS format.

PARMS Format

Many keyword records may be coded using the PARMS format. This is a special form of the keyword record. It is equivalent to the standard form of the keyword record, but it allows expressions in place of constant parameters.

When using the PARMS format for a keyword record, the keyword is coded in the first eight columns, and the year/cycle (field 1) is coded right justified in column 20 as is done when this feature is not used. The remainder of the record is coded

$$\text{PARMS (parameter}_2\text{, parameter}_3\text{, parameter}_4\text{, ... , parameter}_n\text{)}$$

where the word PARMS begins somewhere in columns 21 through 30. Each "parameter$_n$" corresponds to the nth field of the keyword. Its value is represented by an expression that uses constants, variables (Event Monitor pre-defined or user-defined), and/or Event Monitor functions. If the keyword record is long, an ampersand (&) is used to continue the record on the following line.

Below are three examples of the THINBBA keyword, the last two using the PARMS format. The first two would produce the exact same results of a residual target of 100 ft^2/acre. The last keyword would set the basal area target for the thin at 50% of the pre-harvest amount.

```
                                   columns
         1         2         3         4         5         6         7         8
....:....0....:....0....:....0....:....0....:....0....:....0....:....0....:....0

ThinBBA         2012      100.        1.        0.      999.        0.      999.
ThinBBA         2012     Parms(100., 1., 0., 999., 0., 999.)
ThinBBA         2012     Parms(BBA*0.50, 1., 0., 999., 0., 999.)
```

When using the PARMS format, supply all of the parameters used by the keyword. Defaults are not used when parameters are left blank. Ensure that all parameter values are within legal limits as FVS does not check for legal values when the PARMS format is used. Also ensure that variables are defined when the activity is called. If the PARMS function references a variable that is not defined when the activity is called, the activity is canceled. Additional information on the PARMS format can be found in section 6.1 of the EFVS Guide.

Exercise 3-1 – Thinning To a Stand Level Target with Diameter Limits

Thinning to a stand level basal area per acre target such as 100ft^2/acre can be done in FVS through the use of the THINDBH keyword or within the Management Action button and the Thinning & Pruning Operations – Thin throughout a diameter range option. More often than not you have to exclude certain trees from thinning based on their particular characteristics. For example you may not want to thin trees of a particular species or diameter.

In this exercise, the PARMS format will be added to a thinning to exclude trees of a particular diameter class.

Background Information

This set of exercises, is based on silvicultural prescriptions for a small watershed with 6 stands in it. The silviculturist, I.M. Solucky, has developed the future desired condition for the watershed and has begun by building some basic FVS simulations that will model the first step towards meeting the future desired condition for the watershed. I.M. Solucky's plan was to keep the modeling simple, so she could spend less time behind the computer and more time in the woods. Three of the stands will get a thinning throughout the diameter distribution to 100 ft^2/acre, another three stands will get a thinning from below to 90ft^2/acre. After the initial Interdisciplinary (ID) Team meeting, I.M. Solucky, received significant feedback on her prescriptions from the other resource specialist on the team. She realizes that she is going to have to make some changes to her prescriptions. The following exercise will walk through adding complexity to thinning using the PARMS format and computed variables.

Three of the stands in this project are to be thinned to 100ft^2/acre, however to avoid conflict and create collaboration, the Interdisciplinary Team decided it is necessary to reach the stand level target while avoiding the removal of trees greater than or equal to 20 inches DBH. This adjustment can be easily done in FVS by using the PARMS function. A custom variable will be created to calculate the basal area for trees greater than or equal to 20 inches DBH. This custom variable will then be used within the PARMS function to reduce the target basal area for the thinning.

Use the operators and pre-defined functions in Table 5-3 of the EFVS and the associated text following table 5-3 to write the expression for the basal area per acre for trees greater than or equal to 20 inches in DBH.

BigBA =

This variable will be used in the THINDBH keyword to set the residual basal area.

residualBA = 100 - BigBA

Running the Simulation

1) Start Suppose by double-clicking the Suppose icon on your desktop.
2) Make sure that **no previous simulation** is in memory. The title bar should say *new file* if the memory is clear. If a previous simulation is in memory, click **File > New**.
3) Click the File menu and select "Select Locations File"
4) In the Open dialog box, navigate to "C:\Fvsdata\Regional-Training" and open the **Suppose.loc** file.

Step 1
Adding the stands to the simulation

5) If the **Select Simulation Stands** window does not open, click on the "**Select Stands**" button on the main page.
   a. In the large "Locations" box select "Regional Training".
   b. In the large "Groups" box select "Variant=WC".
   c. In the large "Stands" box use the Ctrl Shift button and select "**060305403015**", "**060305403030**", and "**060305403055**".
   d. At the bottom left corner, click the "**Add 3 Stands**" button.
6) Click the "**Close**" button.

Step 2
Changing the time scale.

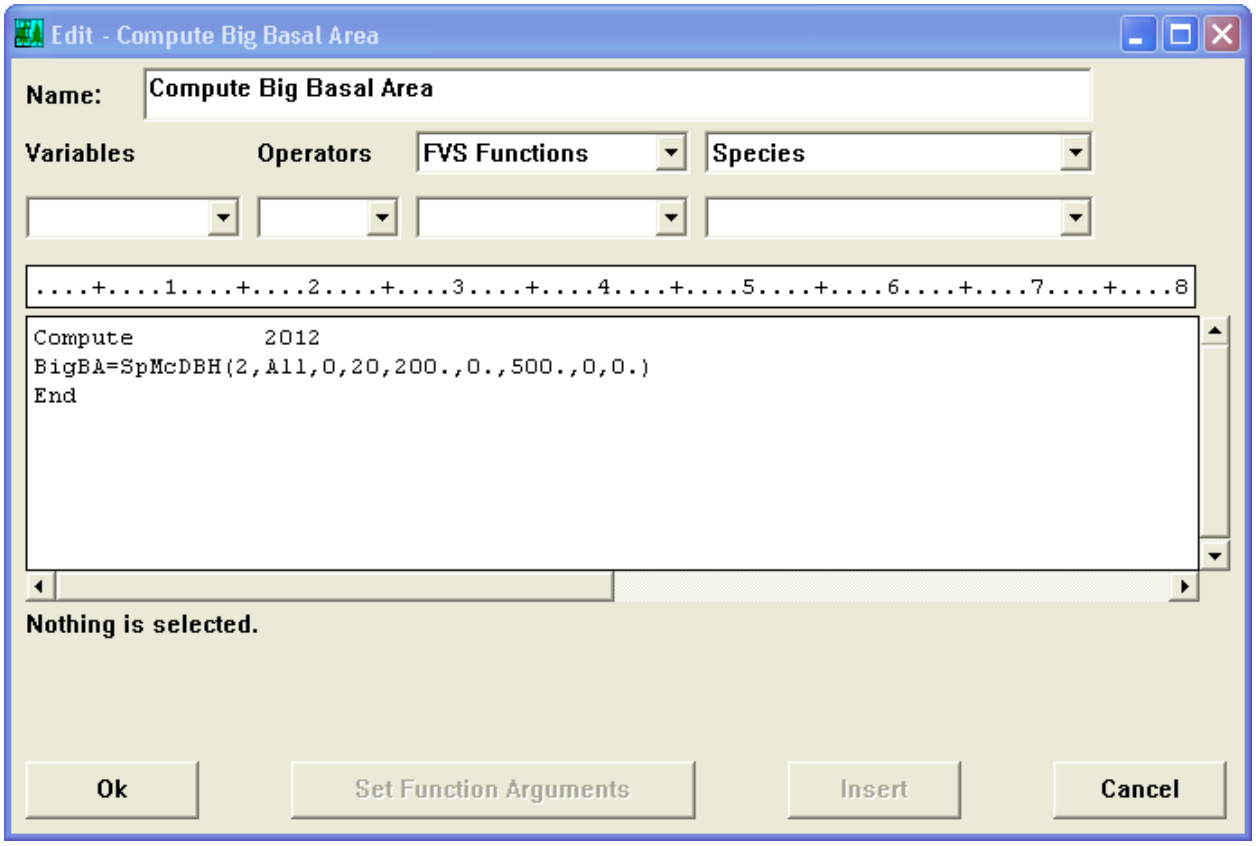
7) Click on the "**Set Time Scale**" button.
   a. Change the common starting year from 2006 to 2012.
   b. Change the common ending year to 2052.
8) Click the "OK" button.

Note: This will grow the stand from 2006 to 2012 before growing the stand cycle by cycle.

Step 3
Adding the compute variables.

9) Click the "**Add Keywords**" button.
10) Select **Base FVS system > Input/Output Controls > Compute.**
11) Click the "**Accept**" button.
   a. Change the name to "**Compute Big Basal Area".**
   b. Change the "Schedule by Year/Cycle" field to "2012".
   c. Click the "**Use Parms**" button.
   d. Click the "**Proceed**" button.
   e. Enter the expression for BigBA.

12) Click the "**Ok**" button.

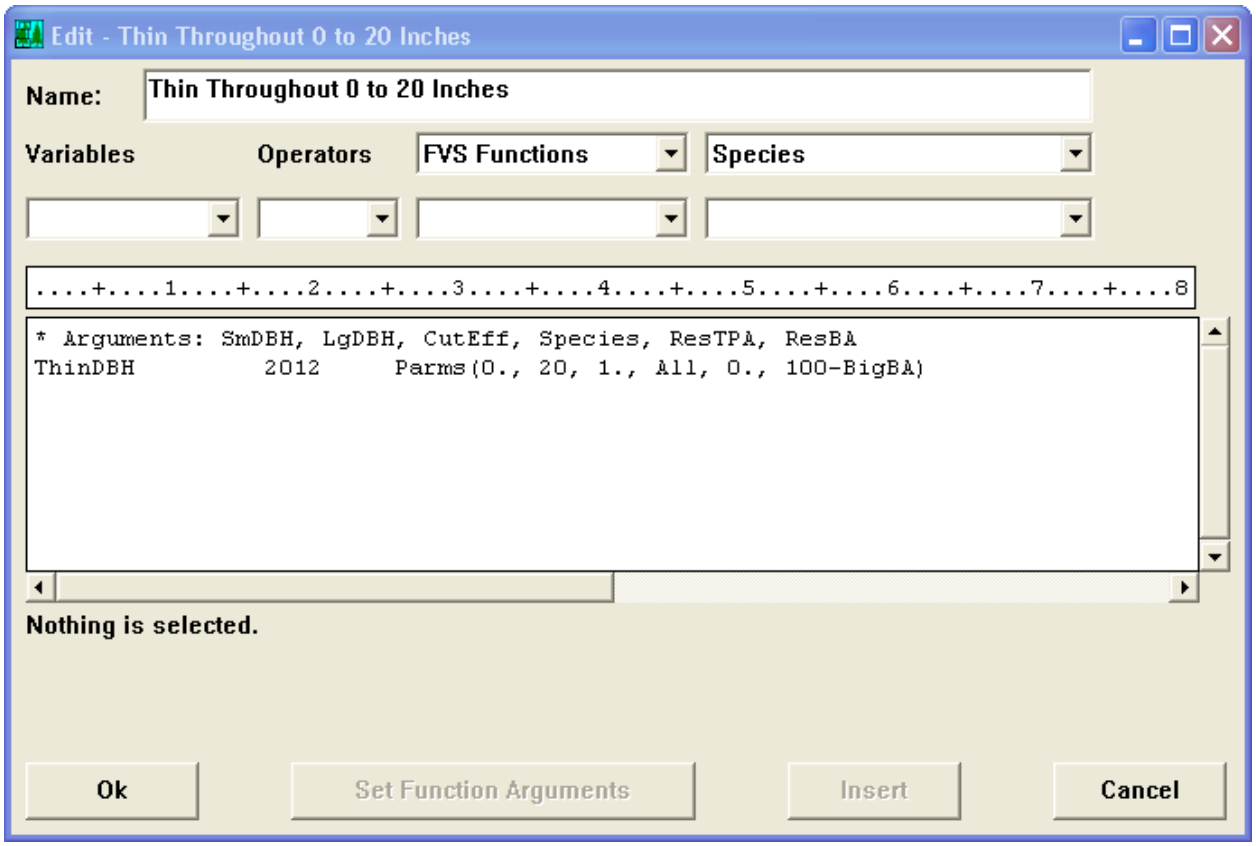


*Note: Custom variables can be created in the Parms editor window by typing in custom expressions directly or through the drop down menus that allow for the selection of a pre-defined function. The "**Set Function Arguments**" button will walk through the functions associated with the selected function. Compute variables can also be created using the "**Select Outputs**" button and selecting **Event Monitor (EM) Compute Variables**.*

Step 4
Defining the management actions.

13) Select **Base FVS system > Thinning and Harvesting > THINDBH**
14) Click the "**Accept**" button.
    a. Change the name to "**Thin Throughout 0 to 20 Inches".**
    b. Change the "Schedule by Year/Cycle" field to "2012".
    c. Change the Largest DBH to be considered for removal to 20.
    d. Click the "**Use Parms**" button.
    e. Click the "**Proceed**" button.
    f. In the last argument of the ThinDBH keyword, enter 100-BigBA
15) Click the "**Ok**" button.

16) Click the "**Close**" button to close the "Use FVS Keywords" window.



Note: In the Regional Training course the Select Management button was used to create thinning management actions. Many of the thinning management actions found in the Select Management button do not provide access to an editor (PARMS option). The individual keyword windows allow access to the PARMS format which allows for the use of functions and formulas as fields within keywords. The last field of the THINDBH keyword indicates the residual basal area for the specified diameter range of interest. In this example, the target stand basal area is 100 which should be met without cutting trees greater than 20" DBH. The basal area for trees greater than 20" DBH needs to be included in the stand target basal area of 100. In other words:

STANDTARGET-BIGBA= ResidualBA for trees less than 20"

Step 5
Selecting the Post Processors.

17) Click on the "**Select Post Processors**" button.
   a. Highlight the "View the Main Output file using system editor" post processor.
   b. Click on the "**Include**" button.

c. Highlight the “Compute1 – Table of Compute Variables (with headers)” post processor.
d. Click on the “**Include**” button.

18) Close the “**Select Post Processors**” window.

Final Step
Running the simulation.

19) Click on the “**Run Simulation**” button.
20) Name the keyword file **AdvMgt3-1.key**.
21) Click on the “**Save**” button.
22) Click on the “**Run**” button.

Note: Check the main output file for errors associated with your compute expressions. If an expression has a recognized problem, FVS will insert a FVS12 error after the expression in the Options Selected by Input section of the main output file. In addition, look in the Activity Summary to see that the Activity Disposition says “DONE IN <YEAR>” for the custom variable. If the disposition says “NOT DONE”, then you have an error in your expression. If your custom variable is not computed or there is no thinning, correct the expressions in Suppose. FVS does not check for legal values when the PARMS format is used. Also ensure that variables are defined when the activity is called. If the PARMS function references a variable that is not defined when the activity is called, the activity is canceled. A screen capture of the ***Compute*** *expressions and* ***THINDBH*** *is located in the Answer Guide. Once you are satisfied that your expressions are functioning properly, rerun the simulation, close the output file.*

Questions

In the Compute post processor, add the before thin stand BA and after thin stand BA from the summary statistics table. You can do this by clicking on the “X=” button. On the right hand side put a check mark in the BBA and ABA boxes.

How many stands have trees greater than 20” DBH for the year 2012? _____

Did the thinning in 2012 produce a residual stand basal area of 100 for each stand? _____

Close the Compute post processor.

Before you close Suppose save this prescription as an addfile (.kcp). To do so:

23) In the Simulation file contents Window, highlight “Compute Big Basal Area”.
24) Click on the “**Write**” button.
25) Name the addfile Rx1.kcp.
26) Click “**Save**” button.
27) Next Highlight “Thin Throughout 0 to 20 Inches”.
28) Click on the “**Append**” button.
29) Highlight Rx1.kcp.
30) Click “Open”.

The management action from this exercise (Prescription 1) is now saved as an addfile called Rx1.kcp.

Exercise 3-2 – Thinning, while retaining a hardwood component

The prescriptions for stands 060305402956, 060305402995, and 060305403020 were to thin the stands from below to a target basal area of 90 ft^2/acre. In FVS this type of thinning can be performed with a THINBBA keyword, or in Management Actions, selecting Thinning & Pruning Operations – Thin from Below. I.M. Solucky's prescription did not mention that some of the stands contained red alder, a species of interest which should not be thinned. Her plan was just to inform the marking crew to ignore the red alder when they went to mark the stand. The Interdisciplinary Team did not like this, and wants the modeling to show that the alder will be maintained, in addition to the 90ft^2/acre. To adjust for red alder in the prescription, a species preference can be associated with red alder. In addition, the thinning keywords need to be adjusted using the PARMS format.

In this exercise, conifer species will be thinned from below to a target basal area of 90 $feet^2$/acre, while leaving the red alder component in the stand. This will result in a post thinning basal area greater than 90 $feet^2$/acre in stands that contain red alder. A custom compute variable will be calculated for the basal area of red alder. In addition, a species preference assigned to red alder will be used in conjunction with a thin from below to remove only conifer species in a stand.

Use the operators and pre-defined functions in Table 5-3 of the EFVS and the associated text following table 5-3 to write the expression for the basal area per acre of red alder.

RABA =

This variable will be used in the THINBBA keyword to set the residual basal area.

residualBA = 90 + RABA

Running the Simulation

1) Make sure that **no previous simulation** is in memory. The title bar should say *new file* if the memory is clear. If a previous simulation is in memory, click **File > New**.

Step 1
Adding the stands to the simulation.

2) If the Select Simulation Stands window does not open, click on the "Select Stands" button on the main page.
   a. In the large "Locations" box select "Regional Training."
   b. In the large "Groups" box select "Variant=WC."
   c. In the large "Stands" box use the Ctrl Shift button and select "**060305402956**", "**060305402995**", "**060305403020**".
   d. At the bottom left corner, click the "**Add 3 Stands**" button.

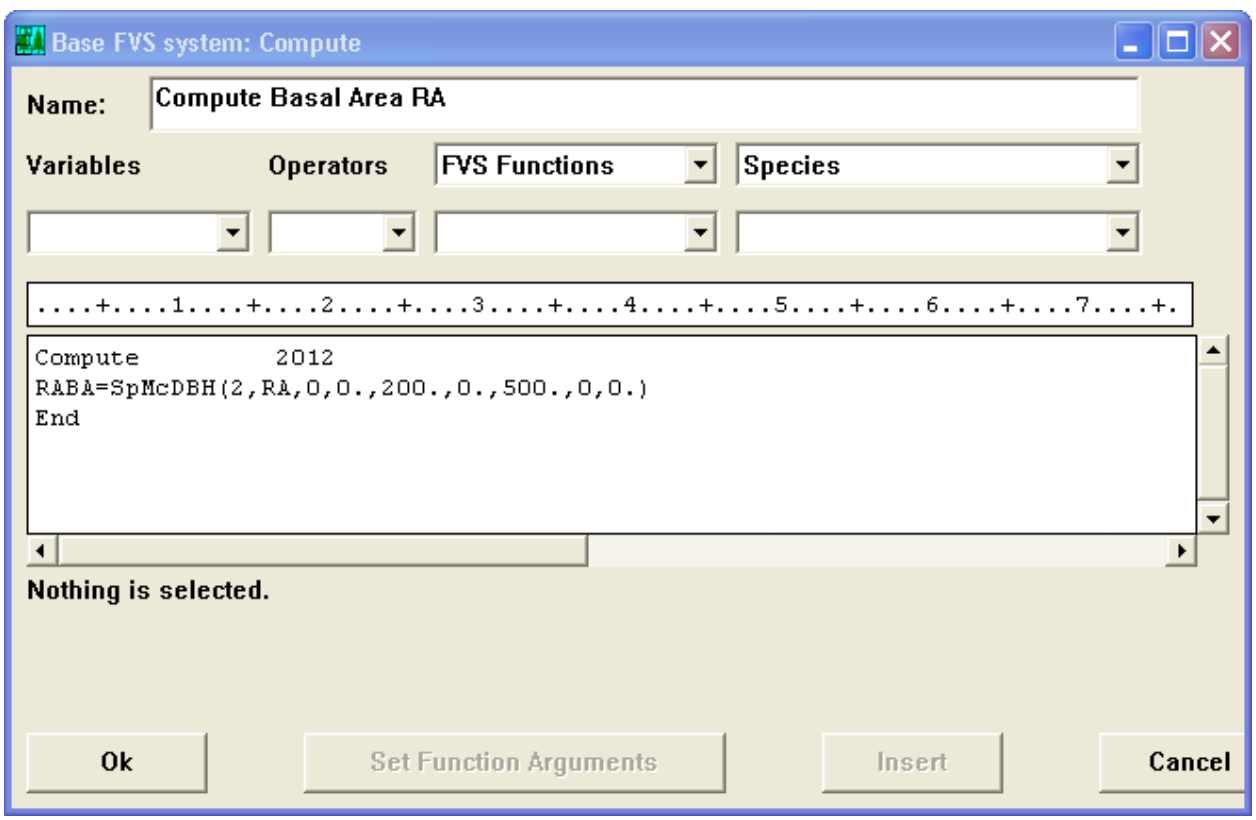
3) Click the “**Close**” button.

Step 2
Changing the time scale.

4) Click on the “**Set Time Scale**” button.
   a. Change the common starting year from 2006 to 2012.
   b. Change the common ending year to 2052.
5) Click the “**OK**” button.

Step 3
Adding the compute variables.

6) Click the “**Add Keywords**” button.
7) Select **Base FVS system > Input/Output Controls > Compute**.
8) Click the “**Accept**” button.
   a. Change the name to “**Compute Basal Area RA**”.
   b. Change the “Schedule by Year/Cycle” field to a “2012”.
   c. Click the “**Use Parms**” button.
   d. Click the “Proceed” button.
   e. Enter the expressions for the red alder basal area (RABA).
9) Click on the “**Ok**” button.



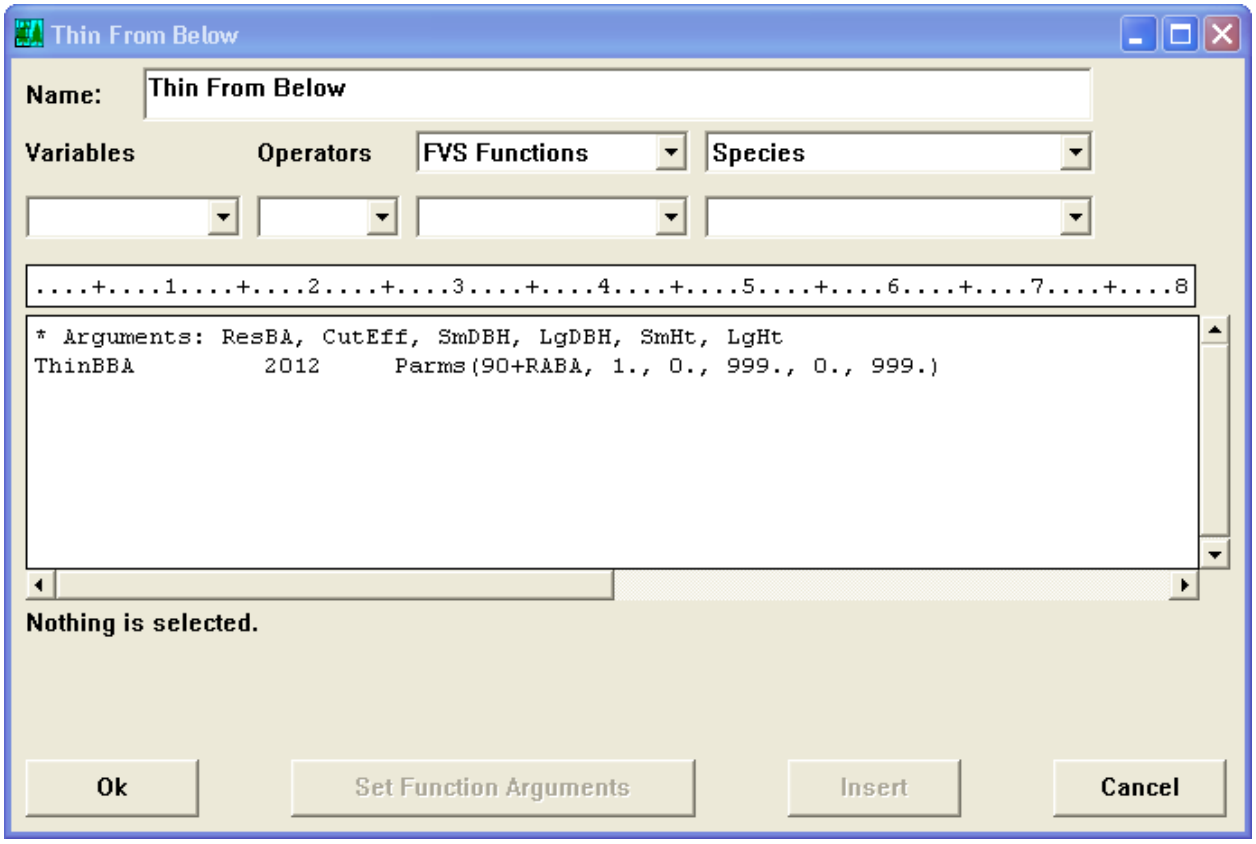
Step 4
Adding a species preference.

10) Select **Base FVS system > All Keywords > SPECPREF**
11) Click the "**Accept**" button.
    a. Change the name to "**Red Alder Species Preference**".
    b. Specify the year to thin to "2012".
    c. Change the species to "red alder".
    d. Change the removal preference to -100
12) Click on the "**Ok**" button.

Note: The species removal priority equation is listed in the Species Preference form. This equation is used to determine which tree is cut first when thinning from above or below (but not throughout a diameter range). For example, if a thin from below is conducted in a stand with a 5" DBH red alder and a 6" Douglas-fir; the Fd is equal to -1 and the species removal preferences (P) are -5 and -6 respectively. In this case, red alder, the tree with the larger removal preference (-5 is greater than -6) will be cut first. If a species preference (SP) of -100 for red alder is added, the removal preferences (P) are -105 for red alder and -6 for Douglas-fir. In this case, Douglas-fir will be cut first. If the species preference is negative it decreases the likelihood that the species will be cut.

Step 5
Defining the management actions.

13) Select **Base FVS system > All Keywords > THINBBA**
14) Click the "**Accept**" button.
    a. Change the name to "**Thin From Below**".
    b. Specify the year to thin to "2012".
    c. Click on the "**Use Parms**" button.
    d. Click on the "**Proceed**" button.
    e. Enter an equation for the red alder basal area in the first field of the THINBBA keyword.
15) Click the "**Ok**" button.
16) Click the "**Close**" button



Note: This window sets the Thinning keyword up in the PARMS format, which allows for computations. The first field of the THINBBA keyword specifies the target basal area for the specified diameter range. To obtain a residual basal area of 90 for all trees excluding the basal area of red alder, the target basal area is set up as 90+RABA. This adjusts the basal area target for the excess red alder.

Step 6
Selecting the Post Processors.

17) Click on the "**Select Post Processors**" button.
    a. Highlight the "View the Main Output file using system editor" post processor.
    b. Click on the "**Include**" button.
    c. Highlight the "Compute1 – Table of Compute Variables (with headers)" post processor.
    d. Click on the "**Include**" button.
18) Close the "**Select Post Processors**" window.

Final Step
Running the simulation.

19) Click on the “**Run Simulation**” button.
20) Name the keyword file **AdvMgt3-2.key**.
21) Click on the “**Save**” button.
22) Click on the “**Run**” button.

Questions

In the Compute post processor, add the before thin stand BA and after thin stand BA from the summary statistics table. You can do this by clicking on the “X=” button. On the right hand side put a check mark in the BBA and ABA boxes.

Fill in the red alder basal area for each stand in 2012?

060305402956= _____ 060305402995= _____ 060305403020= _____

Fill in the post harvest stand basal area in 2012?

060305402956= _____ 060305402995= _____ 060305403020= _____

Can you think of a way to not have to create compute statements for the two variables (BigBA and RABA), but still get FVS to do the thinning correctly?

Close the Compute post processor.

Before you close Suppose save this prescription as an addfile (.kcp). To do so:

23) In the Simulation file contents Window, highlight “Basal Area Red Alder”.
24) Click on the “**Write**” button.
25) Name the addfile Rx2.kcp.
26) Click on the “**Save**” button.
27) In the Simulation file contents Window, highlight “Red Alder Species Preference”.
28) Click on the “**Append**” button.
29) Highlight Rx2.kcp.
30) Click “Open”.
31) Next Highlight “Thin From Below”.
32) Click on the “**Append**” button.
33) Highlight Rx2.kcp.
34) Click “Open”.

The management action from this exercise (Prescription 2) is now saved as an addfile called Rx2.kcp.

Exercise 3-3 – Running multiple stand with multiple prescriptions in one simulation

Grouping labels can be used to apply management to groups of stands in a single simulation. After writing the base prescriptions found in the previous exercises, the Interdisciplinary Team determined that stand 060305402956 should not be thinned. All six stands from the previous exercises need to be run in the same simulation, applying the stands specific prescription created from Exercises 3-1 and 3-2.

In this exercise, grouping labels will be applied based on the prescription each stand is to receive.

Stands 060305403015, 060305403030, and 060305403055 will be assigned to the grouping label “Rx1: EvenThin”; stands 060305402995, and 060305403020 will be assigned to the grouping label “Rx2:ThinBelow”; and stand 060305402956 will be assigned to the grouping label” Rx0:NoThin”. After the stands are grouped, the prescriptions created in Exercise 3-1 and Exercise 3-2 will be applied. Stand level compute variables which will describe the pre- and post- thinning stand-level variables will also be calculated. The variables of interest are pre and post basal area, the percent basal area removed, harvested volume in board feet, acres, and total volume per stand.

Running the Simulation

Step 1
Adding grouping codes to the input database.

1) Navigate to the “C:\FVSDATA\Regional-Training” folder.
2) Open the database “FVS_Data.mdb”.
3) Open the “FVS_StandInit” table.
4) Select the stands for the WC variant.
   a. In the third column, “Variant”, click on the small black arrow next to column heading.
   b. Uncheck “Select All”.
   c. Check “WC”.
   d. Click on the “**Ok**” button.
5) Navigate to the “Groups” column.
6) Add new grouping codes to each stand.
7) Save the changes to the database.

Note: Use the grouping codes that were listed above in the introduction for Exercise 3-3. Remember that grouping codes cannot have spaces in the name. Use the snapshot on the next page as a comparison.

FVS_StandInit

Stand_CN	Stand_ID	Variant	Inv_Year	Groups
272454010602	060305402956	wc	2006	All_Stands forest_type=201 Variant=WC Rx0:NoThin
272511010602	060305402995	wc	2006	All_Stands forest_type=201 Variant=WC Rx2:ThinBelow
272529010602	060305403015	wc	2006	All_Stands forest_type=201 Variant=WC Rx1:EvenThin
290292010602	060305403020	wc	2006	All_Stands forest_type=201 Variant=WC Rx2:ThinBelow
272544010602	060305403030	wc	2006	All_Stands forest_type=201 Variant=WC Rx1:EvenThin
272606010602	060305403055	wc	2006	All_Stands forest_type=201 Variant=WC Rx1:EvenThin
WC_BareGround	WC_BareGround	wc	2012	All_Stands forest_type=999 Variant=WC BareGround

Record: 8 of 8 Filtered Search

Step 2
Adding the stands to the simulation.

8) Make sure that **no previous simulation** is in memory. The title bar should say *new file* if the memory is clear. If a previous simulation is in memory, click **File > New**.
9) Click the File menu and select "Select Locations File"
10) In the Open dialog box, navigate to "C:\Fvsdata\Regional-Training" and open the **Suppose.loc** file.
11) If the Select Simulation Stands window does not open, click on the "Select Stands" button on the main page.
    a. In the large "Locations" box select "Regional Training."
    b. In the large "Groups" box select "Variant=WC."
    c. In the large "Stands" box use the Ctrl Shift button and select "**060305402956**", "**060305402995**", "**060305403020**", "**060305403015**", "**060305403030**", "**060305403055**"
    d. At the bottom left corner, click the "**Add 6 Stands**" button.
12) Click the "**Close**" button.

Step 3
Changing the time scale.

13) Click on the "**Set Time Scale**" button.
    a. Change the common starting year from 2006 to 2012.
    b. Change the common ending year to 2052.
14) Click the "**OK**" button.

Step 4
Defining the management actions.

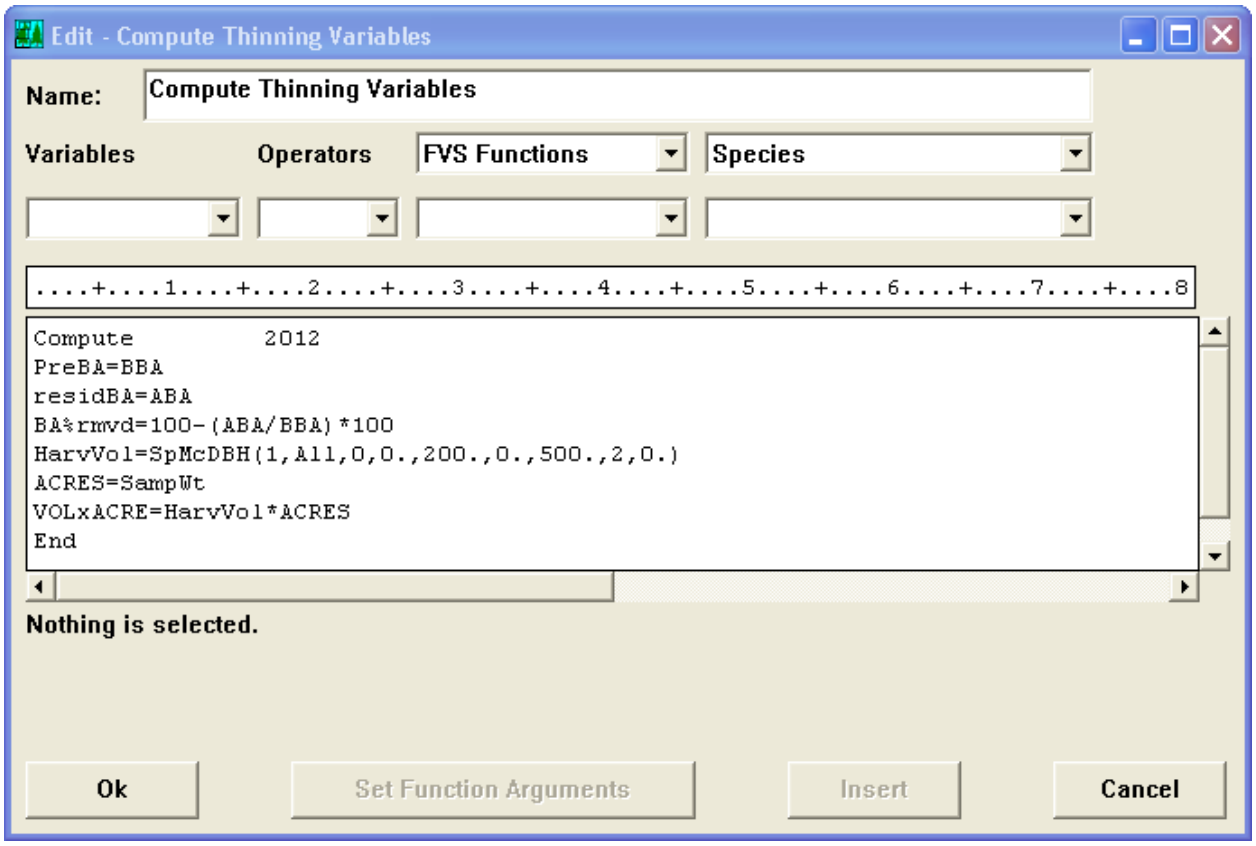
15) In the Simulation file contents window click on the plus sign next to stand "**060305403015**".
16) Under the grouping codes, right click on "Rx1:EvenThin".
17) Click on the "**Insert From File**" button.

18) Navigate to the Rx1.kcp file and highlight it.
19) Click “Open”.
20) Click on the plus sign next to stand 060305402995.
21) Under the grouping codes, right click on “Rx2:ThinBelow”.
22) Click on the “**Insert From File**” button.
23) Navigate to the Rx2.kcp file and highlight it.
24) Click “Open”.
25) Right click “Group:All”

Note: Another option for assigning the prescriptions to each stand would be to rebuild the prescriptions following the steps in Exercises 3-1 and 3-2. Because the prescriptions were saved to an addfile (.key file), they can instead be applied directly to the stands. When selecting grouping codes, the stands that are affected will be listed in the “Affected Stands” box to the right of the “Simulation file contents” window. To set the affected groups back to All Stands, right click on the “Group:All” grouping code, this insures that any additional selections such as computed variables and post processors are applied to all stands.

Step 5
Adding the compute variables.

26) Click on the “**Add Keywords**” button.
27) Select **Base FVS system > Input/Output Controls > Compute**.
28) Click on the “**Accept**” button.
    a. Change the name to “**Compute Thinning Variables**”.
    b. Change the “Schedule by Year/Cycle” field to a “2012”.
    c. Click on the “**Use Parms**” button.
    d. Click the “**Proceed**” button.
    e. Enter expressions for pre and post thinning basal area, the percent basal area removed, harvested volume in board feet, acres, and total volume per stand.
29) Click on the “**Ok**” button.
30) Click on the “**Close**” button.



Step 6
Creating the outputs.

31) Click on the "**Select Outputs**" button.
32) Select **Base FVS Reports > Delete Base Model Reports.**
33) Check "Delete the stand composition table" and "Delete the selected sample tree table".
34) Click on the "**Ok**" button.
35) Click on the "**Close**" button to close the **Model Outputs** window.

Note: These are two tables in the Main Output file that are rarely looked at and take up a large amount of space.

Step 7
Selecting the Post Processors.

36) Click on the "**Select Post Processors**" button.
   a. Highlight the "View the Main Output file using system editor" post processor.
   b. Click on the "**Include**" button.
   c. Highlight the "Compute1 – Table of Compute Variables (with headers)" post processor.

d. Click on the "**Include**" button.

37) Click on the "**Close**" button to close the "**Select Post Processors**" window.

Final Step
Running the simulation.

38) Click on the "**Run Simulation**" button.
39) Name the keyword file **AdvMgt3-3.key**.
40) Click on the "**Save**" button.
41) Click on the "**Run**" button.

Questions

Fill in the information below for each stand:

	060305402956	060305402995	060305403020	060305403015	060305403030	060305403055
Residual Basal Area						
Total Volume Harvested						

Before closing Suppose save your Compute variables to an addfile (.kcp). To do so:

1) In the Simulation file contents Window, highlight "Compute Thinning Variables".
2) Click on the "**Write**" button.
3) Name the addfile "HarvCompute.kcp".
4) Click on the "**Save**" button.

The six compute variables have now been saved as an addfile.

Exercise 3-4 – Applying Addfiles Directly to the Input Database

In this exercise, addfiles and keywords will be applied directly to a database. This will bring in the keywords into FVS along with the stand information.

The Interdisciplinary Team is finally satisfied with I.M. Solucky's prescriptions and the output provided (obviously not a true story). Since the team is happy, and there is a blizzard outside I.M. Solucky decides to try a few shortcuts using some of the database functionality.

Running the Simulation

Step 1
Navigating to the input database.

1) Navigate to the C:\FVSDATA\Regional-Training and open up the database FVS_Data.mdb
2) Open up the FVS_GroupAddfilesAndKeywords table.

Note: The first column is "Groups",the second column is "Addfiles: and the third Column is Keywords. This table allows a user to apply addfiles (.kcp file extension) or keyword based on group codes. We are going to apply both prescription 1 and 2 based on their group code.

Step 2
Adding the prescriptions.

3) In the third row, in the Groups column, type "Rx1:EvenThin", and in the same row in the Addfiles column type Rx1.kcp.
4) In the fourth row, in the Groups column, type "Rx2:ThinBelow", and in the same row in the Addfiles column type Rx2.kcp.

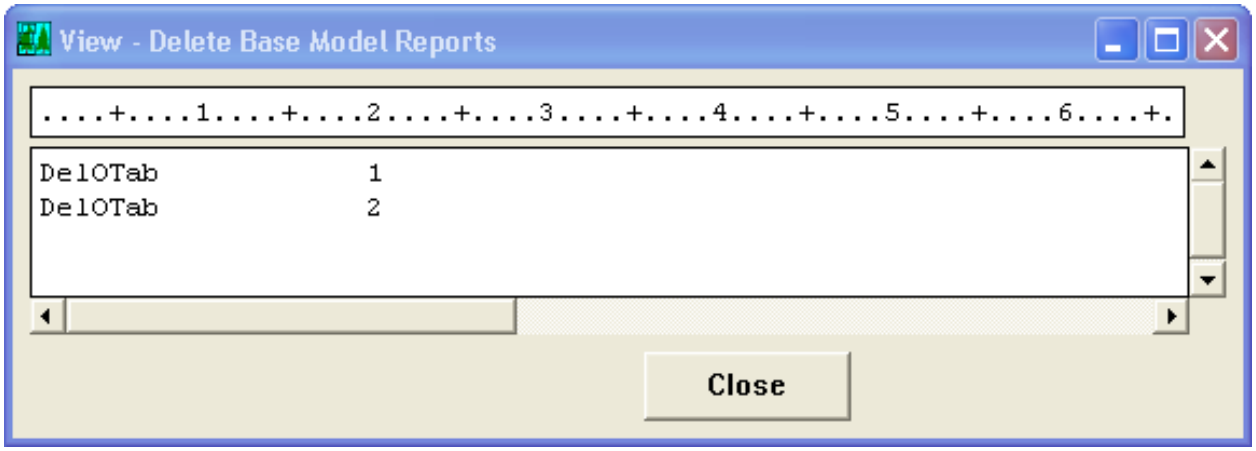
Step 3
Adding the compute variables.

5) In the fifth row, in the Groups column, type "All_Stands", and in the same row in the Addfiles column type HarvCompute.kcp.

Note: In addition to the addfiles, the tables requested in Exercise 3-3 will be deleted from the Main output file. An addfile (.kcp file extension) was never created to do this. To do this, the keywords that delete the tables will be copied and pasted in to the "Keywords" column of the database.

Step4
Deleting the output tables.

6) Go to Suppose, make sure **AdvMgt3-3.key** is in the simulation file content window.
7) Highlight “Delete Base Model Reports”.
8) In the main dropdown menu bar, select **Simulation Preparation > View Component Keywords**.
9) Highlight both lines.
10) In the main dropdown menu bar, select **Edit > Copy**



Note: The View Component Keywords lists the keywords Suppose is using in the simulation. Rather than typing and formatting the keywords directly into the database, copy and paste the keywords to decrease the likelihood of making mistakes.

11) Navigate back to the FVS_Data.mdb, FVS_GroupAddFIlesAndKeywords table.
12) In the fifth row, in the Keywords column, paste the two lines.

Your database should look like this.

FVS_GroupAddFilesAndKeywords		
Groups	**Addfiles**	**FVSKeywords**
All_Plots		Database DSNIn FVS_Data.mdb StandSQL SELECT * FROM FVS_PlotInit WHERE StandPlot_CN= '%Stand_CN%' EndSQL TreeSQL SELECT * FROM FVS_TreeInit WHERE StandPlot_CN= '%Stand_CN%' EndSQL END
All_Stands		Database DSNIn FVS_Data.mdb StandSQL SELECT * FROM FVS_StandInit WHERE Stand_CN= '%Stand_CN%' EndSQL TreeSQL SELECT * FROM FVS_TreeInit WHERE Stand_CN= '%Stand_CN%' EndSQL END
Rx1:EvenThin	Rx1.kcp	
Rx2:ThinBelow	Rx2.kcp	
All_Stands	HarvCompute.kcp	DelOTab 1 DelOTab 2

13) Save and Close your Database.

Step 5
Adding the stands to the simulation.

14) Make sure that **no previous simulation** is in memory. The title bar should say *new file* if the memory is clear. If a previous simulation is in memory, click **File > New**.
15) Click the File menu and select "Select Locations File"
16) In the Open dialog box, navigate to "C:\Fvsdata\Regional-Training" and open the **Suppose.loc** file.
17) If the Select Simulation Stands window does not open, click on the "Select Stands" button on the main page.
    a. In the large "Locations" box select "Regional Training."
    b. In the large "Groups" box select "Variant=WC."
    c. In the large "Stands" box use the Ctrl Shift button and select "**060305402956**", "**060305402995**", "**060305403020**", "**060305403015**", "**060305403030**", "**060305403055**"
    d. At the bottom left corner, click the "**Add 6 Stands**" button.
18) Click the "**Close**" button.

Step 6
Changing the time scale.

19) Click on the "**Set Time Scale**" button.
    a. Change the common starting year from 2006 to 2012.
    b. Change the common ending year to 2052.
20) Click the "**OK**" button.

Step 7
Selecting the Post Processors.

21) Click on the "**Select Post Processors**" button.
    a. Highlight the "View the Main Output file using system editor" post processor.
    b. Click on the "**Include**" button.
    c. Highlight the "Compute1 – Table of Compute Variables (with headers)" post processor.
    d. Click on the "**Include**" button.
22) Click on the "**Close**" button to close the "**Select Post Processors**" window.

Final Step
Running the simulation.

23) Click on the "**Run Simulation**" button.
24) Name the keyword file **AdvMgt3-4.key**.
25) Click on the "**Save**" button.
26) Click on the "**Run**" button.

Note: By applying the addfiles and keywords in the FVS_GroupAddFIlesAndKeywords, the addfiles or keywords are automatically included in the simulation whenever the stand is added into Suppose.

Questions

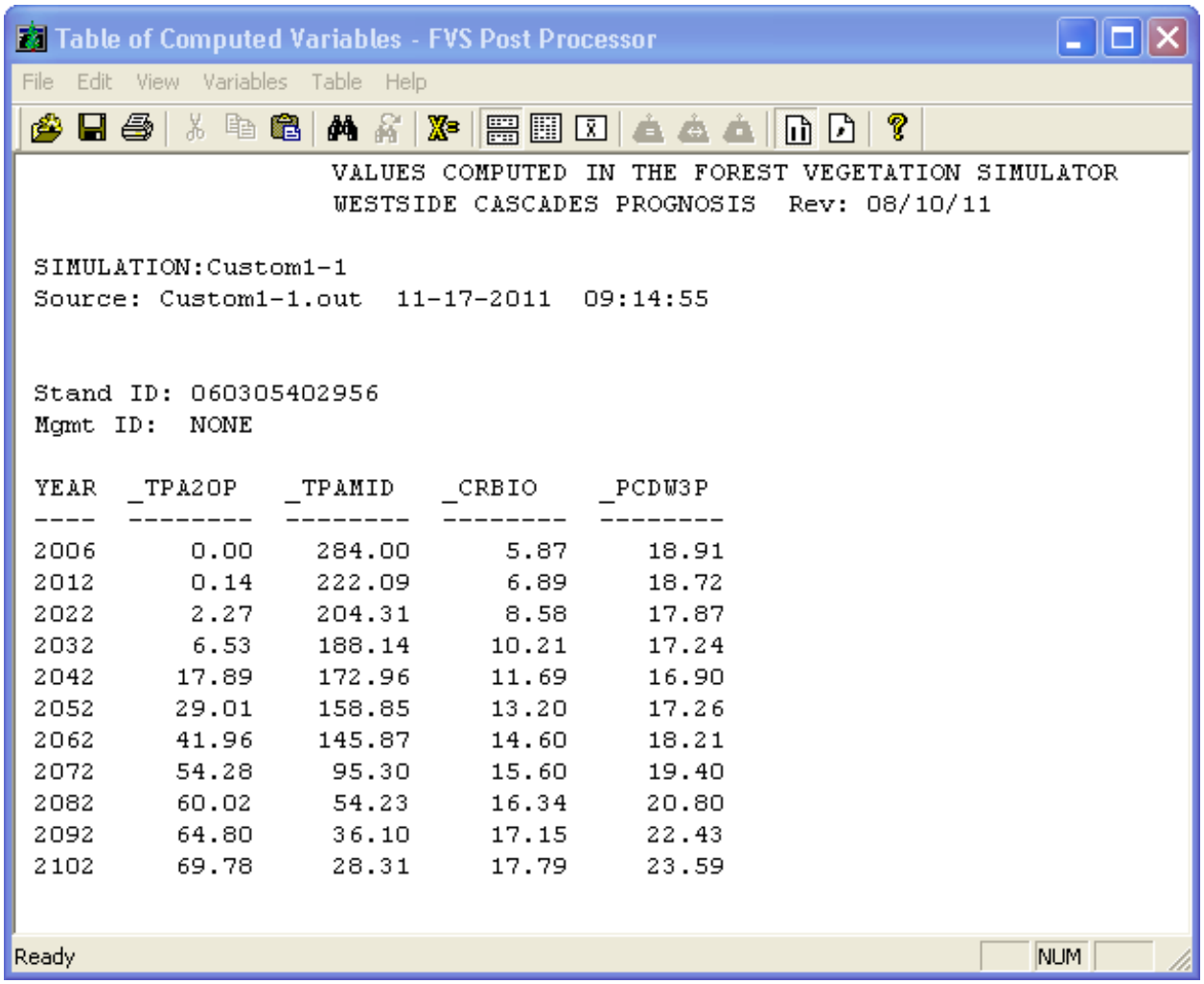
Do the results in 3-3 match the results in 3-4? _____

Answer Guide

Exercise 1-1 – Creating Custom Variables Using Event Monitor Variables and Functions

```
_Tpa20p   = SpMcDBH(1,All,0,20.,999.,0.,999.,0,0.) + &
            Snags(1,All,0,20.,999.,0.,999.,0)
_CrBio    = TreeBio(-1,1,0,All,DBHDist(5,3),999.,0.,999.)
_TpaMid   = SpMcDBH(1,All,0,0.,999.,0.,30.,0,0.)
_PCDW3p   = DWDVal(2,0,2,7)
```

Custom Variable Expressions: Screen capture of Compute keyword editor window with attribute expressions.



YEAR	_TPA20P	_TPAMID	_CRBIO	_PCDW3P
2006	0.00	284.00	5.87	18.91
2012	0.14	222.09	6.89	18.72
2022	2.27	204.31	8.58	17.87
2032	6.53	188.14	10.21	17.24
2042	17.89	172.96	11.69	16.90
2052	29.01	158.85	13.20	17.26
2062	41.96	145.87	14.60	18.21
2072	54.28	95.30	15.60	19.40
2082	60.02	54.23	16.34	20.80
2092	64.80	36.10	17.15	22.43
2102	69.78	28.31	17.79	23.59

Fill in the table with your results.

Year	Resting Score	Foraging Score	Regress Score	Hiding Cover Score
2012	0	0	2	3
2042	2	1	1	3
2072	3	2	0	3
2102	3	3	0	2

Exercise 1-2 – Creating Indices Using Conditional Statements and the LinInt Function

```
RestSc  = LinInt(_Tpa20p,5,5,15,15,25,25,0,1,1,2,2,3)
ForagSc = LinInt(_CrBio,7.5,7.5,12.5,12.5,17.5,17.5,0,1,1,2,2,3)
RegrsSc = LinInt(_TpaMid,100,100,200,200,300,300,0,1,1,2,2,3)
HideSc  = LinInt(_PCDW3p,5,5,10,10,15,15,20,20,25,25,30,30, &
                         0, 1, 1, 2, 2, 3, 3, 2, 2, 1, 1, 0)
```

Table of Computed Variables - FVS Post Processor

File Edit View Variables Table Help

VALUES COMPUTED IN THE FOREST VEGETATION SIMULATOR
WESTSIDE CASCADES PROGNOSIS Rev: 08/10/11

SIMULATION:Custom1-2
Source: Custom1-2.out 11-17-2011 09:21:23

Stand ID: 060305402956
Mgmt ID: NONE

YEAR	_TPA20P	_TPAMID	RESTSC	REGRSSC	_CRBIO	_PCDW3P	FORAGSC	HIDESC
2006	0.00	284.00	0.00	2.00	5.87	18.91	0.00	3.00
2012	0.14	222.09	0.00	2.00	6.89	18.72	0.00	3.00
2022	2.27	204.31	0.00	2.00	8.58	17.87	1.00	3.00
2032	6.53	188.14	1.00	1.00	10.21	17.24	1.00	3.00
2042	17.89	172.96	2.00	1.00	11.69	16.90	1.00	3.00
2052	29.01	158.85	3.00	1.00	13.20	17.26	2.00	3.00
2062	41.96	145.87	3.00	1.00	14.60	18.21	2.00	3.00
2072	54.28	95.30	3.00	0.00	15.60	19.40	2.00	3.00
2082	60.02	54.23	3.00	0.00	16.34	20.80	2.00	2.00
2092	64.80	36.10	3.00	0.00	17.15	22.43	2.00	2.00
2102	69.78	28.31	3.00	0.00	17.79	23.59	3.00	2.00

Ready NUM

Fill in the table with your results.

Year	Resting Score	Foraging Score	Regress Score	Hiding/Regress Cover Score
2012	0	0	2	3
2042	2	1	1	3
2072	3	2	0	3
2102	3	3	0	2

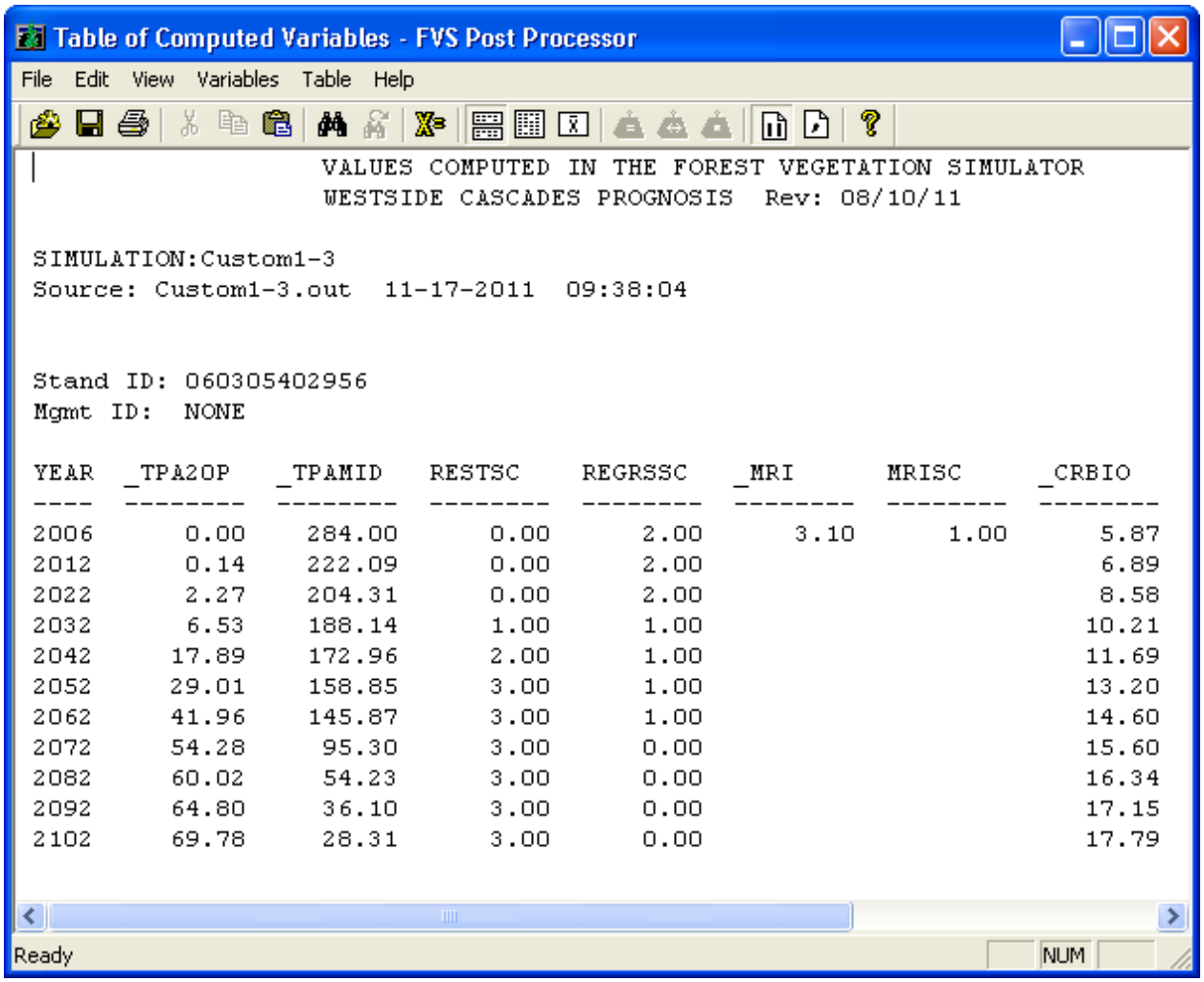
Do these results match what you wrote down in the previous exercise? It should. If not, check both exercises for errors.

Exercise 1-3 – Adding Custom Variables Using Database – Event Monitor Connectivity

SQLIn keyword logic:

```
SQLIn                1
SELECT MOISTURE
FROM FVS_StandInit
WHERE Stand_ID = '%StandID%'
EndSQL
```

What is the MRI and MRI score for this stand: 3.10 and 1.00, respectively.



YEAR	_TPA2OP	_TPAMID	RESTSC	REGRSSC	_MRI	MRISC	_CRBIO
2006	0.00	284.00	0.00	2.00	3.10	1.00	5.87
2012	0.14	222.09	0.00	2.00			6.89
2022	2.27	204.31	0.00	2.00			8.58
2032	6.53	188.14	1.00	1.00			10.21
2042	17.89	172.96	2.00	1.00			11.69
2052	29.01	158.85	3.00	1.00			13.20
2062	41.96	145.87	3.00	1.00			14.60
2072	54.28	95.30	3.00	0.00			15.60
2082	60.02	54.23	3.00	0.00			16.34
2092	64.80	36.10	3.00	0.00			17.15
2102	69.78	28.31	3.00	0.00			17.79

Exercise 1-4 – Sending Custom Variables to a Database

1st Option: Conditional Compute with LinInt

```
IF                  0
MRISc EQ 1
Then
Compute             0
ScSum = RestSc + ForagSc + RegrsSc + HideSc
CatMrIdx = Linint(ScSum,3,4,8,10,11,0.00,0.25,0.50,0.75,1.00)
End
Endif
IF                  0
MRISc EQ 0
Then
Compute             0
CatMrIdx = 0
End
Endif
```

2nd Option: Compute with LinInt function

```
Compute             0
ScSum = RestSc + ForagSc + RegrsSc + HideSc
CatMrIdx = LinInt(MRISc,1,1,0, &
          Linint(ScSum,3,4,8,10,11,0.00,0.25,0.50,0.75,1.00))
End
```

3rd Option: Single LinInt function

```
Compute             0
CatMrIdx = LinInt(MRISc,1,1,0, &
           Linint(RestSc + ForagSc + RegrsSc + HideSc, &
           3,4,8,10,11,0.00,0.25,0.50,0.75,1.00))
End
```

American Catmar Suitability Index

Stand ID	2012	2052	2112
060305402956	0.31	0.62	0.50
060305402995	0.25	0.62	0.44
060305403015	0.00	0.00	0.00
060305403020	0.44	0.50	0.44
060305403030	0.00	0.00	0.00
060305403055	0.00	0.00	0.00
Average Value	0.17	0.29	0.23

Extra credit

Reorganize the custom variables so that you use less than 5 custom variables.

```
Compute            0
RestSc  = LinInt(SpMcDBH(1,All,0,20.,200.,0.,500.,0,0.) + &
          Snags(1,All,0,20.,999.,0.,999.,0) &
          ,5,5,15,15,25,25,0,1,1,2,2,3)
ForagSc = LinInt(TreeBio(-1,1,0,All, &
          DBHDist(5,3),200.,0.,500.)&
          ,7.5,7.5,12.5,12.5,17.5,17.5,0,1,1,2,2,3)
RegrsSc = LinInt(SpMcDBH(1,All,0,0.,200.,0.,30.,0,0.) &
          ,100,100,200,200,300,300,0,1,1,2,2,3)
HideSc  = LinInt(DWDVal(2,0,2,7), &
          5,5,10,10,15,15,20,20,25,25,30,30, &
          0,1, 1, 2, 2, 3, 3, 2, 2, 1, 1, 0)
CatMrId2 = LinInt(MOISTURE,2.5,2.5,0, &
          Lininit(RestSc + ForagSc + RegrsSc + HideSc, &
          3,4,8,10,11,0.00,0.25,0.50,0.75,1.00))
End
```

Exercise 2-1 – Conditionally Scheduling Multiple Management Activities

What FVS keywords were added to the simulation to perform the conditional thinning, prescribed burn, and natural regeneration?

Condition – IF and THEN, Thin from below – THINBBA, Prescribed burn – SIMFIRE
Natural regeneration – ESTAB, SPROUT, NATURAL, PLANT

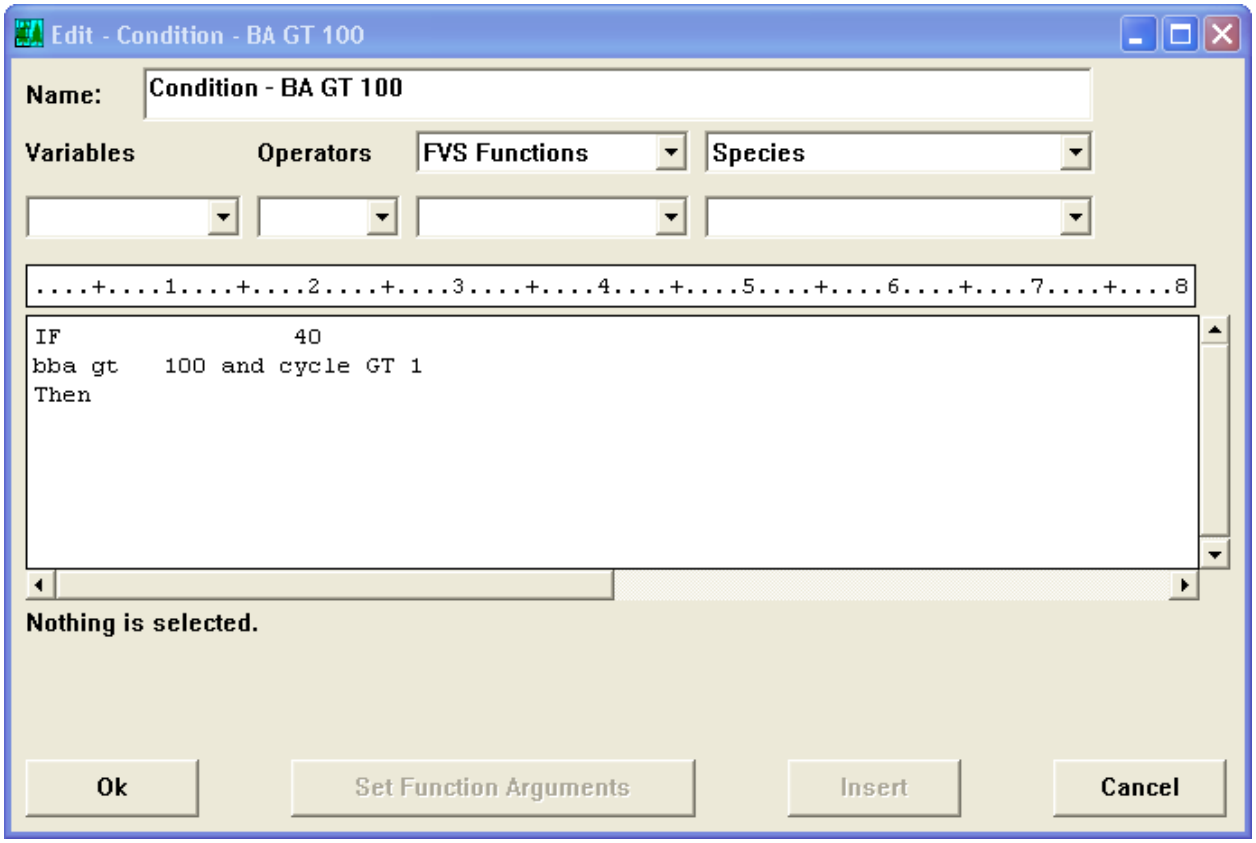
How many times was the stand thinned? Three times
Did the stand get thinned every time basal area exceeded 100? yes

When did the natural regeneration get entered into the simulation?
Natural regeneration - 2006, 2024, 2022, and 2042

Extra Credit

To adjust the simulation run so that you have a minimum waiting time of 40 years between thinning events and so that thinning does not occur in cycle 1 you will need to use the free form button on the condition statement.

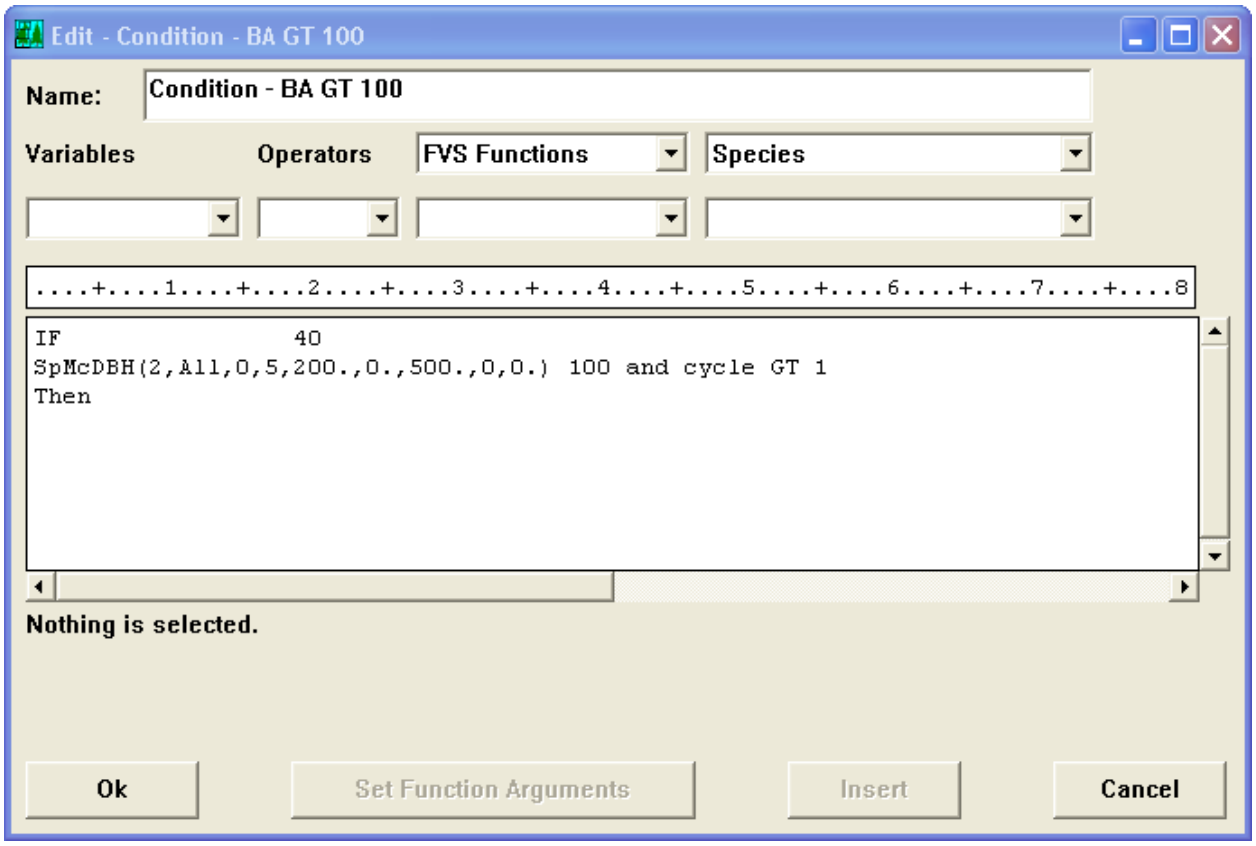
```
IF              40
bba gt   100 and cycle GT 1
Then
```



Extra Extra Credit

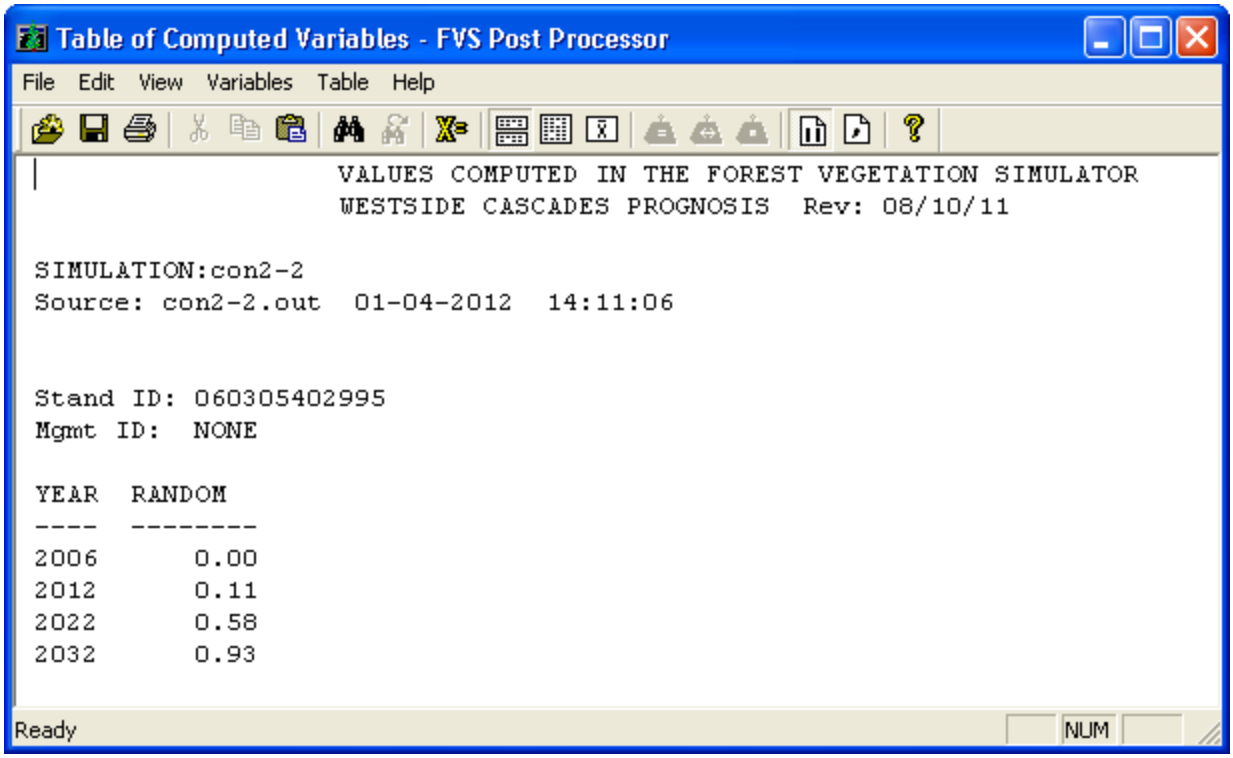
To adjust the simulation run so that you base the conditional thinning on basal area in trees greater than 5” DBH you can use the SpMcDBH function found by using the dropdown tab located under FVS Functions

```
IF                    40
SpMcDBH(2,All,0,5,200.,0.,500.,0,0.) gt 100 and cycle gt 1
Then
```



Exercise 2-2 – Conditionally Scheduling Based on a Random Event

In which years is the random number less than 0.10? 2006

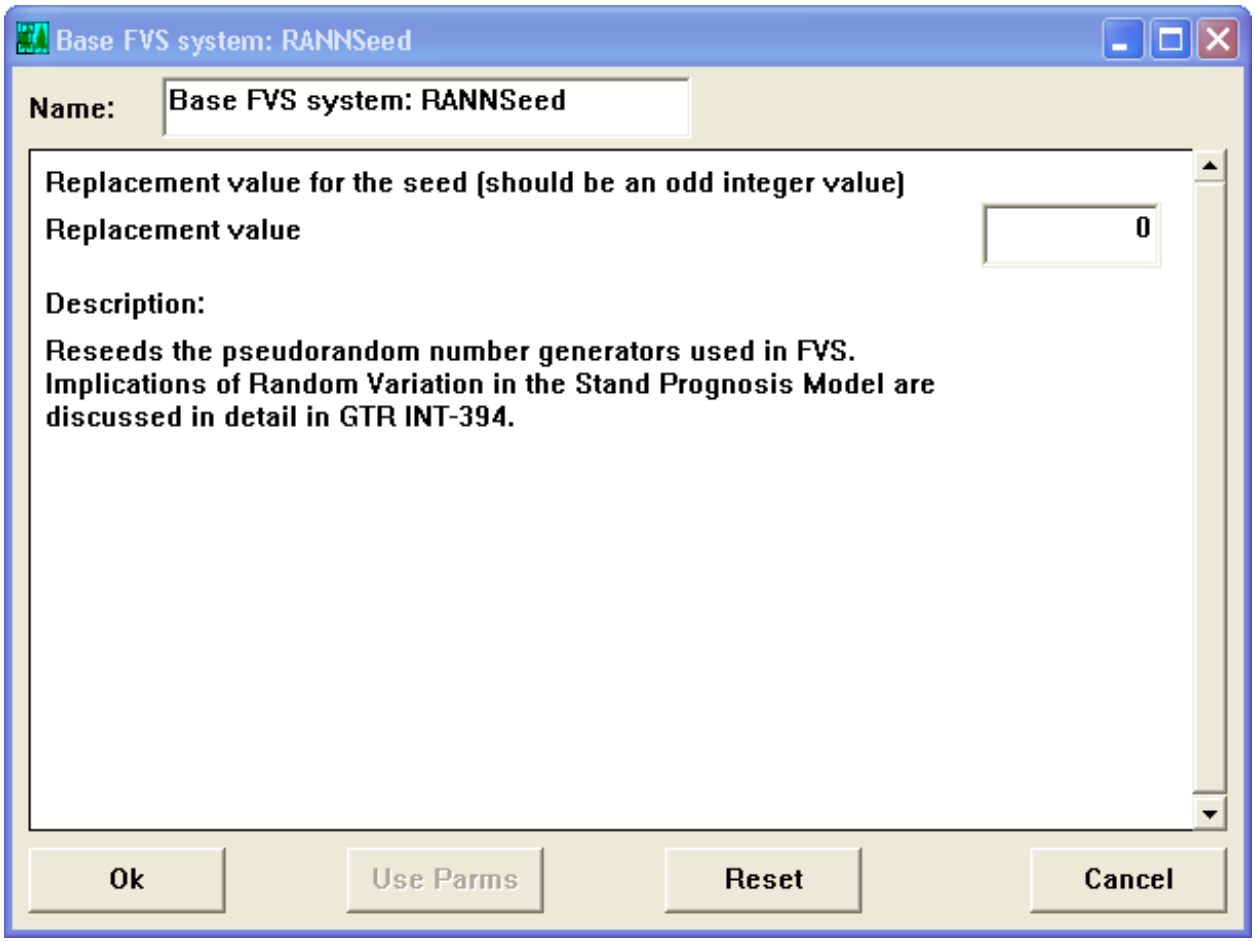


Did the conditional statement appear? Yes

Did a fire occur? Yes. If so, in what year? 2006. What random number caused the fire to occur? 0. Did regeneration occur 2 years after the fire? Yes

Extra Credit

When you ran the simulation again, did you obtain the same results? Yes.

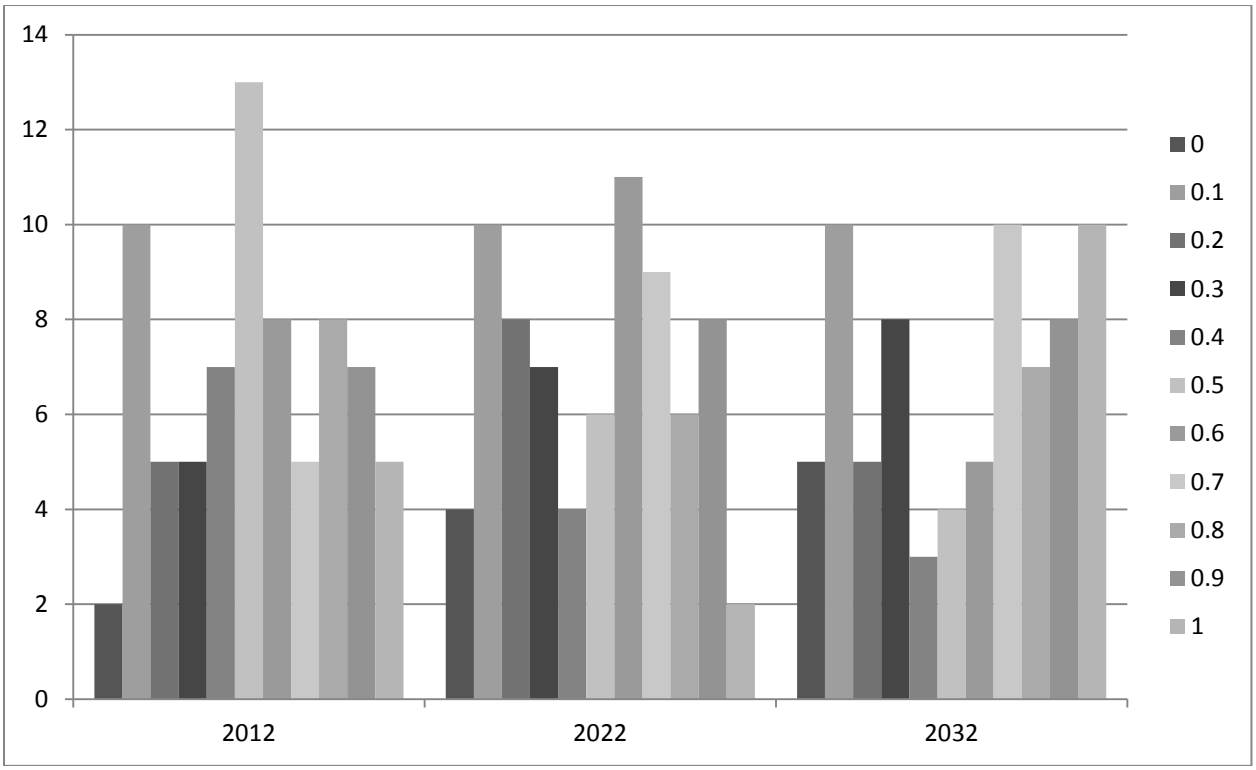


Extra Extra Credit

To export the compute variable to an excel file:

1) Click on the "**Select Outputs**" button.
2) Select **Database Extension > Specify Output Database**.
    a. Select a name for your .xls database.
3) Click on the "**Ok**" button.
4) Select **Event Monitor (EM) Compute Variables > Build Compute Table in Database**.
5) Click on the "**Ok**" button.

Here is an example of what the pivot chart might look like. The chart should show no discernable patterns as each value between 0 and 1 has an equal chance of being selected.



Exercise 2-3 – Scheduling Alternative Management Activities Based Upon a Condition

From the *Summary Statistics Table,* in what year did the basal area begin to exceed 225? 2042

How many lodgepole seedlings were added into the simulation for each cycle?

2007- 30, 2013- 30, 2023- 30, 2033- 30, 2043- 10, 2053- 10, 2063- 10

Exercise 2-4 – Customized Library of Condition Statements

Extra Credit

Include the following condition statements in your library:

1- Basal area at the beginning of a cycle is less than 100 square feet per acre

BBA LT 100

2- Trees per acre at least 15 inches in DBH at the beginning of a cycle is greater than 50

SpMcDBH(1,All,0,15,200.,0.,500.,0,0.) GT 50

3- Quadratic mean diameter for trees 10 inches in DBH or larger at the beginning of a cycle is greater than 20 inches.

SpMcDBH(5,All,0,10,200.,0.,500.,0,0.) GT 20

Exercise 3-1 – Thinning To a Stand Level Target with Diameter Limits

```
Compute          2012
BigBA=SpMcDBH(2,All,0,20,200.,0.,500.,0,0.)
End

* Arguments: SmDBH, LgDBH, CutEff, Species, ResTPA, ResBA
ThinDBH          2012      Parms(0., 20, 1., All, 0., 100-BigBA)
```

How many stands have trees greater than 20” DBH for the year 2012: 1

Did the thinning in 2012 produce a residual stand basal area of 100 ft/acre for each stand: Yes

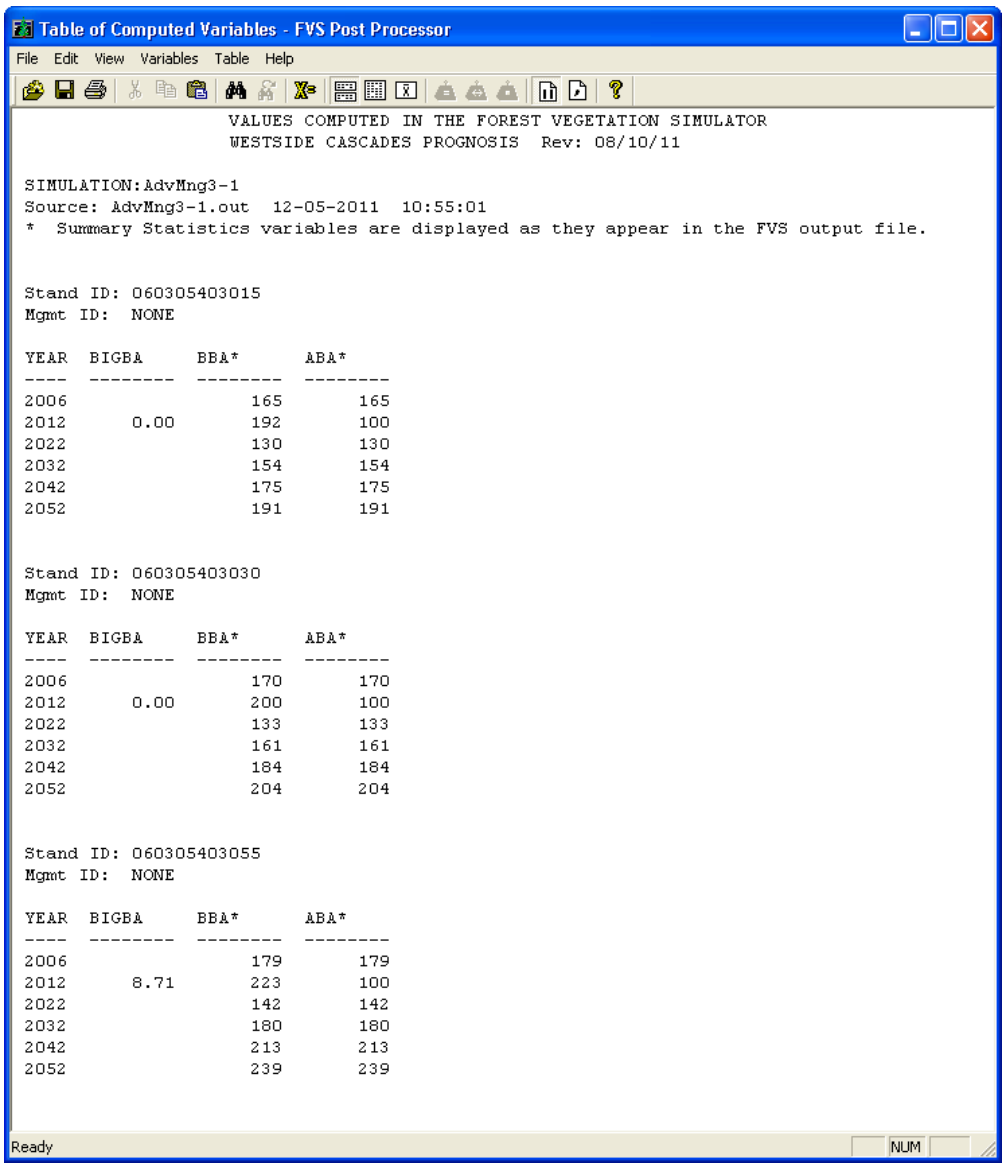


Table of Computed Variables - FVS Post Processor

File Edit View Variables Table Help

VALUES COMPUTED IN THE FOREST VEGETATION SIMULATOR
WESTSIDE CASCADES PROGNOSIS Rev: 08/10/11

SIMULATION:AdvMng3-1
Source: AdvMng3-1.out 12-05-2011 10:55:01
* Summary Statistics variables are displayed as they appear in the FVS output file.

Stand ID: 060305403015
Mgmt ID: NONE

YEAR	BIGBA	BBA*	ABA*
2006		165	165
2012	0.00	192	100
2022		130	130
2032		154	154
2042		175	175
2052		191	191

Stand ID: 060305403030
Mgmt ID: NONE

YEAR	BIGBA	BBA*	ABA*
2006		170	170
2012	0.00	200	100
2022		133	133
2032		161	161
2042		184	184
2052		204	204

Stand ID: 060305403055
Mgmt ID: NONE

YEAR	BIGBA	BBA*	ABA*
2006		179	179
2012	8.71	223	100
2022		142	142
2032		180	180
2042		213	213
2052		239	239

Ready NUM

Exercise 3-2 – Thinning, while retaining a hardwood component

```
Compute          2012
RABA=SpMcDBH(2,RA,0,0.,200.,0.,500.,0,0.)
End

* Arguments: ResBA, CutEff, SmDBH, LgDBH, SmHt, LgHt
ThinBBA          2012      Parms(90+RABA, 1., 0., 999., 0., 999.)
```

Fill in the red alder basal area for each stand in 2012?

060305402956= 6.48 060305402995= 0.00 060305403020= 21.77

Fill in the post harvest stand basal area in 2012?

060305402956= 96 060305402995= 90 060305403020=112

```
ThinDBH          2012      Parms(0,20,1,All,0, &
100-SpMcDBH(2,All,0,20,200))

ThinBBA          2012    Parms(90+SpMcDBH(2,RA,0),1,0,999,0,999)
```

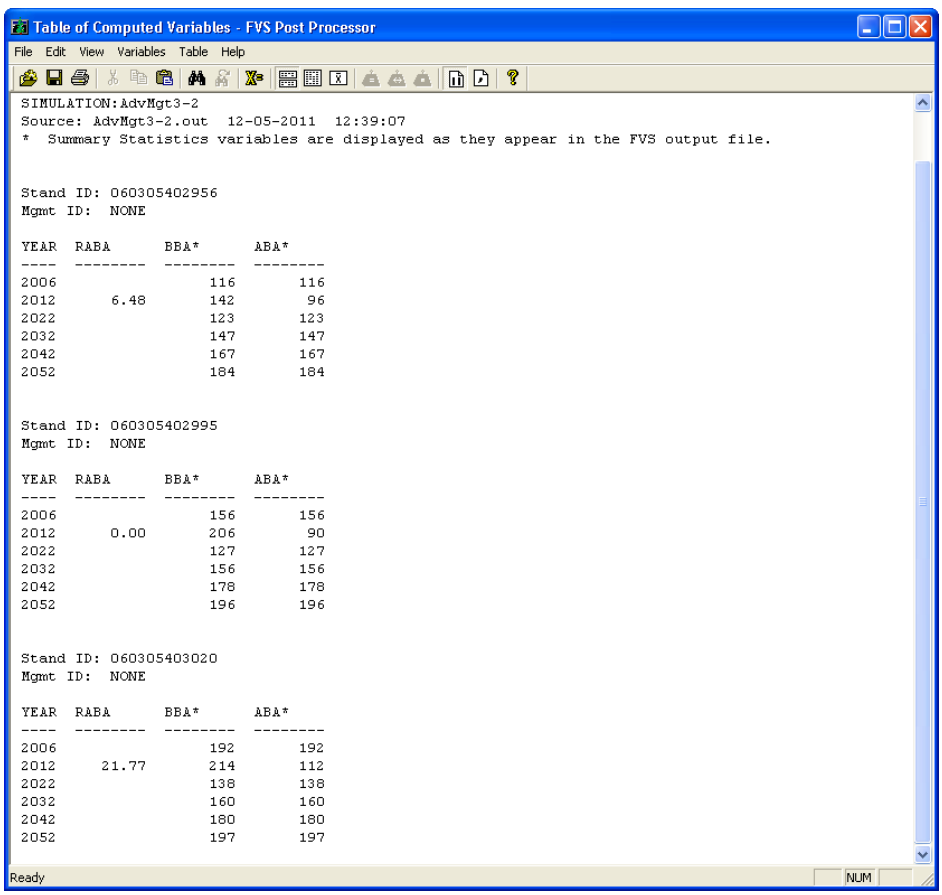


Table of Computed Variables - FVS Post Processor

File Edit View Variables Table Help

SIMULATION:AdvMgt3-2
Source: AdvMgt3-2.out 12-05-2011 12:39:07
* Summary Statistics variables are displayed as they appear in the FVS output file.

Stand ID: 060305402956
Mgmt ID: NONE

YEAR	RABA	BBA*	ABA*
2006		116	116
2012	6.48	142	96
2022		123	123
2032		147	147
2042		167	167
2052		184	184

Stand ID: 060305402995
Mgmt ID: NONE

YEAR	RABA	BBA*	ABA*
2006		156	156
2012	0.00	206	90
2022		127	127
2032		156	156
2042		178	178
2052		196	196

Stand ID: 060305403020
Mgmt ID: NONE

YEAR	RABA	BBA*	ABA*
2006		192	192
2012	21.77	214	112
2022		138	138
2032		160	160
2042		180	180
2052		197	197

Ready NUM

Exercise 3-3 – Running multiple stand with multiple prescriptions in one simulation

```
Compute          2012
PreBA=BBA
residBA=ABA
BA%rmvd=100-(ABA/BBA)*100
HarvVol=SpMcDBH(4,All,0,0.,200.,0.,500.,2,0.)
ACRES=SampWt
VOLxACRE=HarvVol*ACRES
End
```

Table of Computed Variables - FVS Post Processor

File Edit View Variables Table Help

```
                    VALUES COMPUTED IN THE FOREST VEGETATION SIMULATOR
                    WESTSIDE CASCADES PROGNOSIS  Rev: 08/10/11

SIMULATION:AdvMgt3-3
Source: AdvMgt3-3.out  12-05-2011  16:09:30


Stand ID: 060305402956
Mgmt ID:  NONE

YEAR  PREBA     ACRES     RESIDBA   BA%RMVD   HARVVOL   VOLXACRE
----  --------  --------  --------  --------  --------  --------
2012    141.91    102.00    141.91      0.00      0.00      0.00


Stand ID: 060305402995
Mgmt ID:  NONE

YEAR  PREBA     ACRES     RABA      RESIDBA   BA%RMVD   HARVVOL   VOLXACRE
----  --------  --------  --------  --------  --------  --------  --------
2012    205.65     36.00      0.00     90.00     56.24  19306.44 695031.75


Stand ID: 060305403015
Mgmt ID:  NONE

YEAR  PREBA     ACRES     BIGBA     RESIDBA   BA%RMVD   HARVVOL   VOLXACRE
----  --------  --------  --------  --------  --------  --------  --------
2012    191.60     21.00      0.00    100.00     47.81  20032.81 420688.97


Stand ID: 060305403020
Mgmt ID:  NONE

YEAR  PREBA     ACRES     RABA      RESIDBA   BA%RMVD   HARVVOL   VOLXACRE
----  --------  --------  --------  --------  --------  --------  --------
2012    214.44     58.00     21.77    111.77     47.88  16162.53 937426.81


Stand ID: 060305403030
Mgmt ID:  NONE

YEAR  PREBA     ACRES     BIGBA     RESIDBA   BA%RMVD   HARVVOL   VOLXACRE
----  --------  --------  --------  --------  --------  --------  --------
2012    199.61     21.00      0.00    100.00     49.90  16817.30 353163.41


Stand ID: 060305403055
Mgmt ID:  NONE

YEAR  PREBA     ACRES     BIGBA     RESIDBA   BA%RMVD   HARVVOL   VOLXACRE
----  --------  --------  --------  --------  --------  --------  --------
2012    223.20     54.00      8.71    100.00     55.20  23475.291267665.38
```

Ready NUM

Exercise 3-4 – Applying Addfiles Directly to the Input Database

FVS_GroupAddFilesAndKeywords		
Groups	**Addfiles**	**FVSKeywords**
All_Plots		Database DSNIn FVS_Data.mdb StandSQL SELECT * FROM FVS_PlotInit WHERE StandPlot_CN= '%Stand_CN%' EndSQL TreeSQL SELECT * FROM FVS_TreeInit WHERE StandPlot_CN= '%Stand_CN%' EndSQL END
All_Stands		Database DSNIn FVS_Data.mdb StandSQL SELECT * FROM FVS_StandInit WHERE Stand_CN= '%Stand_CN%' EndSQL TreeSQL SELECT * FROM FVS_TreeInit WHERE Stand_CN= '%Stand_CN%' EndSQL END
Rx1:EvenThin	Rx1.kcp	
Rx2:ThinBelow	Rx2.kcp	
All_Stands	HarvCompute.kcp	DelOTab 1 DelOTab 2

Do the results in 3-3 match the results in 3-4? YES___

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