**Plot FVS Variants help screen**

FVS simulations rely on equations (such as those that predict diameter and height growth) and computation code that differ among geographic areas, known as “variants” in FVS parlance. Surface fuel model assignment, site class calculation, mortality estimation, crown ratio and crown width parameters, and fuel moisture content assumptions are a few of the many other items that differ among variants. Thus it is very important that each plot, and the stands (conditions) that it contains be assigned to the variant in which it geographically resides. The *fiadb\_fvs\_variant* table in the *ref\_master* database contains the correct variant assignments for all plots in the FIA database in the states of CA, OR, WA, ID, MT and UT.

1. To assign the appropriate variant to plot records or to review the current assignments, select **<Plot FVS Variants>.**
2. The **Plot FVS** **Variants** window will appear, with a list of plots and their existing FVS variant assignment in a sienna-brown colored, editable column. This table can be browsed, sorted (indexed) or filtered, via functions available from the right click menu when right clicking while the cursor is placed in the desired column. However, it is easier to find cases of plots that lack a variant assignment by running an “audit” on the plot. Ignoring audits could result in unidentified issues that corrupt or invalidate the BioSum analysis.
3. To run an audit select the button labeled **<Check For Plots Without Variant Codes>,** which initiates a script that identifies plots without a variant assignment. A message box will indicate whether the audit passed or failed, and if it failed, those plots without variant assignments will appear in the table in the upper half of this task window, provided they exist in the fiafb\_fvs\_variant table in the database.
4. Select the records to be updated using the **<Check All>** button, or manually select individual plot records. After records are selected, update plot table using the **<Update Plot Records With FIADB FVS Variant Table>** button to automatically make variant assignments based on the values in the fiadb\_fvs\_variant table in the *ref\_master* database. To confirm that all plots have been assigned a variant, the audit can be re-run by selecting **<Check For Plots Without Variant Codes>**.
5. If plots exist outside the states for which the fiadb\_fvs\_variant table contains variant assignments, it will be necessary to correct NULL values manually.
6. Click **<Save>,** then **<Close>** to save the FVS variant assignments and exit the task window.

**Rx- Treatment List window help screen**

We refer to treatments as “Rx” throughout this guide. Treatments ultimately consist of a file of keywords and parameters provided to FVS to guide what happens at a particular time. For example, one might define treatment 200 as “thin across diameter classes (a constant harvest proportion applied to all diameter classes) to a residual density of 85 sq. ft basal area per acre, while cutting no trees larger than 36” in diameter, using mechanized whole tree harvest on gentle slopes and cable manual logging on steep slopes”.

The harvest systems are not specified in the KCP file, but the implications of their use are, for example, via “yardloss” keyword statements indicating the quantity of wood residues left behind. To model a different residual density or upper diameter limit, you would create additional prescriptions (e.g., 201 with residual basal area=100, upper dimeter limit 36”, etc.). Sometimes two treatments will be identical except that one uses whole tree harvest systems and captures all or most forest residues for utilization while the other relies on a log length system that brings only merchantable logs to the landing, leaving residues in the forest, possibly to be treated later at additional expense.

Treatments may also include activities that take place in the stand that are not harvest per se, for example, piling and burning or masticating harvest residues; however, these are usually specified as supplemental (to tree harvest) activities that incur additional harvest costs specified by the user. Once treatments are defined, they can be assigned to one or more prescription packages, which are simply sequences of either the same or different silvicultural prescriptions, implemented over 4 cycles. Note that some cycles in a package may have Rxs that are essentially “grow-only” and harvest no trees. By convention, it can be useful to define Rx 999 as grow-only, for repeated use in a grow-only silvicultural sequence.

Prescription definition workflow is as follows:

1. Define silvicultural treatments to be applied in FVS by clicking **<Rx>** to load the Rx task window.
2. For each treatment to be added to the project:
   1. Select **<New>** to open the **Treatments** window, which will display four tabs: Treatment, Harvest Method, Harvest Costs, and Associated FVS Command(s).
   2. **Treatment:** After selecting the treatment tab, choose a category, sub-category, and ID number. Treatment ids 001 to 699 represent pre-defined treatment categories, and treatment ids 700 to 999 can be used to label any custom-defined treatment. After choosing one for the new Rx, enter a brief description of that treatment. Apply your edits by clicking **<Select>.**
   3. **Harvest Method**: Choose the Harvest Method tab. Select a harvest method for low slopes and a harvest method for steep slopes. Percent slope threshold at which a slope is categorized as steep will be specified later in the Processor module of BioSum. Once a harvest method is selected, a brief description of the method will appear in the Description text box.
   4. **Harvest Costs:** Add any additional harvest cost components – i.e., those that are not accounted for by the OpCost model, such as the cost for conducting prescribed fire or pile and burn operations. The actual costs (in dollars per acre) of these components will need to be assigned during the Processor phase of BioSum. To define a cost component, select **<New>** and enter the name for the cost component and a brief description in the window that pops-up.
   5. **Associated FVS Commands**: A user may wish to enter FVS management keywords for the treatment for documentation purposes; if so, click this tab and then **<New>.** An interactive window will prompt you for FVS keywords and parameter values. Select **<OK>** when finished. This step is not required.
   6. When all desired information has been entered (treatment and harvest method are required; others are optional), select **<OK>** in the upper left hand corner to return to the Treatment List. Click <**Save**> to save the treatment.
3. To make changes to a treatment displayed in the treatment list, select it and click **<Edit>**.
4. When finished creating or editing treatments, click **<Save>,** then **<Close>,** to exit **Treatments** window.

**Rx Package- Treatment Package List window help screen**

In BioSum a series of treatments applied to a stand over a 15 or 30 year time period (three 5-year cycles or three 10-year cycles) is referred to as an Rx package. An Rx package consists of a sequence of one or more of the Rxs already defined with the possibility that some cycles will have no Rx assigned or a prescription of grow only.

1. Assemble a sequence of silvicultural prescriptions to be applied in FVS by clicking **<Rx Package>** to load the Treatment Packages task window.
2. To create a new package:
   1. Select **<New>** to open the Treatment Package Item window, which has three tabs: Package, Harvest Costs, and Associated FVS Command(s).
   2. **Package:** To create a new package**:**
      1. Select an available package ID number from the **<Package ID>** drop-down list.
      2. Write a brief description of the package in the **<Description>** text box.
      3. Next, specify whether your projection will utilize 5- or 10-year cycles by selecting the radio button next to the cycle length of choice in the **<FVS Cycle Length>** box. (Note: all packages within a BioSum project must have the same cycle length.)
      4. To add a treatment to a cycle year, select the year: 00, 10, 20, or 30, and click **<Edit>.**
      5. Uncheck the box next to **<Skip Treatment>** (by default, each cycle will be populated with a “skip treatment” via the check box)**.**
      6. Assign a prescription from the dropdown list next to **<Rx ID>.** You will see a list of prescription ids that have been defined in this project within in the dropdown window. Select the prescription to assign.
      7. Select **<OK>** to add the treatment to the package. The treatment selected should appear next to the desired year along with its description.
      8. To add another treatment to the package, return to step IV. If no treatment is to be administered in a cycle year, no action is necessary; BioSum will assume no treatment when the “skip treatment” box is checked.
      9. An FVS .kcp file can be “attached” to the package by selecting **<Assign KCP File>.** This allows the user to save a link in the BioSum project to the location of the KCP file used to run the FVS simulation for a given package. By establishing these links (for each package), the user can easily view the details of what happens in a package via the “Open KCP file to view/edit contents”, or even make tweaks to it.
   3. **Harvest Costs:** This window contains a list of harvest costs, assigned during **Rx** creation, for each prescription in the package. These items are read-only since they are bound to the treatment.
   4. **Associated FVS Commands:** A list of the FVS commands assigned during Rx creation for all prescriptions in the package. You can add package specific keywords by clicking **<New>** and picking a command from the drop down menu.
   5. Click **<OK>** to close the Treatment Package Item window.
3. Repeat step 2 for each package you wish to create. When finished, click **<Save>** then **<Close>** to exit.
4. To make changes to a treatment package you have already created, simply select the package from the Treatment Package List table and click **<Edit>.** Select **<Delete>** to delete a package from your project. Remember that no changes, including deletions, are saved as final until clicking <**Save**> at the bottom of the Treatment Package List.
5. To display full documentation of prescriptions and packages in the project click **<Properties>** from the Treatment Packages window to open an html file in your default browser. The page will open in your browser and display details for every treatment assembled for this project database. Clicking the hyperlink **<Printer Friendly>** in the upper left hand corner will display a printable version of the summary table.
6. Click **<Close>** to exit the Treatment Packages window.

**Tree Species help screen**

FVS predictions are customized to both geography and tree species, via allometric, regional and tree species specific equations for tree growth, mortality, and volume. Therefore, each tree in a BioSum analysis must be assigned an FVS tree species code. The FIA database, however, has a greater number of tree species than are specifically simulated in FVS. The *tree\_species* table in the project’s *ref\_master* database contains FVS species code assignments for many FVS variant and FIA species combinations. If you have a tree species in your data that is not recognized by the FVS variant used for prediction, the *tree\_species* reference table may be customized to “map” that species to one that FVS does recognize for that variant. Trees that have not been assigned a FVS species code valid for the variant in which they are modeled can lead to unpredictable results, including invalid predictions of growth and biomass and volume that “disappear” from the analysis.

1. The **Tree Species** window displays the *tree\_species* reference table. This table can be browsed, sorted, or filtered to find specific tree and variant combinations, or reference oven dry weight and dry to green values for specific tree species. To sort or filter, right click in a cell under the desired column type and select the desired type of filtering.
2. To ensure every FIA tree species and FVS variant combination in your project has an assigned FVS species code, select **<Run Audit>** from the Tree Species window.
3. A list of species\variant combinations without an assigned FVS species code will appear in the **Audit Results** table in the upper half of the window, and a pop-up window will appear with audit details. If there are no missing values in your project database, a pop-up window will appear stating that the audit has passed. If your project contains tree species that do not have a corresponding FVS species code in the *tree\_species* table, an error message will appear to alert you that the audit failed.
4. To add the records with null values (missing or invalid FIA/FVS species code combinations) to the *tree\_species* table, select the check boxes next to each record, or use the **<Check All>** button to add all records with null values, and then click **<Add Checked Items To Tree Species Table>.** To clear any selected records in the Audit Results table click <**Clear All**>.
5. Once records are in the *tree\_species* table, a record can be edited by clicking the **<Edit>** button to open the Procesor Tree Species Edit window to edit the FVS variant, FIA tree species code, common name, oven dry weight, and other descriptors associated with the selected entry.
6. Save edits to the *tree\_species* table by clicking on the **<Save>** button. Changes to the table will not be updated until saved.
7. If duplicate tree species\variant combinations are found within the table, a warning will appear when changes are saved. Close the warning window using the **<OK>** button, select one of the duplicate records in the table, and click **<Delete>**. Be sure to **<Save>** your update.

**FVS Input Data help screen**

This window allows the analyst to create the files necessary for FVS growth projection: input tree and plot files, destination Microsoft Access databases, and variant-specific KCP files. It is recommended that when using BioSum, these files are created using the FVS Input Data tool to ensure consistancy throughout the workflow.

All data fields required for FVS projections, including fields that are to be used to calibrate growth projections (e.g. increment data, seedling records, tree defect values) will need to be added *before* the initial import of plot data into BioSum. Otherwise, these fields will not be included in FVS input files created by BioSum.

To create FVS input files:

1. The top section of the **Create FVS Input** interactive window contains information about the BioSum project up to this point. Four interactive buttons (Plot Missing FVS Variant Value, Tree Species Missing FVS Variant Value, Number of Treatments, and Number of Packages) can be used to jump to previously completed steps; next to each is a value representing the number of times that event occurs in the project. To make edits, simply click the appropriate button.
   1. Selecting the **<Plots Missing FVS Variant Value>** will pull up the **Plot FVS Variant** window. The number next to this button lists the number of tree species assigned an FVS variant. This number should be zero after completing the Plot FVS Variant step in this module.
   2. **<Tree Species Missing FVS Variant Value**> will open the **Tree Species** table. The number next to this button lists the number of plots not assigned an FVS species code. This number should be zero after completing the Tree Species step in this module.
   3. **<Number of Treatments>**launches the **Treatments List** window. Treatments can be added, edited, or deleted here.
   4. The **Treatment Packages** window can be accessed from the **<Number of Packages>** button. Treatment packages can be added, edited, or deleted here.
2. The **Action Items** drop-down menu contains seven executable functions integral to the FVS input file creation process. These functions are only executed for variant/Rx package combinations selected in the Create FVS Input table. Click<**Check All>** to select all variant/Rx package combinations or select the desired Rx package(s) by clicking on the check box next to each package. To execute a function from the drop down menu simply select the tool and click <**Execute Action>**. A recommended order of operations is outlined here.
   1. **FVSIn Options Tab**: See the FVSIn Options help below for details regarding the usage of DWM and GRM data in the FVSIn process
   2. **Create FVS input text files:** Create the stand list file, location file, and tree files for each variant. These files are required FVS input. The tree file provides data such as plot and tree identification, tree species code, and tree measurements for each tree record. The stand list file (extension .slf) contains attributes for a particular stand, derived from information in the FIA Condition table. One location file is created per variant in the project. The location file is used by FVS to tell the model where the stand list file is located.
   3. **Create FVS output MDB files:** Create the empty database to which FVS output files will be directed (by the KCP file produced in the next step) once the simulation is complete. File names are created by combining vital package and variant information to help the user quickly identify the contents of each file. The format is FVSOUT\_*variant\_packageid-rxid-rxid-rxid-rxid.*mdb. 000 is coded for cycles that have no treatment (rxid) assigned.
   4. **Write KCP template scripts:** This action creates two types of keyword script (.kcp) files.
      1. The first type is a package specific .kcp created for every package in every variant. These files are named FVSOUT\_*variant\_packageid-rxid-rxid-rxid-rxid.*kcp. They contain keywords that direct output files to the appropriate output database, define time cycles of project treatments, and specify output tables to be generated.
      2. Unlike the previous .kcp file, the second type is a variant specific file. These files are named FVSOUT\_*variant*\_POTFIRE\_BaseYr.kcp and will be used to produce base year (year of inventory) potential fire (POTFIRE) values in FVS.
   5. **Delete standard FVS output tables, Delete POTFIRE base year output tables, Delete both standard and POTFIRE base year output tables:** If tables have already been appended via the FVS Output Data window, it is *imperative* that these tables be deleted before rerunning a simulation in FVS. If FVS output tables are not deleted before data is re-appended, duplicate records will be added, corrupting the FVS output databases. Select the appropriate function from the three delete options above and select <**Execute Action>** to delete unwanted output tables.
   6. **View KCP Template Scripts:** This action opens the KCP file created for the selected variant/rx package combination in the default text editing application.
   7. Once the FVS input text files, the FVS output MDB files, and the KCP template scripts have been createdthe FVS Input Data window can be closed.

**FVSIn Options Tab**

The controls in this dialog affect what data is brought into the FVSIn.accdb database. It is up to the analyst to understand how to tell FVS whether and how to use the information that ends up in this database. For example, you can choose to rely on the surface fuel model recorded by FIA field crews (for the years it is available—2013 and later) or the calculated down wood biomass—both can be propagated to the FVSIn file, but the analyst will need to tell FVS which to use as the basis for representing surface fuels (relied on heavily to calculate the estimates in the POTFIRE and CARBON tables, for example) in the KCP file.

**Down woody material** can be filtered by **Transect Length**—for example, if a forested condition occurs on only one subplot, and on only a part of that subplot, the coarse wood (**CWD**) **Transect Length** could be as short as 5 feet or less—a VERY small sample on which to base surface fuel biomass estimates, so the analyst might choose to set a higher threshold and pass CWD to FVS only for conditions (stands) where the transect length on which down wood was sampled, exceeds that threshold. It’s advisable to consult the field guides for each year of data you are interested in using, and/or the down wood tables, and/or an FIA analyst, for assistance in making these choices. The number, orientation and length of down wood transects has changed repeatedly over the past two decades.

**Duff/Litter Years to Exclude**  
Early in the annual inventory, confusion about duff and litter protocols (some due to the use of tenths of inches as a unit) leaves many analysts with little confidence that they are consistently and correctly recorded. These filtering checkboxes provide the option to load duff and litter data (for example to represent fuels or forest floor carbon) except for certain years (in which case FVS will assign what it “thinks” is a viable default for stand data collected in those years).

Checking the **<Use GRM calibration data if available>** checkbox propagates the GRM data loaded into the BioSum project into the FVSIn database for use in FVS projections. It is up to the analyst to know (or learn) how to tell FVS to use this data to adjust its uncalibrated projections.

**FVS Output Data help screen**

The last step in the FVS module of BioSum is to append and reformat all FVS output so that it can be used as input to the BioSum Processor and Core Analysis modules. These data are used to calculate potentially available biomass and merchantable wood volume, and costs of implementing treatment packages and potential revenues from sales of wood, and to provide pre- and post- treatment stand attributes.

1. The **Join and Append FVS Out Data** window will open, showing a list of all variant and package combinations, similar to the window displayed when creating FVS input files. Additonal information is also provided, such as the output database file name, Rx package specifics, whether the file was successfully found, and the number of records in the FVS summary, cut tree, standing tree, and potential fire tables.
2. **Important Note:** If tables have previously been appended and the simulation has been rerun in FVS, you must first return to the **FVS Input Data** window and delete the previously appended tables using the **<Delete FVS Output Tables>** tool from the **Action Items** drop-down menu. If FVS output tables are not deleted before data is re-appended, duplicate records will be created, corrupting the BioSum database.
3. Manually select output databases to be appended or click **<Check All>** to select all variant-package combinations.
4. To append FVS output into a dataset that can be used by BioSum Processor, five steps must be completed:
   1. First, select **<Define PRE/POST Table SeqNum>.** The resulting window enables BioSum user to define a desired sequence of FVS cycles, extracting the correct records to obtain pre and post treatment values in each case.
      1. In the PRE/POST Sequence Numbers window, select the name of the table for which you want to alter pre- and post- year assignments, and click **<Edit>.**  Unless a modified cycle pattern is being used, the Option 2 default will work in most cases. To use the Option 2 default, select **Option 2** from the **Default SeqNum Options** drop-down menu. Then click **<Assign Default>**. Do this for all tables, clicking **<Done>** to save changes.
      2. If FFE POTFIRE variable outputs are required and the modified cycle pattern is being used, a customized pre/post sequence number assignment will be vital to achieving correct designation of pre- and post-treatment year. Select a table, click **<Edit>** and enter the suggested sequence number assignments for each cycle. Click **<Done>** to save changes.
      3. To use an alternate customized sequence number assignment scheme, select a table, click **<Edit>** and use the drop down menus to assign sequence numbers for each cycle. Sequence number assignments can be displayed via the **<View Sequence Number Assignments>** button. Navigate to the project FVS folder, and select an output FVS database. This window contains three tables.
         1. **FVS *table* CURRENT PREPOST SEQNUM ASSIGNMENTS**: Current pre-post cycle assignments based on SeqNum Definition for the FVS table being edited.
         2. **FVS *table* with FVS *table* RowCounts**: SeqNum assignments and row counts.
         3. **FVS *table****:* SeqNum assignments for the FVS output table.
      4. Close window, saving changes.
   2. Next, select the variant/rx package combinations to be appended and click **<Translate FVS Alpha Code To FIA Numeric Code>.** This converts the alpha codes used by FVS to the numeric codes used in the FIA database.
   3. Next, select **<Pre-processing Audit Check>** to run an audit on the output databases. During this audit each table in the FVS output is analyzed and PRE and POST year is assigned to each cycle. The analysis is written to several tables with the name format of *audit\_pre\_post\_rx\_year\_fvsoutputtablename*. Additionally, the data from the FVS\_summary table is analyzed to determine if the year in the table is represented in the other tables. If BioSum detects an error or inconsistency in the data, a pop-up window will appear. If there are errors not significant enough to affect processing, the audit will pass with a warning. It is up to the user to determine if warnings require action. More significant errors will return a failed audit result. The user must address the specified error before continuing. Packages that don’t contain mechanical thinning and therefore do not contain a CUTLIST will receive a message asking if you want to continue without a cutlist. Select <**Yes>** to continue.
   4. After a successful audit, click **<Append FVS Output Data>**. During this stage, FVS output files are formatted for BioSum use and POTFIRE base year values are appended to package specific FVS database tables.
   5. When complete, run a **<Post-Processing Audit Check>** to ensure all necessary data are present and formatted correctly. If errors exist, evaluate and rectify before moving on to the Processor module.