# *Stand Visualization System*

*Version 3.30*



Diameter class distribution



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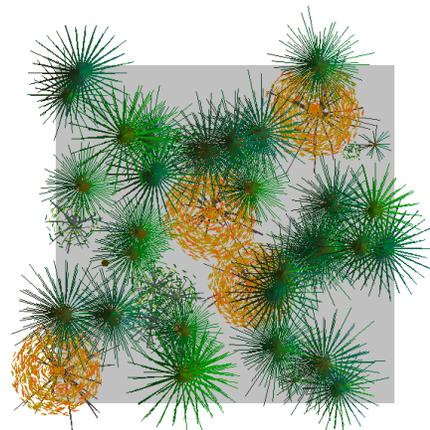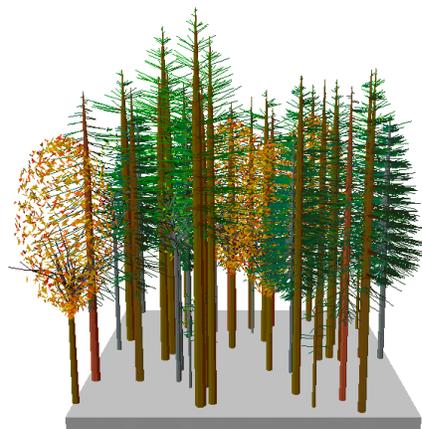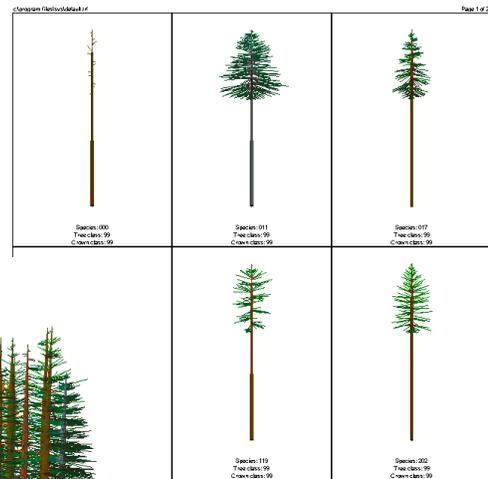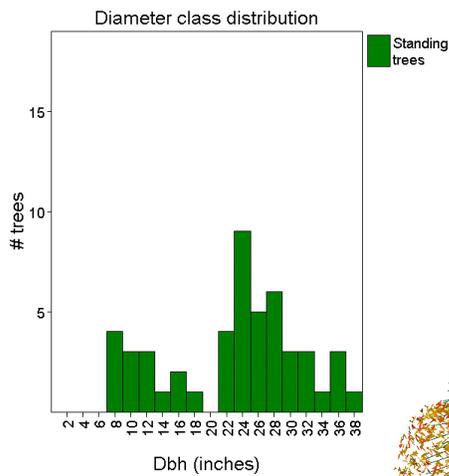
The Stand Visualization System (SVS) was developed by Robert J. McGaughey, USDA Forest Service, Pacific Northwest Research Station.

SVS is public domain software and can be freely distributed.

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Information describing SVS and the latest version of the software are also available on the World Wide Web at:

http://forsys.cfr.washington.edu/svs.html

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# SVS Overview

The Stand Visualization System (SVS) generates images depicting stand conditions represented by a list of individual stand components, e.g., trees, shrubs, and down material, using detailed geometric models (McGaughey 1997). The images produced by SVS, while somewhat abstract, provide a readily understood representation of stand conditions and help communicate silvicultural treatments and forest management alternatives to a variety of audiences.

SVS provides the following capabilities:

- displays individual plant and log components realistically;
- displays stand characteristics to communicate the overall structural diversity present within a stand;
- differentiates between stand components using different plant forms, colors, or other types of marking;
- displays overhead, profile and perspective views of a stand;
- provides a mechanism to define plant forms and colors based on species, growth form, and plant position within the canopy;
- allows users to design silvicultural treatments by "marking" stand components and specifying treatments; and
- provides tabular and graphical summaries of stand information.

SVS uses two types of data: a tree list and plant form definitions. The tree list describes the species, size and location of each component object (tree, snag, plant, log, or special object) in a stand. Plant form definitions describe the appearance of each species and, optionally, the appearance of individuals exhibiting different growth characteristics within a species. Users can change plant form definitions using the SVS tree designer to better adapt SVS to display their stand conditions.

The basic data needed to use SVS consist of a simple stand table containing species, dbh, height, and the number of plants per unit area. SVS provides support for imperial or metric units in stand table input. SVS includes utilities to convert output from the Forest Vegetation Simulator (FVS) (Wykoff and others 1992) and the ORGANON growth model (Hann et. al. 1993) into a tree list for display.

# SVS menu selections

**File**

| | |
|---|---|
| New stand | Create a new SVS tree list from a simple stand table, an ORGANON output file, or FVS tree list. |
| Open... | Open an SVS tree list or tree list index file. |
| Save image as... | Save an image of the current stand to either the Window's clipboard or an image file. An image may be a stand visualization, graphs, or tabular summaries. |

| | |
|---|---|
| Save scene description | Save a scene description for another rendering systems.  SVS supports the creation of VRML 1.0 and POV-raytracer scene files. |
| Print... | Print the current stand image to a printer. |
| Page setup... | Modify page margins to position a stand image on a printed page. |
| Printer setup... | Select the current printer and change configuration information for the printer. |
| Preferences... | Specify parameters affecting the overall behavior of SVS. |
| Exit | Quit SVS. |
| Last file list | SVS maintains a list of the last five files that have been opened.  Selecting one of the files in the list opens the file. |

## Edit

| | |
|---|---|
| Copy screen image to clipboard | Copy the current stand image to the Window's clipboard using a device dependent bitmap format. The resulting image can be pasted into other applications such as word processors or graphics programs. |

## Display

| | |
|---|---|
| Redraw all | Redraw all panels in the current layout. |
| Command line options | Display the command line options needed to duplicate the current view in SVS. |
| Tree list info | Display information describing the currently loaded SVS tree list. |
| Canopy cover info | Compute canopy cover estimates for the SVS stand. |
| SVS error log | Displays error messages describing any problems encountered by SVS.  This option is only enabled when errors occur. |

## SVS options

| | |
|---|---|
| Perspective view options... | Modify the viewing parameters that control the perspective view of a stand. |
| Overhead view options... | Modify the viewing parameters that control the overhead view of a stand. |
| Profile view option... | Modify the viewing parameters that control the profile view of a stand. |
| Marking and treatment… | Simulate the visual effects of silvicultural operations by marking trees and specifying treatments. |
| Default parameters... | Modify default parameters for stand visualizations drawn in SVS. |
| Ground surface definition | Specify or create a ground surface definition file to |

|                          | color the ground under an SVS stand.                        |
| Screen layouts           | Select or define screen layouts.                            |
| Tree designer...         | Modify or create tree form definitions for SVS.             |

**Help**

|                          |                                                             |
| Contents                 | Display the contents for the SVS help.                      |
| Procedures               | Display help describing basic procedures used in SVS.       |
| Using help               | Display help for using help.                                |
| About...                 | Display information about the current version of SVS.       |

# Right Mouse Button Menu

| Redraw all                | Redraw all panels in the current layout.                        |
|---------------------------|-----------------------------------------------------------------|
| Open...                   | Open an SVS tree list or tree list index file.                  |
| Perspective view options... | Modify the viewing parameters that control the perspective view of a stand. |
| Overhead view options...  | Modify the viewing parameters that control the overhead view of a stand. |
| Profile view option...    | Modify the viewing parameters that control the profile view of a stand. |
| Marking and treatment…    | Simulate the visual effects of silvicultural operations by marking trees and specifying treatments. |
| Screen layouts            | Select or define screen layouts.                                |
| Exit                      | Quit SVS.                                                       |

# Specifying SVS preferences

The **File|Preferences...** menu selection allows users to specify parameters that control the overall behavior of SVS.  Selecting the **File|Preferences...** menu option initiates the following dialog:

## Preferences

**Drawing techniques**
- ⦿ Save image of screen after each redraw
- ○ Use double buffered drawing

[Tree legend preferences...]

**Font used for labels and text file display**
Arial, Regular

[Change font...]

**Preferences for saved images**
640*480, BMP, 8-bit color

[Change preferences...]

**Text file editor**
notepad.exe

[Select editor...]

**Image file viewer**
viewpic.exe

[Select image viewer...]

**Miscellaneous**
- ☐ Allow user to modify options when doing command line data conversions
- ☑ Reset view parameters for each stand in an index file

Default command line options: [                    ]

[Set default command line options to duplicate current perspective view]

[OK]   [Cancel]   [Help]

### *Drawing techniques*
SVS can make use of 2 drawing strategies to help prevent unnecessary redrawing as windows are moved.

The first strategy involves saving an image of the SVS screen after each complete redraw then simply copying the saved image to the screen whenever a redraw is needed.  This strategy works well as long as no other applications are activated while SVS is drawing.  If another window obscures part of the SVS window, the overlapping window will be captured as part of the SVS screen.

The second strategy, called double buffering, involves drawing SVS images to an off-screen buffer and then copying the contents of the buffer to the screen. Subsequent redraws involve simply copying the stored image to the screen.  This strategy is not affected by other window activity.  When double buffering is enabled, you cannot watch the SVS image draw.  Instead a special cursor is display to indicate that SVS is busy drawing.  Pressing the [Esc] key or right mouse button can

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stop drawing into the off-screen buffer.  In some cases, using the double buffering option may result in faster redraws.

### Tree legend preferences
Allows you to change the preferences for tree legend displays such as the number of rows and columns of tree forms.  See Preferences for tree legend displays for additional information.

### Font used for labels and text file display
The font specified in the preferences is used for all text panels in SVS.  This includes file names, titles, and other information.  A different font is used for SVS graphs (not user selectable).  When specifying a font for text, only the face name, e.g. Arial or Courier, and font style, e.g. bold or italic, are important.  Text sizes are calculated on the fly to allow for accurate scaling of text as screen resolution or paper size changes.  To specify a new font, select the **Change font...** button to invoke a standard windows font dialog.

### Preferences for saved images
The preferences for saved images affect the initial settings when **the File|Save image as...** menu choice is selected and images saved as a result of command line options (/C).  To change the preferences for saved images, select the **Change preferences...** button.

### Text file editor
Specify the default text editor used to edit text file from within SVS.  Use the **Select editor...** button to navigate to the desired text editor.

### Image file viewer
Specify the default image viewing program used by SVS when the –I command line option is specified.  Use the **Select image viewer...** button to navigate to the desired image-viewing program.

### Miscellaneous
The *Reset view parameters for each stand in index file* checkbox enables (when checked) or disables (when not checked) resetting of the viewpoint when changing from one stand to another in a tree list index using the multiple stand control panel.  When this option is enabled, the viewpoint will be reset to the default viewpoint or the viewpoint specified on the SVS command line for each stand in the tree list index.  Changes made to the perspective viewpoint settings will be lost when the next stand is displayed.  When this option is disabled, you can make changes to the perspective viewpoint settings and view subsequent stands from the same viewpoint.

The *default command line options* alter the startup behavior of SVS.  Any valid command line options can be specified.  When SVS is loaded, the command line options are appended to the startup options.  In this way, options specified on the

command line (or in a batch file) can override the default options.  For information describing the SVS command line options see Command line options.


## Image size preferences

When saving SVS images, users can select from a list of predefined image size or specify a custom image size using the following dialog box:
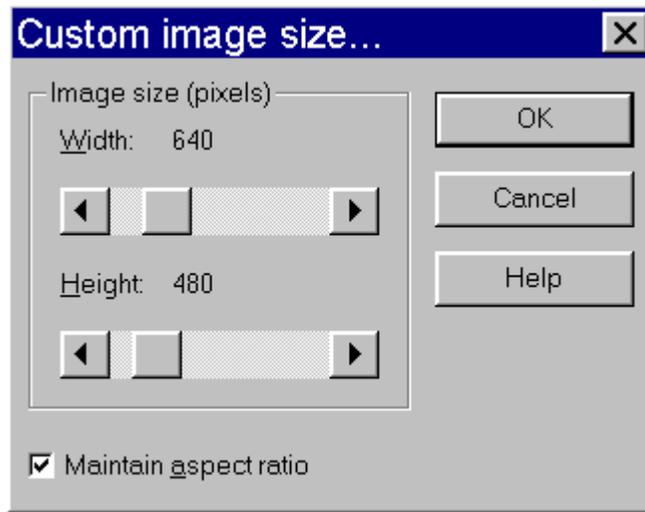


*Image size (pixels)*
The width and height slider control the size of the image saved to a file or the clipboard.  It is possible to save images that are larger than the current screen size defined in the display properties.  If the **Maintain aspect ratio** checkbox is selected, the sliders are coupled to provide image sizes that maintain the correct aspect ratio.  If the **Maintain aspect ratio** checkbox is not selected, the slider can be adjusted independently to the desired image size.

*Maintain aspect ratio*
When this checkbox is selected, SVS will adjust the display, printing, and image save window sizes to reflect the aspect ratio defined in the current screen layout.  In most cases, you should use the aspect ratio defined in the screen layout.  If this checkbox is not selected the width and height sliders can be adjusted independently.

*Preferences for saved images*
The preferences for saved images affect the initial settings when **the File|Save image as...** menu choice is selected and images saved as a result of command line options (/C).  To change the preferences for saved images, select the **Change preferences...** button to invoke the following dialog:
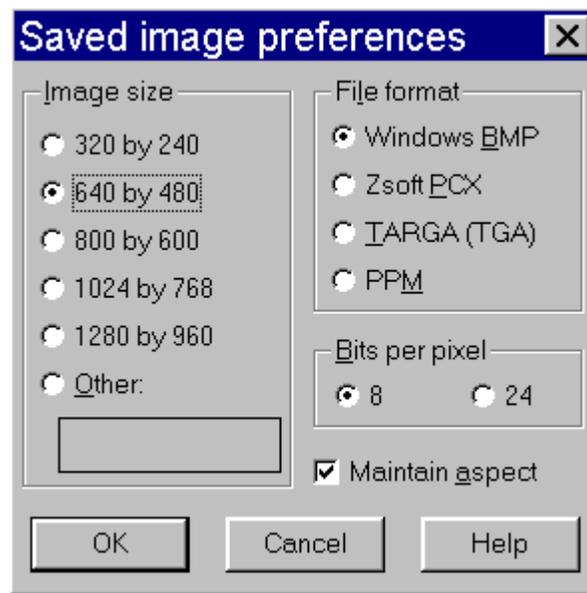
*Image size*

Select the desired image size. You can specify an image size that is larger than your current display size. Image size values will change depending on the current layout selected in SVS and the use of the layout aspect ratio. For a standard layout aspect ration of 4:3, the display sizes will be as shown above. See SVS image size for additional information.

*File format*

Select the desired image file format. The Bits per pixel selections may change depending on the selected file format. SVS supports the following file formats:

| | |
|---|---|
| Windows Bitmap (BMP) | 8- and 24-bit color |
| Zsoft's PCX | 8-bit color |
| Truevision's TARGA (TGA) | 8- and 24-bit color |
| Portable Bitmap (PPM) | 24-bit color |

PCX images will most often produce the smallest files as they use run-length encoding to minimize storage of redundant pixel information. Windows bitmaps can also use run-length encoding but support for the compressed format is not widespread. TARGA files also support run-length compression but the TARGA format is not widely supported. PPM files tend to be very large and are most often needed when files will be transferred to non-windows operating systems (UNIX, AIX, and others).

If your current display properties allow only 16 colors, the only file format available is a 16-color Windows Bitmap.

### *Bits per pixel*
Select the desired color resolution.  Eight-bit color can represent up to 256 colors and 24-bit color up to 16 million colors.  The **Bits per pixel** values depend on the selected file format.

### *Maintain aspect*
Select the **Maintain aspect** checkbox to use the aspect specific in the current screen layout.  When this item is checked, image sizes will be constrained to provide the correct aspect ratio.  When not checked, image sizes will correspond to the default aspect ratio of 4:3.

## Tree legend preferences

Tree legend displays allow you to create images or print outs that show the appearance of individual trees, plants, or special objects.  The legend parameter dialog is used to specify legend preferences.
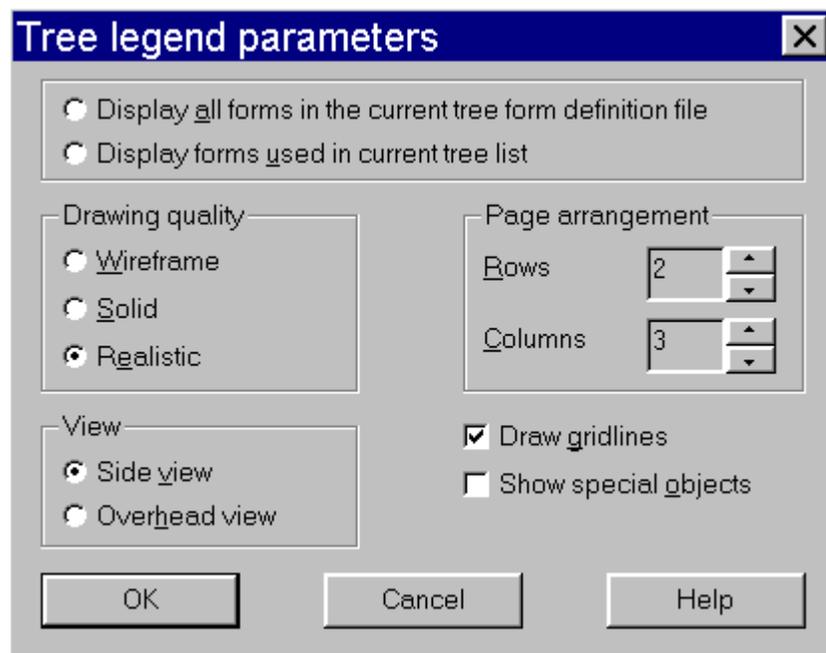


### *Display all tree forms in the current tree for definition file*
Causes legend displays to show all tree forms in a form definition file.

### *Display forms used in current tree list*
Causes legend displays to show only those tree forms used in the current tree list.

### *Drawing quality*
Quality for the trees drawn in the legend display.  In most cases, you will want this parameter set to match the drawing quality used in the stand views.

*Page arrangement*
Specifies the number of rows and columns in the legend display.

*Draw gridlines*
Controls the display of the gridlines separating individual trees in the legend display.

*Show special objects*
Controls the display of special objects as part of the tree legend display.


# Working with SVS Tree Lists

## Tree Lists

## Tree List Index Files

# Creating a New Stand

## Importing a Stand Table

## Entering a New Stand Table

## Importing ORGANON Data

## Importing FVS Data

## Using Command Line Utilities to Automate Data Conversion

# Creating a new stand in SVS

The File...New stand option in SVS allows you to create a new SVS tree list from a simple stand table, ORGANON growth model output, or Forest Vegetation Simulator (FVS) growth model output.  The following dialog is used to specify the data source for the new stand:
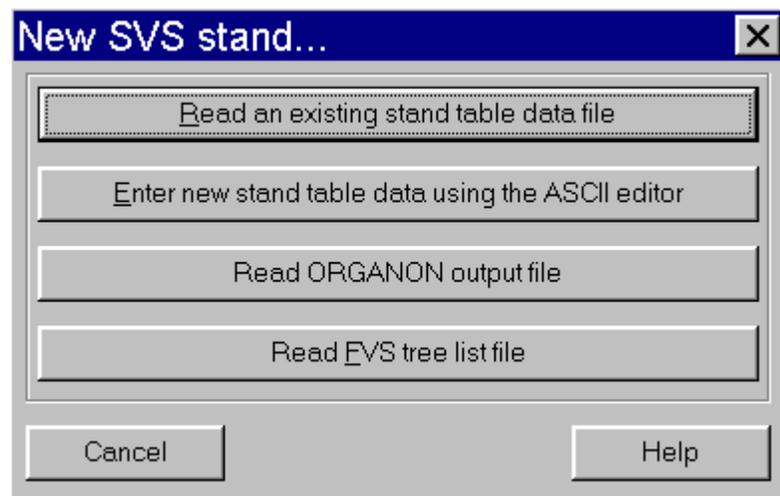
### Read an existing stand table data file
Allows you to convert an existing stand table data file into an SVS stand using the TBL2SVS conversion engine.  Select this option if you have already entered your stand table data in the appropriate format.

### Enter new stand table data using the ASCII editor
Allows you to enter a new stand table data file and convert it into an SVS tree list using the TBL2SVS conversion engine.  Select this option if you want to use the ASCII file editor to create a new stand table data file and then convert the new file into an SVS tree list.

See **Creating a new stand for use with the TBL2SVS internal conversion engine** for details of this process.

### Read ORGANON output file
Allows you to convert an output file from the ORGANON growth model into a series of SVS tree lists.  Select this option if you have an ORGANON output file that you want to view in SVS.

See Importing ORGANON growth model data into SVS for details of this process.

### Read FVS tree list file
Allows you to convert a tree list produced by the Forest Vegetation Simulator (FVS) into a series of SVS tree lists.  Select this option if you have an FVS tree list that you want to view in SVS.

See Converting FVS tree list data for use in SVS for details of this process.

## Creating a new stand using the TBL2SVS internal conversion engine

The TBL2SVS conversion engine allows users to convert simple stand tables into SVS tree lists. Previous versions of SVS relied on a command line program, TBL2SVS, to do similar conversions. For details about the TBL2SVS conversion engine see Using the TBL2SVS internal conversion engine.

The first step when using the TBL2SVS engine is to create an input file containing stand table data. Input files can be created outside of SVS or from within SVS using the ASCII file editor specified in the SVS preferences. The following dialog is used to control creation of an input file from within SVS:
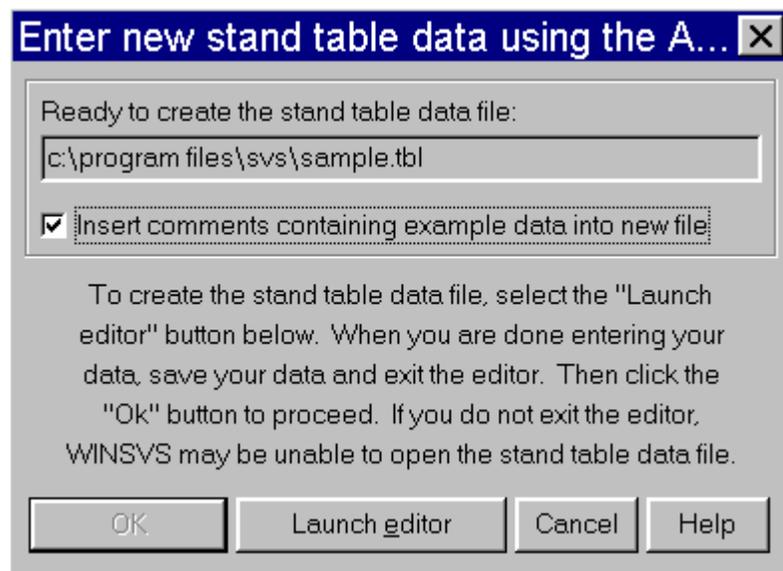


*Insert comments containing example data into new file*
This option allows you to insert comment lines in the new ASCII file that provide examples of different types of stand table data. When this option is turned off, you will still get comments showing column heading for the new stand table data.

To create a new stand table data file, select the *Launch editor* button to run the ASCII file editor specified in the SVS preferences. The editor will be started with the specified file name and comments describing the file format and example data (if requested). You should enter your stand table data in the appropriate columns. After you have entered all of your stand table data save the file in the editor and exit the editor. Then select the *Ok* button to proceed to **Converting a stand table into an SVS tree list**.


## Converting a stand table into an SVS tree list

The following dialog is used to specify input and output file names when converting a stand table data file into an SVS tree list:
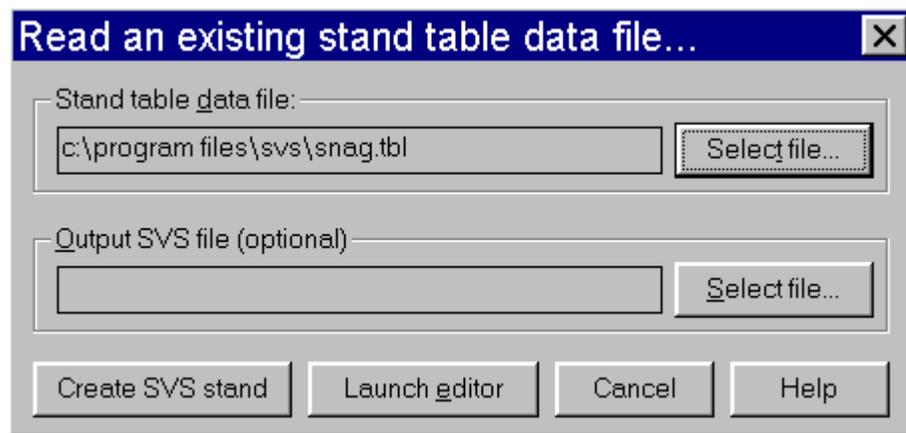
### *Stand table data file*

Specifies to name of the stand table data file.  When the dialog is first displayed, an Open file dialog will be presented for you to select the stand table file.  If you need to change the file, use the *Select file...* button to locate and select the output file.

### *Output SVS file (optional)*

Specifies the name of the SVS tree list file that will be created.  By default the SVS file will have the same name as the stand table file with the .SVS extension.

### *Command line options file (optional)*

Specifies the name of the file containing TBL2SVS conversion parameters.  The parameter values in this file will be used to initialize the conversion parameters prior to the beginning of the conversion.  The parameter file must have been created by saving a set of TBL2SVS conversion parameters from the parameter dialog.  For information about saving parameter files see TBL2SVS conversion parameters.

### *Create SVS stand*

Initiates the conversion process by launching the TBL2SVS conversion parameters dialog.  For more information about the conversion parameters see TBL2SVS conversion parameters.

## TBL2SVS Parameters

The TBL2SVS conversion engine provides several options to control the conversion process.  These options are modified using the following dialog:
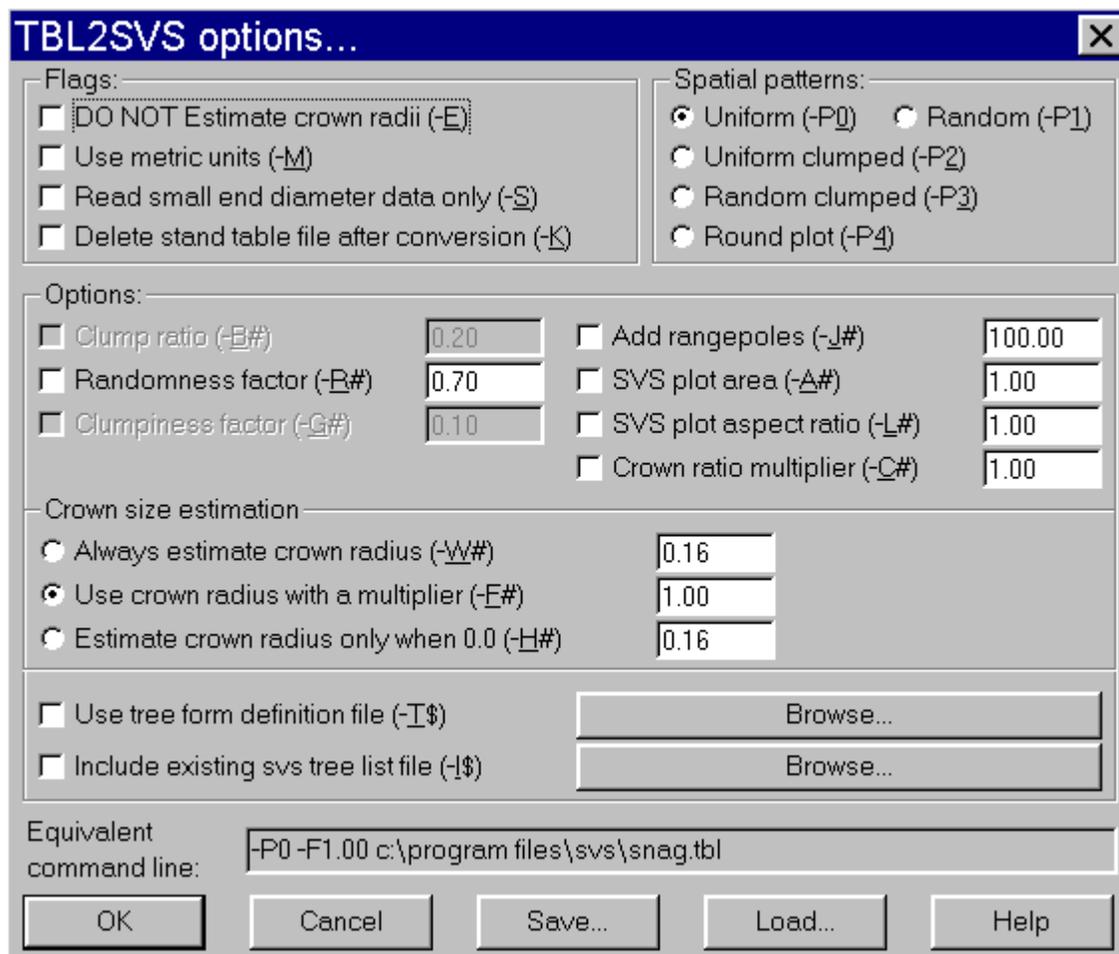
## Flags

Flag parameters act as ON-OFF switches enabling or disabling TBL2SVS behaviors.

*DO NOT Estimate crown radii*: By default, TBL2SVS estimates crown radii whenever the input radius is 0.0. Selecting this option suppresses this behavior allowing the input of trees with no crowns, e.g., stand snags.

*Use metric units*: Instructs TBL2SVS to interpret input data using metric unit conventions. Metric unit input should specify tree diameters in centimeters and tree heights and crown radii in meters. The expansion factor should represent the number of tree per hectare. When metric units are enabled, the stand area should be specified in hectares.

*Read small end diameter data only*: Tells TBL2SVS to read the small end diameter field from the input file but ignore the X, Y, marking status, and felling angle fields. This allows specification of down logs without requiring positional information for each log.

*Delete stand table file after conversion*: Causes TBL2SVS to delete the stand table data file after a successful conversion.  If any errors occur during the conversion process, the file will not be deleted.


## Options

TBL2SVS options include the pattern parameters used to modify the overall spatial pattern of tree locations generated by TBL2SVS.  The following table shows which parameters are applicable to each spatial pattern

| Spatial pattern | Applicable pattern parameters |
| --- | --- |
| Uniform | Randomness and Clumpiness factors |
| Random | None |
| Clumped patterns with uniform clump centers | Randomness and Clumpiness factors and Clump ratio |
| Clumped patterns with random clump centers | Clumpiness factor and Clump ratio |
| Round plot | None |

The *Randomness factor* controls the magnitude of the offset from a perfect lattice pattern for individual tree locations or clump centers.  A value of 0.0 results in tree locations aligned in perfect rows and columns.  Values of 0.4 to 0.8 result in patterns approximating planted stands.  Values greater than 0.8 result in patterns with some clumps of two or three trees.  The randomness factor does not affect random spatial patterns.

The *Clumpiness factor* controls the size of individual clumps of tree locations.  It affects only clumped patterns.  Small values of the clumpiness factor result in large clumps (to the point where the appearance of clumps is lost with a clumpiness factor of 0.0).  Large values result in very tight, widely spaced clumps.  The clump spacing is based on the number of trees per acre in the stand and the value of the Clump ratio parameter.

The *Clump ratio* specifies the number of clump centers generated by the spatial pattern algorithm as a function of the number of individual trees in the stand.  The numeric parameter, ranging from 0.01 to 0.5, is multiplied by the number of individual trees to compute the number of clump centers.  The number of trees located around each clump center is inversely proportional to the clump ratio.  As a simple example, consider a stand with 250 trees per acre and a clump ratio value of 0.1.  If TBL2SVS is creating a 1 acre plot, there will be (250 * 0.1 = 25) clump centers and (250 / 25 = 10) trees per clump.

*Add rangepoles*: Causes TBL2SVS to insert rangepoles at the plot corners in the case of square plots or at the plot center for round plots.  Rangepole height is controlled by the numeric parameter.

*SVS plot area*: Specifies the area of the SVS plot. The plot area is normally expressed in acres. If you are using metric units, express the plot area in hectares.

*SVS plot aspect ratio*: Specifies the aspect ratio (width / height) of the SVS plot. The default value of 1.0 results in a square plot. A value of 2.0 would produce a plot that is half as tall as it is wide. Aspect ratio does no affect round plots.

*Crown ratio multiplier*: Specifies a multiplier for crown ratio values in the input data.

## Spatial patterns

TBL2SVS can generate tree locations using a variety of spatial pattern algorithms. See Spatial Patterns for details describing the available patterns.

## Crown size estimation

TBL2SVS provides several options to estimate or modify crown radius values. If you have data that includes measured crown radius, selecting the *Crown radius multiplier* option with a value of 1.0 will leave the crown radius value from the input file intact. If you do not have crown radius measurements, set the value in the input file to 0.0 and select the *Always estimate crown radius* option using an appropriate multiplier for tree height (0.08 provides aesthetically pleasing crowns). If you have crown radius measurements for some trees in your input data but not others, set the crown radius values for the unmeasured trees to 0.0 and use the *Estimate crown radius only when 0.0* option with an appropriate multiplier for tree height.

*Always estimate crown radius*: Causes TBL2SVS to estimate crown radii using a multiplier for tree height. Selecting this option will replace all crown size data in the input file.

*Crown radius multiplier*: Causes TBL2SVS to use the crown radius from the input file but apply a multiplier to the values. Specifying a multiplier of 1.0 leaves the input data unchanged.

*Estimate crown radius only when 0.0*: Causes TBL2SVS to use the crown radius input from the input data unless it is 0.0 in which case the height multiplier is applied to estimate crown radii.

### Use tree form definition file
SVS provides default tree form definitions for many common tree species. However, users from regions outside the Pacific Northwest may find that their species are not represented. By including a tree form definition file in the SVS tree list, SVS can locate and display tree forms appropriate for the stand data. Selecting this option causes TBL2SVS to insert a #TREEFORM command into the SVS tree list specifying the name of the selected tree form definition file. When the option is first selected, an Open file dialog will be presented so you can select the tree form

definition file.  If you would later like to change the file, simply select the button labeled with the current tree form file name.

### *Include existing SVS tree list file*
TBL2SVS can include an existing SVS tree list file prior to generating new tree locations for plants in the input data file.  This feature makes it possible to build stands one layer at a time or to add an understory component to existing stand data files.  When the option is first selected, an Open file dialog will be presented so you can select the SVS tree list to include.  When a file is included, its trees are added prior to the generation of tree locations for data in the stand table file.  Plant locations within the included SVS file are not changed.

### *Equivalent command line*
The equivalent command line represents the options that could be used with the command line version of TBL2SVS.  You can copy the text from the display but cannot edit the command line directly.

NOTE:  The current version of SVS provides the TBL2SVS command line version as a DOS executable.  Future versions will upgrade TBL2SVS to a Windows version.

### *Save...*
This button allows you to save the current set of TBL2SVS options for later use.  The default extension for TBL2SVS options is .TOP.

### *Load...*
This button allows you to load a previously saved set of TBL2SVS options.


# TBL2SVS Technical Details

## Spatial Patterns

One of the primary tasks during the conversion process is the generation of spatial locations for the trees.  TBL2SVS generates a variety of spatial patterns:

- uniformly distributed tree locations
- randomly distributed tree locations
- clumped pattern of tree locations with uniformly distributed clump centers
- clumped pattern of tree locations with randomly distributed clump centers
- randomly distributed tree locations on a round plot

For all patterns, a map of individual stem locations is maintained and used to prevent trees from being placed on top of one another.

### *Uniformly Distributed Tree Locations*
In this method, a grid is superimposed on the plot.  The grid spacing is equal to the average spacing between trees calculated as:

grid spacing = SQRT(43560 / total stems per acre)

The center of each grid cell is calculated and used as the initial location. Two random variates from -0.5 to 0.5 are then generated and multiplied by the grid spacing to serve as maximum offsets in the X and Y directions. The maximum offsets are multiplied by the *Randomness factor* ranging from 0.0 to 1.0, to determine the actual offset from the grid center. Locations generated using values of the *Randomness factor* from 0.0 to 0.5 yield a pattern that clearly resembles a grid with 0.4 to 0.5 giving a good approximation of hand planted tree locations. Locations generated using values of the *Randomness factor* from 0.5 to 1.0 have a uniform appearance and the grid structure is not obvious.

### Randomly Distributed Tree Locations
This method simply generates uniformly distributed random variates ranging from 0.0 to the width of the plot for the X value and from 0.0 to the height of the plot for the Y value.

Clumped Patterns with Uniformly Distributed Clump Centers

This method generates "clump centers" using the same technique used to generate uniformly distributed tree locations and then generates the individual locations within the clump. The number of clumps can be controlled using the *Clump ratio* parameter. The clump spacing is calculated as follows:

clump spacing = SQRT(435460 / (stems per acre * clump ratio)

Individual locations in a clump are created by generating a random angle ranging from 0.0 to 360.0 degrees and a magnitude calculated as follows:

magnitude = (random number from 0.0 to 1.0) * clump radius

where clump radius is computed using the following equation:

clump radius = (1.5 - 1.4 * *Clumpiness factor*) * clump spacing

The angle and the magnitude are used to offset the location from the clump center.

### Clumped Patterns with Randomly Distributed Clump Centers
The random-clump method generates clump center locations using the same method used for randomly distributed tree locations and then generates individual locations within each clump using the same technique used for clumped patterns with uniformly distributed clump centers.

### Randomly Distributed Tree Location on a Round Plot
This method creates a round SVS plot and places trees using random locations within the plot area. The plot area corresponds to the stand area specified using the *SVS stand area* parameter. Individual plant locations are created by sampling a random distance from the plot center and a random angle around the plot. Round

plots are not affected by the SVS plot aspect ratio parameter. DOS SVS versions 2.20 and newer and all Windows versions recognize round plots.

## Spatial Distribution of Down Material

TBL2SVS provides a specialized algorithm for locating and positioning down material. When down material (status codes 0, 10, 3, or 13) is encountered in an input stand table with no location information, TBL2SVS first generates random locations for the large end of each log. Then TBL2SVS simulates the "jack-straw" effect created by logs falling on top of one another. To do this, TBL2SVS maintains a map of the down material and tests each log being placed to see if it lies on top of another log or several logs. The center of gravity, c.g., is computed for the log being placed, assuming that the log is a conic solid, and the highest point-of-contact with logs on either side of the c.g. is determined. Given the location of the contact points, the height at each end of the log is calculated. If the projected height of either end is below the ground surface or if there is only one contact point, that end is assumed to be supported by the ground. The elevations of the log ends are then used to compute a "lean angle" that SVS will interpret as the angle from vertical for a down stem. The log placement algorithm has some limitations but it results in stands that display well in SVS and that are free of visual inconsistencies such as logs "floating" in the air without any visible support. In most cases, the algorithm exhibits conservative behavior in that it can sometimes generate locations and orientations that result in logs that intersect in the same plane but rarely is an orientation computed that results in an unsupported, or floating, log.

## Crown Width Estimates

TBL2SVS provides three methods for generating crown radius information. The first, and the default, is to use the crown radii from the input stand table with an optional *Crown radius multiplier*. The second allows estimation of crown radii by providing a simple tree height multiplier (specified in the *Always estimate crown radius* field of the parameters dialog). The third, a hybrid of the first two methods, uses the stand table crown radii unless they are 0.0 in which case, crown radii are estimated using a height multiplier (specified in the *Estimate crown radius only when 0.0* field of the parameters dialog).

# Importing ORGANON growth model data into SVS

The ORG2SVS conversion engine allows users to convert output files from the ORGANON growth model into a series of SVS tree lists. For details about the ORG2SVS conversion engine see Using the ORG2SVS internal conversion engine.

The following dialog is used to specify input and output file names when converting an ORGANON output file into an SVS tree list:

Convert an ORGANON output file...

**ORGANON output data file:**
d:\code\winsvs\org2svs\120201x    [Select file...]

**Output SVS file (optional)**
d:\code\winsvs\org2svs\120201x.svs    [Select file...]

[Convert file]  [Launch editor]  [Cancel]  [Help]
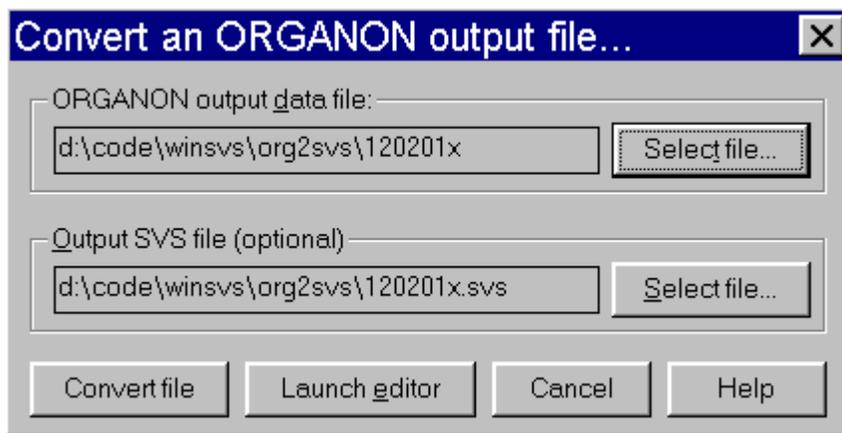
### ORGANON output data file
Specifies to name of the ORGANON output file.  When the dialog is first displayed, an Open file dialog will be presented for you to select the ORGANON output file.  If you need to change the file, use the *Select file...* button to locate and select the output file.

### Output SVS file (optional)
Specifies the name of the SVS tree list file that will be created.  If the ORGANON output file contains a single tree list, the SVS file name will be the actual SVS tree list.  However, if the ORGANON output file contains several tree lists, the output SVS file name will contain an SVS tree list index.  The individual tree lists will be named using the SVS file name and an extension indicating the sequence in which the files were created, e.g., .001, .002, .003, .004, etc.

### Command line options file (optional)
Specifies the name of the file containing ORG2SVS conversion parameters.  The parameter values in this file will be used to initialize the conversion parameters prior to the beginning of the conversion.  The parameter file must have been created by saving a set of ORG2SVS conversion parameters from the parameter dialog.  For information about saving parameter files see ORG2SVS conversion parameters.

### Convert file
Initiates the conversion process by launching the ORG2SVS conversion parameters dialog.  For more information about the conversion parameters see ORG2SVS conversion parameters.

## Overview of the ORG2SVS Conversion Engine

The ORG2SVS conversion engine is designed to convert output files from ORGANON (Hann et. al. 1993) into tree lists compatible with the Stand Visualization System (SVS) (McGaughey, 1997).  In operation, ORG2SVS scans an ORGANON output file looking for valid tree lists and then produces an SVS tree list for each tree list encountered in the ORGANON output file. User-defined parameters control the size and shape of the resulting SVS plot, the technique used to generate spatial

locations for trees, the addition of rangepoles into the SVS tree list to help indicate scale, and the relationship between tree height and crown width. The ORG2SVS conversion engine provides a simple mechanism to visualize the output of the ORGANON projection model. For more information regarding ORGANON, see the following site on the World Wide Web:

**http://www.cof.orst.edu/cof/fr/research/organon/index.htm**

There are a few basic rules that you must follow to use the ORG2SVS conversion engine successfully on the ORGANON output file.

**Rule 1: Request that a tree list be sent to the output file anytime you would like to see a picture of the stand conditions.**

In general, you probably want to request a tree list that shows the initial stand conditions before any growth projections or management activity and tree lists immediately prior to and after management activities. You may want to generate a tree list after each growth period to show predicted stand development. By generating tree lists before and after management activities, you can later create an image of the stand conditions before and after a treatment. To ensure that tree lists match management actions, you should only ask for a tree list from the ORGANON master menu. Tree lists produced from thew management menu while "experimenting" with stand treatments (designated as TRIAL lists) are not used for subsequent growth projections unless the management activities are applied to the stand data using the "PM" option on the management menu.

**Rule 2: Keep track of management activities on paper or through a copy of the run history so you can match activities to the SVS stand images.**

After conversion to SVS format, each tree list will be identified by the project name and stand age. You should take notes describing your stand treatments or keep a copy of the ORGANON run history so you can later match management actions to SVS stand images. You can also have ORG2SVS extract run history information and save it in a special file that can be added to an SVS screen layout. See **ORG2SVS parameters** and **Defining screen layouts** for additional information.

**Rule 3: When you product a tree list in ORGANON, list all tree records. Do not skip any tree records.**

Tree lists in the ORGANON output file that have a skip value of anything other than 1 will be ignored during the conversion process. This only makes sense because such tree lists do not represent the stand. Even when using tripling, make sure you include all tree records in the output tree list.

**Rule 4: If you want to track tree locations over time, do not use tripling in ORGANON.**

Tripling causes ORGANON to split input tree records to better represent stochastic processes during stand projection. Unfortunately, tree numbers change as part of the tripling process. This makes it impossible for ORG2SVS to keep track of individual trees (or trees created from an individual ORGANON tree record) from one time period to the next. If tripling was used during a run, the ability to track tree locations over time will be disabled.

***NOTE: in the current version of ORG2SVS, location tracking is always disabled.***

**Rule 5:  When producing tree lists, include all species.**

ORG2SVS will convert tree lists containing a single species and will indicate the species in the SVS plot title. However, images produced that show only a single species could misrepresent stand conditions.

## ORG2SVS Parameters

The parameters that control the conversion process are modified using the following dialog:

### Options
ORG2SVS uses a variety of on-off options to control its behavior.

*Track tree locations over time*: This option is disabled in this version of ORG2SVS.

*Delete ORGANON file after conversion*: Causes the ORG2SVS conversion engine to delete the ORGANON output file after a successful conversion. You should use this option only if you do not need the ORGANON output file for another purpose, e.g., maintaining a copy of the run history so you know what treatments your new SVS images represent.

*Show status report after conversion*: Causes ORG2SVS to display a conversion summary after conversion is complete. The status report is not saved in a file but you can cut-and-paste the text from the status display into another file or text editor such as NOTEPAD.

*Add rangepoles at plot corners*: Causes ORG2SVS to insert a rangepole at each corner of a square plot. For round plot patterns, a single rangepole will be inserted at the center of the plot.

*Create run history file (.HST)*: Causes ORG2SVS to extract run history information from the ORGANON output file and save it in a file named using the base file name (SVS file name with no extension) and the extension ".HST". This file can be used to provide run history information on the SVS screen by creating a layout panel that displays a text file with the auxiliary panel information set to $SVSFULLFILENAME.hst. For additional information about screen layouts see Defining screen layouts.

### Optional parameters
Optional parameters further define the behavior of the ORG2SVS conversion engine.

*Rangepole height*: Specifies the height of the rangepoles added to an SVS plot. Heights are assumed to be in the same units as used in the tree data

*SVS plot area*: Specifies the area of the SVS plot.

*SVS plot aspect ratio*: Specifies the aspect ratio (width / height) of the SVS plot. The default value of 1.0 results in a square plot. A value of 2.0 would produce a plot that is half as tall as it is wide. Aspect ratio does no affect round plots.

*Crown ratio multiplier*: Specifies a multiplier for ORGANON crown ratio values. For most users, a value other than 1.0 is not recommended. If you find that ORGANON consistently produces crowns that are too short or long, use this multiplier to modify all crown ratios for all trees.

### *Tree form definitions*

During the conversion process ORG2SVS can link a specific set of tree form definitions to the SVS tree lists it produces. This linkage is accomplished using the #TREEFORM command in the SVS tree list file. A set of tree form definitions, ORGANON.TRF, suitable for use with ORGANON output files is distributed with SVS. If you would like to link a different set of tree form definitions to the SVS tree lists, select the button below "Use tree form definition file:" and select the desired file. When designing tree forms for ORGANON output, use the two-letter species codes recognized by ORGANON and tree and crown class values of 99 to represent live trees. Future version of ORG2SVS may use definitions with tree class set to 99 and crown class set to 98 to indicate a dead tree.

### *Spatial patterns*

ORG2SVS can generate tree locations using a variety of spatial pattern algorithms. See Spatial Patterns for details describing the available patterns.

### *Pattern parameters*

Pattern parameters are used to modify the overall spatial pattern of tree locations generated by ORG2SVS. The following table shows which parameters are applicable to each spatial pattern

| Spatial pattern | Applicable pattern parameters |
| --- | --- |
| Uniform | Randomness and Clumpiness factors |
| Random | None |
| Clumped patterns with uniform clump centers | Randomness and Clumpiness factors and Clump ratio |
| Clumped patterns with random clump centers | Clumpiness factor and Clump ratio |
| Round plot | none |

The *Randomness factor* controls the magnitude of the offset from a perfect lattice pattern for individual tree locations or clump centers. A value of 0.0 results in tree locations aligned in perfect rows and columns. Values of 0.4 to 0.8 result in patterns approximating planted stands. Values greater than 0.8 result in patterns with some clumps of two or three trees. The randomness factor does not affect random spatial patterns.

The *Clumpiness factor* controls the size of individual clumps of tree locations. It affects only clumped patterns. Small values of the clumpiness factor result in large clumps (to the point where the appearance of clumps is lost with a clumpiness factor of 0.0). Large values result in very tight, widely spaced clumps. The clump spacing is based on the number of trees per acre in the stand and the value of the *Clump ratio* parameter.

The *Clump ratio* specifies the number of clump centers generated by the spatial pattern algorithm as a function of the number of individual trees in the stand. The

numeric parameter, ranging from 0.01 to 0.5, is multiplied by the number of individual trees to compute the number of clump centers.  The number of trees located around each clump center is inversely proportional to the clump ratio.  As a simple example, consider a stand with 250 trees per acre and a clump ratio value of 0.1.  If ORG2SVS is creating a 1 acre plot, there will be (250 * 0.1 = 25) clump centers and (250 / 25 = 10) trees per clump.

## Crown width estimation

ORGANON does not provide crown width information for sample trees.  ORG2SVS estimates crown widths using a simple linear relationship with total tree height.  A tree's height is multiplied by the *tree height multiplier* to estimate the crown width for the tree.  Studies of tree physiology have produced very detailed models capable of producing more accurate crown width estimates.  Unfortunately, such models are not available for all tree species or all regions of interest.  The simple approach used by ORG2SVS provides trees that "look right" in SVS displays.  Users who need more accurate predictions should use a different technique to produce SVS tree list files.

### *Save...*
Allows you to save a set of ORG2SVS options for later use.  The default (and recommended) extension for the option files is .OOP.  Option files can be loaded at any time using the Load... button.

### *Load...*
Allows you to load a saved set of ORG2SVS options.

# ORG2SVS Status Report

After a successful conversion, the ORG2SVS conversion engine can display a conversion summary using the following dialog:

```
┌─────────────────────────────────────────────────────────────────┐
│ ORG2SVS Conversion Engine                                    [×] │
├─────────────────────────────────────────────────────────────────┤
│ ORG2SVS Conversion Engine                                     ▲  │
│                                                                  │
│ Converting d:\code\winsvs\org2svs\120201x into SVS tree list(s)  │
│                                                                  │
│ ORG2SVS will create a tree list index file named                │
│ d:\code\winsvs\org2svs\120201x.svs                              │
│ so SVS can better organize the data from the ORGANON output file:│
│                                                                  │
│ Converting stand 1: 52 tree records                             │
│ Stand will be identified as:                                    │
│  ALL SPECIES Age: 97                                            │
│ SVS tree list will be stored in:                                │
│ d:\code\winsvs\org2svs\120201x.001                              │
│                                                                  │
│ ORGANON tree list contained 335.92 trees. 339 SVS tree were generated │
│ Estimated canopy closure for the stand is 67 percent            │
│ ─────                                                            │
│ Converting stand 2: 23 tree records                             │
│ Stand will be identified as:                                    │
│  ALL SPECIES Age: 97 TRIAL CUT                                  │
│ SVS tree list will be stored in:                              ▼  │
│ ◄                                                          ►     │
├─────────────────────────────────────────────────────────────────┤
│              ┌──────────┐    ┌──────────┐                       │
│              │    OK    │    │   Help   │                       │
│              └──────────┘    └──────────┘                       │
└─────────────────────────────────────────────────────────────────┘
```

Display of the summary is controlled by the *Show status report after conversion parameter*. The status summary describes the results of the conversion process and provides some indications of possible problems during the conversion. If a serious error occurs during the conversion, the SVS error log will contain information describing the error and possible causes.

Of special interest are the entries that indicate the number of trees in an ORGANON tree list and the number of trees generated for the SVS plot. In general, the two numbers should be about equal. Large differences (greater than 20 trees) may indicate a problem during the conversion. The two numbers will seldom be exactly the same given the random sampling process used in ORG2SVS when fractional trees are encountered in an ORGANON tree list. For example, a record in the tree list might represent 12.47 trees per acre. In an SVS tree list, there is no way to display a fractional tree so the sampling logic in ORG2SVS is designed to always include 12 trees and to include a 13th tree 47% of the time.

Also of interest is the estimate of canopy closure for the stand. This estimate is based on a stem and crown map that is maintained during the conversion process and reflects crown overlap.

Both the tree counts and the canopy cover estimate are also included as comments at the end of the SVS tree list file.

# ORG2SVS Technical Details

The ORG2SVS conversion engine is implemented as a dynamic link library for use with the Stand Visualization System.  Its internal interface has not been made public.  The following information is provided to help users apply the conversion engine and to provide details on specific components of its operation.

## Processing the ORGANON Output File

ORGANON output files contain all information requested by the user (and some information not specifically requested) during a model run.  The output file format is somewhat variable because it is generated in response to user inputs.  During processing, ORG2SVS first scans the entire output file to locate all tree lists.  Location is accomplished by searching each line of the file for the phrase "TREE LIST TOTAL".  Upon finding this phrase, ORG2SVS extracts values from the header to determine of the section of the file represents a newly encountered tree list or simply a new page in a previously encountered tree list.  The result of this initial scan is a list of all tree lists in the output file, the species present in the list (from the list header), the stand age, the skip factor, and flag indicating if the tree list is a CUT list or a TRIAL list.

## Tree Record Expansion

In an ORGANON tree record, the following information is available (excerpt from an output file):

```
**************************************************************
   TREE  SP   DBH    HT    HTCB   CR    EXP    +HT    +D    UC
**************************************************************
     1   DF   7.8   43.3   11.7  .73  14.32    .0    .00    0
```

The expansion factor provides the number of trees per acre represented by the tree record.  In most cases, the expansion factor will not be a whole number.  In SVS, it is difficult to draw fractional trees so some sampling logic is needed to produce a stand that statistically represents the ORGANON tree list.  ORG2SVS uses a simple sampling algorithm to expand the expansion factor into an appropriate number of trees for the SVS plot.  Using the above expansion factor of 14.32 as an example, ORG2SVS would always create 14 trees.  To make up for the fractional tree (0.32 per acre), ORG2SVS would include an additional tree in 32 out of 100 conversion runs.  This approach does a good job of representing the data in the ORGANON tree list but can lead to some interesting side effects.  If our original stand contains a small number of very large trees, e.g., 0.03 42-inch Douglas-fir per acre, ORG2SVS will not include such a tree in every plot it generates.  When viewing the resulting

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SVS images, the appearance and disappearance of such a large tree in different time periods may cause concern among viewers. This problem is further complicated by ORGANON's tripling logic. Tripling serves to break up input tree records to better represent stochastic grow and mortality processes. Unfortunately, tripling creates tree records with very small expansion factors...just the situation that leads to disappearing trees.

When considering this problem it is best to remember that the SVS images are intended to be a representation of the stand data, not an exact replication of the original stand. While it may be confusing to have a large tree or trees appear and disappear over time, it misrepresents the original data if the large trees are always included or excluded.

## Crown Width Estimation

ORGANON does not provide crown width information in its output file so ORG2SVS uses a simple linear relationship between tree height and crown width. The parameter, Tree height multiplier, provides a mechanism to control this predictive relationship. In general, setting the multiplier to 0.16 gives tree crowns that "look right". Future versions of the ORG2SVS conversion engine may incorporate better methods to estimate crown width.

## Spatial Patterns

One of the primary tasks during the file conversion process is the generation of spatial locations for the trees. The conversion engine generates a variety of spatial patterns:

- uniformly distributed tree locations
- randomly distributed tree locations
- clumped pattern of tree locations with uniformly distributed clump centers
- clumped pattern of tree locations with randomly distributed clump centers
- randomly distributed tree locations on a round plot

For all patterns, a map of individual stem locations is maintained and used to prevent trees from being placed on top of one another.

### *Uniformly Distributed Tree Locations*
In this method, a grid is superimposed on the plot. The grid spacing is equal to the average spacing between trees calculated as:

grid spacing = SQRT(43560 / total stems per acre)

The center of each grid cell is calculated and used as the initial location. Two random variates from -0.5 to 0.5 are then generated and multiplied by the grid spacing to serve as maximum offsets in the X and Y directions. The maximum

offsets are multiplied by the *randomness factor*, ranging from 0.0 to 1.0, to determine the actual offset from the grid center.  Locations generated using values of the *randomness factor* from 0.0 to 0.5 yield a pattern that clearly resembles a grid with 0.4 to 0.5 giving a good approximation of hand planted tree locations. Locations generated using values of the *randomness factor* from 0.5 to 1.0 have a uniform appearance and the grid structure is not obvious.

### Randomly Distributed Tree Locations
This method simply generates uniformly distributed random variates ranging from 0.0 to the width of the plot for the X value and from 0.0 to the height of the plot for the Y value.

### Clumped Patterns with Uniformly Distributed Clump Centers
This method generates "clump centers" using the same technique used to generate uniformly distributed tree locations and then generates the individual locations within the clump.  The number of clumps can be controlled using *clump ratio* parameter. The clump spacing is calculated as follows:

clump spacing = SQRT(435460 / (stems per acre * clump ratio)

Individual locations in a clump are created by generating a random angle ranging from 0.0 to 360.0 degrees and a magnitude calculated as follows:

magnitude = (random number from 0.0 to 1.0) * clump radius

where clump radius is computed using the following equation:

clump radius = (1.5 - 1.4 * *clumpiness factor*) * clump spacing

The angle and the magnitude are used to offset the location from the clump center.

### Clumped Patterns with Randomly Distributed Clump Centers
The random-clump method generates clump center locations using the same method used for randomly distributed tree locations and then generates individual locations within each clump using the same technique used for clumped patterns with uniformly distributed clump centers.

### Randomly Distributed Tree Location on a Round Plot
This method creates a round SVS plot and places trees using random locations within the plot area.  The plot area corresponds to the stand area.  Individual plant locations are created by sampling a random distance from the plot center and a random angle around the plot.  Round plots are recognized by SVS DOS version 2.20 and newer and all Windows versions.

A valid ORGANON tree list must use a skip factor of 1 meaning that the tree list contains all tree data for the stand being projected.  Only tree lists, CUT tree lists, and TRIAL CUT tree lists are recognized by ORG2SVS.  Other reports produced by ORGANON will be ignored by ORG2SVS.

# Converting FVS tree list data for use in SVS

The internal conversion capabilities of SVS replace the previous FVS2SVS DOS utility program. An FVS2SVS executable still exists but it is now a windows executable that access the same conversion logic as the internal capability in SVS.

For additional information describing the FVS conversion capability, see FVS2SVS conversion program.

SVS can convert tree list files produced by current variants of the Forest Vegetation Simulator (Wykoff and others 1992) into tree lists for display in SVS. In operation, each cycle in an FVS tree list is converted into a separate SVS tree list. The interface in SVS then lets you easily step forward and backward through the cycles. After specifying the FVS tree list to convert, the following dialog is used to specify conversion options:
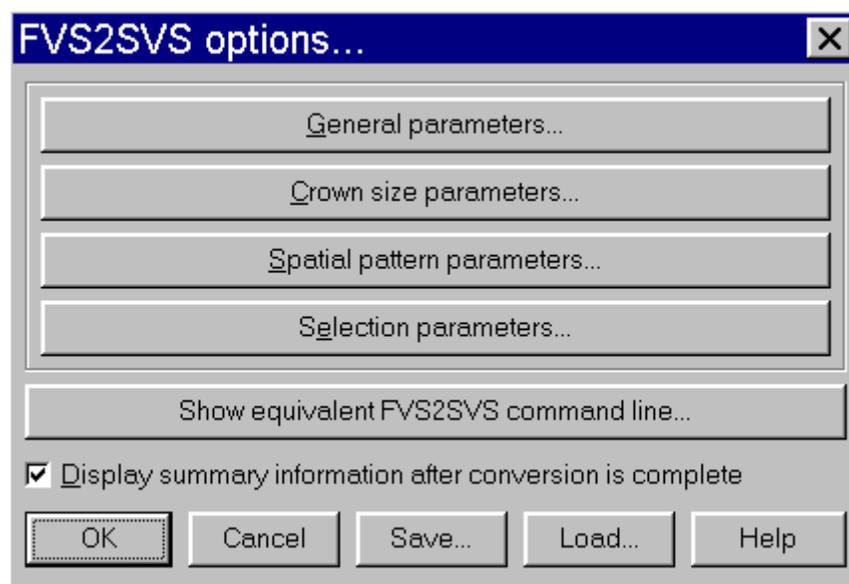


Parameters that control the conversion are grouped into four categories:

- General parameters
- Crown size parameters
- Spatial pattern parameters
- Selection parameters

***Show equivalent FVS2SVS command line***
Displays command line options that correspond to the current option settings in the following dialog:

**FVS2SVS command line** ✕

Equivalent FVS2SVS command line:

-O -P1 -A1.00 -F1.00 c:\program files\svs\ni01.trl c:\program files\

OK                                        Help
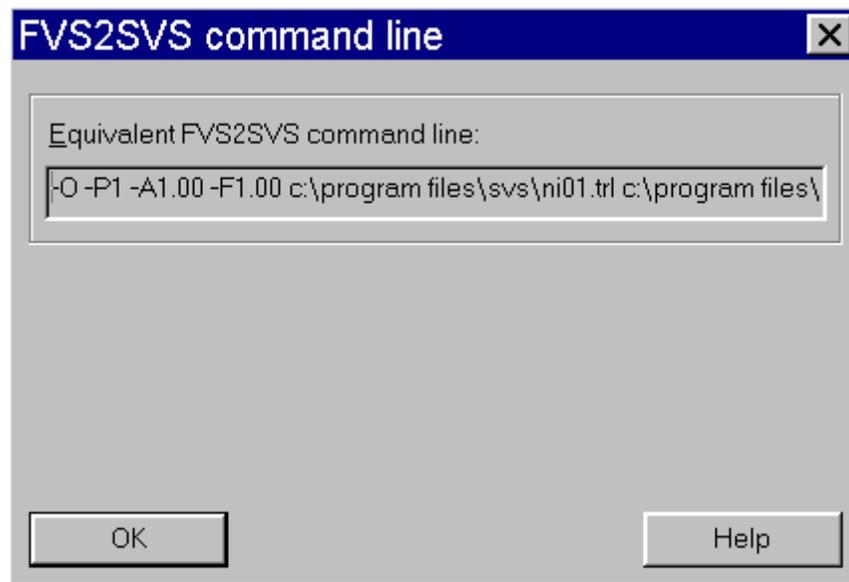
You can duplicate the conversion action from a DOS prompt or batch file by using the command line options and the stand-alone version of FVS2SVS.  To assist with creating command lines or batch files, you can cut-and-paste from the dialog control showing the command line.

For additional information describing the FVS command line options, see FVS2SVS conversion program.

### *Save*
Allows you to save a previously stored set of options for the conversion process.

### *Load*
Allows you to load a previously stored set of options for the conversion process.

## FVS2SVS engine -- General parameters

General parameters control the overall behavior of the FVS2SVS conversion engine. Most parameters correspond to command line options in the original, DOS version of FVS2SVS.
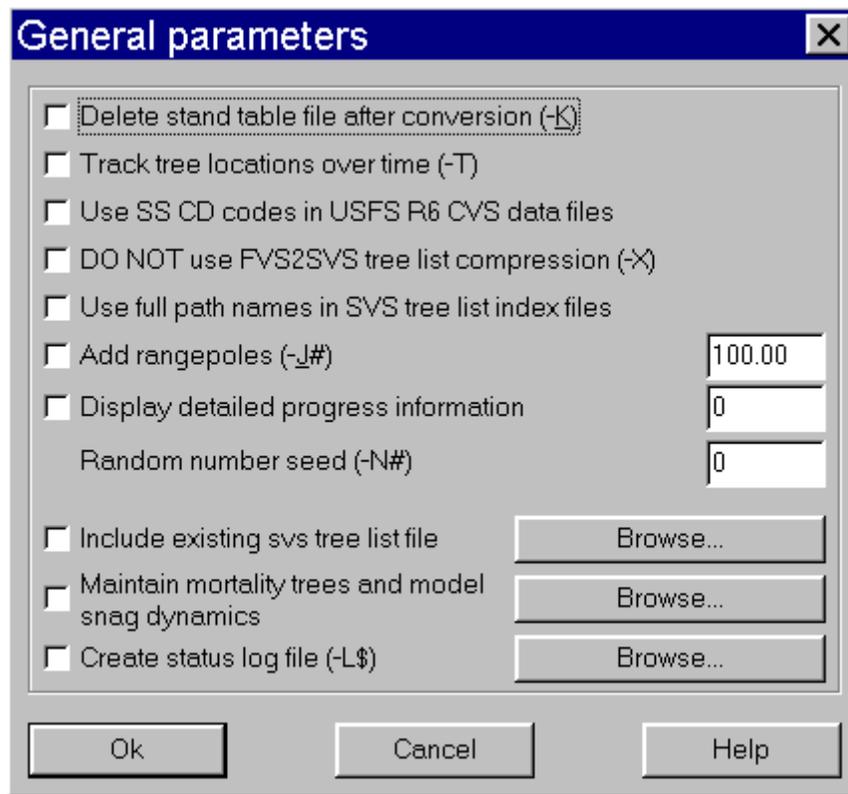
**General parameters**

- ☐ Delete stand table file after conversion (-K)
- ☐ Track tree locations over time (-T)
- ☐ Use SS CD codes in USFS R6 CVS data files
- ☐ DO NOT use FVS2SVS tree list compression (-X)
- ☐ Use full path names in SVS tree list index files
- ☐ Add rangepoles (-J#)                    100.00
- ☐ Display detailed progress information      0
  - Random number seed (-N#)                 0

- ☐ Include existing svs tree list file     [Browse...]
- ☐ Maintain mortality trees and model snag dynamics    [Browse...]
- ☐ Create status log file (-L$)            [Browse...]

[Ok]   [Cancel]   [Help]

For explanation of the options refer to FVS2SVS conversion program -- Command line options.

## FVS2SVS engine -- Selection parameters

Selection parameters control which stand and cycles are converted by the FVS2SVS conversion engine. The four parameters correspond to command line options in the original, DOS version of FVS2SVS.
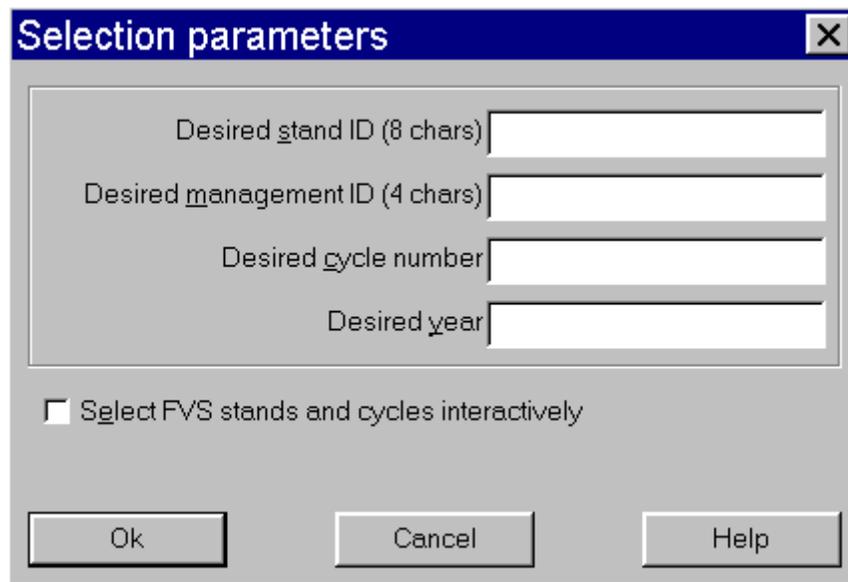
For explanations of the selection criteria refer to FVS2SVS conversion program -- Command line options or FVS2SVS conversion program -- Selecting specific stand from the FVS tree list for conversion.

When selection the stand and cycles interactively, you will be presented with a list of all stands and cycles in the FVS tree list and given the opportunity to select specific stands or cycles for conversion.

## FVS2SVS engine -- Crown size parameters

Crown size parameters control adjustments to crown widths and crown ratios during the conversion process. The parameters correspond to command line options in the original, DOS version of FVS2SVS.
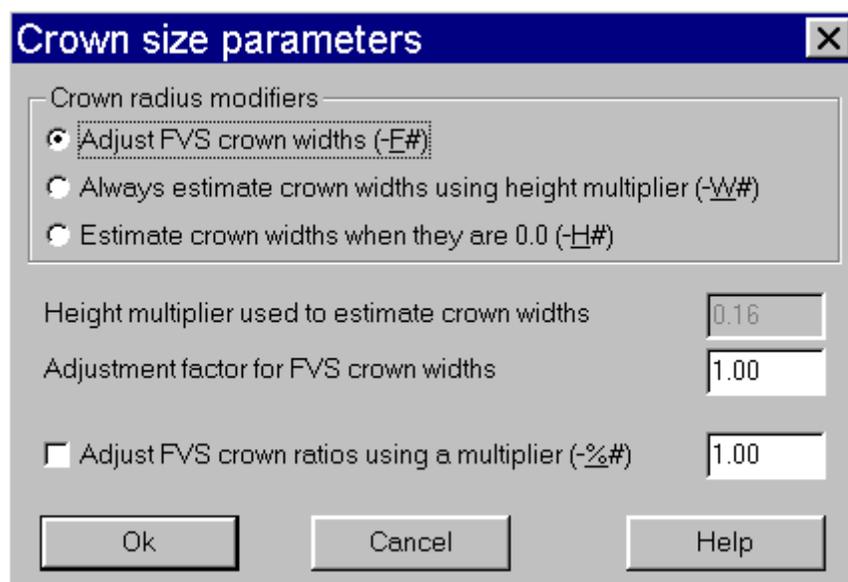
For explanation of the options refer to FVS2SVS conversion program -- Command line options or FVS2SVS conversion program -- Crown width estimates.

## FVS2SVS engine -- Spatial pattern parameters

Spatial pattern parameters control the pattern of tree locations generated during the conversion process.  The parameters correspond to command line options in the original, DOS version of FVS2SVS.



For explanations of the options refer to FVS2SVS conversion program -- Command line options of FVS2SVS conversion program -- Spatial patterns.

# Saving SVS images

SVS allows you to save images of stands, graphs, or other information displayed by SVS to either the Window's clipboard or an image file.  SVS supports a variety of image file formats and color resolutions.  Selecting the **File|Save** image as... choice from the SVS menu initiates the following dialog box:
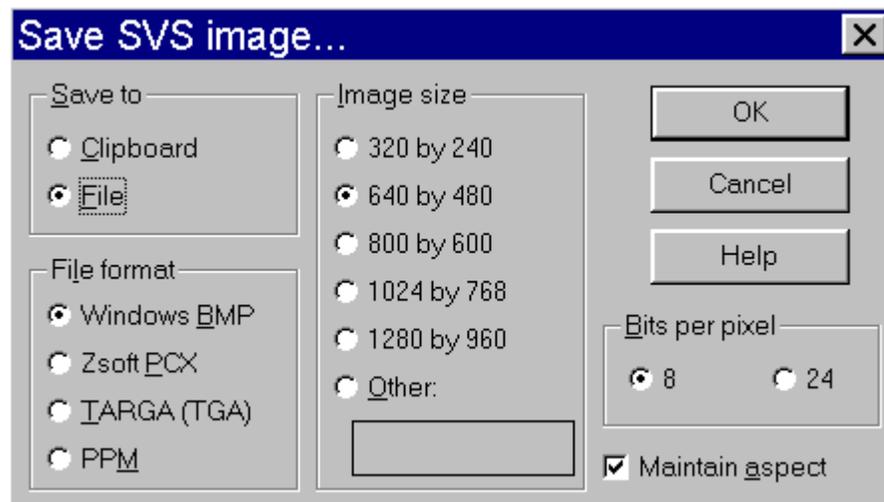
Saving an image to the Window's clipboard allows you to paste the image into another application. You can also save the current image, as displayed, to the clipboard by selecting **Edit|Copy** from the SVS menu. However, when saving images via **Edit|Copy**, you cannot specify the image size. Images saved to the clipboard are saved using a color resolution corresponding to the current display properties. If your display is set to display 24-bit color, the clipboard image will be formatted for 24-bit color.

Saving an image to an image file allows you to maintain a permanent record of a stand's appearance using the currently defined viewing parameters. Image files produced by SVS can later be inserted into documents, posters, or other applications.

### Save to
Select the desired destination for the image. The **File Format** and **Bits per pixel** selections are only enabled when **Save to|File** is selected.

### File format
Select the desired image file format. The Bits per pixel selections may change depending on the selected file format. SVS supports the following file formats:

| | |
|---|---|
| Windows Bitmap (BMP) | 8- and 24-bit color |
| Zsoft's PCX | 8-bit color |
| Truevision's TARGA (TGA) | 8- and 24-bit color |
| Portable Bitmap (PPM) | 24-bit color |

PCX images will most often produce the smallest files as they use run-length encoding to minimize storage or redundant pixel information. Windows bitmaps can also use run-length encoding but support for the compressed format is not widespread. TARGA files also support run-length compression but the TARGA format is not widely supported. PPM files tend to be very large and are most often

needed when files will be transferred to non-windows operating systems (UNIX, AIX, and others).

If your current display properties allow only 16 colors, the only file format available is a 16-color Windows Bitmap.

### Image size
Select the desired image size.  You can specify an image size that is larger than your current display size.  Image size values will change depending on the current layout selected in SVS and the use of the layout aspect ratio.  For a standard layout aspect ration of 4:3, the display sizes will be as shown above.  See SVS image size for additional information.

### Bits per pixel
Select the desired color resolution.  Eight-bit color can represent up to 256 colors and 24-bit color up to 16 million colors.  The **Bits per pixel** values depend on the selected file format.

### Maintain aspect
Select the **Maintain aspect** checkbox to use the aspect specific in the current screen layout.  When this item is checked, image sizes will be constrained to provide the correct aspect ratio.  When not checked, image sizes will correspond to the default aspect ratio of 4:3.

## Printing SVS images

SVS allows you to print high-resolution images to most printers.  The size and placement of an SVS image is controlled through the **File|Page setup...** menu selection.  Selecting the **File|Print...** menu option initiates the following dialog:
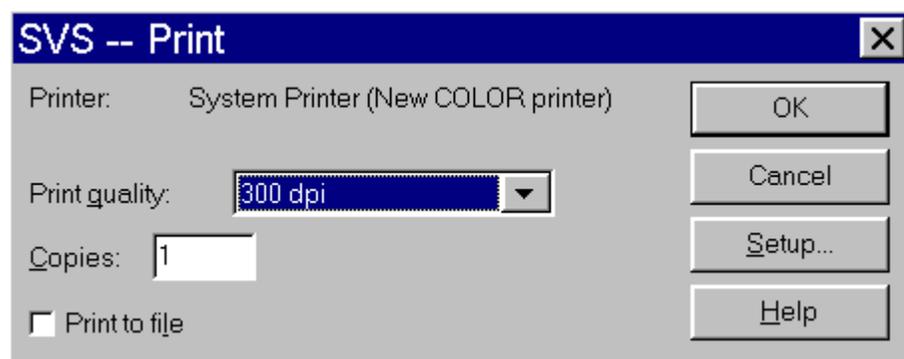


When printing SVS images, you have the choice of printing images with and without annotation.  Annotation refers to the labels used in SVS displays.  Text on charts, graphs, and stand summaries is not considered annotation.  Future release of SVS may provide additional annotation capabilities.

Specific initial settings on this dialog depend on the default printer.

While SVS can print to most printers, you may be better off to save an image file in SVS and then print the image using another application.  Because SVS renders trees using individual lines and polygons, the amount of information sent to the printer (or printer driver) can be excessive.  In addition, SVS may produce very fine lines on some high-resolution printers making tree crowns look less dense that they look on the screen.

## SVS page setup

SVS allows you to control the placement of a stand image on the page.  Selecting the **File|Page** setup... choice from the SVS menu initiates the following dialog box:
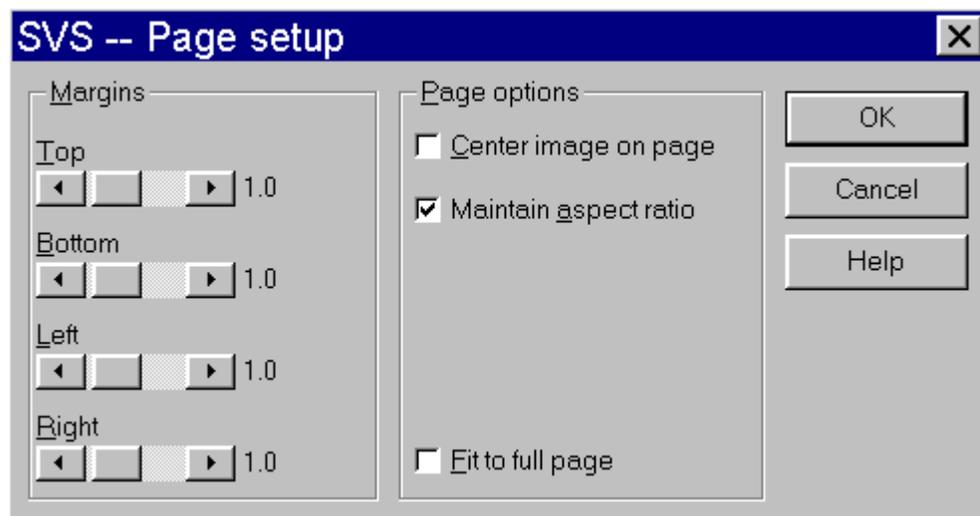


*Margins*
Margin settings are always in inches.  If you specify margin settings that result in an invalid page, e.g., left margin is located to the right of the right margin, SVS will adjust the margins to produce a valid page.

*Page options*
Page options allow you to place the stand image within the specified margins. Selecting the **Center image on page** checkbox will cause the image to be centered within the specified margins.  Selecting the **Maintain aspect ratio** checkbox will enable the use of the aspect ratio specified with the current page layout.  Selecting the **Fit to page** checkbox will cause the image to be scaled to completely fill the available page space.  When the **Fit to page** option is selected, the margin controls are disabled.  If the **Maintain aspect ratio** checkbox is selected, the image may not completely fill the available page space.

# Controlling SVS Stand Displays

## Perspective view options

Parameters that control the viewpoint location, viewing direction, lens focal length, and other attributes for the perspective view of a stand are specified using the following dialog:
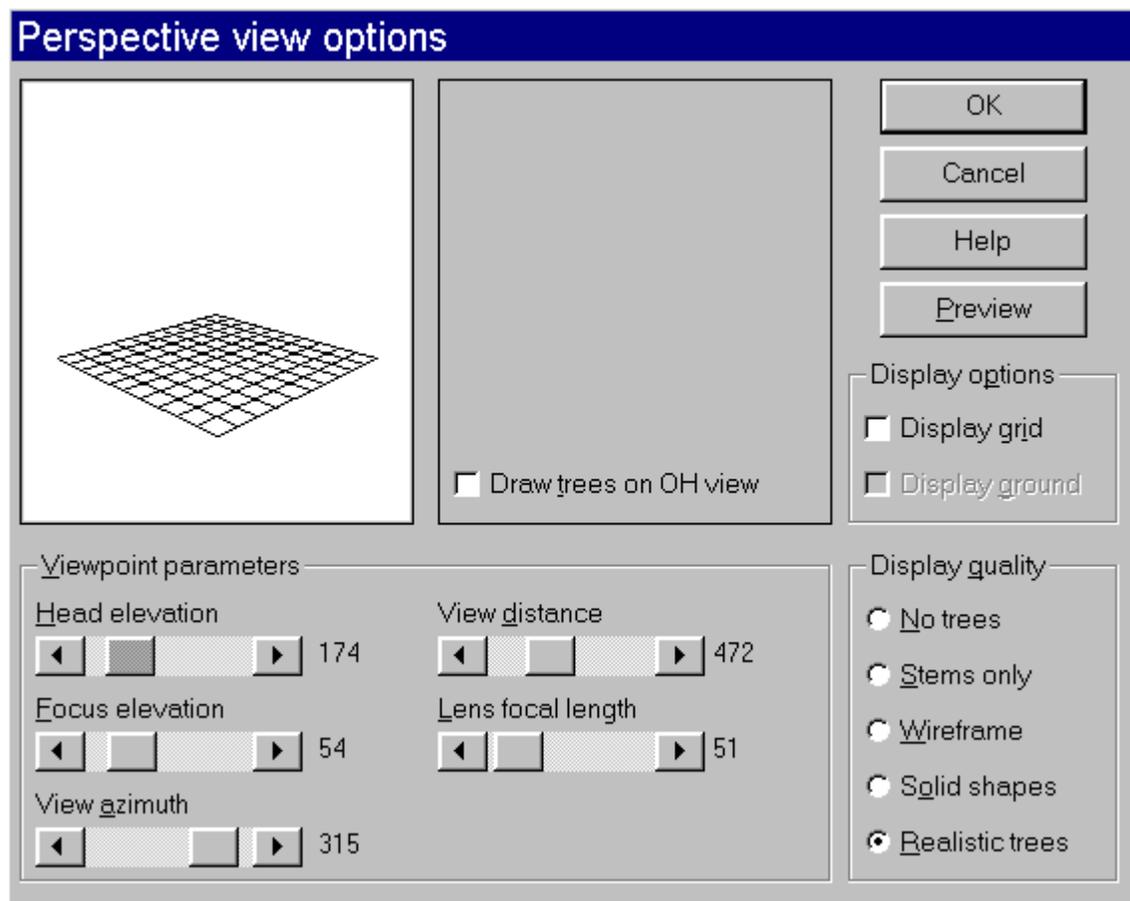


### *Viewpoint parameters*

Viewpoint parameters control the location of the viewpoint, the vertical viewing angle, and the simulated camera lens focal length.  The head elevation controls the height of the viewpoint relative to the ground plane.  Increasing this value tilts the stand towards the viewer and decreasing the value tilts the stand away from the viewer.  The focus elevation raises and lowers the elevation of the point being looked at--creating the effect of looking up or down.  The view azimuth controls the location of the viewpoint relative to the center of the stand.  Changing the view azimuth rotates the stand.  The view distance controls the distance from the center of the stand to the viewpoint.  Increasing this distance makes the stand appear smaller and decreasing the distance makes the stand appear larger.  The lens focal length controls the simulated lens used in the perspective transformations used to draw the stand.  Increasing the focal length has the same effect as using a telephoto

lens on a camera, i.e., the image is zoomed or made larger. Decreasing the focal length produces the same effect as a wide angle lens on a camera, i.e., the image is made smaller. Changing the lens focal length also changes the appearance of trees. As the focal length is decreased, trees appear to lean away from the center of the image. Focal lengths greater then 50 are generally free of most distortion.

### *Display options*
The display options control the display of the ground grid and ground coloration specified in a ground definition file. When no ground definition file is loaded, the ground grid will be 10 cells square. When a ground definition file is loaded, the ground grid is the same size as the grid specified in the ground definition file. Ground definition file can be used to add color to the ground surface displayed in perspective and overhead view in SVS.

### *Display quality*
The display quality options change the types of trees and other objects drawn by SVS. The quality options are:

| Quality setting | Description | Anticipated use | Drawing speed |
|---|---|---|---|
| No trees | No plants are drawn | Turn off plant drawing when you are not interested in one or more of the stand views | Very fast |
| Stems only | Each plant is represented by a wireframe image of its stem | Use while adjusting the perspective view or while marking trees to provide fast image regeneration | Very fast |
| Wireframe trees | Each plant is represented by a wireframe image of its stem and canopy | Use while adjusting the perspective view or while marking trees to provide fast image regeneration | Fast |
| **Solid trees** | | | |
| Perspective and profile views | Each plant is represented using geometric solid volumes to describe the stem and canopy | Use to show the volume occupied by individual plant canopies | Moderate |
| Overhead view | Each plant crown is represented by a circle or irregular polygon | Use to show the volume occupied by individual plant canopies | Fast |
| Realistic trees | Each plant is represented by a solid | Use to produce the most realistic images | Slow |

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|                          |                      |
|--------------------------|----------------------|
| stem and branches, needle covered branches, and individual leaves | showing stand characteristics |

## Overhead view options

Parameters that control the attributes for the overhead view of a stand are specified using the following dialog:



### *Display quality*

The display quality options change the types of trees and other objects drawn by SVS.  The quality options are:

| Quality setting | Description | Anticipated use | Drawing speed |
|-----------------|-------------|-----------------|---------------|
| No trees | No plants are drawn | Turn off plant drawing when you are not interested in one or more of the stand views | Very fast |
| Stems only | Each plant is represented by a wireframe image of its stem | Use while adjusting the perspective view or while marking trees to provide fast image regeneration | Very fast |
| Wireframe trees | Each plant is represented by a wireframe image of its stem and canopy | Use while adjusting the perspective view or while marking trees to provide fast image regeneration | Fast |

**Solid trees**

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| | | | |
|---|---|---|---|
| Perspective and profile views | Each plant is represented using geometric solid volumes to describe the stem and canopy | Use to show the volume occupied by individual plant canopies | Moderate |
| Overhead view | Each plant crown is represented by a circle or irregular polygon | Use to show the volume occupied by individual plant canopies | Fast |
| Realistic trees | Each plant is represented by a solid stem and branches, needle covered branches, and individual leaves | Use to produce the most realistic images showing stand characteristics | Slow |

### *Display options*

The display options control the display of the ground grid and ground coloration specified in a ground definition file, display of the profile strip and the type of crown shape used to represent trees in the overhead view.  When no ground definition file is loaded, the ground grid will be 10 cells square.  When a ground definition file is loaded, the ground grid is the same size as the grid specified in the ground definition file.  Ground definition file can be used to add color to the ground surface displayed in perspective and overhead view in SVS.  SVS can use two methods to represent tree crowns drawn in the overhead view.  First, the four-sided crown data can be interpreted and non-circular crowns drawn and, second, only the average crown radius is considered and crowns are drawn as perfect circles.  This four-sided method provides the most accurate crown shapes but takes longer to draw than simply drawing circular crowns.  The profile strip shows the portion of the stand that will be displayed in profile views.  Its display is controlled by the "Show profile strip" checkbox.

### *Profile strip width*

The profile strip width refers to the width of the profile strip shown on the overhead view and used to select trees to be drawn in the profile view.  The units of measure for the strip width always correspond the units of measure used in SVS tree lists (feet if using ENGLISH units and meters if using METRIC units).

## Profile view options

Parameters that control the attributes for the overhead view of a stand are specified using the following dialog:
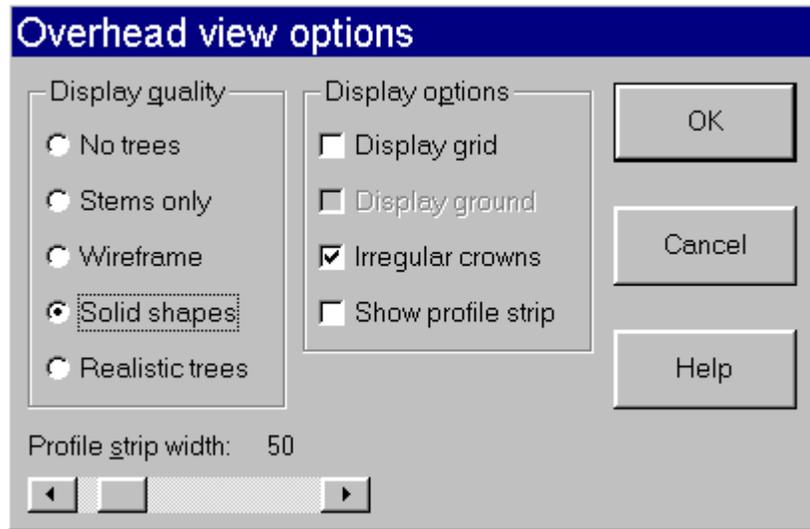
### *Display quality*

The display quality options change the types of trees and other objects drawn by SVS.  The quality options are:

| Quality setting | Description | Anticipated use | Drawing speed |
|---|---|---|---|
| No trees | No plants are drawn | Turn off plant drawing when you are not interested in one or more of the stand views | Very fast |
| Stems only | Each plant is represented by a wireframe image of its stem | Use while adjusting the perspective view or while marking trees to provide fast image regeneration | Very fast |
| Wireframe trees | Each plant is represented by a wireframe image of its stem and canopy | Use while adjusting the perspective view or while marking trees to provide fast image regeneration | Fast |
| **Solid trees** | | | |
| Perspective and profile views | Each plant is represented using geometric solid volumes to describe the stem and canopy | Use to show the volume occupied by individual plant canopies | Moderate |
| Overhead view | Each plant crown is represented by a circle or irregular polygon | Use to show the volume occupied by individual plant canopies | Fast |

| Realistic trees | Each plant is represented by a solid stem and branches, needle covered branches, and individual leaves | Use to produce the most realistic images showing stand characteristics | Slow |

*Profile strip width*

The profile strip width refers to the width of the profile strip shown on the overhead view and used to select trees to be drawn in the profile view.  The units of measure for the strip width always correspond the units of measure used in SVS tree lists (feet if using ENGLISH units and meters if using METRIC units).  The display of the strip can be controlled in the overhead view parameters.

## Default parameters for all views

Default parameters that control the default display quality for newly loaded SVS files, colors used to draw SVS images, and other parameters that affect the behavior of SVS are specified using the following dialog:

## Configuration parameters

### Default colors

- Background...  ☐
- Gridline...  ■
- Ground...  ☐
- Ground base...  ▨

### Default parameters

| | |
|---|---|
| XY step size: | 5 ◄ ░░ ► |
| Elevation step: | 5 ◄ ░░ ► |
| Target radius: | 4 ◄ ░░ ► |
| Strip width: | 50 ◄ ░░ ► |
| Felling angle: | 30 ◄ ░░ ► |
| Angle std dev: | 360 ◄ ░░ ► |
| Minimum DBH: | 0.0 ◄ ░░ ► |

### Default display quality

| Perspective | Overhead | Profile |
|---|---|---|
| ○ No trees | ○ No trees | ○ No trees |
| ○ Stems only | ○ Stems only | ○ Stems only |
| ○ Wireframe | ○ Wireframe | ○ Wireframe |
| ○ Solid shapes | ⦿ Solid shapes | ○ Solid shapes |
| ⦿ Realistic trees | ○ Realistic trees | ⦿ Realistic trees |

- OK
- Cancel
- Help

☑ Use FVS mortality information to compile graphs
(plant class of 90-98 considered dead)

***Default colors***

Default colors specify the color to be used in SVS stand images.  Changes to the default colors affects all images drawn after the changes are made.  In general, a white background color is best for images that will be printed.  For the available color, see Specifying colors for SVS images.

***Default parameters***

The default parameters control the behavior of some features of SVS.  The XY and elevation step sizes control the sensitivity of the controls used to position the viewpoint and focus point in the perspective view options.  The target radius, felling angle, and angle standard deviation are not used in the current version of SVS.  The Strip width refers to the width of the profile strip shown on the overhead view and used to select trees to be drawn in the profile view.  The units of measure for the strip width always correspond the units of measure used in SVS tree lists (feet if using ENGLISH units and meters if using METRIC units).  The Minimum DBH specifies the minimum diameter for trees to be displayed in stand images and graphs.  The units of measure for the minimum DBH correspond to the units used for tree diameters in SVS tree lists (inches if using ENGLISH units and centimeters if using METRIC units).

*Default display quality*
The default display quality specifies the initial quality settings used when SVS first loads a tree list file. These settings do not affect tree lists that are already loaded. In addition, these settings are overridden by command line options in SVS.

The display quality options change the types of trees and other objects drawn by SVS. The quality options are:

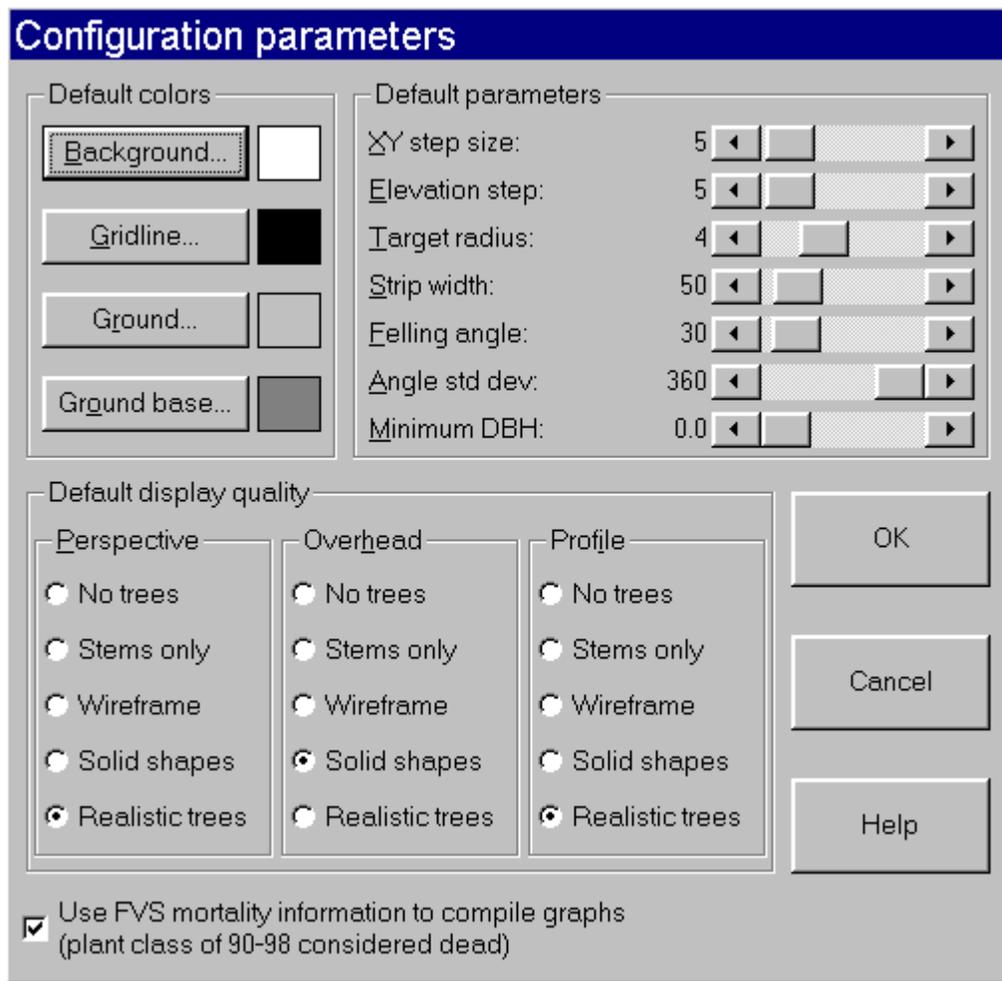| Quality setting | Description | Anticipated use | Drawing speed |
| --- | --- | --- | --- |
| No trees | No plants are drawn | Turn off plant drawing when you are not interested in one or more of the stand views | Very fast |
| Stems only | Each plant is represented by a wireframe image of its stem | Use while adjusting the perspective view or while marking trees to provide fast image regeneration | Very fast |
| Wireframe trees | Each plant is represented by a wireframe image of its stem and canopy | Use while adjusting the perspective view or while marking trees to provide fast image regeneration | Fast |
| **Solid trees** | | | |
| Perspective and profile views | Each plant is represented using geometric solid volumes to describe the stem and canopy | Use to show the volume occupied by individual plant canopies | Moderate |
| Overhead view | Each plant crown is represented by a circle or irregular polygon | Use to show the volume occupied by individual plant canopies | Fast |
| Realistic trees | Each plant is represented by a solid stem and branches, needle covered branches, and individual leaves | Use to produce the most realistic images showing stand characteristics | Slow |

*Use FVS mortality information to compile graphs*
When SVS draws graphs and compiles summaries showing stand conditions, it normally considers all trees and plants to be alive and healthy. The FVS2SVS conversion system, designed to convert data files produced by the Forest Vegetation

Simulator (a stand projects system or stand growth model), uses special tree class codes to indicate dead trees.  When the option is selected, SVS will represent dead trees using separate tables in summaries and colors in graphs.  FVS dead tree codes can range from 90 to 98.

# Specifying colors for SVS images

Individual colors used in SVS images are selected from the following dialog:
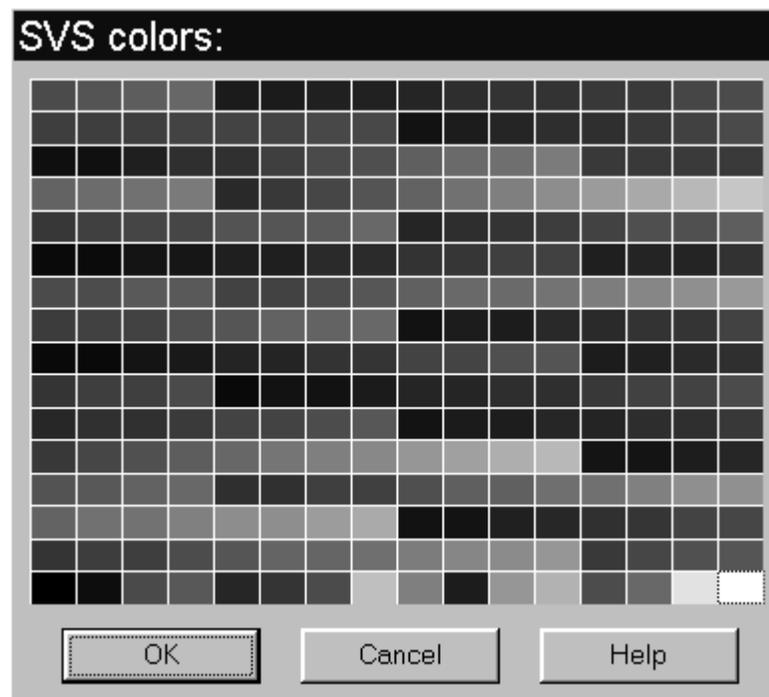


To select a color from the dialog you can simply double click on the desired color or you can single click on the color and then select to Ok button.  This dialog is used to specify the default color used in SVS images, i.e., image background color, ground surface color, gridline color, and the ground base color.

# Working with Screen Layouts

## Selecting a screen layout

The content of the SVS screen is controlled by the current screen layout.  Screen layouts consist of one or more views of stand information including visualizations, graphs, labels, and tabular summaries.  Layout selections can be accessed through the **SVS options|Screen Layouts...** menu selection.  This menu option contains a list of available layouts and selections to modify or create a new layout.

*Use layout aspect ratio*
The **SVS options|Screen Layouts...** menu selection contains an option to use or ignore the aspect ratio specified for a screen layout.  When this checkbox is selected, SVS will adjust the display, printing, and image save window sizes to reflect the aspect ratio defined in the selected screen layout.  In most cases, you should use the aspect ratio defined in the screen layout.

## Defining screen layouts

Screen layouts define the contents of the SVS screen.  Screen layouts consist of one or more views of stand information including visualizations, graphs, labels, and tabular summaries.  SVS includes several pre-defined layouts and allows users to define their own layouts.  The layout definition process is accessed through the **SVS options|Screen layouts…|Define screen layouts...** menu selection.  Selecting this menu option initiates the following dialog:
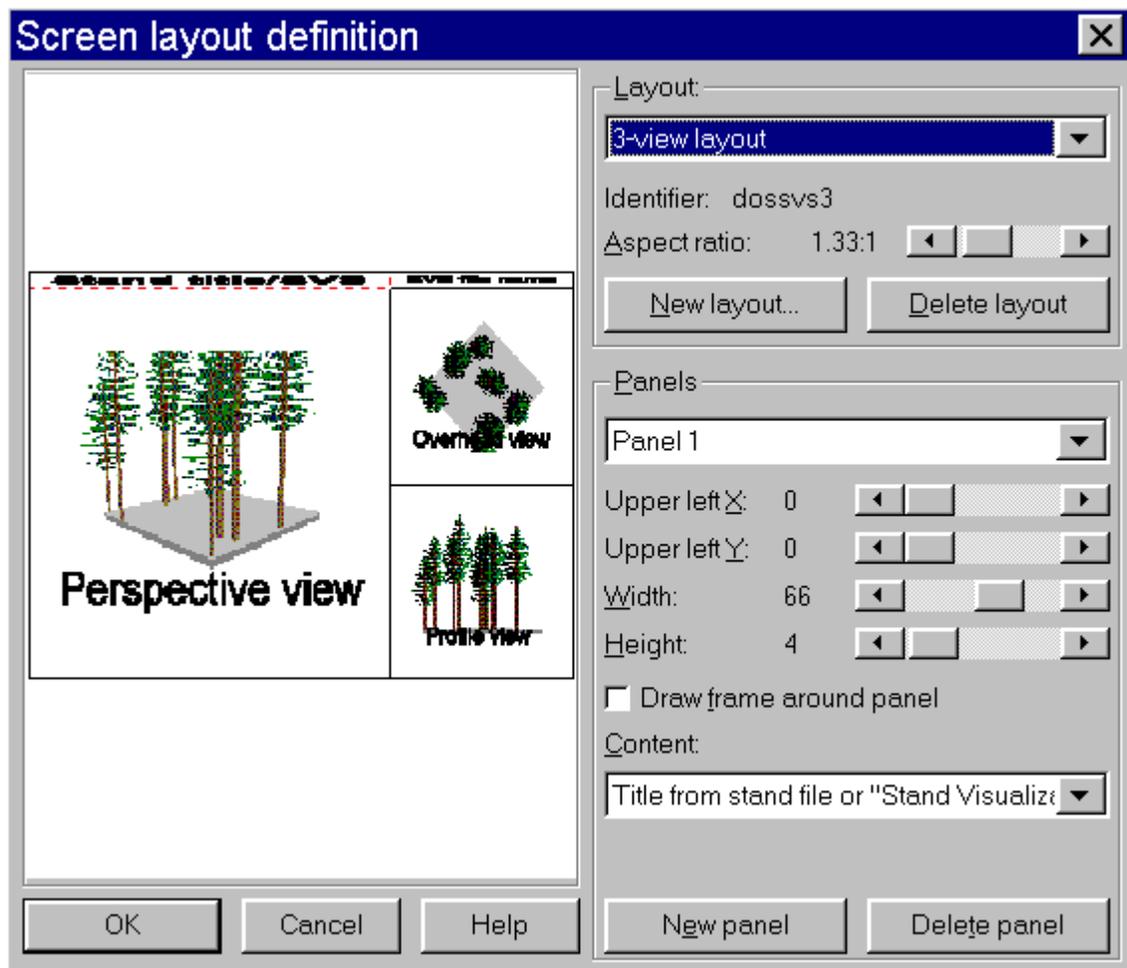


*Layout coordinate system*
Screen layouts are designed using a page that is always 100 by 100 units regardless of the physical size of the page (paper or screen).  The origin of the

coordinate system is the upper left corner of the page.  Panel positions are specified by the location of the upper left corner and the width and height.  Panels can overlap although most panels are opaque so areas of the page under them will not be visible.  Panels can be positioned so that a portion of the panel falls outside the page.  When panels fall outside the page, the portion of the panel outside the page will not be displayed on the screen and may or may not appear on printed pages (depending on the page setup, paper size, and printer).

### Layout preview
The layout preview shows an approximate representation of the layout as it will appear on the screen or printed page.  Panels that appear distorted in the preview will not be distorted on the screen or printed page.  The preview display can be used to select a panel by simply positioning the mouse over the desired panel and clicking the primary mouse button.  If you need to select a panel that lies under another panel, a second click will cycle to the underlying panel.

### Layout names
The list of layouts currently defined for SVS.  By default SVS defines two layouts.  The first displays a perspective view of a stand with the stand title or file name if no title is specified for the stand.  The second displays a perspective, overhead, and profile view for a stand along with the stand title or file name if no title is specified for the stand.  The layout name was specified when the layout was created and cannot be changed.

### Identifier
The internal name used to refer to a layout.  This name will be used in the INI file to organize the panel definitions for a layout.  The identifier was specified when the layout was created and cannot be changed.

### Aspect ratio
The aspect ratio of the layout.  The aspect ratio is expressed as the ratio the page width to the page height.  An aspect ratio of 1:1 specifies a square page.  The default aspect ratio for most computer screens is 1.33:1.  The use of the specified aspect ratio can be turned on or off in various places in SVS.

### New layout
Create a new screen layout.  When creating a new layout you must specify the layout name and the layout identifier.  The layout name can be up to 60 characters long.  When selecting layouts for display, you will be asked to make a selection based on the layout name.  Layout identifiers are used internally by SVS to organize layout panels within its INI file.  You will never be asked to specify a layout using its identifier.  The following dialog is used to specify the name and identifier:
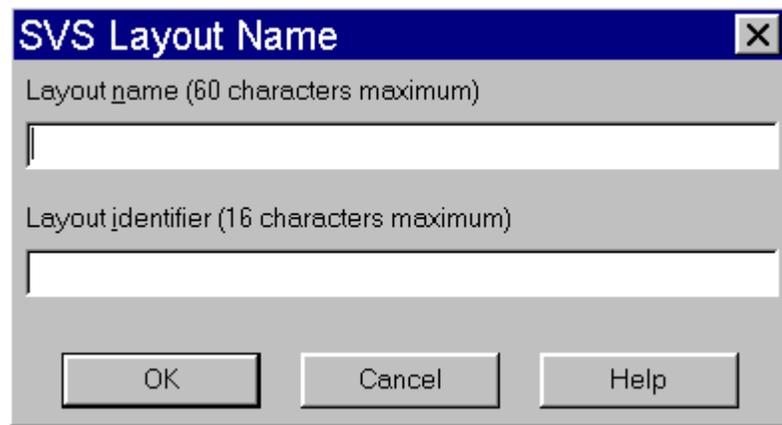
### Delete layout
Delete the layout currently displayed in the layout names control.  If a layer is deleted and then the **Cancel** button is selected, the layer will not be deleted.

### Panel list
The list of panels currently defined for the layout.  Panels a numbered sequentially.  A panel is selected for modification by selecting the panel from this list or by clicking the mouse in the **Layout preview**.  If you need to select a panel that lies under another panel, a second click will cycle to the underlying panel.

### Upper left X
The location (X) of the upper left corner of the panel.  A value of 0 places the panel along the left edge of the page.

### Upper left Y
The location (Y) of the upper left corner of the panel.  A value of 0 places the panel along the top edge of the page.

### Width
Width of the panel.  A value of 100 makes the panel span the full width of the page.

### Height
Height of the panel.  A value of 100 makes the panel span the full height of the page.

### Content
The content of the panel.  Available panel contents are:

    Perspective view of the stand from the left eye perspective
    Overhead view of the stand
    Profile view of the stand
    Perspective view of the stand from the right eye perspective
    Dbh distribution graph with legend
    Height distribution graph with legend
    Height/crown ratio graph with legend
    Species distribution graph with legend

Dbh distribution graph without legend
Height distribution graph without legend
Height/crown ratio graph without legend
Species distribution graph without legend
Stand summary
Tree form legend
Stand file name (name of .SVS file)
Title from stand file or blank if not title
Title from stand file or "Stand Visualization System" if no title
Current date
Current time
Current date and time
SVS logo
Forest Service shield (BW)
BLM Logo (Color)
USDA Logo (Color)
DOI Logo (Color)
BLM Logo (BW)
DOI Logo (BW)
Bitmap file
Text file
Text Message

Text files can be any ASCII text file.  SVS will attempt to fit the entire contents of the text file into the panel so text files containing lots of text may result in a very small font.

Bitmap files can be any image stored as a windows bitmap (.BMP).  When rendering the image to a device supporting 256 or fewer colors, the image colors may be distorted.  On devices that support more than 256 colors, bitmap colors should not be distorted.

See the discussion of auxiliary data for specific information about each of the available content codes.

### Draw frame around panel
When checked, a black line is draw around the panel.  When unchecked, no border is drawn.

### Aux. data
Auxiliary data associated with the panel content.  Not all contents utilize auxiliary data so this input field may not appear depending on the panel content.

### New panel
Add a new panel to the current layout.

### *Delete panel*
Delete the currently selected panel.


## Auxiliary Data for Screen Layouts

Auxiliary data is used to specify characteristics of a display panel. Not all panels types use auxiliary data. When the panel uses more than one auxiliary parameter, parameters should be separated by a colon (:).

The following table summarizes the content codes and their use of auxiliary data:

| Content code | Auxiliary data | Interpretation of auxiliary data |
| --- | --- | --- |
| Perspective view of the stand from the left eye perspective | NA | |
| Overhead view of the stand | NA | |
| Profile view of the stand | NA | |
| Perspective view of the stand from the right eye perspective | NA | |
| Dbh distribution graph with legend | species code | specifies the species shown in the graph |
| Height distribution graph with legend | species code | specifies the species shown in the graph |
| Height/crown ratio graph with legend | species code | specifies the species shown in the graph |
| Species distribution graph with legend | NA | |
| Dbh distribution graph without legend | species code | specifies the species shown in the graph |
| Height distribution graph without legend | species code | specifies the species shown in the graph |
| Height/crown ratio graph without legend | species code | specifies the species shown in the graph |
| Species distribution graph without legend | NA | |
| Stand summary | species code | specifies the species shown in the graph |
| Stand file name (name of .SVS file) | NA | |
| Title from stand file or blank if not title | NA | |
| Title from stand file or "Stand Visualization System" | NA | |
| Current date | NA | |
| Current time | NA | |
| Current date and time | NA | |

| | | |
|---|---|---|
| SVS logo | transparency | transparency: 0 not transparent; 1 transparent |
| Forest Service shield | transparency | transparency: 0 not transparent; 1 transparent |
| Other logos | transparency | transparency: 0 not transparent; 1 transparent |
| Text file | transparency/alignment: file name | transparency/alignment: 0 not transparent, left aligned 1 not transparent, center aligned 2 not transparent, right aligned 3 transparent, left aligned 4 transparent, center aligned 5 transparent, right aligned file name can be any valid file name that includes or does not include a path specifier file name can include the following substitution identifiers: $SVSFILENAME SVS file name only with no path or extension $SVSFULLFILENAME SVS file name with the full path to the file but no extension $SVSFILEPATH full path to the directory containing the SVS file ending without the trailing "\" character text file examples |
| Bitmap file | transparency: file name | transparency: 0 not transparent; 1 transparent file name can be any valid file name that includes or does not include a path specifier |
| Tree form legend | page number | specifies the page of the legend to display. The first page is 1. If the page number is greater than the number of pages, the display is blank. See |

| | | Preferences for tree legend displays to change the arrangement of tree forms per page. |
| Text message | transparency/alig nment: message | transparency/alignment: 0 not transparent, left aligned 1 not transparent, center aligned 2 not transparent, right aligned 3 transparent, left aligned 4 transparent, center aligned 5 transparent, right aligned message: any text message the message can contain \n to start a new line or \t to tab to the next column (10 space columns) |

## Displaying Text Files in SVS Screen Layouts

Auxiliary data for text files included in screen layouts can be used to specify three characteristics: transparency, alignment, and the text file name.  Transparency and alignment are combined into the first field in the auxiliary data using the following code numbers:

- 0    not transparent, left aligned
- 1    not transparent, center aligned
- 2    not transparent, right aligned
- 3    transparent, left aligned
- 4    transparent, center aligned
- 5    transparent, right aligned

The text file name field of the auxiliary data can include the following substitution identifiers:

| Identifier | Description |
|---|---|
| $SVSFILENAME | SVS file name only with no path or extension |
| $SVSFULLFILENAME | SVS file name with the full path to the file but no extension |
| $SVSFILEPATH | full path to the directory containing the SVS file |

For example, Assume we are displaying an SVS file named EXAMPLE.SVS that is stored in the C:\SVS directory, the substitution identifiers would result in the following values:

| Identifier | Replacement text |
|---|---|
| $SVSFILENAME | EXAMPLE |
| $SVSFULLFILENAME | C:\SVS\EXAMPLE |
| $SVSFILEPATH | C:\SVS |

The auxiliary data string 0:$SVSFULLFILENAME.RPT would result in the file named C:\SVS\EXAMPLE.RPT being displayed in the panel with no transparency and each line of text aligned with the left edge of the panel.

The auxiliary data string 1:$SVSFILEPATH\REPORT.TXT would result in the file named C:\SVS\REPORT.TXT being displayed in the panel with no transparency and each line of text centered within the panel.


# Modifying an SVS Stand Using Marking and Treatments

The marking and treatment capabilities in SVS are designed to help you portray silvicultural treatments. A variety of options are available to help you select trees for treatment including individual and group selection, marking rules and thinning prescriptions, pruning, and planting. In addition, you can modify some of the SVS tree parameters such as species code, tree class and plant class. The marking dialog displays information describing individual trees and, as trees are marked, information summarizing the marked and unmarked trees in the stand.

The marking and treatment option is available whenever you have either a perspective or an overhead view displayed. Other stand view types do not support marking activity.

When you first enter marking mode, SVS will redraw the current layout and place marking targets on all trees in perspective and overhead stand views. You can stop the drawing using either the right mouse button or the Esc key but only trees that have been drawn can be selected using individual tree or group selection methods. When marking, screen flicker is minimized if the marking dialog is placed completely outside of the SVS display area.


## Tree Marking and Treatment

Marking and treatment functions are presented using the following dialog:

```
┌─────────────────────────────────────────────────────────────────┐
│ Tree marking and treatment                                      │
├─────────────────────────────────────────────────────────────────┤
│ ┌Tree info┐ Stand info  Marking rules  Thin   Plant  Treatment  History      ┌─────────┐ │
│                                                                   │  Close  │ │
│ ┌─────────────────────────────────────────────────┐▲  └─────────┘ │
│ │Tree is NOT MARKED                               │▲             ┌─────────┐ │
│ │                                                 │              │  Help   │ │
│ │Species:           098                           │              └─────────┘ │
│ │Tree/plant class:  0                             │              ┌─────────┐ │
│ │Crown class:       0                             │              │ Redraw  │ │
│ │Status:            standing                      │              └─────────┘ │
│ │Dbh:               28.00                         │              ┌─────────┐ │
│ │Height:            94.00                          │             │Save stand│ │
│ │Crown size         1      2      3      4        │              └─────────┘ │
│ │  radius:          15.30  15.30  15.30  15.30    │              ┌─────────┐ │
│ │  ratio:           0.65   0.65   0.65   0.65     │              │Copy SVS file│ │
│ │  length:          61.10  61.10  61.10  61.10    │              └─────────┘ │
│ │Felling angle:     0.00                           │             ┌─────────┐ │
│ │Small end diameter: 0.00                         │▼             │Cover info│ │
│ └─────────────────────────────────────────────────┘▼            └─────────┘ │
└─────────────────────────────────────────────────────────────────┘
```
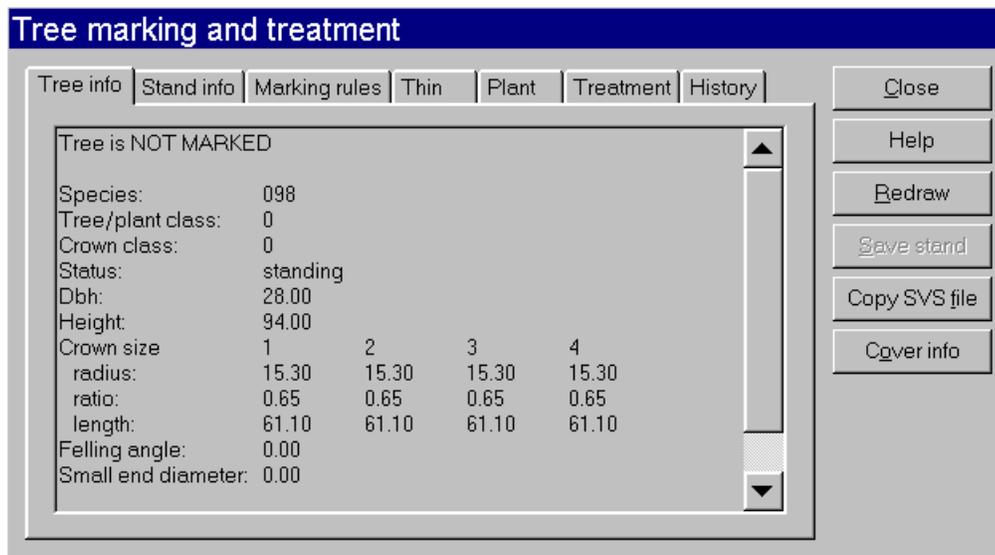
## *Tree info*

This tab show information about the tree currently selected by the "paint gun" or the last tree selected if the mouse is no longer over a tree.  The information contains all fields from the tree's entry in the SVS tree list.  You select a tree by simply moving the mouse to the tree.  The above dialog shows an example of the tree information.

## *Stand info*

Shows a variety of stand information for the marked and unmarked components of the stand.  As trees are marked and unmarked, the information is dynamically updated.  The following dialog shows an example of the stand information:

```
┌─────────────────────────────────────────────────────────────────┐
│ Tree marking and treatment                                      │
├─────────────────────────────────────────────────────────────────┤
│ Tree info ┌Stand info┐ Marking rules  Thin   Plant  Treatment  History      ┌─────────┐ │
│                                                                   │  Close  │ │
│ ┌─────────────────────────────────────────────────┐▲  └─────────┘ │
│ │Marked trees                                     │▲             ┌─────────┐ │
│ │             Mean    SD      Min     Max         │              │  Help   │ │
│ │Dbh          24.10   8.67    8.00    36.00       │              └─────────┘ │
│ │Ht           71.80   23.13   30.00   94.00       │              ┌─────────┐ │
│ │                                                 │              │ Redraw  │ │
│ │Basal area   154.07 sq ft per acre               │              └─────────┘ │
│ │Number of trees  10 (43.56 per acre)             │▼             ┌─────────┐ │
│ ├─────────────────────────────────────────────────┤             │Save stand│ │
│ │Unmarked trees                                   │▲             └─────────┘ │
│ │             Mean    SD      Min     Max         │              ┌─────────┐ │
│ │Dbh          22.23   8.38    8.00    38.00       │              │Copy SVS file│ │
│ │Ht           78.49   24.01   30.00   114.00      │              └─────────┘ │
│ │                                                 │              ┌─────────┐ │
│ │Basal area   521.28 sq ft per acre               │              │Cover info│ │
│ │Number of trees  39 (169.88 per acre)            │▼             └─────────┘ │
│ └─────────────────────────────────────────────────┘▼                       │
└─────────────────────────────────────────────────────────────────┘
```

## *Marking rules*

Allows you to mark trees using a variety of rules.  Rules are based on tree attributes. This tab also allows marking all trees or clearing the marks from all trees and

inverting the mark status (trees that are currently marked are unmarked and trees that are unmarked are marked).

### Thin
Allows you to specify thinning prescriptions to mark trees. Prescriptions are based on the desired characteristics for the residual stand.

### Plant
Allows you to plant trees in the SVS stand. The tab uses the TBL2SVS conversion engine to insert new trees into the stand.

### Treatment
Allows you to modify the status of the marked trees. This tab also allows you to prune trees and to modify some tree attributes.

### History
This tab shows all actions that have occurred in the current stand. This information summarizes marking and treatment activity for the current marking session only. Prior marking and treatment activities are not saved.

### Close
Exits marking mode and redraws the SVS screen without marking targets.

### Help
Displays help for the marking and treatment options dialog.

### Redraw
Redraws the stand with targets placed in their proper location. As marking operations are conducted, SVS only redraws the targets. This can result in targets from trees farther back in the stand being placed on top of targets from trees that are closer to the viewer. Clicking the redraw button causes SVS to redraw all trees and markers in the proper order.

### Save stand
Saves the stand with the current marking status. This button will only be enabled after some marking operations have occurred and will be disabled after the stand is saved. Marking changes are not saved unless some type of treatment is conducted or the Save stand button is selected.

### Copy SVS file
Allows you to make a copy of the SVS stand. Many marking and treatment operations change the SVS tree list. Some of the changes are reversible some are not. You will be notified and given the chance to save a copy of the stand prior to any irreversible changes.

## Individual Tree and Group Marking

When marking trees, the mouse is used to toggle the marked status of a trees. To mark a tree simply move the mouse to the desired tree and click the left mouse button. To unmark a tree repeat the process. To mark groups of trees, press the shift key and stroke a rectangular area containing the trees to be marked. To unmark a group of trees, use the ctrl key instead of the shift key while stroking the rectangular area.

## Using Marking Rules

Marking rules are used to mark trees based on their attributes or attributes relative to other trees in the stand. Marking rules are specified using the following dialog:
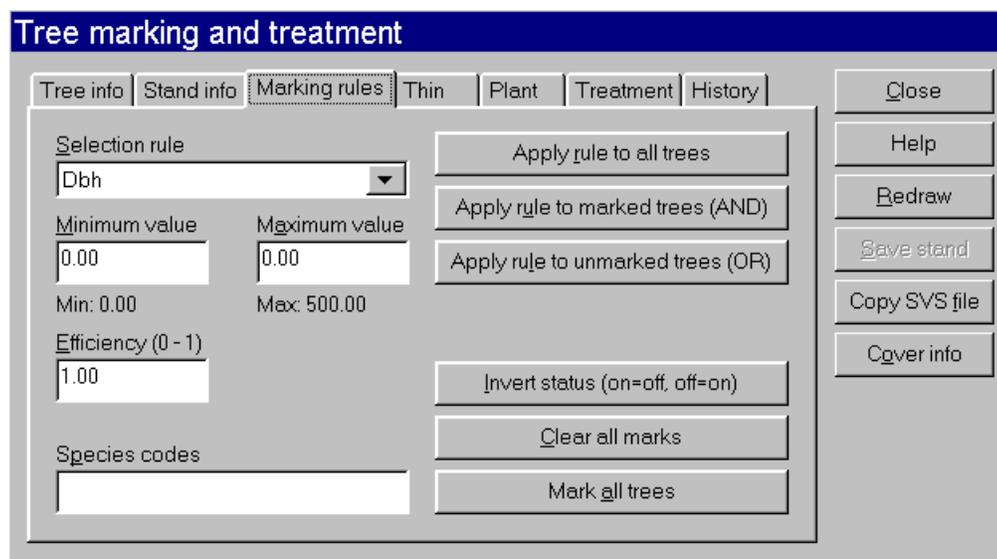


*Tree attribute*
Select the tree attribute to be used for the marking rule. The attributes, with the exception of the relative dbh and height, come from the record in the SVS tree list that represents each tree. The relative dbh and height are computed using the maximum dbh and maximum height in the stand respectively.

*Minimum value*
Enter the minimum value for the attribute. Trees will be selected if their attribute value is greater than or equal to the minimum value. The valid range for the minimum value depends on the tree attribute selected.

*Maximum value*
Enter the maximum value for the attribute. Trees will be selected if their attribute value is less than the maximum value. The valid range for the maximum value depends on the tree attribute selected.

### Efficiency

Enter the efficiency from 0.0 to 1.0 for the selection rule. Efficiency is used to simulate how well a person can mark trees that match a certain criteria in the field. For example, if you specify an efficiency of 0.75, 75 percent of the trees that match the selection criteria would be marked.

### Species codes

Enter the species code or codes to be included in the rule. If you enter more than one code, separate the codes using a comma.

### Apply rule to all trees

Apply the selection rule to all trees regardless of their current marking status. This option will mark all trees that match the selection criteria and unmark all trees that do not match the criteria.

### Apply rule to marked trees (AND)

Apply the selection rule to all trees that are already marked. This option allows you to mark trees that match a series of related selection criteria by applying one rule, modifying the criteria, and applying the new rule. This option is similar to the boolean AND operation common to database applications.

### Apply rule to unmarked trees (OR)

Apply the selection rule to trees that are not marked. This option allows you to mark trees that match a series of independant selection criteria. This option is similar to the boolean OR operation common to database applications.

### Invert status (on=off, off=on)

Toggle the marked status of all trees. When this option is selected, all marked trees are unmarked and all unmarked trees are marked.
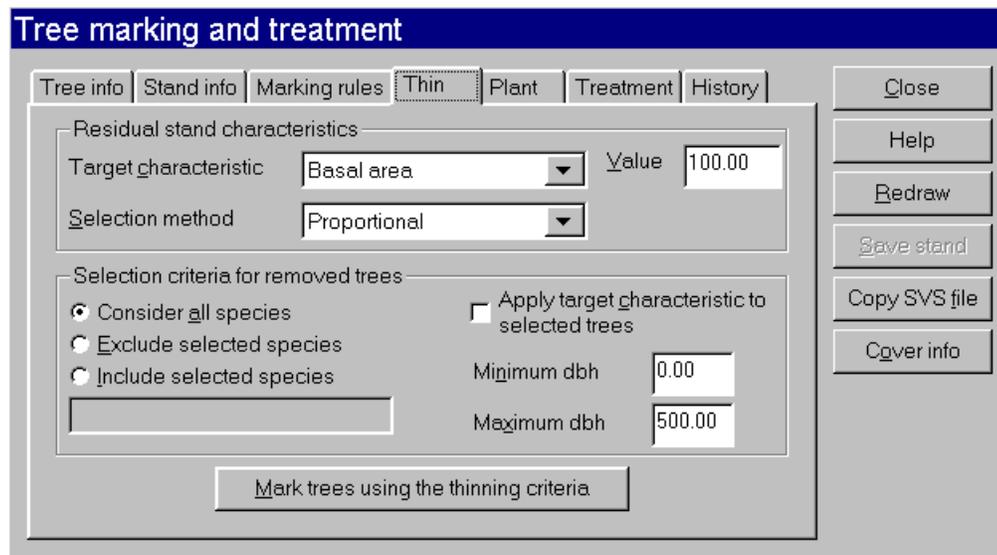
### Clear all marks

Unmark all trees in the stand.

### Mark all trees

Mark all trees in the stand.


## Using Thinning Prescriptions

Thinning prescriptions are used to mark the stand so the residual stand, if the marked trees were cut, has some desired characteristic. Thinning prescriptions are specified using the following dialog:

### Target characteristic
Specifies the characteristic used to determine how many and which trees are left in the stand (not marked). The available characteristics are: basal area, stand density index (Reineke, 1933), trees per acre (hectare), percentage of basal area, percentage of trees per acre (hectare).

### Selection method
Specifies how trees are to be selected for removal. The available methods are proportional, from above based on dbh or height, from below based on dbh or height.

### Value
Specifies the value of the target characteristic for the residual stand. Interpretation of this parameter depends on the selected target characteristic. When the target characteristics is basal area, stand density index or trees per acre (hectare) actual values are entered. When the characteristic is percentage of basal area or percentage of trees per acre (hectare) a value is entered ranging from 0.0 to 100.0.

### Consider all species
When this option is selected, all species are considered for removal.

### Exclude selected species
When this option is selected, the specified species are not considered for removal.

### Include selected species
When this option is selected, only the specified species are considered for removal.

### Apply target characteristic to selected trees
When this option is selected, the target characteristic for the stand is computed using only trees that meet the selection criteria. This allows you to treat a subset of the trees in the stand. For example, consider a case where you specify that you

want to retain 100 square feet of basal area and only trees with dbh between 10.0 and 20.0 inches be removed.  With this option turned off, all trees in the stand would be used to compute the basal area but only those trees that meet the dbh criteria will be removed.  If this option is turned on, only trees that meet the dbh criteria will be used to compute the basal area.  In this way you can develop a prescription that retains 100 square feet of basal area on trees with dbh between 10.0 and 20.0 inches regardless of the other trees in the stand.

### *Minimum dbh*
Specifies the minimum dbh for removed trees.

### *Maximum dbh*
Specifies the maximum dbh for removed trees.

### *Mark trees using the thinning criteria*
Marks the stand using the specified thinning prescription.  This option only marks the trees to be removed.  To actually remove the trees, use the Treatment tab.


## Planting New Trees

The planting option allows you to insert seedlings (or any other plants) into a stand.  This option makes use of the TBL2SVS conversion engine by creating a stand table with one record and then adding the plants represented by the stand table to the existing SVS tree list.  If you want to add a variety of seedlings or other plants, refer to the TBL2SVS help for more information.  The stand table parameters for planting are entered into the following dialog:



### *Species code*
Enter the species code for the trees/plants to be added to the stand.  The species code can be up to 15 characters long and is case sensitive.  If you use a species

code for which there is no tree form defined, SVS will draw the plants using a bright orange conifer type tree.

### Plant class
Enter the plant class value for the trees/plants to be added to the stand.  The plant class can range from 0 to 32768.  The value of 99 is reserved for use by the tree designer to represent a default form for a given species.  The interpretation of the plant class is entirely up to the user.

### Crown class
Enter the crown class value for the trees/plants to be added to the stand.  The crown class can range from 0 to 32768.  The value of 99 is reserved for use by the tree designer to represent a default form for a given species.  The interpretation of the crown class is entirely up to the user.  However, SVS can be told to recognize values of 90-98 as dead trees.  See default parameters for details.

### Status code
Enter the status code for the trees/plants to be added to the stand.  The status code tells SVS whether the tree is standing or down or a stump.  The following values are valid for the status code:

    0 or 10  Indicates the plant is cut, has branches, and is lying on the ground
    1 or 11  Indicates the plant is standing
    2 or 12  Indicates the plant is no longer present and only a stump remains
    3 or 13  Indicates the plant is cut, has no branches, and is lying on the ground

Status values 10, 11, 12, and 13 are used to designate trees that cannot have their status changed using the marking and treatment options in SVS.

### Dbh
Enter the diameter of the trees/plants to be added to the stand.  Use the same units as the trees in the rest of the stand.  If you are inserting trees that are shorter than breast height, enter the diameter at the root collar.

### Height
Enter the height of the trees/plants to be added to the stand.  Use the same units as the trees in the rest of the stand.

### Crown ratio
Enter the crown ratio of the trees/plants to be added to the stand.  Use the same units as the trees in the rest of the stand.  Valid crown rations range from 0.0 to 1.0.

### Crown width
Enter the crown width of the trees/plants to be added to the stand.  Use the same units as the trees in the rest of the stand.

### *Trees per acre (or Trees per hectare)*

Enter the number of tees/plants per acre (or hectare) to be added to the stand.  The label for this item will be changed to match the current units for the stand.

### *Plant trees*

Creates a simple stand table using the parameters entered in the dialog and then calls the TBL2SVS conversion engine to create a new stand by adding the plants represented by the stand table to the current SVS tree list.  This option results in changes to the SVS tree list that cannot be reversed.  Before this option is carried out, you will be given a chance to make a copy of the SVS tree list.

## Specifying Treatments

Treaments are applied to marked trees in the stand.  Some treatments modify a tree's status while others modify tree attributes such as crown ratio.  When a treatment  is implemented, only trees with status codes that are not locked will be changed.  This allows you to specify trees and down logs that cannot be altered, e.g., uncut, during treatments.  Treatments are specified using the following dialog:
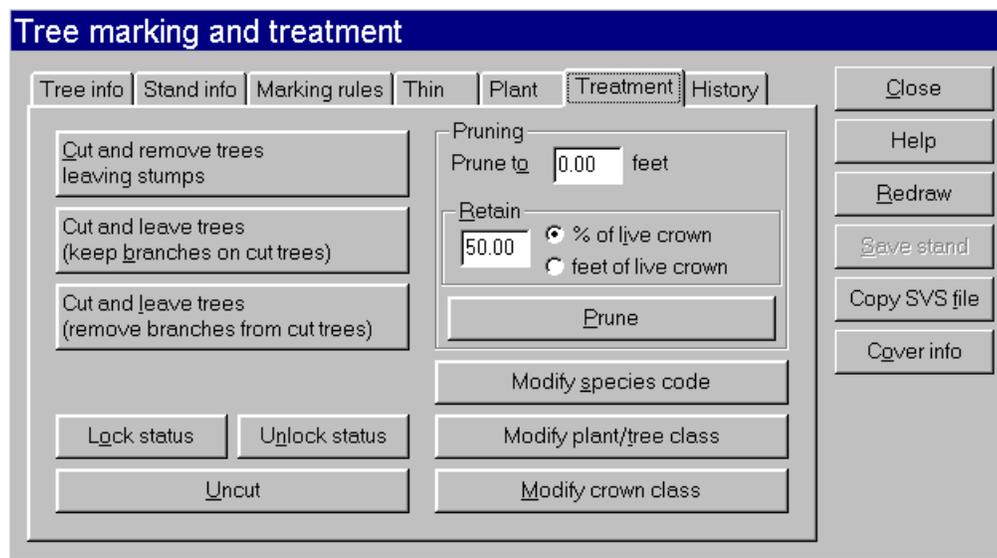


### *Cut and remove trees leaving stumps*
Change the status code of the marked trees to 2 indicating that the tree is to be drawn as a stump.

### *Cut and leave trees (keep branches on cut trees)*
Change the status code of the marked trees to 0 indicating that the tree is lying on the with branches.

### *Cut and leave trees (remove branches from cut trees)*
Change the status code of the marked trees to 3 indicating that the tree is lying on the with no branches.

### Lock status
Sets the status code of the marked trees to indicate that the tree's status cannot be changed by subsequent treatments.  This is accomplished by setting the status code to a value between 10 and 13.  Valid locked status codes are:

    10  Indicates the plant is cut, has branches, and is lying on the ground
    11  Indicates the plant is standing
    12  Indicates the plant is no longer present and only a stump remains
    13  Indicates the plant is cut, has no branches, and is lying on the ground

### Unlock status
Sets the status code of the marked trees to indicate that the tree's status can be changed by subsequent treatments.  This is accomplished by setting the status code to a value between 0 and 3.  Valid unlocked status codes are:

    0    Indicates the plant is cut, has branches, and is lying on the ground
    1    Indicates the plant is standing
    2    Indicates the plant is no longer present and only a stump remains
    3    Indicates the plant is cut, has no branches, and is lying on the ground

### Uncut
Change the status code of the marked trees to 1 to indicate the trees are standing.

### Prune to ???? feet (meters)
Specifies the pruning height in the same units as the tree heights in the SVS tree list.  The actual pruning height for individual trees will depend on the tree's height and crown ratio.

### Retain
This option allows you to retain either a percentage of a trees live crown or a specific length of live crown.  When specifying a percentage of the live crown, enter a value between 0.0 and 100.0.

When pruning trees, SVS first attempts to prune the crown up to the pruning height.  If this level of branch removal violates the retention rule, the pruning height is adjusted downward.  If trees are shorter than the pruning height, they will not be pruned.

### Prune
Apply the pruning criteria to the marked trees in the stand.  This option results in changes to the SVS tree list that cannot be reversed.  Before this option is carried out, you will be given a chance to make a copy of the SVS tree list.

### Modify species code
Allows you to change the species code for all of the marked trees.  This option results in changes to the SVS tree list that cannot be reversed.  Before this option is carried out, you will be given a chance to make a copy of the SVS tree list.

### *Modify plant/tree class*

Allows you to change the plant or tree class for all of the marked trees. This option results in changes to the SVS tree list that cannot be reversed. Before this option is carried out, you will be given a chance to make a copy of the SVS tree list.

### *Modify crown class*

Allows you to change the crown class for all of the marked trees. This option results in changes to the SVS tree list that cannot be reversed. Before this option is carried out, you will be given a chance to make a copy of the SVS tree list.

## Viewing Marking and Treatment History

SVS maintains a record of all marking and treatment activities for the current marking session. The history information is available under the History tab using the following dialog:
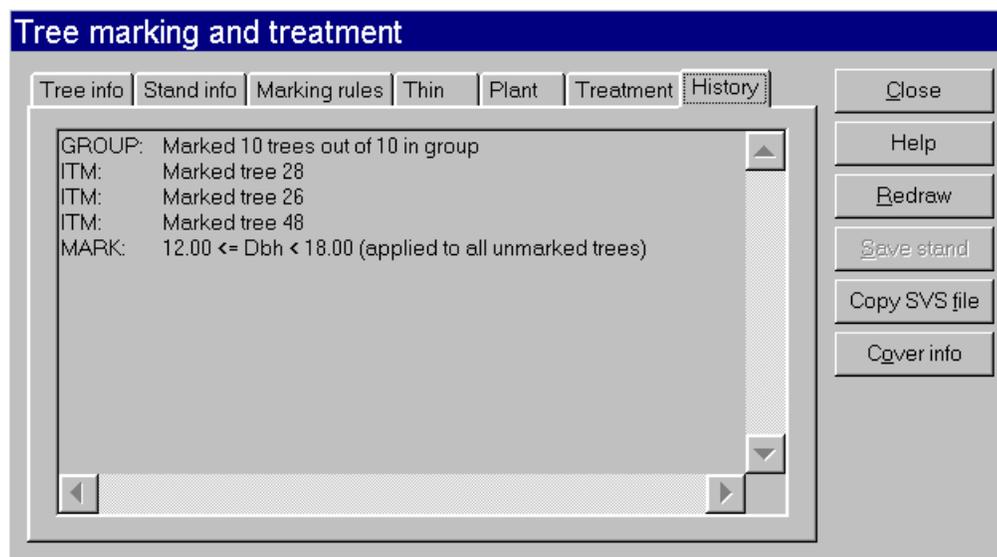


History information is only maintained for the current marking session. History information is lost when the marking dialog is closed.

# Computing Cover Estimates

SVS can compute canopy cover estimates for any stand. Parameters that specify how the estimate is calculated are specified using the following dialog:

## Canopy cover information

**Cover estimation method**
- ⦿ Use graphical method based on overhead view
- ○ Use equation: Cover = 100.0 * (1.0 - exp (-1.0 * (total crown area / plot area)))
- ☑ Use subplot to sample cover (area of subplot = 0.5 * plot area)

**Trees included in cover estimate**
- ⦿ Use all standing trees to estimate cover
- ○ Estimate cover using marked standing trees only
- ○ Estimate cover using unmarked standing trees only

Select 'Compute cover' to calculate the canopy cover

[ Close ]    [ Compute cover ]    [ Help ]

### Cover estimation method
SVS provides two methods to calculate cover estimates.  The first use a graphical method where an overhead view of the stand is drawn and the resulting image scanned to determine canopy cover.  The second method uses the following formula to estimate cover:

$$cover = 100.0 * (1.0 - exp(-1.0 * (total\ crown\ area\ /\ plot\ area))$$

This formula is from the theory of geometrical probability for randomly located figures on a plane as described in Crookston and Stage 1999.  This formula produces good estimates provided the tree locations are randomly distributed.  It does not rely on the spatial locations of trees so its estimate will not necessarily match the estimate computed using the graphical mehtod.

### Use subplot to sample cover
When using the graphical method to estimate canopy cover, SVS can use a sub-plot to sample the actual cover value.  If the entire SVS stand area is scanned, the cover estimate will be off slightly because tree crowns of trees located outside of the SVS stand that have a portion of their crown within the SVS stand area are not considered.  By sampling a portion of the stand area, a more consistent estimate is achieved.  If you are trying to quantify the difference between treatments that are not applied uniformly to the stand, you may want to turn off this option to minimize the effect of the openings created near the center of the stand.

### Trees included in cover estimate
SVS considers only standing trees when estimating cover.  These options allow you to use SVS's marking and treatment capabilities to estimate the canopy cover associated with specific strata in a stand.  For example, using the marking rules you

could mark the tallest trees in a stand and then compute the cover using the marked trees to obtain an estimate of the cover for the strata.

SVS does not know whether or not trees are dead so any standing dead trees are included in cover estimates.  If you have used special combinations of tree and crown class values to indicate live and dead trees, you can use the marking rules to remove the dead trees from the trees considered in the cover estimate.

*Compute cover*
This button tells SVS to compute the cover estimate using the selected parameters. Results of the calculation are shown in the edit control labeled "Select 'Compute cover' to calculate the canopy cover.

# Changing the Appearance of SVS Trees Using the Tree Designer

Tree forms used to represent individual species of tree and other plants are specified using the following dialog:

SVS Tree Designer -- ORGANON.TRF
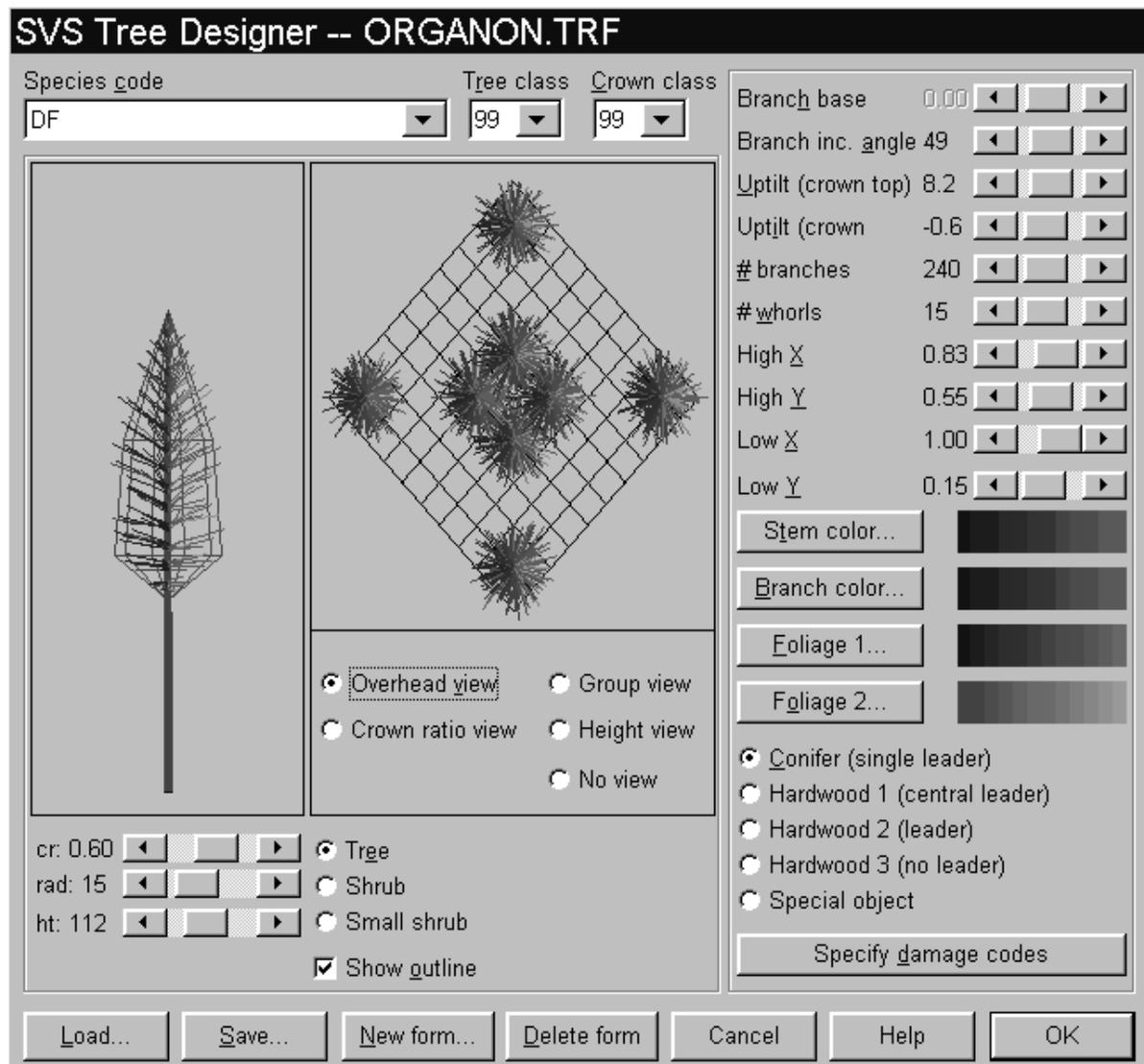
## Design tree window and controls

The design tree window and its associated controls are used to view and control the attributes of a typical tree represented by the form being manipulated.  The controls affect only the appearance of the tree displayed in the tree designer.

The control labeled "cr" represents the crown ratio.  The control labeled "rad" represents the crown radius.  The control labeled "ht" represents the height.  The radio buttons labeled "Tree", "Shrub", and "Small shrub" can be used to change the scaling of the design tree window.  The "Tree" scale works best when the height of the design tree is set to a value larger than 50.  The "Shrub" and "Small shrub" scales work best when designing small trees and herbaceous plants (generally less than 50 feet  or 50 meters tall).  The "Show outline" checkbox controls the display of the overall crown shape.  If the number of branches is set to 0, the wireframe shape will not be displayed regardless of the setting of this checkbox.

## Auxiliary view window and controls

The auxiliary view is used to display trees and other plants as they appear in an SVS image. The overhead view shows a group of eight plants as seen from overhead. The overhead view can be used to make sure that the setting of the branch increment angle results in the desired crown shape and density when viewed from above. The crown ratio view shows a group of trees drawn with varying crown ratios. This view can be used to make sure the plant form represents a variety of crown sizes correctly. The group view shows a group of trees drawn with varying heights and, to some extent, crown ratios. This view can be used to make sure different size trees are represented correctly and to evaluate the apparent crown density when tree crowns overlap. The height view displays a group of trees with varying heights. This view differs from the group view in that the trees are regularly spaced.

### *Species code*
The species code control lists all species currently represented in the set of tree forms. Making a selection from this list displays the first tree form defined for the species and allows you to make changes to the form definition parameters.

### *Tree class*
The tree class list lists all tree class values currently represented for the current species. Making a selection from this list display the associated form and allows you to make changes to the form definition parameters.

### *Crown class*
The crown class list lists all crown class values currently represented for the current species and current tree class. Making a selection from this list display the associated form and allows you to make changes to the form definition parameters.

### *Branch base*
Location of branching point relative to base of live crown. The branch base normally ranges from 0.0 to 1.0 but it can be less than 0.0 to move the branches below the crown. *Applies to multiple leader plant forms only.*

### *Branch increment angle*
Angular increment between branches and leaf structures. The increment angle controls the appearance of tree crowns in overhead views. To maintain full crowns, the increment angle should not divide evenly into 360.0.

### *Uptilt of branches at the top of the crown*
Branch insertion angle for branches located near the top of the crown. To determine the actual insertion angle, a value is interpolated between the branch angle at the base and top of the crown.

### Uptilt of branches at the base of the crown
Branch insertion angle for branches located near the base of the crown.  To determine the actual insertion angle, a value is interpolated between the branch angle at the base and top of the crown.

### Number of branches/leaves
For single leader plant forms, "# branches" refers to the number of branches.  For multiple leader plant forms, "leaves" refers to the number of leaf structures.

### Number of whorls/branches
For single leader plant forms, "# whorls" refers to the number of branch whorls.  If 0, limbs are distributed uniformly along the stem.  For multiple leader plant forms, "# branches" refers to the number of heavy branches in the canopy.  Multiple leader plants are always drawn with at least three heavy branches regardless of the value of this parameter.

### High X
X value of the point defining the high point of the crown.  Either the high or low point x should be 1.0 to prevent scaling of crown widths.  See the discussion of crown shape below for additional information.

### High Y
Y value of the point defining the high point of the crown.  See the discussion of crown shape below for additional information.

### Low X
X value of the point defining the low point of the crown.  Either the high or low point x should be 1.0 to prevent scaling of crown widths.  See the discussion of crown shape below for additional information.

### Low Y
Y value of the point defining the low point of the crown.  See the discussion of crown shape below for additional information.

### Stem color
Color used for the stem of the plant.  See Specifying colors for tree forms for additional information.

### Branch color
Color used for branch portion of a limb.  For single leader plant forms, 25 percent of each limb is considered branch and is colored using the branch color.  For multiple leader plant forms, the entire heavy branch structure is colored using the branch color.  See Specifying colors for tree forms for additional information.

### Foliage color 1
Color used for 75 percent of the crown foliage.  See Specifying colors for tree forms for additional information.

*Foliage color 2*
Color used for 25 percent of the crown foliage.  See Specifying colors for tree forms for additional information.


## Overall plant form

Specify the overall growth form for the current tree form.  The overall growth form controls the type of plant, the general branching characteristics, and the presence of individual leaves.  Some labels on the dialog change depending on the overall plant form selected.

SVS represents four plant forms, one single and three multiple leader forms, and a special object form.  The single leader form (A below), intended to represent coniferous species, consists of a single, central stem with branches projecting from the stem center.  Branches may be arranged in whorls or evenly distributed along the stem.  The multiple leader forms (B, C, D), intended to represent deciduous species, consists of a stem base below the crown, a central leader within the crown, branches, and leaves.  The three different multiple leader forms represent growth forms that have a strong central leader with branches uniformly distributed throughout the live crown (B), growth forms that have a central bole in the live crown but most of the branches are located in the lower portion of the live crown (C), and growth forms that have no central bole in the live crown (D).  For all multiple leader plant forms, the height of the base stem (below the first branch) relative to the total plant height can be controlled along with the distribution, number and insertion angle of the branches.  Leaves are represented as a cloud of triangles positioned around the perimeter of the crown.

SVS represents one single (A) and three multiple (B, C, D) leader plant forms.

### *Damage codes*

Initiate a process to specify damaged foliage or dead branches for a particular tree form.

### *Load...*

Load a new set of tree form definitions for modification and use in SVS. The newly loaded forms will be used to draw tree lists in SVS provided the tree lists do not specify a tree form definition file using the #TREEFORM command.

### *Save...*

Save the current set of tree form definitions.

### *New form...*

Create a new tree form from scratch or based on an existing tree form.

### *Delete form*

Delete the current tree form as defined by it species code, tree class, and crown class. Forms are not fully deleted until the tree form definition file is saved.


## Crown shape

Crown shape for both single and multiple leader growth forms is defined by two points as shown below, called the high and low crown points. These points define the extent and overall shape of a plant crown. The branches on single leader forms will closely follow the crown shape defined by the high and low points. The heavy branches on multiple leader forms can be located independent of the high and low points. The leaves on multiple leader forms are arranged to produce a rounded crown, the outline of which is controlled by the high and low points.

Crown shape for plant forms is defined by two points.

The meaning of some parameters changes depending on the overall plant form. The following table shows the parameters that have different meanings for single and multiple leader plant forms. In some cases, the parameter label changes when the plant form is changed.

| | **Interpretation for:** | |
| --- | --- | --- |
| **Parameter** | **Single leader form** | **Multiple leader form** |
| Branch base | Not used | Defines the lower limit for branch placement and the relative height of the base stem |
| # branches/leaves | Total number of branches | Total number of leaves |
| # whorls/branches | Number of whorls | Number of branches |

## Special Objects

Special objects, shown below, are predefined by SVS. Only their size, color, and orientation can be changed.

SVS provides special objects that can be included in a component list.

SVS defines special objects for use in stand images. The objects, shown above, are fixed in appearance. Only their location, size, orientation, and color can be changed. The following table describes the tree list and plant form definition parameters that influence the characteristics of special objects defined by SVS.

| **Special object** | **Parameter** | **Influence** |
| --- | --- | --- |
| CAR, TRUCK | Height | Height of the vehicle |
| | Crown radius 1 | Length of the vehicle |
| | Felling angle | Orientation of the vehicle |
| | Stem color | Color of the vehicle body |

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| | | |
|---|---|---|
| | Branch color | color of the vehicle windows |
| | Foliage color 1 | Color of the wheels |
| CUBE, TETRAHEDRON | Height | Height of the geometric solid |
| | Crown radius 1 | Width and length of the geometric solid |
| | Felling angle | Orientation of the geometric solid |
| | Stem color | Color of the geometric solid |
| CRANETOWER | Diameter | Diameter of the tower |
| | Height | Height of the tower |
| | Stem color | Color of the tower and lattice elements |
| | X, Y, Elevation | Position of the tower base |
| CRANEBOOM | Diameter | Diameter of the boom |
| | Stem color | Color of the boom and lattice elements |
| | Crown radius 1 | Length of the boom behind the pivot point |
| | Crown radius 2 | Length of the boom in front of the pivot point |
| | X, Y, Elevation | Position of the boom pivot point. The pivot point should be located directly above the tower base (same X and Y). |
| MARKER | Diameter | Diameter and overall height of the marker |
| | Stem color | Color of the marker |
| | X, Y, Elevation | Position of the center of the marker. Marker will extend above and below the center location. |
| ROCK | Diameter | Diameter of rock at widest point |
| | Height | Height of rock |
| | Stem color | Color of rock |
| RANGEPOLE | Diameter | Diameter of the pole |
| | Height | Height of the pole |
| | Stem color | Color of odd-numbered stripes on pole |
| | Branch color | Color of even-numbered stripes on pole |
| | X, Y, Elevation | Position of the base of the range pole |

## Specifying damage codes for tree forms

Tree damage is specified using the following dialog:
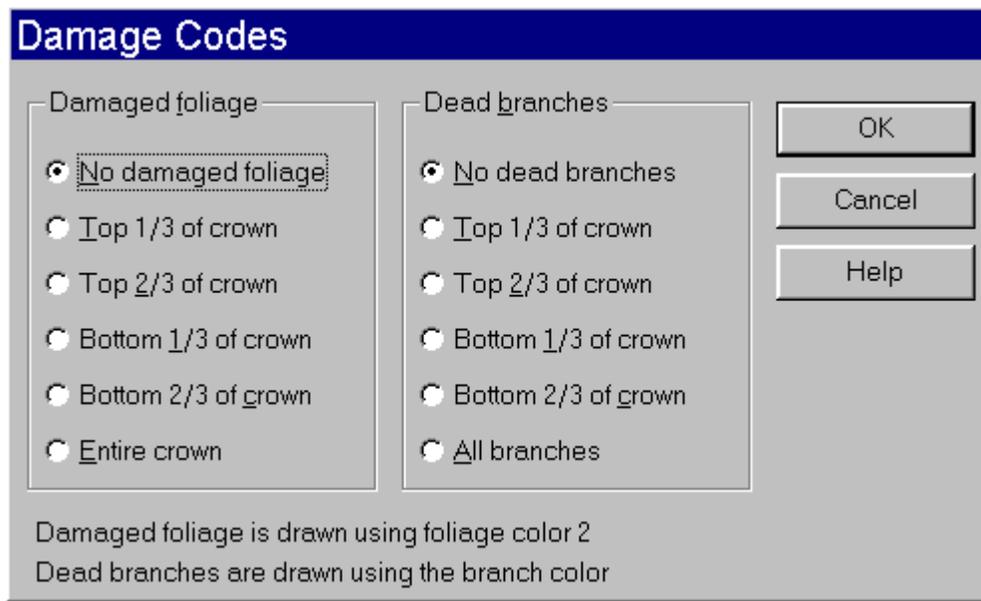
### Damaged foliage

Damaged foliage is represented in SVS by drawing the outer 1/4 of conifer branches and 25% of hardwood leaves using foliage color 2.  Damage is represented in portions of the crown as shown in the dialog.

### Dead branches

Dead branches are represented in SVS by drawing entire conifer branches and 25% of hardwood leaves using the branch color.  Dead branches are represented in portions of the crown as shown in the dialog.  Dead branches are not represented on multiple leader (hardwood) growth forms.

## Creating a new tree form

The parameters needed to create a new tree form are specified using the following dialog:

## Create a new tree form from scratch

When creating a new plant form from scratch, the use must specify the species, tree class and crown class for the new plant form.  If the values entered for these parameters are already represented by another form definition, the user is asked to specify new values.

## Base a new tree form on an existing form

When creating a new plant form, it is often desirable to start with one plant form and modify if to produce another.  When creating a new plant form based on an existing form, the user can select the form too use as the model and then they are asked to change the species, tree class, or crown class for their new plant form.

## Tree and crown class values

When defining several plant forms for the same species, you should use the tree class and crown class to control the use of a specific form for a component in the stand component list.  SVS searches through all form definitions as it draws each stand component.  If it finds an exact match for the species, tree class, and crown class, it will use the corresponding form definition to draw the plant.  If no exact match is found, SVS looks for a species match and either a tree class match and a crown class value of 99 or a tree class value of 99 and a crown class match.  In this way, the value of 99 serves as a "wild-card" and will match any other value for tree or crown class.  Finally, SVS uses plant form definitions with a tree and crown class of 99 to draw individuals of a given species with no better match in the current set of form definitions.  If a component for which there is no species match is encountered, SVS will use and internal default plant form definition that uses color 0 of the palette.  This results in a bright orange plant.

# Process for Creating a New Plant Form

The tree designer dialog box is designed to provide flexibility in the procedure used to define plant forms.  Parameters can be changed in any order, however, the following procedure is recommended when adding new plant forms:

1   Click the "New form..." button on the tree designer dialog to initiate the process of adding a plant form definition.

2   Select either the "Create a new tree from scratch" or "Base a new tree form on an existing form" option.  When creating a form from scratch, you will start with the SVS default tree and make modifications to achieve the desired appearance.  When basing a new form on an existing form, you will start with the existing form's parameters and make modifications to achieve the desired appearance.
Enter or modify the species, tree class and crown class.  Using values of 99 for both the tree and crown classes will provide a "wild card" plant form definition that will match any combination of tree and crown classes for a given species in a tree list.  Plant forms defined with other values for tree and crown class will match only individuals in a tree list with the same tree and crown class values.

3   Select the plant growth form, either single leader or one of the multiple leader forms.  If you are defining new characteristics for a special object, select "Special object form".  You cannot add definitions for new special objects.  You can only define a new set of attributes for a new instance of a special object .  When adding new special object instances, use the tree and crown class values to differentiate between attribute sets.

4   Set the crown ratio, crown width and total plant height using the controls for the design tree.  Set the values to correspond to those typical for the species or plant form being created.  Remember that these values do not affect the size of stand components or special objects drawn by SVS, only the size of the plant or object drawn in the tree designer dialog box.

5   Select the scaling option for the design tree.  "Tree" is appropriate for large plant forms and tall special objects (RANGEPOLE, CRANETOWER, CRANEBOOM), "Shrub" and "Small shrub" are appropriate for small plant forms and short special objects (ROCK, CAR, TRUCK, MARKER).

6   Modify the crown shape parameters to achieve the desired crown shape.  You can temporarily reduce the number of branches to make the wireframe crown shape indicator more visible.

7   Modify the number of branches or leaves and the branch arrangement parameters to achieve the desired crown density and branching structure.

8   Modify the colors used for the various plant components.

9   You can select the "Save..." button to save your changes or you can make additional changes and then save the form definitions.  If you make changes and do not save the changes, they will be lost if you select the "Cancel" button.  You will be prompted to save your changes if you select the "Ok" button.

## Specifying parameters to identify a new tree form

The parameters that identify a new tree form are specified using the following dialog:
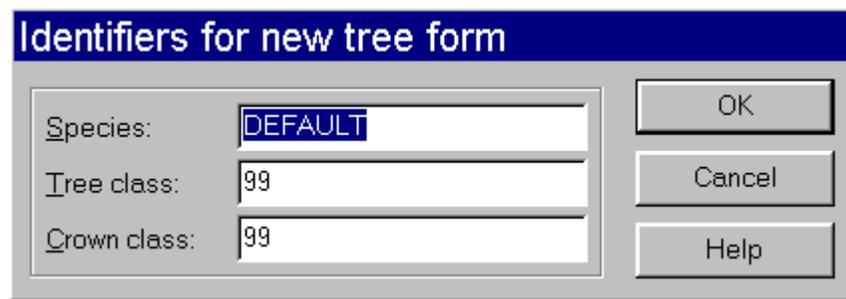


*Species code*

Species codes can be any combination to letter and numbers and can contain spaces. Species codes can be up to 15 characters long.

## Tree and crown class values

Tree and crown class values can range form 0 to 32,767. Values of 99 serves as a "wild card" as explained below. Tree and crown class codes are generally used to differentiate individuals of a species that exhibit different growth form characteristics as they mature and eventually die or different types of damage. For example, a different tree class might be used to distinguish between a seedling and a mature tree while different crown class values might represent diseased and healthy trees. The use of the tree and crown class parameters is completely up to users. SVS only recognizes the values of 99 to have special meaning.

When defining several plant forms for the same species, you should use the tree class and crown class to control the use of a specific form for a component in the stand component list. SVS searches through all form definitions as it draws each stand component. If it finds an exact match for the species, tree class, and crown class, it will use the corresponding form definition to draw the plant. If no exact match is found, SVS looks for a species match and either a tree class match and a crown class value of 99 or a tree class value of 99 and a crown class match. In this way, the value of 99 serves as a "wild-card" and will match any other value for tree or crown class. Finally, SVS uses plant form definitions with a tree and crown class of 99 to draw individuals of a given species with no better match in the current set of form definitions. If a component for which there is no species match is encountered, SVS will use and internal default plant form definition that uses color 0 of the palette. This results in a bright orange plant.

## Specifying colors for tree forms

Colors for the stem, branches, and foliage of trees forms are selected using the following dialog:
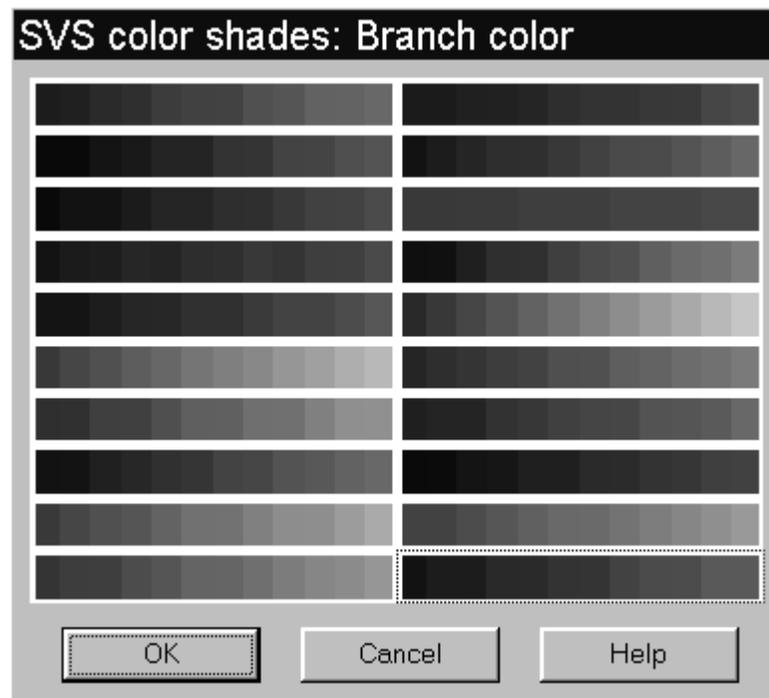
To select a color from the dialog you can simply double click on the desired color or you can single click on the color and then select to Ok button. This dialog is used to specify the shades of color used to draw individual trees, plants, and other objects in SVS. The specific color within a shade is dependent on the orientation of the object and the location of the modeled light source in SVS.

# Creating an SVS Scene Description for Use in Other Programs

## Working with ground surface definition files

SVS can "drape" a simple raster map over the ground surface. Using this feature, you can delineate specific features such as sample plot locations, roads, and streams on the ground surface. Ground surface definitions are stored in "Ground surface definition files", ASCII text files containing an array of single character attribute data with one character representing one grid cell. Ground surface information is independent of stand component information.

SVS allows you to load a surface definition file that you have created or it can create a surface definition using a random color pattern based on one of the SVS color shades. The following dialog is used to specify a ground surface definition:

**Ground surface definition** dialog box:
- Don't use a ground surface definition (selected)
- Use ground surface definition file
  - Browse...
- Create ground surface definition
  - Grid size: 32 * 32 cells
  - Color shade: Color shade 1    Colors...
- OK   Cancel   Help
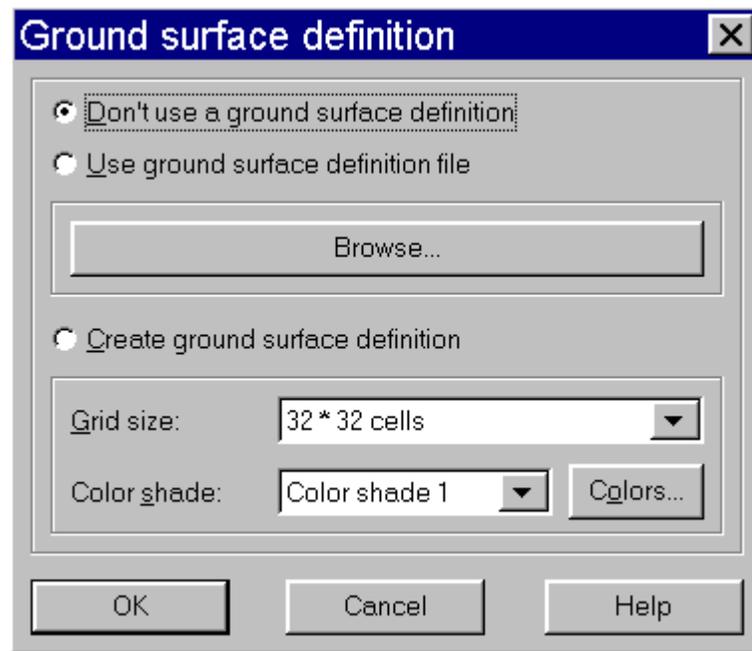
*Use ground surface definition file*
Allows you to specify an existing ground surface definition file for use with the SVS stand currently loaded.  The specified definition file only displayed with the stand currently loaded.  It is not associated with the stand for future use.  To associated a definition file with a stand, see Individual tree lists for information about the #GROUNDFILE command.

*Create ground surface definition*
This option creates a ground surface definition and displays it with the stand currently loaded.  Ground surface definition is created using a single SVS color.  Individual cells in the definition file are randomly assigned a specific shade within the color.  The ground definition can be up to 256 by 256 cells (or pixels).

The following color shades are used in SVS:
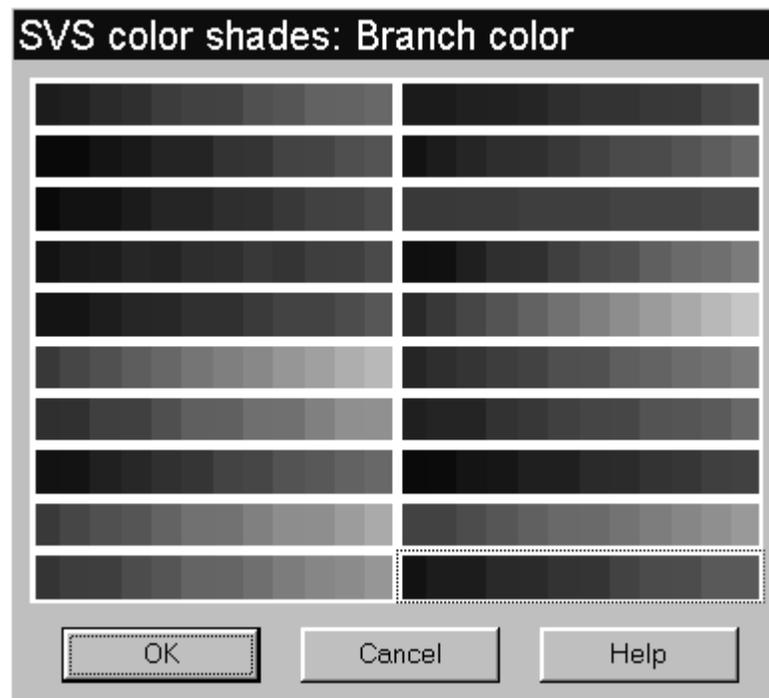
## Tree list information

The **Display|Tree list info...** menu choice displays summary information from the tree list file currently loaded into SVS. This information is contained in the header of the tree list file. The following dialog is used to display the information:

**SVS Tree List Information**

```
Tree list index file: d:\code\winsvs\org2svs\120201x.svs
Tree list file: d:\code\winsvs\org2svs\120201x.001
Title from tree list file: " ALL SPECIES Age: 97 "
No ground definition file specified
No palette file specified
Tree form definition file: ORGANON.TRF
Tree list origin: (0.00,0.00)
Tree list size: 208.71 by 208.71
Tree list uses English units
Tree list uses Format 2 format
Tree list shape code: Square
```

OK    Help

## SVS Error Log

When errors occur within SVS, an error log file is created and the SVS window title is changed to reflect the error conditions. Selecting the **Display|SVS error log...** menu option displays the contents of the error log file in the following dialog:

### *Clear error log*

Clears the current error messages(s) and removes the error notification from the SVS window title.

# Using SVS Help

# Checking for New Versions of SVS

# SVS Command Line Options

SVS is designed as an interactive program, however, command line options provide some batch mode functionality. All command line parameters are optional. If the *treefile* parameter is specified, it must be the last parameter on the command line.

## Syntax

> SVS   *-Aangle -Cfile -Ddist -Eelev -F -G -H -I -Lfl -N -Parrangement - Qqual -Selev -T"title" -Vpt -1 -3treefile*

## Parameter Description

**Parameter  Description**

| | |
|---|---|
| *treefile* | Name of stand file to load and display at startup (default extension .SVS). Titles specified using a #TITLE command in a tree list will override a title specified on the command line. |
| *-A angle* | Azimuth from the center of the SVS plot to the viewpoint location. Changing the azimuth allows you to change the initial viewpoint used in SVS. |
| *-C file* | Capture screen to a file named *file* and exit. If the tree list given on the command line for SVS is a tree list index, each individual tree list specified in the index will be loaded and drawn. The resulting image files will be named *file*.I## where ## corresponds to the image number in the sequence of images. When capturing a series of files, drawing of an individual stand can be stopped by pressing the right mouse button while the mouse cursor is located within the status dialog. When the Cancel button becomes active, clicking it will stop capture of all stands. |

The default format for image captures is a 640 by 480 windows bitmap file using 8-bit color. Future version of SVS will allow you to change the default format and image size.

*-D dist*   Distance from the viewpoint to the center of the stand. The value *dist* can be any distance greater than zero so long as the resulting viewpoint location does not end up within the plot represented in SVS.

*-E elev*   Initial viewpoint elevation for the perspective view. *elev* can be any value greater than zero.

*-F*     Shift to full screen display at startup.

*-G*     Display the ground grid in SVS. The default behavior in SVS is to display the ground grid only while the viewpoint or focus point locations are being changed.

*-H*     Display command line syntax and exit.

-I      Run the image display program, specified in the SVS preferences, after capturing a series of SVS images. This option is usually used with the -C option where the SVS file is a tree list index containing references to several individual SVS tree lists.

*-L fl*    Focal length for the lens used to generate the perspective view. Changing the focal length allows you to zoom in (larger picture) or out (smaller picture). Valid values for *fl* range from 20 to 400 millimeters.

*-N*     Suppress the warning message regarding 256-color operation when SVS is run in 16-color modes.

*-Q qual*   Tree quality for the perspective view where # is one of the following

      0 -- no trees
      1 -- stems only
      2 -- wireframe trees
      3 -- solid trees
      4 -- brushy trees.

*-S elev*   Initial focus point elevation for the perspective view. *elev* can be any value greater than zero. Changing the elevation of the focus point simulates tilting your head up and down.

| | |
|---|---|
| *-T "title"* | Display the title *"title"* across the top of the screen.  the title must be enclosed in quotation marks. |
| *-V pt* | Initial viewpoint location for the perspective view.  Valid *pt* locations are shown in figure 20. |
| *-1* | Shift to full screen display at startup displaying the perspective view only. |
| *-3* | Shift to full screen display at startup displaying the perspective, overhead, and profile stand views. |
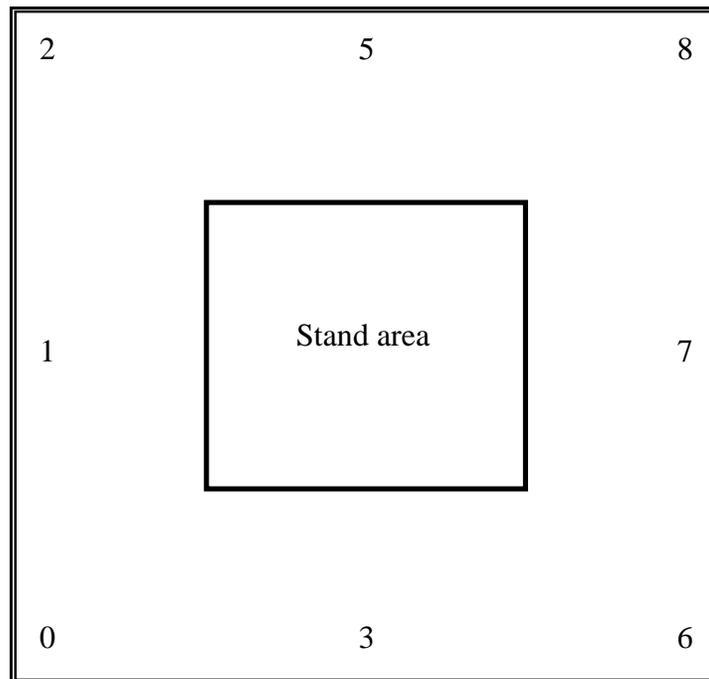


Valid viewpoint locations for *-V* command line option.

The most common use of command line parameters is to specify a tree list for display as follows (in this case a file named TREE5.svs):

    SVS TREE5

The command line options can also be used to automate stand image generation and capture.  The command line:

    SVS -F -CIMAGE.PCX TREE5

tells SVS to load the tree list named TREE5.SVS, display the perspective image in full screen mode, capture the screen to a PCX file named "IMAGE.PCX" and exit. Use of the -A, -D, -E, -L, -S, and -V options allow you to control the initial viewpoint for the captured stand image.

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If the SVS command line specifies a tree list index file along with the -C option, images representing each tree lists in the index will be rendered and saved. Image file names will consist of the base capture name and a zero-padded numeric extension. If the file, INDEX.SVS is a tree list index containing 3 tree lists, the command line:

    SVS -F -CIMAGE.BMP INDEX

will produce 3 image files named IMAGE.I01, IMAGE.I02, and IMAGE.I03. In addition to the individual image files, a list file named, IMAGE.LST, will be created for use with image viewing utilities distributed with SVS.

## References

Crookston, Nicholas L.; Stage, Albert R. 1999. Percent canopy cover and stand structure statistics from the Forest Vegetation Simulator. Gen. Tech. Rep. RMRS-GTR-24. Ogden, UT. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 11 p.

Hann, David W.; Olsen, Christina L.; Hester, Arlene S. 1993. ORGANON user's manual. Corvallis, OR: Department of Forest Resources, Oregon State University.

McGaughey, Robert J. 1997. Visualizing forest stand dynamics using the stand visualization system. In: Proceedings of the 1997 ACSM/ASPRS Annual Convention and Exposition; April 7-10, 1997; Seattle, WA. Bethesda, MD: American Society of Photogrammetry and Remote Sensing. 4:248-257.

Wykoff, William, R.; Crookston, Nickolas L.; Stage, Albert R. 1982. User's guide to the stand prognosis model. Gen. Tech. Rep. INT-133. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 112 p.

# Appendix A:  SVS File Formats

# SVS Tree Form Definitions

Users define plant forms for all species present in a tree list.  When a species exhibits several growth forms or has different appearances due to insect or disease damage, age, or crown position, users can define addition plant form definitions to represent multiple plant forms for a single species.  The primary identifier used to match a tree from a tree list to a plant form definition is the species code.  When more than one plant form is desired for a species, the tree class and crown class parameters are used to differentiate the additional plant form definitions.  You should use the tree designer feature of SVS to modify or create plant forms .  SVS does not validate the data in a plant form definition file before trying to use the definitions it contains.  If you include erroneous values for parameters, SVS may produce unusual plants forms or exhibit unstable behavior.

## *Parameter Description*
SVS uses the following parameters to describe plant form:

| Parameter | Description |
|---|---|
| species | Species identifier.  May be numeric or alphanumeric up to 15 characters long.  SVS reserves some species names for special objects (RANGEPOLE, MARKER, CRANEBOOM, CRANETOWER, CAR, TRUCK, CUBE, TETRAHEDRON) |
| tree class | User-defined parameter used to classify or differentiate individual plant forms within a species. |
| crown class | User-defined parameter used to classify or differentiate individual plant forms within a species. |
| plant type | Overall plant form.  May be 15 for special objects, 0 for single leader form, 1 for multiple leader form with a strong central leader, 2 for multiple leader form with a weak central leader, or 3 for multiple leader form with no central leader.  The plant type parameter also contains damage information for the plant.  The plant type parameter is interpreted as a two-byte integer with the lower four bits used for the overall plant form.  Bits 5, 6, 7, and 8 are used to encode the foliage damage and bits 9, 10, 11, and 12 are used to encode the branch damage. |

Foliage damage codes are:
0    no damage
1    top 1/3 of crown has foliage damage
2    top 2/3 of crown has foliage damage
3    bottom 1/3 of crown has foliage damage
4    bottom 2/3 of crown has foliage damage
5    entire crown has foliage damage
Branch damage codes are:
0    no damage

|   |   |
|---|---|
| 1 | top 1/3 of crown has dead branches |
| 2 | top 2/3 of crown has dead branches |
| 3 | bottom 1/3 of crown has dead branches |
| 4 | bottom 2/3 of crown has dead branches |
| 5 | entire crown has dead branches |

| | |
|---|---|
| #branches/leaves | For single leader plant forms, "# branches" refers to the number of branches.  For multiple leader plant forms, "leaves" refers to the number of leaf structures. |
| #whorls/branches | For single leader plant forms, "# whorls" refers to the number of branch whorls.  If 0, limbs are distributed uniformly along the stem.  For multiple leader plant forms, "# branches" refers to the number of heavy branches in the canopy.  Multiple leader plants are always drawn with at least three heavy branches regardless of the value of this parameter. |
| branch base | Location of branching point relative to base of live crown. Applies to multiple leader plant forms only. |
| branch increment angle | Angular increment between branches and leaf structures. |
| high point x | X value of the point defining the high point of the crown. Either the high or low point x should be 1.0 to prevent scaling of crown widths. |
| high point y | Y value of the point defining the high point of the crown. |
| low point x | X value of the point defining the low point of the crown. Either the high or low point x should be 1.0 to prevent scaling of crown widths. |
| low point y | Y value of the point defining the low point of the crown. |
| branch angle at top of crown | Branch insertion angle for branches located near the top of the crown.  To determine the actual insertion angle, a value is interpolated between the branch angle at the base and top of the crown. |
| branch angle at base of crown | Branch insertion angle for branches located near the base of the crown.  To determine the actual insertion angle, a value is interpolated between the branch angle at the base and top of the crown. |
| stem color | Color used for the stem of the plant. |
| branch color | Color used for branch portion of a limb.  For single leader plant forms, 25 percent of each limb is considered branch and is colored using the branch color.  For multiple leader plant forms, the entire heavy branch structure is colored using the branch color. |
| foliage color 1 | Color used for 75 percent of the crown foliage. |
| foliage color 2 | Color used for 25 percent of the crown foliage. |
| sample height | Height used for the plants drawn in the tree designer dialog box. |
| sample crown ratio | Crown ratio used for the plants drawn in the tree designer |

| | |
|---|---|
| | dialog box. |
| sample crown radius | Crown radius used for the plants drawn in the tree designer dialog box. |
| sample scale | Scale used for the single plant window in the tree designer dialog box.  Valid scales are: |

0   Tree scale
1   Shrub scale
2   Small shrub scale

### *Example tree form definition file*

The following file provides and example of a tree form definition file for several conifer species designated by 2-letter codes.  Each species is represented as a dead tree (plant class of 98) and a live tree (plant class of 99).  This file is intended as an example only.  Modifications to tree form definitions should be made using the SVS tree designer.

| ;Species<br>; code | Plant<br>class | Crown<br>class | Plant<br>form | #<br>branches | #<br>whorls | Branch<br>base | Branch<br>angle | Low pt<br>X | Low pt<br>Y | High pt<br>X | High pt<br>Y | Base<br>uptilt | Top<br>uptilt | Stem<br>color | Branch<br>color | Foliage<br>color 1 | Foliage<br>color 2 | Sample<br>height | Sample<br>cratio | Sample<br>cradius | Scale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AF | 98 | 99 | 0 | 370 | 24 | 0.00 | 32 | 1.00 | 0.01 | 0.12 | 0.87 | -2.50 | 3.80 | 8 | 16 | 14 | 0 | 92.0 | 0.70 | 8.00 | 0 |
| AF | 99 | 99 | 0 | 370 | 24 | 0.00 | 32 | 1.00 | 0.01 | 0.12 | 0.87 | -2.50 | 3.80 | 8 | 16 | 6 | 18 | 92.0 | 0.70 | 8.00 | 0 |
| DF | 98 | 99 | 0 | 240 | 15 | 0.00 | 49 | 1.00 | 0.15 | 0.83 | 0.55 | -0.60 | 8.20 | 10 | 10 | 0 | 9 | 112.0 | 0.60 | 15.00 | 0 |
| DF | 99 | 99 | 0 | 240 | 15 | 0.00 | 49 | 1.00 | 0.15 | 0.83 | 0.55 | -0.60 | 8.20 | 10 | 10 | 18 | 11 | 112.0 | 0.60 | 15.00 | 0 |
| S | 98 | 99 | 0 | 120 | 21 | 0.00 | 68 | 1.00 | 0.01 | 0.78 | 0.73 | -1.60 | -0.60 | 13 | 17 | 10 | 14 | 124.0 | 0.55 | 11.00 | 0 |
| S | 99 | 99 | 0 | 220 | 35 | 0.00 | 68 | 1.00 | 0.01 | 0.78 | 0.73 | -1.60 | -0.60 | 13 | 17 | 6 | 7 | 124.0 | 0.55 | 11.00 | 0 |
| GF | 98 | 99 | 0 | 280 | 19 | 0.00 | 29 | 1.00 | 0.15 | 0.68 | 0.60 | -3.90 | 2.20 | 10 | 3 | 14 | 0 | 108.0 | 0.55 | 13.00 | 0 |
| GF | 99 | 99 | 0 | 280 | 19 | 0.00 | 29 | 1.00 | 0.15 | 0.68 | 0.60 | -3.90 | 2.20 | 10 | 3 | 6 | 18 | 108.0 | 0.55 | 13.00 | 0 |
| LP | 98 | 99 | 0 | 90 | 17 | 0.00 | 41 | 1.00 | 0.17 | 0.11 | 0.87 | -0.10 | 7.80 | 13 | 10 | 0 | 9 | 94.0 | 0.50 | 9.00 | 0 |
| LP | 99 | 99 | 0 | 180 | 22 | 0.00 | 41 | 1.00 | 0.17 | 0.21 | 0.88 | -0.10 | 9.40 | 13 | 10 | 7 | 18 | 94.0 | 0.50 | 12.00 | 0 |
| PP | 98 | 99 | 0 | 90 | 26 | 0.00 | 49 | 1.00 | 0.11 | 0.75 | 0.80 | -0.60 | -0.20 | 1 | 9 | 1 | 2 | 120.0 | 0.50 | 11.00 | 0 |
| PP | 99 | 99 | 0 | 230 | 33 | 0.00 | 23 | 1.00 | 0.11 | 0.75 | 0.80 | -0.60 | -0.20 | 14 | 9 | 7 | 18 | 120.0 | 0.50 | 11.00 | 0 |
| L | 98 | 99 | 0 | 90 | 34 | 0.00 | 49 | 1.00 | 0.15 | 0.63 | 0.57 | -2.40 | 5.00 | 14 | 2 | 15 | 1 | 120.0 | 0.55 | 17.00 | 0 |
| L | 99 | 99 | 0 | 220 | 17 | 0.00 | 49 | 1.00 | 0.15 | 0.63 | 0.57 | -2.40 | 5.00 | 14 | 2 | 4 | 15 | 120.0 | 0.40 | 18.00 | 0 |
| WH | 99 | 99 | 0 | 280 | 50 | 0.00 | 17 | 1.00 | 0.25 | 0.05 | 0.90 | -4.00 | 2.40 | 17 | 19 | 6 | 5 | 140.0 | 0.40 | 15.00 | 0 |
| WH | 98 | 99 | 0 | 130 | 50 | 0.00 | 17 | 1.00 | 0.09 | 0.05 | 0.87 | -6.00 | 0.20 | 3 | 13 | 13 | 8 | 140.0 | 0.40 | 15.00 | 0 |
| C | 99 | 99 | 0 | 480 | 0 | 0.00 | 62 | 1.00 | 0.01 | 0.48 | 0.60 | -5.00 | -6.80 | 2 | 17 | 7 | 18 | 140.0 | 0.40 | 15.00 | 0 |
| C | 98 | 99 | 0 | 80 | 0 | 0.00 | 62 | 1.00 | 0.01 | 0.48 | 0.60 | -7.20 | -7.00 | 2 | 17 | 17 | 19 | 140.0 | 0.40 | 15.00 | 0 |

## SVS Tree Lists

The tree, or plant, lists used by SVS are simple ASCII text files containing a listing of all the components in a stand. The data files are organized with one individual component per line in the file. Fields are separated by spaces. The first field containing the species indicator must occupy the first 15 characters of each line. The species code need not be 15 characters long but it must be padded with trailing spaces to occupy at least 15 characters in the data file. Comments may be included in the list by using a semi-colon (";") in the first column. Commands in the list begin with "#" in the first column. Commands available for use in tree lists are:

| Command | Description and use |
|---|---|
| #GROUNDFILE *file* | *file* specifies a ground definition that should be loaded and displayed with the stand. |
| #FORMAT *number* | *number* indicates the format of the individual tree records. The following formats are recognized: |
| |     1   Original SVS tree list format. This format does not include the tree identifier or lean angle fields. |
| |     2   Extended SVS tree list format. This format includes the tree identifier and lean angle fields |
| #PALETTE *file* | *file* specifies a palette file that should be loaded for use with the stand. Palette files are created when users save a palette while modifying the 256-color configuration parameters. Palette files can be used only when SVS is configured for 256-color operation. |
| #PLOTORIGIN *x y* | (*x,y*) specifies the coordinate location of the lower left corner of the stand. |
| #PLOTSIZE *width height* | *width* specifies the width of the area represented in the tree list measured along the x-axis and *height* specifies the height of the area represented in the tree list measured along the y-axis. |
| #R6CVSPLOT *radius* | specifies that the tree list represents a circular plot with five subplots. This plot design is used by the U.S. Forest Service Region 6. |
| #ROUNDPLOT *radius* | specifies that the tree list represents a circular plot. *radius* specifies the plot radius in feet or meters. |
| #TITLE *text* | *text* is the title that should be displayed in SVS. |
| #TREEFORM *file* | *file* specifies the plant form definition file to be used with the tree list. |
| #TREELISTINDEX | specifies that the file is a tree list index file containing a list of SVS tree list files and titles. When this command is used, all other command in the file are ignored. The format of a tree list index consists of |

one line per SVS file with a title enclosed in quotation marks and the corresponding SVS tree list file name enclosed in quotation marks:

**#TREELISTINDEX**
**"Stand 1005 at year 30" "1005_30.SVS"**
**"Stand 1005 at year 60" "1005_60.SVS"**
**"Stand 1005 at year 90" "1005_90.SVS"**

File names can include a full path to the SVS file. When a tree list index file is loaded into SVS, the user is presented with a list of titles (that correspond to SVS tree list files) to choose from.

#UNITS *name*

*name* can be either ENGLISH or METRIC. English units represent diameters in inches and all other dimensions in feet. Metric units represent diameters in centimeters and all other units in meters.

#LINE *x1 y1 x2 y2 [color linetype linewidth]*

draws a line on the ground surface between (*x1, y1*) and (*x2, y2*). Coordinates are specified using the same coordinate system as tree locations.

*color*, *linetype*, and *linewidth* are optional. The default color is the gridline color specified in default parameters. Color values are references to the SVS palette. The default line type is a solid line. The default line width is one pixel. Line types are defined as follows:

    0   Solid line
    1   Dashed line
    2   Dotted line
    3   Dash-dot line
    4   Dash-dot-dot line

Patterned lines (line type other than 0) must use a width of 1 pixel.

When a drawing command is present in a tree list, the normal ground grid is not drawn.

#CIRCLE *x y radius [color linetype linewidth]*

draws a circle on the ground surface with its center at (*x, y*) and radius *radius*. Coordinates are specified using the same coordinate system as tree locations.

*color*, *linetype*, and *linewidth* are optional. The default color is the gridline color specified in default parameters. Color values are references to the SVS palette. The default line type is a solid line. The default line width is one pixel. Line types are defined as follows:

    0   Solid line

|              | 1   Dashed line |
|              | 2   Dotted line |
|              | 3   Dash-dot line |
|              | 4   Dash-dot-dot line |

Patterned lines (line type other than 0) must use a width of 1 pixel. Patterned lines may not be perfect when used in circles.

When a drawing command is present in a tree list, the normal ground grid is not drawn.

#RECTANGLE *x1 y1 x2 y2* *[color linetype linewidth]*   draws a rectangle on the ground surface using (*x1, y1*) as the lower left corner and (*x2, y2*) as the upper right corner. Coordinates are specified using the same coordinate system as tree locations.

*color*, *linetype*, and *linewidth* are optional. The default color is the gridline color specified in default parameters. Color values are references to the SVS palette. The default line type is a solid line. The default line width is one pixel. Line types are defined as follows:
  - 0   Solid line
  - 1   Dashed line
  - 2   Dotted line
  - 3   Dash-dot line
  - 4   Dash-dot-dot line

Patterned lines (line type other than 0) must use a width of 1 pixel.

When a drawing command is present in a tree list, the normal ground grid is not drawn.

#ARC x y radius startangle stopangle [color linetype linewidth]   draws an arc on the ground surface with its center at (*x, y*), radius *radius*, starting at an azimuth of *startangle* and stopping at an azimuth of *stopangle*. Coordinates are specified using the same coordinate system as tree locations.

*color*, *linetype*, and *linewidth* are optional. The default color is the gridline color specified in default parameters. Color values are references to the SVS palette. The default line type is a solid line. The default line width is one pixel. Line types are defined as follows:
  - 0   Solid line

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| | |
|---|---|
| 1 | Dashed line |
| 2 | Dotted line |
| 3 | Dash-dot line |
| 4 | Dash-dot-dot line |

</div>

Patterned lines (line type other than 0) must use a width of 1 pixel. Patterned lines may not be perfect when used in arcs.

When a drawing command is present in a tree list, the normal ground grid is not drawn.

#FIRE_LINE *y1 y2 y3 y4 …*    specifies the portion of the stand that has been burned. This feature is used by the FFE extension of the Forest Vegetation Simulator to depict fire activity in a stand. The #FIRE_LINE command assumes that y values are evenly spaced across the stand area. The first y value has a corresponding x value of 0.0 (or #PLOTORIGIN's x value) and the last y value has an x value equal to the stand width (or the stand width plus the #PLOTORIGIN x value).

***Parameter Description***

Each individual stand component requires parameters describing its size, location, overall shape, and special characteristics. SVS uses the following parameters to describe an individual stand component:

| **Parameter** | **Description** |
|---|---|
| Species code | Alphanumeric code describing the species. May be numeric or text or a combination of numbers and letters. Length may not exceed 15 characters. The species code must occupy all 15 spaces. If the species code contains fewer than 15 characters, it must be right padded with spaces. |
| Plant identifier | Unique alphanumeric identifier for the plant. May be numeric or text or a combination of numbers and letters. The plant identifier cannot contain any embedded spaces. The length of the plant identifier cannot exceed 15 characters. This parameter is only present in tree lists using the extended SVS format. The plant identifier does not need to be padded with spaces to occupy the full 15-character length. |
| Tree class | User-defined code used to distinguish different growth forms or plant appearances within a species. Values used for the tree class can range from 0 to 32768. |
| Crown class | User-defined code used to further distinguish different growth forms or plant appearances within a species. |

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</div>

| | Values used for the crown class can range from 0 to 32768. |
|---|---|
| Plant status | Code designating the status of the plant component.  The following status codes are recognized: |
| | 0 or 10  indicates the plant is cut, has branches, and is lying on the ground |
| | 1 or 11  indicates the plant is standing and has branches |
| | 2 or 12  indicates the plant is no longer present and only a stump remains |
| | 3 or 13  indicates the plant is cut, has no branches, and is lying on the ground |
| | Plants with status codes of 0, 1, 2, or 3 can have their status codes modified using the marking and treatment features of SVS.  Plants with status codes of 10, 11, 12, or 13 cannot have their status codes modified by any marking or treatment activity within SVS. |
| Diameter | Diameter at breast height (inches or centimeters). |
| Height | Total height of the plant (feet or meters). |
| Lean angle | Angle of lean for the stand component.  The angle is specified as the lean from a vertical.  Thus 0 degrees indicates that a plant is standing perpendicular to the ground (degrees).  This parameter is only present in tree lists using the extended SVS format. |
| Felling angle | Azimuth of the stem for down material relative to the stump end of the stem (degrees, 0 degrees is at 12 o'clock). |
| End diameter | Small end diameter of plant stem (inches or centimeters).  Normally, the end diameter is 0.0 for standing, live trees.  The end diameter can be used to describe down logs or standing trees with a broken top. |
| Crown radius 1 | Radius of the plant's crown measured along a radial line at 0 degrees azimuth (feet or meters). |
| Crown ratio 1 | Ratio of live crown to total plant height corresponding to "Crown radius 1". |
| Crown radius 2 | Radius of the plant's crown measured along a radial line at 90 degrees azimuth (feet or meters). |
| Crown ratio 2 | Ratio of live crown to total plant height corresponding to "Crown radius 2". |
| Crown radius 3 | Radius of the plant's crown measured along a radial line at 180 degrees azimuth (feet or meters). |
| Crown ratio 3 | Ratio of live crown to total plant height corresponding to "Crown radius 3". |
| Crown radius 4 | Radius of the plant's crown measured along a radial line at 270 degrees azimuth (feet or meters). |
| Crown ratio 4 | Ratio of live crown to total plant height corresponding to "Crown radius 4". |

| | |
|---|---|
| Expansion factor | Number of individuals represented by an individual listed in the component list (usually plants per acre or hectare). |
| Marking status | A code indicating the inclusion of the plant in various, user-defined, marking scenarios. This integer can range from 0 to 255. Individual bits in the integer correspond to the eight possible marking scenarios with the least significant bit corresponding to scenario 1. |
| X | Location of the base of the stem (ordinate in feet or meters). |
| Y | Location of the base of the stem (abscissa in feet or meters). |
| Elevation | Elevation at the base of the stem (feet or meters). SVS assumes that the ground is at an elevation 0.0. If plant elevations other than 0.0 are given, the plant will "float" above or below the ground. |

### *Crown Dimensions*

SVS can display asymmetric crowns represented by crown dimensions measured at four points in the crown. Most data sources will produce data describing crown diameter as a constant value for each tree. Many research studies and some stand growth models produce asymmetric crown data. SVS displays the asymmetric crowns in the perspective view when drawing "realistic trees" and in the overhead view when drawing "solid trees" or "realistic trees". Display of asymmetric crown in the overhead view when marking trees is controlled by the configuration parameter: "Use irregular crown on overhead view".

## Example Tree List File -- Original SVS Format

```
#PLOTORIGIN   0.00 0.00
#PLOTSIZE     208.70 208.70
#UNITS        ENGLISH
;
;Species Code   Plant  Crown  Status  DBH  Height  Felling  Small  Crown   Crown  Crown   Crown  Crown   Crown  Crown   Crown  Expansion  Marking   X        Y       Elev
;               class  class                       angle    end    radius  ratio  radius  ratio  radius  ratio  radius  ratio  factor     status
;                                                          dia     1       1      2       2      3       3      4       4
;--------------------------------------------------------------------------------------------------------------------------------------------------------------------------
202             0      0      1     46.00 134.00   0.00     0.00   11.72   0.35   11.72   0.35   11.72   0.35   11.72   0.35   1.00       0        132.00   63.00   0.00
202             0      0      1     32.00 134.00   0.00     0.00   11.72   0.35   11.72   0.35   11.72   0.35   11.72   0.35   1.00       0         84.00   81.00   0.00
263             0      0      1     23.00  88.00   0.00     0.00   11.00   0.50   11.00   0.50   11.00   0.50   11.00   0.50   1.00       0         48.00   57.00   0.00
202             0      0      1     36.00 123.00   0.00     0.00   10.76   0.35   10.76   0.35   10.76   0.35   10.76   0.35   1.00       0         48.00  170.00   0.00
202             0      0      1     40.00 127.00   0.00     0.00   11.11   0.35   11.11   0.35   11.11   0.35   11.11   0.35   1.00       0         78.00   20.00   0.00
263             0      0      1     32.00  94.00   0.00     0.00   14.10   0.60   14.10   0.60   14.10   0.60   14.10   0.60   1.00       0        102.00   31.00   0.00
RANGEPOLE       0      0      1     12.00 100.00   0.00     0.00   22.50   0.90   22.50   0.90   22.50   0.90   22.50   0.90   1.00       0         25.00  125.00   0.00
```

## Example Tree List File -- Extended SVS Format

```
#PLOTORIGIN   0.00 0.00
#PLOTSIZE     208.70 208.70
#UNITS        ENGLISH
#FORMAT       2
;
;Species Code   Plant  Plant  Crown  Status  DBH  Height  Lean  Felling  Small  Crown   Crown  Crown   Crown  Crown   Crown  Crown   Crown  Expansion  Marking   X        Y       Elev
;               ID     class  class                       angle angle    end    radius  ratio  radius  ratio  radius  ratio  radius  ratio  factor     status
;                                                               dia     1       1      2       2      3       3      4       4
;--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
202             100    0      0      1     46.00 134.00   0.00  0.00     0.00   11.72   0.35   11.72   0.35   11.72   0.35   11.72   0.35   1.00       0        132.00   63.00   0.00
202             101    0      0      1     32.00 134.00   7.00  12.00    0.00   11.72   0.35   11.72   0.35   11.72   0.35   11.72   0.35   1.00       0         84.00   81.00   0.00
263             102    0      0      1     23.00  88.00   0.00  0.00     0.00   11.00   0.50   11.00   0.50   11.00   0.50   11.00   0.50   1.00       0         48.00   57.00   0.00
202             103    0      0      1     36.00 123.00   3.00  229.00   0.00   10.76   0.35   10.76   0.35   10.76   0.35   10.76   0.35   1.00       0         48.00  170.00   0.00
202             104    0      0      1     40.00 127.00   9.50  170.00   0.00   11.11   0.35   11.11   0.35   11.11   0.35   11.11   0.35   1.00       0         78.00   20.00   0.00
263             105    0      0      1     32.00  94.00   0.00  0.00     0.00   14.10   0.60   14.10   0.60   14.10   0.60   14.10   0.60   1.00       0        102.00   31.00   0.00
RANGEPOLE       999    0      0      1     12.00 100.00   0.00  0.00     0.00   22.50   0.90   22.50   0.90   22.50   0.90   22.50   0.90   1.00       0         25.00  125.00   0.00
```
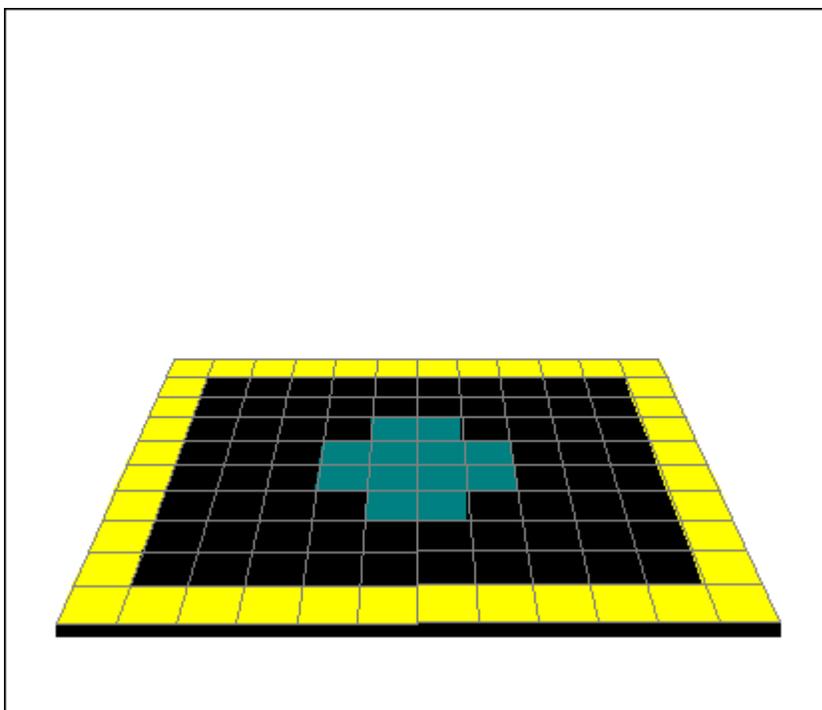
## SVS Ground Definition Files

SVS can "drape" a simple raster map over the ground surface.  Using this feature, you can delineate specific features such as sample plot locations, roads, and streams on the ground surface.  Ground surface definitions are stored in "Ground surface definition files", ASCII text files containing an array of single character attribute data with one character representing one grid cell.  Ground surface information is independent of stand component information.

A ground definition file contains of the following information:

- Header containing the number of rows and columns in the array
- Translation table containing all possible array attributes and the color used to represent the attribute in SVS displays.  Color values can range from 0 to 255.
- Table showing the attribute assigned to each cell in the array.  The attribute table can include up to 256 rows and 256 columns.

The translation table must end with a line containing an asterisk (*) and the color used to represent all attribute values not explicitly listed in the translation table.  SVS orients the attribute table so that the first entry in the table corresponds to the upper left corner (northwest) of the stand.  The following ground definition file produces the ground pattern shown in figure 21.

```
10 12
A 0
B 3
C 14
* 0
CCCCCCCCCCCC
CAAAAAAAAAAC
CAAAAAAAAAAC
CAAAABBAAAAC
CAAABBBBAAAC
CAAABBBBAAAC
CAAAABBAAAAC
CAAAAAAAAAAC
CAAAAAAAAAAC
CCCCCCCCCCCC
```

Ground coloration produced by the sample ground definition file.

Colors available for use in ground definition files are:

| Color | Color Number | Color | Color Number |
|---|---|---|---|
| Black | 0 | Dark Gray | 8 |
| Blue | 1 | Light Blue | 9 |
| Green | 2 | Light Green | 10 |
| Cyan | 3 | Light Cyan | 11 |
| Red | 4 | Light Red | 12 |
| Magenta | 5 | Light Magenta | 13 |
| Brown | 6 | Yellow | 14 |
| Gray | 7 | White | 15 |

In 256-color modes, color numbers above 15 refer to palette entries which are user defined.  The palette is arranged into 20 color shades each containing 12 separate colors:

| Shade | Color number | Shade | Color number |
|---|---|---|---|
| 1 | 16 to 27 | 11 | 136 to 147 |
| 2 | 28 to 39 | 12 | 148 to 159 |
| 3 | 40 to 51 | 13 | 160 to 171 |
| 4 | 52 to 63 | 14 | 172 to 183 |
| 5 | 64 to 75 | 15 | 184 to 195 |
| 6 | 76 to 87 | 16 | 196 to 207 |
| 7 | 88 to 99 | 17 | 208 to 219 |

| 8 | 100 to 111 | 18 | 220 to 231 |
| 9 | 112 to 123 | 19 | 232 to 243 |
| 10 | 124 to 135 | 20 | 244 to 255 |

For most applications, you should limit the colors used in a ground definition file to the first 16 colors.

# Appendix B:  FVS2SVS Conversion Program

The FVS2SVS conversion program distributed with the current version of SVS is a Windows executable.  You can run it from the Windows Explorer or from a DOS prompt.  You can also access FVS conversion capability using the **File|New stand...** menu option in SVS.

## Overview

The FVS2SVS conversion filter is designed to link the Forest Vegetation Simulator (FVS) to the Stand Visualization System (SVS).  To accomplish this, FVS2SVS translates tree list files produced by FVS, versions 6.1 and 6.2, into tree list files for use with SVS.  A secondary goal is to incorporate output files from the insect and disease extensions to FVS into the SVS tree list to allow the display of damaged and diseased trees.  The secondary goal has not been implemented in version 1.0 of FVS2SVS.

## Overview of the Forest Vegetation Simulator

The Forest Vegetation Simulator (FVS) is a FORTRAN computer program for projecting the development of forest stands.  FVS variants have been developed for several geographic regions throughout the United States.  Each variant is intended to represent all ecological conditions that can support forest stands within a region.  Furthermore, since stand growth projections are based on increment predictions for individual trees, the model can simulate a broad spectrum of management actions, including strategies designed to mitigate various pest and disease impacts.

All variants share a common design that bases estimates of stand attributes on predictions of individual tree diameter increment, height increment, change in crown ratio, and probability of survival.  Removals can be simulated in any projection cycle and the composition of regeneration resulting from harvest treatments can be predicted from stand and site attributes.  The system will also produce detail on shrub composition along with descriptions of the horizontal and vertical distributions of shrub and tree canopies.

A multi-stand version (the Parallel Processor) permits simultaneous projection of collections of stands.  The Parallel Processor is particularly useful when management actions for a specific stand are subject to policy constraints that depend on the management of a larger area.  Parallel processing may also be necessary when management decisions must consider the dynamics of contagious forest pests in adjacent stands.

Beyond the basic system, Forest Vegetation Simulator extensions can be invoked to interactively simulate the dynamics and impacts of forest pests such as the Douglas-fir tussock moth, the western spruce budworm, and various root diseases.

FVS runs on several computer platforms including Data General minicomputers, IBM-compatible personal computers, and workstations using on the UNIX operating system.

## General Description

FVS2SVS is a program for IBM-compatible personal computers running the MS-DOS operating system.

In operation, FVS2SVS scans an FVS tree list identifying the variant and version of FVS used to produce the list, the format of the tree list, and the type of headers included in the list. FVS2SVS then determines all "stands" contained in the tree list as defined by unique combinations of stand identifiers, management identifiers, cycle numbers, and years. In non-interactive mode, FVS2SVS converts all stands into SVS tree lists or single stands as defined by command line options. In interactive mode, users can select stands for conversion from a list of all stands present in the FVS tree list. FVS2SVS provides many options that control its behavior. All options are accessed using command line options described later in this manual.

## Functional Overview

FVS2SVS is responsible for the following tasks:

- recognize the variant and version of FVS that created a tree list
- recognize the tree list format and the type of headers used in the file
- determine the number of stands, cycles, and treatment scenarios present in the tree list
- convert individual "stands" from the FVS tree list into SVS tree lists
- expand FVS tree list records into the appropriate number of tree records for SVS
- generate spatial coordinates for the trees in a stand using a variety of spatial patterns and optionally recognizing and maintaining plot identities during the spatial coordinate generation process
- provide an estimate of canopy closure for each "stand" converted into an SVS tree list
- estimate crown widths when they are missing from or equal to 0 in an FVS tree list
- optionally delete FVS tree list files as they are converted to SVS tree lists
- provide grouping logic to help alleviate the "small expansion factor" problem (group similar trees together to increase the per acre expansion factor to provide more stable sample generation)
- optionally accumulate mortality trees and include past mortality in SVS tree lists
- optionally model the decomposition of standing dead trees and down logs

- optionally maintain tree locations, both live and dead, over time

## FVS2SVS Input and Output

FVS2SVS reads FVS tree lists produced by versions 6.1 and 6.2. Tree lists can be in either the old or the new formats and can contain multi-line headers or single line (machine readable) headers. Tree lists can contain a single stand and multiple projection cycles or multiple stands and multiple projection cycles.

FVS2SVS does not read the FVS keyword or output files other than the tree list.

FVS2SVS produces a tree list or lists for use with the stand visualization system. SVS tree lists produced by FVS2SVS contain a link to the appropriate tree form definitions and color palettes for the variant of FVS use to produce the FVS tree list.

When FVS2SVS is used to convert an FVS tree list with several stands and cycles, an index file is created that contains a description and DOS file name for each distinct stand and cycle combination found in the FVS tree list. This index file can be used within SVS to facilitate selection of stands for visualization.

## FVS2SVS Use

The command line syntax for FVS2SVS is as follows:

    FVS2SVS [switches] TRLfile [SVSfile]

Optional command line switches control the behavior of FVS2SVS. The TRLfile is the name of the FVS tree list file and the optional SVSfile is the name for the resulting SVS tree list. If a single stand within the FVS tree list is converted, the SVSfile parameter specifies the name of the SVS tree list file. If multiple stands are converted, the SVSfile parameter specifies the name of the SVS tree list index file and the individual SVS tree list file names will be generated by FVS2SVS.

## Command Line Options

-A#

Area for the SVS stand plot created during the conversion process. FVS2SVS generates a one acre stand by default. Smaller plots may be specified to reduce the number of trees drawn in SVS, thereby reducing the drawing time.

In stands containing tree records with very small expansion factors, producing larger SVS plots may help provide a more statistically correct sample of the stand. SVS can draw any size plot, however, plots containing more than 10,000 trees may not display properly.

-B#

Clump ratio for clumped spatial patterns.  The clump ratio specifies the number of clump centers generated by the spatial pattern algorithm as a function of the number of individual trees in the stand.  The numeric parameter, ranging from 0.01 to 0.5, is multiplied by the number of individual trees to compute the number of clump centers.  The number of trees located around each clump center is equal to the reciprocal of the clump ratio.

-C#

Cycle number for the stand(s) to be converted.  The cycle number will be compared to cycle numbers found in the FVS tree list.  Stands with a matching cycle number will be selected for conversion.  Cycle number must be zero or greater.

For additional information regarding the spatial pattern options in FVS2SVS, see the section titled "Selecting Specific Stands From the FVS Tree List for Conversion" later in this document.

-D#

Display debugging information about a specific portion of the conversion process.  The numeric parameter specifies the type of debugging information displayed.  Valid values and the resulting types of information are:

    1    display information while compressing FVS tree list records
    2    display information while expanding FVS tree list records
    3    display information while scanning the FVS tree list file
    4    display information while reading individual FVS tree list records
    5    display general information while generating tree locations
    6    display detailed information while generating tree locations
    7    display information regarding the use of the stand and canopy map
  99  display all debugging information

-E$

Enable mortality tracking and snag dynamics modeling.  The string parameter specifies the name of the file containing parameters for the snag and down log dynamics model in FVS2SVS.  FVS reports mortality occurring during the current projection cycle.  By default, FVS2SVS only includes the reported mortality in SVS tree lists.  Use of the -E$ option causes FVS2SVS to maintain a separate list of dead trees as a stand is projects over several cycles.  As each cycle for a stand is converted, the dead tree information from previous cycles is added to the SVS tree list.  Dead trees are maintained in the same location over time.  FVS2SVS can also model snag and down log decomposition using a simplistic model controlled by user-specified parameters.  The snag model and its parameters are described later in this manual.

-F#

Use FVS crown width estimates included in the FVS tree list but multiply them by the numeric parameter.  To use the actual FVS widths (the default behavior of FVS2SVS), use a value of 1.0 for the numeric parameter.

-G#

Clumpiness factor for spatial pattern control.  The clumpiness factor controls the size of individual clumps of tree locations.  It affects only clumped patterns.  The following formula is used to compute the clump radius:

clump radius = (1.5 - 1.4 * clumpiness factor) * clump spacing

Small values of the clumpiness factor result in large clumps (to the point where the appearance of clumps is lost with a clumpiness factor of 0.0).  Large values result in very tight, widely spaced clumps.

The clump spacing is based on the number of trees per acre and the value of the clump count parameter specified using the B # command line option.

-H#

Use FVS crown width estimates unless they are 0.0.  For widths of 0.0, estimate the crown widths by multiplying the tree height by the numeric parameter. Valid values for the multiplier are 0.0 - 1.0.

-I

Enable interactive stand selection.  The default behavior of FVS2SVS is to convert all stands contained in an FVS tree list into SVS tree lists.  This option causes FVS2SVS to display a list of all stands found in a particular FVS tree list so the user can select the stands for conversion.  The command line options S$, M$, C#, and Y# can be used to "pre-select" specific stands.  Pre-selected stands will be marked for conversion when the list of stands is displayed.

For additional information regarding the spatial pattern options in FVS2SVS, see the section titled "Selecting Specific Stands From the FVS Tree List for Conversion" later in this document.

-J#

Add range poles at each corner of an SVS plot.  The numeric parameter specifies the height of the range pole.  Range poles consists of a cylinder that is two feet in diameter.  Range poles are marked with ten stripes.  Valid heights can range from 0.1 to 250.0 feet.

-K

Delete the FVS tree list file after a successful conversion by FVS2SVS. The default behavior of FVS2SVS is to leave FVS tree lists intact after the conversion process is complete. If this option is specified, FVS2SVS will delete the FVS tree list file if the conversion is completed without errors. If errors occur during the conversion process, the FVS tree list will not be deleted.

-L$

Create a log file to record conversion results. The string parameter specifies the name of the log file. The log file option is particularly useful if you want to retain a record of the canopy closure results reported by FVS2SVS. The log file is an ASCII text file that can be viewed with most editors and word processors.

-M$

Management identifier for the stand(s) to be converted. The management ID will be compared to management identifiers found in the FVS tree list. Stands with a matching management ID will be marked for conversion. Valid management IDs can be up to 4 characters long.

For additional information regarding the spatial pattern options in FVS2SVS, see the section titled "Selecting Specific Stands From the FVS Tree List for Conversion" later in this document.

-N#

Initialize the random number stream used for the conversion process. If the numeric argument is 0, a seed will be generated based on the current time. Valid seeds range from 1 to 32768.

-O

DO NOT overwrite existing SVS files. The default behavior of FVS2SVS is to overwrite existing SVS data files when it generates names for new SVS data files. This option allows FVS2SVS to preserve existing files.

-P#

Specify the spatial pattern logic used to generate tree locations. The default behavior of FVS2SVS is to generate tree locations using the uniform spatial pattern. Using this option, different patterns can be selected. Valid values for the numeric argument are:

    0    uniform pattern
    1    random pattern
    2    clumped pattern with clump centers generated using the uniform pattern
         logic

3    clumped pattern with clump centers generated using the random pattern logic
4    generate tree locations using FVS plot information
5    generate tree locations for USFS Region 6 CVS data using a circular plot

For additional information regarding the spatial pattern options in FVS2SVS, see the section titled "Spatial Patterns" later in this document.

-Q

Turns off the display of status messages.  The default behavior of FVS2SVS is to display status messages indicating its progress.  When this option is used, FVS2SVS will not display any status information.  FVS2SVS will still display error messages when this option is used.

-R#

Randomness factor for spatial pattern control.  The randomness factor controls the magnitude of the offset from a perfect lattice pattern for individual tree locations or clump centers.  A value of 0.0 results in tree locations aligned in perfect rows and columns.  Values of 0.4 to 0.8 result in patterns approximating planted stands.  Values greater than 0.8 result in patterns with some clumps of two or three trees.  The randomness factor does not affect random spatial patterns.

-S$

Stand ID for the stand(s) to be converted.  The stand ID will be compared to stand identifiers found in the FVS tree list file.  Stands with a matching ID will be marked for conversion.  Valid stand IDs can be up to 8 characters long.

For additional information regarding the spatial pattern options in FVS2SVS, see the section titled "Selecting Specific Stands From the FVS Tree List for Conversion" later in this document.

-T

Enable tree location tracking.  The default behavior of FVS2SVS is to generate a new, independent set of tree locations for each stand converted.  When location tracking is turned on, FVS2SVS generates a set of locations for the first stand converted and then tries to maintain the tree locations for subsequent stands.  When new trees are introduced, e.g., regeneration or planting, new locations are generated for use in subsequent stands.

-U

Recognize special status codes in the FVS tree list and interpret according to the USFS Region 6 Current Vegetation Survey (CVS) protocols (cycle 0 tree lists only).  The condition class codes are:

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21   recently dead snag
22   snag with loose bark
23   snag with no bark
24   soft snag
25   decomposed snag
26   recently cut stump
27   stump with some decay
28   decomposed stump
40   indicator species clump (trees per acre interpreted as percent cover)
60   hardwood clump (trees per acre interpreted as percent cover)
71   downed log (sound)
72   downed log (some decay)
73   downed log (decomposed)

For each code, a special plant form is used to represent the condition of the plant and the diameter and height are used to specify the plant size. For codes 40 and 60, the trees per acre is interpreted as a percent cover (0 to 100). FVS2SVS generated enough plants using size values specified in the dbh and height fields to achieve the desired cover.

-V

Turns on verbose status messages. This option tells FVS2SVS to display detailed status information about the conversion process.

-W#

Estimate crown widths by multiplying the tree height by the numeric parameter. The default behavior of FVS2SVS is to use the crown width included in the FVS tree list. For old format tree lists, which do not include crown width estimates, crown widths will be estimated using a height multiplier of 0.16 unless a different multiplier is specified using this command line option.

-X

Turn off tree list compression. The default behavior of FVS2SVS is to compress the entries in an FVS tree list prior to generating the SVS tree list. If a tree records are encountered that have the same species and plot number and similar diameters and heights, the records will be combined into a single record and the expansion factors will be summed. The compression is necessary to help maintain sampling integrity when a tree list contains many trees with small expansion factors. When compression is disabled, FVS2SVS attempts to expand each individual tree record in the FVS tree list. For records with expansion factors less than one, random sampling is used to determine whether or not a tree should be included in the SVS tree list.

-Y#

Year for the stand(s) to be converted.  The year will be compared to years found in the FVS tree list.  Stands with a matching year will be marked for conversion.

For additional information regarding the spatial pattern options in FVS2SVS, see the section titled "Selecting Specific Stands From the FVS Tree List for Conversion" later in this document.

-Z

Use full path names for individual SVS tree list files when creating a tree list index file for SVS.  This option allows you to access SVS tree list index files and individual tree lists across directories on your hard disk.  Without the -Z option, you can only load the individual tree lists specified in a tree list index from the directory containing SVS.

-%#

Modify crown ratios reported by FVS by multiplying the crown ratio by the numeric parameter.  The default behavior of FVS2SVS is to use the crown ratio reported in the FVS tree list.  The numeric parameter can range from 0.01 to 5.0.

-&#

Generate internal reports describing the features of FVS2SVS.  The numeric parameters and the corresponding reports are:

1    list of the variants supported by FVS2SVS
2    list of the species recognized for each of the supported variants
9    list of all program defaults or the program conditions resulting from a series of command line options when the -&# option is included as the last option


## Spatial Patterns

One of the primary tasks during the conversion process is the generation of spatial locations for the trees.  FVS2SVS generates a variety of spatial patterns:

- uniformly distributed tree locations
- randomly distributed tree locations
- clumped pattern of tree locations with uniformly distributed clump centers
- clumped pattern of tree locations with randomly distributed clump centers
- plot-based tree locations
- USFS Region 6 CVS plot-based tree locations

For all patterns, a map of individual stem locations is maintained and used to prevent trees from being placed on top of one another.  FVS2SVS also provides a location tracking feature to help keep tree locations from the shifting over time.  When location tracking is turned on, FVS2SVS generates a set of locations for the

first stand or cycle converted and then tries to maintain tree the locations for subsequent stands or cycles.  When new trees are introduced, e.g., regeneration or planting, new locations are generated for use in subsequent stands.  The location tracking option should only be used when converting a single stand projected over time.  If using output from the parallel processor, command line options should be used to specify a single stand within the FVS tree list for conversion.

The location tracking implemented by FVS2SVS is not perfect.  Sampling inconsistencies caused by variations in the random number stream used for deciding whether or not fractional trees should be included can cause trees to appear and disappear over simulated time.  This results in trees that are present in one cycle and not in the next.  Also, because FVS is not a distance dependent, individual tree model, trees that appear in SVS visualizations to be free of competition will not grow faster than other similar sized trees.  Likewise, trees growing under a dense, but localized, canopy will not grow slower.

### Uniformly Distributed Tree Locations
In this method, a grid is superimposed on the plot.  The grid spacing is equal to the average spacing between trees calculated as:

$$\text{grid spacing} = \text{SQRT}(43560 / (\text{total stems per acre}))$$

The center of each grid cell is calculated and used as the initial location.  Two random variates from -0.5 to 0.5 are generated and multiplied by the grid spacing to serve as maximum offsets in the X and Y directions.  The maximum offsets are multiplied by the randomness factor (specified using the -R command line option), ranging from 0.0 to 1.0, to determine the actual offset from the grid center.  Locations generated using values of the randomness factor from 0.0 to 0.5 yield a pattern that clearly resembles a grid with 0.4 to 0.5 giving a good approximation of hand planted tree locations. Locations generated using values of the randomness factor from 0.5 to 1.0 have a uniform appearance and the grid structure is not obvious.

### Randomly Distributed Tree Locations
This method simply generates uniformly distributed random variates ranging from 0.0 to the width of the plot for the X value and from 0.0 to the height of the plot for the Y value.

### Clumped Patterns with Uniformly Distributed Clump Centers
This method generates "clump centers" using the same technique used to generate uniformly distributed tree locations and then generates the individual locations within the clump.  The number of clumps created can be controlled using the -B command line option.  The clump spacing is calculated as follows:

$$\text{clump spacing} = \text{SQRT}(43560 / (\text{stems per acre} * \text{clump density}))$$

Individual locations in a clump are created by generating a random angle ranging from 0.0 to 360.0 degrees and a magnitude calculated as follows:

magnitude = (random number from 0.0 to 1.0) * clump radius

where clump radius is computed using the following equation:

clump radius = (1.5 - 1.4 * clumpiness factor) * clump spacing

The angle and the magnitude are used to offset the location from the clump center.

### *Clumped Patterns with Randomly Distributed Clump Centers*
The random-clump method generates clump center locations using the same method used for randomly distributed tree locations and then generates individual locations within each clump using the same technique that was used for clumped patterns with uniformly distributed clump centers.

### *FVS Plot-Based Tree Locations*
When FVS2SVS is instructed to preserve FVS plot information and to group trees from individual plots together, the plot patterns shown in figure 1 are used.  If the FVS tree list contains more than sixteen plots, the plots will be arranged in strips (similar to the pattern used with thirteen plots).  Individual tree locations within the plots are generated using the methods used to generate randomly distributed tree locations.

### *USFS Region 6 CVS plot-based tree locations*
Region 6 of the USDA Forest Service collects data under the current vegetation survey project using a five-plot sampling design.  FVS2SVS can represent these data using a circular plot divided into five regions (similar to a donut with point 1 located in the hold and points 2, 3, 4,and 5 located around the donut.  Within each region representing a sample point, tree locations are randomly generated.  This pattern is most often used with the -U command line option to recognize special status code values in the FVS tree list.


## Selecting Specific Stands From the FVS Tree List for Conversion

Specific stands in an FVS tree list, defined by a unique combination of stand ID, management ID, cycle number and year, can be selected using the -S, -M, -C, and -Y command line options.  These four options can be used singly or in combination to select specific stands for conversion.

FVS2SVS also provides an interactive selection interface to facilitate selection of specific stands for conversion.  The interactive mode is accessed using the -I command line option.  The -S, -M, -C, and -Y options can be used with the interactive mode to "pre-select" stands.  When using the interactive mode, the use can select specific stands from a list of all stands contained in the FVS tree list.

## Crown Width Estimates

FVS2SVS provides three methods for generating crown width information. The first, and the default, is to use the crown widths from the FVS tree list with a optional multiplier. The second allows estimation of crown widths by providing a simple multiplier for the tree height. The third, a hybrid of the first two methods, uses the FVS crown widths unless they are 0.0 in which case, crown widths are estimated using a height multiplier.

The default behavior is to use the crown widths from the FVS tree list. For old format tree lists, which do not contain crown widths, a height multiplier of 0.16 is used to estimate crown widths. The command line options -H#, -W#, and -F# can be used to specify the crown width estimation method.

The crown widths in an FVS tree list generally represent the maximum potential crown with for a given tree. In many cases, this crown width is too large for trees growing in a closed stand. If trees in SVS appear to have crowns that are too large, use the -F# command line option with a value of 0.5 to 1.0 to reduce the FVS crown widths. If you are using an older version of FVS that includes crown widths of 0.0 in the tree list, you should use the -W# command line option to estimate crown widths as a function of the tree height. Numeric values of 0.10 to 0.20 work well with the -W# option.

## Tree Location Tracking

The default behavior of FVS2SVS is to generate a new, independent set of tree locations for each stand/cycle combination converted. The location tracking option, -T, causes FVS2SVS to generate a set of locations for the first stand/cycle converted. As subsequent cycles are converted, FVS2SVS tries to maintain the locations for individual trees. When new trees are introduced, e.g., regeneration or planting, FVS2SVS generates new locations for use in subsequent stands.

To facilitate location tracking, FVS2SVS generates a unique identifier for each tree placed in an SVS tree list. The identifier consists of the eight-character tree number from the FVS tree list, a one-character code indicating whether or not the tree list live (L) or dead (D), a three-digit number representing the sequential number for trees generated by expanding a single FVS tree record into multiple SVS tree records, and a three-digit number representing the FVS plot number. The resulting fifteen-character identifier is used to identify an individual tree. When FVS2SVS generates tree locations for the first stand/cycle combination converted, it also produces a list of identifiers and locations for use in subsequent conversions. When the next stand/cycle is converted, FVS2SVS searches the stored list of identifiers and locations. If a tree is present in the list from previous cycles, the location in the list is used. If a tree is not present in the list, it is assumed to be a new tree in the stand and a new location is generated.

The location tracking algorithm maintains tree locations consistently from cycle to cycle. However, sampling issues that arise when a single FVS tree record is expanded into multiple SVS tree records can cause trees to appear and disappear throughout a multi-cycle projection. Fractional trees, created when a tree record in the FVS tree list represents less than one tree per acre or when the FVS record represents several trees per acre but still contains a fractional tree, e.g., a record represents 0.27 or 5.35 trees per acre may or may not be included in the SVS tree list. When they are included, a location is generated and stored. On subsequent cycles where the fractional tree is not included, the tree location is maintained but not used. On subsequent cycles where the fractional tree is once again included, the old location will be used. The most objectionable behavior of the location tracking algorithm and sampling algorithm occurs when trees appear in early cycles when they are small and then don't reappear until several cycles later when they are much larger. When using SVS to generate animation sequences showing stand through conditions through time, the appearance of large trees seemingly "from nowhere" can be somewhat disconcerting.

## Dead Tree Accumulation and Modeling

FVS reports mortality in the cycle in which it occurs. Once a tree is dead, FVS drops it from its tree list. The mortality tracking option in FVS2SVS, -E$, causes FVS2SVS to accumulate dead trees over time. This means that trees that die in cycle five will still be present in the SVS tree list, and visualizations in SVS, for cycle eight.

FVS2SVS also provides a simple snag and down log decay model to "age" dead trees over time. The model is controlled by user defined annual rates for the following changes in the condition of snags and down logs:

| Parameter | Keyword | Description |
|---|---|---|
| fall rate | FALLRATE | proportion of standing dead trees that fall each year |
| reduction in standing tree height | HTREDUCE | annual proportional height reduction for standing dead trees |
| reduction in crown width | CWREDUCE | annual proportional crown width decrease for standing or down, dead trees |
| reduction in crown ratio | CRREDUCE | annual proportional crown ratio decrease for standing or down, dead trees |
| reduction in log length for down logs | LENREDUCE | annual proportional length reduction for down logs |

| reduction in large-end log diameter for down logs | DBHREDUCE | annual proportional diameter (large end) reduction for down logs |
|---|---|---|
| minimum snag/log diameter | DBHREMOVE | minimum diameter (dbh) snag or log to retain in SVS tree list |

Parameters for the snag model are specified using a simple ASCII text file containing one of the model keywords followed by the rate or value. All proportions are expressed as a decimal percentage, e.g., 0.20 for twenty percent.

The following is a sample parameter file:

```
;snag dynamics parameter file for FVS2SVS
;
;all rates are per year
;
FALLRATE .01
CWREDUCE .007
CRREDUCE .001
HTREDUCE .005
LENREDUCE .002
DBHREDUCE .008
DBHREMOVE 2.0
```

Any line in a snag parameter file that begins with a ";" is considered a comment.

To use the mortality tracking feature of FVS2SVS without the snag decay model, you must create a parameter file with all rates and the minimum diameter set to 0.0 as follows:

```
;snag dynamics parameter file for FVS2SVS
;
;no snag/down log modeling will occur if all rates are 0.0
;
FALLRATE 0
CWREDUCE 0
CRREDUCE 0
HTREDUCE 0
LENREDUCE 0
DBHREDUCE 0
DBHREMOVE 0
```

When using the mortality tracking feature and snag dynamics model, it is important that appropriate rates be used for the various parameters. Very few models exist that model snag and down material decomposition over large, regional areas.

Results from the simple model implemented in FVS2SVS must be evaluated to make sure they represent "feasible" solutions.

## Tree List Compression

FVS tree lists can contain tree records with very small expansion factors. Such files may be the result of widely scattered trees in the original stand or they may be created as FVS projects a stand forward through time. If the NOTRIPLE keyword is not used, FVS splits tree records as the stand is modeled through time. The resulting expansion factors for individual tree records can become quite small causing potential sampling problems for FVS2SVS. The end result is a stand visualization that is statistically accurate but does not "look right" due to the absence of widely scattered, unique trees or to an artificially low density for a given size class.

To illustrate the problem, consider a stand that contains a tree record that represents a Ponderosa Pine with a DBH of 22 inches. The tree record represents 4.5 trees per acre. After two projection cycles, this tree record may become nine records, each representing 0.50 trees per acre. When applied to the original tree record, FVS2SVS will generate either four or five trees for the stand. However, for the stand after cycle 2, FVS2SVS will look at each tree record and have a 50-50 chance of generating a tree. Over many replications the sampling strategy in FVS2SVS would result in an average of 4.5 trees per acre, however it is quite possible for a single stand, or run of FVS2SVS, that less than four or more than five trees will be generated resulting in a "misleading" picture of the stand in SVS.

The FVS keyword, COMPRESS, can help overcome this problem as can including the NOTRIPLE keyword. However, it is not always desirable to use these keywords.

FVS2SVS provides a simple compression scheme to help alleviate the sampling problems associated with small expansion factors. In FVS2SVS, tree records are combined when they meet the following criteria:

- records represent the same species
- records occur on the same point number
- records have similar DBH and height values

As records are combined, the expansion factors for both live and dead trees are accumulated. Using the compression strategy results in stand visualizations that closely represent the "average" condition for a given stand. It is still possible to have stands that are misrepresented due to very small expansion factors but the compression logic reduces the likelihood of gross misrepresentations of stand density and composition.

The command line option, -X, can be used to suppress the use of the compression logic.

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A second strategy to overcome the sampling problems associated with very small expansion factors is to increase the size of the SVS plot using the -A# command line option.  By default FVS2SVS creates one acre stand plots for SVS.  Increasing the size of the plot increases the likelihood that trees with small expansion factors will be included in a visualization.  For example, if an FVS tree record represents 0.2 trees per acre, generating a plot that is five acres in size guarantees that a tree will be included in the visualization.  SVS is not limited in the size of the stand plot, however, SVS tree lists that contain more than 10,000 trees may not display properly.

## File Naming Strategies

FVS2SVS uses a variety of strategies to generate file names for SVS tree list files created during the conversion process.  The strategy selected depends on whether of not the command line contained a name for the SVS file and how many SVS files are created.  The file naming strategies are summarized as follows:

| Command line parameters | Number of SVS tree list files created during the conversion process | File naming strategy |
| --- | --- | --- |
| Command line contains a name for the SVS file(s) | 1 | Use the name given on the command line |
| | More than one | Use the name given on the command line for the tree list index file and generate file names for the individual SVS tree list file names of the form *name.###* |
| Command line does not contain a name for the SVS file(s) | 1 | Create a file name using the name of the FVS tree list file and the extension ".SVS" |
| | More than 1 | Create a name for the tree list index file using the name of the FVS tree list file and the extension ".SVS" and generate individual SVS tree list file names of the form *name.###* |

When FVS2SVS generates file names for individual SVS tree list files, the tree list index filename is used and a zero-padded, three-digit extension is built using the SVS tree list number.

For example, assume an FVS tree list (OTTERCRK.TRL) containing five cycles is converted into SVS tree list files.  Using the command line:

FVS2SVS OTTERCRK.TRL

would result in the following files:

OTTERCRK.SVS   SVS tree list index
OTTERCRK.001   SVS tree list for cycle 1
OTTERCRK.002   SVS tree list for cycle 2
OTTERCRK.003   SVS tree list for cycle 3
OTTERCRK.004   SVS tree list for cycle 4
OTTERCRK.005   SVS tree list for cycle 5

The command line:

FVS2SVS OTTERCRK.TRL SILVTRMT

would result in the following files:

SILVTRMT.SVS      SVS tree list index
SILVTRMT.001 SVS tree list for cycle 1
SILVTRMT.002 SVS tree list for cycle 2
SILVTRMT.003 SVS tree list for cycle 3
SILVTRMT.004 SVS tree list for cycle 4
SILVTRMT.005 SVS tree list for cycle 5

The command line:

FVS2SVS -C 3 OTTERCRK.TRL

would result in the following file:

OTTERCRK.SVS    SVS tree list for cycle 3

By default, FVS2SVS always overwrites existing files with the same name as the file(s) being created.  The command line switch, -O, will prevent FVS2SVS from overwriting existing SVS tree list files (tree list index files are always overwritten).

The default behavior of FVS2SVS is to include only the file name and extension for individual tree list files in a tree list index.  Use of the -Z command line option forces the use of fully qualified file names (including the drive, directory, file name, and extension) within the tree list index.  If you plan to store your SVS tree lists in a location other than the directory where SVS is installed, you should use the -Z command line option.  However, if you use the -Z option, you cannot move the individual SVS tree list files from the directory where they were stored by FVS2SVS without modifying the tree list index file to point to the new file locations.
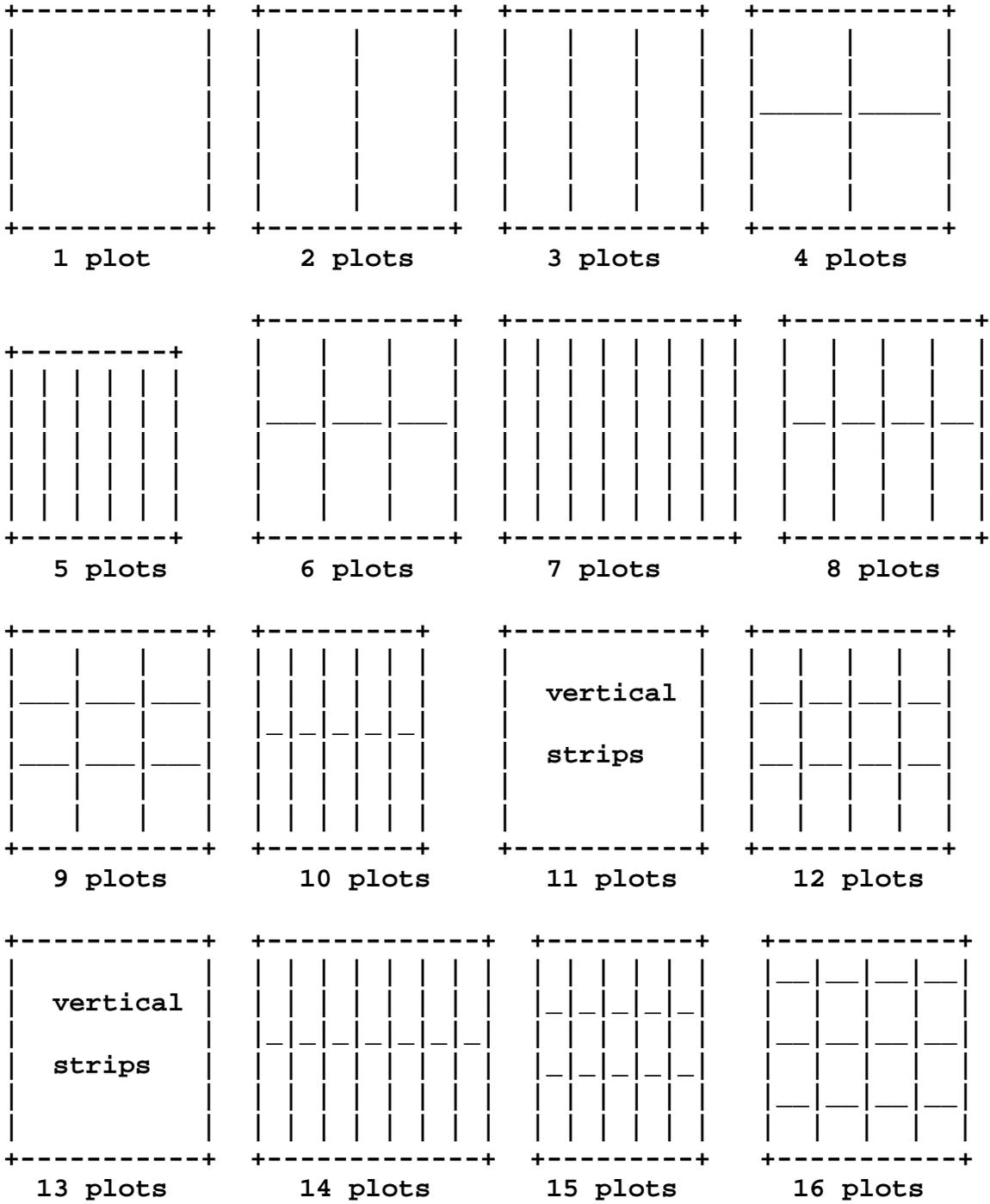
Plot arrangement patterns used by FVS2SVS.

# Appendix C:  TBL2SVS Conversion Program

The current version of the TBL2SVS utility program must be run from a DOS prompt. Future versions of SVS will include a Windows version of TBL2SVS.

## General Description

The TBL2SVS conversion filter is designed to convert simple stand tables into tree lists for use with the Stand Visualization System (SVS). In operation, TBL2SVS scans the input stand table and expands the records into a list of individual trees for use in SVS and, if the stand table does not already contain spatial locations, generates locations for each tree. TBL2SVS can be used with stand tables representing the live-tree component of a stand or it can be used to spatially distribute down material. When distributing down material, TBL2SVS simulates the "jack straw" appearance caused by logs falling, or being placed, on top of other logs.

TBL2SVS is a program for IBM-compatible personal computers running the MS-DOS operating system.

TBL2SVS is responsible for the following tasks:

+expand stand table records into the appropriate number of tree records for SVS
+generate spatial coordinates for the trees in a stand using a variety of spatial patterns
+provide an estimate of canopy closure for the "stand" as it is converted into an SVS tree list
+estimate crown widths when they are missing from or equal to 0 in the input stand table
+optionally delete stand table files as they are converted to SVS tree lists
+optionally accept percent cover estimates for understory plants and expand these estimates into an appropriate number of tree (plant) records for SVS

## TBL2SVS Input

Input to TBL2SVS is a simple stand table containing the following information:

species identifier
dbh
total height
crown ratio
crown radius
status
plant class
crown class
expansion factor (number of trees per unit area) or percent cover estimate (when preceded by a "%" symbol)

The status, plant class, and crown class are parameters specific to SVS.  Valid values for status are:

| Value of status | Interpretation in SVS |
|---|---|
| 0 or 10 | indicates the plant is cut, has branches, and is lying on the ground |
| 1 or 11 | indicates the plant is standing and has branches |
| 2 or 12 | indicates the plant is no longer present and only a stump remains |
| 3 or 13 | indicates the plant is cut, has no branches, and is lying on the ground |

Status values 10, 11, 12, and 13 are used to designate trees that cannot have their status changed using the mark and treat options in SVS.

Consult the SVS users manual for additional details regarding the interpretation and use of these parameters.

The expansion factor typically represents the number of trees (or plant) per unit area, e.g., 120.6 trees per acre.  When preceded by a "%" symbol, the expansion factor is treated as a percent cover estimate.  TBL2SVS will employ special logic to generate enough plants, using the size parameters in the record, to achieve the specified percent cover.  Percent cover estimates should range from 0.0 to 100.0.  When generating SVS files with very small herbaceous plants that occupy a large portion of the stand, it is best to create a "pseudo-plant" that is short with a large spreading crown.  This will give the desired effect of ground cover without generating thousands of tree records for SVS.

Stand tables, or individual records within a stand table, can optionally contain these additional parameters (must include all five parameters although command line options can cause all but the small end diameter to be ignored):

      location specified as an XY coordinate pair
      marking status
      felling angle
      small end diameter

The marking status is an integer used to indicate that the tree is "marked" for an SVS marking scenario.  This integer can range from 0 to 255.  Individual bits in the integer correspond to the eight possible marking scenarios with the least significant bit corresponding to scenario 1.  Thus a value of 1 indicates the tree is marked for scenario 1, a value of 2 indicates the tree is marked for scenario 2, a value of 4 indicates the tree is marked for scenario 3, a value of 8 indicates the tree is marked for scenario 4, etc.  A tree can be marked for more than one scenario.  For example, a marking status value of 12 indicates the tree is marked for scenarios 3 and 4.

The optional parameters are most often used to include a known population of trees or other plants in a larger, less well known stand.  For example, inventoried and mapped down, dead material within a mature stand.  In most cases, the expansion factor for a tree record that includes the optional parameters will be 1.0 as it doesn't make sense to have more than one tree located at the same spatial position.

Comments can be included in a stand table by placing a ";" in the first character position of the comment line.  Individual fields in the stand table must be separated by at least one space.  The species identifier can be up to 15 characters long and cannot contain embedded spaces.

## Example Input Files

The following example shows a simple stand table for use with TBL2SVS (notice that the comments (not required) define column headings):

```
;species dbh height crown crown   status plant crown expansion
;                   ratio radius         class class  factor
DF         8.0   69   0.6   6.3    1      0     0      37.1
DF        12.0   98   0.5   7.6    1      0     0      23.8
DF        16.0  110   0.45  9.4    1      0     0      31.3
DF        20.0  119   0.51 12.3    1      0     0       5.2
DF        24.0  134   0.47 15.2    1      0     0      12.9
DF        28.0  152   0.41 19.6    1      0     0       6.3
```

The following example shows a stand table that lists individual trees and down logs using the optional parameters:

```
;sp dbh ht   crn crown stat plt crn exp    X      Y    mark fell  end
;           rat rad         cls cls              stat angle dia
DF   28 152 .41 19.6   1    0   0  1.0   26.4  57.9  0    0    0.0
RA   14  72 .58  9.6   1    0   0  1.0   98.1 121.5  0    0    0.0
DF   42  53 .00  0.0   0    0   0  1.0  174.8  21.4  0   72   28.0
DF   78 197 .39 26.4   1    0   0  1.0  142.4 171.9  0    0    0.0
RC   62 162 .71 17.5   1    0   0  1.0   48.2 157.1  0    0    0.0
```

The following example shows a stand table that combines records using the basic parameters and records listing individual trees and down logs:

```
;sp dbh ht   crn crown stat plt crn exp    X      Y    mark fell  end
;           rat rad         cls cls              stat angle dia
DF   28 152 .41 19.6   1    0   0  1.0   26.4  57.9  0    0    0.0
RA   14  72 .58  9.6   1    0   0  1.0   98.1 121.5  0    0    0.0
DF   42  53 .00  0.0   0    0   0  1.0  174.8  21.4  0   72   28.0
DF   78 197 .39 26.4   1    0   0  1.0  142.4 171.9  0    0    0.0
RC   62 162 .71 17.5   1    0   0  1.0   48.2 157.1  0    0    0.0
DF    8  69 .60  6.3   1    0   0 37.1
DF   12  98 .50  7.6   1    0   0 23.8
DF   16 110 .45  9.4   1    0   0 31.3
DF   20 119 .51 12.3   1    0   0  5.2
DF   24 134 .47 15.2   1    0   0 12.9
DF   28 152 .41 19.6   1    0   0  6.3
```

The following example shows records that use percent cover estimates instead of expansion factors to create shrub and herbaceous plants in SVS:

```
;species dbh height crown crown  status plant crown expansion
;                   ratio radius        class class factor
SHRUB    1.0   4    0.9   1.5      1      0     0    %10.0
HERB     1.0   1    1.0   5.0      1      0     0    %20.0
```

## TBL2SVS Use

The command line syntax for TBL2SVS is as follows:

TBL2SVS [switches] TBLfile [SVSfile]

Optional command line switches control the behavior of TBL2SVS. The TBLfile is the name of the stand table file and the optional SVSfile is the name for the resulting SVS tree list. If no name is specified for the SVS tree list, the file will be named using the same file name as the stand table file and the extension ".SVS".

Running TBL2SVS with no command line options provides an overview and detailed instructions for all command line options.

## Command Line Options

-A#

Area for the SVS stand plot created during the conversion process. TBL2SVS generates a one acre stand by default. Smaller plots may be specified to reduce the number of trees drawn in SVS, thereby reducing the drawing time. When the metric unit option (-M) is used, the default area is one hectare and areas should be specified in hectares.

In stands containing tree records with very small expansion factors, producing larger SVS plots may help provide a more statistically correct sample of the stand. SVS can draw any size plot, however, plots containing more than 6,000 trees may not display properly.

-B#

Clump ratio for clumped spatial patterns. The clump ratio specifies the number of clump centers generated by the spatial pattern algorithm as a function of the number of individual trees in the stand. The numeric parameter, ranging from 0.01 to 0.5, is multiplied by the number of individual trees to compute the number of clump centers. The number of trees located around each clump center is equal to the reciprocal of the clump ratio.

-C#

Modify crown ratios in the stand table by multiplying the crown ratio by the numeric parameter.  The default behavior of TBL2SVS is to use the crown ratio reported in the input stand table.  The numeric parameter can range from 0.01 to 5.0.

-D#

Display debugging information about a specific portion of the conversion process.  The numeric parameter specifies the type of debugging information displayed.  Valid values and the resulting types of information are:

    1   display information while expanding stand table records
    2   display information while reading individual stand table records
    3   display general information while generating tree locations
    4   display detailed information while generating tree locations
    5   display information regarding the use of the stand and canopy map
    99  display all debugging information

-E

TBL2SVS normally estimates a crown radius whenever it encounters a value of 0.0 for the crown radius in the input table using a simple rull of thumb (crown radius equals 8 percent of the tree height).  The -E option disables the estimates and allows specification of trees with a crown radius of 0.0.  If crown radii, other than 0.0, are specified in the stand table input file, TBL2SVS does not estimate new radii.

-F#

Use stand table crown radius estimates included in the stand table file but multiply them by the numeric parameter.  To use the actual stand table crown radii (the default behavior of TBL2SVS), use a value of 1.0 for the numeric parameter.

-G#

Clumpiness factor for spatial pattern control.  The clumpiness factor controls the size of individual clumps of tree locations.  It affects only clumped patterns.  The following formula is used to compute the clump radius:

$$clump\ radius = (1.5 - 1.4 * clumpiness\ factor) * clump\ spacing$$

Small values of the clumpiness factor result in large clumps (to the point where the appearance of clumps is lost with a clumpiness factor of 0.0).  Large values result in very tight, widely spaced clumps.

The clump spacing is based on the number of trees per acre and the value of the clump count parameter specified using the B # command line option.

-I$

Combine the existing SVS tree list with the newly created tree list prior to the generation of coordinate locations for the new trees and plants.  This option can be used to combine several "stand layers" into a single stand.  Many times different species or size classes exhibit different spatial distribution patterns.  This feature in TBL2SVS allows you to build a stand in several stages by combining a variety of layers into a single SVS tree list.

-H#

Use stand table crown radii estimates unless they are 0.0.  For radii of 0.0, estimate the crown radius by multiplying the tree height by the numeric parameter. Valid values for the multiplier are 0.0 - 1.0.

-J#

Add range poles at each corner of an SVS plot.  The numeric parameter specifies the height of the range pole.  Range poles consists of a cylinder that is two feet in diameter.  Range poles are marked with ten stripes.  Valid heights can range from 0.1 to 250.0 feet.

-K

Delete the stand table file after a successful conversion by TBL2SVS.  The default behavior of TBL2SVS is to leave stand table files intact after the conversion process is complete.  If this option is specified, TBL2SVS will delete the stand table file if the conversion is completed without errors.  If errors occur during the conversion process, the stand table file will not be deleted.

-L#

Aspect ratio for the SVS plot.  The default aspect ratio is 1.0 resulting in square plots.  Aspect values greater than 1.0 result in plots that are wider than they are tall and values less than 1.0 result in plots that are taller than they are wide.

-M

Assume input data and SVS plot size values are in metric units.  TBL2SVS assumes English units are being used for input data and for plot sizes if the -A command line option is used.  The -M option tells TBL2SVS that input data and plot areas are expressed in metric units: tree diameters in centimeters, tree heights and crown radii in meters, and expansion factors represent trees per hectare.

-N#

Initialize the random number stream used for the conversion process.  If the numeric argument is 0, a seed will be generated based on the current time.  The default behavior of TBL2SVS is to use the same seed value each time a stand table is converted.  Valid seeds range from 1 to 32768.

-P#

Specify the spatial pattern logic used to generate tree locations. The default behavior of TBL2SVS is to generate tree locations using the uniform spatial pattern. Using this option, different patterns can be selected. Valid values for the numeric argument are:

  0   uniform pattern
  1   random pattern
  2   clumped pattern with clump centers generated using the uniform pattern
  3   clumped pattern with clump centers generated using the random pattern
  4   random spatial pattern using a round plot

For additional information regarding the spatial pattern options in TBL2SVS, see the section titled "Spatial Patterns" later in this document.

-Q

Turns off the display of status messages. The default behavior of TBL2SVS is to display status messages indicating its progress. When this option is used, TBL2SVS will not display any status information. TBL2SVS will, however, still display error messages.

-R#

Randomness factor for uniform spatial patterns. The randomness factor controls the magnitude of the offset from a perfect lattice pattern for individual tree locations or clump centers. A value of 0.0 results in tree locations aligned in perfect rows and columns. Values of 0.4 to 0.8 result in patterns approximating planted stands. Values greater than 0.8 result in patterns with some clumps of two or three trees. The randomness factor does not affect random spatial patterns.

-S

Tells TBL2SVS to read the optional parameters from the input file but only use the small end diameters. This option is most often used when your stand data contains descriptions of down logs that include a small end diameters but no position information.

-T$

Tells TBL2SVS to insert a #TREEFORM command into the SVS tree list using the string parameter as the SVS tree form file name. The #TREEFORM command tells SVS which tree form definition file to use when drawing a tree list.

-V

Turns on verbose status messages.  This option tells TBL2SVS to display detailed status information about the conversion process.

-W#

Estimate crown radii by multiplying the tree height by the numeric parameter.  The default behavior of TBL2SVS is to use the crown radius included in the stand table file or estimate a crown radius when the radius in the input table is 0.0.

Examples

The following command line converts a stand table named STAND.DAT into an SVS tree list named STAND.SVS:

    TBL2SVS STAND.DAT

The following command line converts a stand table named STAND.DAT into an SVS tree list named NEWSTND.SVS:

    TBL2SVS STAND.DAT NEWSTND.SVS

The following command line converts a stand table named STAND.DAT into a two acre SVS tree list named STAND.SVS using uniformly clumped tree locations with a randomness factor of 0.7 and a clumpiness factor of 0.1:

    TBL2SVS -A2.0 -P2 -R0.7 -G0.1 STAND.DAT


## Spatial Patterns

One of the primary tasks during the conversion process is the generation of spatial locations for the trees.  TBL2SVS generates a variety of spatial patterns:

- uniformly distributed tree locations
- randomly distributed tree locations
- clumped pattern of tree locations with uniformly distributed clump centers
- clumped pattern of tree locations with randomly distributed clump centers
- randomly distributed tree locations on a round plot

For all patterns, a map of individual stem locations is maintained and used to prevent trees from being placed on top of one another.

### *Uniformly Distributed Tree Locations*
In this method, a grid is superimposed on the plot.  The grid spacing is equal to the average spacing between trees calculated as:

    grid spacing = SQRT(43560 / total stems per acre)

The center of each grid cell is calculated and used as the initial location. Two random variates from -0.5 to 0.5 are then generated and multiplied by the grid spacing to serve as maximum offsets in the X and Y directions. The maximum offsets are multiplied by the randomness factor (specified using the -R command line option), ranging from 0.0 to 1.0, to determine the actual offset from the grid center. Locations generated using values of the randomness factor from 0.0 to 0.5 yield a pattern that clearly resembles a grid with 0.4 to 0.5 giving a good approximation of hand planted tree locations. Locations generated using values of the randomness factor from 0.5 to 1.0 have a uniform appearance and the grid structure is not obvious.

### Randomly Distributed Tree Locations
This method simply generates uniformly distributed random variates ranging from 0.0 to the width of the plot for the X value and from 0.0 to the height of the plot for the Y value.

### Clumped Patterns with Uniformly Distributed Clump Centers
This method generates "clump centers" using the same technique used to generate uniformly distributed tree locations and then generates the individual locations within the clump. The number of clumps can be controlled using the -B command line option. The clump spacing is calculated as follows:

clump spacing = SQRT(435460 / (stems per acre * clump density)

Individual locations in a clump are created by generating a random angle ranging from 0.0 to 360.0 degrees and a magnitude calculated as follows:

magnitude = (random number from 0.0 to 1.0) * clump radius

where clump radius is computed using the following equation:

clump radius = (1.5 - 1.4 * clumpiness factor) * clump spacing

The angle and the magnitude are used to offset the location from the clump center.

### Clumped Patterns with Randomly Distributed Clump Centers
The random-clump method generates clump center locations using the same method used for randomly distributed tree locations and then generates individual locations within each clump using the same technique used for clumped patterns with uniformly distributed clump centers.

### Randomly Distributed Tree Location on a Round Plot
This method creates a round SVS plot and places trees using random locations within the plot area. The plot area corresponds to the stand area specified using the -A# command line option. Individual plant locations are created by sampling a random distance from the plot center and a random angle around the plot. Round plots are recognized by SVS versions 2.20 and newer.

## Spatial Distribution of Down Material

TBL2SVS provides a specialized algorithm for locating and positioning down material. When down material (status codes 0, 10, 3, or 13) is encountered in an input stand table with no location information, TBL2SVS first generates random locations for the large end of each log. Then TBL2SVS simulates the "jack-straw" effect created by logs falling on top of one another. To do this, TBL2SVS maintains a map of the down material and tests each log being placed to see if it lies on top of another log or several logs. The center of gravity, c.g., is computed for the log being placed, assuming that the log is a conic solid, and the highest point-of-contact with logs on either side of the c.g. is determined. Given the location of the contact points, the height at each end of the log is calculated. If the projected height of either end is below the ground surface or if there is only one contact point, that end is assumed to be supported by the ground. The elevations of the log ends are then used to compute a "lean angle" that SVS will interpret as the angle from vertical for a down stem. The log placement algorithm has some limitations but it results in stands that display well in SVS and that are free of visual inconsistencies such as logs "floating" in the air without any visible support. In most cases, the algorithm exhibits conservative behavior in that it can sometimes generate locations and orientations that result in logs that intersect in the same plane but rarely is an orientation computed that results in an unsupported, or floating, log.

## Crown Width Estimates

TBL2SVS provides three methods for generating crown radius information. The first, and the default, is to use the crown radii from the input stand table with a optional multiplier (see the -F# command line option). The second allows estimation of crown radii by providing a simple multiplier for the tree height (see the -W# command line option). The third, a hybrid of the first two methods, uses the stand table crown radii unless they are 0.0 in which case, crown radii are estimated using a height multiplier (see the -H# command line option).

## Creating Stands With Multiple Layers

TBL2SVS provides features designed to facilitate the development of SVS tree lists consisting of several distinct "layers" or structural components. TBL2SVS can combine an existing SVS file with new data to create a new SVS tree list. This feature can be used to create stands consisting of distinct species or size classes distributed using different spatial patterns. This feature is also useful when demonstrating several overstory treatments and wishing to maintain the same understory or down wood appearance across the treatments.

To use this feature, first create the initial SVS tree list using a TBL2SVS data file (file named layer1.svs for this example). Next, create a composite SVS tree list by including the -Ilayer1.svs option on the TBL2SVS command line with a new TBL2SVS data file. Tree, plant, and log locations for the initial SVS tree list will

remain the same in the composite tree list and their locations will be considered when placing the new plants in the second layer.

# Appendix D:  Utility Programs

This document describes several utility programs distributed with SVS. Throughout the descriptions several example command lines are presented. In the example command lines, parameters surrounded by "[" and "]" are optional.

***The utilities are all run from the DOS prompt.***


## VIEWPCX

*The VIEWPCX utility is still included with Windows SVS but use of its replacement, VIEWPIC, is recommended.* VIEWPCX is designed to display .PCX files. VIEWPCX can be used to display single .PCX files or sequences of several .PCX files (such as the file generated by a UVIEW script). VIEWPCX responds to the BGIDVR and BGIMODE environment variables to control the screen resolution and number of colors. VIEWPCX also uses the SVSHOME or UTOOLSHOME environment variable, if they are defined, to locate BGI drivers allowing VIEWPCX to be run from any directory on your hard drive. Syntax for VIEWPCX is:

    VIEWPCX [file] [[/Ffile] [/Ddelay] /L /C /X]

| | |
|---|---|
| file | name of PCX to view...include extension |
| /Ffile | read PCX file names from list stored in file |
| /Ddelay | delay between images when displaying a list of PCX files |
| /L | loop through list of PCX files until key is pressed...use [+] to increase and [-] to decrease delay between PCX files |
| /C | clear screen before each PCX file in a list is displayed |
| /S | wait for keystroke before displaying next PCX file in list |
| /X | use XMS memory to display PCX file (much faster). XMS memory option works with 256 color images only. |

Examples:

    VIEWPCX scr000.pcx

Displays the image stored in scr000.pcx

    VIEWPCX scr000.pcx /X

Displays the image stored in scr000.pcx using XMS memory.

    VIEWPCX /Fimages.lst /L /X

Displays the sequence of images listed in images.lst. Sequence will play continuously until a key is pressed. Use [+] to increase the delay between images (slower playback)and [-] to decrease the delay between images (faster playback).

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## OLAYPCX

OLAYPCX is designed to overlay one .PCX image onto another .PCX image. Definition of a transparent color allows selective overlay capabilities. OLAYPCX can be used to overlay a standard title image onto several screen snapshots. To create the title image, use a paint program such as Microsoft PAINT for Windows to create an image containing the desired titles on a black background (or any other solid color). Make sure the title image is the same size as your screen snapshots. Then use OLAYPCX to overlay the title image onto one or more screen snapshots (specify a trans_color of 0 if you used a black background). Syntax for OLAYPCX is:

    OLAYPCX file ofile newfile trans_color

    file            name of PCX file
    ofile           name of PCX file for overlay
    newfile         name for new PCX file
    trans_color     transparent color

***Example:***
    OLAYPCX scr000.pcx title.pcx image1.pcx 0

Overlays the image "title.pcx" onto the image "scr000.pcx" and saves the new image in "image1.pcx". Only areas in the overlay image, "title.pcx", that are not color 0 will be displayed and saved in the new image file.


## STRWHITE

The STRWHITE utility removes extra whits space characters from an ASCII text file and optionally making columns comma delimited. This program is useful for preparing text files, with column data, for input into spreadsheets, statistics software, etc. The syntax for STRWHITE is:

    STRWHITE [-c] [-h] [-v] oldfile [newfile]

    -c          make file comma delimited
    -h          display this help screen
    -v          verbose, echo what is happening (default OFF)
    oldfile     name of the input file to process
    newfile     optional name for the processed file.  If newfile is not specified, the
                processed file will overwrite the input file.

***Example:***
    STRWHITE -c tree3.svs tree3.txt

Process the SVS tree list, tree3.svs, removing excess white space characters and inserting commas to delimit columns if data. This command line can be used to create a simple, columns-delimited file for import into most spreadsheet packages.

## SVS2FVS

The SVS2FVS utility converts an SVS tree list into an input file for the Forest Vegetation Simulator (FVS).  This utility is especially useful if you want to treat stands in SVS, then project the stand forward through time to see the effect of the treatment.  See the documentation for the FVS2SVS conversion utility for instructions to convert the FVS output back into an SVS tree list.  Syntax for SVS2FVS is:

    SVS2FVS [-v] svsfile fvsfile

    -v          echo progress as SVS2FVS runs
    svsfile     name of the SVS tree list to convert
    fvsfile     name for the FVS input file to be created

*Example:*
    SVS2FVS tree3.svs stand.dat

Converts the SVS tree list, tree3.svs, into an input file named stand.dat for use with FVS.


## TLS2SVS

The TLS2SVS utility is designed to convert tree list files produced by the FORSEE silvicultural treatment editor into tree list for use with SVS.  FORSEE was developed for use with a helicopter cost and production model, HELIPACE, and displays simple, overhead views of a stand based on a stand table.  The syntax for TLS2SVS is:

    TLS2SVS tlsfile

    tlsfile     name of tree list file produced by FORSEE.  The normal extension
                is .TLS.

The normal behavior of TLS2SVS is to output the treelist to the screen.  You should use output redirection to send the output to a file.

*Example:*
    TLS2SVS demo.tls > demo.svs

would send the treelist, DEMO.TLS, to a file named DEMO.SVS


## TREEFORM

The TREEFORM utility is designed to display plant definitions stored in .TRF files.  The utility can be used to "browse" a form definition file or it can generate a series of

PCX image files containing the plant forms contained in a .TRF file.  TREEFORM display six plant forms per screen.  Syntax for TREEFORM is:

TREEFORM [-Cimgfile trf_file]

-Cimgfile     tells TREEFORM to generate PCX images for all plant forms in the file specified in trf_file.  PCX image files will be saved in files named file####.PCX where the #### will be replaced with the sequential number of the image file.

trf_file      name of treeform definition file to display including the .TRF extension.

### Examples:
TREEFORM -Cni ni.trf

Displays the plant form definitions stored in NI.TRF and captures the screens to files named NI0000.PCX, NI0001.PCX, NI0002.PCX, etc.

TREEFORM

Runs TREEFORM in interactive mode.  The user can select the .TRF file to display and then "browse" the plant form definitions.