

FORESTER'S YIELD CURVE DESIGNER v1.0 USER'S GUIDE

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Abstract

The Forester's Yield Curve Designer (FYCD) software is aimed at helping forest management planners and field foresters in the development and validation of wood volume yield curves. It uses a mouse-driven graphical user interface (GUI) that facilitates the import and display of results from stand growth models, the comparison of potential curves with permanent sample plot data, and the creation of new curves by drawing, adjusting, and combining curves. In addition to generic input and output formats, it contains specific support for yield data used by the FORMAN+1 and Woodstock forest simulation models, several growth models, and the province of New Brunswick permanent sample plot and forest development survey (FDS) data.

FYCD is designed to improve forest management decision-making by providing a means to directly use the knowledge and experience of field foresters in improving yield forecasts. FYCD also increases the usability of valuable data from permanent and temporary sample plots by creating tools to access it. This software addresses the problem of closing the loop in the forest management planning process, that is, of getting the management plan volume yield curve information out to field foresters for validation against available data and experience, and facilitating feedback from the forester to the planner.

This report provides an overview of the primary functionality of FYCD, describes data formats used, and includes visual and indexed reference guides to all functions. An easy to follow tutorial guides the user through much of the software functionality using six exercises that reflect typical user scenarios. Sample data files are included with the software.

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1. Introduction

The Forester's Yield Curve Designer (FYCD) software was designed to address two separate uses:

- 1) to assist in the development of volume/ha versus age yield curves used in forest management planning and timber supply analysis, and
- 2) to allow field foresters to access, use, and help validate the complex yield curve data sets used in management plans.

FYCD therefore is aimed at two very different types of users, management planners who are constructing the yield curve databases, and field foresters who want to use the management plan or plot information in making decisions.

Developing volume/ha yield curves to be used in management planning is a complex, time-consuming task. FYCD helps with this activity by facilitating the import and display of results from stand growth model runs and the comparison of potential volume/ha curves with permanent sample plot (PSP) data for validation. It also allows the user to build aggregate curves (e.g., to build multi-species curves from single-species data) and to create new curves by drawing, adjusting, and combining curves.

Underpinning virtually every decision in forest management is a forecast of the development of stands under alternative management options. These forecasts are currently embodied in management plans as complex timber supply model data sets, known as "class files" and "yield curve sets", that describe all the different types of forest and their expected development under management alternatives. Every forest stand on Crown or large freehold land in New Brunswick is currently described in this way by planners, yet, this complex information involving dozens of classes and thousands of curveset values is not accessible to foresters. Up until now it was difficult for foresters to conduct field validation of management plan yields and provide feedback to planners to improve forecasts.

Secondary objectives of this project were to improve forest management decision-making by providing a means to directly use the knowledge and experience of field foresters in improving yield forecasts and to improve the usability of valuable data from permanent and temporary sample plots by creating tools to access it. FYCD addresses the problem of closing the loop in the forest

management planning process, that is, of getting the management plan volume yield curve information out to field foresters for validation against available data and experience, and facilitating feedback from the forester to the planner.

FYCD uses a mouse-driven graphical user interface (GUI) and was developed using the Visual Basic programming language. It runs on a PC and requires Microsoft Windows 3.x or Windows 95, a mouse, at least 2 megabytes of free disk space, and 2 megabytes of memory.

FYCD contains functionality designed with both forest planners and foresters in mind. It allows the user to:

1. import data from stand growth and yield models, forest simulation models (FORMAN+1 and Woodstock), and from permanent or temporary sample plot measurements;
2. use three different methods to access FORMAN+1 yield curvesets;
3. select volume yield curves by any factors that might be used to define them in management plans, such as stand species composition, site type, geographic location, ecodistrict, or silvicultural treatment;
4. graphically display the yield curve or curve components (individual species or volume components);
5. view on-screen legends for both data sets and individual curves;
6. validate curves against available data, including permanent sample plots and Forest Development Survey (inventory) plots;
7. build new curves from stand model output, existing curves, or plot data;
8. combine curves and/or plot data using several aggregation methods including summation, averaging and four types of regression;
9. if desired, use drawing and editing tools to alter the development pattern based on the forester's experience or data;
10. save yield curves in either a generic format or formats used in forest simulation models (FORMAN+1 or Woodstock curve sets);
11. enter, store, and view notes or comments on curves (e.g., comments on revised or "questioned" yield patterns from a forester to a planner); and
12. view on-line help.

This report is divided into five sections and three Appendices. Section 2 provides a brief overview of

FYCD and its major functions. Section 3 describes how to obtain and install the software. Section 4 presents six tutorial exercises to help get you started. Section 5 is the FYCD reference, that provides an explanation of all functions. This includes an alphabetical index of all functions and terms, plus Figures that illustrate all buttons, menu items, and data entry forms. These are both numerically cross-referenced to a detailed description of functions, so that you can locate an item in either the index of functions and terms (pp. 12-13) or the Figures (pp. 14-28) and then look it up in the reference (pp. 29-36). Appendices 1 and 2 explain data formats used by FYCD and the sample data files that are included with the software. Appendix 3 provides a glossary of terms.

The best way to learn FYCD is to try it out. The tutorial can be used as a guide to get you started. It presents several possible uses of FYCD. The online Help system provides the most detailed documentation, so we encourage you to use it extensively.

A number of sample input data files from growth and yield models as well as a sample of estimated volumes per hectare based on the New Brunswick Co-operative Permanent Sample Plots (PSP data courtesy of John Upshall, New Brunswick Department of Natural Resources and Energy) are included with the FYCD software. FYCD will also read FORMAN+1 curveset files and Woodstock data as input. All data files on the FYCD disk should be treated as sample data which may not be realistic.

2. Overview of FYCD

The main portion of the FYCD screen (Figure 1) consists of a yield versus age graph, upon which selected data sets are displayed as full curves, curve segments representing repeated plot measurements, or single plot measurement points. Built-in functions and use of a mouse allow the selection and manipulation of any displayed data. FYCD facilitates validation of yield curves by comparison with sample plot data. The user can also create new curves by drawing, adjusting, or combining curves. Age-based curves of volume per hectare, volume per tree, or stems per hectare can be used with the program.

FYCD provides a curve display area with labeled x- and y-axes and a legend. Figure 1 shows the

user interface and identifies several of its components. Data are displayed as colored curves, curve segments, or points on the graph. The Data Sets legend identifies different data source files using different colors. A menu bar, a button bar and dialog boxes provide access to FYCD's capabilities, including importing data; interactively drawing and editing curves; combining curves by summing, averaging and curve-fitting methods; and saving curves in various formats. Specific import routines are included to support PSPs, temporary sample plots, the STAMAN (Vanguard Forest Management Services Ltd. 1993) stand growth model, and the FORMAN+1 (Wang et al. 1987, Vanguard Forest Management Services Ltd. 1991) and Woodstock (Remsoft Inc. 1996) forest models. The user can also create notes or comments and link them to individual curves, send output to a printer, and access on-line help information.

2.1 How FYCD works with data

To avoid confusion, it is important to understand how FYCD works with data. FYCD views data using one of two abstractions, depending on the operation, either as a data set or as an individual curve.

The first data abstraction is based on the idea of the data set. Whenever a data file is opened or a curve is built, FYCD is using a data set, the name of which is displayed in the Data Sets legend (Figure 1). This data set name is a filename or other descriptive label that explains the data. Operations in FYCD that work on a data set include: clearing a data set, opening a data file, saving data, and editing data.

The second data abstraction used by FYCD is a single data curve. Certain operations deal with individual volume per age or stems/ha per age curves directly, rather than with the whole data set. Operations that work on single curves include: selecting curves by clicking on them on the graph or by using the select all button, building a curve, and clearing a curve in the Curve Set Info legend.

It is important to realize that no changes that you make on the screen will affect the original data in your data files. The only way to save data to a file in FYCD is through the **File - Save** menu or through the save buttons on the toolbar, and even then, the new record is added to an existing file,

leaving the original data unchanged. Saving to a filename that does not exist creates a new file.

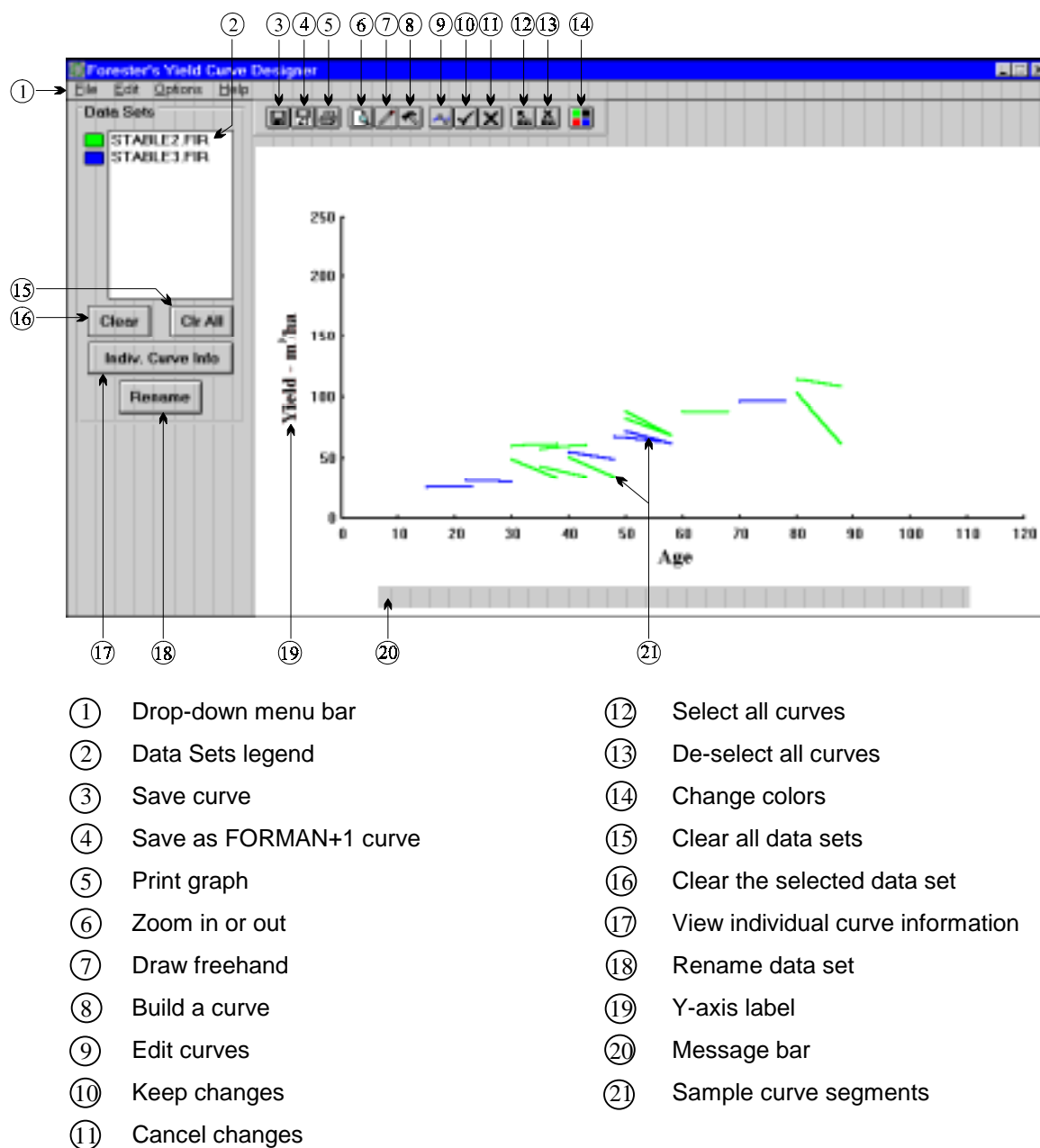


Figure 1. FYCD window with identification of user interface components.

3. Obtaining and Installing the Software

If you have Internet access, the FYCD software can be obtained from the World Wide Web (WWW) or by FTP. On the World Wide Web, direct your browser to the Canadian Forest Service, Atlantic Forestry Centre home page, at <http://www.fcmr.forestry.ca/> and follow the link to the FYCD software.

For FTP, you can either direct your browser to <ftp://mfrc5.fcmr.forestry.ca/FYCD/> or you can use anonymous FTP to retrieve the software. With your ftp client, connect to [mfrc5.fcmr.forestry.ca](ftp://mfrc5.fcmr.forestry.ca), and enter "anonymous" as your log-in name. Enter your email address when asked for a password, change to the directory named **FYCD**, ensure your file transfer type is set to binary, and get the self-extracting zip files named **fycd-v1.exe** (FYCD software and sample data) and **fycd-doc.exe** (this document).

If you do not have Internet access, a diskette with the software can be obtained by sending a high-density 3.5" floppy diskette and a self-addressed, stamped floppy disk mailer to the authors.

3.1 Installation

If you are installing from a diskette, insert it into the 3.5" drive (we'll assume it's the A: drive), then:

Windows 3.x users: From the Program Manager, select **File-Run** from the menu, then type **a:\setup** in the box provided.

Windows 95 users: From the Start button on the taskbar, select **Run**, then type **a:\setup** in the box provided.

If you retrieved FYCD via FTP or WWW:

1. Make sure that the **fycd-v1.exe** file is in an empty directory.
2. Extract the FYCD software from the downloaded file:
Windows 3.x users: From the Program Manager, select **File-Run** from the menu, then select the **fycd-v1.exe** file from the dialog box provided.
Windows 95 users: From the Start button on the taskbar, select **Run**, then select the **fycd-v1.exe** file from the dialog box provided.
3. *Windows 3.x users:* From the Program Manager, select **File-Run** from the menu, then

type in the path to the FYCD **setup.exe** file in the box provided. e.g. **c:\temp\setup.exe**

Windows 95 users: From the Start button on the taskbar, select **Run**, then type in the path to the FYCD **setup.exe** file in the box provided.

e.g. **c:\temp\setup.exe**

4. The setup program first prompts for the directory of the FYCD source files. By default, it is the A: drive. Change this to the directory in which the setup files exist.
5. Follow the rest of the instructions displayed by the setup program. You can then delete **fycd-v1.exe** if desired.

To extract the document file, follow steps 1 and 2 above using **fycd-doc.exe**. The file is a Microsoft Word document.

This will install all program and sample data files for FYCD into a directory called C:\FYCD. You may install FYCD to a directory other than C:\FYCD\, but if so, you will have to change the paths to the FORMAN+1 files by means of the **Options - Configuration** menu item.

All user-definable configuration information is stored in a file called FYCD.CFG. If this file is lost, there is a backup copy on the installation diskette that you can copy to the FYCD directory.

We welcome and encourage your comments on our software and are especially interested in ideas for making FYCD a more useful tool for foresters and management planners. Please contact Kevin Porter (address same as on title page, email kporter@fcmr.forestry.ca).

4. Tutorial

This tutorial is divided into six exercises that demonstrate different functionality of FYCD. Use the FYCD Reference (Section 5) and on-line help, as needed, for explanation of the options you see on the screen. You should clear all data from FYCD before beginning a new exercise, using the clear all (**Clr All**) button in the Data Sets legend.


Boldface text is used in the tutorial to highlight FYCD menu items and other text that appears in the software, and icons are used to identify buttons. File names, data set names, and items to be typed are shown in Courier font.


Exercise 4.1: Construct volume yield curves from stand growth model output and save curves to a file.

This exercise will demonstrate how to open FYCD input files and build aggregate curves. The FYCD distribution disk provides several files that were generated using the STAMAN stand growth model (Vanguard Forest Management Services Ltd. 1993). Using these files, we will build two aggregate curves that demonstrate the volume gained by protecting against spruce budworm (*Choristoneura fumiferana* Clem.) defoliation. The files `stamrep1.1bf`, `stamrep1.2bf`, and `stamrep1.3bf` represent volume projections for three balsam fir stands, from ages 33-63, 57-87, and 64-94 years, respectively. The files `stamrep1.1bf`, `stamrep1.2bf`, and `stamrep1.3bf` represent projections for the same three stands and ages, but under conditions of an uncontrolled spruce budworm outbreak. In each pair of protected and unprotected simulations, the budworm-affected stand has lower volumes, resulting from mortality and growth loss caused by defoliation.

4.1.1 Click the **File** menu, then click **Open**, then **Model Output**, then **STAMAN**. From the file box, choose `stamrep1.1bf`. Repeat this process for `stamrep1.2bf`, `stamrep1.3bf`, `stamrep1.1bf`, `stamrep1.2bf`, and `stamrep1.3bf`. You should see six curve segments. Note the reduced volumes in the unprotected simulation (`stamrep.*`) of each pair.

4.1.2 Select the three protected curves (`stamrep1.*`) by placing the tip of the cursor arrow on each curve and then clicking the left mouse button. Each curve will turn red when selected.


4.1.3 Press the build curve button  on the button bar. In the Build Curve dialog box, select Aggregation Type **Mean**, and Age Points to Aggregate **5 Year**. Press **Continue**. This will build an average protected curve from all selected curves and display it on the graph. This aggregate curve was calculated by taking the average volume for each selected curve at 5-year intervals.

4.1.4 Click on the de-select all button  on the button bar. Repeat steps 4.1.2 and 4.1.3 to build an aggregate curve for the three

defoliated curves (`stamrep.*`).

4.1.5 In the Data Sets legend, successively select each original data file (e.g. `stamrep.1bf`) and press the **Clear** button, until only the two aggregate protected and unprotected curves remain.

4.1.6 In the Data Sets legend, click on the name of the protected aggregate curve (aggregate) and press the **Rename** button. Rename it to 'protected'. Repeat the process for the unprotected curve, naming it 'unprotected'.


4.1.7 Select the protected curve from the Data Sets legend and select **File - Save - FORMAN+1** from the menu or press the save as FORMAN+1 button . In the file box, type in the name of a file with a `.crv` extension (e.g., `bf.crv`) to save the curve to, or select an existing curveset file to add the curve to. Next, fill in the FORMAN+1 fields using appropriate values (e.g., curveset number 1, curveset name `bf`, breakup curve ID 20, volume component `pulp`, and defaults for other values; see Appendix 1.4 and the glossary in Appendix 3 for further explanation), and enter a comment in the **comment** box. An example comment: "This curve is an average protected curve built with the yield curve designer from three STAMAN projections". Use the **Tab** key to move from field to field in the form. Repeat this process to save the unprotected curve to the same file.





Exercise 4.2: Display PSP data, compare it to yield curves, and interactively edit curves.

This exercise will demonstrate how to open a PSP data file, build an average curve based on plot data, and compare the plot-based curve to the model output-based curves built in Exercise 4.1.

4.2.1 From the menu, select **File - Open - PSP**. From the file box, select `dmaclean.psp` and click **OK**. The Open PSP - Options dialog box will appear; select **BFSP** from the species composition window, and select all site regions and treatment units by clicking their respective **All** buttons. Click **Continue**. The curve segments that appear represent volume development from 1983-1991 for

permanent plots maintained by the Canadian Forest Service in New Brunswick (MacLean and Erdle 1986); the volume declines were caused by spruce budworm defoliation and natural stand breakup.

- 4.2.2 Select all curve segments by pressing the select all button  on the button bar. Build a mean curve through these curve segments as in step 4.1.3 above. Remove the PSP data by selecting `dmaclean.psp` in the Data Sets legend and pressing **Clear**.

- 4.2.3 There are spikes in the aggregate curve that was just built, so let's smooth it using editing tools. Select the aggregate curve in the Data Sets legend and click on the edit button  on the button bar to enter "edit mode". A "drag box" should appear over each vertex of the curve. Click on the second last box (or any other one that you would like to move) and hold down the mouse button. Now move the "drag box" to the desired location and release the mouse. Once several "drag boxes" have been moved to create a smoother curve, click on the keep button  to save your changes. If after modifying the curve it is desired to change back to the original, press the cancel-changes button . Click on the edit button  again to exit "edit mode".

- 4.2.4 Let's compare this curve to the curves previously saved in Exercise 4.1. From the menu, select **File - Open - FORMAN+1 - File Viewer**. From the file box, choose the curveset file to which the two curves built in Exercise 4.1 were saved. The scroll bars on the file viewer can be used to examine the comments that were saved for these two curves. Click on each of these curves to select them. The selected curves are preceded by ">>>". A curve can be unselected by clicking on it again. Once the two curves are selected, press **Continue**. Now these two curves can be compared to the curve built from the PSP data.

- 4.2.5 Now let's examine the comments saved for the protected and unprotected curves. Select the data set name for these curves in the Data Sets legend. Click on the **Indiv Curve Info** button to enter "individual curve info mode". This mode provides more

information about the curves within a data set by color-coding them and graying out the curves in all other data sets. The curveset number, curveset name, and volume component are displayed for each curve in the Curve Set Info box. Each curve is now individually colored. The check marks to the right of each curve name indicate that comments exist for those curves. Select one of the curves in the Curve Set Info box, and click the comment button to view the comment. Click the **Indiv Curve Info** button again to exit this mode.

Exercise 4.3: Import yield curve information formatted for the FORMAN+1 forest simulation model and sample plot data. FORMAN+1 (Wang et al. 1986, Vanguard Forest Management Services Ltd. 1991) is a simulation model commonly used in eastern Canada. This exercise opens FORMAN+1 data by the Class Definition method, using the factors that stratify the assigned forest classes. These data will then be compared with inventory (Forest Development Survey - FDS) and PSP data. See Appendix 1.7 for details on how to set up FYCD to use your own data.

- 4.3.1 FYCD has an option, that can be toggled on or off, to automatically build a sum-aggregate curve whenever a FORMAN+1 curveset file is opened. From the menu, select **Options - Configuration**. Click on the box next to the message that says "Build sum curve automatically when curveset is opened" if it is not already checked. Press **Continue**.

- 4.3.2 From the menu, select **File - Open - FORMAN+1 - Class Definition**. Select `forsampl.crv` from the file box and click **OK**. Select forest class BFSPAA, site type Good, and management unit Q from the selection boxes and press **Continue**. Then the "Curve Selection" window appears. FORMAN+1 curveset formats are explained in more detail in the glossary, Appendix 3.


- 4.3.3 On the Curve Selection form, select V-volume from the curve type box and primary volume from the volume category box; then select both FIRPLP and SPRPLP from the volume component box, by holding the **Ctrl** key while clicking to select more than one volume component. Press **Continue**.

4.3.4 FYCD can be used to examine data from different sources to validate curves. To illustrate this, we will now display FDS data for comparison. From the menu, select **File - Open - FDS**. From the file box, select `bfsp.fds` and click **OK**; a scatter graph of the plot data appears. The fir and spruce pulpwood curves from step 4.3.3 can now be compared to the plot data.

4.3.5 Now you can do the same with some PSP data. Open all `BFSP` data from `dmaclean.psp` as in step 4.2.1; curve segments appear. The point here is that the curve data could now be edited, if they poorly represented the plot data.

Exercise 4.4: Freehand drawing and display configuration options. This exercise demonstrates how to draw a curve with FYCD, perhaps based on empirical data, and save it to a curveset file that could be used as input to a timber supply model.

4.4.1 Display some FDS data once again. From the menu, select **File - Open - FDS**, select `spih.fds`, and click **OK**.

4.4.2 Now draw a single curve that is representative of this survey data. Click on the draw button . This switches FYCD to "draw mode". Click a point on the graph indicating where you want to begin the curve. Points are placed at each spot on the graph where you click and are connected to other points to form a line (curve). Points can also be entered for a curve using the point control box. Enter pairs of x and y coordinates, and then press the **Plot Point** button. When finished drawing the curve, click on the draw button again to exit "draw mode".



4.4.3 Next let's change the scale of the graph and add a grid. From the **Options** menu, select **Scale and Grid**. Change the **Max X value** to 200 either by typing it into the box or by clicking on the arrowheads. Click the **Grid On** button in the **Grid Control** section of the form. Press **Continue**.

4.4.4 Now save the curve to a FORMAN+1 file as in step 4.1.7. For example, you could use curveset number 2, curveset name `spih`,

breakup curve ID 21, volume component `pulp`, and defaults for all other fields. This curve will be appended to the curveset file.

Exercise 4.5: Curve-fitting techniques. This exercise will demonstrate some of the curve fitting capabilities of FYCD.


4.5.1 Display some FDS data once again. Select **File - Open - FDS** from the menu, select the `bfsp.fds` file and click **OK**, and repeat for `spbf.fds`. A scatter graph of plots from the two files appears.

4.5.2 Let's fit an aggregate cubic equation through these data. Select all points by clicking on the select all button . Now press the Build curve button . From the Build Curve dialog box, select Aggregation Type **Cubic**, and press **Continue**. A new aggregate curve appears.

4.5.3 In the Data Sets legend, select the aggregate curve. Now click on the **Indiv Curve Info** button. Notice that the equation and r^2 value for the fitted curve are displayed in the message bar at the bottom of FYCD, and that the r^2 is listed in the Curve Info legend. Click on the **Comment** button in the Curve Info box, and the equation is displayed; if the curve is saved to a FORMAN+1 file, the equation will be saved as a comment in the file. The r^2 value is the coefficient of determination, which describes how closely the curve fits the data. The r^2 represents the proportion of variability in the data explained by the regression equation; the closer the value is to 1, the better the fit.

4.5.4 Experiment with building curves using the linear, quadratic, and logarithmic Aggregation Types.

Exercise 4.6: Procedures for accessing, displaying, editing and saving curve information used in the Woodstock model. Woodstock (Remsoft Inc. 1996) is another forest planning model used extensively in eastern Canada. This exercise will demonstrate how to open several curves from a Woodstock file and save one of these curves to either a Woodstock or a FORMAN+1 curveset file.

- 4.6.1 Select **File - Open - Woodstock** from the menu, select the `model.pri` file, and click **OK**.
- 4.6.2 In the Development Type Selection box, select the development type set1 and press **Continue**.
- 4.6.3 In the Yield Components Selection box, select the first five yield components BFFIB, BFLOG, SPFIB, SPLOG, and WBFIB by holding down the **Ctrl** key while clicking on each name and then press **Continue**. A set of curves, one for each selected component, appears that represents balsam fir, spruce, and white birch fiber and logs.
- 4.6.4 Now five curves from the Woodstock file are displayed. Only one curve can be saved at a time, so let's clear all except one curve from the data set. From the Data Sets legend, select `model.pri`, then press the **Indiv Curve Info** button. The Curve Set Info box displays the development type and yield component of each curve on the graph. Select all except the SPLOG curve in the Curve Set Info box by holding down the **Ctrl** key while clicking on each curve name, and press the **Clear** button. Only the SPLOG curve remains. Press the **Indiv Curve Info** button in the Data Sets legend to close the Curve Set Info box.
- 4.6.5 Now display some validation plot data showing merchantable spruce log volumes: select **File - Open - FDS** from the menu, select the `splogs.fds` file, and click **OK**. A scatter graph of plot data appears.
- 4.6.6 Now adjust the SPLOG curve based on the plot data using "edit mode", as in step 4.2.3.
- 4.6.7 To save the curve to a Woodstock file, we must first ensure that the age of each vertex is an increment of the period length. For example, if the period length is 5 years, the data might begin at age 20, and continue for ages 25, 30, 35, and 40. To ensure that this is the case, build a 5-year interval mean curve through the curve to be saved, as in step 4.1.3 above. Now we'll save this aggregate curve. Select the aggregate curve in the Data Sets Legend, then select **File - Save - Woodstock** from the menu or press the save as Woodstock button . In the

Save as box, type in the name of a file to save the curve to (e.g., `sample.pri`), then press **Continue**. On the Save to Woodstock File form, enter a development type (set1), a yield component (SPLOG), and make sure the period length is 5. Press **Continue** to save the curve.

- 4.6.8 If you want to save the SPLOG curve to a FORMAN+1 curveset file, the procedure is as in step 4.1.7.

The above tutorial describes the major functionality of FYCD and was designed to get users started using the tool. From here, hopefully, you will experiment with FYCD and try out other capabilities of the software.

Some of the other capabilities to look for are zooming, changing data set colors, opening FORMAN+1 files by query, and customizing PSP and FORMAN+1 options. Also, in addition to volume per hectare data, FYCD supports volume per tree and stems per hectare as data types. These can be selected through the **Options - Data Type** menu item. Some sample data files for these other data types have been included with FYCD. See Appendix 2 for a description of all sample data files included with FYCD.

5. FYCD Reference

This section contains detailed reference information for FYCD. Table 1 presents an index of terms and functions, cross-referenced to both a description of functions (Section 5.1, p. 29) and to Figures with screenshots of the visual components on all FYCD screens (pp. 15-28). Table 2 presents a list of all user interface windows and menus, to assist in locating the desired screenshot. This is intended to be an easily accessible hardcopy source of information. Scan through the indexes or screenshots for items that you are interested in. Using the description numbers labeling the screen components, look up the description in Section 5.1, the Description of functions and terms.

All screenshots were taken from a computer running Windows 95. If you are running Windows 3.x, your screens will differ only in the "look" of the bar at the top of each window. The content and operation of FYCD is exactly the same in Windows 3.x and Windows 95.

Table 1. Alphabetical listing of functions and terms. Items are numerically cross-referenced to both Section 5.1, the Description of functions and terms, and to the screenshot Figures.

Function or term	Description		Figure	
	Number	Page	Number	Page
age interval	100	34	15	25
breakup age	89	34	13	24
breakup curve ID	87	33	13	24
build curve	9, 26	29, 30	2, 3	15, 16
cancel changes button	12	30	2	15
change colors	15, 30	30, 31	2, 3	15, 16
check mark	50	31	5	18
clear all data	16, 26	30	2, 3	15, 16
clear curve button	47	31	5	18
clear data set	17	30	2	15
colors	15, 30	30, 31	2, 3	15, 16
comment	92	34	13	24
comment button	48	31	5	18
configuration	30	31	3	16
cubic regression	98	34	15	25
curve selection form	65	32	9	21
curve set info legend	18	30	5	18
curve type	66	32	9	21
curveset name	85	33	13	24
curveset number	84	33	13	24
curveset selection form	61	32	9	21
data sets legend	2	29	2	15
data type	31	31	3	16
de-select all	14, 26	30	2, 3	15, 16
development type	69, 70	33	10	22
draw	8	29	2	15
edit	10	30	2	15
edit menu	26	30	3	16
entry age	88	33	13	24
exit	1	29	2	15
FDS	1	29	2	15
file - open menu	1	29	2	15
file menu	1	29	2	15
file name box	33	31	3	16
file viewer	27, 58	30, 32	3	16
forest class	27, 62	30, 32	9	21
FORMAN+1 curveset	27	30	3	16
grid on/grid off	110	35	16	25
help	28	30	2	15
individual curve info	18	30	5	18
keep button	11	30	2	15
LANDSCAPE section	75	33	11	23
line type	113	35	16	25
linear regression	98	34	15	25
logarithmic regression	98	34	15	25
management unit	64	32	9	21
maximum X value	105	34	16	25

Table 1. Continued.

Function or term	Description		Figure	
	Number	Page	Number	Page
maximum Y value	106	35	16	25
mean aggregation	98	34	15	25
message bar	21	30	2	15
model output	25	30	3	16
open files	1	29	2	15
open FORMAN+1 query	27	30	3	16
open PSP - options	51	32	6	19
open/save dialog box	32	31	3	16
options menu	30	31	3	16
page buttons	49	31	5	18
period length	71, 96	33, 34	10	22
plot point button	42	31	4	17
point control box	41	31	4	17
print	1, 6	29	2, 3	15, 16
product grouping	67	32	9	21
PSP	24	30	3	16
quadratic regression	98	34	15	25
rename data set	19	30	2	15
save	3, 4, 5	29	2, 3	15, 16
save as FORMAN+1	4, 27	29, 30	2, 3	15, 16
scale and grid	30, 104	31, 34	3	16
select all	13, 26	30	2, 3	15, 16
selection color	125	35	18	26
site region	117	35	20	27
site type	63	32	9	21
species composition	116	35	19	27
species grouping	67	32	9	21
stems/ha	31	31	3	16
sum aggregation	98	34	15	25
themes	72	33	10	22
total no. of curves	46	31	5	18
treatment unit	118	35	21	28
volume	31	31	3	16
volume category	67	32	9	21
volume component	68	33	9	21
volume/tree	31	31	3	16
Woodstock	1, 5	29	10	22
X axis tick interval	107	35	16	25
X value	43	31	4	17
Y axis tick interval	108	35	16	25
Y value	43	31	4	17
Y-axis label	109	35	16	25
Y-factor	91	34	13	24
yield component	74, 95	33, 34	10	22
zoom	7	29	2	15

Table 2. FYCD user interface screenshots included in this report.

User interface item	Figure no.	Page no.
Main window of FYCD	2	15
All menus and the Open/Save dialog box	3	16
Main window displaying draw mode	4	17
Main window displaying individual curve information	5	18
File - Open - PSP options dialog box	6	19
File - Open - FORMAN+1 - Query dialog box	7	19
File - Open - FORMAN+1 - file viewer	8	20
Opening FORMAN+1 files by class definition	9	21
File - Open - Woodstock files dialog boxes	10	22
Woodstock landscape section form	11	23
File - Print graph dialog box	12	23
File - Save FORMAN+1 dialog box	13	24
File - Save Woodstock dialog box	14	24
Edit - build curve dialog box	15	25
Options - set scale and grid dialog box	16	25
Options - set configuration	17	26
Options - change colors	18	26
Options - set configuration - species composition	19	27
Options - set configuration - site region	20	27
Options - set configuration - treatment unit	21	28

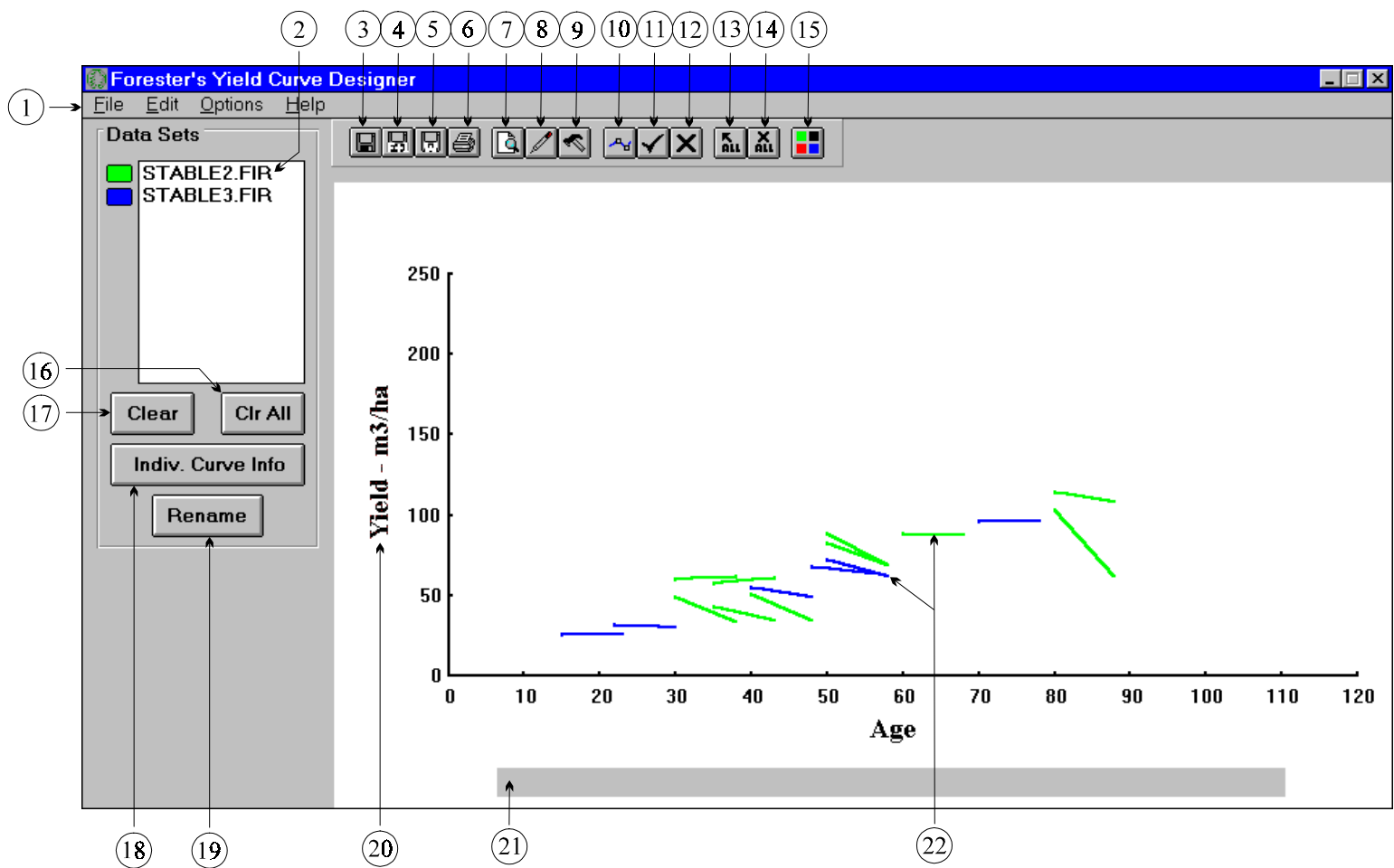


Figure 2 - Main window of FYCD

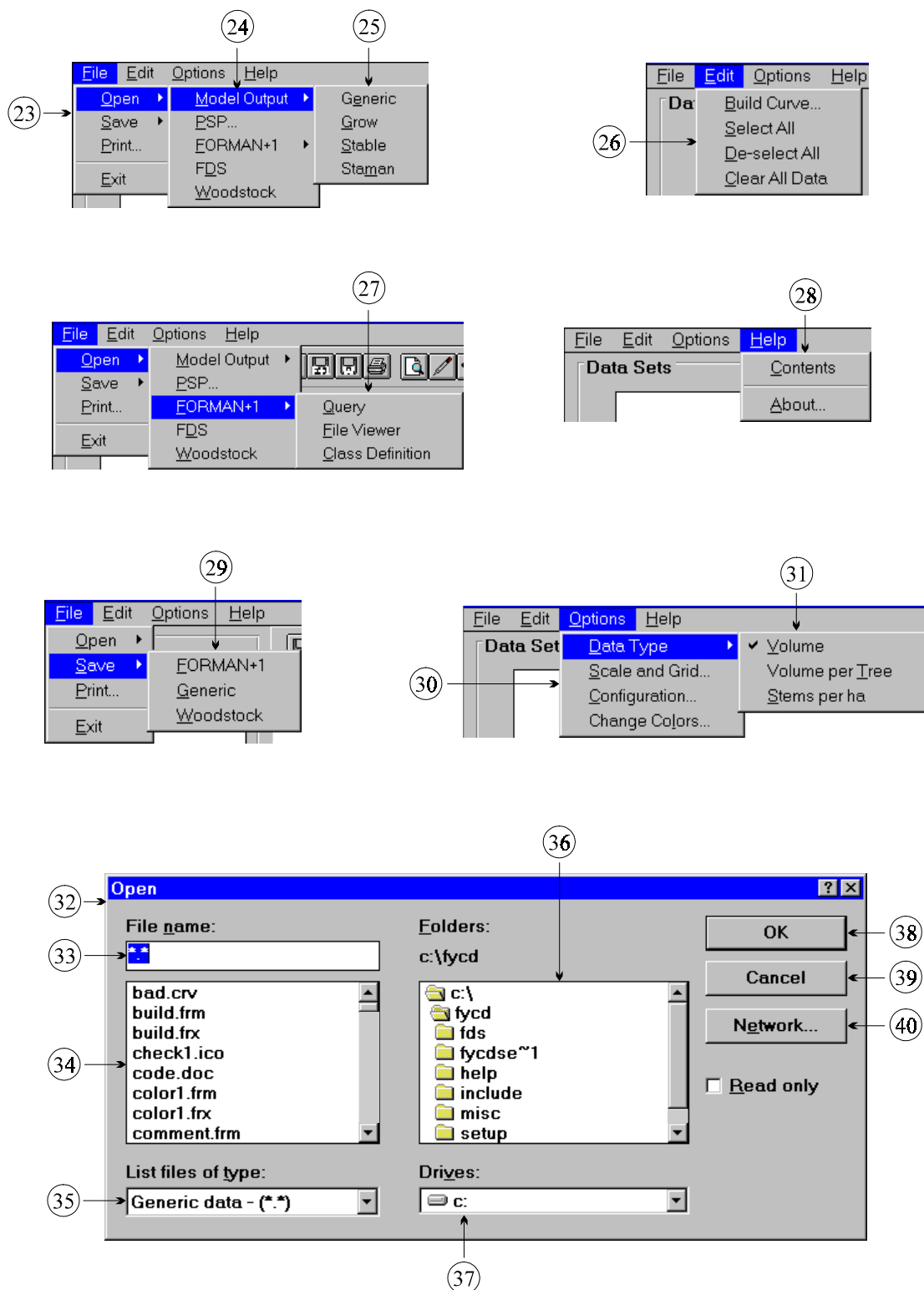


Figure 3 - All menus and the Open/Save dialog box

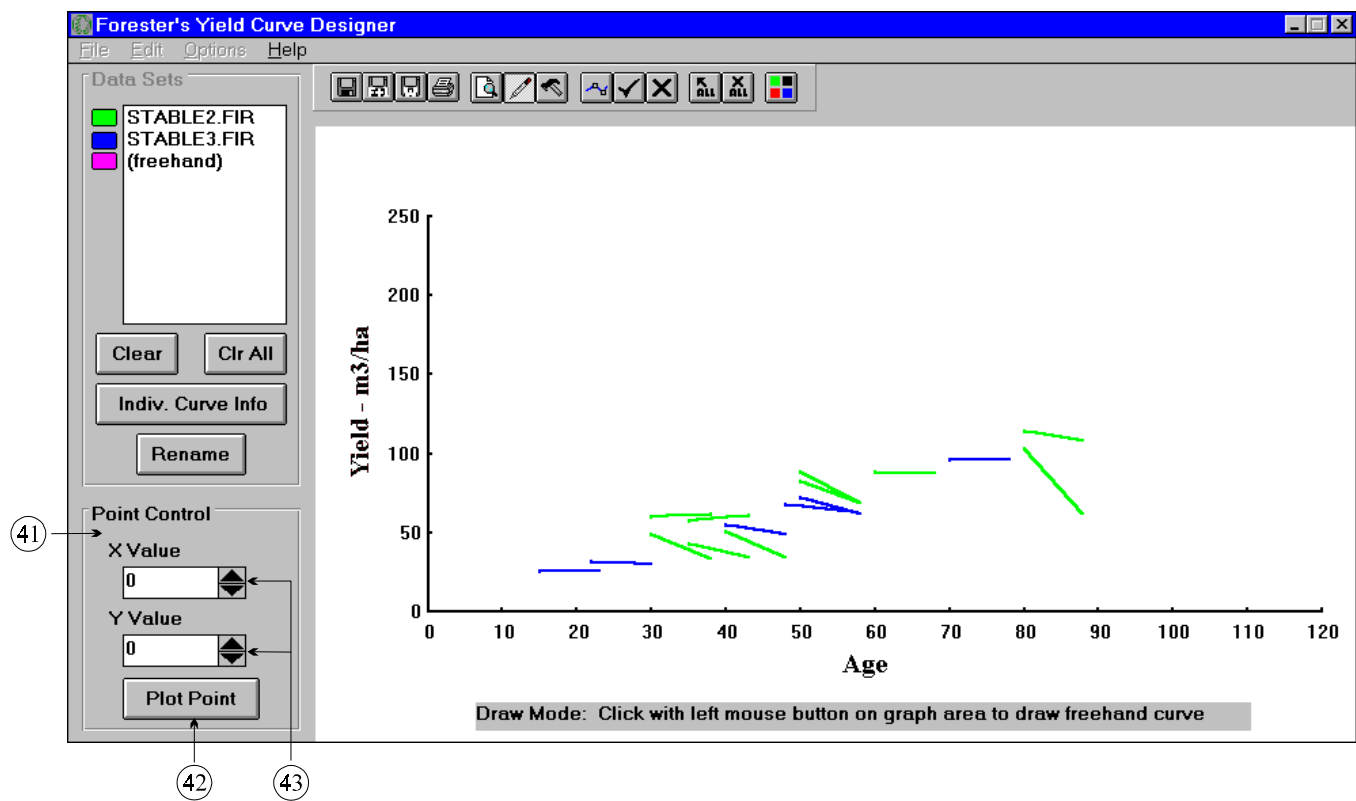


Figure 4 - Main window displaying draw mode

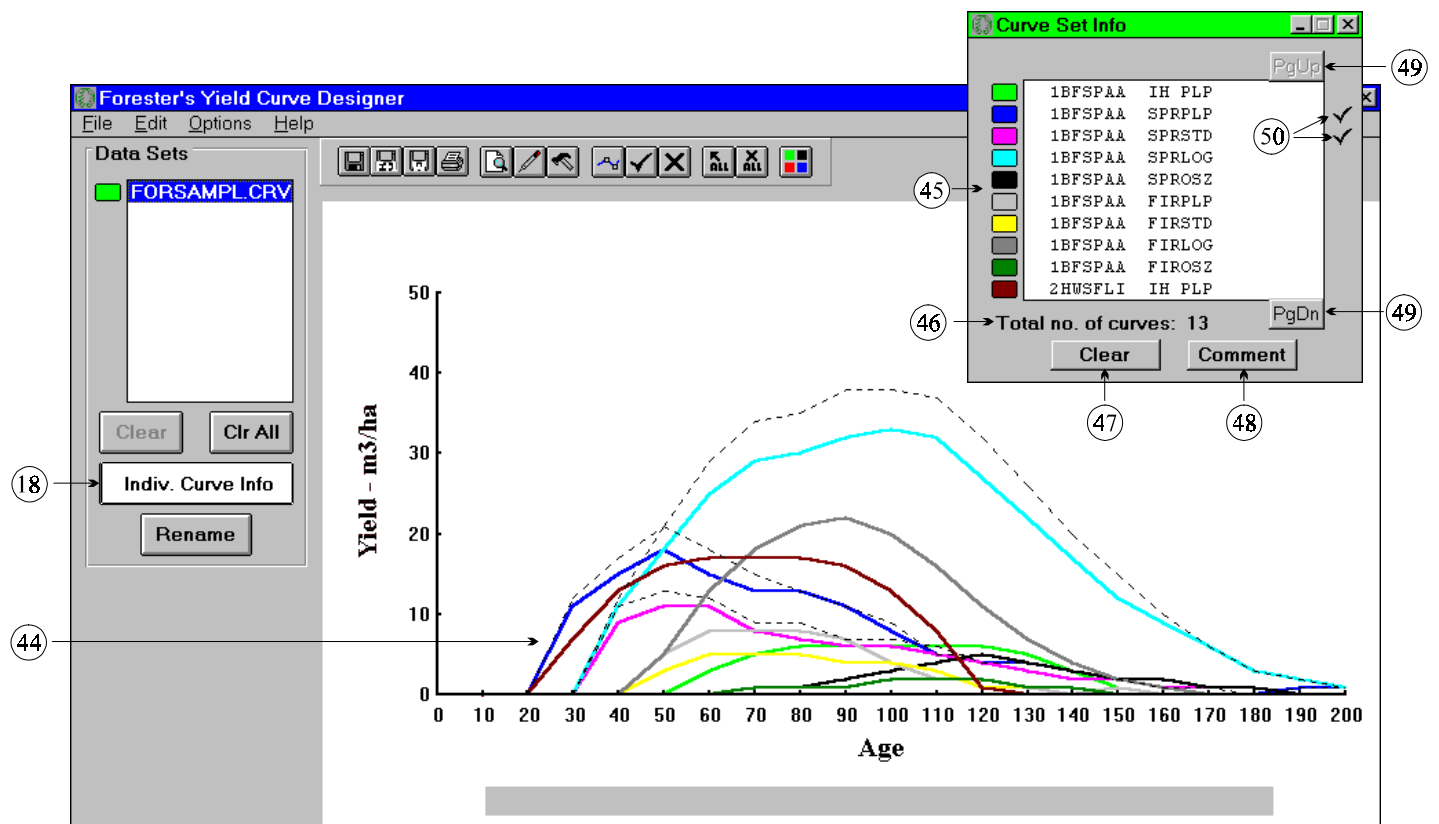


Figure 5 - Main window displaying individual curve information

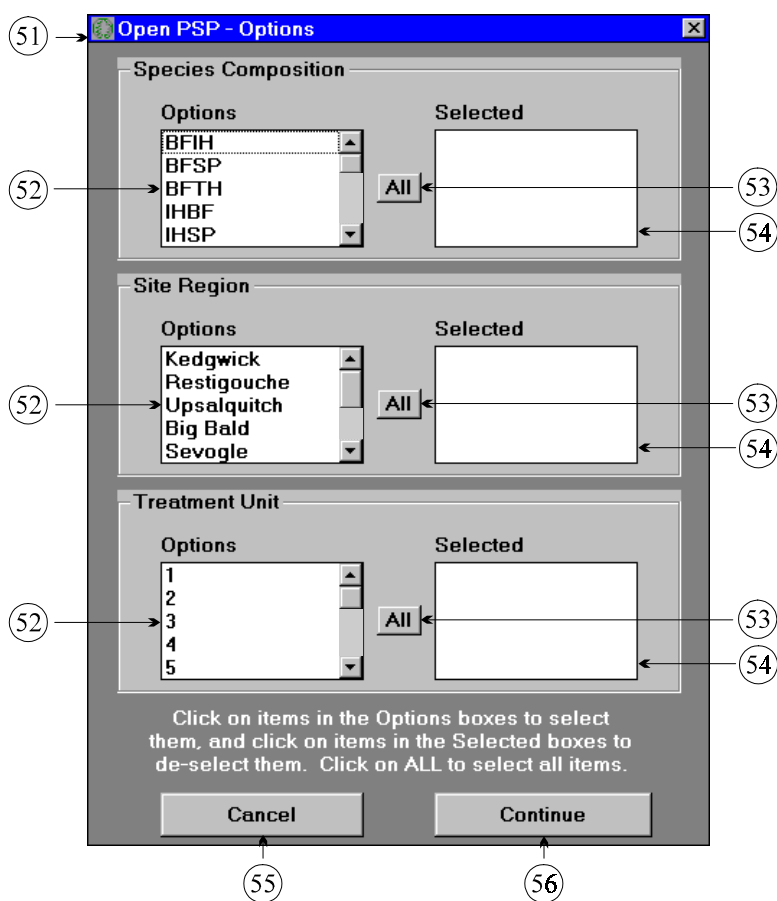


Figure 6 - File - Open - PSP options dialog box

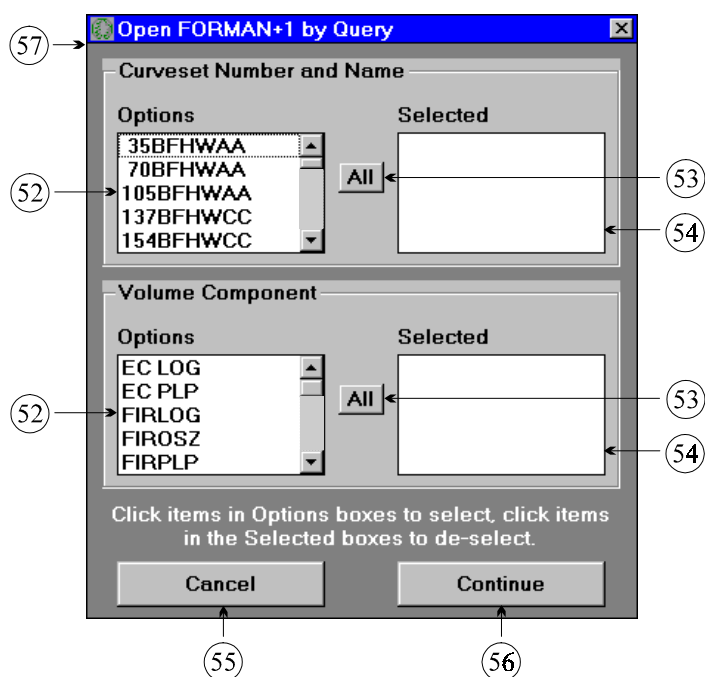


Figure 7 - File - Open - FORMAN+1 - Query dialog box

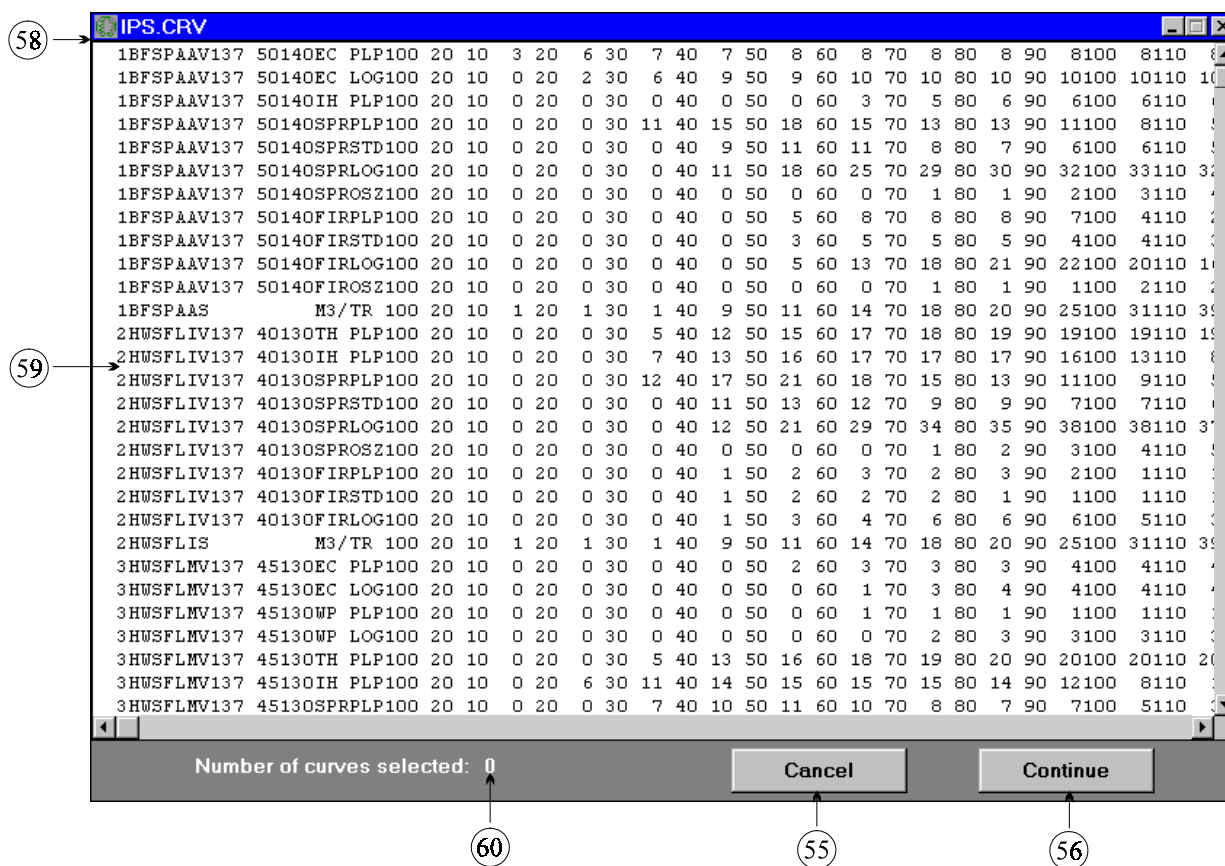


Figure 8 - File - Open - FORMAN+1 - file viewer

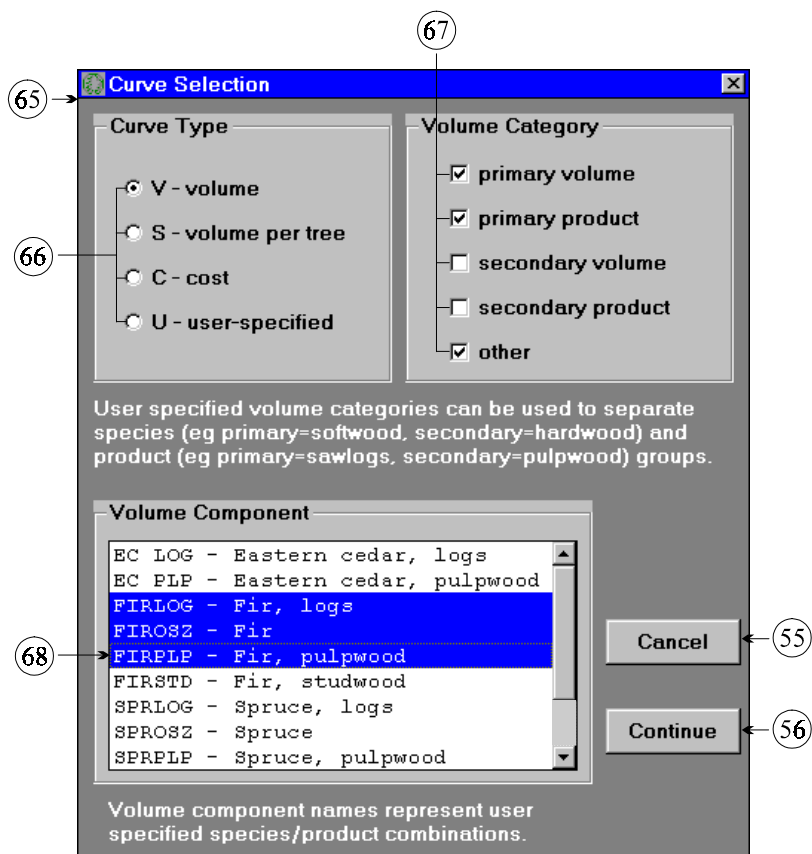
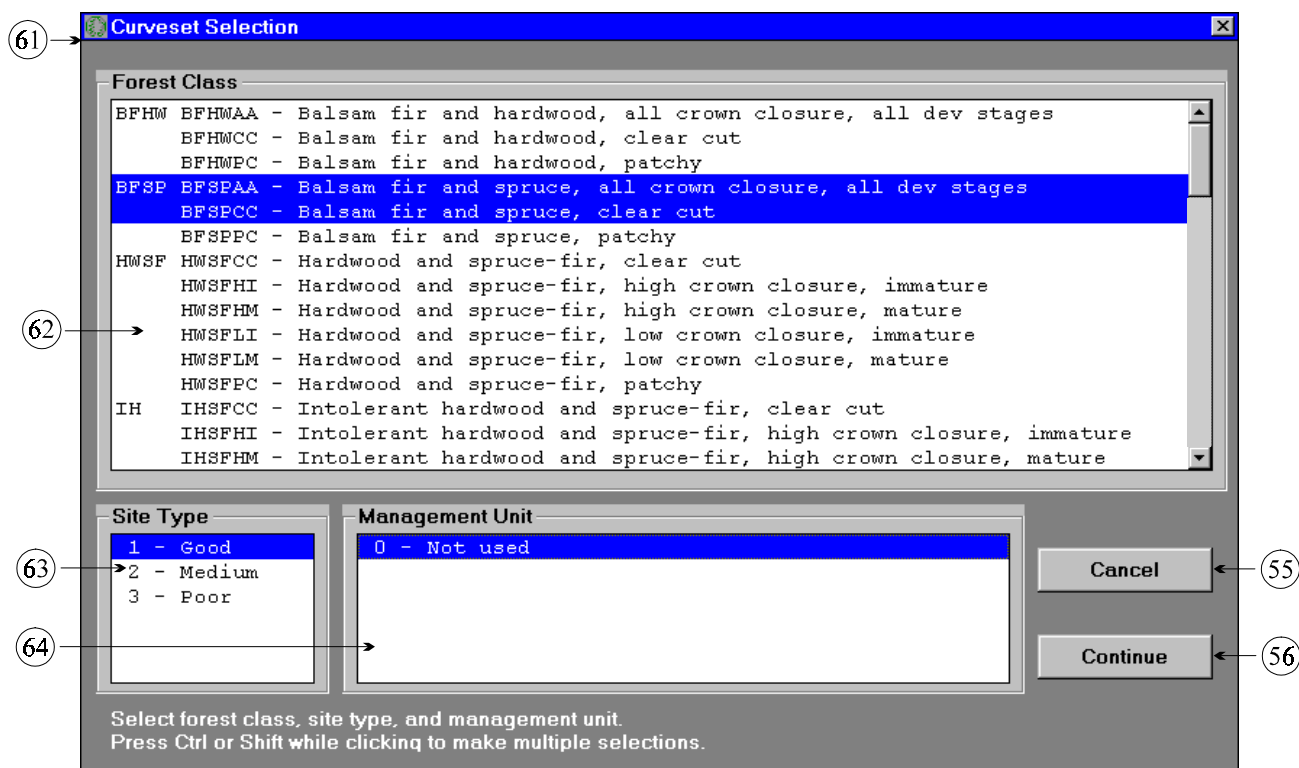


Figure 9 - Opening FORMAN+1 files by class definition

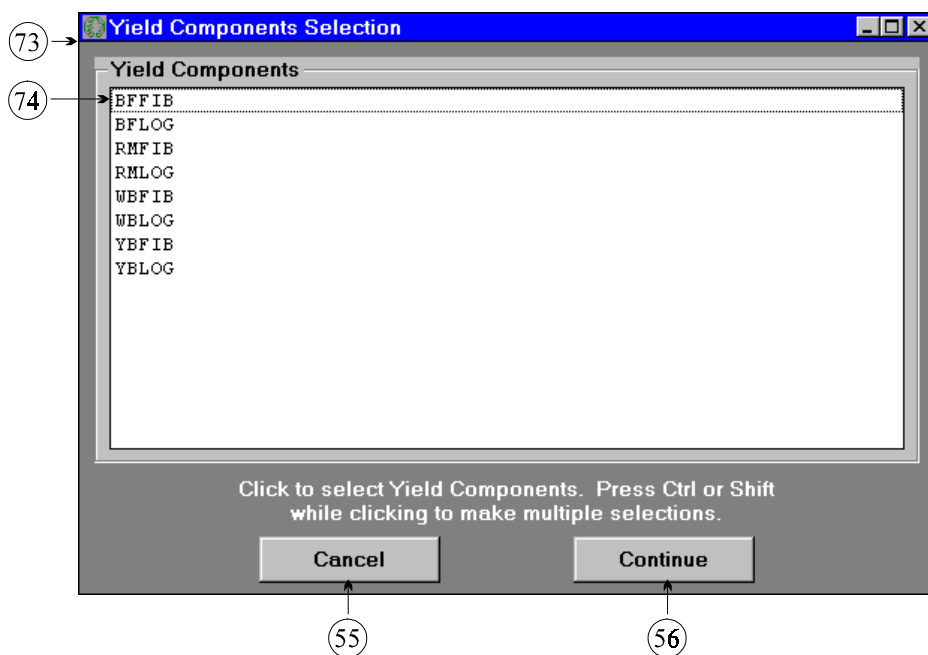
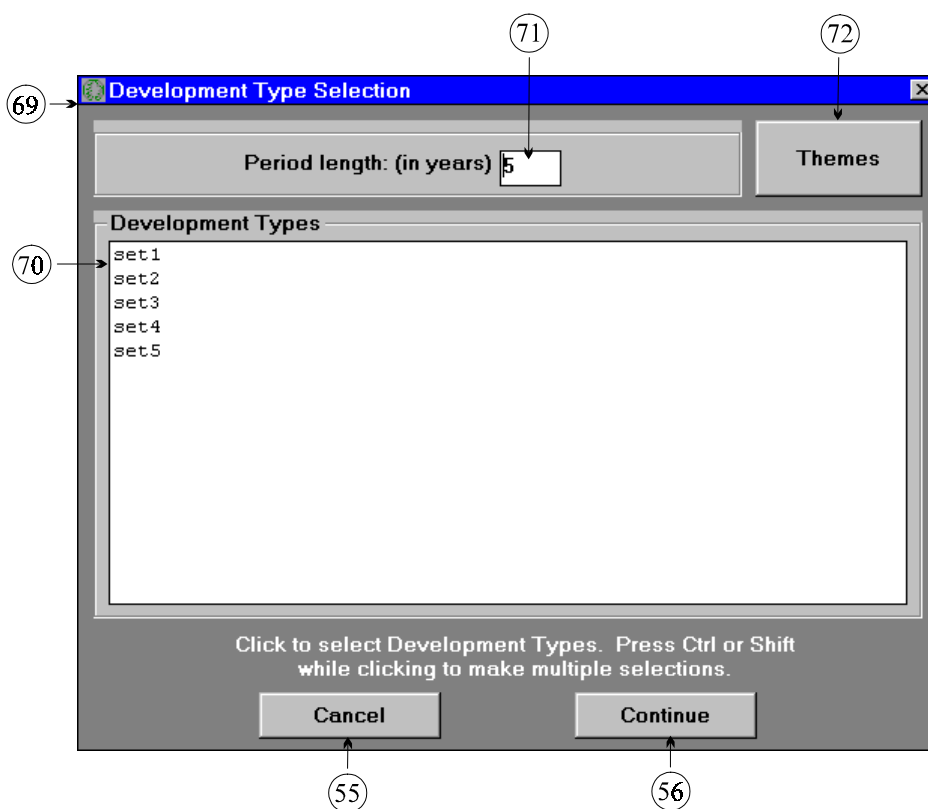


Figure 10 - File - Open - Woodstock files dialog boxes

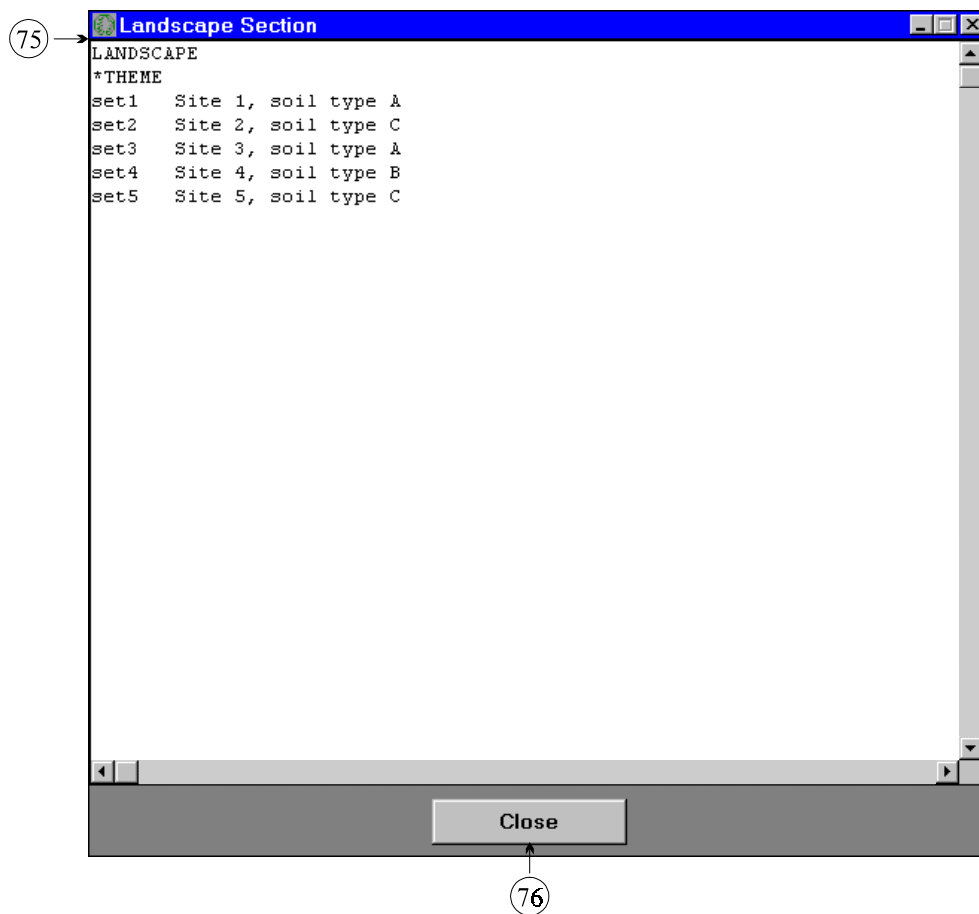


Figure 11 - Woodstock landscape section form

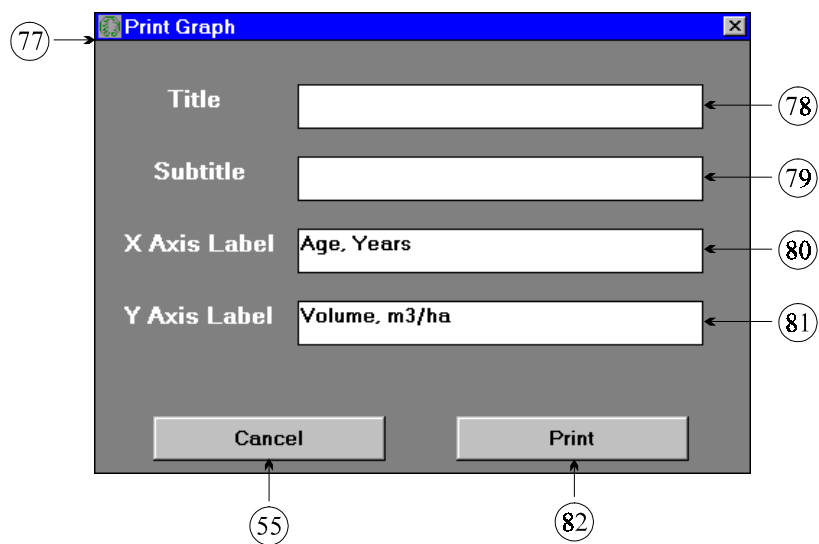
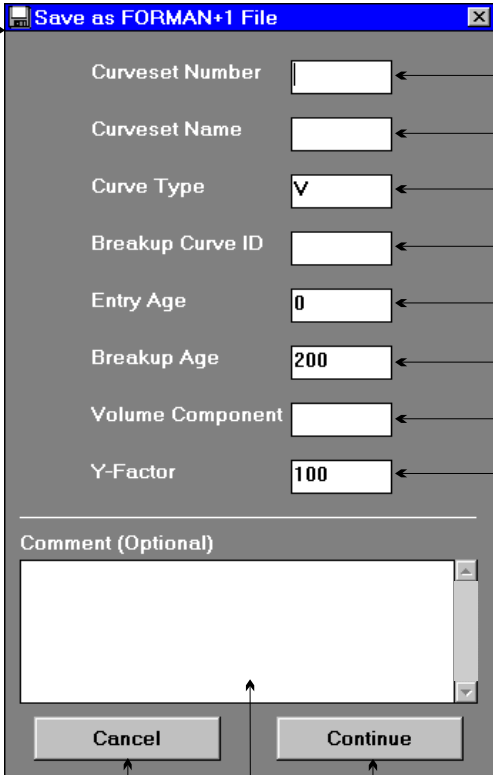


Figure 12 - File - Print graph dialog box



A screenshot of the 'Save as FORMAN+1 File' dialog box. The dialog has a title bar with a blue background and a close button. It contains several input fields with labels to their left: 'Curveset Number', 'Curveset Name', 'Curve Type' (with a dropdown showing 'V'), 'Breakup Curve ID', 'Entry Age' (with a dropdown showing '0'), 'Breakup Age' (with a dropdown showing '200'), 'Volume Component', and 'Y-Factor' (with a dropdown showing '100'). Below these fields is a 'Comment (Optional)' text area. At the bottom are 'Cancel' and 'Continue' buttons. Numbered callouts point to various elements: 83 points to the title bar, 84 to Curveset Number, 85 to Curveset Name, 86 to Curve Type, 87 to Breakup Curve ID, 88 to Entry Age, 89 to Breakup Age, 90 to Volume Component, 91 to Y-Factor, 92 to the Comment text area, 55 to the Cancel button, and 56 to the Continue button.

83 → Save as FORMAN+1 File

Curveset Number → 84

Curveset Name → 85

Curve Type → 86

Breakup Curve ID → 87

Entry Age → 88

Breakup Age → 89

Volume Component → 90

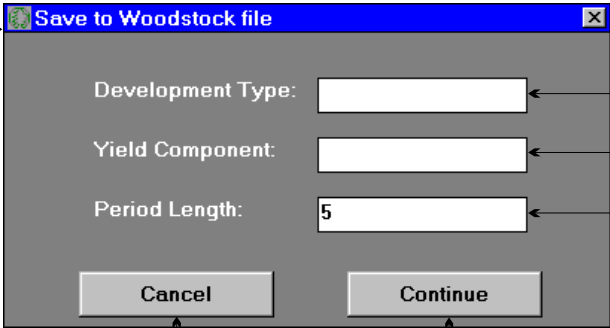
Y-Factor → 91

Comment (Optional)

Cancel → 55

Continue → 56

92 →

Figure 13 - File - Save FORMAN+1 dialog box

A screenshot of the 'Save to Woodstock file' dialog box. The dialog has a title bar with a blue background and a close button. It contains three input fields with labels to their left: 'Development Type:', 'Yield Component:', and 'Period Length:' (with a dropdown showing '5'). At the bottom are 'Cancel' and 'Continue' buttons. Numbered callouts point to various elements: 93 points to the title bar, 94 to Development Type, 95 to Yield Component, 96 to Period Length, 55 to the Cancel button, and 56 to the Continue button.

93 → Save to Woodstock file

Development Type: → 94

Yield Component: → 95

Period Length: → 96

Cancel → 55

Continue → 56

Figure 14 - File - Save Woodstock dialog box

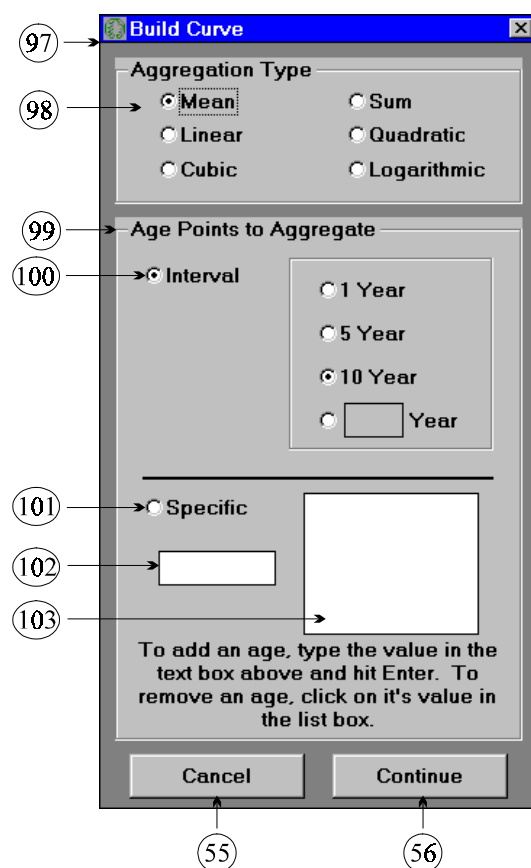


Figure 15 - Edit - build curve dialog box

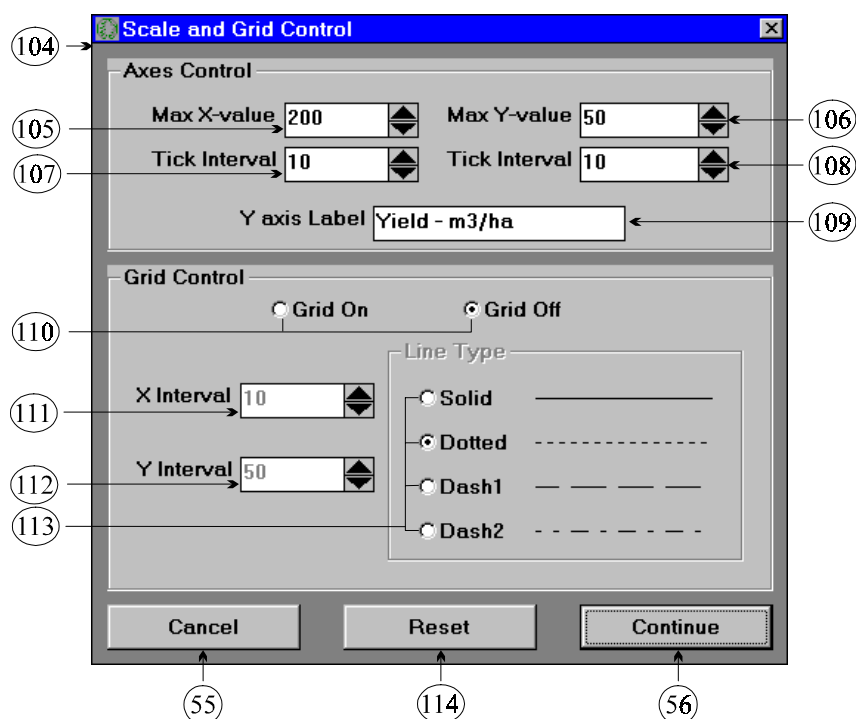


Figure 16 - Options - set scale and grid dialog box

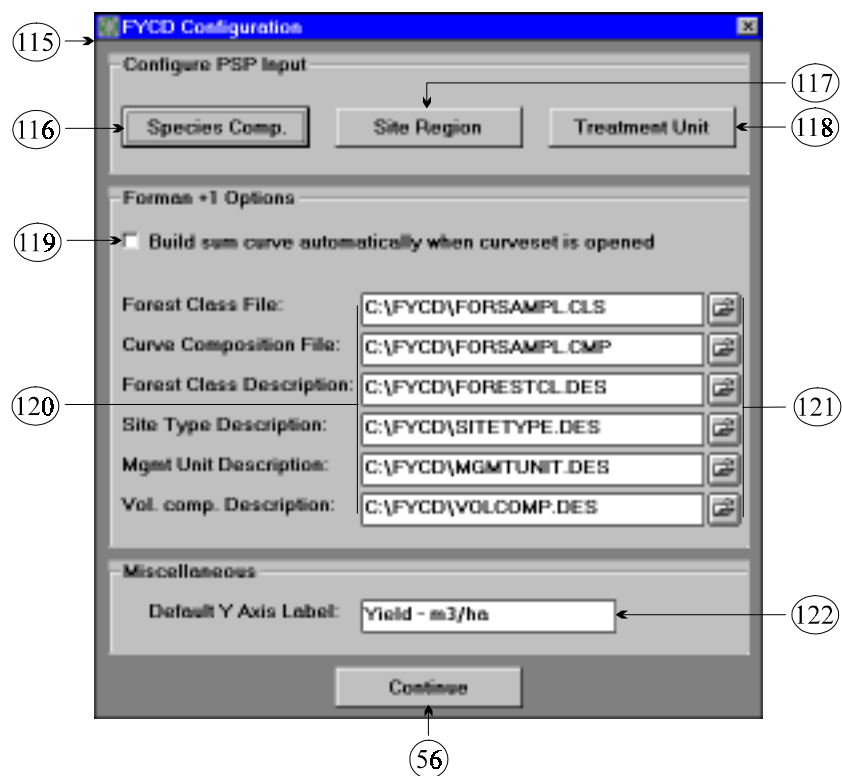


Figure 17 - Options - set configuration

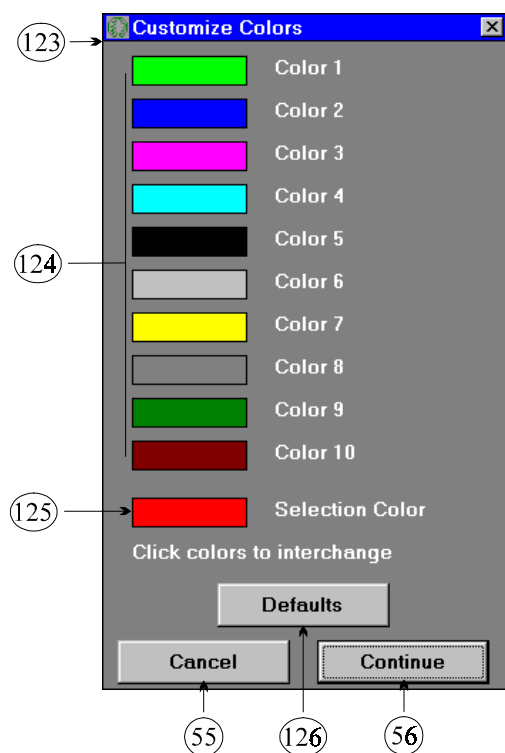
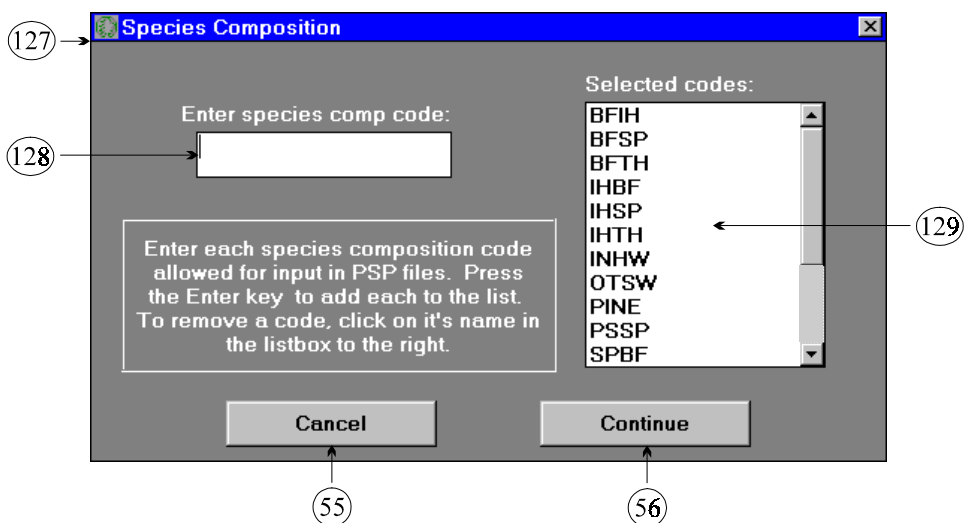
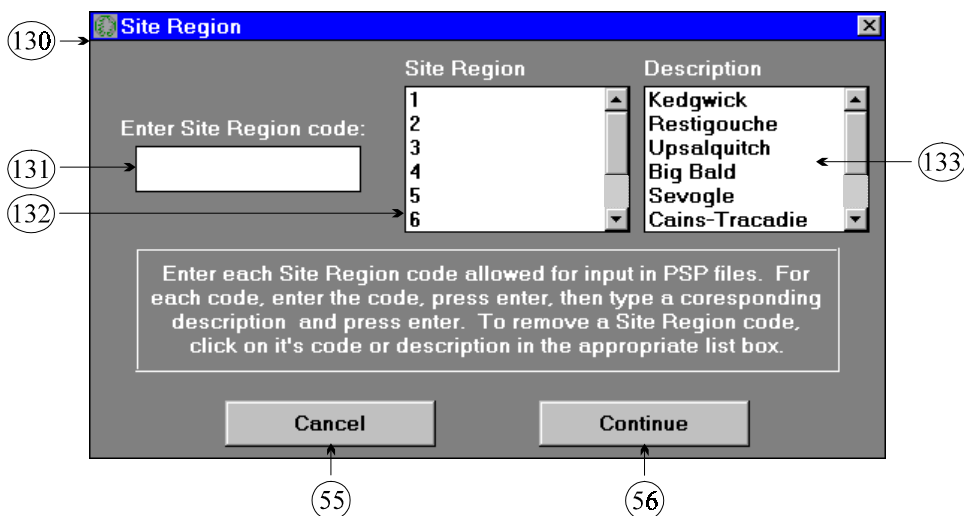


Figure 18 - Options - change colors

**Figure 19 - Options - set configuration - species composition****Figure 20 - Options - set configuration - site region**

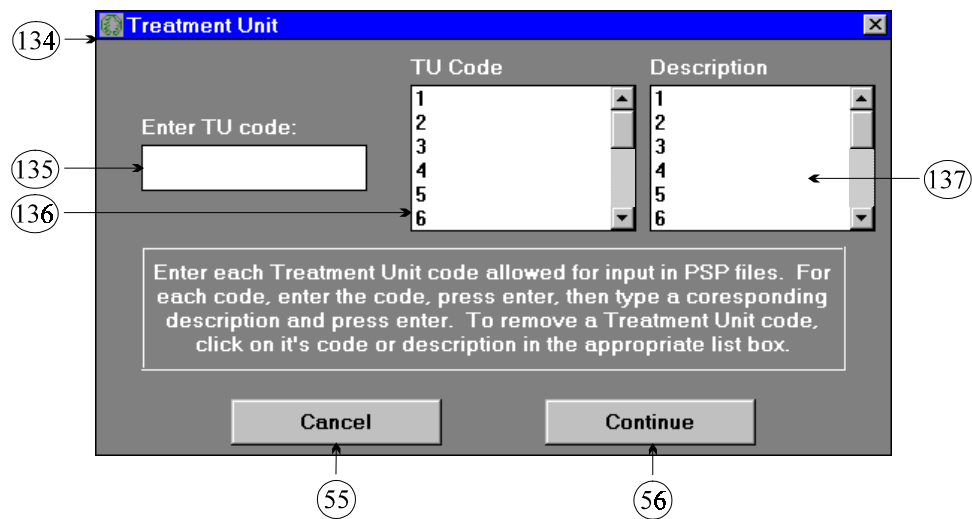


Figure 21 - Options - set configuration - treatment unit




5.1 Description of functions and terms


Note: Numbers provide cross-reference to the items in Figures; see Table 1 for an alphabetical reference listing. *Italicized words* are defined in Appendix 3, the glossary.

1. Menu bar: Includes the menus which contain the FYCD commands.

File menu:


Open: Open a file of one of the following types and display its contents as curve segments or data points: *Model Output* files, *PSP* files, *FDS* files, *FORMAN+1* curveset files, and *Woodstock* files. The source file is closed immediately after the curves are displayed. Therefore, modifications made to the curves in FYCD have no effect on the disk file where the data is stored.


Save: Save a selected curve to a file in either *FORMAN+1* format, *Woodstock* format, or a generic format. Performs the same function as the Save buttons    (3, 4 and 5) on the button bar.


Print: Print the current graph to the default windows printer. All curves on the display are printed. Performs the same function as the Print button  (6) on the button bar.

Exit: Exits the FYCD program

Edit menu:

Build Curve: Builds an aggregate curve when one or more curves or data points are selected. Selected data can be aggregated by one of six different methods: *mean aggregation*, *sum aggregation*, *linear regression*, *quadratic regression*, *cubic regression*, and *logarithmic regression* (See Figure 15). In all cases, the calculated points are connected with straight-line segments. Performs the same function as the Build button  (9) on the button bar.

Select All: Selects and displays in the *selection color* (118), all curve segments currently on the graph. Performs the same function as the Select All button  (13) on the button bar.

De-select All: De-selects all selected curve segments and displays them in their original colors. Performs the same function as the De-select All button  (14) on the button bar.

Clear All Data: Clears all *data sets*/curves from the display.


Options menu:

Data Type: Use to choose the type of data to be used in FYCD: *volume*, *volume/tree*, or

stems/ha.


Scale And Grid: Use to modify graph attributes such as scale, axes labeling and background grid.


Configuration: Set Configuration of FYCD, including the location of *FORMAN+1* data files; codes used for *species composition*, *site region*, and *treatment unit*; and automatic aggregation of *FORMAN+1* curve components (turn on and off).


Change Colors: Allows you to interchange colors used for displaying data. Performs the same function as the Colors button  (15) on the button bar.


Help: Opens the on-line Help system containing detailed information about the concepts and operation of FYCD.


2. Data Sets legend: Contains the color and filename for each *data set* displayed on the graph.


3. Save button:  Save a selected curve to a generic output file. Performs the same function as the **Save - Generic** menu command.

4. Save as FORMAN+1 button:  Save a selected curve to a file in *FORMAN+1 curveset* format. Performs the same function as the **Save - FORMAN+1** menu command.

5. Save as Woodstock button:  Save a selected curve to a *Woodstock* file. Performs the same function as the **Save - Woodstock** menu command.


6. Print button:  Print the current graph to the default Windows printer. All curves on the display are printed. Performs the same function as the **Print** menu command.

7. Zoom button:  Zoom in to a specific portion of the graph by dragging a box over the desired area while holding the left mouse button. Zoom back out by clicking on the zoom button again.


8. Draw button:  Enters *freehand* draw mode allowing the creation of a custom curve. Each click will represent a new vertex of the curve. A colored line connects these vertices. The point control box (see Figure 4) can also be used to plot points.


9. Build button:  Build an aggregate curve


when one or more curves or data points are selected. The selected data can be aggregated by one of six different methods: *mean aggregation*, *sum aggregation*, *linear regression*, *quadratic regression*, *cubic regression*, and *logarithmic regression* (See Figure 15). In all cases, the calculated points are connected with straight-line segments. Performs the same function as the Build Curve menu command.


10. Edit button:  Allows you to modify curves. A *data set* must first be selected from the Data Sets legend. Then, after clicking the edit button, you can move the “drag boxes”, which represent each point in the *data set*, to the desired location using the mouse. To keep the changes, press the **Keep** button (11). The **Cancel changes** button (12) reverts to the original curve.

11. Keep button:  Keeps changes made while in edit mode.

12. Cancel changes button:  Cancels the changes made while in edit mode.

13. Select All button:  Selects all curves and displays them in the *selection color* (red by default). Performs the same function as the Select All menu command.

14. De-select All button:  De-selects all curves and displays them in their original colors. Performs the same function as the De-select All menu command

15. Colors button:  Allows you to interchange the colors used for displaying *data sets*. Performs the same function as the Change Colors menu command.

16. Clear All data sets button: Removes all *data sets* in the Data Sets legend from the FYCD program.

17. Clear data set button: Removes the *data set* selected in the Data Sets legend from the FYCD program.

18. Indiv. Curve Info button: Activates the individual curve info mode. This mode gives more information on a *data set* by coloring individual curves using a separate legend. It can be toggled on and off by pressing this button. This button remains “pressed” when individual curve info

mode is active (see Figure 5).

19. Rename button: Allows you to rename a *data set* in the Data Sets legend. This helps to distinguish between data sets with the same name (i.e. from the same file) in the legend. It has no effect on the file names on disk.

20. Y-axis label: Identifies the type and units of information being displayed (*volume/ha*, *volume/tree* or *stems/ha*). This label can be changed (109).

21. Message Bar: Displays helpful messages when in draw mode, edit mode, or zoom mode.

22. Curve segments that form a *data set*. In this Figure 4, the data were read in from a file called STABLE3.FIR, therefore the data set is named STABLE3.FIR in the legend.

23. File menu: Menu used to open files, save curves, print the graph, or exit the program.

24. File - Open menu: FYCD can open Model output files, PSP data, FORMAN+1 curveset files, FDS data, and Woodstock data.

25. File - Open - Model Output menu: FYCD can open four different kinds of Model output data: generic data, GROW data, STABLE data, and STAMAN data.

26. Edit menu: From this menu, you can build curves, select or de-select all curves on the screen, or clear all data from FYCD.

27. File - Open - FORMAN+1 menu: This menu item allows selection of the method for opening a FORMAN+1 curveset file. Opening a FORMAN+1 curveset file by the Query method allows selection of specific curveset number/curveset name combinations and volume components. Opening by the file viewer method allows curves to be opened from the curveset file by simply clicking on the data representing those curves. Lastly, opening a FORMAN+1 file by class definition allows selection of specific forest classes, site types and management units, and then selection of curve types, volume categories and volume components.

28. Help menu: Click on contents to get help for FYCD. The About option displays the FYCD title screen.

29. File - Save menu: FYCD allows you to save curve data in one of three formats: a Generic format, as explained in the Input File Formats section, FORMAN+1 format, or Woodstock format.

30. Options menu: From this menu, you can change the data type, change the scale of the graph or add a grid to the graph, change the configuration of FYCD, or change the colors used for particular data sets.

31. Options - Data Type menu: From this menu, you can choose the type of data that you would like to work with in FYCD: volume data, volume per tree data, or stems per hectare data.

32. Open/Save dialog box: Whenever you are asked to specify a file for opening or saving, FYCD displays a box like this one. With it you can specify a filename and path on your computer.

33. File name box: This box displays the name of the file you are selecting. You can either select a file from the files list box (34), or you can type the name directly into this box.

34. Files list box: This box displays all files that are in the directory currently selected in the Folders list box (36) that match the mask in the file types box.

35. File type box: This box displays information about the files that you are interested in, as well as a mask showing how those files are found. For example, *.crv will match only those files with the .crv extension.

36. Folders list box: This box displays the directory structure on your computer. You can select different directories by double clicking on their names.

37. Drives box: This box displays the current drive. By clicking on the arrow button to the far right of this box, you can select another drive, such as the floppy drive (A:) or another disk drive.

38. OK button: Pressing this button continues with the file name you've chosen.

39. Cancel button: This button cancels the current operation.

40. Network button: Press this button if you would like to connect a drive from the network to

your computer.

41. Point Control box: This box becomes visible in *freehand* mode and allows a curve to be drawn based on the exact X, Y coordinates of its vertices.

42. Plot Point button: While in *freehand* mode, pressing this button will plot a point as specified in the X and Y Value text boxes (43). Each point plotted in this way will be connected to the previously plotted point with a line segment.

43. X and Y Values: Click on the arrows to increment or decrement the X and Y values of a vertex. You can also manually enter values into the text boxes.

44. In Individual Curve Info mode, all curves in the selected *data set* (see Data Sets legend (2)) become colored individually and a new legend, named "Curve Set Info" is displayed in a separate window. Curves from the non-selected data sets are displayed with dotted gray lines when in this mode.

45. Curve Set Info. legend: When individual curve info mode is active, this window is displayed, containing the color and curve identifier for each curve in the selected *data set*.

46. Total No. of curves: This counter shows how many individual curves are in the selected *data set*.

47. Clear button: This button removes the curve selected in the Curve Set Info. legend (45) from the *data set*.

48. Comment button: Pressing this button will display the *comment*, if one exists, for the curve selected in the legend window. A comment exists if there is a check mark (50) to the right of the curve identifier in the legend.

49. Page buttons: PgUp and PgDn allow you to page up and page down through the list of curves if there are more than 10 curves in the chosen *data set*. Only 10 curves are colored at a time.

50. A Check Mark next to a curve's identifier means that a *comment* exists for that curve. It can be viewed by selecting it in the Curve Set Info. legend (45) and clicking the **Comment** button (48).

51. Open PSP - Options form: Using this form, you can view curve segments contained in a permanent sample plot (*PSP*) data file. Select the *species compositions*, *site regions*, and *treatment units* that you are interested in to view the curve segments that match these criteria.

52. Options list boxes: Each of these list boxes contain all selection options for the specified data item. To select an option, click on its name in the list box. Its name will then appear in the 'selected' list box. (54). The contents of a list box are dependent on the option being selected, namely, *Species Composition*, *Site Region*, *Treatment Unit*, *Curveset Number and Name*, or *Volume Component*.

53. Select All button: This button selects all items in the Options list box (52) and moves them to the selected list box (54).

54. Selected list box: This list box contains all the options selected from the options list box (52). To de-select an option, click on its name in this list box.

55. Cancel Button: Cancels any changes made in the window and closes the window.

56. Continue Button: Continues, using the values specified on the form.

57. Open FORMAN+1 by Query form: Using this form, you can open curves from a *FORMAN+1 curveset file* by the factors that identify a unique curve: *curveset number*, *curveset name*, and *volume component*.

58. Open FORMAN+1 by File Viewer form: Using this form, you can select curves from a *FORMAN+1 curveset file* by viewing the file directly and clicking on the desired curves.

59. File Viewer window: The file viewer displays the contents of the *FORMAN+1* file that has been opened and allows you to view curveset data and select individual curves for display. Each line represents an individual curve which may be selected or de-selected by clicking on it, or by holding the mouse button down and dragging a selection box over the curves to select/de-select several at a time. The **Shift** key can also be pressed, when clicking, to select multiple curves.

60. No. of Curves Selected: This value represents the total number of curves that have

been selected.

61. Curveset Selection form: Opening a *FORMAN+1* file by class definition allows you to select curves from a *curveset file* by the factors that stratify them. On this form you choose the *forest classes*, *site types*, and *management units* of the desired curves.

62. Forest Class window: This window displays the list of *forest classes* in the *forest class file*. Forest classes are selected by clicking on the desired *forest class name*, by holding the mouse button down and dragging a selection box over several forest classes, or by multiple selection using the mouse along with the **Shift** or **Ctrl** keys.

63. Site Type window: This window displays the list of *site type* values found in the *forest class file*. Site types are selected by clicking on the desired one, by holding the mouse button down and dragging a selection box over the values, or by multiple selection using the mouse along with the **Shift** or **Ctrl** keys.

64. Management Unit window: This window displays the list of *management unit* values found in the *forest class file*. Management units are selected by clicking on the desired management unit, by holding the mouse button down and dragging a selection box over several values, or by multiple selection using the mouse along with the **Shift** or **Ctrl** keys.

65. Curve Selection form: This form is the second step in opening a *FORMAN+1* file by class definition. On this form, you can choose the *curve types*, *volume categories* and *volume components* that you are interested in. Only those curves from the *curveset file* that match selections from this form and the previous form (61) are opened.

66. Curve Type: *FORMAN+1* curves can be any of these four types. Click on one of them to select the *curve type*. Choosing any type other than **V-volume** disables the *Volume Category* section of the form since it is not applicable.

67. Volume Category: These check boxes allow selection of the *volume category product grouping*, either **volume** or **product**, and the *species groupings* for the desired curves, either primary, secondary, or other. The species groupings along with the *product grouping* narrows down the choice of curve *volume components* (68) to those that are applicable.

68. Volume Component: This window displays all *volume components* in the chosen *curveset file* that match your *forest class* (62), *site type* (63), *management unit* (64), *curve type* (66), and *volume category* (67) selections. They are selected by either clicking on the desired value, by holding the mouse button down and dragging a selection box over them, or by multiple selection with the **Shift** or **Ctrl** keys.

69. Development Type Selection form: This form allows selection from the different development type 'masks' that exist in the YIELDS section of a *Woodstock* input file. The period length (71) must also be specified.

70. Development Types list box: This list box displays all development types (or 'masks') that appear in the YIELDS section of the specified *Woodstock* file. Click on the desired development types to select them. More than one can be selected by holding the **Shift** or **Ctrl** keys while clicking with the mouse.

71. Period Length box: To use *Woodstock* data, the period length (five years by default) must be specified. You must ensure that this value matches the period length used in the *Woodstock* data you are using, since there is no way for FYCD to verify this.

72. Themes button: When this button is clicked, a form that displays the LANDSCAPE section of the *Woodstock* file will appear (75), if one is found.

73. Yield Components Selection form: Allows selection from the list of Yield Components that match the previously selected development types.

74. Yield Component list box: Allows selection of the yield components of interest. Select more than one yield component by holding the **Shift** or **Ctrl** keys while clicking with the mouse.

75. Landscape Section form: This form displays the LANDSCAPE section of the *Woodstock* file, for use as a reference when picking development types. This form can be left open or minimized while selecting development types. Remove it from the screen using the **Close** button (76).

76. Close button: This button closes the LANDSCAPE Section form (75).

77. Print Graph form: This form allows entry of titles and labels to be printed on the graph.

78. Title: A user-defined title to be printed on the graph.

79. Subtitle: A user-defined subtitle to be printed on the graph.

80. X Axis Label: A user-defined label to appear on the x-axis. The default is 'Age, Years'.

81. Y Axis Label: A user-defined label to appear on the y-axis. The default is 'Volume, m³/ha'.

82. Print button: Prints the graph, with the user-defined titles and labels, to the default Windows printer.

83. Save as FORMAN+1 file form: This form allows you to specify the *FORMAN+1* field values to be saved to the *curveset file* for the selected curve.

84. Curveset Number (integer 3): Each *FORMAN+1 curveset* in a *curveset file* must have a unique ID number. All curves within a set must have the same ID. See the *FORMAN+1* User Manual for more information.

85. Curveset Name (character 6): The name assigned to each curveset, which should describe the stand condition to which it relates. All curves within a set must have the same *curveset name*. See the *FORMAN+1* User Manual for more information.

86. Curve Type (character 1): The type of curve being defined. Valid type codes are:
V = volume (the default)
S = volume per tree
C = cost
U = user-specified curve.

87. Breakup Curve ID (integer 3): The number of the curveset along which classes on the existing curveset are expected to develop if they break up and regenerate naturally. See the *FORMAN+1* User Manual for more information.

88. Entry Age (integer 3): The age at which classes will enter their new curveset upon natural breakup. Due to advanced regeneration and development in the understory of a deteriorating stand, entry ages greater than zero for the new stand condition may be appropriate in some

cases. The default value is zero. See the *FORMAN+1* User Manual for more information.

89. Breakup Age (integer 3): The age after which classes will shift from their present curve to the breakup curveset as a result of natural stand breakup. The default is 200 years. See the *FORMAN+1* User Manual for more information.

90. Volume Component (character 6): The name of the species/product combination to which the curve data apply. See the *FORMAN+1* User Manual for more information.

91. Y-Factor (integer 3): The factor used to scale the Y-values for that curve either up or down. The default is 100%. See the *FORMAN+1* User Manual for more information.

92. Comment (text - no limit): Allows optional entry of a text *comment* for this curve. The intended use of this comment capability is to facilitate and record communication between foresters and the management planners regarding individual curves. The comment will be written to each curveset record beyond the end of the actual curve data and will not affect the operation of the *FORMAN+1* program.

93. Save to Woodstock file form: This form allows you to specify the development type, yield component, and period length to be saved to a *Woodstock* file for the selected curve.

94. Development type: A development type represents a parcel of forest land which is represented by a particular sequence of landscape theme attributes. See the *Woodstock* User's Guide for more information.

95. Yield Component: The name of the species/product combination to which the curve data apply. See the *Woodstock* User's Guide for more information.

96. Period Length: A time interval composed of one or more years. Periods are the basis for age classes as well as planning periods. See the *Woodstock* User's Guide for more information.

97. Build Curve form: This form allows selection of the type of aggregation to be used in building a curve. Six different aggregation types can be chosen, and the age interval or specific ages at which to calculate curve values can be specified.

98. Aggregation Type: Selects the method for building a curve:

A *mean aggregation* creates an average curve from the selected curves by calculating the average y-value at each age point.

A *sum aggregation* builds a composite curve by summing the y-values for all selected curves at each age point. This is especially useful when building a mixed-species curve from several pure-species component curves.

A *linear regression* fits a straight line through the data from the smallest age to the largest age.

A *quadratic regression* fits a curve of $y = a + bx + cx^2$ through the selected data.

A *cubic regression* fits a curve of $y = a + bx + cx^2 + dx^3$ through the selected data.

A *logarithmic regression* fits a curve of $y = a + b * \log_{10}x$ through the selected data.

99. Age Points to Aggregate: Select either an age interval or specific ages for the x-values of your aggregate curve.

100. Interval ages: Choosing interval allows you to specify a uniform age interval at which the volume calculation is performed. FYCD allows selection of a 1-year, 5-year, 10-year or a custom age interval. To select an interval, click on the button next to it. If you choose to create a custom interval, also enter an interval value in the text box. For example, if you enter 3 in this text box, y-values will be calculated at ages 3, 6, 9, 12, etc.

101. Specific ages: Choosing this option allows input of specific ages at which the volume calculation is performed. These age values can be non-uniform. For example, if 25, 42, and 60 are entered in the input text box (**102**) and y-values will be calculated only at those ages.

102. Input text box: Ages are added to the selected list (**103**) by typing an age in this text box and pressing the enter key.

103. Selected list: This list box contains the selected interval ages (**100**). To remove an age from the selected list, click on it.

104. Scale and Grid Control form: Use this form to change the scale of and add a grid to a graph.

105. Maximum X Value: Specify the maximum value for the x axis either by typing the desired value in the box or by adjusting the value by clicking on the up and down arrows to the right of the box. The default value is 120.

106. Maximum Y Value: Specify the maximum value for the y axis either by typing the desired value in the box or by adjusting the value by clicking on the up and down arrows to the right of the box. The default value is 250.

107. X Axis Tick Interval: Specify the interval at which each tick mark is placed on the x axis either by typing the desired value in the box or by adjusting the value by clicking on the up and down arrows to the right of the box. The default value is 10.

108. Y Axis Tick Interval: Specify the interval at which each tick mark is placed on the y axis either by typing the desired value in the box or by adjusting the value by clicking on the up and down arrows to the right of the box. The default value is 50.

109. Y Axis Label: Use this box to specify a label for the Y axis of the graph.

110. Grid On/Grid Off buttons: Turn the background grid on and off by clicking on the appropriate button. The grid is off by default.

111. X Interval: If the Grid On option (110) is selected, specify the interval for x-axis grid lines (e.g. every 10 years) either by typing the desired value in the box or by adjusting the value by clicking on the up and down arrows to the right of the box. The default value is 10.

112. Y Interval: If the Grid On option (110) is selected, specify the interval for y-axis grid lines (e.g. every 50 m³/ha) either by typing the desired value in the box or by adjusting the value by clicking on the up and down arrows to the right of the box. The default value is 50.

113. Line Type: Specify one of four grid line styles if the Grid On option (110) is selected.

114. Reset button: This button resets all Scale and Grid control values to the defaults.

115. FYCD Configuration form: Use this form to customize some of the settings in FYCD, such as the *species composition*, *site region*, and *treatment unit* codes used to query *PSP* data. There is also an option that builds a sum curve automatically whenever *FORMAN+1* curves are brought in (119). Also, the paths and filenames for the *FORMAN+1* files can be changed.

116. Species Composition button: This button brings up the *species composition* configuration form to allow entry of the species composition codes. These codes are used as selection criteria when opening *PSP* data.

117. Site Region button: This button displays the *site region* configuration form to allow entry of site region codes. These codes are used as selection criteria when opening *PSP* data.

118. Treatment Unit button: This button brings up the *treatment unit* configuration form to allow entry of treatment unit codes. These codes are used as selection criteria when opening *PSP* data.

119. Build sum curve automatically when curveset is opened: When this check box is checked, a *sum aggregate* curve will be built automatically for any set of curves that are brought in to FYCD via the Open - *FORMAN+1* menu commands. This option is off by default.

120. FORMAN+1 path and filenames: These text boxes contain the pathnames to several important *FORMAN+1* files used by FYCD. To change them, use the open buttons to the right of the names (121). All of these files must exist for the **Open - FORMAN+1 - Class Definition** menu command to work properly.

121. Open buttons: When one of these buttons is pressed, the path and filename of the *FORMAN+1* file can be specified using a standard Windows open-file dialog box.

122. Default Y axis label: Change the default y axis label (Yield, m³/ha) by entering text.

123. Customize Colors form: Use this form to choose the color used to represent each *data set* on the graph. You can also choose the highlight color and revert the colors back to the defaults.

124. Data Set Colors: These ten colors will be used to display curves on the graph. To interchange colors, click consecutively on two colors.

125. Selection Color: This is the color used for curve segments that are selected. It may be interchanged with any of the other ten colors by clicking first on the current selection color, then the color with which it is to be interchanged.

126. Defaults button: This button will reset all colors to the default colors.

127. Species Composition form: This form allows addition to or deletion from the list of *species compositions* used by FYCD as selection criteria when opening *PSP* data files.

128. Species Composition text: To enter a new *species composition*, type the code here and press enter. The code will then appear in the selected types list box (**129**).

129. Species Composition list box: This box contains all *species composition* codes that have been previously entered. To remove a species composition code, click on it in this list box.

130. Site Region form: Use this form to add to or delete from the list of *site regions* used by FYCD as selection criteria when opening *PSP* data files.

131. Site Region text box: This box is used to enter new *site regions* codes and descriptions. To enter a new code, type it here then press enter. Notice that the prompt then changes to "Enter Description". Next, type in a description for that site region code and press enter. The new site region and description will appear in the site region list box and description list box, respectively.

132. Site Region list box: This box contains all *site region* codes that have been previously entered. To remove a site region, click on either its code in this list box or its description in the Site Region Description list box (**133**).

133. Site Region Description list box: This box contains all *site region* descriptions that have been previously entered. To remove a site region, click on either its description in this list box or its code in the Site Region list box (**132**).

134. Treatment Unit form: Use this form to add to or delete from the list of *treatment units* used by FYCD as selection criteria when opening *PSP* data files.

135. Treatment Unit text box: To enter a new *treatment unit (TU)* code, type it here and press enter. Notice that the prompt then changes to "Enter Description". Next, type a description for that code and press enter. The new TU code and description will appear in the TU code list box and description list box, respectively.

136. TU Code List box: This box contains all TU codes that have been previously entered. To remove a *treatment unit*, click on either its TU code in this box or its description in the treatment unit description list box (**137**).

137. Treatment Unit Description list box: This box contains all *treatment unit* descriptions that have been previously entered. To remove a treatment unit, click on either its description in this list box or its TU code in the TU Code list box (**136**).

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Appendix 1. Data Formats

FYCD uses five general types of data as input: output files from stand growth models, PSP data, FDS (inventory) data, FORMAN+1 timber supply model files, and Woodstock timber supply model files. Output from four different stand growth models are supported, the STABLE model (Steinman and MacLean 1994), the STAMAN model (Vanguard Forest Management Service Ltd. 1993), the GROW model (Steinman et al. 1993), and a generic format. PSP and FDS data files consist of repeated and single measurements, respectively, of volume/ha, stand age, and other variables. Both FORMAN+1 (Vanguard Forest Management Services Ltd. 1991) and Woodstock (Remsoft Inc. 1996) timber supply models require several files as described below.

This appendix describes formats of each of the file types which can be used by FYCD. With this information, any data can be customized to conform to one of these file formats, for use with FYCD. Some file formats are column-specific, meaning that each value must be in the proper columns in the file, while others must have delimited fields. A field with * for length means that the value can be any length.

Appendix 1.1. Input data from stand growth models

1.1.1. Stable model

Fields can be delimited by spaces, tabs, or commas.

<u>Field</u>	<u>Type</u>	<u>Length</u>
1. species	character	6
2. age	integer	*
3. vol/ha or vol/tree	real	*
4. License	integer	*
5. stand	integer	*

Example lines in a STABLE output file:

```
fir 22 17 1 108
fir 30 14 1 108
fir 25 25 1 113
fir 33 28 1 113
```

1.1.2. STAMAN model

Fields can be delimited by spaces, tabs, or commas.

<u>Field</u>	<u>Type</u>	<u>Length</u>
1. age	integer	*
2. vol/ha or stems/ha	real	*

Example lines from a STAMAN output file:

```
33, 26
38, 45
43, 57
48, 79
```

1.1.3. GROW model

Fields can be delimited by spaces, tabs, or commas.

<u>Field</u>	<u>Type</u>	<u>Length</u>
1. age	integer	*
2. vol/ha or vol/tree	real	*

Example lines from a GROW output file:

```
11 .9
12 1.4
13 2
14 2.7
```

1.1.4. Generic format

The generic format can be used for any other data you have; simply format it as described for input to FYCD. This format is column-specific.

<u>Field</u>	<u>Type</u>	<u>Length</u>	<u>Columns</u>
1. age	integer	3	1-3
2. volume	integer	3	5-7
3. identifier	character	15	9-23

Example of the above STABLE sample file in generic format:

```
22 17 fir 1 108
30 14 fir 1 108
25 25 fir 1 113
33 28 fir 1 113
```

In the above example, all of "fir 1 108" is the curve identifier, giving species, region number, and plot number.

Model output files can have multiple curves (like the example generic file above) or single curves (like the GROW and STABLE models). FYCD recognizes different curves in the generic file by their identifiers. In the above example, FYCD knows that the second curve starts when the identifier changes from "fir 1 108" to "fir 1 113", since this changes the 15 character identifier string. To use the generic format for a single curve, either leave the identifier blank or make sure it is the same for all points in the curve.

Appendix 1.2. PSP Data

Fields are delimited by spaces. Species composition values must be in double quotes.

	<u>Field</u>	<u>Type</u>	<u>Length</u>
1.	plot number	integer	*
2.	age	integer	*
3.	volume/ha	real	*
4.	species composition	character	4
5.	site region	integer	*
6.	treatment unit	integer	*

Example lines from a PSP output file:

```
1205 43 72.2 "BFIH" 1 8
1205 48 70.4 "BFIH" 1 8
1205 51 69.5 "BFIH" 1 8
701 59 68.2 "BFIH" 3 3
701 64 62.8 "BFIH" 3 3
```

Appendix 1.3. Forest Development Survey (inventory) data

This format is column-specific.

	<u>Field</u>	<u>Type</u>	<u>Length</u>	<u>Columns</u>
1.	identifier	character	12	2-13
2.	age	integer	3	15-18
3.	volume	real	3	19-21

Example lines from an FDS data file:

```
1BFSPM62 63 110
252BFSPM64 59 116
299BFSPY62 37 30
491BFSPY64 34 14
```

Appendix 1.4. FORMAN+1 files

File types 1.4.1-1.4.3 are standard FORMAN+1 files, while 1.4.4-1.4.7 are custom files needed by FYCD for descriptive purposes.

1.4.1. FORMAN+1 Curveset file

This format is column-specific. This file normally has a `.crv` extension.

	<u>Field</u>	<u>Type</u>	<u>Length</u>	<u>Columns</u>
1.	curveset number	integer	3	1-3
2.	curveset name	character	6	4-9
3.	curve type	character	1	10
4.	breakup curve ID	integer	3	11-13
5.	entry age	integer	3	14-16
6.	breakup age	integer	3	17-19
7.	volume component	character	6	20-25
8.	Y-factor	integer	3	26-28

9. number of vertices integer 3 29-31
10. curve vertices: (pairs of age and volume values for each vertex; max. 42 vertices)

age	integer	3	32 +
volume	integer	3	

Example lines from a FORMAN+1 curveset file:

```
1BFSPA137 50140EC PLP100 20 10 30 12 ...
1BFSPA137 50140EC LOG100 20 10 30 15 ...
1BFSPA137 50140IH PLP100 20 10 30 17 ...
```

(lines shown above are truncated)

1.4.2. FORMAN+1 Forest Class file

This format is column-specific. This file normally has a `.cls` extension.

	<u>Field</u>	<u>Type</u>	<u>Length</u>	<u>Columns</u>
1.	forest class id	integer	4	1-4
2.	forest class name	character	6	5-10
3.	age	integer	3	11-13
4.	area	integer	8	14-21
5.	present curve	integer	3	22-24
6.	site	integer	1	25
7.	management unit	integer	3	26-28
8.	percent reserve	integer	3	29-31

Example lines from a FORMAN+1 forest class file:

```
1BFHWAA 30 3 702 0
2BFHWAA 40 3 351 0
3BFHWAA 55 2 351 0
```

1.4.3. FORMAN+1 Curve Composition file

This format is column-specific. This file normally has a `.cmp` extension.

	<u>Field</u>	<u>Type</u>	<u>Length</u>	<u>Columns</u>
1.	volume component	character	6	1-6
2.	product code	character	1	8

Example lines from a FORMAN+1 curve composition file:

```
IH PLP 2
SPRPLP 1
SPRSTD P
SPRLOG P
```

1.4.4. Forest Class description file - forestcl.des

This format is column-specific.

	<u>Field</u>	<u>Type</u>	<u>Length</u>	<u>Columns</u>
1.	class group	character	4	1-4

2. forest class			
name	character	6	6-11
3. description	character	68	13-80

2 Management Unit B
3 Management Unit C

Note: class group is only used to visually group forest classes in the selection list when opening FORMAN+1 files by Class Definition.

Example lines from forestcl.des:

```
BFHW BFHWAA Balsam fir and hardwood, all ...
    BFHWCC Balsam fir and hardwood, clear cut
    BFHWPC Balsam fir and hardwood, patchy
BFSP BFSPAA Balsam fir and spruce, all crown..
    BFSPCC Balsam fir and spruce, clear cut
    BFSPPC Balsam fir and spruce, patchy
```

(lines shown above are truncated)

1.4.5. Volume Component description file - volcomp.des

This format is column-specific.

Field	Type	Length	Columns
1. volume			
component	character	6	1-6
2. description	character	25	8-32

Example lines from volcomp.des:

```
EC PLP Eastern cedar, pulpwood
EC LOG Eastern cedar, logs
IH PLP Intolerant hardwood, pulpwood
SPRPLP Spruce, pulpwood
SPRSTD Spruce, studwood
SPRLOG Spruce, logs
```

1.4.6. Site Type description file - sitetype.des

This format is column-specific.

Field	Type	Length	Columns
1. site type	integer	3	1-3
2. description	character	10	4-13

Example lines from sitetype.des:

```
1 Good
2 Medium
3 Poor
```

1.4.7. Management Unit description file - mgmtunit.des

This format is column-specific.

Field	Type	Length	Columns
1. management unit	integer	3	1-3
2. description	character	44	4-47

Example lines from mgmtunit.des:

```
1 Management Unit A
```

Appendix 1.5. Woodstock Files

The Woodstock Forest Modeling System (Remsoft Inc. 1996) was designed to model many aspects of forest dynamics and management. Woodstock is very flexible, and description of its structure and input files is beyond the scope of this report. In brief, there can be up to 15 sections of input data, that contain information needed to run the program. One input file must be designated as primary. The forest yield information of interest for FYCD is stored in the YIELDS section. The LANDSCAPE section can also be used by FYCD and contains a description of themes that can be used to define various forest characteristics such as forest type, site quality, or ecoregion. These may be in the primary file or in separate data files that are referenced in the primary file.

FYCD will read information from the YIELDS and LANDSCAPE sections, whether they exist in the primary file or in separate files.

1.5.1 YIELDS section

The beginning of the YIELDS section is denoted by the YIELDS keyword, unless the YIELDS section is in an external file, in which case there may be no section header. Woodstock supports three different types of yield data, age-dependent, time-dependent, and complex (combinations of the other two types). FYCD only supports age-dependent yield sets. Other yield sets will be ignored if present in the data file. Also, FYCD will ignore scale factors if found in the yield set information. In the following format description, mask represents a curveset name (e.g., all curves in a forest class), yield-component defines species-product groups, period specifies the time (in periods, e.g., a period of 4 with a period length of 5 years would start the curve at 20 years) when the curve starts, and volume specifies volume/ha in each successive period.

```
*Y mask1 {optional comment}
yield-component1 period volume1 .. volumen
yield-component2 period volume1 .. volumen
yield-componentn period volume1 .. volumen
*Y mask2 {optional comment}
yield-component1 period volume1 .. volumen
yield-componentn period volume1 .. volumen
*Y maskn
```

Example lines from a Woodstock YIELDS section:

```
*Y set1
```



```

BFFIB 4 6 7 8 9 10 10 11 11 11 11 10 9 9 8 7
BFLOG 4 6 8 10 11 13 14 14 14 14 14 13 12 10
*Y set2 { this set resembles set4}
BFFIB 8 2 3 3 4 4 5 5 6 7 8 9 10 10 10 9 9 9
BFLOG 8 2 3 4 5 6 6 7 7 8 7 7 7 6 6 5 4
YBFIB 4 1 2 2 2 3 3 4 4 5 5 6 6 6 6 6 3 2

```

Appendix 1.6. Using customized input files

You can use your own customized input files for FYCD, from any stand growth model, by re-formatting them to conform to one of the formats described in Appendix 1.1. The generic format was provided specifically for this purpose, though any of the other formats can be used. To use the generic format, follow these guidelines:

- if the data file consists of only one curve, make sure that the identifier is the same for each line of data (see generic format, Appendix 1.1.4).
- if the data file consists of more than one curve, make sure that the identifier is the same for all points in the curve and unique to the curve.
- if the data file includes point data, make sure that the identifier is unique for each line of point data.
- to open a file having this generic format, choose the **File - Open - Model Output - Generic** menu item.

Input files produced using STAMAN must follow the formats used by FYCD (Appendix 1.1.2). To produce this format using STAMAN, generate an ASCII report, choose no titles, and select one volume component or density component (if creating stems/ha data). This format supports only one curve per file.

Appendix 1.7. Using FORMAN+1 files

In order to use FORMAN+1 curveset files, simply copy them to the FYCD directory, giving them names with .crv extensions. Remember: if you want to use the **File - Open - FORMAN+1 - Class Definition** capability, you need to also include the additional files required by FYCD.

The following is a list of data files needed by FYCD to open FORMAN +1 files by the **Class Definition** method:

FORMAN +1 standard files

.crv - the curveset file
.cls - forest class file

.cmp - curve composition file

Additional files required by FYCD

forestcl.des - forest class description file
volcomp.des - volume component description file
sitetype.des - site type description file
mgmtunit.des - management unit description file

The FORMAN+1 standard files must be valid. In other words, they must be usable as input to a FORMAN+1 run. The various FORMAN+1 data files contain interrelated data. Therefore, the .crv, .cls, and .cmp files must be used together as a set. FYCD also requires additional description files, listed above. All files must exist in the locations specified in the FYCD **Options - Configuration** menu.

Appendix 2. Sample Data Files

The following data files are included with FYCD. See Appendix 1 for a description of the file formats used by these sample files.

growl.* - Each file contains output from the GROW model consisting of volume/ha by age predictions (one yield curve) for a single species. The species is identified by the filename extension, shown here as an asterisk.

growltr.* - Each file contains output from the GROW model consisting of volume/tree by age predictions (one curve) for a single species. The species is identified by the filename extension, shown here as an asterisk.

stable** - Each file contains output from the STABLE model consisting of volume/ha by age predictions for a single species. Several 8-year curve segments (one per plot) are included in each file. The species is identified by the filename extension, shown here as an asterisk.

stab*tr.* - Each file contains output from the STABLE model consisting of volume/tree by age predictions for a single species. Several 8-year curve segments (one per plot) are included in each file. The species is identified by the filename extension, shown here as an asterisk.

staman.* - Each file contains output from the STAMAN model consisting of volume/ha by age predictions (one yield curve) for a single species. The species is identified by the filename extension, shown here as an asterisk. The files listed below are also of this type:

stamrep.1bf - fir stand type, 30-60 yrs of age, unprotected against spruce budworm
stamrep.2bf - fir stand type, 55-85 yrs of age, unprotected against spruce budworm
stamrep.3bf - fir stand type, 65-95 yrs of age, unprotected against spruce budworm
stamrep1.1bf - fir stand type, 30-60 yrs of age, protected against spruce budworm
stamrep1.2bf - fir stand type, 55-85 yrs of age, protected against spruce budworm
stamrep1.3bf - fir stand type, 65-95 yrs of age, protected against spruce budworm
stamrep.1sp - spruce stand type, 45-75 yrs of age, unprotected against spruce budworm
stamrep.2sp - spruce stand type, 65-95 yrs of age, unprotected against spruce budworm
stamrep.3sp - spruce stand type, 85-115 yrs

of age, unprotected against spruce budworm
stamrep1.1sp - spruce stand type, 45-75 yrs of age, protected against spruce budworm
stamrep1.2sp - spruce stand type, 65-95 yrs of age, protected against spruce budworm
stamrep1.3sp - spruce stand type, 85-115 yrs of age, protected against spruce budworm

stamanst.* - Each file contains output from the STAMAN model consisting of number of stems/ha by age predictions (one curve) for a single species. The species is identified by the filename extension, shown as an asterisk.

***.fds** - Each file contains a set of volume/ha values stratified by FDS plot identifier and stand age. Each plot in the file has one volume measurement. The plots were grouped into files according to species composition (forest unit FUNA code) which is denoted by the filename, shown here as an asterisk.

dmaclean.psp - Data from Dr. D.A. MacLean's permanent sample plots. A curve segment showing volume/ha by age from 1983-1991 is included for each of several plots.

bf.psp - N.B. Co-operative PSP data (volume/ha by age) from a portion of the province for plots with balsam fir as the primary species (specifically, Forest Unit (FUNA) = 'BFTH' or 'BFSP').

spbf.psp - N.B. Co-operative PSP data (volume/ha by age) from a portion of the province, for plots with FUNA = 'SPBF'.

allbfsp.psp - N.B. Co-operative PSP data (volume/ha by age) from all plots with FUNA = 'BFSP'.

allspbf.psp - N.B. Co-operative PSP data (volume/ha by age) from all plots with FUNA = 'SPBF'.

forsampl.crv - sample FORMAN+1 curveset file.

forsampl.cls - sample FORMAN+1 forest class file.

forsampl.cmp - sample FORMAN+1 curve composition file.

forestcl.des - forest class description file for **forsampl.*** files

sitetype.des - site type description file for
forsampl.* files

mgmtunit.des - management unit description
file for forsampl.* files

volcomp.des - volume component description
file for forsampl.* files

manual.crv - FORMAN+1 curveset file from the
FORMAN+1 demo disk

manual.cls - FORMAN+1 forest class file from
the FORMAN+1 demo disk

manual.cmp - FORMAN+1 curve composition file
from the FORMAN+1 demo disk

manfcl.des - forest class description file for
manual.* files

mansite.des - site type description file for
manual.* files

manmgmt.des - management unit description file
for manual.* files

manvolc.des - volume component description
file for manual.* files

model.pri - sample Woodstock primary file

Appendix 3. Glossary

comment - textual notes associated with a curve.

The intended use of this *comment* capability is to facilitate and record communication between foresters and the management planner regarding individual curves.

cubic regression - a cubic regression fits a curve of the equation $y = a + bx + cx^2 + dx^3$ through a set of points, and then calculates values for that equation at each specified age. The r^2 value and equation of the regression are stored as a label in FYCD and can be viewed by selecting the regression curve in the Data Sets legend and then pressing the **Indiv. Curve Info** button.

curve type - the type of curve being defined. Valid curve type codes are:

V = volume per hectare by age (the default)
S = volume per tree by age
C = cost by age
U = user-specified curve

curveset file - see *FORMAN+1 curveset*.

curveset number - the identification number assigned to each *FORMAN+1 curveset*. See the FORMAN+1 User Manual for more details.

curveset name - the name assigned to each curveset, which can be used to describe the stand condition to which it relates. See the FORMAN+1 User Manual for more details.

data set - this is the term used by FYCD to describe a set of data that is displayed on the graph as a curve, a point, or a set of curves or points. The data in a data set may have been read into FYCD or created within FYCD using one of its functions. A data set is an entity only within the FYCD program and has no permanence. Each data set is uniquely colored and named in the Data Sets legend.

freehand - refers to the 'draw mode' in FYCD where you can draw your own curves by placing curve vertices on the graph using the mouse. It is meant to replicate "drawing" yield curves by hand on graph paper.

FDS - Forest Development Survey (inventory) data from the N.B. Department of Natural Resources and Energy. It consists of volume/ha by stand age data (one record per FDS plot) based on data collected at temporary sample

plots. Records for similar plots would probably be placed in the same FDS data file for use in FYCD.

forest class - a grouping of forest stands based on stand characteristics.

forest class file - a *FORMAN+1* data file characterizing all forest classes which comprise a particular forest area. This file is used by FYCD to get *forest class*, *curveset number*, *site type*, and *management unit* information.

FORMAN+1 - a wood supply planning model that forecasts the development of a forest over time according to user-defined development expectations and management strategies. See the FORMAN+1 User Manual (Vanguard Forest Management Services Ltd. 1991) for more information.

FORMAN+1 curveset - a curveset is a series of curves for a *forest class* with separate curves for each species component. Four *curve types* are supported by *FORMAN+1*. Volume/age curves are the primary *curve type* dealt with by FYCD. See the FORMAN+1 User Manual for details.

linear regression - a linear regression fits a straight line ($y = a + bx$) through a set of points, then calculates values for that equation at each specified age. The r^2 value and equation of the regression are stored as a label in FYCD and can be viewed by selecting the regression curve in the Data Sets legend and then pressing the **Indiv. Curve Info** button.

logarithmic regression - a logarithmic regression fits a curve of the equation $y = a + b * \log_{10}x$ through a set of points, then calculates values for that equation at each specified age. The r^2 value and equation of the regression are stored as a label in FYCD and can be viewed by selecting the regression curve in the Data Sets legend and then pressing the **Indiv. Curve Info** button.

management unit - used in a *FORMAN+1 forest class file* to divide forest classes according to some delineation related to management intentions.

mean aggregate - a type of curve that is built with the build curve function. Each resulting point in the aggregate curve is the average y-value of all selected curve segments at that age.

model output - results (output files) from growth and yield or stand development models. FYCD supports formats derived from the STABLE, STAMAN, and GROW models, as well as a generic format.

product grouping - a component of the *volume category*, that has two possible values: volume or product. This term is not standard FORMAN+1 terminology, but is introduced in FYCD to clarify the explanation of the FORMAN+1 volume category.

PSP - permanent sample plot. A location in the forest at which the trees are remeasured periodically in order to determine stand structure, productivity, and other variables at specific points in time. These plots may be used to construct or validate/invalidate stand growth projections made with stand models.

quadratic regression - a quadratic regression fits a curve of the equation $y = a + bx + cx^2$ through a set of points, then calculates values for that equation at each specified age. The r^2 value and equation of the regression are stored as a label in FYCD and can be viewed by selecting the regression curve in the Data Sets legend and then pressing the **Indiv. Curve Info** button.

selection color - the color used by FYCD to highlight curve segments that are selected.

site region - a classification of geographic area in N.B. used in deriving site productivity.

site type - used in FORMAN+1 *forest class files* to associate a forest class with the site on which it resides. Defines site productivity.

species composition - a classification based on the most abundant tree species occurring in a forest stand.

species grouping - component of the *volume category*, that has three possible values: primary, secondary, or other. This term is not standard FORMAN+1 terminology, but is introduced in FYCD to clarify the explanation of the FORMAN+1 volume category.

stems/ha - number of trees per hectare.

sum aggregate - a type of curve that is built with the build curve function. Each resulting point in

the aggregate curve is the sum of all y-values of all selected curve segments at that age.

treatment unit (TU) - a classification of site productivity used in N.B. based on soil type and vegetation.

volume/tree - volume per tree (m^3).

volume - tree volume per hectare (m^3/ha).

volume category - the four main FORMAN+1 volume categories are:

Primary volume - the aggregate merchantable yield upon which harvesting is controlled when using volume based management strategies.

Primary product volume - a subset of the primary volume that will be available in a specific product form.

Secondary volume - the non-primary aggregate merchantable yield in the stand that could be harvested in the course of harvesting primary volume. It does not contribute to the achievement of volume based harvest targets.

Secondary product volume - a subset of the secondary volume that will be available in a specific product form.

volume component - a term used with the FORMAN+1 model to identify a species/product combination to which an individual curve applies.

Woodstock - a forest modeling program (Remsoft Inc. 1996).