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Stand-Damage Model with Java (Version 3.0)

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Abstract

The Stand-Damage Model with Java is a distance-independent tree-growth simulator. The model follows the life of a forest stand represented by species and diameter-class widths. The user supplies the initial state of the stand along with management prescriptions and defoliation amounts. Growth, mortality, and regeneration are then simulated. Windows® installation and operating instructions for version 3.0 of the model are provided.

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Before You Begin

This guide contains the information you need to install, configure, and use the Stand-Damage Model with Java. A PC with the Microsoft Windows[1] operating system is required.

Stand-Damage Model

The Stand-Damage Model calculates tree diameter growth, current diameter and height, and tree mortality for every simulated year. The model is a distance-independent tree-growth simulator, a gap model based on the work of Botkin (1993) and Shugart (1984). Parameters are included for 78 tree species. The user assigns tree counts by species and diameter class. Users can supply data on defoliation history (in broad categories by species for the 2 years prior to the simulation) and describe defoliation scenarios (for each species each year as a percentage for the overstory and for the understory). Each year, the model calculates the diameter growth of trees as a function of relative stocking (a measure of tree crowding), shading, heat, and defoliation.

Tree-growth simulation is driven by weather. An accumulative heat unit measure (day-degrees above a single threshold of 40 degrees F) is used as the driver of diameter growth. Tree mortality comprises three factors: a base rate, stress induced, and induced by defoliation. The base tree mortality rate is increased, depending upon reduced growth, gypsy moth defoliation, and other stresses. Following mortality calculations, tree growth is updated for the residual stems, and new stems are recruited to the smallest classes. Management through silvicultural prescriptions can be simulated. The user provides data for management actions, including the year of entry, selection criteria for removals, and species-specific targets.

The model interface is written in Java. The Java programming language was chosen because it is object-oriented, secure, architecture-neutral, and multithreaded.

Document Conventions

This document's description follows the order of the software's typical use. All menu items and buttons are shown in **Bold**. A **`Bold Courier`** font indicates drives, directories or folders, and file names.

Related Publications

The "Description of the Stand-Damage Model" (Colbert and Sheehan 1995) provides the model's biological basis, the algorithms, and variable descriptions. The "User's Guide to the Stand-Damage Model" (Colbert and Racin 1995) provides a description of the DOS version. The "Guide to the Stand-Damage Model Interface Management System" (Racin and Colbert 1995) describes the interface design and data files. The "How to Use the Stand-Damage Model" (Colbert and Racin 2001) describes features added to version 2 of the DOS model.

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[1] The use of trade, firm, or corporation names in this document is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture or the Forest Service of any product to the exclusion of others that may be suitable.

Installing the Stand-Damage Model

Before beginning the installation procedure, close any open applications. Insert the CD into the PC and start Windows Explorer, the desktop file manager. In the left pane of Windows Explorer, click on the D: Drive (or CD ROM drive letter). Double-click on **`Setup.exe`** to start the model installation. Follow the directions provided by the install wizard. The installer should place the files in:

`C:\Program Files\JavaSoft\JRE\1.1\bin`.

The installation is complete.

Creating a Desktop Icon

To create a desktop icon within Windows, perform the following steps. Choose the **Start** button and then select **Find** (or **Search**). Select **Files or Folders** and search for **`jr.bat`** (type this in the space provided). Right click on the **`jr.bat`** file and select **Create Shortcut** from the menu list. This will place a shortcut on the desktop.

Rename the icon to **Java SDM** and then right click and select **Properties**. Select **Change Icon** (and press **OK** at the next warning screen), then choose **Browse**. Change to the directory **`C:\Program Files\JavaSoft\JRE\1.1\bin`** and highlight **`Tree2.ico`** with the mouse and then press **Open**. Press **OK** at the next two screens and the icon will change to the Java Stand-Damage Model icon.

Getting Started

Starting the Software

After installation, you can start the software in two ways. You can click the **Java SDM** icon on your desktop or click Windows **Start** button and highlight **Programs** with the mouse. Then highlight **Java Stand-Damage Model** and click on **Java Stand-Damage Model**. The following command prompt window will be displayed:

```
C:\Program Files\JavaSoft\JRE\1.1\bin>jre  -cp  menu.jar  SDMMenu
```

If the model does not run and an error message is displayed, try typing the following at the command line from **`C:\Program Files\JavaSoft\JRE\1.1\bin:`**

```
java –cp menu.jar SDMMenu
```

If the interface still does not run, you may need to install a Java Virtual Machine. A free copy can be obtained at:

`http://www.java.com`

For additional assistance, refer to the end of this document.

Understanding the Main Menu

When the model is started, the Main Interface (Fig. 1) is displayed.

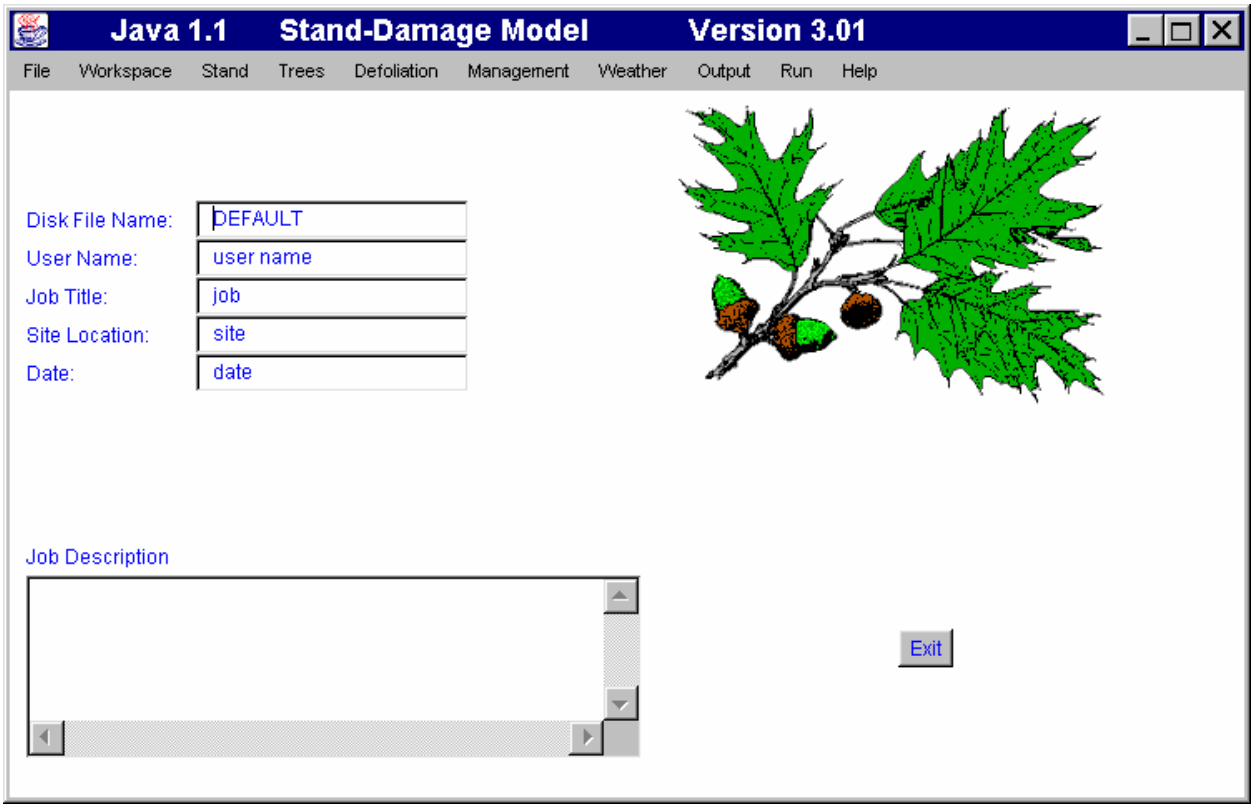

Figure 1.—Main Interface screen.

On the left of the screen are text fields that identify the **Disk File Name** (**`DEFAULT`**), the **User Name**, **Job Title**, **Site Location**, and **Date**. These identifiers are from the **`DEFAULT`** file that is read when the software starts. At lower left is **Job Description**, a text area for describing the user's data. The **Exit** button at lower right is used to provide a quick exit from the software.

The Main Menu across the top of the window consists of:
File Workspace Stand Trees Defoliation Management Weather Output Run Help
Each menu item activates a pull-down submenu.

File

The pull-down menu for **File** includes **Open**, **Save**, **Reload default file**, and **Exit**.

Open

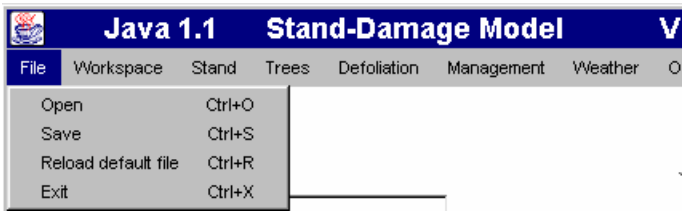

Figure 2.—File pull-down menu.

Use **Open** to select a preexisting data file. A pop-up dialog box (Fig. 3) will display all the files that end in the Stand-Damage extension (**`.inp`**). Select the file that you wish to load and press

the **Open** button. In Figure 3, **`example.inp`** is highlighted and will be loaded. This file, used for most of this document, includes eight tree species and a simulation length of 18 years.

The file **`java.inp`** (Fig. 3) is produced (and overwritten) every time a simulation is run. Should the software malfunction during a simulation, you can load this file from disk to prevent the loss of data.

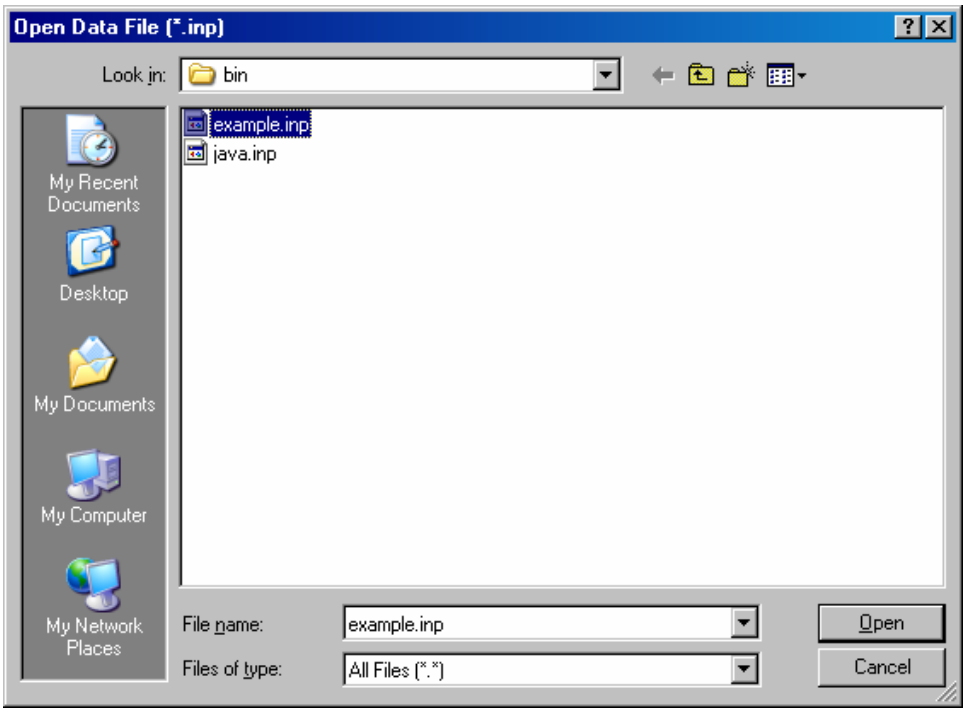

Figure 3.—File Open dialog box.

Save

Use **Save** from the **File** pull-down menu (Fig. 2) to save your data for future use. In the **Save** dialog box (Fig. 4), **`sample`** is entered as the file name.

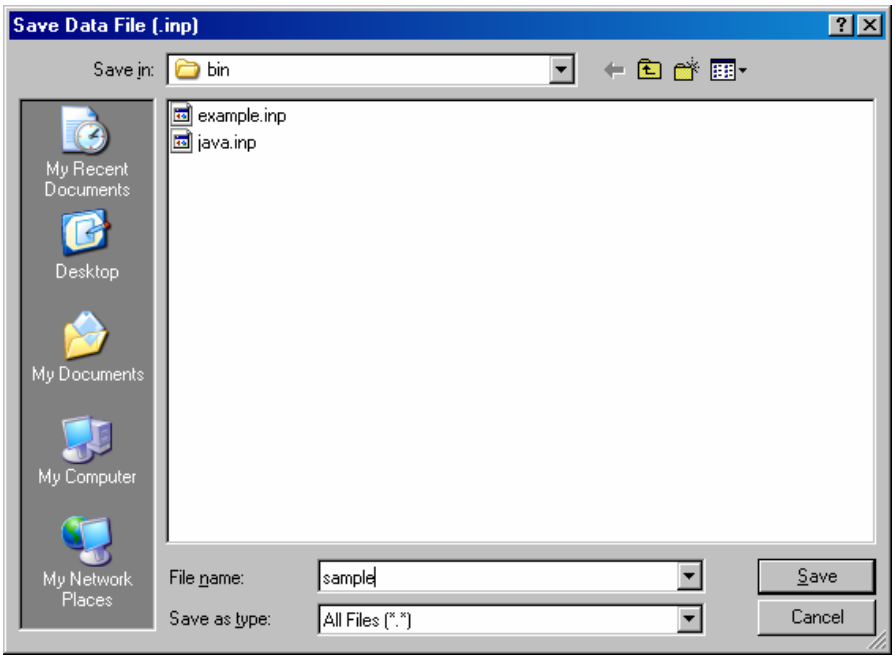

Figure 4.—File Save dialog box.

Press the **Save** button to save the file to the hard drive. The **`.inp`** extension is appended to the end of the file name, i.e., **`sample.inp`** within the file system.

Reload Default File

Select **Reload default file** from the **File** pull-down menu (Fig. 2) to restore the model with the **`DEFAULT`** file settings.

Exit

Select **Exit** (Fig. 2) to exit the software. If you have edited data that has not been saved, a dialog box (Fig. 5) will be displayed. Press **Yes** to stop the software, **No** to continue using the model.

Figure 5.—Exit dialog box.

Shortcut Keys

Shortcut keys to the right of each pull-down selection (Fig. 2) can be used to bring up menu items. For example, pressing **Cntrl+O** will bring up the **Open** dialog box.

Workspace

Workspace, the next item from the Main Menu (Fig. 1), refers to the colors that the user can select in running the model. The choices are: **Foreground Colors** and **Background Colors**. The default colors are **Blue** and **Cyan** respectively, for the foreground and background text.

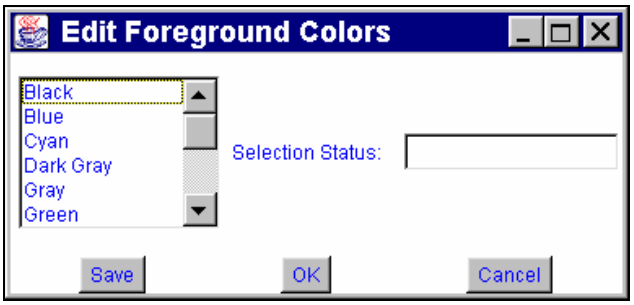

Figure 6.—Foreground Colors dialog box.

From the **Foreground Colors** dialog box (Fig. 6), select text color from the list on the left and press **OK**. Click on **Save** to make your selection permanent.

Select **Background Colors** to edit window colors (Fig. 7). The buttons are similar to those in Figure 6 except that you can test your selection by pressing **Test**. If you press **Save**, your selection is saved to disk.

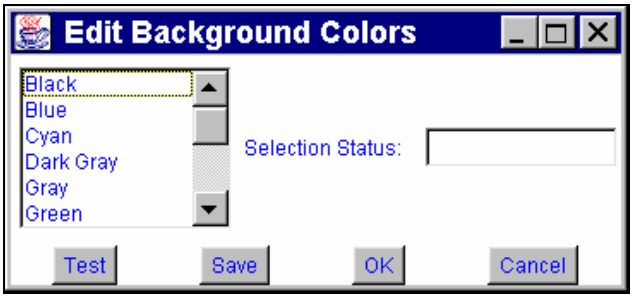

Figure 7.—Background Colors dialog box.

Stand

From the Main Menu, **Stand** includes two pull-down items: **General data** (Fig. 8) and **Stand data** (Fig. 9).

General Data

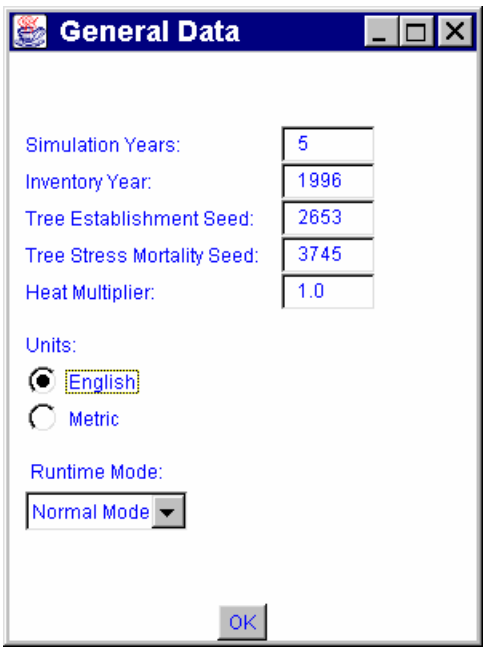

Figure 8.—General Data screen.

The **General Data** screen is used to designate simulation length (**Simulation Years**) and the initial conditions at the start of the simulation (**Inventory Year**). **Tree Establishment Seed** and **Tree Stress Mortality Seed** are used to introduce variability in simulating regeneration and mortality of stressed trees. **Heat Multiplier** allows you to change the effect of temperature across all years. Of available radio buttons for **English** or **Metric**, only English units are used in this version. Runtime Mode toggles between **Normal Mode** (the default) and **Debug Mode**. **Debug Mode** is used to fix software problems, so casual users should not select this option. After you have adjusted the values, press **OK** to register changes.

Stand Data

The **Stand Data** screen (Fig. 9) is used to edit Stand-level information. The standard **Diameter Class Width** is 2 inches. From a drop-down list you can choose standard 1, 4, and 6-inch diameter classes. To choose a nonstandard width, select **User-Defined** from the drop-down list and click on **User-Defined Class Width** to bring up a pop-up screen (Fig. 10). Enter a new width and lower limit in the appropriate fields. Note that a change in diameter class width requires changes in stem counts in each class for all species (see **Stem Counts** in the **Add Tree Species** section).

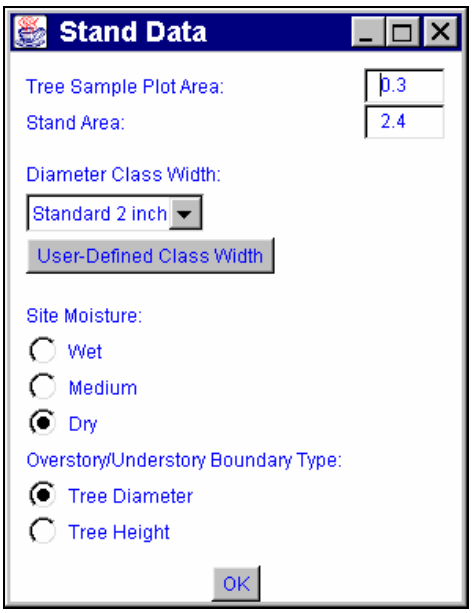

Figure 9.—Stand Data screen.

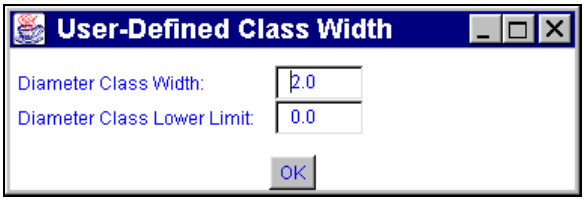

Figure 10.—User-Defined Class Width screen.

Site Moisture and **Overstory/Understory Boundary Type** selections are made through the **Stand Data** screen (Fig. 9).

Trees

From the Main Menu the **Trees** pull-down includes **Add Tree Species**, **Edit Tree Species**, and **Delete Tree Species**. These screens are used to manipulate the composition of your stand.

Add Tree Species

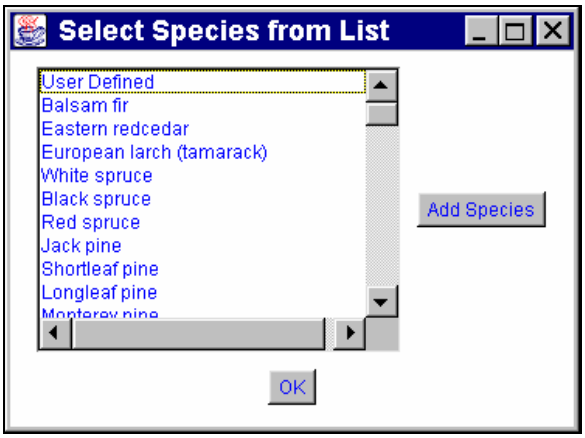

Figure 11.—Add Tree Species selection list.

Selecting **Add Tree Species** brings up a list tree of species from which to choose (Fig. 11). Highlight the species from the list and press **Add Species**. Move the list box downward to display all of the available species. If you do not want to add a species to the stand, press **OK** to exit.

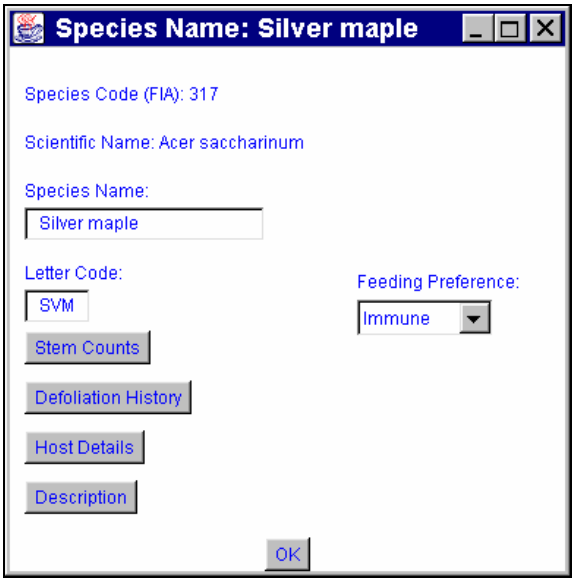

Figure 12.—Edit Species screen.

In Figure 12, we chose **Silver maple** from the species list. Items related to this species can be edited from this screen (**Species Code** and **Scientific Name** cannot be changed). Under **Feeding Preference** (by gypsy moth), the choices are **Susceptible**, **Resistant**, and **Immune**.

Stem Counts (Fig. 13) is the most important item to be edited. Stem counts are arranged by diameter class. When a species is added, one stem is added automatically to the 1-inch class because at least one stem is required to run the model correctly. After editing these values, press **OK**. Use the **Stand Data** menu option discussed earlier to change diameter-class width.

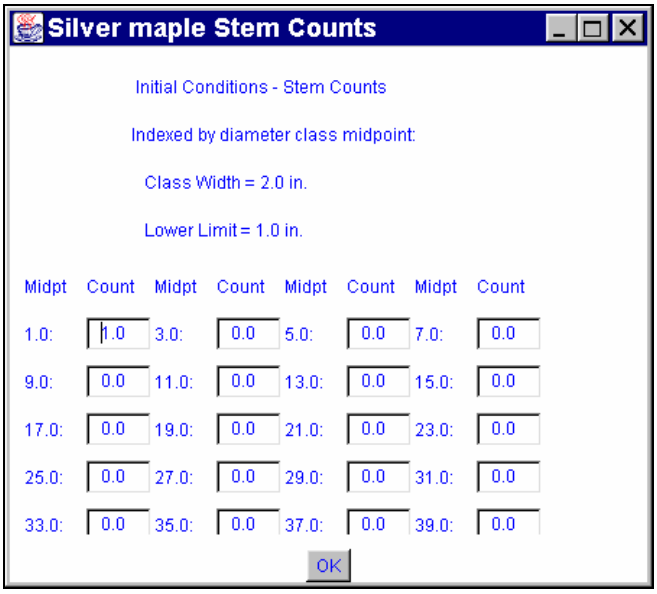

Figure 13.—Stem Counts screen.

Selecting **Defoliation History** in Figure 12 brings up a window (Fig. 14) with drop-down lists showing percent defoliation for **Overstory** and **Understory**. Press **OK** after editing these values.

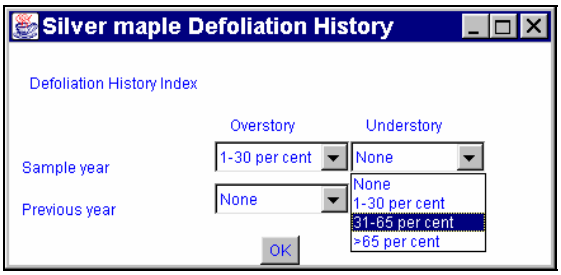

Figure 14.—Defoliation History screen.

Selecting **Host Details** (Fig. 12) brings up the screen shown in Figure 15. The typical user generally does not edit the values in this screen.

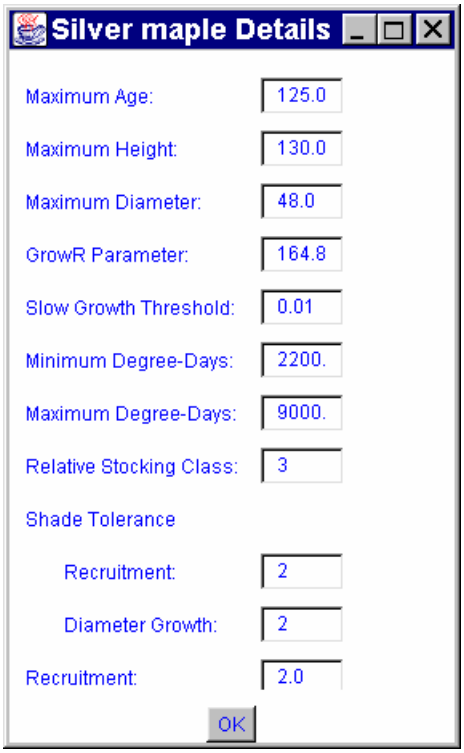

Figure 15.—Host Details screen.

The last item in Figure 12, **Description** brings up the species description when selected (Fig. 16). The window text cannot be edited.

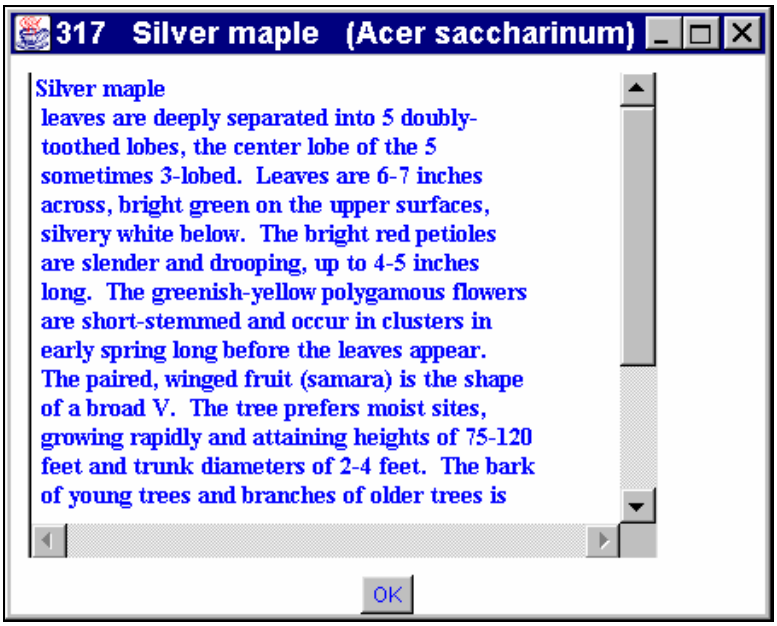

Figure 16.—Species Description screen.

Edit Tree Species

After selecting a tree species using **Add Tree Species**, you can edit the species by selecting **Edit Tree Species** from the **Trees** pull-down. A list is displayed (Fig. 17) from which the tree to be

edited, e.g., **Silver Maple**, is highlighted. Clicking on **Edit Species** brings up the **Edit Species** screen (Fig. 12). To exit without editing a species, press **OK** to close the window.

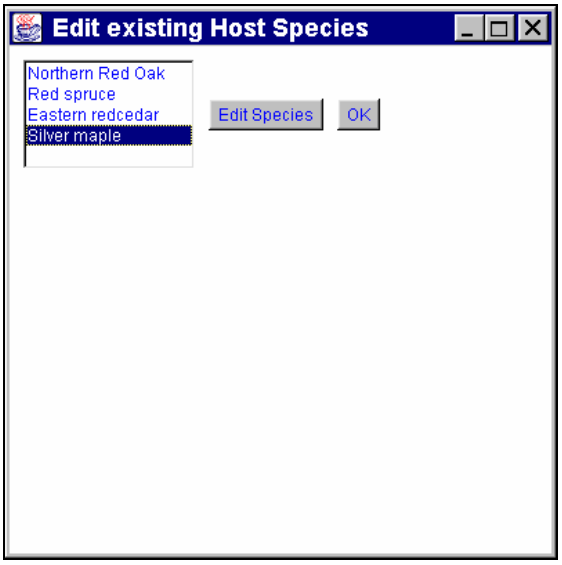

Figure 17.—Edit Tree Species screen.

Delete Tree Species

Select **Delete Tree Species** from the **Trees** pull-down to delete a species from your tree list. A list of trees to choose from will be displayed (Fig. 18). Since at least one species is required to run a simulation, you cannot delete every species from your list.

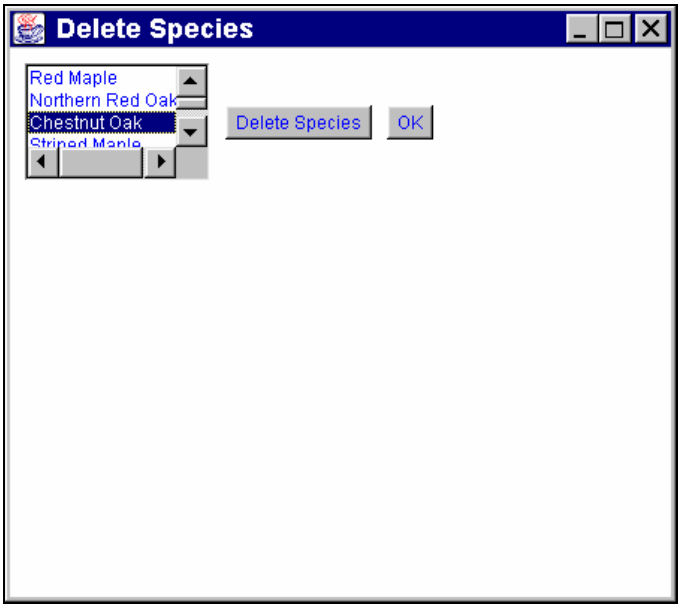

Figure 18.—Delete Tree Species screen.

In Figure 18, Chestnut Oak has been highlighted as the species to delete. After clicking on the **Delete Species** button, a dialog box (Fig. 19) will be displayed as a safety measure. Click on **Yes** to delete the species and associated Stem Counts; click on **No** to cancel the Delete operation.

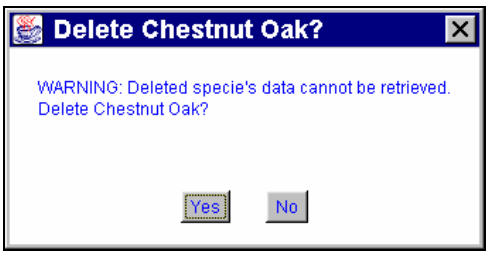

Figure 19.—Delete Species dialog box.

Defoliation

To describe defoliation that takes effect during a simulation, one selects the defoliation year and percent defoliation for that year. For each host species, the average defoliation for that year is entered for all overstory and understory trees. The **Defoliation** pull-down includes: **Add defoliation year**, **Edit defoliation year**, **Delete defoliation year**, and **Remove all defoliation**.

Add Defoliation Year

When **Add defoliation year** is selected, the screen in Figure 20 is displayed. Note: this uses the **`example.inp`** file as the data source, which has an 18-year simulation length. To change the simulation length or starting year, use **Stand/General data**. From **Add defoliation year**, highlight a specific year and then click on **Add Year**. A pop-up window is displayed (Fig. 21). In our example, 1994 was selected. Enter defoliation in percent (values between 0 and 100).

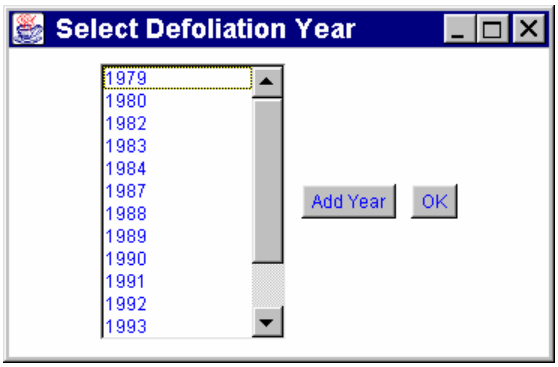

Figure 20.—Select Defoliation Year screen.

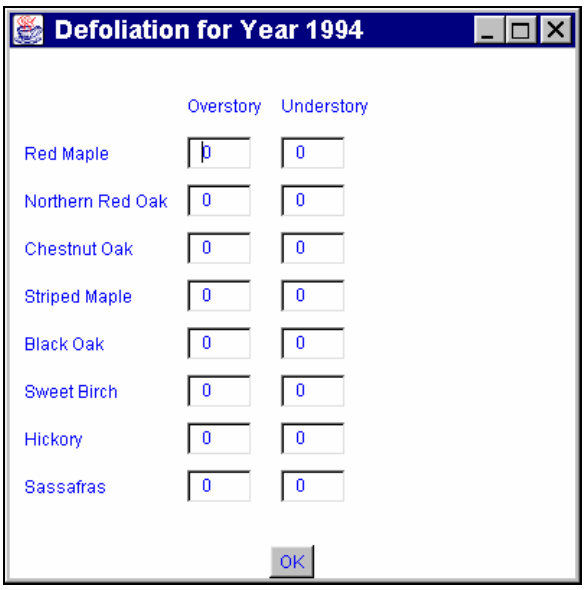

Figure 21.—Defoliation Edit screen.

Edit Defoliation Year

When **Edit defoliation year** is chosen, the dialog box in Figure 22 is displayed. In this example, data is edited for **1994** and a pop-up window is displayed (Fig. 21). Select a year with defoliation and press **Edit Year** to return to the **Defoliation Edit** screen.

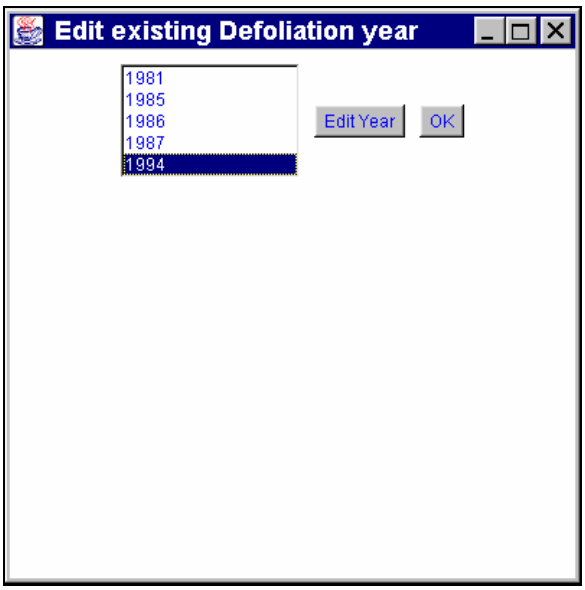

Figure 22.—Edit Defoliation Year dialog box.

Delete Defoliation Year

When **Delete defoliation year** is chosen, a list is displayed (Fig. 23). **1994** has been highlighted with the mouse. Select **Delete Year** to bring up a dialog box (Fig. 24). Click **Yes** to delete this year's defoliation data; **No** to cancel the deletion.

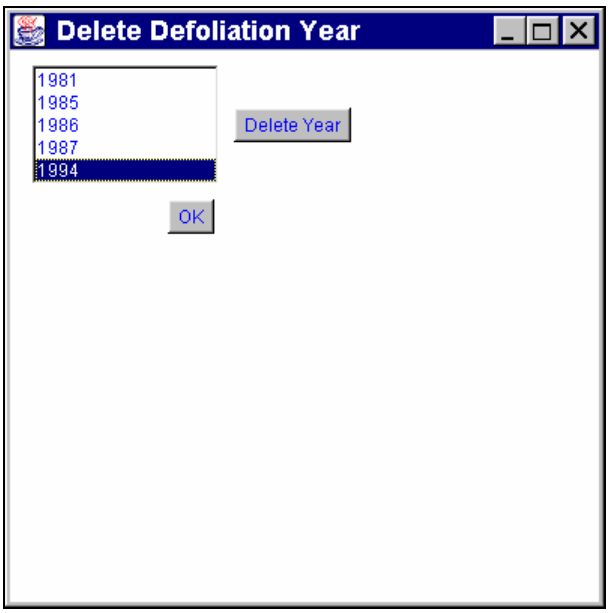

Figure 23.—Delete Defoliation Year screen.

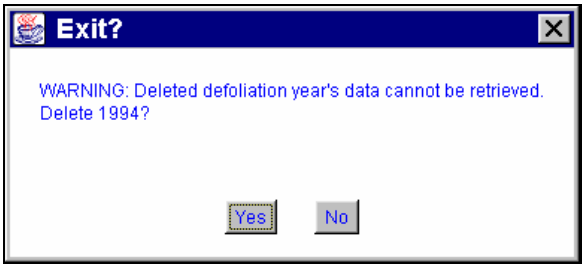

Figure 24.—Delete Defoliation Year dialog box.

Remove All Defoliation

To remove all defoliation effects from your simulation, select **Remove all defoliation** from the **Defoliation** pull-down. In the dialog box displayed (Fig. 25), select **Yes** to delete all defoliation.

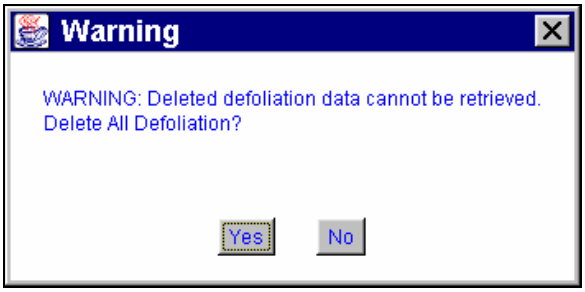

Figure 25.—Remove All Defoliation dialog box.

Management

You can prescribe stand cultural practices by selecting **Management** (Fig. 1). Three choices are available: **Add management year**, **Edit management year**, and **Delete management year**.

Add Management Year

When **Add management year** is chosen, a list of all years to be simulated is displayed (Fig. 26). Recall that **`example.inp`** has an 18-year simulation length. To change the simulation length, return to **Stand/General Data** screen (Fig. 8) and enter a new value for **Simulation Years**.

Highlight the year from the year list and select **Proportion of Stems Removed** or **Target Residual Stem Count**. With the proportional method, one selects the proportions of stem counts to be removed within prescribed diameter limits for each species. With the target thinning method, one stipulates the final total stem count for each species and the diameter limits within which trees may be removed.

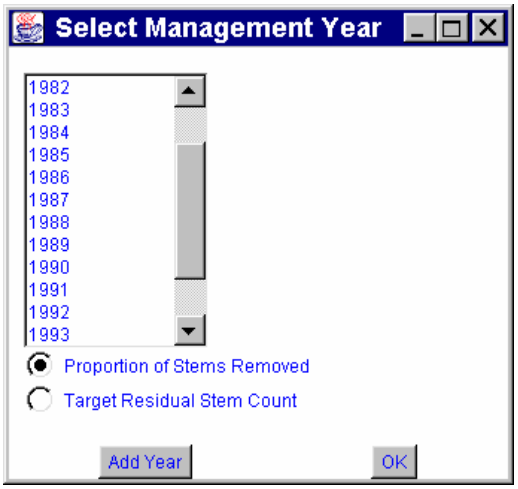

Figure 26.—Add Management Year screen.

Clicking on **Add Year** (Fig. 27) shows the result of adding 1987 to data from the **`example.inp`** file using the proportion method.

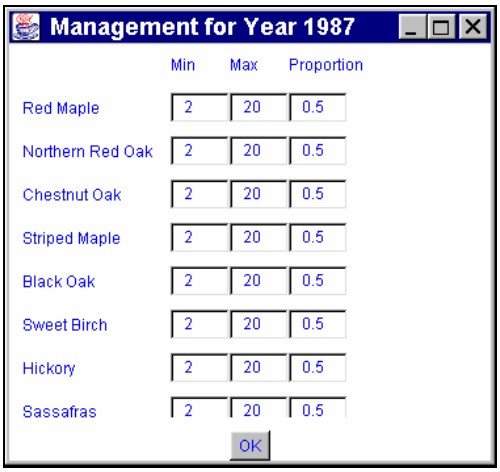

Figure 27.—Management For Year 1987 screen.

Edit Management Year

After management years have been entered, you can go back and edit management data with **Edit Management Year** (Fig. 28) which shows the year 1987 highlighted. Selecting **Edit Year** returns you to the screen shown in Figure 27.

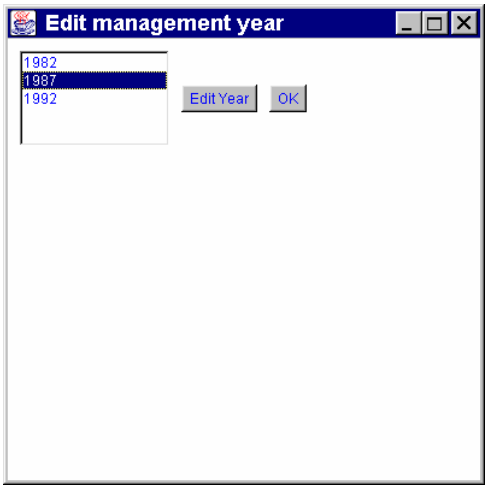

Figure 28.—Edit Management Year screen.

Delete Management Year

To delete a management year, select **Delete Management Year** (Fig. 29). After highlighting the year, press **Delete Year**. A dialog box (Fig. 30) is displayed to ensure that you meant to delete the year selected. Select **No** to cancel your choice.

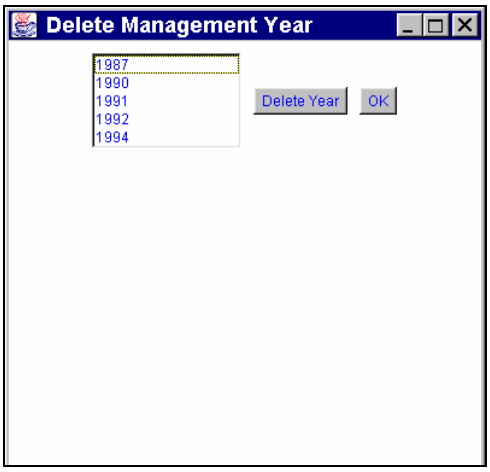

Figure 29.—Delete Management Year screen.

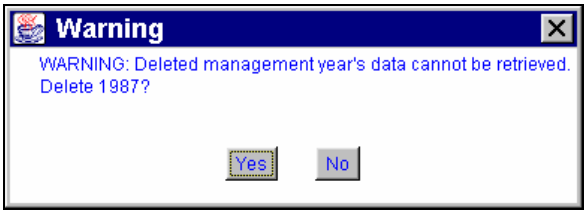

Figure 30.—Delete Management Year dialog box.

Weather

Choosing **Edit Weather Year** from the **Weather** menu (Fig. 1) brings up the list shown in Figure 31. Highlight the year you want and press **Edit Year** to bring up the **Edit Weather Year** window (Fig. 32). The units represent the total number of day-degrees for the year.

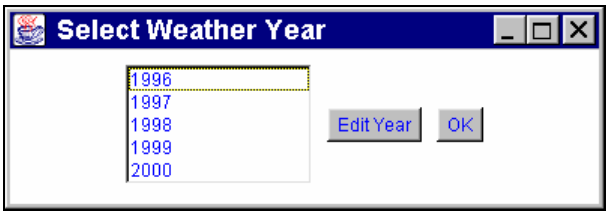

Figure 31.—Select Weather Year screen.

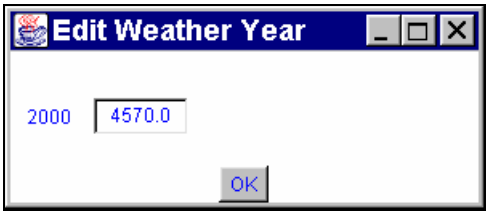

Figure 32.—Edit Weather Year screen.

Run

The **Run** menu includes two options: **Run Model** and **Run Scenarios**.

Run Model

Select **Run Model** to perform a simulation (Fig. 33). You will see the message "Please Wait…Model is Loading." A separately loaded executable is run to perform the simulation. When the message "Job Complete" is displayed, the simulation is completed and the output can be viewed. If you receive error messages after running the model, refer to **Run Model Error** in the Appendix.

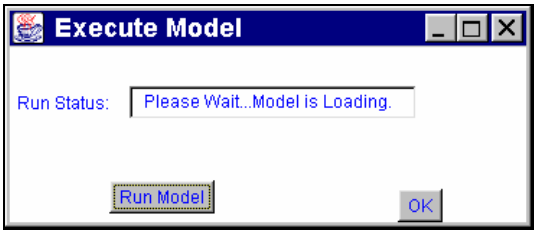

Figure 33.—Run Model screen.

Run Scenarios

The software generates a set of designed scenarios for simulating None, Light, and Heavy Outbreaks of gypsy moth over a 20-year interval. Choosing **Run Scenarios** brings up a screen similar to that shown in Figure 33. Press **Run Model Scenarios** to perform the three simulations. If you receive error messages after running the model, refer to **Run Model Error** in the Appendix.

Output

The **Output** pull-down includes five options: **Options**, **View**, **Graph**, **Print**, and **Save**. When any of the items (except **Options**) is selected before running the model, a Message window is displayed (Fig. 34). Always run the model *before* selecting **View**, **Graph**, **Print**, or **Save**.

Figure 34.—No Output Message.

Options

Choosing **Options** from the **Output** menu brings up the menu shown in Figure 35. Stipulate the output type to generate during a simulation. The first two text fields are year intervals providing fine-grain control over simulation output. Then a list of simulated tables and graphs is presented. By default, only **Summary Table** is activated (Fig. 35). To activate more outputs, click on others from this list. **Class Boundary** fields are used for scenario simulations (see **Run Scenarios** section).

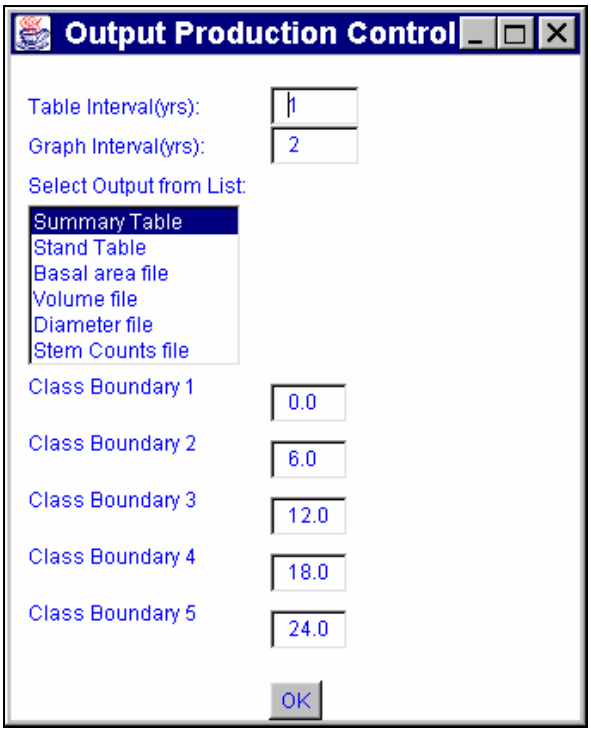

Figure 35.—Options Menu.

View

After running a simulation, select **View** to bring up the window shown in Figure 36. Of the six buttons at the top of the window, the first two represent tables (**Summary Table** and **Stand Table**); the other buttons represent ASCII text files. In Figure 36, the stand table is displayed because **Stand Table** was selected. The text field above the display shows the file name of the table (**`STSTEM.OUT`**). If the file display is empty and an error message states that a file cannot be opened, refer to **Run Model Error** in the Appendix.

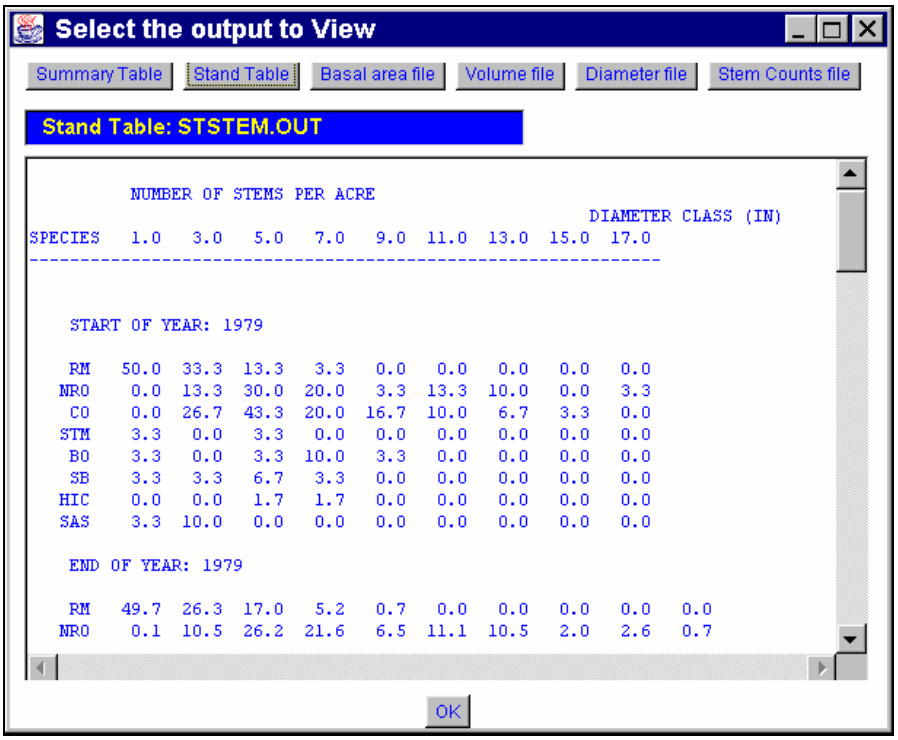

Figure 36.—Output View screen.

When **View** is chosen after selecting **Run Scenarios**, the display (Fig. 37) shows available viewable files. The volumes that are generated include board-foot (BFV), sawlog, and total. To view a file, click **View File** after highlighting the file (Fig. 38).

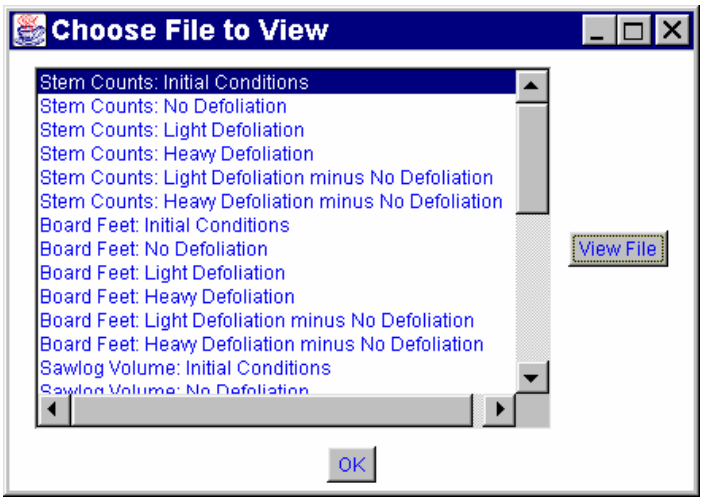

Figure 37.—Canned Scenario Output Files screen.

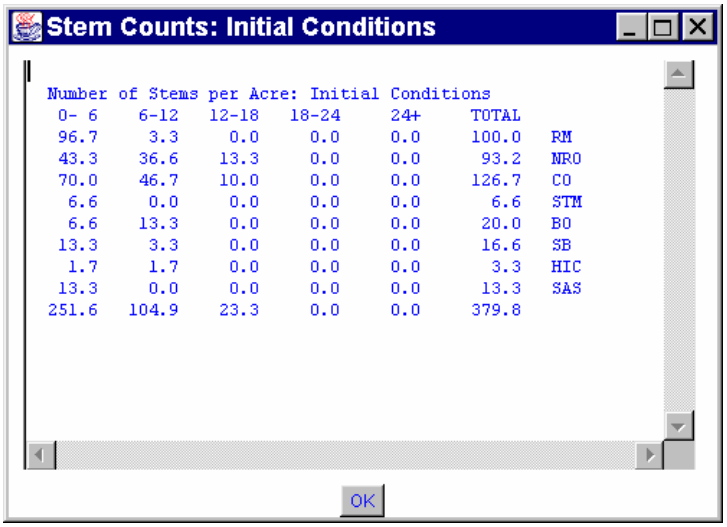

Figure 38.—Stem Counts Scenario Output screen.

Graph

To get graphic output select **Graph** from the **Output** pull-down (Fig. 39). Selecting **Current Simulation Graphics** brings up the screen shown in Figure 40. The **Basal Area** button has been selected, producing the related graph. Select **Print** to print the graph and **OK** to close the window.

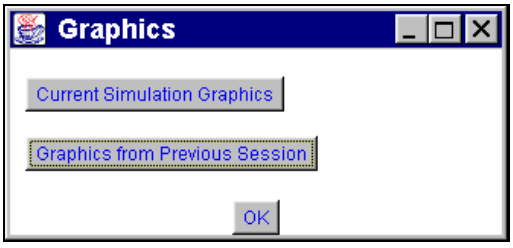

Figure 39.—Graphics dialog box.

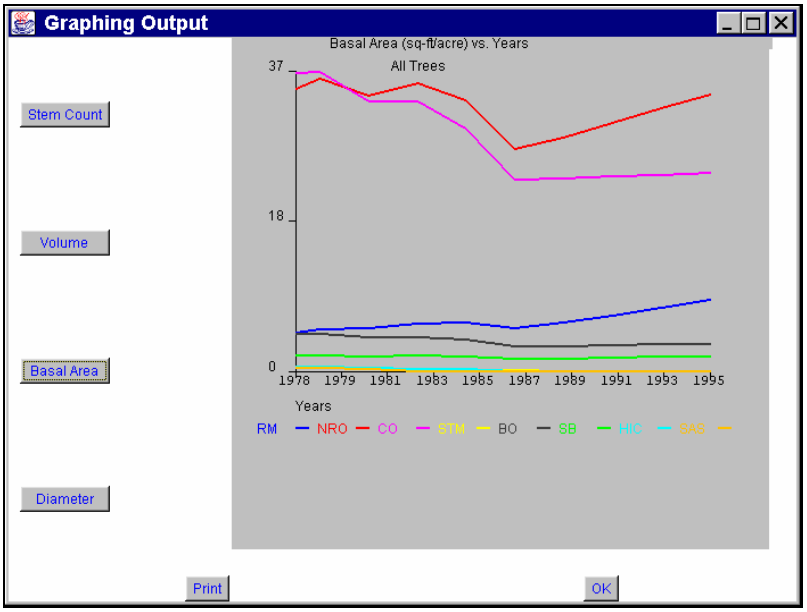

Figure 40.—Graph Output screen.

You can display graphics from a previous simulation by selecting **Graphics from a Previous Simulation** (Fig. 39). An Open Graph File dialog box will be displayed (Fig. 41). Stand-Damage graph files end with the **`.gr`** extension. There are four files with this extension in Figure 46. Highlight the needed file and click on **Open**. A display (Fig. 40) will allow you to view the graph. If you wish to view graphic files after executing the **Run Scenarios** option, note that the Scenario graph file extension is **`.gra`**.

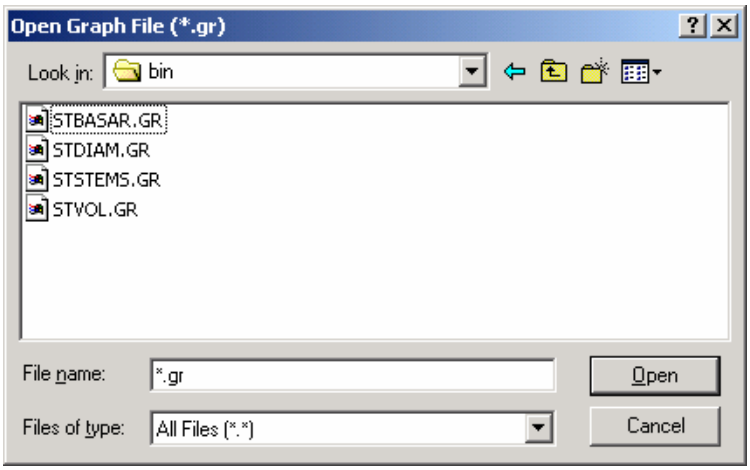

Figure 41.—Open Graph File dialog box.

Print

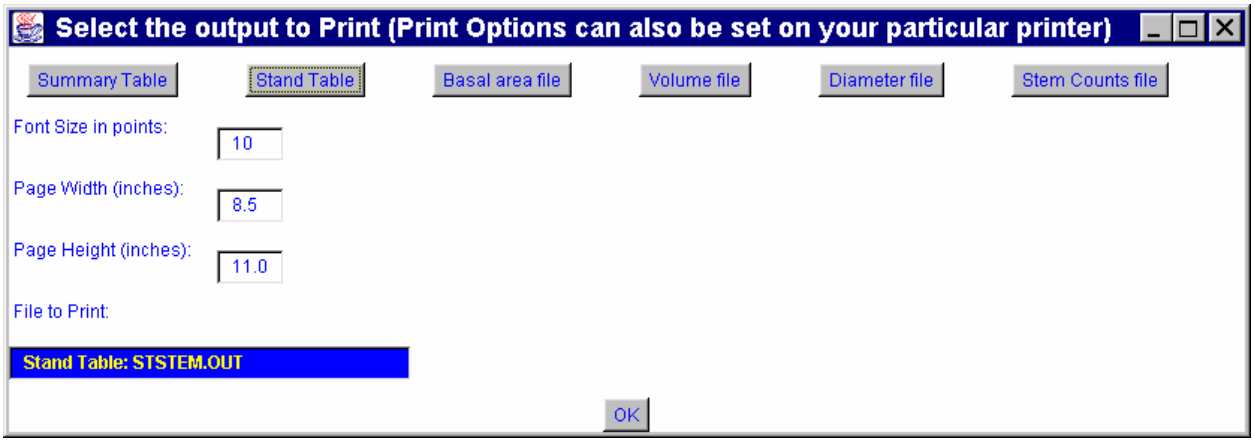

Figure 42.—Print Output Files screen.

After running the simulation, you can print output files in text format. Select **Print** from the **Output** pull-down to bring up the window shown in Figure 42. You can edit the font size, page width, or page height. Clicking on one of the buttons at the top of the window will bring up a dialog box (Fig. 43), from which you can select the printer. Click **OK** to print.

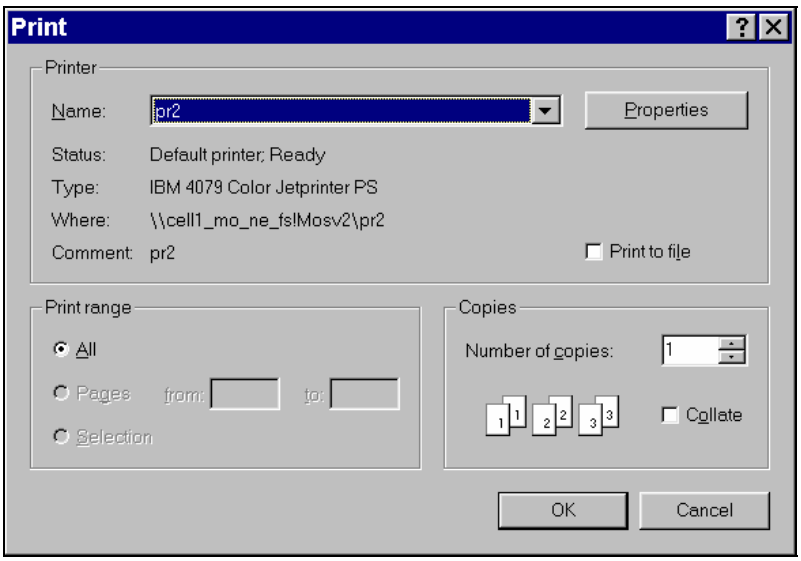

Figure 43.—Printer dialog box.

Save

After viewing output files you can save them to disk. The following six output files are generated as temporary files: Summary Table (**`STSUM.OUT`**), Stand Table (**`STSTEM.OUT`**), Basal Area (**`STBASAR.GR`**), Volume (**`STVOL.GR`**), Diameter (**`STDIAM.GR`**), and Stem Counts (**`STSTEMS.GR`**). Select **Save** from the **Output** pull-down to copy these temporary files to files with unique names (Fig. 44).

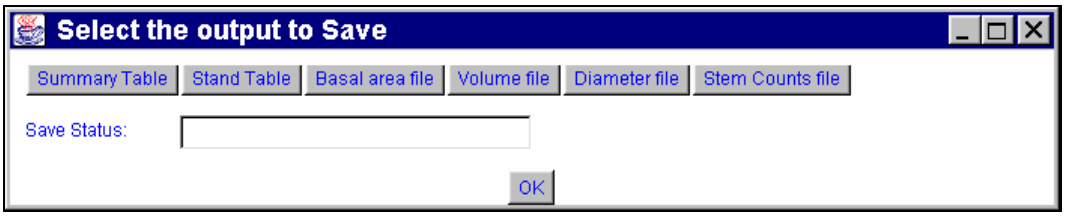

Figure 44.—Save Output screen.

Clicking a temporary file to save brings up a dialog box (Fig. 45) with text fields provided for entering the file name that you choose. Press **Save** to save the file.

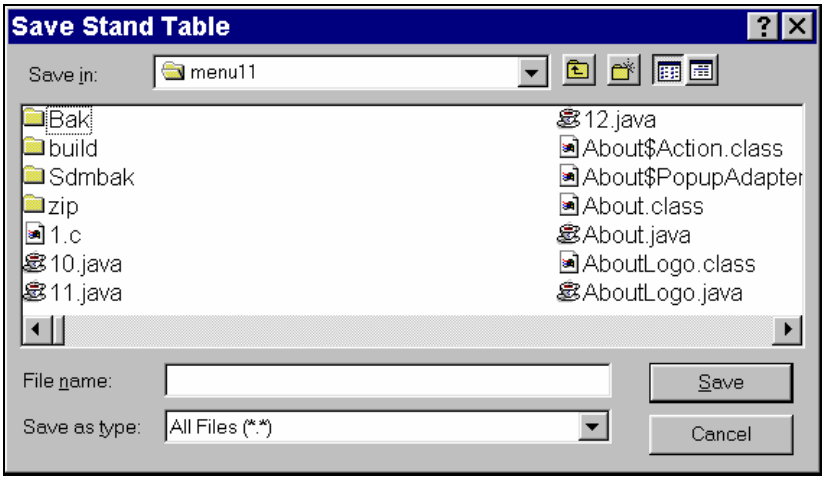

Figure 45.—Save File dialog box.

Help

From the Main Menu, **Help** has four pull-down items: **About**, **Introduction**, **Submit Comments**, and **System Information**.

About

The **About** screen shows the version number and our address. Right mouse-click within this window to obtain the software compilation Build Date and other details about the Build.

Introduction

The **Introduction** window (Fig. 46) includes a model overview and a list of related publications.

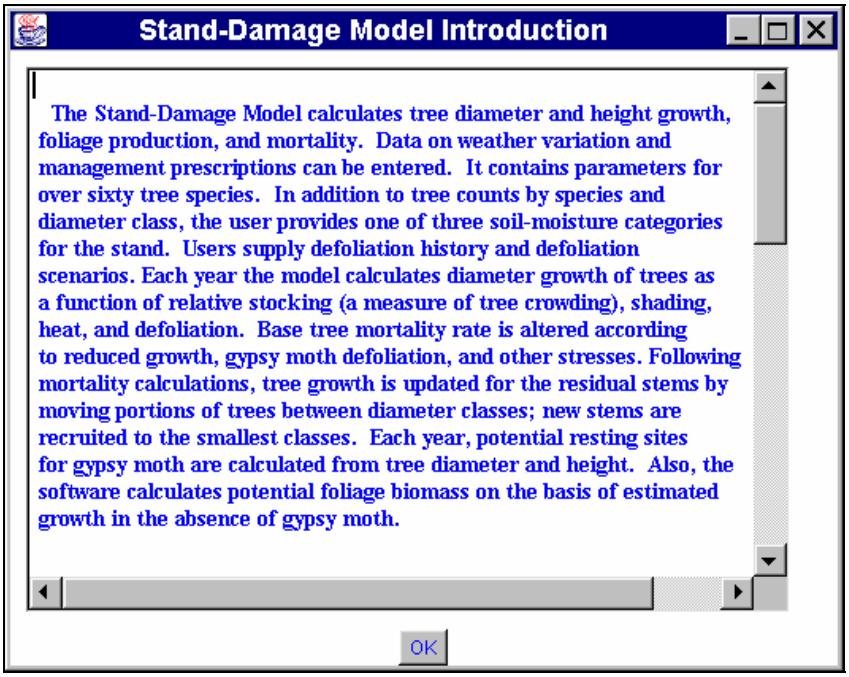

Figure 46.—Introduction screen.

Submit Comments

Use the **Submit Comments** window (Fig. 47) to email comments about this model to the developers. Press the **Submit Comments** button to email your comments. To review the sendmail server and email address of the recipient, right click within the window. Note: you must be connected to the Internet and be able to make a socket connection to our Mail Server. If you cannot submit comments using this utility, email comments to the address in the **Obtaining Assistance** section. Press **OK** to exit.

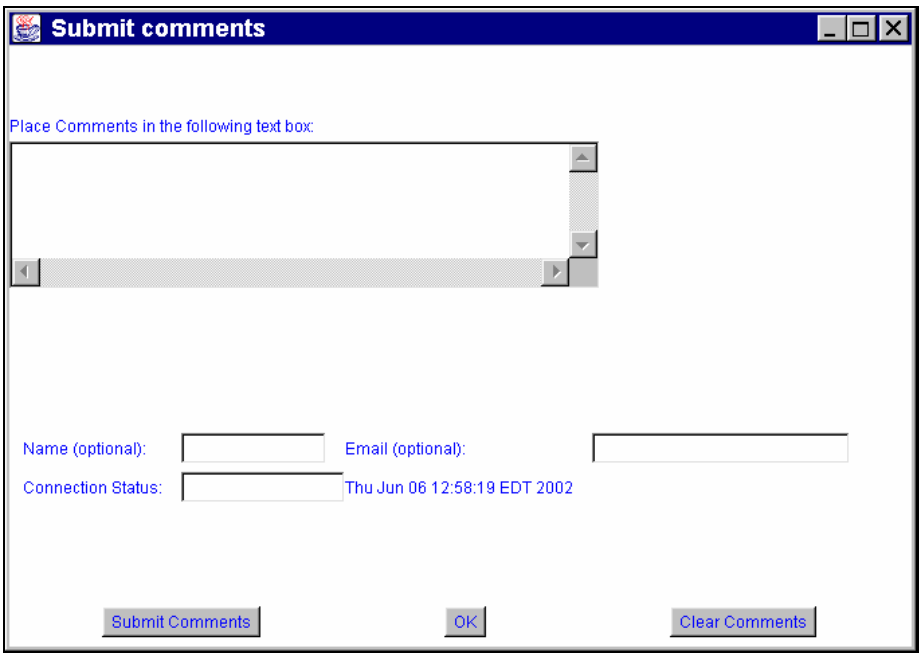

Figure 47.—Submit Comments screen.

System Information

System Information (Fig. 48) provides run-time information and helps developers identify and debug problems with the software. Most of the information is related to the software's **Java Classpath** environment. Press **Print** to print this information.

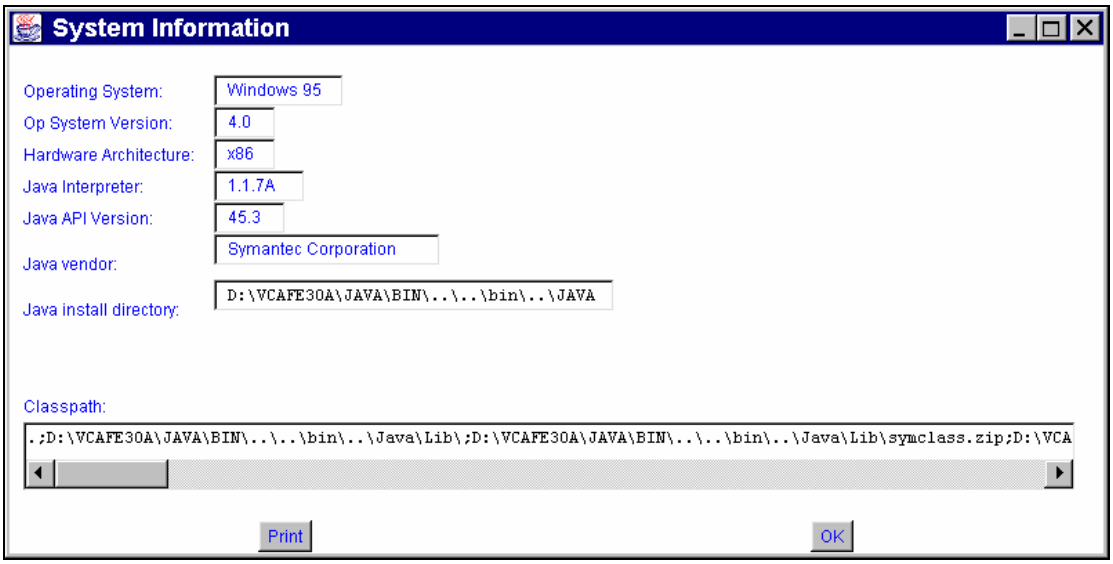

Figure 48.—System Information screen.

Obtaining Assistance

For additional information or assistance, contact:

George Racin, USDA Forest Service, 180 Canfield Street, Morgantown, WV 26505
Phone: 304-285-1577; Fax: 304-285-1505. Email: gracin@fs.fed.us

Website: **www.fs.fed.us/ne/morgantown/4557/gypsymth**

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Colbert, J. J.; Racin, George., 2001. **How to use the Stand-Damage Model** (Version 2.0) [Computer program]. Gen. Tech. Rep. NE-281. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 79 p.

Colbert, J. J.; Racin, George., 1995. **User's guide to the Stand-Damage Model: a component of the Gypsy Moth Life System Model (Version 1.1)** [Computer program]. Gen. Tech. Rep. NE-207. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 38 p.

Colbert, J. J.; Sheehan, Katharine A., 1995. **Description of the Stand-Damage Model: part of the Gypsy Moth Life System Model.** Gen. Tech. Rep. NE-208. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 111 p.

Racin, George; Colbert, J. J., 1995. **Guide to the Stand-Damage Model Interface Management System.** Gen. Tech. Rep. NE-209. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 149 p.

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Appendix

Run Model Error

When **Run/Run Model** is selected, the simulation is performed by a **DOS** executable (**`sdm.exe`**). The software starts **`sdm.exe`** by invoking it within a **DOS** window with "**`sdm j`**". **`sdm`** uses the **`java.inp`** file produced by the Stand-Damage Model interface to perform the simulation and produce output files.

Once the model is run, the results are viewed in **Output/View** or **Output/Graph**. You may see the following error message in a **DOS** window:

```
Can't open file - Error: STSTEM.OUT
```

This means that **`sdm`** did not run successfully. If this occurs, open a **DOS** window and switch to the Stand-Damage Model directory:

```
C:\Program Files\JavaSoft\JRE\1.1\bin
```

Execute the model by typing **`sdm j`** at the **DOS** prompt. Then return to the Stand-Damage Model to view the output. This problem is a known Windows operating system error, and has been reported to Microsoft. For additional assistance, contact the senior author (**Obtaining Assistance** section).

Racin, George; Colbert, J.J. 2004. **Stand-Damage Model with Java (Version 3.0).** Gen. Tech. Rep. NE-322. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 27 p. (CD-ROM).

The Stand-Damage Model with Java is a distance-independent tree-growth simulator. The model follows the life of a forest stand represented by species and diameter-class widths. The user supplies the initial state of the stand along with management prescriptions and defoliation amounts. Growth, mortality, and regeneration are then simulated. Windows® installation and operating instructions for version 3.0 of the model are provided.

Keywords: forest, phenology, simulation, population dynamics, growth

Headquarters of the Northeastern Research Station is in Newtown Square, Pennsylvania. Field laboratories are maintained at:

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