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How to Use the Stand-Damage Model: Version 2.0

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Abstract

The stand-damage model is a distance independent tree growth simulator that represents a stand, a spatially homogeneous collection of forest trees growing on a site. The model simulates growth from an initial inventory, user-defined management practices, and the effects of gypsy moth defoliation. Installation and operating instructions for version 2.0 of the model are provided. The following new features are presented: an expanded list of tree species, how to add new tree species, how to edit parameters for a tree species, how to enter data directly from plots, and the packaged scenarios for simulation of gypsy moth outbreak sequences. The scenarios provide a variety of tabular and graphic outputs contrasting the range of gypsy moth effects over a 20-year horizon.

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Introduction

The Stand-Damage Model

The Stand-Damage Model, a component of the Gypsy Moth Life System Model, calculates tree diameter growth, current diameter and height, and tree mortality for each year of a simulation. The model is a distant-independent, tree-growth simulator, a gap model based on the work of Botkin (1993), Shugart (1984) and others. For details on model formulation or computational algorithms, see Colbert and Sheehan (1995), Colbert and Racin (1995), and Racin and Colbert (1995). The model interface now includes parameters for 71 tree species or species groups. The user can add up to 10 additional species for a stand simulation; 20 species can be included in a single simulation. Seven additional categories for including noncommercial or other unidentified species (grouped by susceptibility to defoliation as conifers or deciduous trees) allow you to provide a more complete and accurate set of initial conditions. In addition to tree counts by species and diameter class, you can assign one of three soil-moisture categories for the stand. Users supply information 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.

Weather drives photosynthesis and tree growth. A cumulative heat unit measure, degree-days above a single threshold (40° F) is used for all tree species as a primary driver of diameter growth. Default constant weather data can be overridden by entering weather variation for each year simulated. Tree mortality comprises three factors: a base rate, stress-induced mortality, and gypsy moth defoliation-induced mortality. The base rate is increased as diameter growth is reduced. 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.

Calculations that are used when linked to the Gypsy Moth Life System Model are available from the authors (see page 7). Each year, potential resting sites for gypsy moth are calculated from tree diameter and height using a predicted live crown ratio. The software calculates potential foliage biomass on the basis of estimated growth in the absence of gypsy moth. Factors for converting foliage biomass to surface area are species specific but used only for estimating defoliation when gypsy moth growth and feeding is being simulated in the combined model. Foliage budbreak and growth also are handled outside of the stand model code since these are important only in relation to gypsy moth feeding.

Platforms Supported by Stand-Damage Model

The model currently runs under MS-DOS® and within a DOS Window or emulator under Windows® 3.1/95/98/NT on Intel or compatible processors[1]. It operates as a DOS package of programs, using a graphical interface for management of input and output data, controlling simulations, and viewing results. The model can run on older computer and does not require more than the base 640K of memory, though usage is enhanced by a mouse for easy access and movement within and among windows within the user interface. Instructions are included with the installation package for running the program from Windows® 3.1 with the included PIF and icon files or from Windows® 95/98/NT.

[1]The use of trade, firm, or corporation names 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 Forest Service of any product or service to the exclusion of others that may be suitable.

Errors in Original Documentation

In the Description manual (GTR NE-208, Colbert and Sheehan 1995), following equation (11b) on page 14 and following equation (15) on page 17, Table 6 should be referenced rather than Table 4. Also, in the caption for Figure 8 on page 18, the measure for DMAX should be 121.92 cm (48 inches). In the User's Guide (GTR NE-207, Colbert and Racin 1995), the illegible text box in Figure 17 (page 22) below the "Edit Tree Species" box, should read "choose from list." And on page 36, the reference to "General Technical Report NE- " should include "208."

Apart from these errata, we have made several revisions to the original Stand-Damage Model. Feeding preference, which was not considered in Version 1 is included in this report for all original and added tree species (Tables 3 and 4 in the Appendix). Also, recent work on the model revealed that the maximum regeneration-establishment parameter, RECRUT, was set too high in earlier versions, causing more than expected ingrowth. This has been corrected for all of the new and previously defined species. Finally, the parameter that provides the stumpage value for species has been added to the `SPECIES` parameter file. This parameter is used only in the packaged scenarios in Version 2.0.

Companion Documents

The data required for adding species to the model can be found in basic dendrology texts. The "Textbook of Dendrology" (Harlow et al. 1979), the "Silvics of North America" volumes compiled by Burns and Honkala (1990), and "Trees of the Southeastern United States" (Duncan and Duncan 1988) are excellent sources. For scientific and common names, we follow the nomenclature in "Checklist of United States Trees" (Little 1979). "Oaks of North America" (Miller and Lamb 1985) is valuable for searches within specific families or genera. "Knowing Your Trees" (Collingwood and Brush 1978) was used to assess tree-crown shape in assigning stocking classes, and "Important Forest Trees of the Eastern United States" (USDA Forest Service 1991) was the source of information for each species.

"General Technical Report NE-211" (Liebhold et al. 1995) was the source for species feeding preference of the gypsy moth (Appendix); data from Botkin (1993) and Shugart (1984) contributed significantly to the formulations used in the model. To better understand and interpret the current Stand-Damage Model, review the documentation for Version 1.0 (Colbert and Racin 1995, Colbert and Sheehan 1995, Racin and Colbert 1995).

Growing Degree-Days

A basic function of the model is the use of growing degree-days for range specificity. As a result, you will need to know the heat requirements for each species that you add as well as the average growing degree-days for each stand to be simulated. A degree-day map of the coterminous United States is available from our web site (http://www/fsl.wvu.edu/gypsymth/ddmap.html). When downloaded, the map can be used to assess the local climatic conditions of a specific area at a spatial resolution of 10 km. The resolution of the data available for devising this map is course, so we recommend that they be considered an approximation and that the surrounding cells be averaged. If local weather data are available, you can calculate local degree-days from nearby weather stations and adjust for slope, aspect, and elevation (Regniere et al 1995, Regniere and Bolstad 1994). A minimum sequence of twenty years of historical data is recommended.

Other Revisions to the Model

In previous versions of the model, a stand was simulated as a stand table. Each cell in the table represented trees/acre for the species (row) and diameter class (column). In Version 2.0 we summarize data from various plot systems in that same way but we grow the inventory on a sample tree basis. This eliminates the need to simulate tree growth by moving portions of the stem counts from a diameter class to the next higher class. Now the initial inventory is used to create a stand inventory, the stand inventory is projected forward, and then is classified and summarized for output and management. Each tree diameter class is apportioned to a set of tree cohorts (1 to 10 depending on the diameter-class width) so that the total number of stems per acre (per ha) is maintained.

We have also provided means for an unlimited species library, that is, you can add species to the files or edit the currently available species to localize the model as necessary. The help information for each tree species is in a separate file, `SPECIES.HLP`, that users can edit or to which they can append new species-specific information. This allows you to add help information to this file for your own use.

Note that there still is a limit of 20 tree species for inclusion in a single stand for a simulation. Additional information has been provided in the species selection list and the species edit window. Alphabetic code, numeric FIA (Forest Inventory and Analysis) code, and common name appear in the selection list. You can edit the scientific name and three-letter alphabetic code for any species that is added to a stand. Within a saved input file, these can be distinguished by the user-defined tree species scientific name field, the alpha code, and the program-defined numeric species code (000, 001, 002, ..., 009).

The greatest revision to the model concerns the user interface. The interface now allows direct input from fixed- or variable-radius plots with variable plot size and prism factors supported. The initial inventory to describe a stand for simulation is automatically compiled from plot data. Users can view the per-acre summaries in several ways. The user interface has a second Run menu choice on the Run pull-down menu. This Run Scenarios menu item allows the user to run a series of three simulations from the initial stand inventory. Comparison tables are generated for assessing changes in growth and mortality caused by moderate and severe outbreaks.

Conventions

Throughout this report, *click* refers to the left mouse button. **Bold** is used to signify either keys that are to be pressed, or menu items or buttons that are to be activated when installing or running the software. The `Courier` type face is used to signify a DOS file name or text to be typed at a DOS prompt. *Italics* are used to indicate extremely important or cautionary text

Using the Stand-Damage Model

Installation

The model is installed using a Windows-based installation package that can be downloaded from the Internet or mailed to you on a 3-1/2-inch floppy diskette. If you download the model from the Internet, you will get a single, self-extracting file. By placing it in a clean directory and double clicking on it, you will extract all of the files that are found on the installation diskette. The self-extracting file will remain and can be moved or deleted. The Stand-Damage Model diskette contains the program that installs the model onto your computer. To use the installation program, first close all other applications and then place the diskette in floppy drive (usually A:). Select **Start** and then **Run** from the Windows task bar. In the text field provided, type **A:\SETUP** (or the path to the folder where you unpacked the Internet download) and *click* on **OK** or press **Enter** to start the installation. You will see a screen with the Stand-Damage Model oak leaf logo and be presented with the options **Next** and **Cancel**. The default option is **Next** for the following six screens:

1. Stand-Damage welcome screen;
2. `README.TXT` file (You can scroll through and read this file at any time as it is installed along with the model program);
3. Name and Organization entry;
4. Destination folder choice for installation (the default is C:\DAMAGE);
5. Program folder destination;
6. All of the options selected. When you select **Next**, all of the Stand-Damage Model files are installed.

When Setup is complete, you can choose to view the `README.TXT` file and/or launch the Stand-Damage Model software. If you reviewed this file under step 2 of the installation, you can skip this step or fill in the registration form for printing and submission. Click on **Finish** to complete the installation.

Using Windows® 3.1

The Stand-Damage model can be run as a DOS application from Windows® 3.1. To make the model accessible from within Windows, open the program group in which you wish to place Stand-Damage. For example, if you want the model in the Applications group, double-click on the Applications Group icon. From the Program Manger **File** menu select **New**, choose **Program Item**, and then click on **OK**. Fill in the lines within Program Item Properties as follows:

Description:	Stand Model
Command Line:	c:\damage\damage
Working Directory:	c:\damage
Shortcut Keys:	None

This assumes you have named the Stand-Damage Model directory “DAMAGE” and that you installed it on the C drive. After filling out this information, choose **Change Icon**. You will see the message “no icons available for the specified file”. Click on **OK** to get to the Change Icon screen. Type in the path to where the model was installed, ending with DAMAGE.ICO and click on **OK**. Using the default path you would type

`C:\DAMAGE\DAMAGE.ICO`

From the Program Item Properties menu click on **OK**. You now have an icon representing the Stand-Damage Model with “Stand-Damage Model” beneath it. When you wish to invoke Stand-Damage from Windows, double-click the icon. The model will run the same from Windows 3.1 as it does from DOS.

Installing Shortcut to the Windows® 95/98/NT/2000 Desktop

The Stand-Damage model can be run as a DOS application directly from the Windows® 95/98/NT/2000 Desktop. Because many users do not want to have program shortcuts automatically loaded to their desktops, we do not do that automatically. When the installation is complete, a program folder and shortcut are added to your start menu. If you want to have access directly from your desktop, copy that shortcut to your desktop by opening the Program folder for the model:

C:\WINDOWS\Start Menu\Programs\Stand-Damage Model

One way to find this path (or an alternate that you chose during installation) is to go to the **Start** menu, choose **Settings** and then **Task Bar & Start Menu.** Then click on the **Start Menu Programs** tab to reveal the **Advanced** button. When you click on that button a file navigator window will appear. In the left pane, double-click on the **Programs Folder** and then click the **Stand-Damage Model** folder. The start shortcut will appear in the right pane. Copy it to the desktop by clicking on it to highlight it, click the **Copy** button, then right-click on the desktop and choose **Paste**. To ensure that the DOS window closes on exit, right-click on the icon, choose Properties, click on the Program tab in the Properties window, then click to check the "Close on exit" box. You can now double-click on the Stand-Damage icon to run the Stand-Damage Model from the Windows® desktop.

Error Messages

If you start the Stand-Damage Model and the program does not run (a typical error message is: Cscape error 141), you may have insufficient memory. As a DOS application, the model runs in the first 640K of memory or an equivalent area assigned to it by the operating system. To check the amount of available DOS memory, type the following at the DOS prompt:

C:\Windows > `mem`

A short report will be generated; look for the amount of Free Conventional Memory. Ideally, you should have over 550K of Free Memory. If you have less than 550K, first restart your computer in DOS Mode. Go to the **Start** Menu and choose **Shut Down**. When the **Shutdown Windows** screen appears, select **Restart in DOS Mode** and click on **OK**. Then use the DOS `cd` command (change directory) to navigate to the directory in which you installed the model. You can then start it from the DOS prompt (assuming the default path):

C:\Damage > `damage`

and exit from DOS mode using the `Exit` command (type `exit` and press **Enter**) when you are finished. You also may want to examine your AUTOEXEC.BAT file or CONFIG.SYS file for programs that can be temporarily commented out (with the REM tag) so that you can run the Stand-Damage Model. Start with your Autoexec.bat file. Look for lines that load programs (that contain either the name of a program or fully qualified program [e.g., d:\myprogram\bin\program]). You should not temporarily remove lines that start with Path or Set.

Cautions

The Stand-Damage Model can be run within a DOS window on the desktop on some systems. We recommend running the application full screen and only switching to a window for short periods to access other Windows applications. If you want to run the model within a window on the desktop under Windows® 3.1 rather than full screen, you must edit the DAMAGE.PIF file in the model's home directory. Open the PIF editor, usually found under the Main Program Group. Add the Optional Parameter: "T" (for text mode); change the Video Memory to Text mode from High Graphics, and the Display Usage from "Full Screen" to "Windowed." These changes will provide reasonable response but you will not be able to view graphical results. Under this configuration, it is possible that your mouse will not function within the window. Under some video display systems, the "DOS" mouse is visible but locked in the center of the widow. Also, the Windows mouse pointer cannot be used within the application. Under some video hardware and driver combinations, the application does run in full High Graphics mode and provides graphical output but the response times for graphic screen changes (repaints) are poor. Because of these potential problems, we recommend running the model full screen and quitting the program before running other Windows applications to avoid loss of data and possible fatal program interactions.

Disk Files

Once the program is installed, you should be able to locate the following files in the directory that holds the software. If a file is missing, reinstall the software or contact the authors. Before reinstallation, click on the Add/Remove Programs in the Control Panel folder. If the Stand Damage Model is there, remove it before installing again.

EXECUTABLE FILES

`DAMAGE.EXE`	Stand-Damage Model logo screen
`SDM.EXE`	main executable program file

DATA FILES

DEFAULT.	default initial conditions and parameters for the model
FILENAME.PRF	filenames for output files
HELP.	context-sensitive help system
HELP.IDX	index for help file (speeds access to text)
INTRO.	introductory text that describes the model and provides assistance with program use
OUTFILES.TXT	file names for packaged scenario output files
SDMTRANS.TXT	packaged defoliation scenarios input: data for running from the command line (DOS Window) only; when packaged scenarios are run from the user interface, the current stand and tree data are used to initialize each simulation
SPECIES.	parameter values for each tree species
SPECIES.HLP	help information for each tree species
TSTRINGS.INT	output file headings
TAPER.DAT	taper adjustment data for volume calculations

README FILES

README.TXT	documentation — on the installation diskette, contains final changes not found in the documentation as well as installation and registration instructions
SP-TMPLT.TXT	document file — templates for use in inserting text blocks into the SPECIES and SPECIES.HLP files; use to add new tree species

EXAMPLE FILES

EXAMPLE.INP	resource file — example input file
EXAMPLE.TBL	documentation file — output table generated from input file EXAMPLE.INP
PLOT-123.INP	fixed area plot data file for the same stand used to generate EXAMPLE.INP; Plot no. 123 is described in the EXAMPLE.INP file and can be viewed by selecting **Edit job description** under the **Setup** pull-down menu
STAND123.XLS	all of the data that were used to create and additional history form that stand for the period 1978-92; use these data to compare model output with actual field data and build simulations of actual defoliation histories for that stand
W-A-9614.INP	variable-radius prism plot example file; data are from Stand 14 in Compartment 96 on the Athens District of the Wayne National Forest in Ohio; the data are used in the Plot System Tutorial along with the field data sheets used to create this file
WAYNE.XLS	sheet 1: data form for collecting example data for Stand 14; this form can be modified to fit your data input needs; sheet 2: codes used in data collection and their definitions, as well as notes for field collection work

FONT AND GRAPHIC FILES

COURB.FON	font file for graphic interface
OAK.PCX	logo graphic file
ROMAN.FON	font file for graphic interface

UTILITY FILES

COMPARE.EXE	program to find differences between two ASCII text files

WINDOWS FILES

DAMAGE.ICO	icon for use in Windows shortcut

There are additional installation files that are not part of the model but are used to uninstall the software if you choose to do that. These are deisreg.isr, isreg32.dll, and DelsL1.isu. To

remove these as well as all program files and linkages, use the Add/Remove Programs item in the Control Panel.

User Interface and Documents

In addition to this document and the read-me file in the installation package, there are three publications (manuals) that form the written documentation for the software. A copy of the Version 1.1 installation diskette is included with the User's Guide (Colbert and Racin 1995). This document and the User's Guide should be your first references. This document explains the installation process and the new components to the user interface. The User's Guide explains how to access and use the model. The Stand-Damage Model Description (Colbert and Sheehan 1995) provides the form, background, and biological basis for the model code. The software's internal help system is cross-referenced to the equations, tables, and figures in these publications. The Model Description also contains a complete listing of the model equations and other formulations in the original FORTRAN. If you are interested in the C language source code, it can be downloaded from our web site or requested by mail. This document, updates and additions to it, and associated graphs and files also can be downloaded or requested. The Interface Guide (Racin and Colbert 1995) provides details of design and organization of the user interface and a description of associated data files. It contains a listing of the user-interface written in C.

Running the Software

Start the software by typing `damage` and press **Enter** at the DOS prompt or by double-clicking on the model icon. The horizontal Main Menu controls the program. Select your choice with the **Arrow** keys or the capital letter of the appropriate menu item. Once a choice is highlighted, press **Enter** or point and click the mouse. Use the **Arrow** keys or mouse to move between data fields. To exit a pop-up window (or if you get lost) press **Esc** (possibly several times) to return to the main menu. From the main menu, type **T** and press **Enter** to bring up the Add-Species list. This is an example of a scrollable list. It is also searchable using the keyboard by typing the first letter of a common name (or alpha code) for a tree species. Retyping that letter will cycle you through all the entries starting with that letter. Note the arrows on the right border of this screen. Text windows such as output or help screens use arrows and scroll bars to indicate that additional text is available. To reach this text, use the mouse or the **Page Up**, **Page Down**, or **Arrow** keys. Each menu item and data-entry field is mouse sensitive, so you can use it to move quickly between fields in a window, scroll or resize a window, or exit a window (to exit, click outside the active window). Press the **F1** function key to obtain context sensitive help. Details on accessing the model and running simulations can be found in the User's Guide.

Obtaining Assistance

Your comments and criticism are always welcome. To obtain assistance with any aspect of the Stand-Damage Model, you can contact us in several ways.

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Internet

For accessing information, updates, or to make requests, use:

http://www.fsl.wvu.edu/gypsymth/

To download models and related files, point your FTP client to:

anonymous@www.fsl.wvu.edu

Or you can download directly from our web site by looking for the download link from our home page. If you have trouble using the 32-bit installation package, you can contact us for a 16-bit installer.

Editing Tree Species Defaults

Order in the Pick List

The tree species data file (`SPECIES`) and the species help file (`SPECIES.HLP`) are ordered alphabetically by scientific name and coincidently by the three-digit FIA species code. This code is used as the index search key by the software to locate the data for a species in the `SPECIES` file and to locate the help information in the `SPECIES.HLP` file. This ordering is used by the software as it builds the selection list for a user to add species to a stand for simulation. While it is ordered by scientific name, you can search by common name. This pick list can be traversed using the keyboard to move to the next common name starting with any letter entered. This process loops back to the beginning of the list if there is no common name following the current location of the prompt as a letter is pressed. This search function uses the first character on each line of the list so that having the 3-character code start with the same letter as the common name allows the search to work with both the code and the common name.

Change Values for Particular Species

There are slight changes in the mnemonic codes given to previously defined species since the addition of the third character. In Version 1 we provided only two-letter codes; the 3-character codes in Version 2 allow more useful mnemonics. These distinguish one species from others with similar names, e.g., red oaks — northern and southern. As we move to the new Internet-based server/client version using Java, we will provide 6-character mnemonic codes to allow for additional rational codes and improve flexibility. You still can use 2 characters for a species mnemonic code.

Tables 1 and 2, respectively, list the original 21 species in Version 1 along with their new codes and the 50 species that were added in Version 2.0.

Table 1.—Species carried over from Version 1.1 of the Stand-Damage Model

Species code	Survey code	Common name	Scientific name
UD[a]	000	user defined	
EWP	129	eastern white pine	*Pinus strobus* L.
STM	315	striped maple	*Acer pensylvanicum* L.
RM	316	red maple	*Acer rubrum* L.
SM	318	sugar maple	*Acer saccharum* Marsh.
YB	371	yellow birch	*Betula alleghaniensis* Britton
SB	372	sweet (black) birch	*Betula lenta* L.
PB	375	paper birch	*Betula papyrifera* Marsh.
HIC	400	hickory sp.	*Carya* sp.
FD	491	flowering dogwood	*Cornus florida* L.
AB	531	American beech	*Fagus grandifolia* Ehrh.
WA	541	white ash	*Fraxinus americana* L.
YP	621	yellow-poplar	*Liriodendon tulipifera* L.
BGU	693	blackgum (black tupelo)	*Nyssa sylvatica* Marsh.
QAS	746	quaking aspen	*Populus tremuloides* Michx.
BC	762	black cherry	*Prunus serotina* Ehrh.
WO	802	white oak	*Quercus alba* L.
SO	806	scarlet oak	*Quercus coccinea* Muenchh.
CO	832	chestnut oak	*Quercus prinus* L.
NRO	833	northern red oak	*Quercus rubra* L.
BO	837	black oak	*Quercus velutina* Lam.
BAS	951	American basswood	*Tilia americana* L.

[a]Model values provided for all parameters of user-defined species; range-checking values are similar for all parameters of all tree species.

Table 2.—Species added to Version 2.0 of the Stand-Damage Model

Species code	Survey code	Common name	Scientific name
BF	012	balsam fir	*Abies balsamea*
ERC	068	eastern redcedar	*Juniperus virginiana*
TAM	071	European larch (tamarack)	*Larix laricina*
WS	094	white spruce	*Picea glauca*
BS	095	black spruce	*Picea mariana*
RS	097	red spruce	*Picea rubens*
JP	105	jack pine	*Pinus banksiana*
SLP	110	shortleaf pine	*Pinus echinata*
LLP	121	longleaf pine	*Pinus palustris*
MOP	124	Monterey pine	*Pinus radiata*
RP	125	red pine	*Pinus resinosa*
PP	126	pitch pine	*Pinus rigida*
LOP	131	loblolly pine	*Pinus taeda*
NWC	241	northern white-cedar	*Thuja occidentalis*
EH	261	eastern hemlock	*Tsuga canadensis*
BEM	313	boxelder maple	*Acer negundo*
SVM	317	silver maple	*Acer saccharinum*
MM	319	mountain maple	*Acer spicatum*
GAL	349	green alder	*Alnus crispa*
SAL	353	speckled alder	*Alnus rugosa*
RRB	373	river (red) birch	*Betula nigra*
GB	379	gray birch	*Betula populifolia*
AHB	391	American hophornbeam (musclewood)	*Carpinus caroliniana*
CNX	421	American chestnut	*Castanea dentata*
BLA	543	black ash	*Fraxinus nigra*
GRA	544	green ash	*Fraxinus pennsylvanica*
PUA	545	pumpkin ash	*Fraxinus profunda*
BUT	601	butternut	*Juglans cinerea*
BWA	602	black walnut	*Juglans nigra*
SGU	611	sweetgum	*Liquidambar styraciflua*
MAG	652	southern magnolia	*Magnolia grandiflora*
EHH	701	eastern hophornbeam (ironwood)	*Ostrya virginiana*
SOW	711	sourwood	*Oxydendrum arboreum* (L.) DC.
ASY	731	American sycamore	*Platanus occidentalis*
BP	741	balsam poplar	*Populus balsamifera*
ECW	742	eastern cottonwood	*Populus deltoides*
BTA	743	bigtooth aspen	*Populus grandidentata*
SCW	744	swamp cottonwood	*Populus heterophylla*
PC	761	pin cherry	*Prunus pensylvanica*
CC	763	choke cherry	*Prunus virginiana*
SRO	812	southern red oak	*Quercus falcata*
LO	820	laurel oak	*Quercus laurifolia*
BJO	824	blackjack oak	*Quercus marilandica*
PO	835	post oak	*Quercus stellata*
WIL	920	willow sp.	*Salix* sp.
SAS	931	sassafras	*Sassafras albidum* (Nutt.) Nees

Continued

Table 2.—Continued

Species code	Survey code	Common name	Scientific name
MAS	935	American mountain-ash	*Sorbus americana*
ELM	970	elm species	*Ulmus* sp.
WEL	971	winged elm	*Ulmus alata*
AEL	972	American elm	*Ulmus americana*
No$	999	other noncommercial	Mixture of species
OSC	1010	other susceptible conifers	Mixture
ORC	1020	other resistant conifers	Mixture
OIC	1030	other immune conifers	Mixture
OSD	1040	other susceptible deciduous	Mixture
ORD	1050	other resistant deciduous	Mixture
OID	1060	other immune deciduous	Mixture

Green ash (*Fraxinus pennsylvanica*) is one species that grows differently in the extremes of its range. Its base growth rate ranges from 80 in the north to 100 in the south, and its maximum diameter and height average 30 inches and 120 feet in the south verses 24 inches and 60 feet in the north. You can edit any parameter for any of the existing species to suit local conditions or create your own race variants within species; be sure to give them unique species and FIA survey codes and common name identifiers. If you do not want to edit the `SPECIES` file of defaults directly, you can edit any of the parameters for the species through the interface once you have added the data for that species. By selecting that species to edit from the Tree Menu and Edit Tree Species item, you can access the parameters and alter maximum height or diameter. Remember that by making changes for a single stand through the interface, your changes will not carry to another stand and you will have to make the changes again for each stand you simulate. You can save changes made through the interface to an input (`.INP`) file, then paste that block into the `SPECIES` file. If you want to have two species that differ only in their growth rate, use a text editor like DOS Edit, Windows Notepad, or your word processor to open the `SPECIES` file for editing. Then use copy/paste to duplicate the species block you want to "almost" duplicate. Make the changes to particular parameter fields in the new block and give it a new set of identifiers (code and name). Changes or additions made to the `SPECIES` file will be available for all future simulations.

In Tables 1 and 2 there are the original user-defined, noncommercial, as well as other-species groups. These six groups correspond to the three defoliation susceptibility classes (susceptible, resistant, and immune) for conifers and deciduous species.

Data Defaults/Constants and Critical Values

There are blocks of seven lines of data in the `SPECIES` file that provide all of the information and parameters needed to describe a species. There are 30 numeric data items that must be supplied (lines 4 - 7) for each species defined, but only 10 of these are essential to define the species. Nine of the other 20 are needed only for predictions of foliage biomass, foliage growth during the larval feeding stage, and those associated with gypsy moth dynamics. Ten others are mortality-interaction parameters that have been given similar default values across all species. The final one is the default (0.0) stumpage value given each species. Because stumpage values are volatile and subject to local circumstances, it is left to the user to specify values. Users still can edit any parameter through the interface for a particular simulation. Thus, there are only 10 values that must be supplied to define a species. Each of these is described in detail in the following section.

Editing Data

Detailed descriptions and rational for setting values of each of the following parameters are found in Colbert and Sheehan (1995) but they are scattered throughout that report. Here we cover the data that need to be entered to parameterize a tree species in the order in which they occur in the `SPECIES` file. A block of seven lines defines a species. Each block has a similar structure and format. The template that follows provides a roadmap for data entry. For each of the places that you are required to fill in information, that place is filled in the template by words (first two lines) or a set of letters (lines 3-7),

some with a decimal place shown, some without (these should be entered as integers, i.e., without inserting a decimal place, just a series of digits). The following is similar to one of the SPECIES blocks:

```
            1         2         3         4         5         6
   123456789012345678901234567890123456789012345678901234567890
L1: common name
L2: scientific name
L3: nnn aaa m
L4:   n  n   0.5000   0.5000   xxx.x  llll  hhhhh  0.010
L5:    4.00  0.004   2.50  0.025     0.0
L6:    xx.x xxx nnn 0.03 1.8 600.0  n  mmm
L7:  0.10 0.20 0.35 0.10 0.20 0.35 0.10 0.20 0.35
   123456789012345678901234567890123456789012345678901234567890
            1         2         3         4         5         6
```

By printing or viewing the SPECIES file in an editor or word processor, you will see how each block has been constructed. Choose a mono-spaced font (e.g., Courier) to keep the alignment visible. A template like the one shown is provided in the SP-TMPLT.TXT file. The following text is a detailed review of each entry in the order in which they should appear. There should be at least one blank space between entries. The exact location of data within a line is not critical but some white space must separate individual parameters.

L1-L2:
The first line can contain up to 80 characters to describe the common name(s) for the species. The second line should contain the scientific name.

L3:
1,2 There are two ways in which a species is coded in the model. First, the FIA or survey code (nnn) is entered in the first three columns; this is used as the indexing internal code (Appendix, Table 3). The second entry is the alphabetic code (aaa) that you can edit. This second code is used in all graphic and tabular output to label lines for that species.

3 The final element (m) is the numerical code for feeding preference of this species by gypsy moth: m = 1 for resistant species, m = 2 for acceptable species, m = 3 for preferred species. These values have been summarized by Liebhold et al. (1995) and can be found in Table 4 in the Appendix.

L4:
1,2 There are two single-digit, shade-tolerance class indices (n); the first is for recruitment of new trees into the smallest diameter class, the second is the shade tolerance of diameter increment growth. Possible values for each range from most intolerant = 1 to most tolerant = 4, with special cases for red maple (n = 5) and northern red oak (n = 6). See ISHADE, Table 4, page 9, in Colbert and Sheehan (1995) for additional details.

3,4 Following the two required values are two constants: 0.5 = the number of resting sites per 100 cm^2 on both lower boles (below crowns) and on upper boles and branches (within crowns). Note that these are the first 2 of the 20 parameters that are read automatically by the input routines for each species, but they do not affect a simulation unless it is used within the full Gypsy Moth Life System Model where gypsy moth dynamics are simulated.

5 Base growth rate coefficient is next (xxx.x) and is defined as the coefficient that produces annual growth increment (ΔD) such that two-thirds of the maximum diameter is reached at half of the maximum age for a species. While the model code does not use the following computation method, the growth rate multiplier, G, can be estimated from the maximum annual diameter-growth increment (ΔD_{max}) at breast height for a species as:

$$G = \alpha H_{max} (\Delta D_{max} / D_{max})$$

where α = 152.4 if the maximum value for H_{max} is provided in feet and ΔD_{max} and D_{max} are in inches. Replace α with 12.7 if all units are in inches and with 5.0 if all maximum values are given in centimeters. Smaller values of G mean that the species will gain diameter slowly during early life while larger values will force the species to grow faster during its earlier life.

***IMPORTANT*:** The earlier documentation (GTR-NE-207 and GTR-NE-208 [GROWR in equation 15 on page 17]) incorrectly states that this is a dimensionless constant. Here this parameter is maintained consistently in the interface in units of cm/yr. The interface does not alter the values provided as units of measure change between English and metric. So long as you use the appropriate value of α when computing a new value for G, the model will use your derived data (G value) correctly.

6,7 The lower (`lllll`) and upper (`hhhhh`) degree-day thresholds ($COLD_h$, HOT_h) for a species (h) are accumulated using a 4.4° C (40° F) temperature threshold and summing the difference between the daily temperature and the threshold, when positive, to accumulate an annual heat input for growth. We have provided a somewhat course approximation to this process using monthly average temperatures for a each 10-km grid cell across the continental United States and summing these temperatures, less the lower threshold of 4.4° C, times the number of days in each month. We then used a simple linear correction factor to adjust to the historical data (Botkin 1993; Shugart 1984). The map can be obtained from the web site as either a GIF [24,212 bytes] or BMP [209,678 bytes] file or as an EDRISI map (DOC [478 bytes] and IMG [277,300 bytes] files). Because it is a color image, it is not reproduced in this document, as printed.

8 The final item is SLOWD = 0.01 in. (0.25 mm), the minimum diameter increment to avoid additional mortality. If a tree's diameter is below this threshold, additional stresses are assumed to accompany this slow growth, and raise the probability of tree mortality.

L5:
1-4 These four parameters, CR1-CR4 (`4.00 0.004 2.50 0.025`), are the coefficients for the crown ratio function; the crown ratio is used to predict bole length which, in turn, is used to predict resting sites. While the model interface reads these parameters, crown ratio and resting sites are relevant only to the full Gypsy Moth Life System Model.

5 The default value for stumpage value (0.0) for a species. Since the current formulation uses this variable only when running the predefined simulations associated with the GypsES Decision Support System linked version, it is not editable nor does it affect output. In a future release, it will be activated but retain the zero initial value because stumpage prices vary greatly among regions and over time.

L6:
The next three variables are critical to defining a tree's basic growth and mortality models. These maximums are not the champion or extreme values but the generally accepted maximum values of the "average" tree of the species (Burns and Honkala 1990).

1 DMAX is the maximum diameter (`xx.x`), in inches; it is required for designing the diameter growth function as well as serving as the upper limit to diameter growth.

2 HMAX is the maximum height (`xxx`), in feet; it is required for designing the tree height function as well as serving as the upper limit to height growth.

3 AGEMAX is the maximum age of the species (`nnn`), in years; it is assumed to be under normal growing conditions (naturally occurring in expected habitat).

4,5 F1 and F2 (`0.03 1.8`) are the foliage prediction equation parameters. This is an allometric equation for predicting the average foliage biomass of a tree, given its diameter.

6 The surface area conversion factor (from foliage biomass) SURFAR (`600.0`) is needed to predict foliage consumption and destruction by gypsy moth when the stand model is part of the full Life System Model.

7 Relative stocking index, ISTOKG (`n`), is calculated using a species group-specific set of prediction equations that are indexed for narrow (1), intermediate (2), or broad (3) crowns. Choose the value that best fits the tree species average tendency in crown width.

8 RECRUT (`mmm`) is the maximum recruitment of new trees into the smallest diameter class. This is equivalent to surveying for trees that are between the lower limit for tree measurements (i.e., above 0.0 inch at breast height by default) and the diameter class width (2.0 inches at breast height by default) each year to find what new individuals have grown into the survey.

L7:
1-9 FDIE is the matrix of mortality rate parameters that are site moisture regime-specific (1-3: mesic; 4-6: intermediate; 7-9: xeric) and vary as the number of consecutive years of defoliation above 65 percent (`0.10 0.20 0.35 0.10 0.20 0.35 0.10 0.20 0.35`).

Table 5 in the Appendix shows the new parameter values for each species that has been added to Version 2.

Relation to Other Variables

The species-specific parameters interact with setting made for the stand as a whole, particularly with the weather data. The default for annual total degree-days can be reset in the DEFAULT file to a number that most effectively represents local conditions. This value will then be used as you alter the simulation length or inventory year, filling in values for years not previously assigned values.

Cautions

Operate at your own risk! Care should be taken to see that data are properly being read in from the SPECIES or DEFAULT file after edits, alterations, or additions are made to these files. Always back up your files before appending or editing them. For laurel oak, note that the maximum number of new trees that can move into the smallest diameter class is 4.5/acre, a nonintegral value. It is possible to provide nonintegral data but you must be sure that the data are being read in and interpreted correctly. Use the interface to edit a particular variable to see if the software will accept nonintegral values for that parameter.

Changes to the "Edit tree species" Window

In updating the model interface to add the Plot Data-entry system, we have added information to assist users in identifying and incorporating tree species into the model, and provided greater flexibility in stand level tree data (per acre) entry. See page 12 and Figure 9 of the User's Manual (Colbert and Racin 1995). The changes can be seen at the top of the data-entry window (Fig. 1). First, the common and scientific names are given, followed by the FIA and Letter codes, and then the gypsy moth feeding preference class for the species is provided. (Liebhold et al. 1995). Pressing **Enter** while highlighting the common name activates the species help system, providing a description useful for species identification. The last addition is a lower limit for tree diameter classes (DLENBASE_min) that allows you to input data for tree diameters starting at any nonnegative diameter less than 6 inches. This parameter is set once for all tree data and is found in the **Stand Data** input window off the **Stand** pull-down menu. Using this parameter has two effects: it eliminates small trees from the initial inventory and adjusts all diameter class midpoints up by this same amount, and it removes small trees from the simulation. For example, if DLENBASE_min is set to 1.0, the first diameter class includes trees greater than or equal to 1.0 inch and less than 3.0 inches. This first class midpoint is at 2.0 inches. Other classes are centered at 4.0, 6.0, etc.

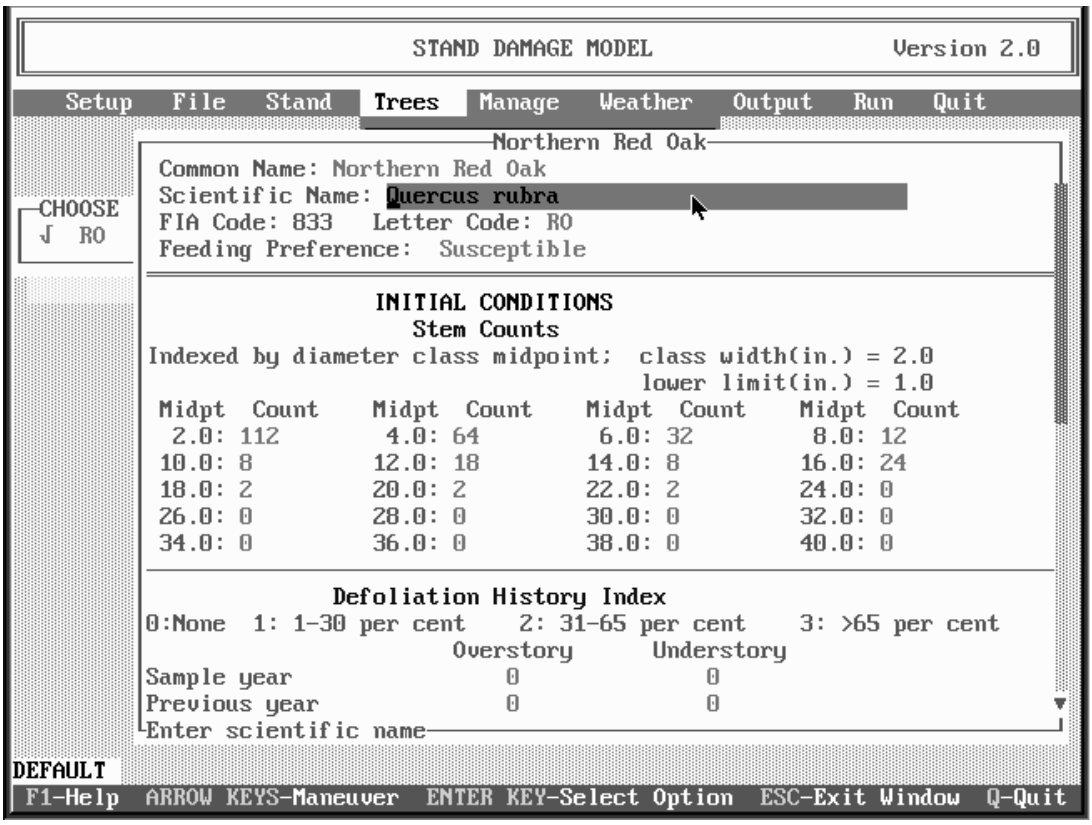


Figure 1.—The Tree Species Edit window is used to enter initial condition stem counts on a per-acre basis, set defoliation history for start of simulations, or change the default parameters for a tree species.

Add New Species

Use the Template/Interface

The easiest way to ensure that the information is saved in the proper format is to use the program user interface to create user-defined species (**Add tree species** choice off the **Trees** selection item of the main menu) and then save that information as an input file (the user interface will save the file with a .INP file extension). You can then copy and paste the blocks into the `SPECIES` file after replacing the first 3 lines of each block with a common name (line 1), scientific name (line 2), and entering a survey (FIA) code and three character label for each new species (line 3). If the species is not in the Appendix, we suggest using a survey code number distinct from those in the list so that your new species will not conflict with future updates to the supplied species list.

FORMATs in Template File

There are two templates in the file `SP-TMPLT.TXT` that is installed with the model (and in the self-extracting ZIP file). These templates are designed to assist you in locating and editing or inserting a block in the `SPECIES` file or in the associated help text in the `SPECIES.HLP` file. Because the text requires formatting, lines surrounding each block are provided to indicate column position. These lines are not part of the blocks and should not be left in the final text that is copied into the `SPECIES` or `SPECIES.HLP` files. To make best use of this information, first print a copy of the file. Then, using a text editor or word processor, open the template file, delete all lines but the template you want to use, and then duplicate the template lines once for each species block you are going to enter. Next, use the Save as... command to save this block as the `SPECIES.NEW` file. Finally, you can enter the data you have prepared, and a final save upon exit will provide you with the product that you will need to merge with the existing file. If you use a word processor, be sure that you save the final result as an ASCII text file. See Editing Tree Species Defaults (page 8) and Editing data (page 10) for details on editing these data.

User-Defined Species

As you add user-defined species through the user interface, the program automatically assigns them survey code index values 0-9. If you add more than 10 of these to a single input file (saved input files are provided with the .INP extension), you run the risk of possible interactions with lower FIA codes. If you know you have a large number of new or user-defined species and want to use the interface to construct them, add 10 or fewer new species, save them to an input file, and incorporate the contents of that file into the SPECIES file. Following this process will avoid problems such as the loss of data.

Merging New Data with Existing Files

Once you have built a set of species that you want to add to the SPECIES file, first make a backup of the current file using the DOS copy command as follows:

```
>copy species species.bak
```

Now you can append your new file to the old one:

```
>copy species.bak+species.new species
```

or replace the old one:

```
>copy species.new species
```

This procedure can be used to add help information to the SPECIES.HLP file. Remember that the blocks are ordered in these files and that maintaining the survey code (and scientific name) order enhances the search for a particular entry.

Plot Data-Entry System

Accessing the Plot Data System

Allowing users to enter data directly from field data sheets was suggested as an addition to the user interface. This removes the need for a user to convert plot tallies to tree-per-acre estimates for each species in the stand and then enter those data. The Plot data-entry system, the result of that suggestion, has two sections. In the first section, you describe the plot system; in the second, you enter the data for each plot. The **Plot data** system is entered via the **Trees** pull-down menu. When **Plot data** is selected from the menu, the following message is displayed:

WARNING: Plot data replaces species specific Stem Counts
Utilize plot entry system?

By answering 'Yes' to this question, you are replacing the stem count (tree per acre) method of providing initial tree data with the plot method. Be sure to save any data that you may already have entered before starting a new input data set that uses the plot data system. After answering 'Yes', you get two menu choices: **Add new plot data** (enter plot data for the first time) and **Cancel** (exit back to the menu system). If you choose **Cancel**, the software reverts to the stem count method.

Setting Up for Data Entry: Plots

When you choose **Add new plot data**, you get a widow that allows you to design the specific use of the plot data-entry system to fit your data. The software will automatically convert your plot data to trees per acre for your review, create summaries of your data on a per-acre basis, and create the initial conditions for simulations. Figure 2 shows the initial window as it appears with all defaults set. You provide the method used to collect data and the options reflecting the data that were collected as follows:

> **Plot type** — Select the plot type(s) that you used in collecting the data: variable-radius prism plots only, fixed-area plots only, or both prism and fixed-area plots. The default setting is for fixed-area plots only.

Default prism — Enter the prism factor to be used for most of the variable-radius plots. You will be able to reset the prism used in specific plots if necessary. A prism is a tool used to sample trees in proportion to their basal area. To learn more about point sampling, see "Simplified Point-Sample Cruising" (Northeast. Area, State and Priv. For.) or consult a book on forest measurements or forest mensuration. Once you have provided the diameter at breast height, the software will convert each sample tree to trees per acre.

Default fixed area — Set the size of most of the fixed-area plots. Again, you will be able to reset this for any plot where a different plot area was used during data collection. Units are given in acres; the default is 0.1 acre. Any positive number, up to 10 acres, can be entered.

Number of plots — This is the total number of plots of tree data that you wish to enter. If you have both fixed-area and variable-radius prism plots, enter the larger of the two. The interface will provide twice that number of plots, assuming that you collected an equal number of fixed and variable radius plots. The software will delete any unused plots that it initially sets up. The default is three plots per stand, but this can be reset to any positive integer, up to 100.

Maximum number of trees in any one plot — In building the data-entry screen, the software constructs a fixed number of data-entry records for each plot. This keeps the software efficient and the window interface for data entry manageable. Enter the largest number of records to be entered in any one plot. This assures that you always will have sufficient space for your data while keeping the size of the data-entry window manageable (default: 5). This can be set to any positive integer, up to 120.

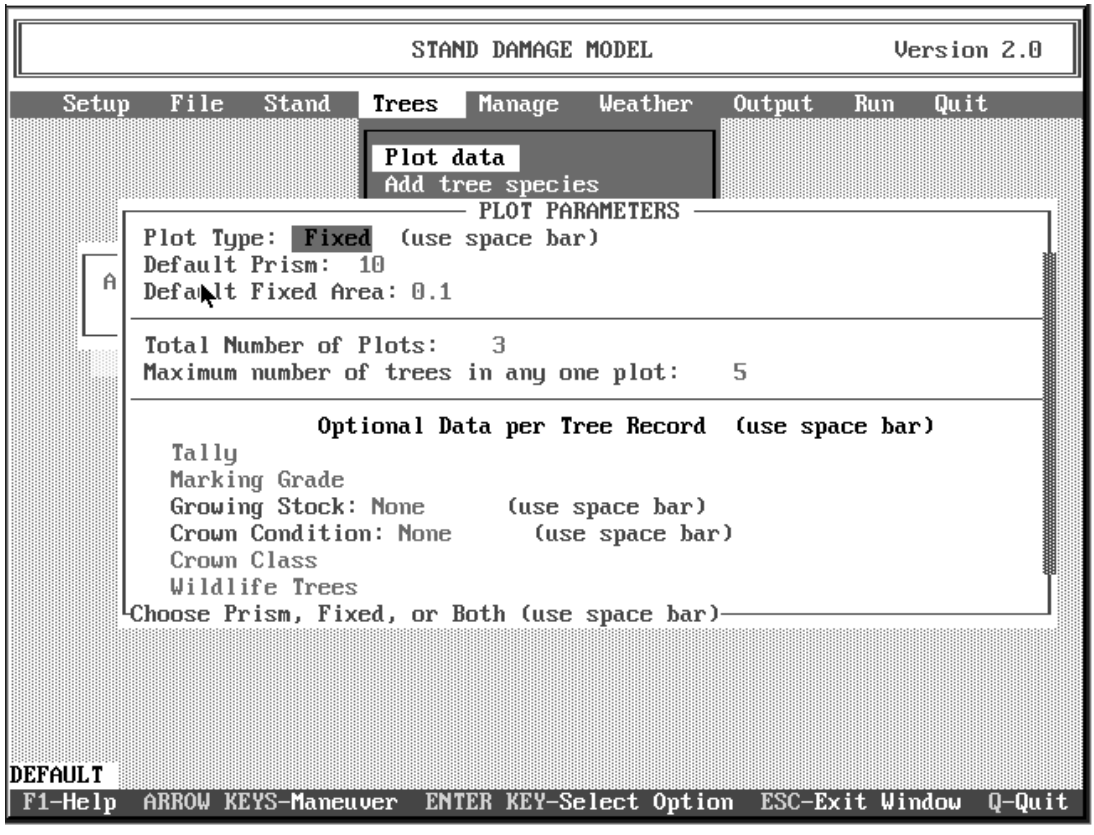


Figure 2.—When the plot system is entered, you are first taken to the Plot Design window where you can edit the default or previously entered plot parameters. The defaults settings are shown here.

Setting up for Data Entry: Trees

Next is a collection of six choices that relate to the data collected for each tree. Each adds a data-entry field to each tree record. These allow you to store most of the standard inventory tree characteristics on sample trees. The first two and last two can be toggled on or off using the mouse or the space bar. The Growing Stock and Crown Condition schemes are multi-choice selections and you are provided with choice lists for the available categories.

Tally — The number of trees that are represented by one record. This is set to one tree per record or, equivalently, one tree for each entry line in the plot data-entry window by default. If you choose to tally your plot data by diameter classes, turning on this option will add fields to the data-entry window where you can enter the tallies (counts) along with the associated diameters and species.

Marking grade — This field is used when the inventory should provide a measure of the quality as sawtimber. A nine-class system is used here. This does not tally individual logs within trees but the grade is for the whole tree. Log Grade specification for wood products uses (Marquis and Ernst 1992):

1 - Factory-lumber log grade 1;
2 - Factory-lumber log grade 2;
3 - Factory-lumber log grade 3;
4 - Locally defined log product (e.g., pallet) or construction log grade;
5 - Locally defined bulk product (e.g., boltwood);
6 - Pulpwood (minimum 2 contiguous 4-foot half-logs; minimum top DIB = 4.0 inches and 50% sound);
7 - Fuelwood (same as pulpwood except min top DIB = 1.0 inch);
8 - Cull (tree with less than 50% sound wood or does not qualify for any of the grades or products listed);
9 - Veneer log.

Growing stock — Growing stock is the silviculturist's marking guide for tree-quality assessment for retention or removal, looking toward either thinning to improve growing space for specific residual trees. You can select either of the following systems:

For the 3-class system (Marquis et al. 1992):
A-Acceptable: suitable for retention for at least next 15 years, commercial species of form and quality for sawtimber in future;
U-Unacceptable: undesirable species or disease, dieback, or damage threatens survival, poor form;
X-Dead: standing dead tree.

For the 7-class system (USDA Forest Service, Eastern Region: FSH 2409.21d, R9, Compartment Prescription Handbook, pages 245-2,3):
D-Desirable: optional use for black cherry, white ash, or yellow poplar;
A-Acceptable: growing stock that meets requirements in Marquis et al. (1992);
M-Mature: acceptable trees which are mature:

Species	Age
red and white pine	60
shortleaf and Virginia pine	50
scarlet oak	70
all other hardwoods	80

U-Undesirable: All other growing stock unless cull, wildlife, or dead;
C-Cull: does not meet minimum merchantability standards, i.e., no sound log 8 feet by 4 inches DIB at small end;
W-Wildlife tree: see wildlife tree descriptions below;
X-Dead.

Crown condition — Crown Condition is a classification system for assessing and rating tree health. There are two schemes that are available; each uses numeric codes.

For the 3-class system, definitions and a photo-guide can be found in Gottschalk and MacFarlane (1993).
1-good: healthy foliage, less than 25% dead branches, little or no epicormic sprouting;
2-fair: 25-94% of branches dead, epicormic sprouting is evident;

3-poor: 50% or more dead branches, foliage density, size, and coloration is subnormal, epicormic sprouting is heavy.

For the 7-class system: unpublished study site guide, on file at the Northeastern Research Station, 180 Canfield St., Morgantown, WV 26505-3101):

1-very good: 1-10% dead branches, healthy crown;
2-good: 11-25% dead branches, fair to good crown occasional dead branches in upper portions, foliage density subnormal, some decline symptoms evident;
3-fair: 26-50% dead branches, fair to poor crown foliage density and color subnormal, some branch sprouting;
4-poor: 51-80% dead branches, very poor crown, foliage density, color and size subnormal, sprouting heavy;
5-dying: dead branches, apparently dying, subsisting on epicormic branches;
6-dead crown with some live stump sprouts;
7-completely dead tree.

Crown class — Crown classification or relative position of trees in the stand canopy:

1-open grown - full sunlight to all sides;
2-dominant - above general canopy, full sun from above and partly from sides;
3-codominant - forms general canopy, full sun from above but comparatively little from sides;
4-intermediate - shorter than codominant/dominant but crown extends into those above;
5-suppressed - crown entirely below main canopy, no direct sunlight from above or side.

Wildlife trees — Wildlife trees are classified as live or dead trees (snags) and whether they currently are used by wildlife:

1-potential den tree, not actively used;
2-existing den, live tree is used;
3-snag-inactive, may serve as a wildlife tree;
4-snag with den, used by wildlife.

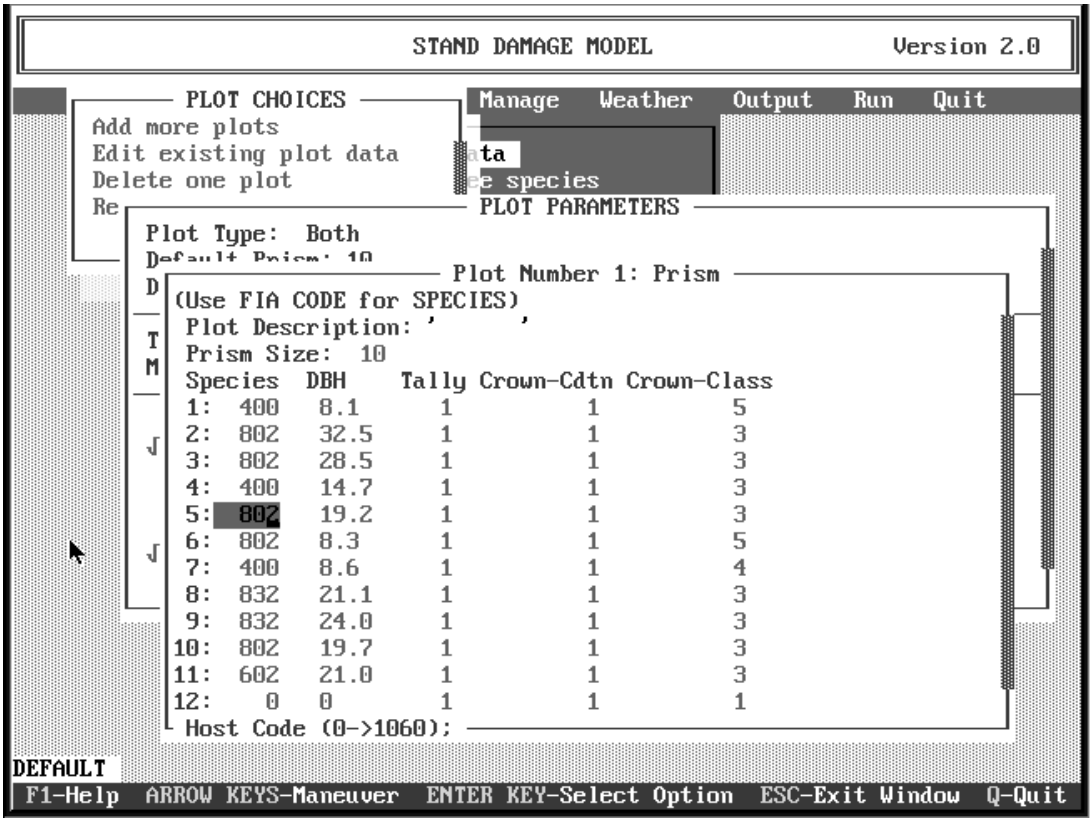


Figure 3.—The prism plot data entry screen is set to enter tally, crown condition, crown class and default tree species and diameter for each record.

Entering Tree Data

Once you have specified the design of your plot data, a series of plot data-entry screens will appear, one for each plot (Figs 3-4). These are numbered sequentially but you are given a 6-character plot description field that can be used to identify each plot to your choosing. If you chose to enter prism data, the first plot will be a prism plot (Fig. 3) and you are allowed to reset the default prism for this or any particular prism plot. If you chose to enter any additional fields, they appear in this and subsequent plot data-entry windows to the right of the species code and diameter fields. If you chose to use both prism and fixed area plots, the second plot will be a fixed-area plot (Fig. 4). In this case, each odd numbered plot will be a variable-radius prism plot and each even numbered plot will be a fixed area plot. Each tree record must have a species code and nonzero diameter (inches) before it will be saved. Recall that zero (0) is a valid (user defined) species code, so be sure that the proper code is next to each diameter. You can go to the **Tree** pull-down menu and activate the **Edit tree species** menu to see a list of all species in the stand after completing data entry. If you enter no data in a plot, that plot will be dropped. The next time you enter the plot system to review, edit, or add data, each plot data-entry window that you actually used (i.e., into which you entered data) will be present. You can change the area of any fixed-area plots in the same way that the prism is changed for individual variable-radius plots.

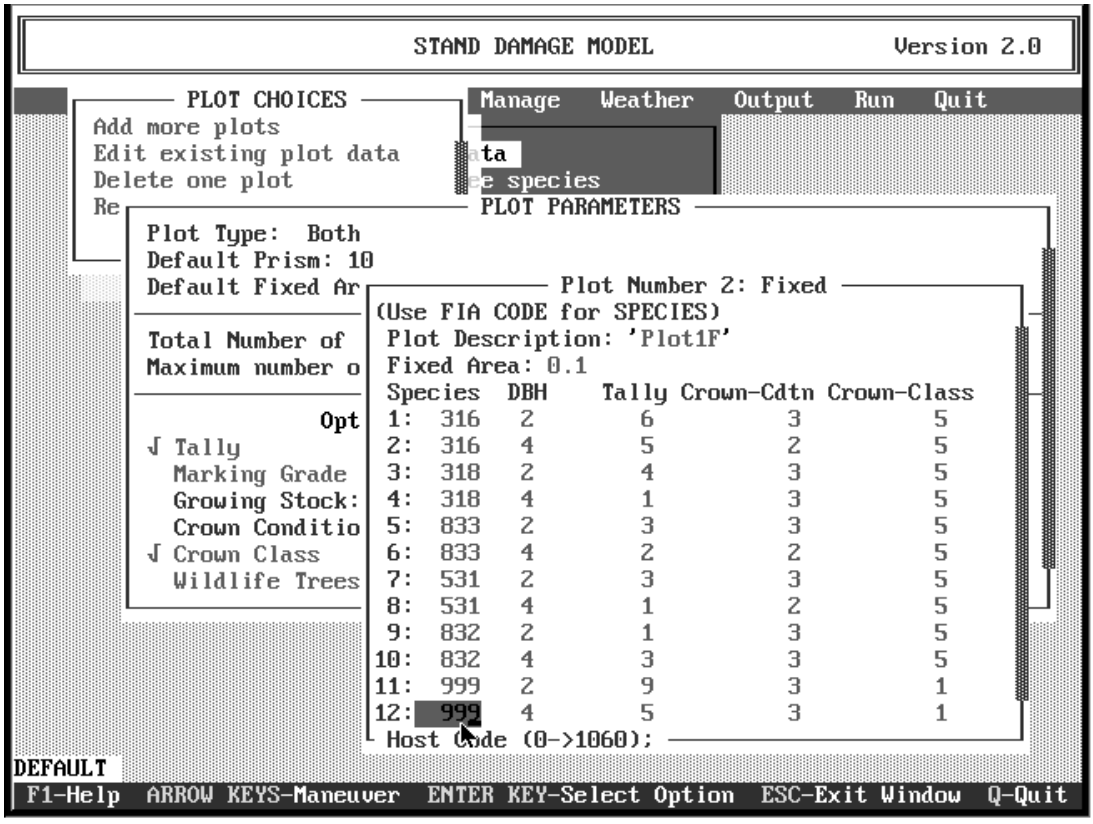


Figure 4.—Data entry screen for a fixed-area plot.

When entering data for any plot, the software will make sure the species codes that have been entered are valid. This is not done on the individual field level as you enter data. When you exit from a plot data-entry screen, each field is checked. If an unrecognized species code is found, the interface will alert you to the particular offending record and provide you with the current species list from which you will choose a valid species code for that sample. If you press **Esc** at that point, the software will return you to the data-entry screen where you can make a series of edits or delete individual-tree sample records by changing the associated diameters to zero (0).

Managing Plot Data

If you return to the plot data-entry system from the **Tree** Menu after you have entered plot data, you will find additional choices on the **Plot data** pop-up menu:

Add more plots	Select this option to Add new plots to the existing plot data system.
Edit existing plot data	Select this option to enter the existing plot data-entry screens to review or edit your current data.
Delete one plot	This is where you can remove one plot and all the associated data from your field data entries.
Replace with new plot data	Replace the entire existing plot system with new plot data. Be certain that you want to delete all existing tree data before completing this sequence of steps.
Cancel	Exits back to the menu system. Note that this does not reset the system to per-acre stand-level tree data entry.

This menu provides you with the ability to review, edit, add to, or delete plots. If you choose the **Delete one plot** option, you are prompted with the current plot list. If you gave each plot a name that you can associate with the field data sheet, you can see that name beside the plot number that the user interface software has assigned to the plot. This will help you ensure that you are deleting the correct data. *Caution*: Once a plot has been deleted, it cannot be retrieved. You will need to **Add more plots** and reenter all data.

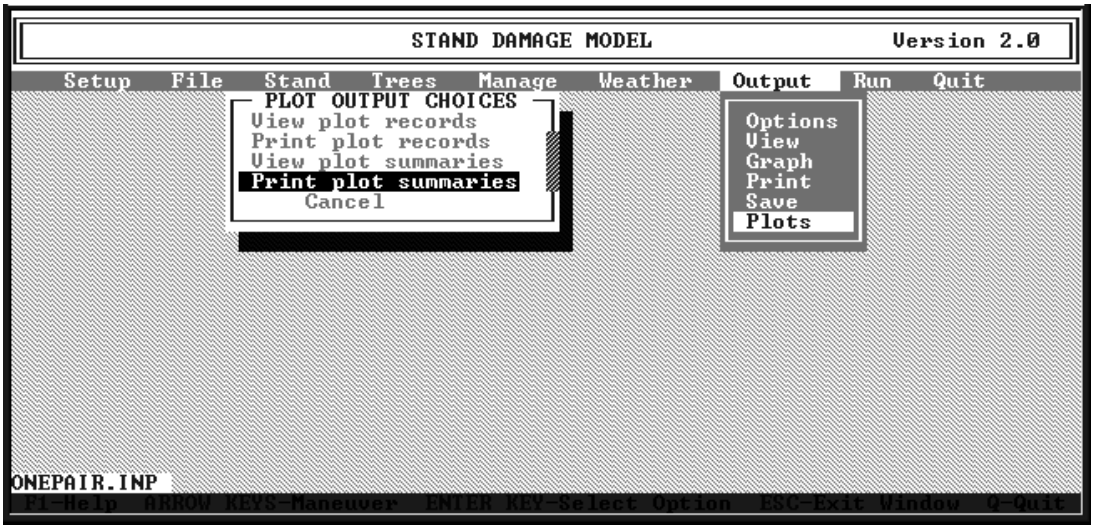


Figure 5.—Following plot data entry, use the Output pull-down menu and select Plots to access plot data records in file format and data summaries on a per-acre basis for the stand.

Reviewing Plot Data

Once all plot data are entered and you exit the **Plot data-entry** system, a notification message appears that alerts you that these data have been converted to a per-acre summary set of data for the stand. Remember to save these plot data before exiting the user interface. If you then go to the **Output** pull-down menu and select **Plots** (Fig. 5), you can then **View plot data records** or **Print plot data records,** or **View plot summaries** or **Print plot summaries** as they have been saved to disk:

View plot records	Provides a viewing window for plot data. The **Arrow**, **Page-up**, and **Page-down** keys allow you to navigate through these data. Press **Esc** to exit the viewing window.

Print plot records	Prints plot data to your local printer. Make sure the printer is turned on, on line, and using parallel port LPT1. If the printer cannot be initialized (as is the case for laser printers), a WARNING message will be displayed. If the printer is not functioning properly, proceeding with the print job may abort the program. It is advised that you first save any data that has not been backed up to disk before doing this for the first time.
View plot summaries	Plot data are summarized on a per-acre basis from all plots for the stand.
Print plot summaries	Similar to printing plot records, this is limited to local printers on LPT1.

From **View plot records** you can review the file copy of the individual plots so that you can review or verify your entries as they will be saved to disk. Or you can look at several ways in which these data have been summarized by choosing **View plot summaries** (Fig. 6). Similarly, **Print plot summaries** provides the means to make paper copies of these summary data. **Sawlog Volume**, **Total Volume**, **Board-Foot Volume**, **Basal Area**, or **Stem Count** summaries can be accessed. If you forget to save these plot data, you will be prompted that they are unsaved as you exit the software. The summary data are created as temporary files. You can save any of the summary data files by renaming the temporary files (look for the `.plt` extension) found in the model directory. There is no way to save these summary files directly from the user interface.

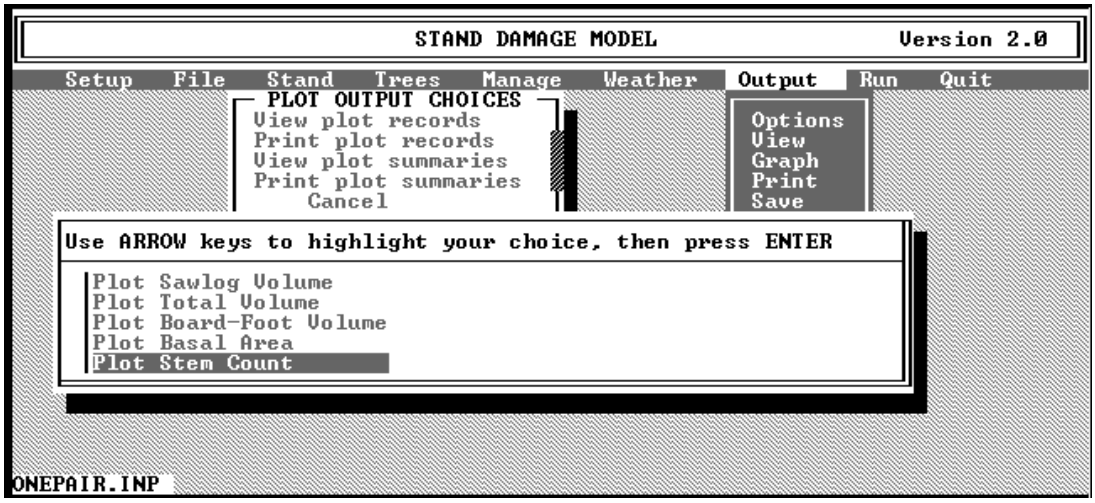


Figure 6.—The View plot summaries option provides a selection list of the five summary formats.

These summaries are constructed according to the diameter tally system that you are using. If you left this set to the defaults, it will be 2-inch classes, starting at 0.0 as the lower limit, so the class midpoints will be 1.0, 3.0, etc. These can be altered using the **Stand** pull-down menu, selecting the **Stand Data** and then changing the lower limit, the diameter class width, or both. If you decide to do this after you have entered plot data, to recalculate the summary statistics, enter the **Plot Data** system and cycle through the data by selecting **Edit existing plot data** and hitting **Esc** as each data-entry window pops up. Once all data have been reviewed, the summary statistics are recalculated automatically using the revised diameter class limits.

Packaged Scenarios for Simulating Defoliation

Background

The Stand-Damage Model now generates a set of designed scenarios for simulation of no, light, and heavy outbreaks over a 20-year interval. These scenarios allow you to quickly review the range of possible damage from gypsy moth. The none or no-outbreak scenario provides a baseline for seeing the effect of a sequence of two light outbreaks and a sequence of two heavy outbreaks. Volume, basal area, and stem counts are totaled at the end of each simulation and the net effects (differences between none and the light, and the difference between none and the heavy) are calculated. These packaged scenarios have been used to evaluate the probable loss from gypsy moth damage in Ohio (Colbert et al. 1997) and are being used to evaluate potential losses in the Ozark Ouachita Mountains of southern Missouri, northern Arkansas, and eastern Oklahoma (Gottschalk et al. in press). Using ecological land classification (Bailey 1995, Guldin in press), tree species distribution maps (Iverson et al. 1999) and growing degree-days (http://www.fsl.wvu.edu/gypsymth/ddmap.html) for an area, one can assess the potential for gypsy moth damage. Data are available from USDA Forest Service FIA units for analyzing large regions of the United States. The Forest Service is developing high-resolution maps of public lands as ecological land units (100's to fewer than 10 acres) for project and management-area planning and analysis[2] (McNab and Avers 1994; Bailey 1995, 1997, 1998). These tools will allow a much broader audience to make similar assessments of potential losses.

Scenario Design

The defoliation scenarios use susceptibility of tree species (three classes) to gypsy moth defoliation (percent), the pattern of difference between the tallest trees (overstory) and those that are lower in the stand canopy (understory):

	Light Outbreak		
Year/Strata	Susceptible Species	Resistant Species	Immune Species
1 – Overstory	30	0	0
1 – Understory	40	10	0
2 – Overstory	50	15	0
2 – Understory	70	30	10
3 – Overstory	0	0	0
3 – Understory	0	0	0
4 – Overstory	0	0	0
4 – Understory	0	0	0
5 – Overstory	0	0	0
5 – Understory	0	0	0

	Heavy Outbreak		
Year/Strata	Susceptible Species	Resistant Species	Immune Species
1 – overstory	40	0	0
1 – understory	60	30	0
2 – overstory	90	25	0
2 – understory	100	40	10
3 – overstory	100	50	10
3 – understory	100	70	25
4 – overstory	50	30	0
4 – understory	30	15	0
5 – overstory	0	0	0
5 – understory	0	0	0

These percent defoliation values were derived beginning with the scenarios used in the final national gypsy moth environmental impact statement analysis (Northeast. Area, State and Priv. For. 1995), and modifying them to account for overstory/understory differences in defoliation of each feeding

[2]National hierarchical framework of ecological units, ECOMAP. [http://www.fs.fed.us/gpnf/ei/ maps/ ecomap.htm].

preference class and adding the minimal defoliation seen on immune species when the gypsy moth completely defoliates the overstory susceptible trees and large larvae, searching for feeding sites, move to nearby trees. See the Appendix (Table 4) to locate gypsy moth feeding preference for a particular tree species. To use these data and generate the packaged scenario outbreaks through the user interface, choose the **Run scenarios** option from the **Run** pull-down menu.

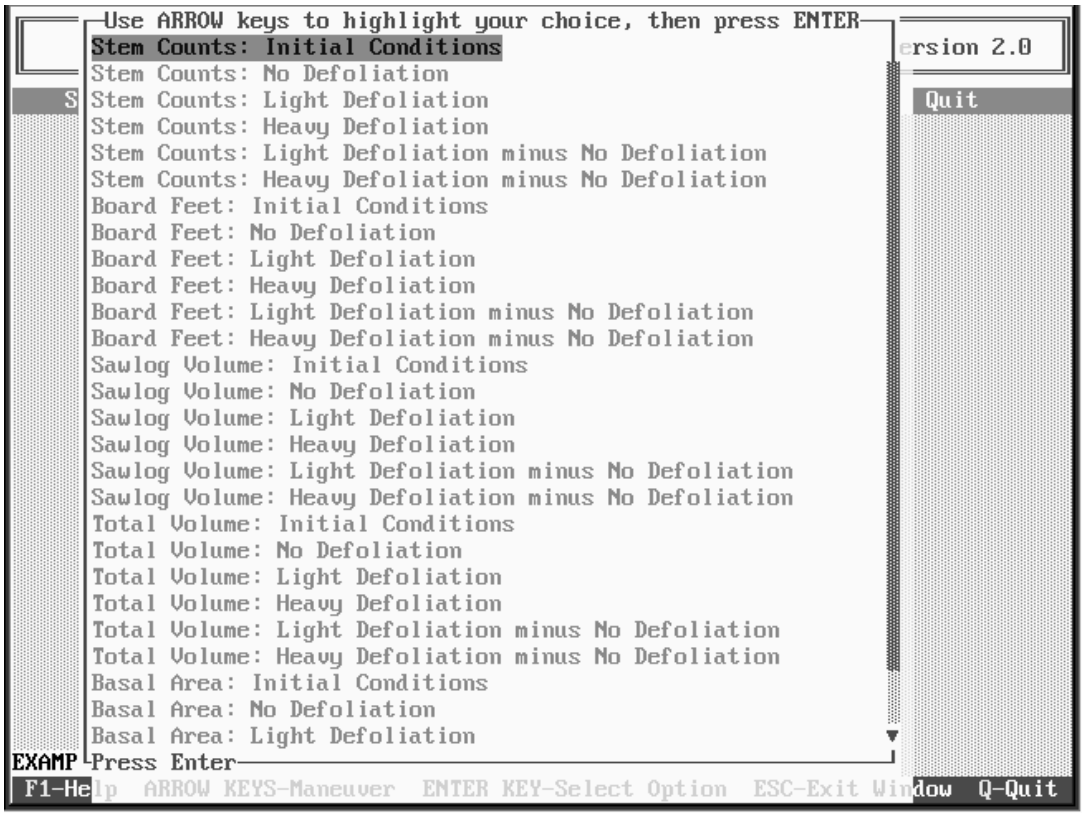


Figure 7.—The packaged scenarios provide 30 tables, 6 for each variable, including the initial conditions, the final state at the end of each simulation, and difference between defoliation and no-defoliation scenarios.

Scenario Results

Figure 7 shows the variety of simulation initial condition and result files that can be viewed following the simulation of the package scenarios. The volume totals that are generated include board-foot volumes (BFV), sawlog volume, and total volume (sawlog plus pulpwood; the last two are in units of cubic feet). The 20-year period provides two 10-year sequences: a 5-year defoliation period and a 5-year period with no outbreak.

Volume and value calculations. Most of these parameters are set using the defaults from the simulation program SILVAH (Marquis et al. 1992; Marquis and Ernst 1992). The age of the stand is set at 65 years. Stand age is used for calculating log heights to the nearest half log. Form class, computation rule (International ¼-inch), and sawlog, pulpwood, and BFV correction factors are SILVAH defaults. Species-specific dollar values and a discount rate also are needed to compute Net Present Value. These computations are not made unless the model is run from the command line with the `sdmtrans.txt` file. See the section on **Run as Batch Process from Command Line** for details. (Total dollar values will be calculated for the stand and on a per-acre basis.)

While the model is simulating each scenario, a message box is presented that displays a title line showing which of the three simulations is currently running, and a status bar showing what portion of the simulation is complete. Once the simulations are run, output table data are generated and placed in ASCII text files. The output are on a per-acre basis. The names of these data files are:

File Name	Description
STEMS.IC	Stem Counts: initial conditions
STEMS.NUN	Stem Counts: no defoliation
STEMS.LGT	Stem Counts: light defoliation
STEMS.HEV	Stem Counts: heavy defoliation
STEMS.DFL	Stem Counts: no defoliation minus light defoliation
STEMS.DFH	Stem Counts: no defoliation minus heavy defoliation
BASAL.IC	Basal Area: initial conditions
BASAL.NUN	Basal Area: no defoliation
BASAL.LGT	Basal Area: light defoliation
BASAL.HEV	Basal Area: heavy defoliation
BASAL.DFL	Basal Area: no defoliation minus light defoliation
BASAL.DFH	Basal Area: no defoliation minus heavy defoliation
BDFT.IC	Board-Foot Volumes: initial conditions
BDFT.NUN	Board-Foot Volumes: no defoliation
BDFT.LGT	Board-Foot Volumes: light defoliation
BDFT.HEV	Board-Foot Volumes: heavy defoliation
BDFT.DFL	Board-Foot Volumes: no defoliation minus light defoliation
BDFT.DFH	Board-Foot Volumes: no defoliation minus heavy defoliation
SAWLOG.IC	Sawlog Volume: initial conditions (cubic feet)
SAWLOG.NUN	Sawlog Volume: no defoliation
SAWLOG.LGT	Sawlog Volume: light defoliation
SAWLOG.HEV	Sawlog Volume: heavy defoliation
SAWLOG.DFL	Sawlog Volume: no defoliation minus light defoliation
SAWLOG.DFH	Sawlog Volume: no defoliation minus heavy defoliation
TOTVOL.IC	Total Volume (Sawlog + Pulpwood): initial conditions (cubic feet)
TOTVOL.NUN	Total Volume (Sawlog + Pulpwood): no defoliation
TOTVOL.LGT	Total Volume (Sawlog + Pulpwood): light defoliation
TOTVOL.HEV	Total Volume (Sawlog + Pulpwood): heavy defoliation
TOTVOL.DFL	Total Volume (Sawlog + Pulpwood): no defol. minus light defol.
TOTVOL.DFH	Total Volume (Sawlog + Pulpwood): no defol. minus heavy defol.

And graph output from each simulation is available:

File Name	Description
STEMNUN.GRA	Stem Count graph file for no defoliation
STEMLGT.GRA	Stem Count graph file for light defoliation
STEMHEV.GRA	Stem Count graph file for heavy defoliation
BASALNUN.GRA	Basal Area graph file for no defoliation
BASALLGT.GRA	Basal Area graph file for light defoliation
BASALHEV.GRA	Basal Area graph file for heavy defoliation
VOLNUN.GRA	Volume graph file for no defoliation
VOLLGT.GRA	Volume graph file for light defoliation
VOLHEV.GRA	Volume graph file for heavy defoliation

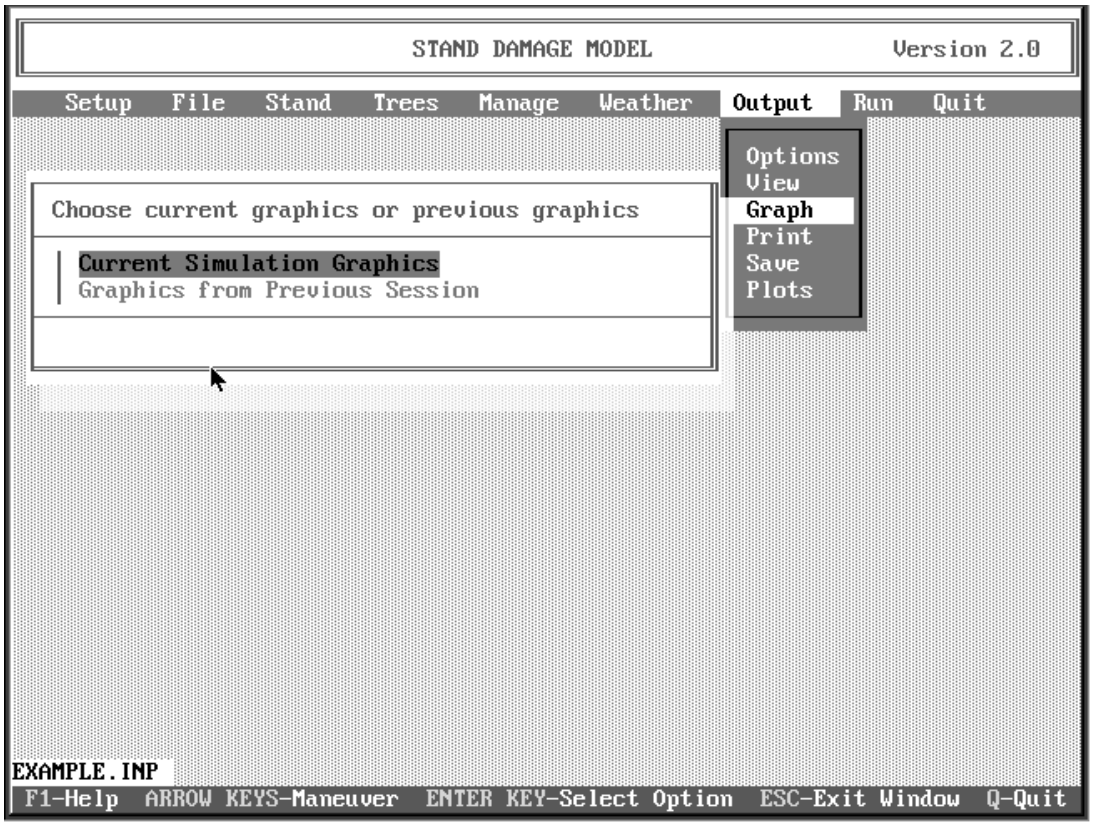


Figure 8.—Following simulations, graphs you chose to generate are available for viewing; for packaged scenarios, the final simulation (heavy defoliation) graphs are available.

Choose **Graph** from the **Output** pull-down menu (Fig. 8). Selecting **Current Simulation Graphics** provides a selection list of the three graphs from the heavy (most severe) simulation — the last one run. These graphs are immediately available to you from the Current Simulations selection list after running the package from the user interface. Note that you will have to select **Graphics from Previous Session** to view the graphs for the light (Fig. 9) and no defoliation scenarios and use the file names provided here. File names are not case sensitive but you will need to enter the full name, including the file extension (".GRA"). Figure 10 shows the result of running data from the `example.inp` file through the packaged scenarios.

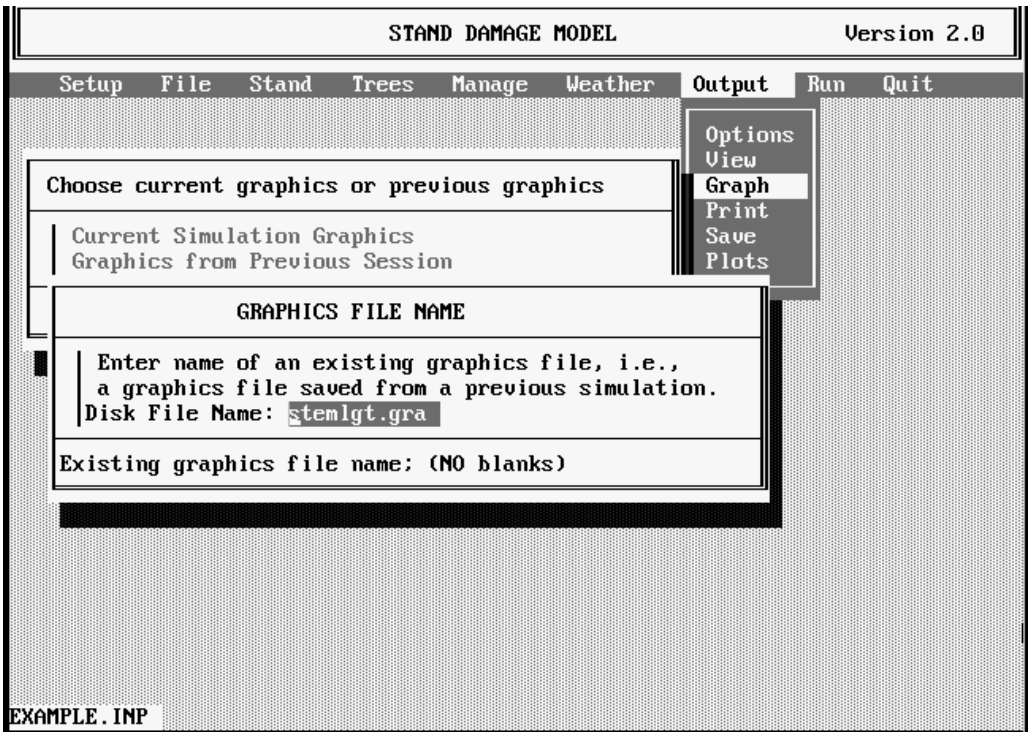


Figure 9.—To access a graph from the no-defoliation or light-defoliation scenario, choose the Graph from Previous Session option and enter a name from the list.

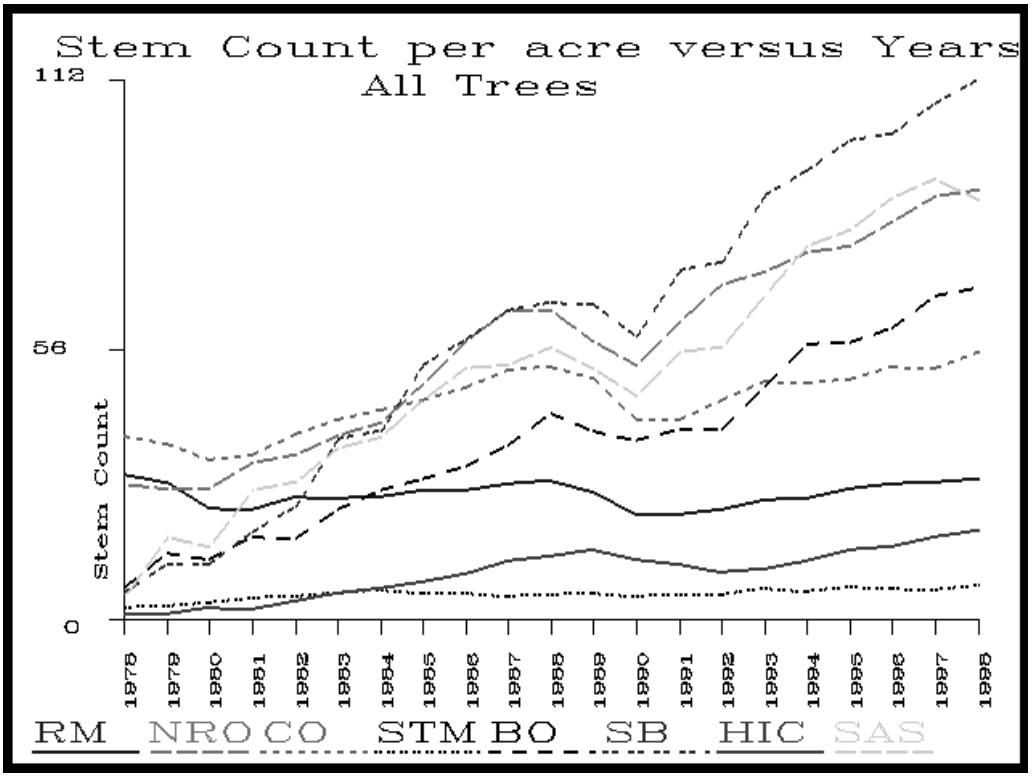


Figure 10.—Graphs can be viewed following simulations, one line for each species; there are nine graphs available following simulations of the packaged scenarios; here stem counts are shown for each species following light defoliation.

Command-Line Switches

The Stand-Damage Model can be run directly from a DOS window using the command line. It can be run in different modes depending on what command-line parameters are set when executing the model. The model is run from the DOS prompt as:

```
C:\DAMAGE>damage
```

In other words, **damage** is typed in at the prompt, followed by the **Enter** key. This brings up the Stand-Damage interface. However, by typing in a space and an extra letter, one can access other special features.

Packaged Scenario Mode

In order to "enable" the generation of packaged scenarios by the Stand-Damage Model, the user must pass an "S" to the model as a command line switch. To generate packaged scenarios output files from the model, type:

```
C:\DAMAGE> sdm  s
```

The "s" stands for Stand-alone (no user interface). This will generate basal area, volumes, and stem count by species, as well as totals for each outbreak scenario: heavy, light, and no defoliation. Otherwise, the normal user interface is activated when the model software is executed.

You can produce your own `sdmtrans.txt` file and run these scenarios from DOS if you are interested in automating the process for a large set of input files. Currently, the transfer file, `sdmtrans.txt`, contains the following information in the first line:

```
1       1985    2       183.92  1.0     2.0     5.00    8
```

where:	1	means that data are being passed in this file (use them to replace the defaults);
	1985	initial inventory year, year "0" for simulations;
	2	site (site moisture regime; 1 = dry, 2 = moderate, 3 = wet);
	183.92	stand area (will be used only for the total dollar valuation);
	1.0	DLENBASE_min (minimum [left edge] of first diameter class);
	2.0	DLENBASE (diameter class width for incoming tree list);
	5.00	discount rate used to estimate present value of future stand;
	8	number of tree species that follow in this file.

Note that the maximum number of species that may be simulated in a stand is 20 and the first 20 species you provide will be used. The most dominant or most important to your particular analysis should be the first 20 species. You can group "other" species as a single species entry to provide an adequate estimate of the full stocking or stand density. If you find a stand with more than 20 species and want to maintain them all in the `sdmtrans.txt` file, the model will read the first 20 and ignore the trailing data.

The second line of the file contains the output table column or class boundaries, with defaults:

```
0       6       12      18      24
```

The output is displayed in columns defined by class boundaries: current boundaries produce the following classes: 0-6 inches, 6-12 inches, 12-18 inches, 18-24 inches, > 24 inches, (0, 6, 12, 18, 24). These class boundaries are passed from the interface to the simulator, allowing the user to modify the output table column definitions. Data generated during the simulations are passed as plain ASCII text files with a title line at the top and a totals line at the bottom. Totals for rows are given in the last (rightmost) column of numbers, followed by a trailing list of the species codes. The species order is the same as that passed from the user interface, or from the sdmtrans.txt file. Marginal column totals are placed at the bottom of each column. A grand total is provided as the lower right hand entry of the file. If the user redefines the columns, the model will accept fewer than five distinct columns. For example, if the user resets the values to 0, 0, 10, 20, 20, the model will return data for each of the ranges: 0-10 inches, 10-20 inches, and > 20 inches, The resulting data files will contain four columns (three range

totals, and a row total at the end) and a title line, one line (row) for each species, and the total line at the bottom.

The remainder of the file depends on the number of species (last item on the first line) and number of non-zero diameter classes within species. A two-line block is passed for each species. Each species is designated by the 3-digit FIA species code and followed by the stumpage price for that species ($100/Mbf is used in the default `sdmtrans.txt` file) and the number of diameter-class counts being passed; the following line contains counts for each diameter class on a tree/acre basis.

For each species, the format of the next line is:

```
837     150.0     16
```

Where 837 species code;
150.0 stump price;
16 number of input classes.

and the next line would then have 16 entries, the last one being the largest non-zero count:

```
0.0  0.0  0.0  0.0  0.0  0.0  8.5  0.0  0.0  1.9  0.0  0.0  0.0  0.0  0.8  0.7
```

In this example, since we have the lowest class starting at 0.0 and each class is 2.0 inches wide, one can see that the 13-inch class (12-14 inches) has 8.5 trees per acre while the 31-inch class has 0.7 trees per acre.

Specific-Year Mode

To run the model to a specific year, you need to use two parameters on the command line, for example:

```
C:\DAMAGE> sdm f 2020
```

The first parameter **f**, informs the software that you want to run forward to the year **2020** (the second parameter). This option is most often used to bring a collection of stands that were sampled over a period of several years to a common starting point for analysis. For example, if a watershed may be defoliated in the near future and one is concerned of the impacts of that happening but the watershed comprises many individual stands that were sampled over the past decade, the data for each stand could be grown forward to some common year (2020) so that analysis of future defoliation impacts could be assessed on each stand.

Details Mode

Use the details switch to obtain additional information on how the model generates the final results. To obtain details on intermediate calculations and to maintain on disk all files that usually are temporary as well as some that otherwise are not seen by the user (those deleted by the program upon exit), type the following:

```
C:\DAMAGE> sdm d
```

The **d** switch tells the model to run in Details Mode.

Monochrome Mode

To run the model on monochrome monitors, type:

```
C:\DAMAGE> sdm m
```

This switches all menu displays into a mode that allows the various color differences (used in normal color mode) to be mapped into gray shades for a monochrome (“back and white”) monitor.

Fast Start

To go directly to the model interface and skip the logo login screen, type:

```
C:\DAMAGE> sdm
```

that is, type **sdm** and press **Enter** to bypass the logo; this can be used from a Windows shortcut.

Plot System Tutorial

Why Use the Plot System

This tutorial describes in detail how to use the plot data-entry system, which allows direct data entry from field tally sheets and eliminates the need for conversions by the user. This automatically converts data to a stand table format, i.e., one that contains tree counts per acre by species and diameter class. This table can be used immediately as the initial stand conditions for a simulation. These data also are summarized in basal area/acre and three stand volume-per-acre formats. Whole-tree, log, and board-foot volume tables are provided.

Entering Plot Data

Data collected from fixed-area plots, variable-radius (prism) plots, or from any combination of these can be entered in to the program for summarization and projections. Fixed-area plots can be of any size; any of six basal-area factors can be used on a prism plot. In the following examples, one plot area was used for each fixed-area plot and all variable-radius plots were cruised with a 10-factor prism (10 ft^2 of basal area for each in-tree). To learn more about variable-radius point sampling, see "Simplified Point-Sample Cruising" (Northeast. Area, State and Priv. For.).

In the following sections we will use data sets that are located in the Appendix. Data sheets labeled Central Pennsylvania Risk Rating Plots Study 15 will be used as example data for the fixed-area plot entry, and Stand 96-14 from the Dorr Run Gypsy Moth Survey will be used for the variable-radius plot entry.

Sample Fixed-Plot Data

The Central Pennsylvania Risk Rating study was established in 1978. This stand was located in Mifflin County. The data consist of information collected on all trees more than 1 inch in diameter at breast height (4.5 feet). Three 1/10-acre circular plots were established at the corners of an equilateral triangle, 300 feet on a side. Stands were located throughout central Pennsylvania to measure the effects of gypsy moth defoliation. The following are lines of the data collected from one plot:

Central Pennsylvania Risk Rating Plots Study 15 ---- Stand 123

STAND	PLOT	TREE	SPECIES	DBH78	VIGOR78	CCLASS78	DEFOL78
123	1	1	316	3.30	2.00	5.00	10.00
123	1	2	316	3.00	3.00	5.00	90.00
123	1	3	316	5.30	1.00	4.00	0.00
123	1	5	315	5.30	2.00	4.00	0.00
123	1	6	833	10.00	1.00	3.00	0.00
123	1	7	832	4.30	1.00	5.00	0.00
123	1	8	832	12.80	2.00	3.00	30.00
123	1	9	833	5.30	2.00	4.00	10.00
123	1	10	832	14.30	1.00	3.00	0.00

These data also are in an Excel ™ file, stand123.xls, in the directory where the software was installed. That file includes both a copy of the data in the Appendix and a complete set of data for these plots. If you examine that file you will find individual-tree defoliation data for 1978-92. You can use these data to compile a test and compare simulation output to growth and mortality resulting from the defoliation data stored there.

The Species column on the data sheet lists tree species by 3-digit FIA codes. A look-up table listing these codes is found in Table 3 of the Appendix. From the table, one can see that the following species are present in this plot:

Code	Common	Scientific name
316	red Maple	*Acer rubrum*
315	striped Maple	*Acer pensylvanicum*
833	northern Red Oak	*Quercus rubra*
832	chestnut Oak	*Quercus prinus*

The column DBH78 refers to the diameter of each tree at breast height (4.5 feet above ground on the uphill side of the tree). The Vigor78 column refers to the health of the tree's crown; Vigor78 will be referred to as crown condition in the Stand-Damage Model. This study used the 3-class system to rate crown condition.

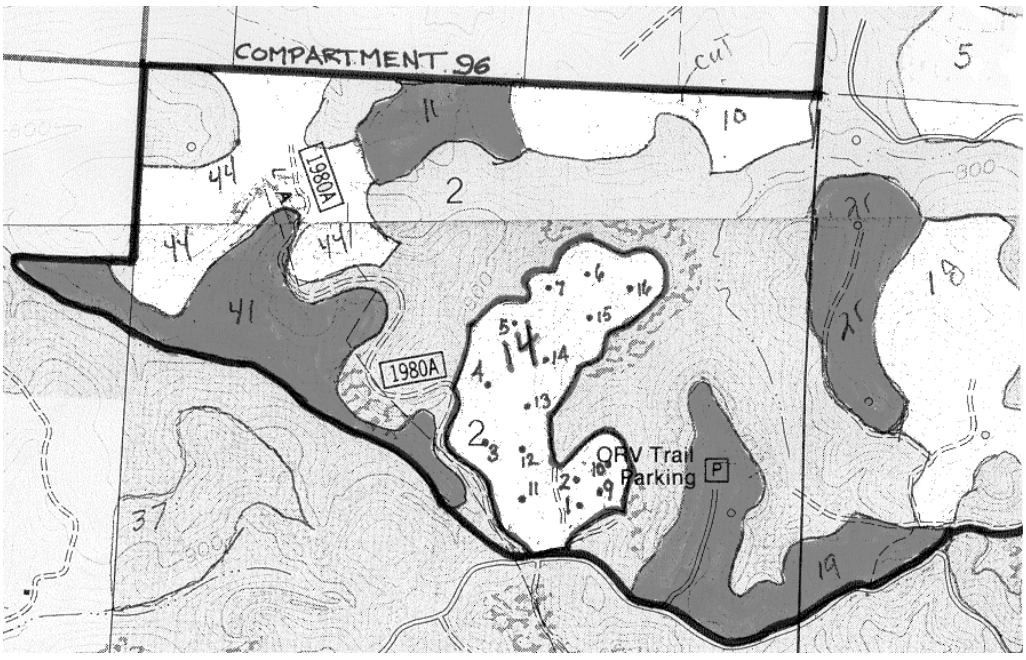
Code	Definition
1	**good:** healthy foliage, less than 25% dead branches, little or no epicormic sprouting
2	**Fair:** 25- 49% of branches dead, epicormic sprouting is evident**.**
3	**Poor:** 50% or more dead branches, foliage density, size and coloration is subnormal, epicormic sprouting is heavy.

The final column in the display, CClass78, refers to the Crown Class of the tree in the forest canopy. Five codes were used for rating:

Code	Definition
1	**open grown:** full sunlight to all sides
2	**dominant:** above general canopy, full sun from above and partly from the sides
3	**codominant**: forms general canopy, full sun from above but comparatively little from sides
4	**intermediate:** shorter than codominant/ dominant but crown extends into those above
5	**suppressed:** crown entirely below canopy, no direct sunlight from above or side

Sample Variable-Radius or Prism-Plot Data

The Dorr Run Gypsy Moth Survey sample data sheets consist of fifteen 10-factor prism plots distributed throughout Stand 14, Compartment 96, Athens District, on the Wayne National Forest. Data were collected in April 1999. These inventory data collected were used with the Stand Damage Model to simulate the growth of this stand. The following stand map shows the distribution of plots sampled in this and six other stands. Plots usually are located along a series of transects or line segments that traverse the plot and are reasonably equally spaced



The protocol established for data collection on each prism plot entailed identifying the tree species, and measuring DBH, crown condition (vigor), and crown class for each overstory tree. As in the Pennsylvania Risk Rating data set, the FIA species codes and five crown class codes were used. Here the 3-class system for crown condition was replaced with a 5-class system. Since the software has options only for 3- or 7-class data, we choose the latter to accommodate the data, noting the differences between the 5-class definitions that follow and those given in the on-line help and on page 23 of this report. These are essentially the same except that the 7-class system refines the dead-tree information.

Species	Dbh	Vigor	Crown Class
837	26.2	1	3
802	16.3	1	3
837	13.1	3	4
318	2.8	1	5
806	15	1	3
833	16.7	1	3
837	15.1	1	3
832	14.8	1	4

5-Class System (Crown Condition)

Code	Definition
1	**Healthy crown:** 0-10% dead branches
2	**Fair to good crown:** 11-25% dead branches
3	**Fair to poor crown:** 26-50% dead branches; some branches sprouting
4	**Very poor crown:** 51-80% dead branches; heavy sprouting
5	**Apparently dying:** 81-100% dead branches; subsisting on epicormics

Fixed-Area Plot Data Entry

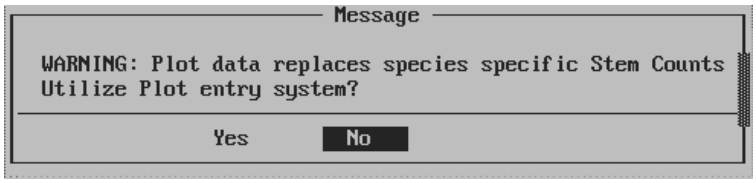
The following steps will guide you into the plot system (steps 1-3), through set up (4), data entry (5-6), saving your work (7), and viewing the results of your work in file format (8) as it was saved to disk, or in summary form (9) on a per-acre basis. Steps 10-13 demonstrate how to make additions, deletions, and edits to existing plot data. Step 14 leads you through printing your data as well as comparing your work to the fixed-plot example data file that should match yours exactly.

1) Locate field data sheets labeled Central Pennsylvania Risk Rating Plots Study 15 in the Appendix (page 62). There are three plots; data for each is on a separate page that is a copy of the field data sheet and is included as one of the installed files,

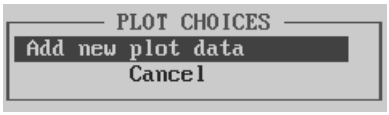
   `PLOT-123.XLS`

   that can be found where you installed the software.

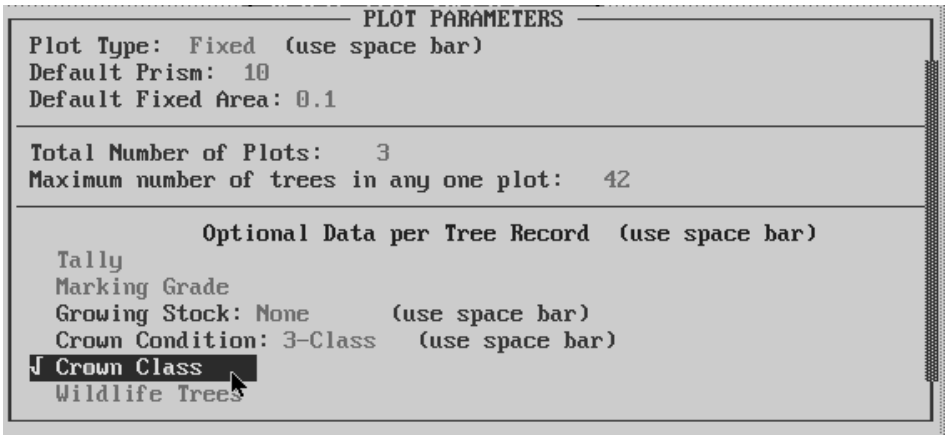
2) Click on **Trees** located on main menu bar. Next, click on **Plot data** on the drop menu**.** A warning will appear.



3) If you have data that previously were entered but not saved, this is your chance to stop and save those data. Click on **No** on the warning. Click on **File** on the main menu bar to access the **Save** option. See step 7 for details on saving data to disk. Once you have saved your data return to step 2. If there are no data to save, click on **yes**. Then click on **Add new plot data** to gain access to Plot Parameters.

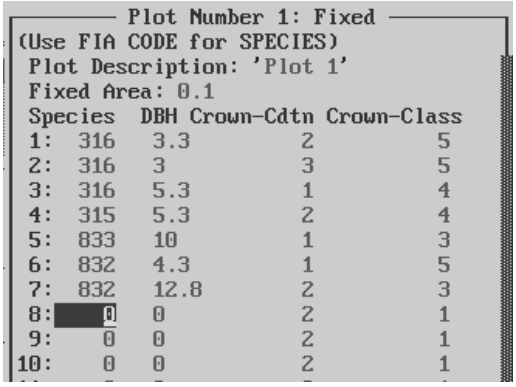


4) The previous description of the Risk Rating Study tells us that the **Plot Type** is **Fixed** and that each plot is 1/10 acre, so we set the **Default Fixed Area** to **0.1**. Because we are using only fixed- area plots in this example, we ignore the **Default Prism**. Using the **Arrow** keys or the mouse, navigate to each field to enter the parameters. Navigation on the Plot Parameters screen should be done with the mouse or **arrow** keys; the **Enter** key may inadvertently exit this screen. There are three plots in this sample so set **Total Number of Plots** to **3.** By counting the trees on each plot the **Maximum number of trees in any one plot** is **42**. **Crown Condition** is labeled as VIGOR78 on the data sheet and the **3-Class** system was used; clicking on the data-entry field to the right of the Crown Condition label exposes the three choices for this field. **Crown Class** data were collected so *check* that field (this can be done with the mouse). Press **Enter** to advance to the next screen only when all fields are complete. Your screen should look like this when you are finished.

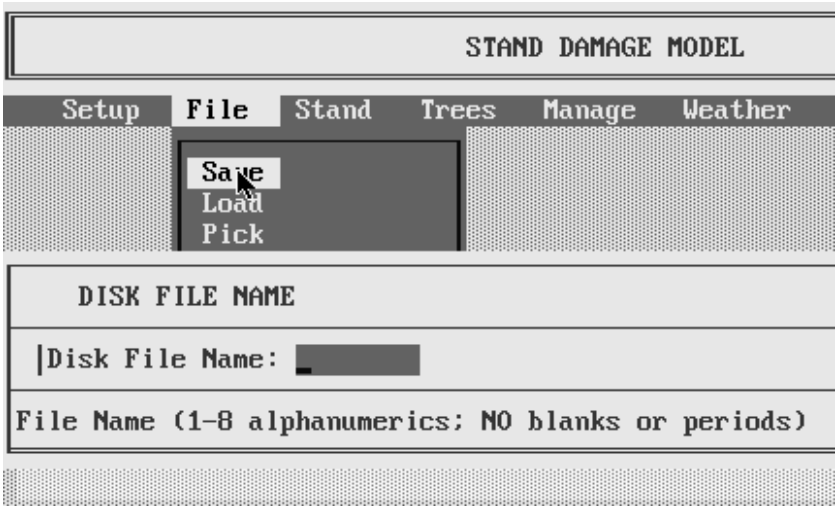


5) Once parameters are set and the Plot Parameter screen is exited, the first data-entry screen will appear. Navigation to each field can be accomplished using the mouse or pressing **Enter**. The first seven lines of tree data entry have been completed in the display below. When plot data-entry screens appear, the cursor is placed in the Species field for the first line of tree data. If you want to label the plot or change the plot area from the default, use the **up-arrow** key to navigate to the field you wish to access. When finished entering plot 1 data, press **Esc** or click the mouse outside the window to exit and move to the next plot.

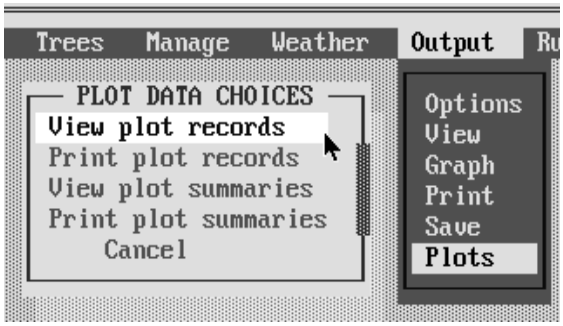
6) Repeat tree data entry (step 5) for plots 2 and 3.

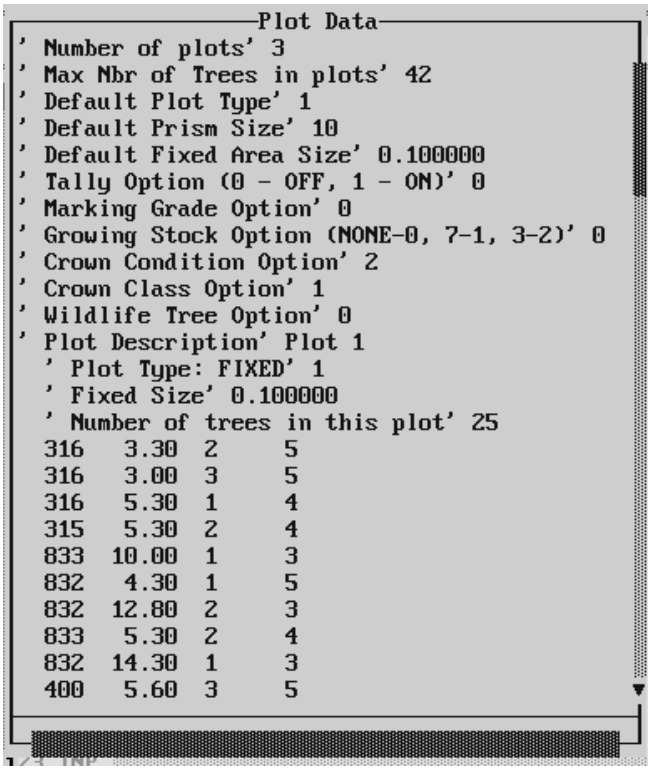


7) To save your work, Click on **File** on main menu bar followed by **Save.** Enter file name `myfixed` in the **Disk File Name** field. When completed, press **Enter** to save file. The software adds the `.inp` automatically.



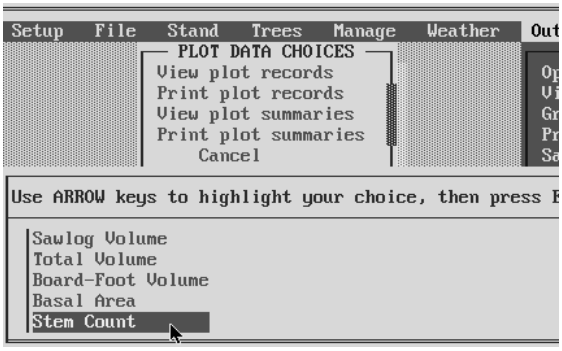
8) After the file is saved, the data can be reviewed. Click on **Output** on the main menu bar. Then click on **Plots** on the drop-down menu to gain access to four options under **Plot Data Choices.** Click on **View plot records** to review the data entered.





Note that the scroll bar along the right edge or bottom of this and other windows can be manipulated with the mouse. As you scroll down through this file you will see these data in the format as they are stored on disk.

9) Access **View plot summaries** from the same drop-down menu (step 8). This will give you four options to view the data as species by diameter tables. Here is an example of **Stem Count** per acre calculated from the data you entered.

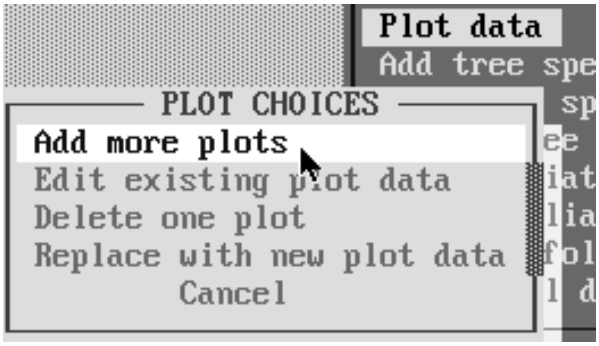


Stem Count

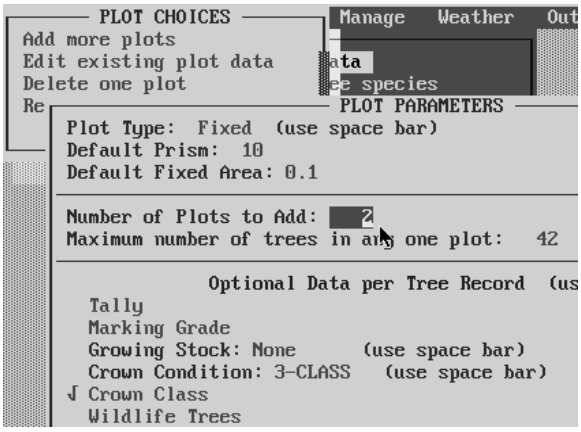
Number of Stems Per Acre

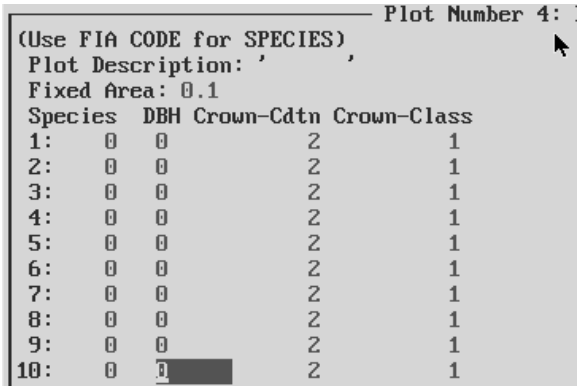
SPECIES	DIAMETER CLASS (IN) 2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18
315	0	0	3.3	0	0	0	0	0	
316	0	33.3	13.3	3.3	0	0	0	0	
372	0	3.3	0	6.7	0	3.3	0	0	
400	0	0	3.3	0	0	0	0	0	
832	0	26.7	50.0	20.0	16.7	10.0	6.7	3.3	
833	0	10.0	23.3	20.0	13.3	10.0	0	3.3	
837	0	0	3.3	10.0	3.3	0	0	0	
931	0	10.0	0	0	0	0	0	0	

10) If a mistake is found after reviewing data, click on **Plot** on the main menu bar to access the **Plot Choices** pop-up menu. You now can add, edit, delete, and replace trees or plots.

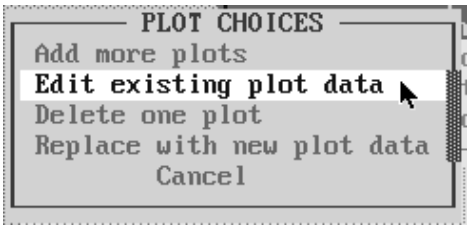


11) **Add more plots** returns you to the **Plot Parameters** screen and new plots can be added in the same manner as the original data. Type in the number of new plots; they will be added to the originals, and the new data can be entered. Shown here is the addition of one plot. Since data for three plots were entered earlier, the new plot is automatically given the label “Plot Number 4” at the top of the data-entry screen.

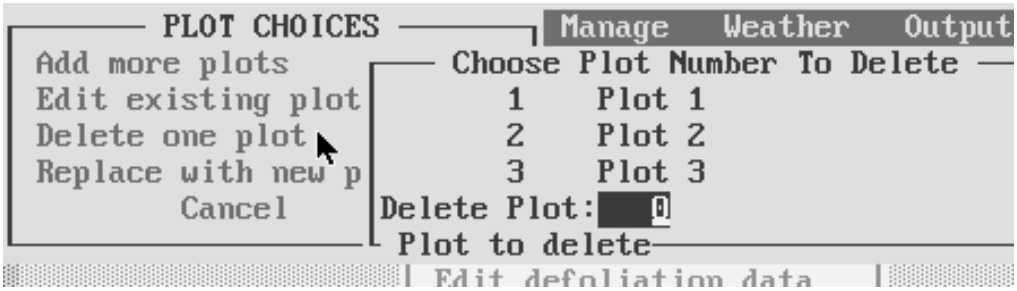




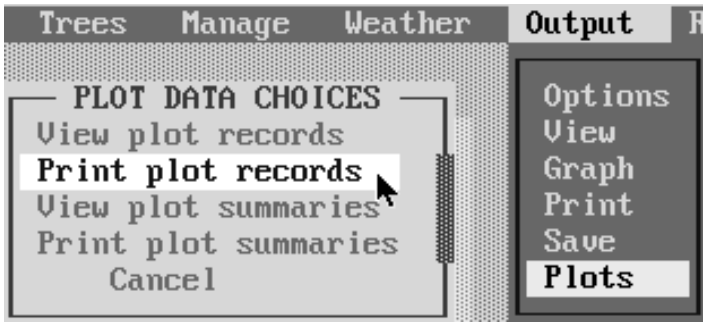
12) **Edit existing plot data** returns to the Plot Data screens (steps 4-5) where edits can be made. Remember to save (step 7) any changes that you make.

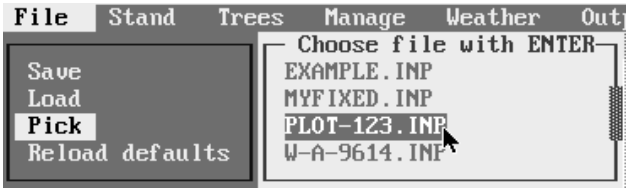


13) **Delete one plot** displays a new window and allows you to delete a particular plot. Plots are numbered consecutively as the data are entered; if you choose to use the Plot description labels ("Plot 1" was entered for the first plot), they appear beside the list of index numbers.



14) When all steps are completed, return to **Output/Plots Plot Data Choices** (Step 8). Click on **Print plot records** to print a copy of data you have entered. Next load the file **PLOT-123.INP**; this is the same data set and can be used for comparison. Click on **File** on the main menu bar followed by **Pick**. Four files will appear in the next window; three files are pre-loaded example files and the third will be the file **MYFIXED.INP** that you saved in step 7. Choose **PLOT-123.INP** and return to the Output-Plots to print. To check your work, compare the two files using the Compare.exe program found in the directory in which you installed the program software. Execute the program at the DOS prompt or by double-clicking on the program from Windows Explorer. They should match exactly. The Compare.exe program will prompt you for the file names and provide a description of the output it provides. If it finds any differences, it will provide the line numbers for these.



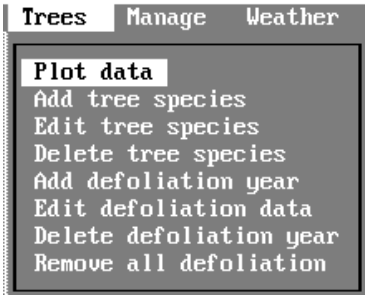


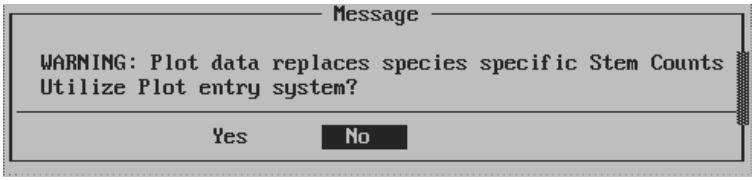
Variable-Radius Plot Data Entry

As was done for fixed-area plots, the following steps will guide you into the plot system (steps 1-3), through set up (4), data entry (5-6), saving your work (7), and viewing the results of your work in file format (8) as it was saved to disk, or in summary form (9) on a per-acre basis. Steps 10-13 demonstrate how to make additions, deletions, and edits to existing plot data. Step 14 leads you through printing your data as well as comparing your work to the variable-radius plot example data file that should match yours exactly.

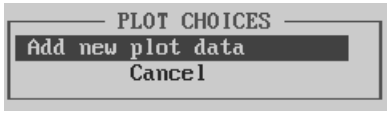
1) Locate field data sheets labeled Dorr Run Gypsy Moth Survey in the Appendix (pages 65-78).

2) Click on **Trees** located on main menu bar. Next, click on **Plot data** on the drop-down menu**.** A warning will appear.

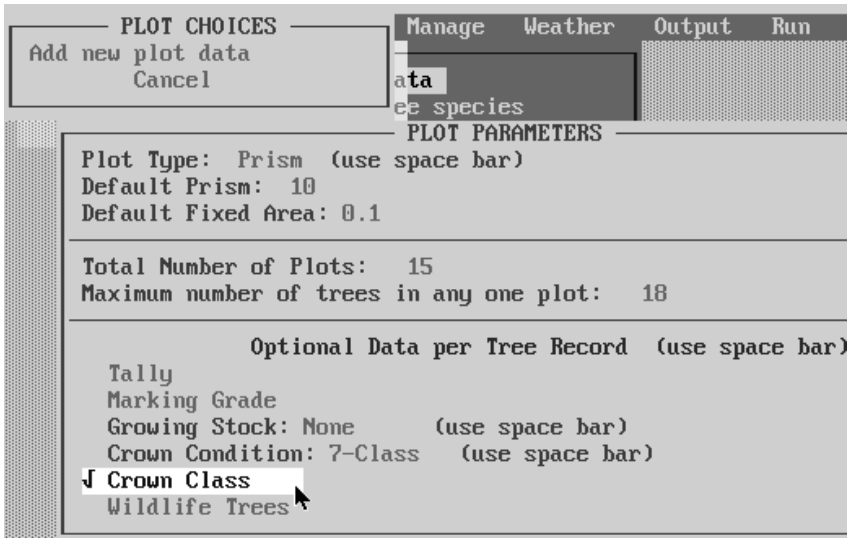




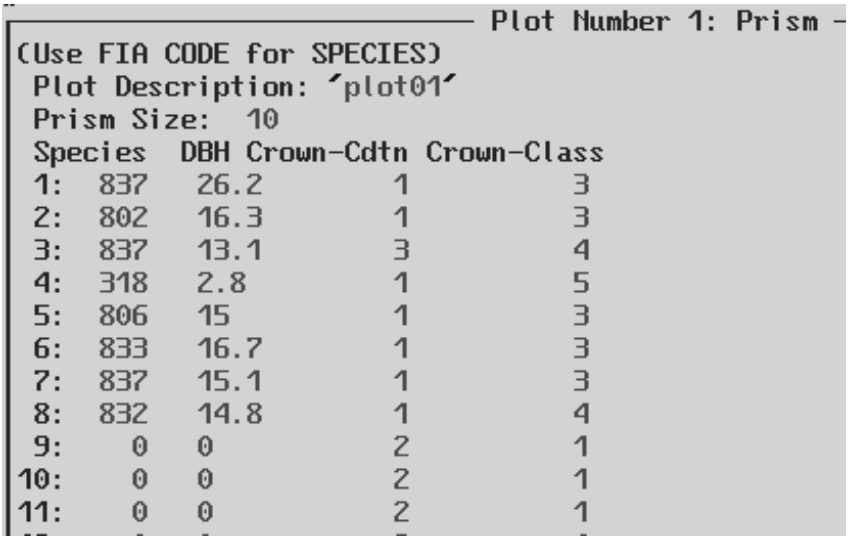
3) If you have data that previously were entered but not saved, this is your chance to stop and save that data. Click on **No** on the warning. Click on **File** on the main menu bar to access the **Save** option. See step 7 for details on saving data to disk. Once you have saved your data, return to step 2. If there are no data to save click on **Yes.** The Plot Choices window appears, click on **Add new plot data** to gain access to Plot Parameters.



4) Navigating on the Plot Parameters screen is done using the **arrow** keys or the mouse; the **Enter** key is used only to advance to the next screen. Set the **Plot Type** to **Prism**. The cruise data were obtained using a *10-factor* prism (the default) and consists of **15** plots; set the **Total Number of Plots** to 15. The **Maximum number of trees in any one plot** was 18, and can be found by counting the trees on each data sheet. As mentioned previously, the **Crown Condition** classification used in the tally was a 5-class system, but the **7-Class** system is chosen on this screen because the 5 class shares the first five definitions of the 7-class system. Data on the crown class were collected with the variable-radius cruise, so use the space bar to *check* (toggle on) the **Crown Class** option. This completes the setting of plot parameters. Press **Enter** or **Esc** to bring up the first plot screen for data entry.

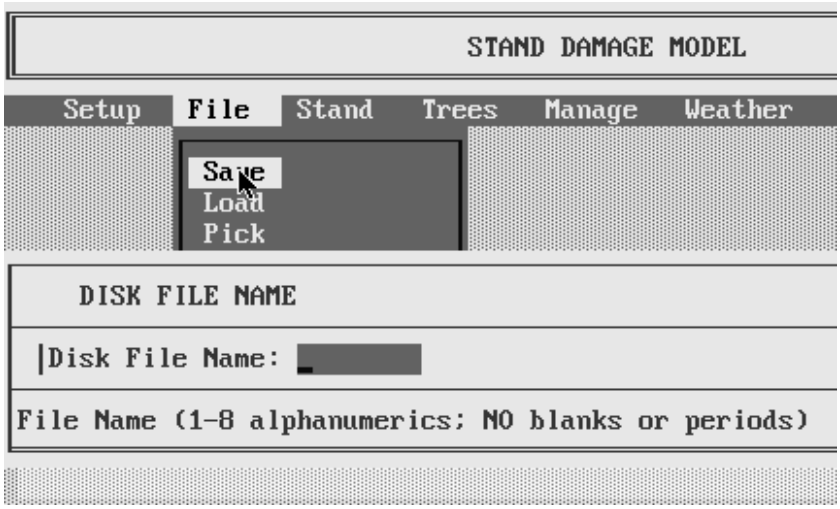


5) Once parameters are set, the data-entry screen will appear. Navigation to each field can be accomplished using the mouse or pressing **Enter**. Because two optional data fields were selected, there are four columns for data entry. Tree **Species** code and **DBH** are always present. The first seven lines of entry are demonstrated in the following display. The software will ignore lines that do not have a valid species and non-zero diameter entered. Because this example consists of 15 plots that were numbered in the field 1-7, and 9-16 (plot 8 was dropped), using the **Plot Description** field to provide the field label is advised. As new Plot data screens appear, the cursor is initially placed in the first **Species** field. Use the mouse or the **up-arrow** key to access the **Plot Description** field. When finished entering plot 1 data, press **Esc** to move to the next plot.

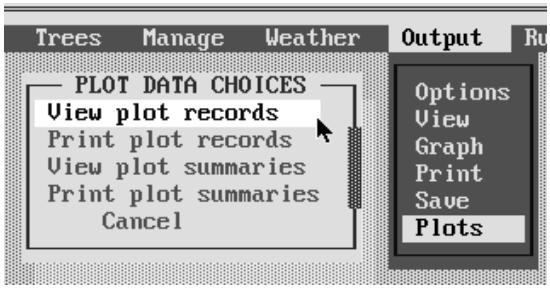


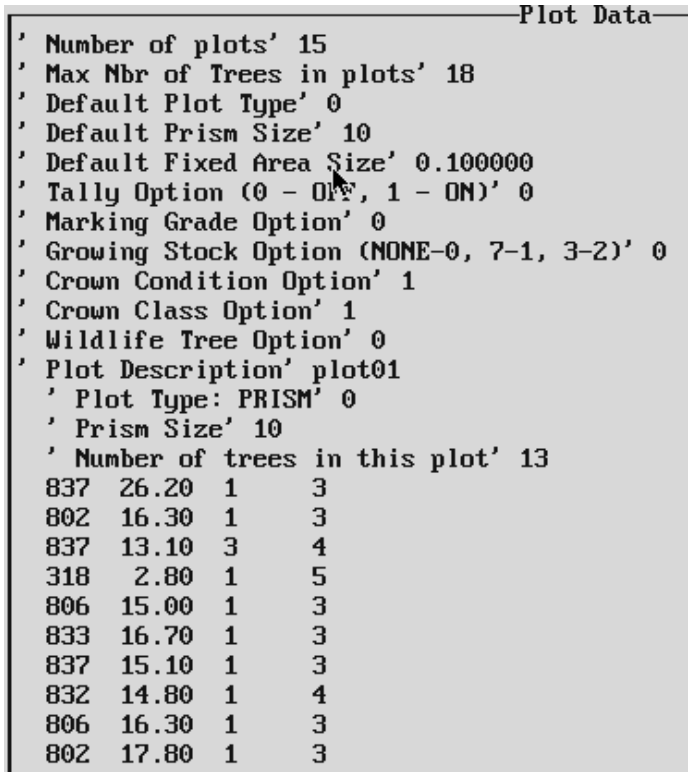
6) Repeat data entry (step 5) for plots 2-7, 9-16. Press **Esc** or click outside the window to move to the next plot data screen.

7) Save File
   Click on **File** on main menu bar followed by **Save**
   Enter file name `myfile` in the **Disk File Name** field. The software will add the `.inp` file extension for you.
   Press **Enter** to save to the file and exit the screen.

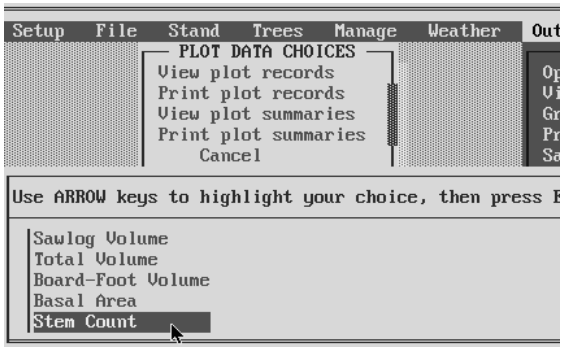


8) After the file is saved, the data can be reviewed. Click on **Output** on the main menu bar. Then click on **Plots** on the drop down menu to gain access to four options under **Plot Data Choices.** Click on **View plot records** to review the data entered. Your data should appear as in the following display. You can scroll through the data using the scroll bar on the right edge of the window.





9) Access **View plot summaries** from the same drop-down menu as in step 8. This will give you four options to view the data organized by species and diameter. Following is a display of **Stem Count** calculated from these data. All tables are on a per-acre basis.

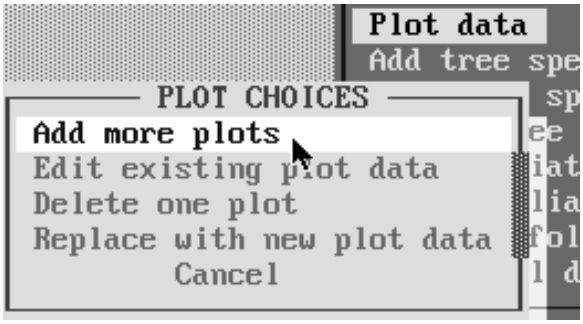


Stem Count

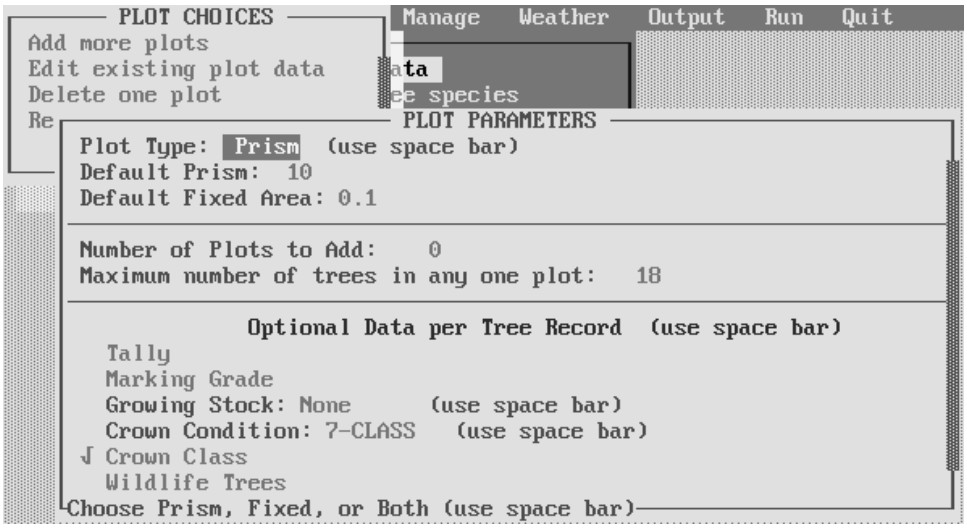
Number of Stems Per Acre

SPECIES	DIAMETER CLASS (IN) MIDPOINTS 2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0
316	0	13.6	0	6.3	2.6	0.8	0	0	0	0
318	15.6	13.0	15.7	4.1	5.8	2.9	0	0	0	0
400	0	5.5	5.7	5.7	0	0.8	0.6	1.0	0	0
602	0	0	0	0	0	0.9	0	0	0	0.3
621	0	9.4	0	0	0	0	0.6	0	0.7	0.3
693	0	0	4.5	4.1	0	0	0	0	0	0
711	0	0	0	0	1.5	0	0	0	0	0
743	0	0	0	0	0	1.6	0.6	0	0	0
802	0	0	4.2	1.6	2.6	4.2	4.1	4.3	4.6	2.7
806	0	0	0	0	0	0	0.6	1.0	0	0.9
832	0	0	3.2	0	0	0	0.6	0	0.4	0.3
833	0	0	0	0	0	2.5	0.6	2.8	2.2	1.3
837	0	0	0	0	0	0.9	1.4	2.8	0.4	1.2
999	0	0	0	1.7	0	1.0	0	0	0	0

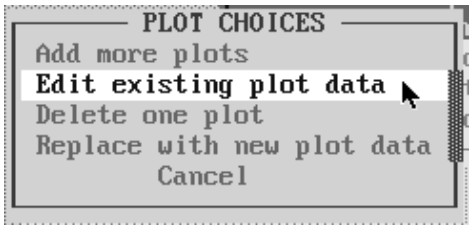
10) If a mistake is found after reviewing data, click on **Plot data** on the pull-down menu under **Trees** on the main menu bar to access the **Plot Choices** selection list. The first time you made this choice, the only options were to Add new plot data or Cancel. This list is now expanded, allowing you to add, edit, delete, and replace all plots.



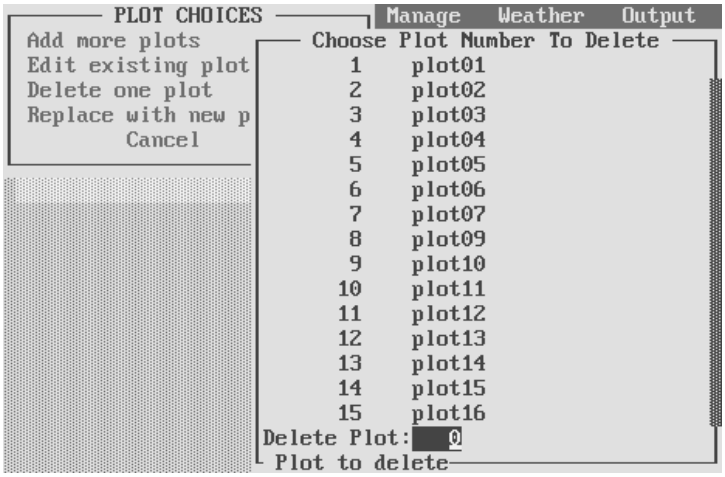
11) **Add more plots** returns to the **Plot Parameters** screen and any number of new plots can be added in the same manner as the original data. At this point it is possible to add fixed-area plots, more **Prism** plots, or both to your data. Type in the number of new plots; they will be added to the originals and the new data can be entered.



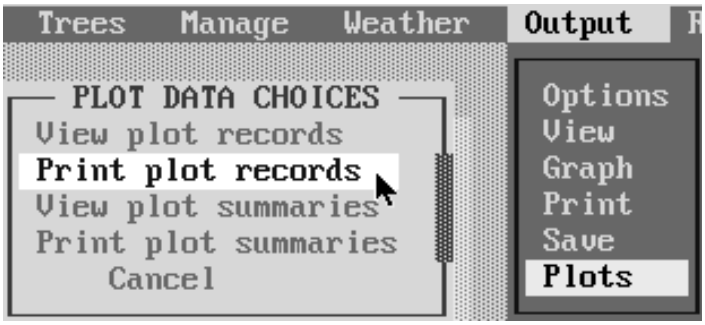
12) **Edit existing plot data** also returns you to the **Plot Parameter** screen (step 4). After making corrections to the design parameters, press **Enter** to access the actual tree data-entry screens (step 5).



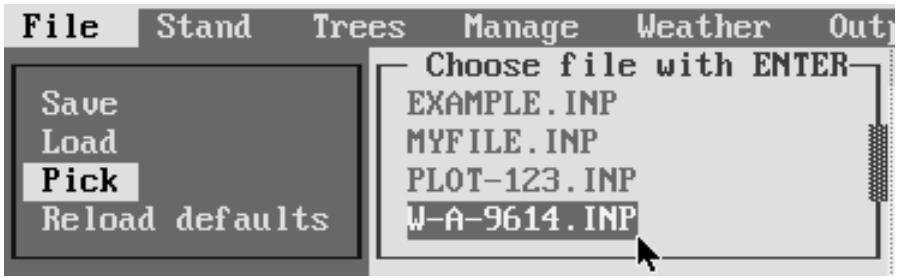
13) **Delete one plot** displays a new window and allow you to delete a particular plot by selecting the index number (note that in this case it differs by one from the plot number for plots 9-16).



14) When all steps are completed, return to **Output/ Plots Plot Data Choices** (step 8). Click on **Print plot records** to print a copy of data you have entered. Next load the file `W-A-9614.INP`; this is the same data set and can be used for comparison. Click on **File** on the main menu bar followed by **Pick**. Four files will appear in the next window; three files are pre-loaded example files and the fourth will be `myfile.inp` that you created in step 7.



Choose `W-A-9614.INP` and print. Compare the two printouts as a check. To check your work electronically, compare the two files using the Compare.exe program found in the directory in which you installed the program software. Execute the program at the DOS prompt or by double-clicking on the program from Windows Explorer. They should match exactly. The Compare.exe program will prompt you for the file names and provide a description of the output it provides. If it finds any differences, it will provide the line numbers for these.



Congratulations! You have completed the Plot System Tutorial.

Acknowledgments

We would like to thank John Juracko for his careful use of the model and for pointing out inconsistencies in the code. Juracko also assisted on the Plot System Tutorial. We also thank David Breakey for his suggestions regarding the use of DOS mode when problems arise, and thank Dan Yaussy, Arlyn Perkey and Dan Twardus, USDA Forest Service, and Dean Coble, Stephen F. Austin University, for their thoughtful reviews of this publication. Finally, we thank the users of the first version and beta releases of Version 2 for their feedback and assistance in making the Stand-Damage Model a more useful product.

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Appendix

Table 3.—Forest Service FIA species codes (species currently included in the model are followed by asterisk), common names and scientific names

Survey code	Common name	Scientific name
10	fir sp.	*Abies sp.*
11	Pacific silver fir	*Abies amabilis*
12*	balsam fir	*Abies balsamea*
15	white fir	*Abies concolor*
16	Fraser fir	*Abies fraseri*
17	grand fir	*Abies grandis*
18	corkbark fir	*Abies lasiocarpa v. ari.*
19	subalpine fir	*Abies lasiocarpa v. las.*
20	California red fir	*Abies magnifica*
21	Shasta red fir	*Abies magnifica v. sha.*
22	noble fir	*Abies procera*
40	white-cedar sp.	*Chamaecyparis sp.*
40	white-cedar sp.	*hamaecyparis sp.*
41	Port Orford white-cedar	*Chamaecyparis lawsoniana*
42	Alaska cedar	*Chamaecyparis nootkatensis*
43	Atlantic white-cedar	*Chamaecyparis thyoides*
50	cypress sp.	*Cupressus sp.*
51	Arizona cypress	*Cupressus arizonica*
59	redberry juniper	*Juniperus erythrocarpa*
60	juniper sp.	*Juniperus sp.*
62	California juniper	*Juniperus californica*
63	alligator juniper	*Juniperus deppeana*
64	western juniper	*Juniperus occidentalis*
65	Utah juniper	*Juniperus osteosperma*
66	Rocky Mt. Juniper	*Juniperus scopulorum*
67	southern redcedar	*Juniperus silicicola*
68*	eastern redcedar	*Juniperus virginiana*
69	oneseed juniper	*Juniperus monosperma*
70	European larch	*Larix decidua*
71*	tamarack	*Larix laricina*
72	subalpine larch	*Larix lyallii*
73	western larch	*Larix occidentalis*
74	Japanese larch	*Larix leptoleptis*
81	incense cedar	*Calocedrus decurrens*
90	spruce	*Picea sp.*
91	Norway spruce	*Picea abies*
92	Brewer spruce	*Picea breweriana*
93	Engelmann spruce	*Picea engelmannii*
94*	white spruce	*Picea glauca*
95*	black spruce	*Picea mariana*
96	blue spruce	*Picea pungens*
97*	red spruce	*Picea rubens*
98	Sitka spruce	*Picea sitchensis*
101	whitebark pine	*Pinus albicaulis*
102	bristlecone pine	*Pinus aristata*
103	knobcone pine	*Pinus attenuata*
104	foxtail pine	*Pinus balfouriana*
105*	jack pine	*Pinus banksiana*
106	pinyon	*Pinus edulis*
107	sand pine	*Pinus clausa*
108	lodgepole pine	*Pinus contorta*
109	Coulter pine	*Pinus coulteri*
110*	shortleaf pine	*Pinus echinata*

Continued

Table 3 continued

Survey code	Common name	Scientific name
111	slash pine	*Pinus elliottii*
112	Apache pine	*Pinus engelmannii*
113	limber pine	*Pinus flexilis*
114	Mexican white pine	*Pinus flexilis v. ref.*
115	spruce pine	*Pinus glabra*
116	Jeffrey pine	*Pinus jeffreyi*
117	sugar pine	*Pinus lambertiana*
118	Chihuahua pine	*Pinus lambertiana v. Chi.*
119	western white pine	*Pinus monticola*
120	bishop pine	*Pinus muricata*
121*	longleaf pine	*Pinus palustris*
122	ponderosa pine	*Pinus ponderosa*
123	Table Mountain pine	*Pinus pungens*
124*	Monterey pine	*Pinus radiata*
125*	red pine	*Pinus resinosa*
126*	pitch pine	*Pinus rigida*
127	Digger pine	*Pinus sabiniana*
128	pond pine	*Pinus serotina*
129*	eastern white pine	*Pinus strobus*
130	Scots pine	*Pinus sylvestris*
131*	loblolly pine	*Pinus taeda*
132	Virginia pine	*Pinus virginiana*
133	Austrian pine	*Pinus nigra*
133	singleleaf pinyon	*Pinus monophylla*
134	border pinyon	*Pinus discolor*
200	Douglas-fir sp.	*Pseudotsuga sp.*
201	bigcone Douglas-fir	*Pseudotsuga macrocarpa*
202	Douglas-fir	*Pseudotsuga menziesii*
211	coast redwood	*Sequoia sempervirens*
212	giant sequoia	*Sequoiadendron giganteum*
221	baldcypress	*Taxodium distichum*
222	pondcypress	*Taxodium distichum v. nut.*
231	Pacific yew	*Taxus brevifolia*
241*	northern white-cedar	*Thuja occidentalis*
242	western redcedar	*Thuja plicata*
251	California torreya	*Torreya californica*
260	hemlock sp.	*Tsuga sp.*
261*	eastern hemlock	*Tsuga canadensis*
262	Carolina hemlock	*Tsuga caroliniana*
263	western hemlock	*Tsuga heterophylla*
264	mountain hemlock	*Tsuga mertensiana*
300	acacia	*Acacia sp.*
310	maple sp.	*Acer sp.*
311	Florida maple	*Acer barbatum*
312	bigleaf maple	*Acer macrophyllum*
313	boxelder	*Acer negundo*
314	black maple	*Acer nigrum*
315	striped maple	*Acer pensylvanicum*
316*	red maple	*Acer rubrum*
317*	silver maple	*Acer saccharinum*
318*	sugar maple	*Acer saccharum*
319*	mountain maple	*Acer spicatum*
321	Rocky Mountain maple	*Acer glabrum*
322	bigtooth maple	*Acer grandidentatum*
330	buckeye sp.	*Aesculus sp.*
331	Ohio buckeye	*Aesculus glabra*

Continued

Table 3 continued

Survey code	Common name	Scientific name
332	yellow buckeye	*Aesculus octandra*
333	buckeye (except 331; 332)	*Aesculus sp.*
340	ailanthus sp.	*Ailanthus sp.*
341	tree-of-heaven	*Ailanthus altissima*
350	alder sp.	*Alnus sp.*
351	red alder	*Alnus rubra*
352	white alder	*Alnus rhombifolia*
353*	speckled alder	*Alnus rugosa*
354	European alder	*Alnus glutinosa*
355	serviceberry	*Amelanchier sp.*
360	madrone sp.	*Arbutus sp.*
361	Pacific madrone	*Arbutus menziessii*
367	pawpaw	*Asimina triloba*
370	birch sp.	*Betula sp.*
371*	yellow birch	*Betula alleghaniensis*
372*	sweet (black) birch	*Betula lenta*
373*	river (red) birch	*Betula nigra*
375*	paper birch	*Betula papyrifera*
376	western paper birch	*Betula papyrifera v. sub.*
379*	grey birch	*Betula populifolia*
381	chittamwood	*Bumelia lanuginosa*
391*	American hornbeam	*Carpinus caroliniana*
400*	hickory	*Carya sp.*
401	water hickory	*Carya aquatica*
402	bitternut hickory	*Carya cordiformis*
403	pignut hickory	*Carya glabra*
404	pecan	*Carya illinoensis*
405	shellbark hickory	*Carya laciniosa*
407	shagbark hickory	*Carya ovata*
408	black hickory	*Carya texana*
409	mockernut hickory	*Carya tomentosa*
421*	American chestnut	*Castanea dentata*
422	Allegheny chinkapin	*Castanea pumila*
423	Ozark chinkapin	*Castanea ozarkensis*
430	chinkapin sp.	*Castanopsis sp.*
431	giant chinkapin	*Castanopsis chrysophylla*
450	hardy catalpa	*Catalpa sp.*
451	southern catalpa	*Catalpa bignonioides*
452	northern catalpa	*Catalpa speciosa*
460	hackberry sp.	*Celtis sp.*
461	sugarberry	*Celtis laevigata*
462	northern hackberry	*Celtis occidentalis*
471	eastern redbud	*Cercis canadensis*
475	curlleaf cercocarpus	*Cercocarpus ledifolius*
476	alderleaf cercocarpus	*Cercocarpus montanus*
477	hairy cercocarpus	*Cercocarpus breviflorus*
479	little leaf cercocarpus	*Cercocarpus intricatus*
481	yellowwood	*Cladrastis lutea*
491*	flowering dogwood	*Cornus florida*
492	Pacific dogwood	*Cornus nuttallii*
500	hawthorn	*Crataegus sp.*
510	eucalyptus	*Eucalyptus sp.*
521	common persimmon	*Diospyros virginiana*
531*	American beech	*Fagus grandifolia*
540	ash sp.	*Fraxinus sp.*
541*	white ash	*Fraxinus americana*

Continued

Table 3 continued

Survey code	Common name	Scientific name
542	Oregon ash	*Fraxinus latifolia*
543*	black ash	*Fraxinus nigra*
544*	green ash	*Fraxinus pennsylvanica*
545*	pumpkin ash	*Fraxinus profunda*
546	blue ash	*Fraxinus quadrangulata*
551	waterlocust	*Gleditsia aquatica*
552	honeylocust	*Gleditsia triacanthos*
555	loblolly bay	*Gordonia lasianthus*
571	Kentucky coffeetree	*Gymnocladus dioicus*
580	silverbell sp.	*Halesia sp.*
591	American holly	*Ilex opaca*
600	walnut sp.	*Juglans sp.*
601*	butternut	*Juglans cinerea*
602*	black walnut	*Juglans nigra*
611*	sweetgum	*Liquidambar styraciflua*
621*	yellow-poplar (tuliptree)	*Liriodendron tulipifera*
631	tanoak	*Lithocarpus densiflorus*
641	Osage-orange	*Maclura pomifera*
650	magnolia sp.	*Magnolia sp.*
651	cucumbertree	*Magnolia acuminata*
652*	southern magnolia	*Magnolia grandiflora*
653	sweetbay	*Magnolia virginiana*
654	bigleaf magnolia	*Magnolia macrophylla*
660	crab apple	*Malus sp.*
661	apple sp.	*Malus sp.*
680	mulberry sp.	*Morus sp.*
681	white mulberry	*Morus alba*
682	red mulberry	*Morus rubra*
691	water tupelo	*Nyssa aquatica*
692	Ogeechee tupelo	*Nyssa ogeche*
693*	black tupelo (blackgum)	*Nyssa sylvatica*
694	swamp tupelo	*Nyssa biflora*
701*	eastern hophornbeam	*Ostrya virginiana*
711	sourwood	*Oxydendrum arboreum*
712	paulownia; empress tree	*Paulownia tomentosa*
721	redbay	*Persea borbonia*
730	sycamore sp.	*Platanus sp.*
731*	American sycamore	*Platanus occidentalis*
740	poplar	*Populus sp.*
741*	balsam poplar	*Populus balsamifera*
742*	eastern cottonwood	*Populus deltoides*
743*	bigtooth aspen	*Populus grandidentata*
744*	swamp cottonwood	*Populus heterophylla*
745	plains cottonwood	*Populus sargentii*
746*	quaking aspen	*Populus tremuloides*
747	black cottonwood	*Populus trichocarpa*
748	Fremont cottonwood	*Populus fremontii*
749	narrowleaf cottonwood	*Populus angustifolia*
752	white poplar	*Populus alba*
755	mesquite	*Prospopis sp.*
760	cherry; peach; plum sp.	*Prunus sp.*
761*	pin cherry	*Prunus pensylvanica*
762*	black cherry	*Prunus serotina*
763*	chokecherry	*Prunus virginiana*
764	plums; cherries	*Prunus sp.*
765	Canada plum	*Prunus nigra*

Continued

Table 3 continued

Survey code	Common name	Scientific name
766	American plum	*Prunus americana*
800	oak sp. (deciduous)	*Quercus sp.*
801	coast live oak	*Quercus agrifolia*
802*	white oak	*Quercus alba*
803	Arizona white oak	*Quercus arizonica*
804	swamp white oak	*Quercus bicolor*
805	canyon live oak	*Quercus chrysolepis*
806*	scarlet oak	*Quercus coccinea*
807	blue oak	*Quercus douglasii*
808	Durand oak	*Quercus durandii*
809	northern pin oak	*Quercus ellipsoidalis*
810	Emory oak	*Quercus emoryi*
811	Engelmann oak	*Quercus engelmannii*
812*	southern red oak	*Quercus falcata*
813	cherrybark oak	*Quercus falcata v. pag.*
814	Gambel oak	*Quercus gambelii*
815	Oregon white oak	*Quercus garryana*
816	bear oak	*Quercus ilicifolia*
817	shingle oak	*Quercus imbricaria*
818	California red oak	*Quercus kelloggii*
819	turkey (scrub) oak	*Quercus laevis*
820*	laurel oak	*Quercus laurifolia*
821	California white oak	*Quercus lobata*
822	overcup oak	*Quercus lyrata*
823	bur oak	*Quercus macrocarpa*
824*	blackjack oak	*Quercus marilandica*
825	swamp chestnut oak	*Quercus michauxii*
826	chinkapin oak	*Quercus muehlenbergii*
827	water oak	*Quercus nigra*
828	Nuttall oak	*Quercus nuttallii*
829	Mexican blue oak	*Quercus oblongifolia*
830	pin oak	*Quercus palustris*
831	willow oak	*Quercus phellos*
832*	chestnut oak	*Quercus prinus*
833*	northern red oak	*Quercus rubra*
834	Shumard oak	*Quercus shumardii*
835*	post oak	*Quercus stellata*
836	Delta post oak	*Quercus stellata v. mis.*
837*	black oak	*Quercus velutina*
838	live oak	*Quercus virginiana*
839	interior live oak	*Quercus wislizenii*
840	bluejack oak	*Quercus incana*
843	silverleaf oak	*Quercus hypoleucoides*
850	oak sp. (evergreen)	*Quercus sp.*
899	oak	*Quercus sp.*
901	black locust	*Robinia pseudoacacia*
902	New Mexico locust	*Robinia neomexicana*
920*	willow	*Salix sp.*
921	peachleaf willow	*Salix amygdaloides*
922	black willow	*Salix nigra*
923	diamond willow	*Salix eriocephala*
925	Chinese tallowtree	*Sapium sebiferum*
931*	sassafras	*Sassafras albidum*
935*	American mountain-ash	*Sorbus americana*
936	European mountain-ash	*Sorbus aucuparia*
945	saltcedar; tamarisk	*Tamarix chinesis*

Continued

Table 3 continued

Survey code	Common name	Scientific name
950	basswood sp.	*Tilia sp.*
951*	American basswood	*Tilia americana*
952	white basswood	*Tilia heterophylla*
970*	elm	*Ulmus sp.*
971*	winged elm	*Ulmus alata*
972*	American elm	*Ulmus americana*
973	cedar elm	*Ulmus crassifolia*
974	Siberian elm	*Ulmus pumila*
975	slippery elm	*Ulmus rubra*
976	September elm	*Ulmus serotina*
977	rock elm	*Ulmus thomasii*
980	tung-oil-tree	*Aleurites fordii*
981	sparkleberry	*Vaccinium arboreum*
981	California laurel	*Umbellularia californica*
983	chinaberry	*Melia azedarach*
984	water elm	*Planera aquatica*
985	American smoketree	*Cotinus obovatus*
990	tesota	*Olneya tesota*
999*	unknown/not listed;	currently: *Alnus crispa*, green alder

Table 4.—Gypsy moth suitability rankings: 1 is preferred food for gypsy moth, 2 is resistant but fed upon, 3 is immune

Scientific name	Common name	Ranking
Abelia chinensis var. grandifa	glossy abelia	3
Abies amabilis	Pacific silver fir	2
Abies balsamea	balsam fir	3
Abies bifolia	Rocky Mt. alpine fir	3
Abies bracteata	bristlecone fir	2
Abies concolor	white fir	2
Abies fraseri	Fraser fir	3
Abies grandis	grand fir	2
Abies holophylla	Manchurian fir	2
Abies lasiocarpa	subalpine fir	2
Abies lowiana	Sierra white fir	2
Abies magnifica	California red fir	2
Abies procera	noble fir	2
Acacia baileyana	Bailey acacia	2
Acacia farnesiana	sweet acacia	2
Acacia greggii	catclaw acacia	2
Acacia koa	koa acacia	2
Acacia longifolia	Sydney golden wattle	2
Acacia sp.	Acacia	2
Acacia tortuosa	twisted acacia	2
Acacia wrightii	Wright acacia	2
Acer barbatum	Florida maple	2
Acer campestre	hedge maple	2
Acer circinatum	vine maple	2
Acer ginnala	Amur maple	3
Acer glabrum	Rocky Mountain maple	2
Acer grandidentatum	bigtooth maple	2
Acer japonicum	fullmoon maple	2
Acer leucoderme	chalk maple	2
Acer macrophyllum	bigleaf maple	2
Acer negundo	boxelder	2
Acer nigrum	black maple	2
Acer palmatum	Japanese maple	2
Acer pensylvanicum	striped maple	3
Acer platanoides	Norway maple	2
Acer pseudoplatanus	sycamore maple	2
Acer rubrum	red maple	2
Acer saccharinum	silver maple	3
Acer saccharum	sugar maple	2
Acer spicatum	mountain maple	3
Acer tataricum	Tatar maple	2
Achras emarginata	wild dilly	2
Acoelorrhaphe wrightii	paurotis-palm	3
Adonidia merrillii	Manila palm	3
Aesculus californica	California buckeye	3
Aesculus glabra	Ohio buckeye	2
Aesculus hippocastanum	horsechestnut	3
Aesculus octandra	yellow buckeye	3
Aesculus pavia	red buckeye	2
Aesculus sylvatica	painted buckeye	2
Ailanthus altissima	tree-of-heaven	2
Albizia julibrissin	silk tree	3
Aleurites fordii	tung-oil-tree	2
Alnus maritime	seaside alder	1
Alnus oblongifolia	Arizona alder	1
Alnus rhombifolia	white alder	2

Continued

Table 4 continued

Scientific name	Common name	Ranking
Alnus rubra	red alder	1
Alnus rugosa	speckled alder	1
Alnus serrulata	smooth alder	2
Alnus sinuate	Sitka alder	2
Alnus tenuifolia	thinleaf alder	1
Alvaradoa amorphoides	Mexican alvaradoa	2
Amelanchier alnifolia	western serviceberry	2
Amelanchier arborea	downy serviceberry	2
Amelanchier Canadensis	eastern serviceberry	2
Amelanchier laevis	smooth serviceberry	2
Amelanchier sp.	serviceberry	2
Amphitecna latifolia	black-calabash	3
Amyris elemifera	torchwood	2
Annona glabra	pond apple	2
Aralia spinosa	devils-walkingstick	3
Arbutus arizonica	Arizona madrone	2
Arbutus menziesii	Pacific madrone	1
Arbutus texana	Texas madrone	2
Arbutus unedo	strawberry tree	2
Ardisia escallonioides	marlberry	2
Ardisia japonica	ardisia	3
Arecastrum romanzoffianum	queen palm	3
Asimina triloba	pawpaw	2
Avicennia germinans	black mangrove	2
Betula alba	cut leaved birch	2
Betula alleghaniensis	yellow birch	3
Betula lenta	sweet (black) birch	2
Betula nigra	river (red) birch	1
Betula occidentalis	water birch	2
Betula papyrifera	paper birch	1
Betula pendula	cut leaf weeping birch	1
Betula populifolia	grey birch	1
Betula pumila	bog birch	1
Betula verrucosa	European white birch	1
Bourreria ovata	Bahama strongback	3
Broussonetia papyrifera	paper mulberry	3
Bumelia lanuginose	chittamwood	2
Bursera simaruba	gumbo-limbo	2
Callitris glaucophylla	white cypress pine	3
Calocedrus decurrens	incense cedar	3
Calycanthus floridus	hairy (Carolina) alls	3
Calyptranthes pallens	pale lidflower	2
Calyptranthes zuzygium	myrtle-of-the-river	2
Canella winterana	canella	2
Canotia holacantha	canotia	2
Capparis cynophallophora	Jamaica caper	2
Caragana arborescens	Siberian pea tree	2
Carica papaya	papaya	2
Carpinus caroliniana	American hornbeam	2
Carya aquatica	water hickory	2
Carya cordiformis	bitternut hickory	2
Carya floridana	scrub hickory	2
Carya glabra	pignut hickory	2
Carya illinoensis	pecan	2
Carya laciniosa	shellbark hickory	2
Carya myristiciformis	nutmeg hickory	2
Carya ovalis	red hickory	2
Carya ovata	shagbark hickory	3

Continued

Table 4 continued

Scientific name	Common name	Ranking
Carya pallida	sand hickory	2
Carya sp.	hickory	2
Carya texana	black hickory	2
Carya tomentosa	mockernut hickory	2
Caryota urens	wine palm	3
Castanea dentate	American chestnut	2
Castanea ozarkensis	Ozark chinkapin	2
Castanea pumila	Allegheny chinkapin	2
Castanopsis chrysophylla	giant chinkapin	1
Casuarina equisetifolia	horsetail-tree	2
Casuarina stricta	coast beefwood	2
Catalpa bignonioides	southern catalpa	3
Catalpa speciosa	northern catalpa	3
Catalpa sp.	hardy catalpa	3
Ceanothus arboreus	feltleaf ceanothus	3
Ceanothus integerimus	deer brush	3
Ceanothus maritimus	ceanothus	2
Ceanothus spinosus	spiny ceanothus	3
Ceanothus sp.	Ceanothus	3
Ceanothus thyrsiflorus	blueblossom	3
Cedrus atlantica	Atlas cedar	2
Cedrus deodara	deodar cedar	2
Cedrus libani	Cedar of Lebanon	2
Celtis laevigata	sugarberry	3
Celtis occidentalis	northern hackberry	3
Celtis tenuifolia	dwarf hackberry	3
Cephalanthus occidentalis	buttonbush	2
Cercidium floridum	blue paloverde	2
Cercidium microphyllum	yellow paloverde	2
Cercis Canadensis	eastern redbud	3
Cercis occidentalis	western redbud	3
Cercocarpus betuloides	birchleaf cercocarpus	2
Cercocarpus breviflorus	hairy cercocarpus	2
Cercocarpus intricatus	little leaf cercocarp	2
Cercocarpus ledifolius	curlleaf cercocarpus	2
Cercocarpus montanus	alderleaf cercocarpus	2
Cereus giganteus	saguaro	2
Chaenomeles lagenaria	Japanese quince	2
Chamaecyparis lawsoniana	Port Orford white-cedar	3
Chamaecyparis nootkatensis	Alaska cedar	3
Chamaecyparis thyoides	Atlantic white-cedar	3
Chilopsis linearis	desert-willow	3
Chionanthus virginica	fringetree	2
Chrysobalanus icaco	cocoplum	2
Chrysophyllum oliviforme	satinleaf	2
Cinnamomum camphora	camphor-tree	1
Citharexylum fruticosum	Florida fiddlewood	2
Citrus aurantifolia	lime	2
Citrus limon	lemon	3
Citrus sinensis	orange	2
Cladrastis lutea	yellowwood	2
Clethra alnifolia	sweet pepperbush	3
Clethra sp.	pepperbush	3
Cliftonia monophylla	buckwheat tree	2
Coccoloba diversifolia	doveplum	2
Coccoloba uvifera	seagrape	2
Coccothrinax argentata	Florida silverpalm	3
Cocos nucifera	coconut palm	3

Continued

Table 4 continued

Scientific name	Common name	Ranking
Colubrina elliptica	soldierwood	2
Conocarpus erectus	button-mangrove	2
Cordia sebestena	Geiger-tree	3
Cornus alternifolia	alternate-leaf dogwood	3
Cornus drummondii	roughleaf dogwood	3
Cornus florida	flowering dogwood	2
Cornus nuttallii	Pacific dogwood	3
Cornus racemosa	gray dogwood	3
Cornus rugosa	roundleaf dogwood	3
Cornus sp.	dogwood	3
Cornus stolonifera	red-osier dogwood	3
Corylus americana	American hazelnut	1
Corylus avellana	European filbert	1
Corylus cornuta	beaked hazelnut	2
Cotinus coggygria	smoketree	1
Cotinus obovatus	American smoketree	1
Cowania mexicana	cliffrose	2
Crataegus berberifolia	barberryleaf hawthorn	1
Crataegus brachyacantha	blueberry hawthorn	1
Crataegus coccinea	scarlet hawthorn	1
Crataegus crus-galli	cockspur hawthorn	1
Crataegus douglasii	black hawthorn	1
Crataegus intricata	Biltmore hawthorn	1
Crataegus marshallii	parsley hawthorn	1
Crataegus mollis	downy hawthorn	1
Crataegus monogyna	oneseed hawthorn	2
Crataegus opaca	riverflat hawthorn	1
Crataegus oxyacantha	English hawthorn	1
Crataegus pruinosa	frosted hawthorn	1
Crataegus saligna	willow hawthorn	1
Crataegus spathulata	littlehip hawthorn	1
Crataegus sp.	hawthorn	1
Cunninghamia lanceolata	blue Chinese fir	3
Cupressocyparia leylandii	Leyland cypress	3
Cupressus arizonica	Arizona cypress	3
Cupressus bakeri	Baker cypress	3
Cupressus goveniana	Gowen cypress	3
Cupressus guadalupensis	Guadalupe cypress	3
Cupressus macnabiana	MacNab cypress	3
Cupressus macrocarpa	Monterey cypress	3
Cupressus sargentii	Sargent cypress	3
Cydonia oblonga	quince	2
Cyrilla racemiflora	swamp cyrilla	2
Dalea spinosa	smokethorn	2
Diospyros texana	Texas persimmon	3
Diospyros virginiana	common persimmon	3
Dipholis salicifolia	willow bustic	2
Drypetes lateriflora	Guiana plum	3
Elaeagnus angustifolia	Russian olive	3
Elliottia racemosa	Elliottia	2
Eriobotrya japonica	loquat tree	2
Erythrina herbacea	eastern coralbean	2
Eucalyptus botrioides	eucalyptus	2
Eucalyptus camaldulensis	redgum	2
Eucalyptus camphora	eucalyptus	2
Eucalyptus cinerea silver	dollar eucalyptus	1
Eucalyptus diversifolia	eucalyptus	2
Eucalyptus globulus	bluegum eucalyptus	2

Continued

Table 4 continued

Scientific name	Common name	Ranking
Eucalyptus gunnii	cider gum	1
Eucalyptus leucoxylon	white ironbark	2
Eucalyptus polyanthemos	silver dollar gum	2
Eucalyptus pulchella	white peppermint	2
Eucalyptus rudis	desert gum	2
Eucalyptus sideroxylon	red ironbark	2
Eucalyptus sp.	eucalyptus	2
Eucalyptus tereticornis	horncap eucalyptus	2
Euonymus atropurpureus	eastern wahoo	2
Euonymus europaeus	European spindle tree	2
Euonymus japonicus	evergreen euonymus	2
Euonymus occidentalis	western wahoo	2
Exostema caribaeum	Caribbean princewood	2
Exothea paniculata	inkwood	2
Fagus grandifolia	American beech	2
Fagus sylvatica	European (purple) beech	2
Fatsia japonica	Japanese aralia	3
Ficus aurea Florida	strangler fig	2
Ficus benjamina	benjamin fig	3
Ficus carica	common fig	2
Ficus elastica	India-rubber tree	2
Ficus lyrata	fiddle leaf fig	2
Firmiana simplex	Chinese parasoltree	2
Forestiera acuminata	swamp-privet	3
Fraxinus americana	white ash	3
Fraxinus anomala	singleleaf ash	3
Fraxinus caroliniana	Carolina ash	3
Fraxinus cuspidata	fragrant ash	3
Fraxinus excelsior	European ash	2
Fraxinus greggii	Gregg ash	3
Fraxinus latifolia	Oregon ash	3
Fraxinus nigra	black ash	3
Fraxinus pennsylvanica	green ash	3
Fraxinus profunda	pumpkin ash	3
Fraxinus quadrangulata	blue ash	3
Fraxinus sp.	ash	3
Fraxinus texensis	Texas ash	3
Fraxinus velutina	velvet ash	3
Garrya fremontii	silktassel	3
Ginkgo biloba	ginko	3
Gleditsia aquatica	waterlocust	3
Gleditsia triacanthos	honeylocust	3
Gordonia lasianthus	loblolly bay	2
Grevillea 'noellii'	Grevillea	3
Grevillea robusta	silk-oak	3
Guaiacum sanctum	roughbark lignumvitae	2
Guettarda elliptica	elliptic leaf velvetseed	2
Guettarda scabra	roughleaf velvetseed	2
Gyminda latifolia	West Indies falsebox	2
Gymnanthes lucida	oysterwood	3
Gymnocladus dioicus	Kentucky coffeetree	3
Hakea sp.	Hakea	2
Halesia carolina	silver bell	3
Hamamelis virginiana	witch-hazel	1
Heteromeles arbutifolia	Christmas-berry	2
Hibiscus rosa-sinensis	Chinese hibiscus	2
Hibiscus tiliaceus	sea hibiscus	2
Hippomane mancinella	manchineel	3

Continued

Table 4 continued

Scientific name	Common name	Ranking
Ilex aquifolium	English holly	3
Ilex cassine	dahoon	3
Ilex coriacea	large gallberry	3
Ilex decidua	possumhaw	3
Ilex glabra	inkberry	3
Ilex krugiana	tawnyberry holly	3
Ilex montana	mountain winterberry	3
Ilex opaca	American holly	3
Ilex verticillata	common winterberry	3
Ilex vomitoria	yaupon	3
Jasminum nudiflorum	winter jasmine	3
Juglans californica	California walnut	2
Juglans cinerea	butternut	2
Juglans hindsii	Hinds walnut	2
Juglans major	Arizona walnut	2
Juglans microcarpa	little walnut	2
Juglans nigra	black walnut	2
Juniperus ashei	Ashe juniper	3
Juniperus californica	California juniper	3
Juniperus coahuilensis	roseberry	3
Juniperus communis	common juniper	3
Juniperus deppeana	alligator juniper	3
Juniperus erythrocarpa	redberry juniper	3
Juniperus flaccida	drooping juniper	3
Juniperus monosperma	oneseed juniper	3
Juniperus occidentalis	western juniper	3
Juniperus osteosperma	Utah juniper	3
Juniperus pinchotii	Pinchot juniper	3
Juniperus scopulorum	Rocky Mt. juniper	3
Juniperus virginiana	eastern redcedar	3
Krugiodendron ferreum	leadwood	2
Laguncularia racemosa	white mangrove	2
Larix decidua	European larch	1
Larix laricina	tamarack	1
Larix lyallii	subalpine larch	1
Larix occidentalis	western larch	1
Leitneria floridana	corkwood	2
Lindera benzoin	spicebush	3
Liquidambar styraciflua	sweetgum	1
Liriodendron tulipifera	yellow-poplar (tuliptree)	3
Lithocarpus densiflorus	tanoak	1
Lyonia ferruginea	tree lyonia	2
Lyonothamnus floribundus	Lyontree	2
Lysiloma latisiliquum	Bahama lysiloma	2
Maclura pomifera	Osage-orange	3
Magnolia acuminata	cucumbertree	3
Magnolia ashei	Ashe magnolia	3
Magnolia fraseri	Fraser magnolia	3
Magnolia grandiflora	southern magnolia	3
Magnolia macrophylla	bigleaf magnolia	3
Magnolia pyramidata	pyramid magnolia	3
Magnolia soulangeana	rustica rubra	3
Magnolia tripetala	umbrella-tree	3
Magnolia virginiana	sweetbay	3
Malus coronaria	sweet crab apple	1
Malus ioensis	prairie crab apple	1
Malus sp.	crab apple	1
Mastichodendrofoe tidissimum	false mastic	2

Continued

Table 4 continued

Scientific name	Common name	Ranking
Melaleuca decussata	lilac melaleuca	1
Melaleuca quinquenervia	cajeput tree	2
Melia azedarach	chinaberry	2
Mespilus germanica	European medlar	2
Metasequoia glyptostroboides	dawn redwood	2
Metopium toxiferum	Florida poisontree	1
Morus alba	white mulberry	3
Morus alba var. tatarica	Russian mulberry	2
Morus microphylla	Texas mulberry	3
Morus nigra	black mulberry	3
Morus rubra	red mulberry	3
Myrica californica	Pacific waxmyrtle	2
Myrica cerifera	bayberry	2
Nyssa aquatica	water tupelo	3
Nyssa biflora	swamp tupelo	3
Nyssa ogeche	Ogeeche tupelo	3
Nyssa sylvatica	black tupelo (black gum)	3
Olea europaea	olive	3
Olneya tesota	tesota	2
Osmanthus americanus	devilwood	3
Ostrya knowltonii	Knowlton hophornbeam	2
Ostrya virginiana	eastern hophornbeam	1
Oxydendrum arboreum	sourwood	2
Parkinsonia aculeata	Jerusalem thorn	2
Paulownia tomentosa	royal paulownia	3
Persea americana	avocado	2
Persea borbonia	redbay	2
Photinia glabra	Japanese photinia	2
Photinia serrulata	Chinese medlar	2
Photinia sp.	photinia	3
Picea abies	Norway spruce	2
Picea breweriana	Brewer spruce	2
Picea engelmannii	Engelmann spruce	2
Picea glauca	white spruce	2
Picea glauca var. albertiana	dwarf Alberta spruce	2
Picea mariana	black spruce	2
Picea polita	tigertail spruce	2
Picea pungens	blue spruce	2
Picea rubens	red spruce	2
Picea sitchensis	Sitka spruce	2
Picea sp.	spruce	2
Picramnia pentandra	bitterbush	2
Pinckneya pubens	pinckneya	2
Pinus albicaulis	whitebark pine	2
Pinus aristata	bristlecone pine	2
Pinus attenuata	knobcone pine	2
Pinus balfouriana	foxtail pine	2
Pinus banksiana	jack pine	2
Pinus cembroides	Mexican pinyon	2
Pinus clausa	sand pine	2
Pinus contorta	lodgepole pine	2
Pinus coulteri	Coulter pine	2
Pinus discolor	border pinyon	2
Pinus echinata	shortleaf pine	2
Pinus edulis	pinyon	2
Pinus elliottii	slash pine	2
Pinus engelmannii	Apache pine	2
Pinus flexilis	limber pine	2

Continued

Table 4 continued

Scientific name	Common name	Ranking
Pinus glabra	spruce pine	2
Pinus halepensis	Aleppo pine	2
Pinus jeffreyi	Jeffrey pine	2
Pinus lambertiana	sugar pine	2
Pinus longaeva	intermountain bristle	2
Pinus monophylla	singleleaf pinyon	2
Pinus monticola	western white pine	2
Pinus mugo Swiss	mountain pine	2
Pinus muricata	bishop pine	2
Pinus nigra	Austrian pine	2
Pinus palustris	longleaf pine	2
Pinus pinea Italian	stone pine	3
Pinus ponderosa	ponderosa pine	2
Pinus pungens	Table Mountain pine	2
Pinus quadrifolia	Parry pinyon	2
Pinus radiata	Monterey pine	2
Pinus resinosa	red pine	2
Pinus rigida	pitch pine	3
Pinus sabiniana	Digger pine	2
Pinus serotina	pond pine	2
Pinus sp.	pine	2
Pinus strobiformis	southwestern white pine	2
Pinus strobes	eastern white pine	2
Pinus sylvestris	Scots pine	2
Pinus taeda	loblolly pine	2
Pinus thunbergiana	Japanese black pine	3
Pinus torreyana	Torrey pine	2
Pinus virginiana	Virginia pine	2
Pinus washoensis	Washoe pine	2
Piscidia piscipula	Florida fishpoison tree	2
Pistacia texana	Texas pistache	1
Pistacia vera	pistachio	1
Planera aquatica	water elm	2
Platanus occidentalis	American sycamore	3
Platanus orientalis	Oriental planetree	2
Platanus racemosa	California sycamore	3
Platanus wrightii	Arizona sycamore	3
Populus alba	white poplar	2
Populus angustifolia	narrowleaf cottonwood	1
Populus balsamifera	balsam poplar	1
Populus deltoides	eastern cottonwood	2
Populus fremontii	Fremont cottonwood	2
Populus grandidentata	bigtooth aspen	1
Populus heterophylla	swamp cottonwood	1
Populus nigra var. italica	Lombardy poplar	1
Populus sargentii	plains cottonwood	1
Populus sp.	poplar	1
Populus tremuloides	quaking aspen	1
Populus trichocarpa	black cottonwood	1
Prosopis glandulosa	honey mesquite	2
Prosopis pubescens	screwbean mesquite	2
Prunus alleghaniensis	Allegheny plum	2
Prunus americana	American plum	2
Prunus angustifolia	Chickasaw plum	2
Prunus avium	sweet cherry	2
Prunus caroliniana	Carolina laurelcherry	2
Prunus cerasifera var. pissar	purple leaved plum	2
Prunus domestica	common plum	2

Continued

Table 4 continued

Scientific name	Common name	Ranking
Prunus emarginata	bitter cherry	2
Prunus fremontii	desert apricot	2
Prunus glandulosa	dwarf flowering almond	2
Prunus hortulana	hortulan plum	2
Prunus japonica	Japanese plum	2
Prunus laurocerasus	common cherry-laurel	2
Prunus lyonii	Catalina cherry	2
Prunus maritima	beach plum	2
Prunus mexicana	Mexican plum	2
Prunus munsoniana	wildgoose plum	2
Prunus myrtifolia	West Indies cherry	2
Prunus nigra	Canada plum	2
Prunus padus	European bird cherry	2
Prunus pensylvanica	pin cherry	3
Prunus persica	heavenly white nectar	2
Prunus persica	Tilton apricot	1
Prunus persica	peach	2
Prunus pumila	sand cherry	2
Prunus serotina	black cherry	2
Prunus spinosa	sloe	2
Prunus sp.	cherry	2
Prunus subcordata	Klamath plum	2
Prunus umbellata	flatwoods plum	2
Prunus virginiana	chokecherry	2
Pseudophoenix sargentii	buccaneer palm	3
Pseudotsuga macrocarpa	bigcone Douglas-fir	2
Pseudotsuga menziesii	Douglas-fir	2
Psidium guajava	common guava	2
Ptelea trifoliata	common hoptree	2
Punica granatum	pomegranate	2
Pyracantha coccinea	fire thorn	2
Pyrus angustifolia	southern crab apple	1
Pyrus arbutifolia	choke berry	2
Pyrus communis	pear	2
Pyrus fusca	Oregon crab apple	1
Pyrus malus	common apple	1
Quercus agrifolia	coast live oak	1
Quercus alba	white oak	1
Quercus arizonica	Arizona white oak	1
Quercus austrina	bluff oak	1
Quercus bicolor	swamp white oak	1
Quercus chapmanii	Chapman oak	1
Quercus chrysolepis	canyon live oak	1
Quercus cinerea	bluejack oak	1
Quercus coccinea	scarlet oak	1
Quercus douglasii	blue oak	1
Quercus durandii	Durand oak	1
Quercus ellipsoidalis	northern pin oak	1
Quercus emoryi	Emory oak	1
Quercus engelmannii	Engelmann oak	1
Quercus falcate	southern red oak	1
Quercus gambelii	Gambel oak	1
Quercus garryana	Oregon white oak	1
Quercus grisea	Arizona gray oak	1
Quercus hemisphaerica	Darlington oak	1
Quercus hypoleucoides	silverleaf oak	1
Quercus ilicifolia	bear oak	1
Quercus imbricaria	shingle oak	1

Continued

Table 4 continued

Scientific name	Common name	Ranking
Quercus incana	bluejack oak	1
Quercus kelloggii	California red oak	1
Quercus laevis	turkey (scrub) oak	1
Quercus laurifolia	laurel oak	1
Quercus lobata	California white oak	1
Quercus lyrata	overcup oak	1
Quercus macrocarpa	bur oak	1
Quercus margaretta	sand post oak	1
Quercus marilandica	blackjack oak	1
Quercus michauxii	swamp chestnut oak	1
Quercus muehlenbergii	chinkapin oak	1
Quercus myrtifolia	myrtle oak	1
Quercus nigra	water oak	1
Quercus nuttallii	Nuttall oak	1
Quercus oblongifolia	Mexican blue oak	1
Quercus oglethorpensis	Oglethorpe oak	1
Quercus pagoda	cherrybark oak	1
Quercus palustris	pin oak	1
Quercus phellos	willow oak	1
Quercus prinus	chestnut oak	1
Quercus rubra	northern red oak	1
Quercus shumardii	Shumard oak	1
Quercus sp.	oak	1
Quercus stellata	post oak	1
Quercus suber	cork oak	1
Quercus velutina	black oak	1
Quercus virginiana	live oak	1
Quercus wislizenii	interior live oak	1
Rapanea guianensis	Guiana rapanea	2
Reynosia septentrionalis	darling plum	2
Rhamnus californica	California buckthorn	3
Rhamnus caroliniana	Carolina buckthorn	3
Rhamnus cathartica	European buckthorn	3
Rhamnus frangula	glossy buckthorn	3
Rhamnus purshiana	cascara buckthorn	2
Rhizophora mangle	red mangrove	2
Rhus copallina	shining sumac	1
Rhus glabra	smooth sumac	1
Rhus integrifolia	lemonade berry	2
Rhus typhina	staghorn sumac	1
Robinia neomexicana	New Mexico locust	3
Robinia pseudoacacia	black locust	3
Robinia sp.	locust	2
Robinia viscosa	clammy locust	3
Rosa bracteata	Macartney rose	2
Rosa eglanteria	sweetbrier rose	2
Rosa setigera	climbing prairie rose	2
Rosa sp.	rose	1
Roystonea elata	Florida royalpalm	3
Sabal palmetto	cabbage palmetto	3
Salix alaxensis	feltleaf willow	1
Salix alba	white willow	1
Salix alba var. tristis	golden weeping willow	1
Salix amygdaloides	peachleaf willow	1
Salix babylonica	weeping willow	2
Salix bebbiana	Bebb willow	1
Salix bonplandiana	Bonpland willow	1
Salix caroliniana	coastal plain willow	1

Continued

Table 4 continued

Scientific name	Common name	Ranking
Salix cordata heart	leaved willow	1
Salix discolor	pussy willow	1
Salix eriocephala	diamond willow	1
Salix exigua	sandbar willow	1
Salix fragilis	crack willow	1
Salix hookeriana	Hooker willow	1
Salix laevigata	red willow	1
Salix lasiandra	Pacific willow	1
Salix lasiolepis	arroyo willow	1
Salix lucida	shining willow	1
Salix mackenzieana	Mackenzie willow	1
Salix nigra	black willow	1
Salix pentandra	laurel leaved willow	2
Salix scouleriana	Scouler willow	1
Salix sp.	willow	1
Salix taxifolia	yewleaf willow	1
Salix viminalis	basket willow	1
Sambucus callicarpa	Pacific red elder	2
Sambucus canadensis	American elder	3
Sapindus drummondii	western soapberry	2
Sapindus marginatus	Florida soapberry	2
Sapindus saponaria	wingleaf soapberry	2
Sapium sebiferum	Chinese tallowtree	3
Sassafras albidum	sassafras	2
Schinus molle	California peppertree	1
Sequoia sempervirens	coast redwood	2
Sequoiadendron giganteum	giant sequoia	2
Simarouba glauca	paradise-tree	2
Sophora affinis	Texas sophora	3
Sophora japonica	Japanese pagoda tree	3
Sophora secundiflora	mescalbean	2
Sorbus americana	merican mountain-ash	1
Sorbus aucuparia	European mountain-ash	1
Spirea bumalda	spirea	3
Stewartia koreana	Stewartia	3
Stewartia ovata	mountain Stewartia	2
Swietenia mahogany	West Indies mahogany	2
Symphori carposalbus	snowberry	3
Symplocos tinctoria	common sweetleaf	2
Tamarix parviflora	smallflower tamerisk	2
Taxodium distichum	baldcypress	3
Taxus brevifolia	Pacific yew	3
Taxus floridana	Florida yew	3
Thrinax microcarpa	brittle thatchpalm	3
Thrinax parviflora	Jamaica thatchpalm	3
Thuja occidentalis	northern white-cedar	3
Thuja orientalis	Chinese arborvitae	3
Thuja plicata	western redcedar	3
Tilia americana	American basswood	1
Tilia caroliniana	Carolina basswood	1
Tilia cordata	little leaf linden	1
Tilia europaea	European linden	1
Tilia floridana	Florida basswood	1
Tilia heterophylla	white basswood	1
Torreya californica	California torreya	3
Torreya taxifolia	Florida torreya	3
Toxicodendron vernix	poison-sumac	1
Trema micrantha	Florida trema	2

Continued

Table 4 continued

Scientific name	Common name	Ranking
Tsuga canadensis	eastern hemlock	2
Tsuga caroliniana	Carolina hemlock	2
Tsuga heterophylla	western hemlock	2
Tsuga mertensiana	mountain hemlock	2
Ulmus alata	winged elm	2
Ulmus americana	American elm	2
Ulmus crassifolia	cedar elm	2
Ulmus glabra	Wych elm	2
Ulmus parvifolia	Chinese elm	2
Ulmus procera	European elm	2
Ulmus pumila	Siberian elm	2
Ulmus rubra	slippery elm	3
Ulmus serotina	September elm	2
Ulmus sp.	elm	2
Ulmus thomasii	rock elm	2
Umbellularia californica	California laurel	3
Vauquelinia californica	Torrey vauquelinia	2
Viburnum acerifolium	maple leaved arrowwood	3
Viburnum ellipticum	oval leafed viburnum	2
Viburnum lantana	wayfaring tree	2
Viburnum lentago	nannyberry	3
Viburnum opulus	cranberrybush	3
Viburnum prunifolium	black haw	2
Viburnum pubescens	downy arrowwood	2
Viburnum rhytidophyllum	leatherleaf viburnum	2
Viburnum sp.	viburnum	3
Viburnum tomentosum	viburnum	3
Washingtonia filifera	California palm	3
Ximenia americana	tallowwood	3
Zanthoxylum americanum	common prickly-ash	2
Zanthoxylum clava-herculis	Hercules club	2
Zanthoxylum fagara	lime prickly-ash	2
Zanthoxylum flavum	West Indies satinwood	2

This and additional information can be found in Liebhold et al. 1995 or at our World-Wide-Web site: **http://www.fsl.wvnet.edu**

Table 5.—Format used in collecting data to add new species to the Stand-Damage Model (See Editing Data, pages 10-13 for explanations of each column)

Common name	Scientific name	Survey code	Char. code	Feeding pref.	Shade tolerance		Growth factor	Heat accum. range		Diameter (max.)	Height (max.)	Age (max.)	Crown cover	Recruit-ment
					Recruit.	Growth		Cold	Hot					
							cm/yr	*Days-degree*		*inches*	*feet*	*years*		
balsam fir	*Abies balsamea*	012	BF	3	3	3	102.7	700	3700	35	75	200	1	2
eastern redcedar	*Juniperus virginiana*	068	ERC	3	1	1	88.7	2966	10204	24	50	250	1	3
European larch	*Larix laricina*	071	EL	1	1	1	86.3	600	3800	33	100	200	1	10
white spruce	*Picea glauca*	094	WS	2	3	2	91.8	600	3750	21	110	200	1	2
black spruce	*Picea mariana*	095	BS	2	2	2	32.0	600	3800	18	90	250	1	2
red spruce	*Picea rubens*	097	RS	2	3	3	50.7	1300	3800	24	75	400	2	2
jack pine	*Pinus banksiana*	105	JP	2	1	1	142.0	1150	4000	20	100	185	1	50
monterey pine	*Pinus radiata*	124	MOP	2	2	3	250.0	6000	9000	30	105	100	1	5
red pine	*Pinus resinosa*	125	RP	2	1	1	156.4	2000	4100	36	100	275	1	3
pitch pine	*Pinus rigida*	126	PP	3	1	1	86.5	3800	5800	36	100	200	2	2
northern white-cedar	*Thuja occidentalis*	241	WC	3	2	2	35.7	1500	3700	40	80	400	1	2
eastern hemlock	*Tsuga canadensis*	261	EH	2	3	3	86.0	2416	6559	60	120	600	2	3
silver maple	*Acer saccharinum*	317	SIM	3	2	2	164.8	2200	9000	48	130	125	3	2
mountain maple	*cer spicatum*	319	MM	3	3	3	72.6	1800	6300	6	18	25	2	2
green alder	*Alnus crispa*	999	GAL	3	2	2	143.3	540	3000	6	12	30	1	10
speckled alder	*Alnus rugosa*	353	SAL	1	2	2	196.9	2174	5299	9	15	30	1	10
grey birch	*Betula populifolia*	379	GB	1	1	1	119.5	2800	4800	15	30	50	2	10
American chestnut	*Castanea dentata*	421	CNX	2	2	2	195.2	3686	8499	50	90	200	3	0
butternut	*Juglans cinerea*	601	BUT	2	1	1	192.2	3200	6500	36	100	90	2	3
balsam poplar	*Populus balsamifera*	741	BP	1	1	1	232.5	1000	4300	48	128	150	2	3
bigtooth aspen	*Populus grandidentata*	743	BTA	1	1	1	176.7	2100	6000	60	92	70	2	3
pin cherry	*Prunus pensylvanica*	761	PC	3	1	1	227.2	1100	6000	20	75	30	2	60
choke cherry	*Prunus virginiana*	763	CC	2	1	1	233.3	1700	10000	20	45	20	2	60
American mt. ash	*Sorbus americana*	935	MAS	1	2	2	155.6	1800	4000	30	40	30	2	2

This table is an example of one you might build as you add new species to the model. We would like to have your input on any changes that you think should be made to default parameters for existing species. We also would like to add any parameter sets for species that you have developed. Note that we have included a shrub species, *Alnus crispa* (Little 1979), that was included in Botkin's (1993) most recent list. This is coded 999 in the species file. Other than this species, the order of appearance in this table is the same as species will appear in the `SPECIES` file, ordered by Survey Codes. Remember that only one entry of each value of a this numeric code can be used, so if you want to use 999 to designate another tree species, delete our entry in the species files (`SPECIES & SPECIES.HLP`). Also, we could not locate an FIA code for *Alnus rugosa*, so we used 353, which we believe is an unused code (see Table 1).

Sample Data Sheets for Fixed-Area Plot Data Entry

Plot 1.

Central Pennsylvania Risk Rating Plots Study 15 —— Stand 123

STAND	PLOT	TREE	SPECIES	DBH78	VIGOR78	CCLASS78
123	1	1	316	3.30	2.00	5.00
123	1	2	316	3.00	3.00	5.00
123	1	3	316	5.30	1.00	4.00
123	1	5	315	5.30	2.00	4.00
123	1	6	833	10.00	1.00	3.00
123	1	7	832	4.30	1.00	5.00
123	1	8	832	12.80	2.00	3.00
123	1	9	833	5.30	2.00	4.00
123	1	10	832	14.30	1.00	3.00
123	1	11	400	5.60	3.00	5.00
123	1	12	316	7.80	1.00	4.00
123	1	13	833	6.10	1.00	4.00
123	1	14	837	9.10	1.00	3.00
123	1	15	832	16.50	1.00	3.00
123	1	16	833	8.80	1.00	3.00
123	1	17	833	9.30	1.00	3.00
123	1	18	832	8.50	2.00	4.00
123	1	20	833	15.30	1.00	3.00
123	1	22	316	3.50	1.00	5.00
123	1	23	833	3.10	2.00	5.00
123	1	24	832	11.80	1.00	3.00
123	1	25	832	10.10	1.00	3.00
123	1	28	316	3.00	3.00	5.00
123	1	29	316	6.80	2.00	3.00
123	1	31	316	5.00	1.00	4.00

Plot 2.

Central Pennsylvania Risk Rating Plots Study 15 —— Stand 123

STAND	PLOT	TREE	SPECIES	DBH78	VIGOR78	CCLASS78
123	2	1	832	4.30	1.00	4.00
123	2	2	832	5.00	2.00	4.00
123	2	3	832	6.10	1.00	3.00
123	2	4	832	6.10	1.00	3.00
123	2	5	832	5.10	1.00	3.00
123	2	7	832	7.10	1.00	3.00
123	2	8	833	8.30	1.00	3.00
123	2	9	316	3.30	2.00	5.00
123	2	10	832	5.10	3.00	3.00
123	2	11	832	4.30	3.00	3.00
123	2	13	316	3.10	2.00	3.00
123	2	14	316	4.30	2.00	3.00
123	2	15	837	7.60	1.00	3.00
123	2	16	837	7.50	1.00	3.00
123	2	17	931	3.10	3.00	5.00
123	2	18	837	5.10	3.00	5.00
123	2	19	832	6.80	1.00	3.00
123	2	20	832	8.00	1.00	3.00
123	2	21	832	4.60	3.00	4.00
123	2	22	832	4.30	3.00	4.00
123	2	23	316	4.00	1.00	4.00
123	2	24	832	9.50	1.00	3.00
123	2	25	833	6.30	1.00	3.00
123	2	26	833	7.00	1.00	3.00
123	2	27	833	5.10	3.00	5.00
123	2	28	316	3.60	1.00	5.00
123	2	29	931	3.30	3.00	5.00
123	2	30	833	12.00	1.00	3.00
123	2	31	833	8.30	1.00	4.00
123	2	32	832	5.80	1.00	3.00
123	2	33	832	6.10	1.00	3.00
123	2	34	832	5.80	2.00	3.00
123	2	39	832	8.80	1.00	3.00
123	2	40	832	6.30	1.00	4.00
123	2	41	316	5.10	1.00	5.00
123	2	42	837	8.30	2.00	3.00
123	2	43	372	8.80	1.00	3.00
123	2	44	372	4.00	1.00	5.00
123	2	45	931	3.10	1.00	5.00
123	2	47	832	9.10	1.00	3.00
123	2	48	832	7.80	1.00	3.00
123	2	49	832	6.80	1.00	3.00

Plot 3.

Central Pennsylvania Risk Rating Plots Study 15 —— Stand 123

STAND	PLOT	TREE	SPECIES	DBH78	VIGOR78	CCLASS78
123	3	1	832	8.50	1.00	3.00
123	3	2	833	9.60	1.00	3.00
123	3	3	832	9.30	1.00	3.00
123	3	5	832	3.60	3.00	5.00
123	3	6	832	5.60	2.00	5.00
123	3	7	833	4.60	3.00	5.00
123	3	8	833	9.80	1.00	3.00
123	3	9	833	7.00	2.00	4.00
123	3	10	833	8.10	2.00	4.00
123	3	12	316	3.30	3.00	5.00
123	3	13	372	7.10	1.00	4.00
123	3	14	833	3.30	2.00	5.00
123	3	15	832	6.60	1.00	4.00
123	3	16	833	5.60	3.00	5.00
123	3	17	832	12.80	1.00	3.00
123	3	19	833	5.30	3.00	5.00
123	3	21	833	11.80	1.00	3.00
123	3	22	372	12.30	1.00	3.00
123	3	23	832	10.10	1.00	3.00
123	3	24	832	4.10	3.00	4.00
123	3	25	833	5.80	2.00	4.00
123	3	26	832	14.00	1.00	3.00
123	3	27	832	5.30	3.00	4.00
123	3	28	832	4.80	3.00	4.00
123	3	29	832	6.30	1.00	4.00
123	3	30	833	11.30	1.00	3.00

Sample Data Sheets for Variable-Radius Plot Data Entry

Dorr Run gypsy Moth Survey -- Stand 96-14

Forest__Wayne__District_Athens_Compartment_96_____Stand__14____

FS Type__59_____ Yr. of Origin___1903___ Plot Size_____

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number____1_____Date_4/8/99_ Crew_DLF/SF__ Page ____ of ___

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
_837____	__26.2__	__1_____	__3_____	_108____	_____	_____	_____	_____	_____
_802____	__16.3__	__1_____	__3_____	_____	_____	_____	_____	_____	_____
_837____	__13.1__	__3_____	__4_____	_____	_____	_____	_____	_____	_____
__318___	___2.8__	__1_____	__5_____	_____	_____	_____	_____	_____	_____
__806___	__15.0__	__1_____	__3_____	_____	_____	_____	_____	_____	_____
__833___	__16.7__	__1_____	__3_____	_____	_____	_____	_____	_____	_____
__837___	__15.1__	__1_____	__3_____	_____	_____	_____	_____	_____	_____
__832___	__14.8__	__1_____	__4_____	_____	_____	_____	_____	_____	_____
__806___	__16.3__	__1_____	__3_____	_____	_____	_____	_____	_____	_____
__802___	__17.8__	__1_____	__3_____	_____	_____	_____	_____	_____	_____
__802___	__15.9__	__1_____	__3_____	_____	_____	_____	_____	_____	_____
__400___	__4.7___	__1_____	__5_____	_____	_____	_____	_____	_____	_____
__316___	__10.4__	__2_____	__4_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

Forest__Wayne__District_Athens_Compartment_96_____Stand__14____

FS Type__59_____ Yr. of Origin___1903___ Plot Size_____

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number___2_____ Date_4/8/99_ Crew_DLF/SF__ Page ____ of ___

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
833	20	1	3						
833	14.6	1	3						
833	18.4	1	3						
833	17.6	1	3						
802	14.9	1	3						
802	20.8	1	3						
802	21.4	1	3						
837	11.9	4	4						
802	18.2	1	3						
833	21.3	1	3						

Forest__Wayne__District_Athens_Compartment_96_____Stand__14____

FS Type__59_____ Yr. of Origin___1903___ Plot Size_____

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number___3_____ Date_4/8/99_ Crew_DLF/SF__ Page ____ of ___

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
__837___	**__15.8__**	**___1____**	**____3___**	___84___					
__832___	**__20.7__**	**___1____**	**____3___**						
__833___	**__25.7__**	**___1____**	**____3___**						
__316___	**___8.1__**	**___1____**	**____3___**						
__802___	**__25.9__**	**___1____**	**____3___**						
__806___	**__27.0__**	**___1____**	**____3___**						
__400___	**___6.5__**	**___1____**	**____3___**						
__802___	**__17.2__**	**___1____**	**____3___**						
__837___	**__25.3__**	**___1____**	**____3___**						
__602___	**__11.4__**	**___1____**	**____3___**						

Forest__Wayne__District_Athens_Compartment_96_____Stand__14____

FS Type__59_____ Yr. of Origin___1903___ Plot Size_____

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number___4_____ Date_4/8/99_ Crew_DLF/SF__ Page ____ of ___

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
__837___	__22.0__	___2____	___3____						
__802___	__20.4__	___1____	___3____						
__318___	___5.2__	___1____	___5____						
__802___	__17.5__	___1____	___3____						
__806___	__23.7__	___1____	___3____						
__802___	__15.6__	___1____	___3____						
__833___	__20.0__	___1____	___3____						
__802___	__18.9__	___1____	___3____						
__802___	__22.3__	___1____	___3____						
__837___	__24.5__	___1____	___3____						
__802___	__23.7__	___1____	___3____						

Forest__Wayne__District_Athens_Compartment_96_____Stand__14____

FS Type__59_____ Yr. of Origin___1903___ Plot Size_____

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number___5_____ Date_4/8/99_ Crew_DLF/SF__ Page ____ of ___

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
__837___	___21.3_	____1___	___3____						
__802___	___13.3_	____1___	___3____						
__802___	___28.4_	____1___	___3____						
__833___	__22.0__	____1___	___3____						
___837__	__19.9__	___1____	___3____						
___837__	__16.3__	____1___	___3____						
___806__	__19.7__	____1___	___3____						
___833__	__18.2__	____1___	___3____						
___833__	__26.4__	____1___	___3____						
___802__	___5.4__	____1___	___3____						
___833__	__20.0__	____1___	___3____						
___802__	__14.0__	____1___	___3____						

Forest__Wayne__District_Athens_Compartment_96_____Stand__14____

FS Type__59_____ Yr. of Origin___1903___ Plot Size_____

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number___6_____ Date_4/8/99_ Crew_DLF/SF__ Page ____ of ___

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
316	12.6	1	3						
316	9.0	1	4						
833	24.9	1	3						
802	19.7	1	3						
833	11.9	1	3						
802	23.5	1	3						
837	27.2	1	3						
802	18.2	1	3						
837	13.1	2	3						
802	14.8	1	3						
743	12.7	1	3						
802	19.7	1	3						
833	22.4	1	3						

Forest__Wayne__District_Athens_Compartment_96_____Stand__14____

FS Type__59_____ Yr. of Origin___1903___ Plot Size_____

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number___7_____ Date_4/8/99_ Crew_DLF/SF__ Page ____ of ___

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
____316_	____7.9_	___1____	___5____						
____837_	__16.9__	___1____	___3____						
___833__	__23.4__	___1____	___3____						
___806__	__20.6__	___2____	___3____						
___806__	__24.6__	___1____	___3____						
___400__	___8.2__	___1____	___4____						
___833__	__16.3__	___2____	___3____						
___400__	__14.2__	___1____	___3____						
___802__	__18.1__	___1____	___3____	__97____					
___316__	___7.0__	___1____	___5____						
___743__	__14.5__	___2____	___3____						
___806__	__22.3__	___1____	___3____						

Forest __WAYNE___ District _Athens_ Compartment __96__ Stand _14____

FS Type_____59_____ Yr. of Origin___103____ Plot Size __F10___

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number ___9_____ Date 4/8/99 Crew _BS&RY___ Page ____ of ____

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
802	**14.8**	**1**	**3**						
802	**15.6**	**1**	**3**						
802	**21.0**	**1**	**3**						
802	**15.6**	**1**	**3**						
833	**11.9**	**1**	**4**						
802	**20.9**	**1**	**3**						
802	**18.7**	**1**	**3**						
833	**16.7**	**1**	**3**	105ft					
806	**14.7**	**1**	**3**						
802	**16.9**	**1**	**3**						
802	**19.3**	**1**	**3**						
318	**5.2**	**1**	**5**						
833	**22.5**	**1**	**2**						

Forest __WAYNE___ District _Athens_ Compartment __96__ Stand _14____

FS Type_____59_____ Yr. of Origin___103____ Plot Size __F10___

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number __10_____ Date 4/8/99 Crew _BS&RY___ Page ____ of ____

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
837	17.8	1	3		318	5.6	1	5	
400	6.6	1	5		318	9.6	1	4	
833	19.6	1	3						
833	16.5	1	3						
833	18.3	1	2						
837	20.0	1	3						
837	20.4	1	3						
837	16.8	1	3						
400	8.1	1	5						
833	16.0	1	2						
833	18.3	1	2						
802	14.8	1	4						
833	15.8	1	3						
833	18.6	1	3						
802	12.4	1	3						
802	12.9	1	3						

Forest __WAYNE___ District _Athens_ Compartment __96__ Stand _14____

FS Type_____59_____ Yr. of Origin___103____ Plot Size __F10___

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number __11_____ Date 4/8/99 Crew _BS&RY___ Page ____ of ____

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
__316___	**____3.0_**	**____1___**	**___5____**						
__833___	**__19.4__**	**____1___**	**___3____**						
__602___	**__20.1__**	**____1___**	**___3____**						
__802___	**__15.7__**	**____1___**	**___3____**						
__802___	**__16.0__**	**____1___**	**___3____**						
__802___	**__11.4__**	**____1___**	**___3____**						
__802___	**__10.5__**	**____1___**	**___4____**						
__802___	**__20.1__**	**____1___**	**___3____**						
__802___	**__22.4__**	**____1___**	**___3____**						
__318___	**___4.1__**	**____1___**	**___5____**						
__802___	**__17.4__**	**____1___**	**___4____**						
__806___	**__19.0__**	**____1___**	**___3____**						
__802___	**__17.0__**	**____2___**	**___3____**						
__833___	**__21.9__**	**____1___**	**___2____**	_103 '__					
__802___	**__12.7__**	**____1___**	**___4____**						
__802___	**__20.5__**	**____1___**	**___3____**						

Forest __WAYNE___ District _Athens_ Compartment __96__ Stand _14____

FS Type_____59_____ Yr. of Origin___103____ Plot Size __F10___

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number __12_____ Date 4/8/99 Crew _BS&RY___ Page ____ of ____

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
__318___	**___10.7_**	**____1___**	**___4____**						
__318___	**____7.1_**	**____1___**	**___4____**						
__802___	**___29.4_**	**____1___**	**___2____**						
__802___	**___22.1_**	**____1___**	**___3____**						
__802___	**___29.4_**	**____1___**	**___2____**						
__318___	**__10.8__**	**____2___**	**___4____**						
__802___	**__25.0__**	**____1___**	**___3____**						
__833___	**__25.4__**	**____1___**	**___2____**						
__400___	**__15.1__**	**____1___**	**___3____**						

Forest __WAYNE___ District _Athens_ Compartment __96__ Stand _14____

FS Type_____59_____ Yr. of Origin___103____ Plot Size __F10___

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number __13_____ Date 4/8/99 Crew _BS&RY___ Page ____ of ____

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
832	**6.2**	**1**	**5**						
802	**17.6**	**2**	**3**						
837	**22.6**	**1**	**3**						
832	**22.2**	**1**	**2**						
802	**19.7**	**1**	**3**						
802	**22.2**	**1**	**3**						
802	**16.7**	**2**	**3**						
802	**18.2**	**2**	**3**	110 ‘					
400	**15.7**	**1**	**3**						
802	**11.2**	**2**	**3**						
318	**4.6**	**1**	**5**						
318	**6.6**	**1**	**5**						
621	**18.5**	**1**	**3**						
832	**17.0**	**2**	**4**						

Forest __WAYNE___ District _Athens_ Compartment __96__ Stand _14____

FS Type_____59_____ Yr. of Origin___103____ Plot Size __F10___

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number __14_____ Date 4/8/99 Crew _BS&RY___ Page ____ of ____

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
621	3.6	1	5						
318	10.2	1	3						
318	10.1	1	4						
318	11.3	1	3						
318	11.1	1	3						
318	11.1	1	3						
318	8.6	1	4						
837	25.4	1	2						
837	22.0	1	4						

Forest __WAYNE___ District _Athens_ Compartment __96__ Stand _14____

FS Type_____59_____ Yr. of Origin___103____ Plot Size __F10___

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number __15_____ Date 4/8/99 Crew _BS&RY___ Page ____ of ____

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
400	**12.3**	**1**	**3**						
621	**18.6**	**1**	**3**						
833	**12.8**	**1**	**3**	65 ’					
400	**7.8**	**1**	**4**						
711	**9.0**	**1**	**4**						
802	**14.8**	**1**	**3**						
802	**8.7**	**1**	**4**						
999	**8.4**	**2**	**4**						
999	**11.3**	**2**	**4**						
806	**22.5**	**2**	**2**						

Forest __WAYNE___ District _Athens_ Compartment __96__ Stand _14____

FS Type_____59_____ Yr. of Origin___103____ Plot Size __F10___

Aspect_____ Elevation_____ Slope_____ Slope Position_____

Plot Number __16_____ Date 4/8/99 Crew _BS&RY___ Page ____ of ____

Comments:

Species	Dbh	Vigor	Crown Class	Total Height	Species	Dbh	Vigor	Crown Class	Total Height
__621___	**___20.5_**	**____1___**	**___2____**						
__693___	**____7.9_**	**____1___**	**___4____**						
__693___	**____7.6_**	**____1___**	**___4____**						
__802___	**____9.1_**	**____2___**	**___4____**						
__743___	**___12.1_**	**____2___**	**___3____**						
__837___	**___28.6_**	**____3___**	**___3____**						
__837___	**___16.4_**	**____1___**	**___3____**						
__693___	**____5.2_**	**____3___**	**___5____**						
__621___	**___14.8_**	**____1___**	**___2____**						

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 Research Station. 79 p. (1 computer disk (3 ½ in.)).

The Stand-Damage Model simulates the growth of a forest stand, a spatially homogeneous collection of trees growing on a site. The model simulates growth from an initial inventory, user-prescribed management practices, and the effects of gypsy moth defoliation. Here we provide installation and operating instructions for Version 2.0.

Keywords: forest growth, simulator, gap model, gypsy moth, defoliation

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