



User's Guide to SILVAH

A Stand Analysis, Prescription, and Management Simulator Program for Hardwood Stands of the Alleghenies

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Abstract

This user's guide for the SILVAH computer program, version 6.2, supersedes the 1992 user's guide (Gen. Tech. Rep. NE-162). Designed for stand-alone Windows-based personal computers, SILVAH recommends a silvicultural prescription for a forest stand based on a summary and analysis of field inventory data. The program also includes a simulator that can be used to project stand growth and development, estimating yields from either prescribed or user-defined treatments. The software is distributed with an online help system and this printed user's manual. The computer program described in this publication is available on the Internet at <http://nrs.fs.fed.us/tools/silvah>

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The computer program described in this publication is available on request with the understanding that the U.S. Department of Agriculture, the Forest Service, or the authors cannot assure its accuracy, completeness, reliability, or suitability for any other purpose than that reported. The recipient may not assert any proprietary rights thereto nor represent it to anyone as other than a Government-produced computer program.

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Introduction

This user's guide describes how to use SILVAH, a computer program that recommends a silvicultural prescription for a forest stand, based on a summary and analysis of field inventory data. As such, it is an "expert" system. The program also includes a simulator that can be used to project stand growth and development, estimating yields from either prescribed or user-defined treatments. The program's acronym—SILVAH—stands for Silviculture of Allegheny Hardwoods, although it has been updated to include guidelines for mixed oak forests in the Mid-Atlantic region. Thus, SILVAH incorporates the current knowledge about silvicultural treatments in cherry-maple, beech-birch-maple, and mixed oak forests in the Alleghenies, and packages all the decisionmaking criteria that have been developed through research into a form that is easily used by practicing foresters.

The SILVAH computer program was first developed in 1985 and was thoroughly tested on lands of the Hammermill Paper Company (later International Paper Company). Revisions based on their experience resulted in version 2 of the program—the first version made available for public distribution in 1986. Periodic revisions and improvements were made since then. The most significant improvements resulted from development of guidelines for mixed oak forests, work completed through a partnership among the U.S. Forest Service Northern Research Station, the Pennsylvania Department of Conservation and Natural Resources (DCNR) Bureau of Forestry, the Pennsylvania State University, and others. The current version (6.2) is described in this user's guide.

The user's guide is divided into the following chapters: Chapter 1 describes the purpose and function of the program in general terms, Chapters 2 through 6 provide detailed instructions on use of the program, Chapters 7, 8, and Appendix A provide information on program organization and data formats.

Proper use of the SILVAH program requires some knowledge of silvicultural principles in Allegheny forests. A summary of the silvicultural information on which SILVAH is based is presented in the 1992 U.S. Forest Service General Technical Report NE-96 (revised), "Prescribing Silvicultural Treatments in Hardwood Stands of the Alleghenies," by David A. Marquis, Richard L. Ernst, and Susan L. Stout, and the 2008 General Technical Report NRS-33, "Prescribing Regeneration Treatments for Mixed Oak Forests," by Brose et al. Separate 4-day training courses based on silviculture in Allegheny hardwoods and silviculture in mixed oak forests are given each year by the Northern Research Station in cooperation with the extension service of The Pennsylvania State University, the Pennsylvania DCNR Bureau of Forestry, and the Jefferson County Conservation District. A 1-day course on the use of the SILVAH computer programs is also given periodically. A nominal fee exists for both courses. Further information may be obtained from the Warren Forestry Sciences Laboratory, Northern Research Station, PO Box 267, Irvine, PA 16329; telephone: 814-563-1040.

Every effort is made to provide accurate and useful information. However, the U.S. Department of Agriculture, the U.S. Forest Service, and their employees and contractors assume no legal liability for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed herein. Neither the U.S. Forest Service, nor their employees and contractors makes any warranty, express or implied, including the warranties of merchantability and fitness for a particular purpose with respect to SILVAH software or documentation.

About Forest Management Decision Support

Our knowledge of the factors affecting regeneration, growth and yield, and proper management of forest stands has improved dramatically, especially during the past 30 years. In spite of this vast amount of scientific information, the practice of silviculture is still more of an art than a science. Subjectivity and intuitive judgment are required to determine the most appropriate silvicultural treatment and to apply that treatment in individual stands. For example, we know that successful regeneration after clearcutting in many eastern hardwoods is highly dependent upon advance seedlings. But how many advance seedlings are needed? How does the number vary with size of seedling, with site, and with deer-browsing pressure? How can one evaluate seedling numbers without tedious and costly surveys? What levels of advance reproduction will permit overstory removal, and what levels require other methods to establish and culture adequate regeneration?

The thrust of silvicultural research by the Northern Research Station units in Warren, PA; Morgantown, WV; and Delaware, OH, has not been only to identify important factors and discover how they function in regulating regeneration or stand growth, but also to develop objective guidelines on how much is enough or too much in particular circumstances. These guidelines have been integrated into a complete stand analysis and prescription procedure that provides a systematic way of measuring and evaluating critical stand conditions and using that data to arrive at a recommended treatment.

This “system” involves a stand inventory of basic overstory, understory, and site factors that are then summarized and analyzed to evaluate the stand’s potential for growth and regeneration. The necessary calculations can be done by hand, but we recommend use of the computer program for increased precision and efficiency. Then, decision tables are used to determine the proper prescription based on critical levels of the various site, overstory, and understory variables in combination with landowner objectives.

Since all steps of this process are based on stand and site parameters that have been measured during a sample inventory, the entire process can be handled by a computer. SILVAH was written for this purpose.

After field data are entered into the computer, SILVAH performs a data summary, outputting all of the tabular data that one normally expects from a stand inventory. In addition to the tabular data, SILVAH prints an analysis of the stand, rationale for stand treatment, and a specific recommendation or prescription in an easily understood, narrative form. Details on application of the recommended treatment are also provided. If that treatment is a partial cutting of any kind, SILVAH provides specific marking instructions on which sizes, qualities, and species of trees to cut; the volumes involved; and information on the desired residual stand.

Once an inventory is made, SILVAH does the entire job of analysis, prescription, and marking instruction preparation. It even assists with report writing, providing text files that can be incorporated directly into such reports as the Environmental Analysis Report in the National Forest System, or the Landowner Management Plan prepared by most service foresters and consultants. In fact, we have found the narrative to be especially valuable in dealing with nonindustrial private landowners, who are more likely to accept a forester’s recommendations when they are backed by documentation that they can read and understand. Thus, SILVAH greatly reduces the amount of time required for all aspects of silvicultural decisionmaking and ensures consistency across all areas and among all individuals.

Obviously, no system of this sort can substitute for professional judgment, nor is it intended to do so. The prescriptions are based on average or usual situations. Circumstances not evaluated may often dictate that the recommendations be modified, or landowner objectives may deviate from those assumed, or the guides just may not work in every situation. So the system provides a starting point or standard that must be verified by professional judgment. Nevertheless, it greatly reduces the work involved and generally improves the quality of decisions made by professional silviculturists.

Several additional features of SILVAH greatly expand its capabilities beyond those already described. SILVAH also optionally outputs stand summaries into a format that can be incorporated into a database, using key information from the original stand plus data on any cut and residual stands that may result. Output data from individual stands can be combined into a single file which facilitates the development of a forest-wide inventory database that provides a powerful tool for forest management planning.

If a cruise is completed in each stand before treatment, a complete inventory can be built up even on large properties over a 10- or 15-year period. With such a complete database, extremely accurate information is available. Managers can query the database to find out virtually anything they need to know about the property. For all properties, selected forest districts, or individual properties, managers can quickly determine how much volume they have in any or all stand classes, how many areas are ready for harvest, how many are in need of herbicide treatment, and so forth. Unlike many similar sorts of inventory systems, the database output from SILVAH permits users to identify each of these stands on the ground. For example, managers can not only determine that there are X acres needing herbicide treatment, but also can get a listing of the stand, property, and district where every one of those acres is located.

SILVAH also makes it easy to test treatments other than the recommended one. Users can choose one of the many standard cuttings built into SILVAH, or they can modify these standard cuttings to fit particular needs. Each of these standard cutting methods provides a specific formula for control of residual stand density, structure, species composition, and quality. As a result, it is very easy to specify common types of cuts with just a few instructions. The ability to specify individual species, diameters, and quality classes of trees to cut is also provided. After each treatment used, printouts showing the effect of that treatment on cut volumes and residual stand parameters may be obtained. It is easy to test the immediate effect of alternative treatments.

Another feature of SILVAH is a stand growth simulator. Individual stand projections can be made and the expected yield can be estimated under virtually any treatment one desires. If the projections are made using SILVAH expert-recommended prescriptions, SILVAH will recommend a treatment at the end of each 5-year projection interval. When this is done, the end result is a recommended schedule of silvicultural treatments for that stand from the present to the end of the rotation. A typical output for such a run might include the recommendations that the stand be thinned now, thinned again in 15 years, then clearcut 35 years from now. If the projections are made with modifications to standard treatments or custom, user-specified treatments, SILVAH will attempt to implement the treatment at the end of each 5-year projection interval. Either way, detailed estimates of the yields (in volume and value) from each cut and for the entire period are included.

However, we do not visualize most stands being analyzed by time-consuming trial and error simulation. Simulators should not be used extensively by practicing foresters for routine stand prescription.

It would be time consuming and costly to do this for any large number of stands, and subject to many erroneous conclusions by individuals unfamiliar with the simulator's function and limitations. The recommendations that are incorporated into SILVAH are themselves the result of many simulation runs to determine treatments that maximize particular products under particular conditions. Expert system programs such as SILVAH, which make definite recommendations based upon usual responses of similar stands, are likely to be the most useful approach to daily silvicultural decisionmaking.

However, we do see another major use for simulators in connection with the database generated by SILVAH. As that database is built, it is possible to project each stand, and to accumulate these projections and prescriptions in the database, thereby incorporating the expected inventory at any time in the future. Such projections could drastically reduce the amount of field work needed by permitting computer updating of the database and by eliminating the need for field work during future inventories in stands that will not require treatment. Furthermore, the database can be queried to quickly estimate how much volume there will be or how many stands (or acres) will be ready for final harvest in the future.

The stand analysis and prescription system on which SILVAH is based was originally developed for Allegheny hardwoods—a variation of the northern hardwood type in which black cherry is a major component. As a result of some recent research advances in evaluation of stand density that can be applied in eastern hardwoods of almost any species composition, by adopting more general data collection procedures and by incorporating research information on oaks, we have broadened the application of the procedure to beech-birch-maple, cherry-maple, oak-hickory and transition forest types. Many of the critical factors affecting prescriptions are the result of localized conditions, so the stand analysis system and program SILVAH should not be applied unquestioningly outside of the Allegheny Plateau and Allegheny Mountain provinces of Pennsylvania, New York, Ohio, West Virginia, Maryland, and New Jersey. Nevertheless, the basic procedures could easily be adapted to other forest regions by incorporating decision criteria and critical levels appropriate to the type and geographic area.

SILVAH operates on individual stands without consideration of the landscape context in which they occur. Many forest management considerations, such as wildlife habitat or aesthetics, are better assessed on larger landscapes. NED-2, another Northern Research Station decision-support tool, downloadable from their website (located at www.nrs.fs.fed.us/tools/ned, as of the time of this printing), can interpret SILVAH data files and provide this type of landscape assessment.

Chapter 1 - SILVAH Overview

Getting Started

This chapter provides an overview of the SILVAH system and briefly describes the major features. Follow these steps to get started with SILVAH:

1. Review this chapter.
2. Browse the table of contents, index, and reference material in the appendices, so you can quickly find answers to any questions that arise as you use SILVAH.
3. Install SILVAH on your computer. See Chapter 2 on installation for further instructions.
4. Run SILVAH using the sample data file included in the installation. This will help you become familiar with SILVAH and will also assure you that SILVAH is working properly on your machine. Refer to Chapter 5 on running analysis and prescription to become familiar with the software.
5. Refer to Appendix C on troubleshooting for coverage of some issues and their solutions. If all else fails, feel free to contact us using the information below.

The computer program described in this publication is available on request, as well as on the Internet at <http://nrs.fs.fed.us/tools/silvah>, with the understanding that the U.S. Department of Agriculture cannot assure its accuracy, completeness, reliability, or suitability for any other purpose than that reported. The recipient may not assert any proprietary rights thereto nor represent it to anyone as other than a government-produced computer program.

We welcome your suggestions on how to improve SILVAH. If you need help or have comments, please write to:

Northern Research Station
USDA Forest Service
Forestry Sciences Laboratory
PO Box 267
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Getting Help with SILVAH

Online help is available for many SILVAH6 features.

Quick access to help within SILVAH6 can be achieved by the following actions:

- Press F1 for information on the active SILVAH6 window or dialog.
- Double-click a column or row header for help with a particular variable.

To launch the help system within SILVAH6, from the Help menu, click **Help with SILVAH6**, or outside SILVAH6, from the Start menu, select **Programs - Silvah6 - Help on Silvah6**.

When a topic is displayed in the help system, click the **Contents** tab to see where the given topic fits within the organization of the help system.

In the help system, click the **Index** tab to find topics of interest. Click the **Search** tab to find all topics that reference a word or phrase.

SILVAH Layout

SILVAH consists of four main components. Through these components, you will find the features that enable you to input and analyze forest stand data and perform calculations on individual trees in a stand. To access these features, click on the large buttons at the top of the SILVAH window as shown in Figure 1 described below.

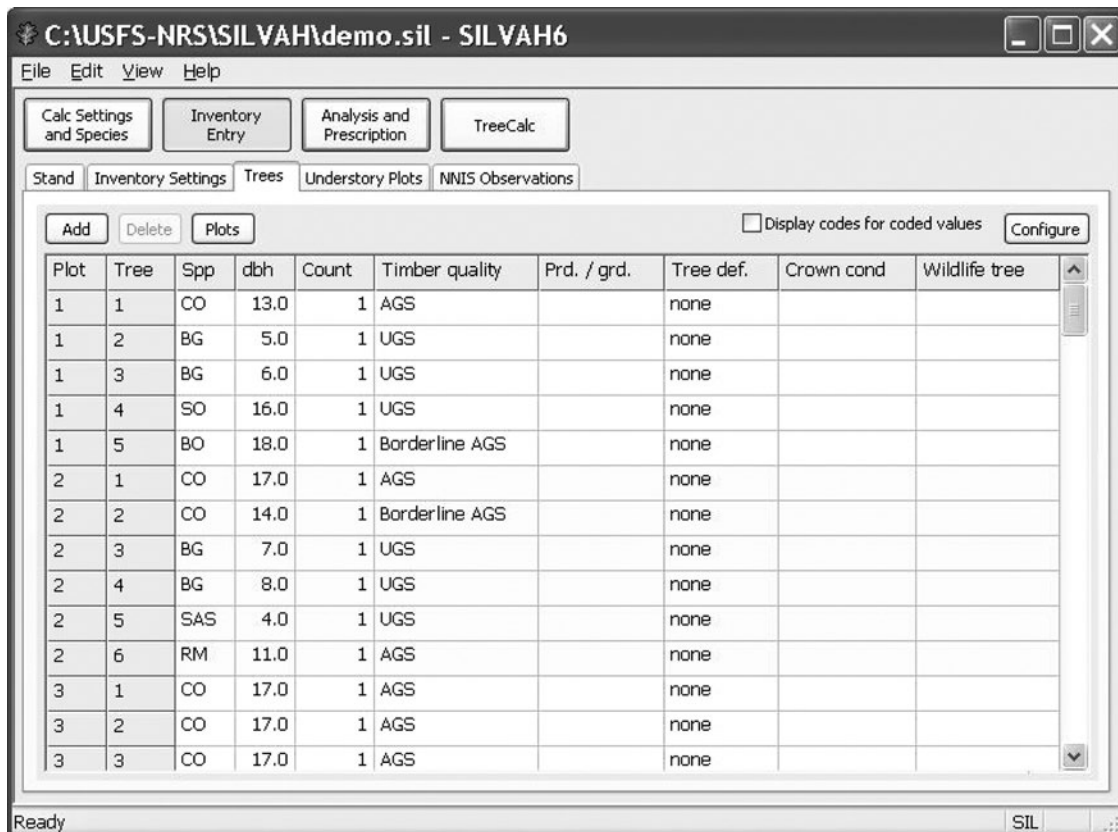


Figure 1.—The SILVAH6 program showing a list of tree records in Inventory Entry.

Calc Settings and Species

This component provides settings that allow for customization of timber pricing and volume estimations. In addition, you can establish the minimum amount of volume required for SILVAH to prescribe intermediate commercial cuts (thinnings). You can indicate which species are desirable or undesirable, exotic or native, and SILVAH will use this information in evaluating stand conditions. You can also create custom species identification codes (mnemonic codes) for use in your field inventory. See Chapter 4 for more detail on these functions.

Inventory Entry

In this component, you can enter data, save it to a file, edit an existing file, and convert older data formats to the current up-to-date format. You can also import data from other sources. See Chapter 3 for more detail on these functions.

Analysis and Prescription

This is the component in which SILVAH analyzes forest stands and generates reports of the results. SILVAH can summarize inventory data regarding stand volume and value, structure, and species composition, understory regeneration data, and site conditions. You can write your own prescriptions or ask SILVAH to recommend one. You can simulate stand growth and develop prescriptions for projected stand conditions in the future. All SILVAH output is produced in text report files that can be opened in any word processor. You can also create database output that allows you to compile information into a single table that can be used in a database. SILVAH can analyze the current inventory data loaded into memory, as well as any number of stands all during the same run. See Chapter 5 for more detail on these functions.

Tree Calc

This component (hereafter referred to as TREECALC) provides a way to calculate the volume and value of individual trees. It is an electronic volume table. TREECALC uses the same volume, density, grade distribution, and value equations used in SILVAH when it analyzes stands and writes prescriptions, so it gives you a convenient way to check on answers produced during analysis of forest stands. TREECALC can also be educational; by examining the volumes and values of a few trees with this feature, you will have a much better understanding of the procedures that SILVAH uses in its inventory processing. TREECALC is also useful any time you want to calculate and sum values on a small number of individual trees. See Chapter 6 for more detail about this SILVAH feature.

System Requirements

SILVAH will run on any Microsoft Windows computer. On early versions of SILVAH (early 1990s), when systems were much slower, hardware made a significant difference in the performance of SILVAH. Currently, any personal computer should be able to process your data quickly (in seconds) without any noticeable delays.

Earlier versions of SILVAH ran on DOS (the predecessor of Windows), and therefore required a file called "ansi.sys" to provide user interface features. SILVAH no longer runs on DOS nor does it use screens that resemble the old DOS interface of previous versions (prior to version 6.0).

A minimum of 5 megabytes (MB) of disk space is required for the installation of the software. A monitor with 800x600 resolution or higher is recommended.

An important software requirement should be noted. In order to take advantage of new installation technologies for improved system security and to enhance deployment over the internet, SILVAH uses the Microsoft Windows Installer technology (version 3.1 or newer), which requires relatively recent versions of Windows in order to run the installation. The installation requires Windows 2000 service pack 4 or newer versions of Windows.

No other software is required to run SILVAH. All of the output is generated as plain text files that can be opened in Notepad or WordPad—applications that are packaged with Windows.

Discontinued Features

SILVAH 6 provides a major redevelopment of the traditional SILVAH user interface. The use of DOS-like screens for stand processing has been replaced by Windows interface tools. As a result of the new SILVAH interface design, the following features have been discontinued in SILVAH 6.

Analysis and Prescription Operating Mode

Formerly there were three operating modes when analyzing stands: Interactive, Script, and Batch. You had to tell SILVAH which mode you were using during a run. In the current version of SILVAH, there is no operating mode. Instead, how you use the program will directly control what it does. You can still work interactively on a single stand, using the mouse to select options, and asking SILVAH to provide reports and prescriptions as desired. You can go one step further to save your processing options in a script file to reuse the same set of options repeatedly.

Batch Processing

There is no longer a utility for processing separate lists of stands against multiple script files all in one run. Batch processing of stands has been replaced with a new capability of using the mouse to browse and select multiple stands for processing. You can process as many stands as you want, regardless of whether you are working interactively or with a script file. You can store the list of stands for future use if desired.

Simulation Output (.syy) and Database Output (.dyy) Files

Simulated stand data was formerly output into files ending with the .yy extension. The 'yy' indicated the projection year for a simulated stand. Thus, if you started with a file called MYSTAND.sil which was tallied in 2008, and projected that stand for 20 years, the simulated output file would have been called MYSTAND.S28. In older SILVAH versions (pre-version 5.5) this data could be re-entered into SILVAH for further processing if desired. Similarly, if you had asked for database output at the end of the projection period, a file called MYSTAND.D28 would have been created. Database output files of this naming convention have been discontinued. However, database output remains and has been enhanced in the current version of SILVAH. Database output now goes into a user-selected file name, and if you are processing multiple stands, data from all stands will be output into the file that you specify.

Data, Output, and Script-batch File Directories

SILVAH no longer maintains any directories for your files. Furthermore, these directories are no longer stored in the defaults (.def) file. For each stand that you select for processing, all output associated with that stand will be created in the same folder in which the stand originated. Database output is generated into a folder and file that you specify.

Adding Stands Together

Formerly SILVAH would let you add (combine) stands into one printout, giving you the average or total volume or value of a tract. This feature has been discontinued. To achieve similar results, use the database output feature of SILVAH6 to accumulate summaries of multiple stands, and use a spreadsheet program to open the database output and summarize the columns with headings such as “[net cd vol],” “[net bdft vol],” and “[value].” Alternatively, you can import SILVAH stands into NED-2 software, or manually input table results into a spreadsheet to produce averages or totals.

Chapter 2 - Installing SILVAH On Your Computer

Installation Procedure

The SILVAH installation requires Administrative privileges.

The installation and setup of SILVAH requires the Microsoft Windows Installer engine, version 3.1 or newer. You may already have Windows Installer 3.1 if you have Windows XP service pack 2 or newer. The SILVAH setup will automatically determine whether or not you need to upgrade the Windows Installer on your machine. If the SILVAH setup does not find the correct version of the Windows Installer, the setup will stop and inform you that it cannot proceed until you upgrade the Windows Installer on your computer. If you do not have the proper version of the Windows Installer engine, you can download it for free from Microsoft Corporation. NOTE: You will need to have administrator privileges to upgrade the Windows Installer engine, and a system reboot is required after the Windows Installer upgrade.

Follow the prompts on the SILVAH setup to install SILVAH on your computer.

Whether you install from a CD or from the web, we encourage you to visit the SILVAH website (<http://nrs.fs.fed.us/tools/silvah/>) to check for updates that are newer than your full installation package.

Installing from CD

To begin the installation, insert the SILVAH CD into the CD-ROM drive. If auto-play is enabled on your computer, the installation program will launch automatically. If the CD does not start within 5-10 seconds, follow these steps below to start the setup manually:

1. From the Start menu, click **Run**, and from the Run dialog box, enter “**d:\silvah6setup.exe**,” where “d:” is the name of your CD-ROM drive.
2. Click **OK**.
3. Follow the installation instructions on the screen.

Installing from the web

You may download the installation from the SILVAH website, as of the time of this printing, at <http://nrs.fs.fed.us/tools/silvah/>. Do *not* click **Run** from the pop-up window. Instead, click **Save** to download the SILVAH setup, then run it. The SILVAH setup is called “silvah6setup.exe.”

Starting up SILVAH after a successful installation

Immediately after the installation has finished successfully, you may start the SILVAH program as follows:

1. From the Start menu, click **Programs** ("All Programs" in Windows XP).
2. Click **Silvah6** from the list of installed programs.
3. From the pop-up list of options, click **Silvah6**.

Creating a desktop shortcut to the SILVAH program

1. From the Start menu, click **Programs** ("All Programs" in Windows XP).
2. From the list of installed programs, click **SILVAH6**.
3. From the pop-up list of options, right-click **SILVAH6**.
4. From the pop-up menu, click **Copy**.
5. Move the cursor to your desktop.
6. Right-click anywhere in the open space on your desktop.
7. From the pop-up menu, click **Paste Shortcut**. You can use this shortcut to launch SILVAH from the desktop.

Chapter 3 - Data Entry and Manipulation

About Inventory Entry

Inventory Entry is where you create and edit data files (.sil). Proceed with the steps below to learn about Inventory Entry using the sample file distributed with SILVAH.

To start SILVAH 6 and open the sample file:

1. Click the Windows Start menu button. Click **Programs** (“All Programs” in Windows XP), then click **Silvah6** from the list of programs. Click **Silvah6** from the SILVAH6 program options. When it starts up, SILVAH6 automatically selects the Inventory Entry component.
2. On the menu at the top of SILVAH6, click **File**.
3. From the File menu, click **Open SIL file**.
4. Browse to the SILVAH6 installation folder (default = C:\USFS-NRS\SILVAH6) and select the **newdemo.sil** file.
5. Click **Open**.

NOTE: Data that uses species identification codes other than the default codes known internally by SILVAH require the use of a defaults (.def) file to properly interpret species. See the topic “About SILVAH defaults” in Chapter 4 for more information. The newdemo.sil file opened in step 4 above uses default species codes, allowing it to be viewed successfully without opening a defaults file.

- Click the **Inventory Settings** tab to review the inventory settings for the stand. Inventory settings are stored with your data and can be edited once you have opened the data file. Inventory settings can be retained as a set of defaults and applied to all of your *new* stands if you intend on following the same inventory procedures (see the topic on entering stand inventory settings for more details). You should specify your inventory settings before you begin entering data.
- Click the **Stand** tab to examine stand detail which identifies the stand and includes management guidelines that are used by SILVAH when writing a prescription for the stand. You will see separate blocks for management information, identification, and physiography and site data for the stand.
- Click the **Trees** tab to examine the overstory (tree) data. All of the plots and trees will appear together in a large matrix, with each row pertaining to a single tree, and columns containing data about the tree. The plot and tree number appear off to the far left in dark gray columns to signify that they *cannot* be edited. To help your eye distinguish data from each plot at a glance, rows of trees of every other plot are colored in light gray—this data *is* editable.

- Click the **Understory Plots** tab to examine the understory data. Each column represents a plot. Desirable regeneration (collected in the 6 foot or milacre regeneration plot) is represented by the upper rows which contain desirable tree regeneration, saplings, and residuals. The lower rows contain data that is collected in the interference plot, such as tall woody interference, percent fern cover, and site limitations.
- Click the **NNIS Observations** tab to examine the nonnative invasive species (NNIS) data. In the left side of the screen, rows represent the presence of NNIS in the regeneration plots. In the right side of the screen, check boxes indicate the presence of NNIS outside of the regeneration plots within the stand or near the stand.

Starting a New Stand

You can edit one stand at a time. When you are ready to start a new stand (a new data file), follow these steps:

1. Click the **Inventory Entry** button.
2. From the top menu, click **File**, then click **New SIL File**. You may also try the shortcut, **[Ctrl] + [N]** (press and hold the **Control [Ctrl]** key and then press the letter “**N**”), to start a new file. If you have previously been editing data, SILVAH will prompt you to save the changes before starting a new file.
3. Click the **Stand** tab to enter appropriate information about the stand.
4. Click the **Inventory Settings** tab to enter the inventory settings for the stand.
5. Click the other tabs to enter plot data.
6. Be sure to save your work. Your stand will be stored in a new data (.sil) file. You may continue to enter overstory and understory data if necessary.

See Chapter 5 to learn about analyzing a stand and about prescription and report options.

Saving Your Data

To save the current inventory data to a file:

1. Click the **Inventory Entry** button.
2. From the top menu, click **File**, then click **Save SIL File**. You may also try the shortcut, **[Ctrl] + [S]** (press and hold the **Control [Ctrl]** key and then press the letter “**S**”), to save a file. The file will contain the data for one stand only.
3. If you are saving the data for the first time, enter a file name, and be sure you are aware of the folder where the file is being created.

Generating Raw Screen Output

You can create raw output of the data that appears on the screen. This may be useful in proofreading data, plant species codes, and other items in SILVAH.

Raw output can be generated for any of the SILVAH screens. The output is formatted in HTML and is automatically opened in your default web browser.

To generate raw output from any screen:

1. Click the **View** menu at the top of the SILVAH window.
2. From the View menu, click **Raw Output of Current Screen**. You may also try the shortcut, **[Ctrl] + [h]** (press and hold the **Control [Ctrl]** key and then press the letter “**h**”), to generate raw output of the current screen in HTML format.

Opening an Existing Data File

To open an existing data file:

1. Click the **Inventory Entry** button.
2. From the top menu, click **File**, then click **Open SIL File**. You may also try the shortcut, **[Ctrl] + [O]** (press and hold the **Control [Ctrl]** key and then press the letter “**O**”), to open a file.

Converting Data from Older Versions

SILVAH has existed since the 1980s. As it evolved, additional capabilities were added. Along with those additions came format changes in the data. To accommodate older formats, SILVAH can convert files going back to version 4.0. The program attempts to read the old formats directly, and when you save the file, the data will be saved in the current format.

It is recommended that you back up your older files before converting them to the current format.

Converting older data requires a few simple steps. You must also review the data to ensure it was correctly interpreted.

1. Click the **Inventory Entry** button.
2. Open the data (.sil) file that contains data with an older format.
3. Once the data has been loaded, review the data to be sure it is accurate. Pay close attention to inventory settings, management information, and understory woody interference, as these items have gone through several revisions over the years.

4. If you are working with a file that has already been backed up, save the file. If you are not sure, then click **File**, click **Save As...**, and use a slightly different file name in order to preserve the contents of the original data file.
5. Data processed in this way will be saved in the current SILVAH6 file format.

Entering Stand Inventory Settings

It is important to provide information on how your stand data was collected in order for SILVAH to be able to analyze your data and properly assess your stand. Inventory settings are stored with your data, in the .sil file, so they can be readily available to SILVAH.

1. Click the **Inventory Entry** button.
2. Click the **Inventory Settings** tab.
3. Enter your settings. See below if you want to establish these settings as defaults.

Establishing Default Inventory Settings

If you think you will sample your stands the same way repeatedly, you can establish a set of default inventory settings that will be applied each time you start a new stand.

To establish defaults that match the *current settings* you have entered in the **Inventory Settings** tab:

1. Click the **Make these your default inventory settings** button.
2. The next time you create a new stand, it will inherit the default settings. Of course, you can modify the settings for a stand at any time.

Entering Stand Management Information

In writing a prescription for your stand, SILVAH requires information on management policies, goals, and other factors that may affect the treatment options for the stand.

These questions are of vital importance because they influence the kind of prescription generated by SILVAH. To record your management information, such as deer impact, restrictions on silviculture systems, whether to start regenerating the stand now, etc.:

1. Click the **Inventory Entry** button.
2. Click the **Stand** tab.
3. Provide your answers in the upper section labeled "Management."

Establishing Default Management Guidelines

If you think that the same management policies, goals, deer impact, etc. will apply to most of your stands, you can establish a set of default answers that will be applied each time to you start a new stand.

To establish defaults that match the *current settings* you have entered on the **Stand tab**:

1. Click the **Make these your default mgmt settings** button.
2. The next time you create a new stand, it will inherit the default settings. Of course, you can modify the settings for a stand at any time.

Entering Stand Identification Data

Identification data helps identify the stand when you examine reports. Currently, this information is not used in writing a prescription.

To provide a unique stand ID, county, land cover type, comments, etc.:

1. Click the **Inventory Entry** button.
2. Click the **Stand** tab.
3. Provide your answers in the upper section labeled "Identification."

Entering Stand Physiography and Site Data

The sum total of all factors in a stand, such as climate, physiography, soil, and vegetation results in a site with specific characteristics important to tree growth and forest management. As an expression of site quality (productivity), you can record site index and species, or site class.

Stand area and site index or class are used by SILVAH in determining a prescription. If you elect to follow the prescription charts for oak, you are required to provide information about site quality. Site class can be used as an alternative to site index. You do not need to record both site index and site class.

If you are not recording heights, you may use a merchantable height adjustment if the SILVAH-estimated heights are not representative for your site. Valid merchantable height adjustment values range from 0.5 to 1.5. The merchantable height adjustment is applied to the estimated sawtimber and total merchantable height of each tree.

Other physiographic features such as slope and aspect are not currently used but may be used in the future, and may be useful to you if you are using SILVAH to create a database of stand information.

Working with Grid Tables

About Grid Tables

Tabular data, such as overstory and understory data, is entered on a grid table, hereafter referred to as a grid. It resembles a worksheet in Microsoft Excel and has some similarities. There are a series of rows and columns each with appropriate labels for guidance. Anything that appears in a dark gray background color is fixed and cannot be edited or altered in any way.

Overstory data is entered in rows, with each column representing a particular field or tree variable such as species or diameter. Each row is a separate tree observation.

Understory data is entered in columns, with each column representing a plot. Each row represents a particular regeneration variable, such as the count of black cherry seedlings, or percent fern cover.

A grid is also used in setting plant species codes and default parameters.

Data cannot be copied *into* the grid. However, data may be copied *from* the grid and pasted into another application for other purposes. If you are interested in importing data from other sources, see the section on importing data at the end of this chapter.

Moving Through the Grid

To move between the cells on the grid, use the Tab key, the arrow keys, or the mouse cursor. When you move to a cell, it becomes active and is ready to accept input. When you press the **Enter** key, you will be moved to the next cell of the current observation.

Data Entry Shortcuts for the Grid

There are a variety of keystrokes or key combinations that provide quick shortcuts to oft-repeated actions during data entry, such as creating records, copying fields, and looking up values. All of these grid shortcuts apply to the overstory and the understory grids.

[Enter] Move to next cell - The Enter key exits the current cell and moves to the next cell, or into the first nonfixed column in the next row if currently in the last column. If you are in the very last column of the very last row, it will add an observation to the current (last) plot.

[Ctrl] + [Enter] Add new obs to plot - Press and hold the **Control [Ctrl]** key and then press **Enter**, and a new observation is inserted below the current row. Example: if you have five plots and are currently positioned on the second observation in plot 3, it will add a new observation to plot 3, as the third observation—below the second observation. What used to be the third observation will now be the fourth observation.

[Ctrl][Shift][Enter] Add new obs to next plot - Press three keys at once, **[Ctrl][Shift][Enter]**, and a new observation is inserted into the next plot. If that plot does not have an observation, it will create one. If you are in the last plot, it will create a new plot. Example: If you have five plots, and you are in plot 3, it will add the observation to the “bottom” of plot 4. If there is no observation in plot 4, it will create one. If you are in plot 5, it will add a sixth plot and a new observation in that plot.

[Ctrl] + [Q] Query - Press and hold the **Control [Ctrl]** key and then press the letter **Q** key to look up the possible values for a given field. You can make a selection from the list of choices. Example: If you don't know the species code for black cherry, press **[Ctrl] + [Q]** to view all species. Above the choices, indicate the type of code you are interested in viewing. Choose a species from the list if desired.

[Ctrl] + [D] Copy content from cell above - Press and hold the **Control [Ctrl]** key and then press the letter **D** key to copy the contents of the cell above. D stands for “ditto” and not delete! Example: You are working in a pure black cherry stand and you want to save a few key strokes by repeating some information from row to row. The next time you need to enter the species, press **[Ctrl] + [D]** to copy the species from the cell above.

[Ctrl] + [Del] Delete current row - Press and hold the **Control [Ctrl]** key and then press the **Delete [Del]** key to delete the current row. Existing rows will be renumbered.

Configuring Data Fields on the Grid

You can arrange the data fields of a grid in any order that you prefer, and you can turn off fields that you do not need. Turning off a field doesn't cause a loss of data, nor does it eliminate the field—it only tells the program not to display it. SILVAH will remember these settings after you close the program.

When you click the **Configure** button that typically appears in the upper-right corner above the grid, the **Select variables dialog** appears. Fields currently being displayed are shown on the right-hand side, and they are arranged from top to bottom to reflect their display from left to right during data entry.

Turning off a field

1. Click the **Configure** button to launch the **Select variables dialog**.
2. Click on the field that you wish to remove from display on the right hand side.
3. Click the **left-pointing arrow** to remove the field from the list of items displayed. Alternatively, you can double-click the item you wish to remove from the display.
4. If desired, click the **double left-pointing arrow** to remove all fields from the right hand side at the same time.
5. Click **OK**.

Turning on a field

1. Click the **Configure** button to launch the **Select variables dialog**.
2. Click on the field on the lefthand side that you wish to display.
3. Click the **right-pointing arrow** to add the field to the list of items displayed. Alternatively, you can double-click the item you wish to add to the display.
4. If desired, click the **double right-pointing arrow** to add all fields on the left hand side at the same time.
5. Click **OK**.

Changing the order that fields appear during data entry

1. Click the **Configure** button to launch the **Select variables dialog**.
2. From the list of items to be displayed, use the mouse to drag-and-drop a field up or down the list until the order from top to bottom reflects the desired order from left to right during data entry.
3. Click **OK**.

Toggle fields displayed or not displayed

1. Click the **Configure** button to launch the **Select variables dialog**.
2. Click the **cycling arrows** to exchange displayed fields with nondisplayed fields. This option swaps fields in the left list with fields in the right, and vice-versa.
3. Click **OK**.

Copying Data from the Grid

Data can be copied from most of the grid tables displayed throughout SILVAH, with the exception of the plant species grid. Copying the information in the grid may be useful if you want to obtain a printout of your data for proofreading or to perform additional analyses outside of SILVAH. Remember that data cannot be pasted *into* a grid.

1. Click anywhere in the data entry grid.
2. Select the cells you wish to copy. If you click once in the header cell of the dark gray columns to the left side of the grid, all cells will be selected.
3. Press **[Ctrl] + [C]** - Press and hold the **Control [Ctrl]** key and then press the letter "**C**" key to copy to the clipboard. Then paste the contents into other software as desired.

Entering Overstory Data

About Tree and Plot Records

Overstory data consists of a hierarchy of plot and tree records. Plot records are used solely to identify the trees that were sampled in specific plots. Currently, there are no plot-specific attributes and thus there are no tools for editing plot attributes such as plot identification, comments, etc. To enter data on a tree observation, you must first establish a new tree record, and then enter the data. However, tree records must be associated with at least one plot record, which means you must first create a plot record before you can create tree records. You can establish all of your plot records ahead of time or you can establish plot records as you need them. The latter approach tends to work well and is most commonly used. There are buttons for adding tree and plot records, but these are not always necessary and faster ways of creating records are available. See the topic on data entry keyboard shortcuts for the grid in the section on working with grid tables to learn how to create tree records and plot records most efficiently.

SILVAH displays all tree records in a stand concurrently in a grid. Each tree record is assigned a sequential tree number, which is always in display. The plot number of each tree record is displayed in the column to the left of the tree number. Plot numbers and tree numbers are fixed and cannot be reconfigured.

Adding Tree Observations

Tree observations can be added or inserted at any time, or you can add trees as you proceed through your tally sheets during data entry. See the topic “Entering Tree Data” in this chapter for information on specific fields, and be sure to review the data entry shortcut topics for helpful tips on data entry. The steps below will always apply, but you may find the shortcuts more efficient.

Adding the First (Initial) Tree of the Stand

1. Click the **Inventory Entry** button.
2. Click the **Trees** tab.
3. Click the **Add** button or click anywhere in the space that includes the caption, **Click here to begin data entry**. The tree will be added as the first record of the first plot. SILVAH will create the first plot automatically and add the new tree record to that plot, then the new tree record will appear in the display.

Adding More Trees

1. Click the **Inventory Entry** button.
2. Click the **Trees** tab.
3. Click the **Add** button.

4. If you want the new tree to be added as the last tree in an existing plot, click the desired plot number from the list box in the Choose a plot dialog. Then, click **OK**.
5. Click **Add a new plot** from the Choose a plot dialog if you want the new tree record to be added as the first record in a new plot. SILVAH will immediately create a new tree record in a new plot that follows the existing plots.

Inserting a Tree Record

1. Click the **Inventory Entry** button.
2. Click the **Trees** tab.
3. Click anywhere in the row of an existing tree record.
4. Press **[Ctrl] + [Enter]** (press and hold the **Control [Ctrl]** key and then press the **Enter** key) to insert a new tree record below the existing one.

Default values for new tree records

There are a limited number of fixed default values that appear every time you create a tree record. Timber quality is Acceptable Growing Stock (AGS) and diameter at breast height (dbh) is 0.6 inches. The number of trees represented by this observation (the count) is 1, and defect is assumed to be zero.

Entering Tree Data

These instructions assume the fields are configured on the grid in the order as presented below. If your fields are arranged in a different order, the information about each field is the same.

The species code, diameter, and quality fields should be completed for each tree in order to obtain the most appropriate silvicultural prescription for your stand. The remaining fields are optional and may be left blank if desired. See Marquis et al. (1992) and Brose et al. (2008) for silvicultural details of recommended inventory procedures.

All units are in English. Currently, metric units are not supported in SILVAH.

Entering Species Codes

After you enter the species code of a tree record, press either the **Tab**, **Enter**, or **right arrow** key to move to the next field. Species entries are *not* case sensitive but will be displayed in upper case. If you type in a species code that does not exist, you will be presented with a pop-up list. The list is initially sorted by the species code specified under Inventory Settings. Select a species from the list and click **OK**. If you click **Cancel**, the species cell is returned to the previous value.

To learn more about how to identify species during data entry—see the topic “About Species Codes” in the Plant Species Information section of Chapter 4 on setting up defaults.

Entering the Diameter

When the species code is accepted, the next field to the right will become active, which is the diameter field. Enter the diameter of the observed tree. SILVAH works only with whole numbers, and if you enter more precise values, the display will retain them, but only rounded values will be stored in the data (.sil) file. If applicable, you may only need to record even numbers if your cruise is by 2-inch size classes. If you are using broad size classes, then use only the midpoints of the diameter classes. You will not be able to enter a diameter larger than 40 inches.

Entering the Quality

The quality field is the next one to be filled in. You may record AGS, Unacceptable Growing Stock (UGS), or dead. If you are using a prism cruise, you may also record borderline AGS, borderline UGS, or borderline dead. You may enter the first letter of the quality, such as “a” for AGS, or the equivalent numeric code (“1” for AGS). If you prefer to display numeric codes instead of alphabetic codes, check the **Display codes for coded values** box in the space above the tree grid. If you are not sure what codes are available, press **[Ctrl] + [Q]** (press and hold the **Control [Ctrl]** key and then press the letter “Q” key) to look up the possible values for timber quality.

Entering Merchantable Height or A Tree Count

The Tree observations include an option under the Inventory Settings tab determines which value is entered in the next field. Specifically, if you indicate that your tree observations contain counts, then SILVAH will display a count field. If you indicate that your tree observations contain heights, then you will see a M. Height field for merchantable height. There are actually two separate variables, one for counts, and another for merchantable heights, but the program will not allow both to be used at the same time—only one of them will be available. You can switch back and forth and SILVAH will redisplay the values previously entered, but only while the file is open. Once the file is closed (and saved), the most recent value displayed is the one that will be saved with the data.

Entering Grade, Defect, Crown, and Wildlife Codes

The remaining four fields, grade, defect, crown condition, and wildlife code, are entered similarly as the fields above. All four of these fields are optional, and need not be filled in. The grade, crown, and wildlife fields are all coded values. The codes and meanings can be found in Appendix A. Defect is a percentage recorded as tens of percent; that is, 1 for 10 percent, 2 for 20 percent, and so on.

Proceeding to the next tree observation

When you reach the end of a row, if you press the **Enter** key after editing the last field, and this is the *last* observation in the current plot, SILVAH will add a new tree to the plot, otherwise, you will jump to the next row below if an existing record occurs after the current one. When you are ready to add a new observation that begins in the next plot, instead of pressing the Enter key, press **[Ctrl][Shift] + [Enter]**—that is, press and hold down the **Control [Ctrl]** key and the **Shift** key at the same time and then press the **Enter** key. Refer to the topic “Data Entry Shortcuts for the Grid” earlier in this chapter for more information.

You should periodically save your work while you are entering data to avoid losing information and having to start over.

Working with Empty Plots

When a plot is empty (i.e., when the inventory found no trees on that plot), it is very important to record it in SILVAH. Failure to do so may result in inaccurate, biased assessments of your stand, with potentially inappropriate prescriptions from SILVAH.

An empty plot can be entered in SILVAH in the order it was encountered in the field. Note that empty plots are handled differently for the overstory and understory.

In the overstory, the empty plot will not appear in the grid. The example in Figure 2 shows trees from plots 1, 3, and 4, but not plot 2. When a plot is not shown in the grid, as in Figure 2, it signifies that an empty plot was entered without any tree observations. An exception would be if the last plot in the inventory was empty. In this case, there is no way to tell by looking at the grid whether the last plot in the field was empty, or whether the inventory simply stopped with the last plot shown in the grid. The only way to be sure is to click **Plots** button (located immediately above the grid) to view the list of plots and see if another plot exists beyond the last plot shown in the grid.

Plot	Tree	Spp	dbh	Count	Timber quality
1	1	NRO	12.0	1	AGS
1	2	EH	8.0	1	AGS
3	1	WA	14.0	1	AGS
3	2	NRO	11.0	1	AGS
3	3	BC	18.0	1	AGS
4	1	AE	4.0	1	AGS
4	2	RM	6.0	1	AGS
4	3	WA	12.0	1	AGS

Figure 2.—Sample tree data in SILVAH where plot 2 is empty and not shown in the grid.

To add an empty plot in the overstory

1. Click the **Plots** button near the top of the grid.
2. Click the **Add** button on the Manipulate plots dialog.
3. Click **OK**.
4. Click the **Add** button near the top of the grid.
5. At the top of the Choose a plot dialog, click the **Add new plot** button. A new tree record will be added to the grid in the plot *after* the empty plot, and you may resume entering data.

To add an empty plot in the understory

When a new understory plot is added in SILVAH, items that require counts or percent cover data are given zero values by default. Thus, the way to enter an empty plot is to add it and then leave it alone. Be sure that no values are entered in the column for the empty plot, and that zeros appear where appropriate. In the understory, empty plots will appear in the grid.

1. Click the **Add** button near the top of the grid.
2. If there are additional plots beyond the empty plot, repeat step 1 and then enter appropriate inventory values in the new plot.
3. Be sure that no values (i.e., only zeros) are entered in the column that represents the empty plot.

Manipulating Plots

If the need arises, you can rearrange plots even after you have entered data. This would result in a renumbering of all plots according to the order you want. You can also insert a plot at any time, and this may be important if order is critical and you discover later that you inadvertently skipped a plot or entered data out of order.

Change Plot Order

1. Click the **Inventory Entry** button if you aren't already there.
2. Click the **Trees** tab.
3. Click the **Plots** button at the top of the trees grid to launch the Manipulate plots dialog as shown in Figure 3.
4. In the list of existing plots, drag-and-drop the plot to its appropriate place on the list.
5. Click **OK** when you are finished.



Figure 3.—Manipulating overstory plots.

Add a Plot

1. Click the **Inventory Entry** button.
2. Click the **Trees** tab.
3. Click the **Plots** button at the top of the trees grid to launch the Manipulate plots dialog as shown in Figure 3.
4. Click the **Add** button, and you will see New Plot 1 appear at the bottom of the list.
5. Drag-and-drop the plot to its appropriate place in the list if you don't want it to be the last plot in the group.
6. Click **OK**.

Insert a Plot

1. Click the **Inventory Entry** button.
2. Click the **Trees** tab.
3. Click the **Plots** button at the top of the trees grid to launch the Manipulate plots dialog as shown in Figure 3.
4. Click on one of the existing plots where you wish to insert a plot.
5. Click the **Insert** button.
6. Choose whether to insert the plot before or after the highlighted plot.
7. Click **OK**.

Delete a Plot

1. Click the **Inventory Entry** button.
2. Click the **Trees** tab.
3. Click the **Plots** button at the top of the trees grid to launch the Manipulate plots dialog as shown in Figure 3.
4. In the list of existing plots, click on the one you wish to delete. Note: All tree observations in the plot will also be deleted.
5. Click **Delete** button.
6. Click **OK**. If you accidentally deleted the wrong plot, click **Cancel** and try again.

Entering Understory Data

About Understory Data

Understory data is recorded by plot. Unlike overstory data, SILVAH does not maintain records below the plot level.

There are two ways that understory data can be collected, and what you see on the Understory Plots tab in SILVAH will depend on your choice of understory cruise type under the Inventory Settings tab. The first, and substantially most common, is what is known as Extended regeneration data, where you enter seedling counts, percent cover of interfering vegetation, and site characteristics for each plot. The second, less common and older method is known as Checkmark data. With Checkmark data, you enter the number of plots stocked with each category of commercial seedling regeneration, interfering vegetation, and site limitations. If you select **Checkmark** for the Understory cruise under the Inventory Settings tab, you must also enter the total number of checkmark plots assessed in the field before completing the Inventory Settings.

The presence of nonnative invasive species may be recorded while sampling. For further information, see the section “About Nonnative Species Data” later in this chapter.

See Marquis et al. (1992) and Brose et al. (2008) for silvicultural details of recommended understory inventory procedures.

Entering Extended Regeneration Data

This is the preferred and most beneficial of the methods for collecting understory data because you are collecting and retaining quantitative data that can be analyzed against known criteria in an objective manner, and it allows for a more meaningful comparison with data in the future. You can begin an extended regeneration tally by following the steps below:

Adding the First (Initial) Understory Plot of the Stand

1. Click the **Inventory Entry** button.
2. Click the **Understory Plots** tab.
3. Click the **Add** button or click anywhere in space that includes the caption, **Click here to begin data entry**. SILVAH will create the first plot and then display it in the Understory data grid.

Adding More Understory Plots

1. Click the **Inventory Entry** button.
2. Click the **Understory Plots** tab.
3. If you want the new plot to be added as the next or last plot, click the **Add** button.

Inserting an Understory Plot

1. Click the **Inventory Entry** button.
2. Click the **Understory Plots** tab.
3. Click anywhere in the column of an existing understory plot column.
4. Click the **Add** button to insert a new understory plot after the existing plot selected in Step 3.

Refer to the topic “Data Entry Shortcuts for the Grid” in the Working with Grid Tables section in this chapter for tips on how to add or insert plots without using the mouse.

Behavior of the Enter Key on the Understory Plot Grid

If only one plot has been entered, after you enter a value, when you press the **Enter** key, you will move down to the next row in the plot. However, when several plots have been added, the Enter key will move over to the next column within the same row. At the end of a row (in the last understory plot), the **Enter** key will move down to the first column of the next row.

Use the down and up arrow keys to move within the same plot if you prefer to enter data for each item in a plot before moving on to the next plot.

Desirable regeneration data is displayed in the upper half of the rows in the understory data grid. Lower rows contain interfering vegetation and site limitations.

Desirable Regeneration

Enter the weighted counts of black cherry, yellow-poplar, new oak, established oak, competitive oak, other desirable species, and conifers.

Items with Species

Enter the appropriate species code when applicable. Species entries are *not* case sensitive but will be displayed in upper case. If you type in a species code that does not exist, you will be presented with a pop-up list to choose from. The list is initially sorted by the species code specified under Inventory Settings. Select a species from the list and click **OK**. If you click **Cancel**, the species cell is returned to the previous value. See the topic “About Species Codes” in the Plant Species Information section of Chapter 4 for more information on how to identify species during data entry.

Percent Cover

For these items, enter the percent cover using whole numbers such as 15 percent, 70 percent, and so on.

Total Height of Oak Seedlings

This data is an optional prerequisite for running the Pennsylvania State University Appalachian Oak Guide (Steiner et al. 2008). It represents, to the nearest 0.5 feet, the total combined height of all oak seedlings in the central milacre of the regeneration plot. If you do not collect data on the height of oak seedlings, but you collect extended regeneration data, SILVAH will estimate the total

height of oak seedlings based on conservative assumptions regarding the height of the different classes of oak regeneration. SILVAH uses 0.25, 0.5, and 3 feet for new, established, and competitive oak, respectively.

Grapevines

This is the total count of grapevines that have ascended into the overstory.

Thick Duff, Rocky Surface, Poor Drainage

Answer yes or no for these items as found during the inventory of the interference plot.

Deleting an Understory Plot

To delete an existing plot, click anywhere inside the column of the plot you wish to delete, and then click the **Delete** button above the understory plot grid.

You should periodically save your work while you are entering data to avoid losing information and having to start over.

Entering Checkmark Regeneration Data

Checkmark data is quick but rather inflexible, and is based on field judgment at the time of sampling. During inventory, the data collector compares the observed weighted count of seedlings or interference on the sample plot against the stocking criteria for the ambient deer impact level, and records whether or not the observation met or exceeded the criteria. These data cannot be reassessed at a different deer impact level. You can begin a checkmark tally by following the steps below:

1. Click the **Inventory Entry** button.
2. Be sure you have specified Checkmark for the Understory cruise on the Inventory Settings tab.
3. Click the **Understory Plots** tab.

Enter the number of plots stocked with each category of regeneration, interfering vegetation, and site limitations.

Several rules apply as follows:

- The maximum value for any category must not exceed the total number of plots taken.
- The established and competitive desirables subtotal fields must be at least as much as any of the individual regeneration fields.
- The total oak field must be at least as much as any of the individual oak regeneration fields.
- The established oak field must be less than or equal to the established desirables subtotal field.
- The any interference field must be at least as much as any of the individual interference fields.

Validations of the rules above are typically postponed until you try to select a different tab. If there are errors, you will get an appropriate message and the opportunity to make corrections.

When you are finished, be sure to save your work to avoid losing information and having to start over.

Entering Nonnative Invasive Species

About Nonnative Invasive Species Data

NNIS may be present in or adjacent to the stand. Without being aware of their presence, any disturbance that reduces competition, increases light, or disturbs the soil may result in a rapid and near-complete dominance of the ground cover and the understory by aggressive nonnative species, which will likely displace most native herbaceous and shrub species and eliminate desirable tree regeneration.

While there are dozens of problematic invasive species in the eastern United States, SILVAH includes about 14 of the more common species in the Allegheny Plateau. This number was arrived at through consultation with U.S. Forest Service research scientists and practicing foresters in Ohio, Pennsylvania, and West Virginia.

Knowing what to look for, and knowing their whereabouts, is the first step in determining the severity of this issue and whether NNIS require additional sampling, or specific treatment prior to or in conjunction with other forestry practices.

SILVAH provides for the collection of presence-absence data, provides reports on which species were observed, and provides information about the ecology of each species. While percent cover or other quantitative sampling of NNIS would be provide the most useful information, there is currently an insufficient amount of evidence to suggest appropriate levels of NNIS that would require treatment, as well as which treatments are the most effective according to soil, climate, vegetation, management practices, land use, etc. Until we develop more understanding about the science and management of NNIS, a useful alternative is to note the presence of NNIS while sampling.

There are two ways to record information on NNIS in SILVAH. During understory sampling, you can record the presence of one or more NNIS that occur anywhere within the interference plot. NNIS can also be observed “off-plot” within the stand, or near the stand, such as across the road, in adjacent stands, etc.

NNIS data entry is split into two sides of the NNIS Observations tab. The left side is for recording observations made within plots. The right side is for recording the presence of NNIS “off-plot” within or near the stand.

Entering Plot-based NNIS Observations

NNIS observations observed within interference plots are entered in a manner similar to tree data, using understory plots as the basis. If you have already entered understory data, then you do not need to establish understory plots again—you will use the same plots for recording NNIS observations.

To enter data on an NNIS observation, you must first establish a new NNIS observation record, and then enter the data. NNIS records must be associated with at least one plot record. You will need to choose from the list of existing understory plots (or create new plots if necessary) before you can create NNIS records.

Getting Started after Entering Other Understory Data

1. Click the **Inventory Entry** button.
2. Click the **NNIS Observations** tab.
3. Click the **Add** button in the upper left corner of the tab.
4. From the pop-up Choose a plot dialog, click on the plot that contains the NNIS observation you wish to record. Alternatively, you can double-click on a given plot, and step 5 is omitted.
5. Click **OK**.

Getting Started without Existing Understory Data (No Understory Plots Created Yet)

1. Click the **Inventory Entry** button.
2. Click the **NNIS Observations** tab.
3. Click the **Add** button in the upper left corner of the tab. This step will automatically create the first understory plot record and also establish the first NNIS observation record for you.

Entering the data

Currently, only the identification of species is required. No other data can be recorded. Species entries are *not* case sensitive but will be displayed in upper case. If you type in a species code that does not exist, you will be presented with a pop-up list to choose from. The list is initially sorted by the species code specified under Inventory Settings. Select a species from the list and click **OK**. If you click **Cancel**, the species cell is returned to the previous value. Be aware that Forest Inventory and Analysis (FIA) codes may not have existed for many of the nonnative herbaceous species, as early FIA data was targeted mainly at trees and other frequently observed woody shrubs. The FIA codes displayed for NNIS were arbitrary assigned but can be used throughout the program to recognize the species.

If you enter a native species that is “invasive,” or any species that is *not* marked as exotic under Plant Species information, the species cell will be highlighted in yellow to distinguish native species from nonnative ones.

Adding new understory plots

If you need to add additional understory plots, you may create them during understory data entry, or while entering NNIS observations.

1. Click the **Inventory Entry** button.
2. Click the **NNIS Observations** tab.
3. Click the **Add** button in the upper left corner of the tab.
4. From the pop-up Choose a plot dialog, click the **Add new plot** button.

Deleting understory plots

If you need to delete an understory plot, it must be done through understory data entry. Please see the instructions for deleting an understory plot in the topic “Entering Extended Regeneration Data.” You can, however, remove any row that contains an NNIS observation within a plot. Click anywhere inside the row, then click **Delete** to remove the observation.

Proceeding to the next NNIS observation

When you reach the end of a row, if you press the **Enter** key after editing the last field, and this is the last observation in the current plot, a new NNIS observation will be added automatically, otherwise, you will jump to the next row below. When you are ready to add a new observation that begins in the next plot, instead of pressing the **Enter** key, press **[Ctrl][Shift] + [Enter]** (press and hold down the **Control [Ctrl]** key and the **Shift** key at the same time and then press the **Enter** key). Refer to the topic “Data Entry Shortcuts for the Grid” for other related shortcuts. You can use the arrow keys to move between observations without adding new rows.

Entering Off-plot NNIS Observations

Off-plot NNIS observations are recorded on a list of known exotic invasives in your sampling area. Before you can record your off-plot observations, you must first establish a list of exotic species. This list is used for species observed within the stand and near the stand, and is displayed on the right-hand side of the NNIS Observations tab. Your observations are made by checking species on the list.

Establishing a list of exotic species

1. At the top of the SILVAH6 window, click the **Calc Settings and Species** button.
2. Click the **Plant Species Information** tab to modify plant species attributes.
3. Make sure the Exotic column is in display. If it is not, try scrolling to the right or left, or click **Configure** button to add or rearrange the plant species fields in the grid. See the topic “Configuring Data Fields on the Grid” in Chapter 3 for further information.
4. In the species row, enter **yes** (or the press the letter “**y**”) in the exotic field. Repeat this process for all species that should be considered exotic in your area.

To see all of the exotic species together, try sorting by the exotic field: click once in the header of the exotic column to sort in ascending order, and click again to sort in the opposite order.

Entering the data

When you are ready to record your off-plot NNIS observations, follow these steps:

1. Click the **Inventory Entry** button.
2. Click the **NNIS Observations** tab.
3. If you do not see any species to the far right-hand side, that probably means there are currently no species marked as exotic in the list of plant species. Refer to the instructions above on establishing a list of exotic species.

4. For off-plot observations made within the stand, check the appropriate species under the within stand column on the right-hand side of the NNIS Observations tab.
5. For off-plot observations made outside the stand, check the appropriate species under the near stand column on the right-hand side of the NNIS Observations tab.

Importing Data

About Importing Data

The process of importing data involves reading in “foreign” data, interpreting it, and converting it so it can be viewed and analyzed by SILVAH.

The following are two formats that you can import:

Text

If you have data from commercially available tools for recording inventory data, or from generic word processing or spreadsheet tools (such as Microsoft Excel), you can import it into SILVAH—provided that these programs have a mechanism for converting or exporting their data into text format (.txt, .csv, etc.). Please read the topic on preparing text data before you begin.

NED-2

NED-2 is forest ecosystem decision-support software developed by the U.S. Forest Service, Northern Research Station. NED-2 is designed to improve project-level planning and decisionmaking by providing useful and scientifically sound information to natural resource managers. Resources currently addressed include visual quality, ecology, forest health, timber, water, and wildlife. NED-2 expands on previous versions of NED applications by integrating treatment prescriptions, growth simulation, and alternative treatment comparisons with evaluations of multiple resources across a management unit.

NED-2 data is stored in a Microsoft Access database.

Preparing Text Data for Import

Before your text data can be imported into SILVAH, a considerable amount of cleanup may be necessary in order for the import to be successful.

Your data must be organized into distinct columns (one per variable), and each column should contain values and formats that closely match SILVAH. For instance, if you maintain “live or dead” status separate from timber quality, these items are represented by a single variable in SILVAH (timber quality). So you would need to understand the quality codes used by SILVAH (e.g., 1= “live AGS,” 2=“live UGS,” 3=“dead,” etc.) and perhaps invent a new column in your raw data that reflects live or dead and timber quality simultaneously as shown here.

It is helpful if the first row in your data contains column headers, as these will help you map your variables with ones in SILVAH.

SILVAH data (.sil) files only contain information for a single stand, and if your data contains multiple stands, you will need to split them into separate files unless you are importing data from NED-2.

If your data is in metric, you must convert to English units before importing the data.

If you collected overstory and understory data, they must be split into separate files and imported in separate steps.

Order of your columns (variables) is not important, and you do not need to remove variables unless you prefer to work with a smaller set of variables.

Once all of this work has been completed, save your data in text format (.txt, .csv, etc.).

How to Import Text data

Once you have organized and prepared the text data for import, importing involves two phases—opening your raw data, and mapping your variables to SILVAH variables.

Opening Your Raw Data

1. From the File menu, click **Import Data**.
2. From the pop-up Import SIL dialog, click **File** to browse and select the text data you wish to import.
3. From the Open dialog, be sure to click **Files of Type** at the bottom center of the dialog and select **ASCII files (*.txt)** or **All files (*.*)** if .csv or other.
4. Select the file that contains your data and click **Open**.
5. At the top of the Import ASCII data dialog, specify whether you are importing TREE data or UNDERSTORY data. If you have both kinds of data, they must be imported in separate steps, using these same instructions.
6. Below the upper window that displays your raw data within the Import ASCII data dialog, select the **delimiter** that separates your variables (tab, comma, semicolon, other).
7. If your data contains column headers, be sure to check the box that says **first line contains column headings**.

Your data is displayed in the bottom window of the Import ASCII data dialog. If you applied column headings, you should see them near the top of your columns. If the data looks correct, you are ready to map the variables to SILVAH variables, as described below.

Mapping Your Variables

1. To map your variables to SILVAH variables, double-click in the top cell of one of the columns in your raw data in the bottom window of the Import ASCII data dialog. This will launch the Pick a variable for column dialog that lists the possible SILVAH variables that you can match with your variable.
2. By default, **ignore column** is selected. This allows you to skip variables that you do not wish to import.
3. To make a selection, uncheck **ignore column**.
4. Click an item on the list.
5. Click **OK**. The column you just matched will be shaded in white to let you know that it has been mapped (selected). Any data values that are out of bounds or invalid will be highlighted in red. Once a SILVAH variable has been mapped, it will disappear from the list of available variables when you continue mapping other data.
6. If you change your mind or want to unselect a previous match, repeat these steps and instead check **ignore column** to reset or undo the match.
7. Proceed through each of the variables that you intend to match.
8. When you are finished, click **OK** on the Import ASCII data dialog.
9. The program will examine the data and report errors, if any. Click **Yes** to attempt the import anyway, or click **No** if you want to fix any problems that were found.

How to Import NED-2 Data

1. From the File menu, click **Import Data**.
2. From the pop-up Import SIL dialog, click **File** to browse and select the text data you wish to import.
3. From the Open dialog, be sure to click **Files of Type** at the bottom center of the dialog and select **NED-2 database files (*.mdb)**.
4. Select the file that contains your data and click **Open**.
5. Click only *one* stand from the list.
6. Click **OK**.

NED-2 has many more variables than exist in SILVAH. For those NED-2 variables that have a counterpart in SILVAH, some require special handling to most accurately represent NED-2 data in SILVAH, as described below. Not all SILVAH variables are described here. In such cases, there is a direct match between NED-2 and SILVAH and no special handling is necessary.

Overstory Variables

Merchantable Height

If the NED-2 data contains user-entered sawtimber height or individual sawlog lengths (i.e., not calculated but entered by user) then the SILVAH setting for Tree observations include under the Inventory Settings tab will be set to *heights* instead of stem counts. Either the sawtimber height or the total length of sawlogs from the logs table will be divided by 8.0 to get the number of 8-foot bolts for SILVAH. Since SILVAH will only accept an integer, the value will be rounded down to the nearest integer. If the NED-2 overstory observation also contains a stem count greater than 1, SILVAH will have multiple tree records to match the number of stems in NED. That is, each tree record in SILVAH will have the same species, diameter, and number of 8-foot bolts calculated as described above. NED-2 pulpwood heights are not imported into SILVAH, since there is no equivalent variable for pulpwood height in SILVAH.

Live or Dead Tree

Live trees in NED-2 are brought over to SILVAH without any special considerations. If the tree is DEAD, then the SILVAH timber quality will be set to DEAD.

Timber Quality

Any NED-2 tree recorded as a CROP tree will be recorded as AGS in SILVAH. Trees recorded as AGS and UGS can be imported without modification (unless the tree is dead, in which case the timber quality in SILVAH will be set to DEAD).

Timber Product

The NED-2 most valuable product, if entered, will be used as the product in SILVAH. If any sawtimber grade (i.e., any product that is not related to pulpwood) is found in NED-2, then the SILVAH Tree grading procedure under the Inventory Settings tab will be set to **Grade every tree**. If only pulpwood products and culls are found in NED-2, then it will be assumed that the set the SILVAH Tree grading procedure will be set to **Grade only culls and large pulp**.

Defect

Only the NED-2 sawlog defect will be used, and it will be divided by 10 for SILVAH. This value will be recorded as the SILVAH tree defect.

Crown Condition

The NED-2 crown condition is recorded as percent of crown living, which would be converted into the SILVAH crown categories as shown below:

Category 1 - Healthy - Living Crown \geq 90 percent

Category 2 - Good - Living Crown \geq 75 percent and $<$ 90 percent

Category 3 - Fair - Living Crown \geq 50 percent and $<$ 75 percent

Category 4 - Poor - Living Crown $<$ 50 percent

Understory Variables

Oak Seedlings

If there were NED-2 oak seedlings in the ground plot, and height classes were not used, or they did not match well with SILVAH oak seedling classes, then all NED-2 oak seedlings will be recorded as new oak in SILVAH. If the NED-2 data has ground plot observations using the NED default height classes, then any oak seedling in the 0- to 3-foot height class would be recorded as new oak in SILVAH. Any oak seedling taller than 3 feet would be recorded as competitive oak.

Conifers

The total number of seedlings for all coniferous species identified in the NED-2 ground plot will be recorded in SILVAH as the total count of coniferous seedlings in the understory plot.

Other Desirables

In NED-2, desirable species should be identified with a growth form = tree and a timber value class = 1 (high value) in the Plant Species module. Thus, all species not specifically counted already (black cherry, yellow-poplar, oaks, and conifers) and marked as high value will be added together to get a total count of other desirables for SILVAH.

Tall Woody Interfering Vegetation

For species in the NED-2 ground plot, they must be designated with a height or height class taller than 15 feet (despite that the practical cut-off height in SILVAH is the eye level of the observer) and must not be considered high value and must not be one of the species singled out in SILVAH (e.g., black cherry, yellow-poplar, etc.) in order to be counted as tall woody interference in SILVAH. If more than one tall woody interfering species is detected in NED, the most abundant woody interfering species will be recorded in SILVAH. However, where there is a tie in species abundances, then the only the *first* tall woody interfering species found will be recorded in SILVAH.

Low Woody Interfering Vegetation

For species in the NED-2 ground plot, they must be designated with actual stem height or a height class lower than 15 feet (despite that the practical cut-off height in SILVAH is the eye level of the observer) and must not be considered high value and must not be one of the species singled out in SILVAH (e.g., black cherry, yellow-poplar, etc.) in order to be counted as low woody interference in SILVAH. If no height information is entered by the user in the NED-2 ground plot, a species will not be included as low woody interference. If more than one tall woody interfering species is detected in NED, the most abundant woody interfering species (by percent cover only—not by stem count) will be recorded in SILVAH. However, where there is a tie in species abundances, then the only the *first* low woody interfering species found will be recorded in SILVAH. Furthermore, if the NED-2 ground cover species are not recorded with percent cover data, all species would be considered to have equal abundance, and the first species that met the criteria as low woody interference would be recorded in SILVAH but without any percent cover data.

Percent Grass and Sedge

If the NED-2 data contains percent grass and sedge recorded as a separate ground plot variable, that value will be recorded into SILVAH without further modification. Otherwise, the total combined cover of all grass and sedge species in the NED-2 ground cover plot observations will be recorded as the total percent cover of grass and sedge in SILVAH.

Percent Fern

If the NED-2 data contains percent inhibiting fern or percent other fern recorded as separate ground plot variables, then the value recorded in SILVAH would be the sum of the percent inhibiting fern plus half the value of percent other fern. Otherwise, the total combined cover of hay scented and New York fern, plus half of the combined percentages of all other fern species in the NED-2 ground cover plot observations will be recorded as the total percent fern in SILVAH.

Thick Duff

There is no equivalent in NED-2 for this variable.

Rocky Surface

The value of the NED-2 ground plot variable, Rockiness barrier to regen ("too rocky"), will be recorded in SILVAH without modification.

Poor Drainage

The value of the NED-2 ground plot variable, Wetness barrier to regen ("too wet"), will be recorded in SILVAH without modification.

Chapter 4 - Setting up a Defaults File

About SILVAH defaults

SILVAH uses defaults files (.def) to maintain information on local stumpage prices, the log rule you want to use, a list of your own species codes (if you do not like ours), and other parameters. Every time you analyze stands in SILVAH, or perform calculations using TREECALC, you will have the opportunity to specify the name of the defaults file you want to use.

SILVAH supplies default values for all parameters in the program, so you do not absolutely have to have a defaults file. The default values in the program are ones that we find convenient for our computers and our forest conditions in northwestern Pennsylvania. For example, some species such as red maple are listed as undesirable, but they may be desirable in other regions. You can change the default values to suit your situation, resulting in a defaults file that suit your needs.

Some users will find it convenient to create more than one defaults file, especially if you work in several different geographic areas where stumpage prices vary, for example. Thus, you could create a defaults file for each area, and then read the appropriate one when running SILVAH.

A sample defaults file (silvah.def) is installed with the program into the SILVAH6 installation folder (default = C:\USFS-NRS\SILVAH6). You may want to open this file to examine the defaults, and if desired, modify the defaults as necessary.

To open the sample defaults file:

1. At the top of the SILVAH6 window, click the **Calc Settings and Species** button.
2. Click the **Calculation Parameters** tab to modify commercial sale breakpoints that are used by SILVAH in determining if you have enough volume to make a commercial sale. You can also specify the log rule for board-foot volume, and other settings that effect calculations. These settings are stored in the defaults (.def) file.
3. Click the **Plant Species Information** tab to modify plant species attributes. Each row pertains to a single species, and each column contains information about the species. This is where you would record your species codes so that SILVAH can interpret your species, and you can also set volume correction factors and timber prices (i.e., sawtimber 1,000 board foot (MBF) pricing and pulpwood pricing per cord). Other traits such as whether a species is exotic (nonnative) and desirable are also set here. These settings are stored in the defaults (.def) file.

Starting a New Defaults File

You may store and use multiple defaults files. To start a new defaults file, follow these steps:

1. Click the **Calc Settings and Species** button.
2. From the top menu, click **File**, then click **New DEF File**. You may also try the shortcut, **[Ctrl] + [N]** (press and hold the **Control [Ctrl]** key and then press the letter “**N**”), to start a new file.
3. Click the **Calculation Parameters** tab to review and modify the calculation settings as necessary.
4. Click the **Plant Species Information** tab to review and modify and plant species characteristics as appropriate.
5. Be sure to save your work. Your defaults will be stored in a new defaults (.def) file.

Opening an Existing Defaults File

To open an existing file:

1. Click the **Calc Settings and Species** button.
2. From the top menu, click **File**, then click **Open DEF File**. You may also try the shortcut, **[Ctrl] + [O]** (press and hold the **Control [Ctrl]** key and then press the letter “**O**”), to open a file.

Saving Your Defaults

To save the current defaults to a file:

1. Click the **Calc Settings and Species** button.
2. From the top menu, click **File**, then click **Save DEF File**. You may also try the shortcut, **[Ctrl] + [S]** (press and hold the **Control [Ctrl]** key and then press the letter “**S**”), to save the file.
3. If you are saving the defaults file for the first time, enter a file name, and be sure you are aware of the folder where the file is being created.

Converting Older Defaults Files

SILVAH has been around since the 1980s. As it evolved, additional capabilities were added. Along with those additions came format changes in the data. To accommodate older formats, SILVAH can convert files going back to version 4.0. The program attempts to read the old formats directly, and when you save the file, the defaults file will be saved in the current format.

It is recommended that you back up your older defaults files before converting them to the current format.

Converting older defaults files requires a few simple steps. You must also review the defaults to ensure they were correctly interpreted.

1. Click the **Calc Settings and Species** button.
2. Open the defaults (.def) file with the older format.
3. Once the defaults have been loaded, review the data to be sure it is accurate. Pay close attention to plant species information.
4. If you are working with a file that has already been backed up, save the file. If you aren't sure, then click **File**, then click **Save As...** and use a slightly different file name in order to preserve the contents of the original data file.

Importing Defaults Files

SILVAH allows you to import portions of information from other defaults files. With this feature, you can import only the plant species information, or only the calculation parameters, or both. This allows you to reuse portions of a defaults file while preserving what you do not want changed.

1. Click the **Calc Settings and Species** button.
2. From the File menu, click **Import DEF file**.
3. From the pop-up Import DEF file dialog, click **File** to browse and select the defaults file that contains information you wish to import.
4. Check **Calculation parameters** to import calculation parameters. If you do not wish to import plant species information at the same time, be sure to *uncheck* **Plant species information**, and then click **OK**.
5. Check **Plant species information** to import plant species characteristics including codes, prices, and other species traits. If you do not wish to import calculation parameters at the same time, be sure to *uncheck* **Calculation parameters**, and then click **OK**.

Calculation Settings

Default Commercial Sale Breakpoints

These values specify how much volume per acre must be available for SILVAH to prescribe a commercial cutting. For example, the default breakpoints supplied by SILVAH require a minimum of 2,000 board feet to be removed during a sawtimber only sale. If there is insufficient volume available for such a sale, SILVAH will check if sufficient volume is available for an integrated sale, using default values of 1,500 board feet and 5 cords as breakpoints. If there is not enough volume for an integrated sale, SILVAH will check to see if 7 cords (the default) are available for cutting in a pulpwood only sale. If the volume is inadequate to support any of these commercial sale minimums, the recommended prescription from SILVAH will be "DEFER CUT - VOLUME < THRESHOLD."

1. Click the **Calc Settings and Species** button.
2. Click the **Calculation Parameters** tab.
3. Enter the desired commercial sale breakpoints.
4. Remember to save your work. Doing so will place your values into a defaults (.def) file that you can use with SILVAH.

Minimum Diameters for Volume Estimates

These are the threshold diameters for calculating volumes. For example, hardwood sawtimber volumes will be calculated for trees larger than 10.5 inches (11-inch class if you use 1-inch classes, or 12-inch class if you use 2-inch classes). You can set any threshold diameter you wish for these calculations. Setting the threshold diameter to 41 inches will prevent any calculation of volumes. Thus, you could prevent pulpwood volume from being calculated (if you have no pulpwood market, for example) by setting minimum diameter for pulpwood to 41 inches.

1. Click the **Calc Settings and Species** button.
2. Click the **Calculation Parameters** tab.
3. Enter the desired minimum diameters.
4. Remember to save your work. Doing so will place your values into a defaults (.def) file that you can use with SILVAH and TREECALC.

Log Rule, Trees to Include, and Other Values

These values effect calculations by SILVAH and TREECALC.

To set calculation parameters:

1. Click the **Calc Settings and Species** button.
2. Click the **Calculation Parameters** tab.
3. Remember to save your work. Doing so will place your values into a defaults (.def) file that you can use with SILVAH and TREECALC.

Log Rule

You can select a board foot log rule to use: International 1/4 inch, Doyle, or Scribner.

Trees Included

Specify whether to include live trees only, live and dead, or only dead trees in your calculations.

Name of local log and boltwood product

You can specify the names you want to use on reports for a bulk and local sawlog product. For example, if you have a pallet log market or a railroad tie market, you can define that product name here. Note that you must grade appropriate trees as “local log” or “local bulk” in your inventory to obtain volumes for local products.

Sugar maple site condition

Sugar maple growth and seed production are affected by site quality. The seed source calculation of SILVAH utilizes this value. If you know that your site is rich in nutrients (high base cation levels), choose “**good**” as the sugar maple site condition. If your site is low in base cation levels, such as on upper slopes and ridge tops in the unglaciated Allegheny Plateau, choose “**poor**.” The default sugar maple site condition is “poor.”

Use NY relative density equation

If you are in New York or New England, you can use a relative density equation that accounts for site differences there. Relative density is a measure of crowding in forests, and is influenced by species composition and stand structure. The default relative density equation was developed in stands with little white ash. Most of the sugar maple occurred in lower canopy positions. Use the New York equation if your stand has healthy sugar maple in the dominant and codominant positions and/or a high proportion of dominant and codominant white ash.

Species codes (TREECALC)

Specify the species codes you prefer to use when running TREECALC (see Chapter 6). This setting is not used elsewhere.

Default Management Values

For convenience, you can establish default management values, saving you the effort of reentering these values for each stand.

The following are management-oriented values:

Owner

Management Value

Restrictions on Silvicultural System

Prescription Charts to Follow

Intend to Regenerate

Increase Oak

Residuals Desired

Operability

Accessibility

Deer Impact

Management values have always been stored in the data files (.sil), and they are no longer stored as part of the defaults (.def) file. However, you can still specify default management values in the Stand tab under Inventory Entry. To establish default management values, refer to the topic “Establishing Default Management Guidelines” in Chapter 3 for further information.

Default Inventory Settings

You can specify default inventory settings that you can use repeatedly whenever you start a new stand.

The following are inventory-related values:

Overstory Cruise Type

BAF or Fixed Overstory Plot Size

Observations Include Counts or Merchantable Heights

Tree Grading Procedure

Understory Cruise Type

Understory Plot Size

Species Code Type Used in Data

DBH Size Classes Used in Data

Tally Month and Year

Inventory settings have always been stored in the data files (.sil), and they are no longer stored as part of the defaults (.def) file. However, you can still specify default inventory settings in the Inventory Settings tab under Inventory Entry. To establish default inventory settings, refer to the topic “Establishing Default Inventory Settings” in Chapter 3 for further information.

Plant Species Information

About Species Codes

SILVAH will only use one of three possible codes, either the FIA, Mnemonic, or User code, to display your species entries and to store species in your data. However, there are additional ways to enter a species, according to any of several possible species identifiers shown below. This may be advantageous if you remember one identifier but not the one that belongs to the set of codes you have specified on the Inventory Settings tab. For example, if you have chosen the Mnemonic species code and you enter “318”—the FIA code for sugar maple, the program will recognize the species and display “SM” in the species field because “SM” is the mnemonic code. If you could not remember either of these codes, you could try entering the common name, such as “sugar maple,” and the program would display “SM.” The code “SM” would be stored in the data file (*.sil).

Types of species codes

- **FIA** - The original U.S. Forest Service Forest Inventory and Analysis (FIA) codes. A three-digit numeric code that was formerly used throughout the United States. Almost exclusively used for woody species only.
- **USDA Plants Symbol** - This is a relatively new identifier that replaced the FIA codes. It is the first two letters of the genus and the first two letters of the species, followed by a number if there are other plants that have similar genus and species abbreviations. You cannot change this code because it is maintained in the PLANTS database developed by the USDA Natural Resources Conservation Service for every species found in North America (native or exotic). SILVAH will readily interpret these codes, but they will never show up in the display, nor will they appear in the data (.sil) file.
- **Mnemonic** - A user-defined code, typically two or three letters that abbreviate the common name. Used on all reports, regardless of what code occurs in the data. Based on the first letter of the common name to represent individual species (thus, “SM” for sugar maple), and the first letters of the common genus name to represent an entire genus (thus, “B” for birch). You can change these abbreviations to meet your own needs, if desired.
- **User Defined (Local)** - Another user-defined code, allowing only numeric values. Often used to represent multiple species of a genus or family, such as “pine,” “conifers,” and so on.
- **Common Name** - The common name of the species. SILVAH will readily interpret the common name, but it will never show up in the display, nor will it appear in the data (.sil) file.

Number of species

Currently there are 148 species included in the program, mostly trees, some woody shrubs, and a few nonnative invasive herbaceous species. This is a fixed list of species, representing those most likely to be encountered in the Allegheny Plateau of Pennsylvania, New York, Ohio, Pennsylvania, and Maryland. You may not change the species that are included.

Sorting the display of species

You can sort the display of species by any of the species attributes. This is very useful in searching for species as well as examining prices or other attributes.

To sort by an attribute, click once in the header of the column that contains the attribute. The first click will toggle the sort in descending order, and second click will sort in ascending order.

Configuring the display of species attributes in the grid

You can rearrange the order of the columns of species attributes, or turn on or off attributes that you do not intend to use. See the topic “Configuring Data Fields on the Grid” in Chapter 3 for further instructions.

Editing Species Codes

You may edit the mnemonic and user-defined (local) species codes. Other identification codes displayed in the gray columns cannot be changed.

Warning!

If you want to change species codes that you have already used in the past, be careful! When you run the old data files (*.sil) with the original species codes through SILVAH, you will need to load and use the old defaults file so that species codes are interpreted properly. Therefore, you should retain a copy of the original defaults file that contains the older codes before you alter the species codes. Be sure not to replace or edit the original defaults (*.def) file.

To edit species codes:

1. Click the **Calc Settings and Species** button.
2. Click the **Plant Species Information** tab.
3. Edit the species codes.
4. See the warning above about maintaining a copy of the original species codes. When you are ready, remember to save your changes.

Perhaps a better solution is to convert the species codes in your old data files to the new codes. That way, you will need to maintain only one defaults file for species codes. SILVAH will make the conversions automatically for you, but you must do this in the proper sequence to avoid loss of data.

To update species codes in older data files (*.sil), proceed as follows:

1. Make backup copies of all data files to be converted to the new codes, in case something goes wrong.
2. Make certain that you have available your old defaults file (containing the old species codes), and your new defaults file containing new species codes.
3. Click the **Calc Settings and Species** button.
4. Open the original defaults file (*.def) containing the old species codes.
5. Click the **Inventory Entry** button.

6. Open the data file (*.sil) containing the old codes that you want to update with new codes.
7. Click the **Calc Settings and Species** button.
8. Then open the new defaults file (*.def) that contains your new species codes.
9. Click the **Inventory Entry** button.
10. Click the **Trees** tab to review the updated codes in the overstory data.
11. Click **Understory Plots** tab to review the updated codes in the understory data. The old codes should now be replaced by the new codes.
12. Save the data file by choosing **File Save As...** to create a new copy. Be sure not to overwrite the original version that had the original species codes.

Editing Species Parameters

SILVAH maintains several species parameters that effect the calculation of volume and value. Other attributes help SILVAH determine the stocking of undesirable and exotic species.

To edit species parameters:

1. Click the **Calc Settings and Species** button.
2. Click the **Plant Species Information** tab.
3. Enter the desired values for the parameters you wish to modify.
4. Remember to save your work. Doing so will place your values into a defaults (.def) file that you can use with SILVAH and TREECALC.

Form

This is the Girard Form Class that will be used in calculating volumes.

Cubic VC, Bdft VC

These are volume correction factors that may be used to adjust the volumes, both board-foot and cubic-foot. If you find that the program consistently gives high or low volumes for a species, then you may change these factors to more reasonably reflect your volumes.

Exotic

This determines whether a species is not native to your area. If you wish to obtain reports on off-plot nonnative species in your data, you must identify exotic species as appropriate. SILVAH identifies several species by default.

Desirable

This determines whether a species is desirable for your management objectives. This attribute is currently used in two ways. During data entry, if you try to record a sapling of undesirable species, you will be warned that the regeneration plot will *not* be considered stocked with saplings since you recorded an undesirable species. SILVAH also checks the basal area per acre of saplings of undesirable species detected in the overstory inventory. If this value is at least 10 square feet per acre or greater, SILVAH will increase the understory inventory stocking value for tall woody interference to 70 percent. If the understory inventory stocking value was already 70 percent or greater, the undesirable sapling basal area will be reported in the understory inventory, but the stocking value will not be changed.

Prices

There are several columns that provide the stumpage values for sawtimber, veneer, pulp, local bulk, and local sawlog products.

Chapter 5 - Analysis and Prescription

About Analysis and Prescription

Once you have completed a stand inventory and entered it into a SILVAH data file (.sil), use the analysis and prescription component of SILVAH to summarize the data and develop prescriptions that will help meet your forest management objectives.

Proceed with the steps below in your first attempts to learn about SILVAH's analysis and prescription capabilities:

Start SILVAH6 and open the sample file:

1. Click the **Windows Start menu** button.
2. Click **Programs** ("All Programs" in Windows XP), then click **Silvah6** from the list of programs.
3. Click **Silvah6** from the SILVAH6 program options. When it starts up, SILVAH6 automatically selects the Inventory Entry component.
4. On the menu at the top of SILVAH6, click **File**.
5. From the File menu, click **Open SIL file**.
6. Browse to the SILVAH6 installation folder and select the file, newdemo.sil.
7. Click **Open**.

Select the stands to analyze and find the defaults file that has your specific calculation settings and species attributes:

1. Click the **Analysis and Prescription** button.
2. Click the **Pick Stands** tab.
3. To analyze the sample file that you opened above, click the **Add current SIL file** button.
4. Click the **DEF file** button.
5. Browse to the SILVAH6 installation folder and select the file: silvah.def. The calculation parameters and species attributes stored in silvah.def will be used when you analyze the sample file (newdemo.sil) in SILVAH.

Select the desired reports:

1. Click the **Reports** tab.
2. A set of standard reports are available for analyzing the original stand inventory data. Right-click once on the header of the Initial stand column.
3. From the pop-up context menu, click **Standard reports** to select a set of reports that are generated during the analysis.
4. Other reports are available for analyzing prescribed treatments on the original stand. Right-click once on the header of the Current Rx column.
5. From the pop-up context menu, click **Standard reports** to select a set of reports that will describe the recommended treatment and display the effects of the recommended treatment by showing the original, cut, and residual stand data.

Ask SILVAH to recommend a prescription:

1. Click the **Current Rx** tab.
2. Make sure to select **SILVAH expert-recommended prescription**.

Run the Analysis:

1. Click the **Run** tab.
2. On the Run tab, click the **Run** button.
3. All of the output from the analysis will be placed into an output file (.prn) that matches the name of the stand (e.g., newdemo.prn). SILVAH will display the results on the Run tab for quick viewing. If you prefer to open the file in Notepad, click the **Open** button.
4. Compare the output you get (newdemo.prn) with those in Appendix B. They should be identical. If they are not, you may have specified a different parameter file or selected different reports, or something may be wrong. See the section "Solution to Common Problems" in Appendix C, or feel free to contact us.

Establishing a List of Stands to Run

Adding Stands to the List

Before SILVAH can provide results, you must supply the names of the stands you wish to run. SILVAH can just as easily process one stand at a time as it can many stands.

1. Click the **Analysis and Prescription** button.
2. Click the **Pick Stands** tab.
3. Click the **DEF file** button to browse to and select a defaults file (*.def). If you do not select a defaults file, SILVAH will supply the default parameter values during the run.

4. Click the **Add current SIL file** button if you want to run the stand currently opened in the Inventory Entry component. This is convenient in situations where you opened a stand, edited the data, and are now ready to analyze it.
5. Click the **Add** button to browse to and select one or more SILVAH data files (*.sil). Within a folder, use the **Control [Ctrl]** and **Shift** keys as in other Windows applications to select multiple files. You also may add as many files from other folders as desired.

Removing Stands from the List

If you have more stands than you need, you can remove individual stands. You can also empty the list if you want to start over.

1. Click the **Analysis and Prescription** button.
2. Click the **Pick Stands** tab.
3. To remove one stand at a time, click once on the stand and then click the **Remove** button.
4. To empty the list of stands to run, click the **Remove all** button.

Changing the Stand Order

Once you have a list of stands to run, you can modify the stand order if desired. The order that stands appear in the list is the order in which they will be processed.

1. Click the **Analysis and Prescription** button.
2. Click the **Pick Stands** tab.
3. To change the order of a stand, click the stand and then drag it to its desired location in the list. A stand cannot be dragged to the bottom of the list. Instead, it must be dragged to the 2nd-to-last position and the last item must be moved up one position.

Saving and Retrieving the List

You can store the list of stands if you intend to use it repeatedly.

Storing a list

1. Click the **Analysis and Prescription** button.
2. Click the **Pick Stands** tab.
3. Click the **Store this list of files** button to save the list into a text file.
4. Browse to the desired folder and enter a file name in the Save As dialog.
5. Click the **Save** button when you are finished.

Retrieving a list

1. Click the **Analysis and Prescription** button.
2. Click the **Pick Stands** tab.
3. Click the **Read a list from a file** button to retrieve a previous list of stands.
4. Browse to and select the desired file name.
5. Click the **Open** button when you are ready.

Script Files

About Script Files

A script file contains a list of all of the processing options for your reports, prescriptions, stand growth and yield, and database output. To save time, you can save your options in a script file and reuse them when processing stands.

Script files from older versions of SILVAH also can be used. However, it is recommended that you review the options after opening older script files.

The list of selected stands on the Pick Stands tab also can be stored and retrieved, but it is saved in its own file and not with script files.

Creating a Script File

To create a new script file:

1. Click the **Analysis and Prescription** button.
2. From the top menu, click **File**, then click **New SCR File**. You may also try the shortcut, **[Ctrl] + [N]** (press and hold the **Control [Ctrl]** key and then press the letter “N”), to start a new file.
3. Begin selecting options for reports, prescriptions, stand growth and yield, and database output.

Saving a Script File

To save the current processing options to a file:

1. Click the **Analysis and Prescription** button.
2. From the top menu, click **File**, then click **Save SCR File**. You may also try the shortcut, **[Ctrl] + [S]** (press and hold the **Control [Ctrl]** key and then press the letter “S”), to save a file. The file will contain all of your selections for reports, growth and yield, prescriptions, and database output.
3. If you are saving the options for the first time, enter a file name, and be sure you are aware of the folder where the file is being created.

Opening an Existing Script File

After you have selected one or more stands, if you have previously saved a script file, you can process your stands quickly by opening the script file that contains your desired processing options.

To open an existing script file:

1. Click the **Analysis and Prescription** button.
2. From the top menu, click **File**, then click **Open SCR File**. You may also try the shortcut, **[Ctrl] + [O]** (press and hold the **Control [Ctrl]** key and then press the letter “**O**”), to open a file.
3. View or modify the options if necessary for the current run.
4. If the options are okay, you are ready to proceed with selecting stands or running them.

Reports

About Reports

Reports provide concise summaries of stand conditions which include information on all of the factors that affect silvicultural prescription recommendations. If prescriptions involve cutting, you can generate reports to compare the before and after effects on stand structure, species composition, and stand volume and value.

Reports are managed under the Analysis and Prescription component of SILVAH, on the Reports tab. A variety of reports are available. You decide which reports to use. For convenience, in one step you can select a standard set of reports that collectively provide pertinent information on important management criteria such as how much volume is available in your stand, whether the stand is ready for harvest, and how to mark the stand for intermediate treatments. Most reports are available at any stage in the planning cycle. The reports you select for initial stand conditions and prescriptions may also be selected over the course of simulating future conditions.

The output from reports is written into a single text file. The output file will be created in the same folder as the source data file (*.sil), with an identical file name except for a .prn suffix to identify it as a reports file. Existing reports files will always be replaced (overwritten) by new output. If you wish to preserve older reports files, consider archiving them so that multiple versions can be identified in the future. Report output can be opened readily in Notepad. You can copy portions of the output into other word processors as desired.

In the reports file (.prn), reports will appear in a predetermined order regardless of the manner in which they were selected. If you have selected reports over the course of simulation, the same order will be followed at each time-step. Each report is uniquely identified with an underlined, uppercase title. Below the report title is the date and name of the source data file (*.sil). At the top of the file (first page only), SILVAH outputs a header that identifies the stand name, forest type, acres, and so on.

Some of the values in SILVAH reports have definitions specific to SILVAH and are based on research. To better understand these definitions, see Marquis et al. (1992) and Brose et al. (2008).

Report Descriptions

There are nine categories of SILVAH reports. Categories are highlighted in bold to help you distinguish them. Some categories contain only one report, in which case the highlighted category is the report. Use the following descriptions to learn about each report offered in SILVAH.

Cruise Information - This is a report that describes the inventory settings and sampling statistics for the stand. Information on overstory sampling error includes the number of plots required to be within 10 percent and 15 percent of the mean. For the understory, the report determines the minimum number of plots that should have been collected, based on the number of acres in the stand. If the actual number of understory plots is less than the desired number, the report will list how many additional understory plots are necessary to meet SILVAH standards.

Site Characteristics and Regeneration Summary - This is a key report that describes conditions affecting forest regeneration. Regeneration of desired tree species is assessed according to the percent of plots stocked with adequate numbers of seedlings under current deer browsing impact. An additional regeneration stocking assessment is performed against standards for fenced stands (no deer impact) if extended regeneration data were collected. The average number of desirable tree seedlings per acre also is reported. Factors affecting regeneration difficulty such as rocky or wet soils, thick duff, deer impact, seed supply, the presence of nonnative invasive species, and interfering vegetation are also described. The report concludes with a table of general site characteristics of the stand.

Exotic Species Present—This report lists the nonnative invasive species present in the overstory and understory, on or between sample plots as well as adjacent to the stand.

Narrative Descriptions for Nonnative Invasive Species—This report provides detailed, narrative descriptions of the identification characteristics, ecology, and response to management or disturbance for the nonnative invasive species found in the stand. Due to the potential length of this report, unlike other reports it is output in a separate file, in the same folder as the source data file (*.sil), with an identical file name except for a .nns suffix to identify it as narrative output for nonnative invasive species.

Narrative Summary and Analysis of Stand—This report summarizes the stand in a series of descriptive paragraphs. The forest type and the dominant overstory species comprising 85 percent of the stand basal area are identified. An assessment of average diameter, timber volume, and quality is included. The report describes the impact of relative density on tree growth, and the need for thinning. It includes the effective age and number of years to maturity for the stand. The narrative concludes with an assessment of desirable seedling regeneration, and possible factors such as deer impact, site limitations, and other vegetation that could interfere with regeneration after a final harvest. This report may be particularly valuable for communicating with private landowners or public land stakeholders unfamiliar with forestry data tables.

Central Appalachian Oak Guide—This report uses overstory and understory data to project the proportion of oak that would be found in thirty years if a final overstory removal took place now. It can use standard SILVAH data or, if collected, the total height of all oak seedlings on the interior milacre of each regeneration plot. This report was developed in the Ridge and Valley region of central Pennsylvania by researchers at Pennsylvania State University (Steiner et al. 2008). It provides an additional assessment of oak regeneration in case you are unsure whether you already have sufficient

oak regeneration. The report provides a table of expected contributions (percent stocking) from stump sprouts of five oak species plus the total expected contribution (percent stocking) from all oak seedlings. It is most applicable to the conditions of the Central Pennsylvania Ridge and Valley.

Information on Silvicultural Systems and Wildlife Habitat—This report lists any user-specified restrictions on silvicultural systems along with the relative value of this stand in fulfilling whatever management objectives may have been planned. This is followed by an assessment of stand characteristics that may benefit wildlife, such as the number of trees per acre of existing and potential den trees, and the number of stems per acre of snags with existing and potential cavities. Aquatic features within the stand are noted, as are other habitat conditions that are within 1 mile of the stand. The wildlife portions of this report are only useful if the overstory inventory included information on den trees and snag potential, and landscape context variables are only available if users provide them.

Treatment Description with Marking Instructions—This is a key report that provides a description of the treatment prescribed in SILVAH, along with the reasons for that prescription if it was provided by SILVAH (i.e., an expert prescription). The report outlines treatment steps along with special considerations. For prescribed cuts, the report estimates the amount of volume available. Marking instructions detail the amount of trees to retain (leave) in each size class, followed by information on removals, such as the target relative density and the proportion of trees to cut in each size class. A companion report is automatically generated along with this report, and is output in a separate file in the same folder as the source data file (*.sil), with an identical file name except for a .prx suffix to identify it as a prescription history file. It contains a history of the prescription chart decisions leading up to the treatment prescribed by SILVAH.

Comparison of Residual, Cut, Residual Stand Data—This report provides tables that show the effects of a treatment on basal area, number of trees, average diameter, relative density, volume, timber quality, and species composition. These characteristics are displayed in three columns to allow you to compare values for the original, cut, and residual stand.

Timber Volume and Value by Species—This report is available only for the initial stand. It provides net sawtimber and pulpwood volume and value by major timber product (veneer, grades 1-3, pallet, boltwood, pulpwood, and firewood) and species. The breakdown of timber products will follow the grading in the data. If trees were not graded, then SILVAH calculates the proportion of trees in each factory sawlog grade plus veneer (see Chapter 7 for details about volume and value calculations). Two versions of this report are available—one produces per acre values, and the other produces total stand values.

Overstory Summary—This is a key report that provides tables on stand composition, timber quality, average diameter, structure (Q factor), relative density, volume, and value. Species are listed to the right in descending order of basal area per acre, along with number of trees, and relative percent basal area for each species. Succeeding tables maintain this species order, and you may notice in some tables that the values across species do not always proceed in descending order.

Overstory Species X Diameter Tables—These are a series of reports that produce two species by diameter tables. In the first table, diameter classes are established in rows according to the dbh size class specified in the inventory settings for the stand. Thus, if you specified the 2-inch size class, those are the diameter classes shown in the table. If you specified the 1-inch size class for your inventory

settings, but recorded dbh using 2-inch diameter classes in the data, the table will contain 1-inch diameter classes, and you will notice a lot of zeros for the ranges where no diameters were entered. On the other hand, if you specified the 2-inch size class but recorded dbh using 1-inch diameter classes, SILVAH will adjust the diameters to fit the 2-inch size classes. This is followed by a second table of species by major size classes (saplings, poles, sawtimber, etc.) for AGS only.

Selecting Reports

SILVAH provides several scenarios for which you can obtain reports as you analyze a stand and consider various treatment alternatives.

1. Click the **Analysis and Prescription** button.
2. Click the **Reports** tab. Reports are listed in the first column of the table.
3. Select one or more reports by checking the corresponding boxes under the column that indicates when the report will be generated. Review the column descriptions for further information below.

Scenarios under Which You may Select Reports

The following are the columns that represent specific stages or events during which SILVAH will generate the reports you have selected.

Initial stand—Report on stand characteristics prior to any simulation or treatment implementation. These are summaries of the inventory data entered in SILVAH.

Every cycle—Report on stand characteristics throughout a simulation period. If you are projecting stand growth into the future, SILVAH projects growth in 5-year increments. A cycle represents one 5-year increment. Reports will be generated at the end of each 5-year increment.

Final results—Report on final stand characteristics at the end of a simulation period.

Current Rx—Report on the details of a treatment prescribed for the initial (current) stand.

Future Rx—Report on the details of a treatment prescribed at the end of each 5-year increment within a simulation period.

Standard Reports

For your convenience, a set of standard reports can be selected under each scenario. In most cases, standard reports will be satisfactory in providing all of the information you need for analyzing your stands.

1. Click the **Standard reports** button if you want to select the standard reports in every scenario.
2. To select standard reports only for a single scenario, right-click once in the header cell at the top of the scenario column. Click **Standard reports**.

Short Reports

For the Initial stand, Every cycle, and Final results scenarios, a reduced set of standard reports can be selected, known as short reports.

1. To select short reports, right-click once in the header cell at the top of the scenario column. Click **Short reports**.

Clearing Report Selections

1. Click the **Clear selections** button if you want to wipe out all report selections quickly.
2. If you want to clear the selections only for a single scenario, right-click once in the header cell at the top of the scenario column. Click **Clear selections**.
3. For individual report selections, uncheck the box of a selected report to remove the selection.

Silvicultural Prescriptions

About Prescriptions

SILVAH offers four flexible options for prescriptions of management activities designed to move stands toward their desired future condition. SILVAH's expert prescriptions are based on years of experience and research (Marquis et al. 1992, Brose et al. 2008) into silvicultural prescriptions that should produce consistent results among stands of similar characteristics within the Allegheny hardwood and mixed oak forests of the Allegheny Plateau and Allegheny Mountain sections of Pennsylvania, Ohio, New York, West Virginia, and Maryland. Even if you decide not to follow them, the treatments recommended by SILVAH will provide a starting point for selecting and documenting your management actions.

SILVAH will apply your prescription choice (below) for all stands in the same run. After reviewing the results, you may want to design a different treatment for one or more stands. If you need to tailor treatments for specific stands, you may need to run those stands separately.

If you are projecting forest growth and yield, you may implement prescriptions on future stands. If desired, your prescription choice for simulated stands may be different than the initial (current) stand.

SILVAH provides the following choices for implementing prescriptions:

No treatment—If you make this selection, SILVAH will not recommend or implement any treatment.

Silvah expert-recommended prescription—SILVAH will evaluate stand conditions and recommend a silvicultural treatment for you. SILVAH will implement any treatment it recommends, allowing you to compare the original, cut, and residual stands. Thinnings in merchantable tree size classes are implemented only if timber volume is adequate for a sale. Harvest cuttings are implemented only if the stand is adequately stocked with desirable tree regeneration.

Modify a standard prescription (semi-custom)—Select this option if you would like to implement your own treatment using a standard SILVAH prescription as a template. You may adjust parameters such as residual relative density, proportion of stocking removed to come from different diameter classes, etc. A treatment you design will be implemented without evaluating stand conditions and there are no checks against minimum sale quantities in timber volume.

Develop a prescription of user's own design (custom)—This option allows you to specify almost any kind of cut you desire. You will need to specify the target relative density (minimum residual density) and maximum density (percent) to be removed at one time. You will also need to specify the proportion of each species to be cut by diameter and quality—for each of three cutting priorities. A completely custom treatment will be implemented without evaluating stand conditions and there are no checks against minimum sale quantities in timber volume.

Major Prescription Variables

SILVAH summarizes a stand inventory into major factors that form the basis for writing a prescription. These are the prescription variables described below, which are described in further detail in Marquis et al. (1992) and Brose et al. (2008).

Site and Environmental Prescription Variables

- Silvicultural systems permitted or desired by manager
- Manager's intentions for regenerating the stand (final harvest)
- Manager's desire to increase oak in the stand
- Prescription charts manager wants to use (oak or northern/Allegheny hardwoods)
- Manager's desire to retain post-harvest overstory residuals (legacy trees)
- Seed source index (seed-producing capacity of overstory)
- Deer impact
- Oak site quality (oak species are easier to regenerate on poor-quality sites)
- Thick duff on the forest floor¹
- Soils that are very poorly drained or too wet¹
- Rocky surface that would inhibit seedling establishment¹

Overstory Prescription Variables

- Basal area of saplings
- Basal area of shade tolerant species
- Basal area of black cherry, white ash, and yellow-poplar combined
- Basal area of oak sawtimber
- Relative stand density
- Relative stand density of AGS
- Stand diameter
- Years to maturity
- Amount of timber volume available for a commercial sale

¹ Denotes variables that are summarized and evaluated against stocking criteria as described for understory prescription variables.

Understory Prescription Variables

In the understory tally, several vegetation and site variables are evaluated against predetermined stocking thresholds, such as the number of seedlings or the presence or absence of site conditions that would inhibit seedling establishment. Each variable is represented as the number of plots (percent) that satisfy the threshold requirements for that variable. Variables evaluated against stocking criteria are as follows:

- Established seedlings²
- Competitive seedlings²
- New oak seedlings²
- Established oak seedlings
- Competitive oak seedlings
- All sizes of oak seedlings combined²
- Desirable sapling species
- Oak stump sprouts³
- Any competitive seedlings supplemented with overstory residuals²
- Any interfering vegetation (tall woody plants, cover of shrubs, fern, grass)

Initial Stand Prescription

To implement a silvicultural prescription on the initial (current) stand:

1. Click the **Analysis and Prescription** button.
2. Click the **Current Rx** tab.
3. Choose how to implement a prescription.
4. If you choose **No treatment** or **Silvah expert-recommended prescription**, no further treatment specifications are necessary.
5. If you choose **Modify a standard treatment (semi-custom)** or **Develop a prescription of user's own design (custom)**, review and modify the treatment parameters as necessary.

If you want to experiment with different treatments on the initial stand, you will need to accomplish this through multiple runs. SILVAH will not prompt you for an alternate cut when the run is finished. Therefore, you will need to establish a different prescription for each run in order to compare the effects of different treatments on the current stand. Be sure to manage file names or folders to avoid overwriting a file you will need for comparison.

Future Stand Prescription

You may implement treatments on stands during the simulation of stand growth and yield. SILVAH will apply your prescription choice at the end of each 5-year increment during the simulation cycle.

² Denotes variables that are evaluated a second time, under different stocking criteria based on the assumption that deer impact is very low or absent (such as behind a fence). If a variable meets the stocking requirement only when deer impact is very low, then a fencing prescription is included in the silvicultural prescription generated by SILVAH.

³ The contribution (stocking) of oak stump sprouts is calculated using the basal area of oak species in the overstory.

The impacts of treatments are compounded throughout a simulation cycle. Projection will occur on the residual stand after each cut has been removed.

If you choose **Silvah expert-recommended prescription**, SILVAH will reevaluate stand conditions prior to recommending a prescription. This is the only way to get different prescriptions along a simulation period during a run. For instance, if you project growth and yield for 30 years, SILVAH might not recommend any treatments for the first 10 years, then at year 15 you might see a commercial thinning, and at year 25 you might see a final harvest prescription.

If you choose to modify a standard prescription or design one of your own, SILVAH will apply that same prescription consistently, at the end of each 5-year interval throughout the simulation cycle. If you want to experiment with different treatment designs, you will have to accomplish this through multiple runs, where you specify different treatments in each run.

To implement a silvicultural prescription on a simulated stand (during the projection of stand growth and yield):

1. Click the **Analysis and Prescription** button.
2. Prior to establishing a future stand prescription, you must specify that you want to project stand growth and yield. Otherwise the future prescription options will be disabled.
3. Click the **Simulated Future Rx** tab.
4. Choose how to implement a prescription.
5. If you choose **No treatment** or **Silvah expert-recommended prescription**, no further treatment specifications are necessary.
6. If you choose **Modify a standard treatment (semi-custom)** or **Develop a prescription of user's own design (custom)**, review and modify the treatment parameters as necessary.

Modifying Standard Treatments

Standard SILVAH treatments can be adjusted to suit your needs. Note that this does *not* alter the kinds of treatments that SILVAH would prescribe if you were to ask for an expert-recommended prescription. Instead, by modifying a standard treatment, you can experiment with treatment parameters to adjust the attributes and the amount of timber cut and the indirect effects on timber quality, relative density, stand diameter, and species composition in the residual stand.

1. Click the **Analysis and Prescription** button.
2. Click the **Current Rx** tab to modify a treatment for the current stand, or the click the **Simulated Future Rx** tab to modify a treatment for a stand during simulation of stand growth and yield.
3. Click **Modify a standard prescription (semi-custom)**.
4. Select a standard treatment that you wish to modify. Treatments are briefly described below.
5. Enter the treatment parameters, explained below.

Even-aged Treatments

Even-aged management prescriptions all share the same parameters. The meaning of these variables and the implications of the choices made here are described in Roach and Gingrich (1968), Stout and Nyland (1986), Marquis and Ernst (1991), Nowak (1995), Nowak (1996), and Nowak and Marquis (1997).

Minimum residual density desired

This is the target relative density desired after the cut is complete.

Maximum percent density to be removed in this cut

This is the maximum percent of the original stand density to be removed at one time. The maximum amount removed will prevent excessively heavy cuts in stands that are at or above full stocking.

Percent of the cut relative density to come from below mean stand diameter

This controls the structure of the residual stand. Unless you understand the principle here, it is best to use the 75 percent value that the program suggests, or the 80 percent value supplied for first removal cuts in oak stands. Using a lower value will result in cutting of more large trees, potentially reducing average diameter and delaying maturity.

The following even-aged treatments are available:

Precommercial thinning

This treatment is appropriate when relative stand density is 80 percent or more, and when sapling basal area is at least 20 square feet per acre or more. It is designed to provide more growing space for the better-quality stems and eliminate excess small saplings. We recommend this treatment only when used to ensure survival of desirable species in dominant and codominant positions that would otherwise drop out of the stand.

Pulpwood thinning plus timber stand improvement in saplings

If stand relative density is at least 80 percent or more, this treatment may be appropriate if there is sufficient volume to make a pulpwood sale, and the landowner is willing to make some investment in timber stand improvement (precommercial thinning).

Pulp and sawlog thinning plus timber stand improvement in saplings

If stand relative density is at least 80 percent or more, this treatment may be appropriate if there is sufficient sawlog and pulpwood volume to make an integrated sale, and the landowner is willing to make some investment in timber stand improvement (precommercial thinning).

Commercial pulpwood only thinning

This prescription is appropriate when relative stand density is 80 percent or more, and there is sufficient volume in (and market for) pulpwood size trees to justify a thinning. The thinning should remove smaller and poorer quality trees to concentrate growth on the largest and best quality trees. The effect should be to raise the average stand diameter and reduce the time required for trees to reach sawtimber size. Cutting only occurs in the pulpwood sizes.

Commercial pulp and sawlog thinning

This prescription is appropriate when relative stand density is 80 percent or more, and there is sufficient sawlog and pulpwood volume to make an integrated sale. The thinning should remove smaller and poorer quality trees to concentrate growth on the largest and best quality trees. The effect should be to raise the average stand diameter and reduce the time required for trees to reach sawtimber size. Most of the cutting occurs in pulpwood sizes, but some also occurs in sawtimber sizes.

Thin-harvest

This treatment is appropriate toward the end of the stand rotation. As the stand matures, species will reach maturity at different ages. Some species may be ready for harvest while others require one or two more thinnings. This treatment should remove trees from the smaller size classes as well as the largest size classes. The effect should be to concentrate growth on trees in the small sawtimber size class since these are the ones that increase most rapidly in value.

Seed cut

This treatment is appropriate in mature Allegheny or northern hardwood stands with high relative stand density (e.g., 75 percent or higher), and where competitive seedlings are inadequate, but seed sources are adequate and there are minimal site limitations. This treatment is designed to provide for the establishment of desirable seedlings and to begin harvesting the stand. It is also prescribed when seedling establishment is needed in immature stands due to management objectives. This is the first cut in a shelterwood sequence for these forest types.

First removal cut (mixed oak stands)

This treatment is appropriate in mixed oak stands after oak regeneration has been established. The treatment should reduce overstory stocking to 40 to 60 percent relative density, and retain sufficient trees in sawtimber sizes so that a seed source is maintained on the site in case of a regeneration failure. This is the first harvest in a shelterwood sequence in mixed oak forest types.

Uneven-aged Treatments

Uneven-aged management prescriptions share the same parameters. The meaning of these variables and the implications of the choices made here are described in Stout (1994) and Miller et al. (1995).

The following two parameters of uneven-aged treatments are shared with even-aged treatments: minimum residual density desired and maximum percent density to be removed in this cut.

Maximum diameter to be retained

This is the maximum diameter of trees to be retained in the stand.

Q-ratio (also called Q-factor)

This represents a geometric progression of increasing numbers of trees with decreasing diameters (Smith 1986). For example, using 2-inch diameter classes, if the q-ratio is 1.2, the number of trees in the 6-inch diameter class will be 1.2 times the number of trees in the 8-inch diameter class. This controls the residual stand structure, and you need to understand the silvicultural implications of this parameter to use this option wisely.

The following uneven-aged treatments are available:

Group selection cut (all age)

This treatment is appropriate in stands where the use of moderate canopy openings may permit the regeneration of some intolerant species, while maintaining a forest canopy at all times. A maximum tree size of 22 inches is recommended for timber production, along with a higher Q-ratio.

Single-tree selection cut (all age)

This treatment is appropriate in stands where large canopy openings are not permitted and a forest with the appearance of many large trees is desired. A maximum tree size of 28 to 30 inches is recommended, along with a low Q-ratio.

Defining Custom Treatments

With this option, it is possible to define almost any kind of treatment desired. Trees can be selected for removal based on diameter, species, and timber quality. Furthermore, trees can be assigned a removal priority which provides more control in meeting the objectives of the treatment.

1. Click the **Analysis and Prescription** button.
2. Click the **Current Rx** tab to design a treatment for the current stand, or the click the **Simulated Future Rx** tab to design a treatment for a stand during simulation of stand growth and yield.
3. Click **Design a prescription of user's own design (custom)**.
4. Enter the **minimum residual density desired**.
5. Enter the **maximum percent density to be removed in this cut**. This is the maximum percent of the original stand density to be removed at one time. The maximum amount removed will prevent excessively heavy cuts in stands that are at or above full stocking.
6. Click one or more of the priority buttons above the grid table to establish rows (records) by priority in which to enter cutting specifications. A maximum of 24 rows may be used for establishing cutting specifications. For example, if you established 12 specifications for priority 1, that would leave 12 rows available for priorities 2 and 3. If you then established 7 specifications for priority 2, 5 rows would be available for priority 3.
7. Enter the cutting specifications for each row.

Add first priority—This button will add a row to the grid table, to be used for cutting priority 1. Priority 1 specifications are implemented regardless of the effect on timber quality, stand structure, or relative density. New rows are added at the bottom of existing rows for cutting priority 1, and above any rows for cutting priorities 2 or 3.

Add second priority—This button will add a row to the grid table, to be used for cutting priority 2. Priority 2 specifications are implemented on the stand after priority 1 cuts have been implemented,

and within stand density goals entered above. New rows are added at the bottom of existing rows for cutting priority 2, below any rows for cutting priority 1 and above any rows for cutting priority 3.

Add third priority—This button will add a row to the grid table, to be used for cutting priority 3. Priority 3 specifications are implemented on the stand after priority 1 and 2 cuts have been implemented, and within stand density goals entered above. New rows are added at the bottom of existing rows for cutting priority 3, below any rows for cutting priorities 1 and 2.

Delete record—This button will immediately remove the current row (where a cell has been highlighted or entered).

Stand Growth Projection

About Stand Growth Projection

The growth and mortality equations in SILVAH have been fairly well tested on 30- to 90-year-old, even-aged cherry-maple stands in northwestern Pennsylvania (Marquis 1982). There are equations for other northern hardwoods species and for oaks (Hilt 1985) in the program and the simulator was tested in stands where these other species dominate the species composition. Schuler et al. (1993) report those results.

We know that results are erratic in some oak-hickory stands, and in some northern hardwood stands dominated by sugar maple or beech. There is also no ingrowth function in the program, so projections using uneven-age procedures should not be attempted for more than a 20- to 40-year period.

The equations estimate growth and mortality using the following individual tree and stand parameters:

- Relative diameter (dbh/medial stand diameter)
- Stand density (relative stand density)
- Species
- Site index (oaks only)
- Age

Projecting Stand Growth

The stand growth option is turned off by default. To project stand growth:

1. Click the **Analysis and Prescription** button.
2. Click the **Growth and Yield** tab.
3. Uncheck **Do not project stand growth**.
4. Enter the number of **years to grow**. The default is 5 years but may be any whole number > 0.

Database Output

About Database Output

SILVAH can output a stand summary into a text file that can be used in building a forest-wide database. A stand is summarized on a single row comprised of 231 columns separated by commas. If the stand is cut, two additional rows are output for the cut and residual stand. Even if a stand does not receive any treatment, it can be output multiple times during a run if database output is requested at every cycle during the projection of stand growth and yield.

Since each stand is output on a single row, you can aggregate output from separate stands into a single file if desired. This is accomplished by asking SILVAH to append database output into the same text file repeatedly during successive runs.

The output can be viewed in any word processor, but it is recommended that you view the data in a spreadsheet program such as Microsoft Excel.

Each row begins with columns that identify the stand, the output date, source data file (*.sil), tally date, and whether the row contains the original, cut, or residual stand, and the treatment type. The next series of 97 columns contain key management factors for the stand, such as deer impact, site index, total relative density, percent stocking of understory desirable and interfering species, timber volume, and so on. The final columns contain the basal area per acre of 126 overstory species, in alphabetical order. Species that do not occur in a stand will be shown with zero (0) basal area.

Generating Database Output

All stands displayed on the Pick Stands tab will be summarized and output to the file of your choice. If you wish to maintain separate output for one or more stands, you must process them separately.

1. Click the **Analysis and Prescription** button.
2. Click the **Run** tab.
3. Under the **Database output** caption, select when you want database output to be generated. Click **Initial stand** if you want to summarize the initial stand conditions prior to any treatment or growth simulation. Click **Every cycle** if you want to summarize the stand at each 5-year cycle during simulation of stand growth and yield. Click **Final results** if you want to summarize the stand at the end of the growth and yield period. Note: Every cycle and Final results are *disabled* unless and until you turn on stand growth projection on the Growth and Yield tab.
4. Click the **Output file** button, which will open a Save As dialog. Note: This button will remain disabled until you select when you want output to be generated (e.g., Initial stand).
5. Browse to and select an existing database output file, or type in a new one.
6. Click **Save** when you have specified a database output file name.
7. Click **Append to file** if you selected an existing file in Step 5 and you wish to accumulate multiple stand summaries in the same file, or click **Overwrite current file** if you want to replace the contents of an existing file with new output.

Opening Database Output In Excel

The database output of SILVAH can be opened in Notepad or any word processor. However, the output is arranged in a tabular format. Because of the extensive number of columns, it is strongly recommended that you use Microsoft Excel or a similar spreadsheet program to open and view the database output of SILVAH.

The following instructions pertain to Microsoft Excel.

1. Launch Microsoft Excel.
2. Begin the steps for opening an existing file.
3. From the Files of type list at the bottom of the Open dialog, select **text files (*.txt)**.
4. Browse to the folder that contains the database output from SILVAH. The default file name is "databaseoutput_silvah.txt."
5. Click **Open**.
6. On the first page of the Text Import Wizard, be sure to select **Delimited** as the file type that best describes the data. Then, click **Next**.
7. On the second page of the Text Import Wizard, be sure to check **Comma** in the choice of Delimiters. The columns in the database output from SILVAH are separated by commas. Then, click **Next**.
8. On the third page of the Text Import Wizard, click **Finish**.

Running Stands

Running Your Stands

After you have selected stands and chosen options for reports, prescriptions, growth and yield, and database output, you are ready to run your stands.

Consider using script files if plan to use the same run options repeatedly.

Consider storing your selected stands in a file.

1. Click the **Analysis and Prescription** button.
2. Click the **Run** tab.
3. Click the large **Run** button.

Error handling during a run

SILVAH will process stands one at a time and report errors as they occur. When SILVAH reports an error in the processing of a stand, a Run Errors dialog will pop up. In most cases you will be provided with a brief explanation. You will be given the following choices for handling errors in the current run:

STOP - do not continue

Select this option if you want to halt processing for all stands in this run. No further processing will occur for any stand. Prior to the error, if any stands have already been processed in the run, you will be able to view the output from those stands.

Continue processing

If you want to continue processing, despite errors, you have two choices. Select **Continue displaying messages as they occur** if you want to be prompted the next time an error occurs. Select **Stop showing error messages** if you want SILVAH to work through all stands in the run, without showing you error messages during processing. If a stand has minor issues in the data, one or more reports may include information about the problem. However, SILVAH will not produce any pop-up errors during the remainder of the run.

Keep a log file

Check this box if you want to keep a history of the errors generated during this run. As soon as you make this selection, SILVAH will prompt you for a file name. Browse to and select a folder, then specify a log file name. Click **Save** when you are finished. SILVAH will display the folder and file name on the Run Errors dialog.

Viewing the Output

When the run is completed, SILVAH will display the output of the first stand on the Run tab. Other stands can be selected from the pick list with the caption **Display report for stand**. To view another stand, click the pick list arrow. Stands will be listed with the full path and file name in the pick list. Click once on the name of the stand to display it on the Run tab.

If desired, any stand already displayed on the Run tab can be opened in Notepad by clicking the **Open** button. This will allow you to print the output or copy the contents into another word processor if necessary. Each stand opened in Notepad will be displayed in a separate window, allowing you to have several stands open at once.

Skipping Options during a Run

Occasionally you may want to skip certain options between runs. You can temporarily disable reports, prescriptions, and growth and yield as desired, without switching tabs and redoing options each time.

To temporarily skip options during a run:

1. Click the **Analysis and Prescription** button.
2. Click the **Run** tab.
3. At the top of the Run tab, check the appropriate boxes to **skip treatments** or to **skip stand growth**.
4. Check the appropriate boxes to temporarily disable reports at various times during the run.
5. To re-enable any option, uncheck the box and reprocess the stands.

Chapter 6 - TreeCalc, A Volume and Value Calculator

About TreeCalc

How many times have you asked yourself what was the volume of an 18-inch black cherry tree? Or, what is the basal area or relative density of a tree? TreeCalc helps to answer these questions. It also can be used to sum all of those values for a number of trees. Thus, TreeCalc is a general purpose volume table and forestry calculator.

The values that are displayed in TreeCalc are identical to those that are used elsewhere in SILVAH. In addition, TreeCalc can read the same defaults (.def) files that are used during Analysis and Prescription.

To start using TreeCalc, follow these steps:

1. At the top of the SILVAH6 screen, click the **TreeCalc** button.
2. If you wish to load a defaults (.def) file, click the **DEF file** button.
3. Click inside the species cell, enter a species, then click in other cells and enter appropriate values.
4. When you are ready to calculate, click the **Calculate tree** button.

How to Use TreeCalc

Some of the boxes (cells) on TreeCalc are white and some are gray. White values are ones that can be changed, except the row of cells for trees that have been added to the grid at the bottom of the screen. Gray cells represent calculated values. An example calculation for an 18-inch black cherry is shown in Figure 4.

Most of the values that can be changed (white cells) are self explanatory, and are described elsewhere in this documentation. See Chapter 4 for information about the species codes accepted, as well as how to adjust the calculated volume using pulp and sawlog correction factors (CF).

TreeCalc will use the default species codes and volume correction factors loaded into memory. If you wish to load your own defaults into TreeCalc, click the **DEF file** button.

SILVAH6

File Edit View Help

Calc Settings and Species Inventory Entry Analysis and Prescription Tree Calc

Tree calculation

DEF file: C:\USFS-NRS\SILVAH6\silvah.def

Reset entries

Species: BC BLACK CHERRY DBH: 18.00 Saw cf: 1.00

Quality: 1- AGS 8-ft bolts: 3 Pulp cf: 1.00

Grade: 1- grade 1 sawlog Defect: 0- none Form class: 82.00

Sawtimber: 400.00 Veneer: 999.00 Const/Local: 0.00 Bolts: 0.00 Pulp: 2.00 Log rule: 1- International 1/4 inch

Calculate tree

	Pulp (cuft)	Sawlogs (BF)	Total (cuft)	% Grade 3+
Basal area: 1.77	Gross vol: 20.61	208.92	49.94	% Veneer: 0.00
Rel Dens: 0.59	Net vol: 16.49	208.92	39.96	% Grade 1: 1.00
Pulp ht: 3.00	Value: 0.41	110.13	110.55	% Grade 2: 0.00
Saw ht: 5.99	Lumber price relative: 0.551			% Grade 3: 0.00

☐ Display totals from tree list below

Add tree to grid Delete tree Clear grid Double-click a row to review tree values, edit parameters and recalculate.

Species (n=1)	Dbh	Quality	Grade	Bolts	Defect
BLACK CHERRY	18.00	1	1	3	0

Ready

Figure 4.—An example calculation of an 18-inch black cherry in TreeCalc.

Entering Tree Characteristics

To change any of the white cells, click inside the cell with the mouse or use the **Tab** key to move to the cell. Type in a new value and press the **Enter** key, or use the pick list provided for some cells.

When you change species, the pricing and form class information immediately changes. However, many species are supplied with similar pricing and form class, and the screen may not appear to change. None of the other values on the screen will change, so be sure that all values are set the way you want them before you calculate.

Calculating Tree Values

When you have entered all of the characteristics on the tree for which you want volumes and values calculated, click the **Calculate tree** button to calculate.

You can calculate volumes and values for several different diameters of any species quickly. Just click in the diameter field, enter the diameter and press the **Enter** key, then click the **Calculate tree** button. Likewise, you can change any of the other values, such as grades, heights, and so on, and calculate a series of answers quickly.

The answers displayed in gray cells include Saw ht and Pulp ht, which are based on local height equations, unless the height was entered. The Lumber price relative field is described in the Stand Evaluation Tools (SETS) equation system in the topic "Volume and Value Calculations" in Chapter 7 on definitions and references. The percentage breakdowns represent the proportion of trees that are grade 3 or better, and for those trees, the proportion that are grade 1, grade 2, grade 3, and veneer grade. The cubic volumes (cuft) are calculated from U.S. Forest Service Region 9 equations. The board-foot volumes (BF) are calculated by the rule specified, using a generalized formulation of the Girard-Messavage form class tables. The Basal area is the standard calculation based on the diameter. And the Rel Dens is the density accounted for by this tree.

Accumulating totals for multiple trees

You can also accumulate volumes and values for a number of trees. This makes it easy to calculate the volume, value, basal area, and relative density of any tree, and to sum these values for several trees.

TreeCalc can accumulate totals only for trees that have been calculated and added to the grid at the bottom of the TreeCalc screen.

1. After a tree is calculated, click the **Add tree to grid** button. The tree will appear as a row in the grid at the bottom of the TreeCalc screen. As you repeat this process, several trees will appear in the grid.
2. Check **Display totals from tree list below** when you are ready to display a total for all of the trees displayed in the grid. The total values will appear in the middle of the TreeCalc screen in the gray cells that are also used for displaying values for single trees.
3. When you are ready to resume calculating other trees, *uncheck* **Display totals from tree list below**.

Managing the Tree List in the TreeCalc Grid

Removing Trees

A tree can be removed from the grid at any time.

1. Click anywhere in the row of the tree you wish to delete.
2. Click the Delete tree button. If TreeCalc is currently displaying an accumulated total for all trees in the grid, the total will be recalculated based on the remaining trees in the grid.
3. To remove all trees from the grid at once, click the **Clear grid** button.

Reviewing Tree Values

The values for any tree in the grid can be retrieved and displayed in the TreeCalc screen. Double-click a row in the TreeCalc grid to retrieve and review the values for that tree.

Chapter 7 - SILVAH Calculations

About SILVAH Calculations

This chapter describes some of the calculations performed in SILVAH. Some literature references are provided in connection with these calculations. There are many kinds of calculations in the SILVAH software, and a discussion of all them is beyond the scope of this manual. There are many other publications from which general information was used in developing the SILVAH approach. These are cited in Marquis et al. (1992) and Brose et al. (2008).

Cover Types

At present, SILVAH does not use cover type for any calculations or determinations. If users enter cover type, the information is stored with the stand in any databases that the user may create using SILVAH data.

SILVAH accepts the following cover types: Forest, Seedlings, Opening, Pasture, Cropland, Wetland, Water, Urban, and Other.

Forest Types

SILVAH assigns a forest type using the proportion of total stand basal area represented by a particular species or species group. SILVAH includes all trees 1.0 inch dbh and larger in this determination.

The types recognized are as follows:

Northern hardwood - Stands that have at least 65 percent of the basal area in sugar maple, red maple, American beech, yellow birch, sweet birch, eastern hemlock, American basswood, cucumber tree, black cherry, white ash, or yellow-poplar.

Northern hardwood-hemlock - Stands meeting the requirements for the northern hardwood type that also have at least 50 percent of their basal area in eastern hemlock.

Allegheny hardwood - Stands meeting the requirements for the northern hardwood type that also have at least 25 percent of their basal area in black cherry, white ash, and yellow-poplar, and less than 50 percent of their basal area in eastern hemlock.

Mixed oak - Stands that have at least 65 percent of their basal area in northern red oak, black oak, scarlet oak, white oak, or chestnut oak, or any hickory species.

Transition - Stands that have at least 65 percent of their basal area in species of either the northern hardwood or oak-hickory types, but do not qualify for any of the other types alone.

Unknown - Any stand that does not qualify for one of the types above.

Stand Size Classes

Stand size classes used in SILVAH are based on the “average” stand diameter, which is calculated as the medial diameter (MD) of all trees 1.0 inch dbh and larger.

Note that the diameter breaking points for stand size classes do not correspond to the diameter breaking points for individual tree size classes. For example, individual trees grow from the sapling class to the pole class when they exceed 5.5 inches dbh, but stands with a medial diameter of more than 4.5 inches are pole stands. This is because the stand diameter usually lags behind the average diameter of the crop trees in the stand.

The stand size classes are as follows:

1. Sapling stands = MD less than 4.5 inches
2. Small pole stands = MD between 4.5 and 7.5 inches. Such stands will rarely support commercial cutting.
3. Large pole stands = MD between 7.5 and 10.5 inches. These stands may support a combined commercial thin—timber stand improvement (TSI)—if there is a good pulpwood market.
4. Small sawtimber stands = MD between 10.5 and 13.5 inches. In most areas, small sawtimber stands will support commercial thinning.
5. Medium sawtimber stands = MD between 13.5 and 16.5 inches. Medium sawtimber stands will support commercial thinning or thin-harvests.
6. Large sawtimber stands = MD larger than 16.5 inches. Such stands usually have a MD in merchantable-size trees of 18 inches or more, and are economically mature.

Tree Size Classes

SILVAH defines several diameter break points for trees, also called tree size classes. These help to distinguish broad diameter classes of trees. Note that tree size classes do not correspond to diameter breaking points for stand size classes.

The tree size classes are as follows:

1. Sapling = 1.0 to 5.5 inches
2. Pole = 5.5 to 11.5 inches
3. Small Sawtimber = 11.5 to 17.5 inches
4. Medium Sawtimber = 17.5 to 23.5 inches
5. Large Sawtimber = 23.5 inches or more

Stand Density Classes

SILVAH typically characterizes stand density (Gingrich 1967, Roach 1977, Stout et al. 1987, Stout 1991) as follows:

Relative density over 95 percent - Stands are at or near the maximum density possible. If SILVAH recommends a partial cutting, SILVAH will constrain the density to be removed.

Relative density between 80 and 95 percent - Stands are above the optimum density for best growth and the volumes available will usually permit a commercial sale.

Relative density between 50 and 80 percent - Stands are in the optimum density range for growth of high-quality sawtimber and veneer.

Relative density below 50 percent, but density of AGS above 35 percent - Stands are understocked, but still contain enough good trees to make further management worthwhile. They simply need time to accumulate additional growing stock.

Relative density of AGS below 35 percent - Stands do not contain enough good trees to warrant further management of the existing overstory cohort. They are economically mature, and should be regenerated.

Volume and Value Calculations

Merchantable Heights

SILVAH will accept field measurements of sawlog merchantable height in 8-foot logs, and use that information in calculating volumes. If no heights are entered, SILVAH will calculate sawlog height from an equation developed from data provided by the Hammermill Paper Company (Marquis et al. 1992), where sawlog height is a function of dbh and species.

Before SILVAH calculates board-foot volume, estimated sawlog merchantable height may be increased or decreased according to the user-entered merchantable height adjustment factor for the stand.

Measurements of pulpwood height are not accepted. SILVAH always estimates the number of 8-foot bolts in the *total* merchantable height, which includes the sawtimber and pulpwood portion of each tree. Instead of calculating pulpwood merchantable height as a means for estimating pulp volume, SILVAH calculates pulp volume by obtaining the difference between total cubic volume and sawtimber cubic volume of a tree. We developed the equation (Marquis 1977) for total merchantable height from Allegheny National Forest data—no Hammermill data were available. Total merchantable height is a function of dbh, species, and effective age of the stand. If age is unknown, SILVAH uses 65 years.

Before SILVAH calculates cubic foot and pulp volume, estimated total merchantable height is increased or decreased according to the user-entered merchantable height adjustment factor for the stand.

The sawlog heights determined from the Hammermill data average about 25 percent lower than those from the Allegheny National Forest data. Since the Hammermill data correspond better with the volumes actually utilized for sawlogs, we use the Hammermill data exclusively for sawlog heights. To make the total merchantable heights correspond to the utilization standards of sawlogs, total merchantable heights calculated from the Allegheny National Forest data are reduced by 25 percent.

Height equations return values only if the height is at least half of a full 8-foot bolt (0.5-0.9 bolts is rounded up to one full bolt). However, fractional bolts are retained for trees with more than 1.0 bolt. For species on which height equations are unavailable, SILVAH uses equations for sugar maple, red maple, and northern red oak.

Cubic Volumes

SILVAH calculates gross cubic volumes using a U.S. Forest Service Region 9 composite volume equation. The equation (Marquis 1977) uses dbh, total merchantable height in 8-foot bolts, and various transformations and interactions.

Users may enter a cubic-foot correction factor for each species in the SILVAH defaults file. Refer to the topic “Editing Species Parameters” in Chapter 4 for instructions on entering correction factors. Cubic-foot correction factors are applied to gross cubic-foot volume—*before* net cubic-foot volume is calculated.

SILVAH calculates gross sawlog and gross total cubic volume for any tree with at least one half of an 8-foot bolt.

Board Volumes

SILVAH calculates gross board-foot volume for the International 1/4 inch, Doyle, and Scribner log rules, as defined in the widely used Mesavage and Girard form-class volume tables (Mesavage and Girard 1956). These volumes are approximated using a simplified series of equations developed by Wiant and Castenada (1977).

Users may enter a board-foot correction factor for each species in the SILVAH defaults file. Refer to the topic “Editing Species Parameters” in Chapter 4 for instructions on entering correction factors. Sawlog correction factors are applied to gross board-foot volume—*before* net board-foot volume is calculated.

SILVAH calculates board-foot volume for any tree with at least one half of an 8-foot log. Board-foot volume is a function of dbh, sawlog height in 8-foot logs, and form class.

Net Volumes

SILVAH reduces gross volumes of a tree as follows:

Board-foot volume

If tree product grade is unknown, SILVAH may reduce gross board-foot volume by the estimated proportion of all sawtimber-size trees of similar species and diameter that do not have at least one log of grade 3 or better, based on examinations of tree grade distributions (Ernst and Marquis 1979, Myers et al. 1986).

SILVAH also reduces gross board-foot volume by defect percent (if observed). There is no utilization loss for net board-foot volume.

Pulpwood volume

SILVAH determines gross pulpwood volume by subtracting gross cubic-foot sawtimber volume from total gross cubic-foot volume of the tree.

SILVAH reduces gross pulpwood volume by defect percent (if observed). After accounting for defect, SILVAH reduces gross pulpwood volume by 20 percent to reflect typical utilization standards.

About Report Volumes

SILVAH reports five different stand volumes on the Stand Summary Report.

GTOT CDS, or Gross Total Cords, represents the gross amount of cordwood in the stand, including the cordwood volume equivalence for sawtimber in the stand.

NTOT CDS, or Net Total Cords, represents the net amount of cordwood in the stand, including the cordwood volume equivalence for sawtimber in the stand. SILVAH computes net cubic pulpwood volume and converts to cord volume assuming 80 cubic feet per cord.

PULP CDS, or Net Pulpwood Cords, represents the net amount of cordwood in the stand excluding the volume that will be marketed as sawtimber.

GRS BDFT represents the gross board foot volume in the stand.

NET BDFT represents the net board foot volume in the stand.

See specific volume topics for ways in which volumes are calculated.

Grade

SILVAH will accept field measurements of grade, and use that information in calculating value. If no grade observations are entered, SILVAH will estimate grade based upon dbh and species. Grade equations are based on data from Allegheny hardwood (Ernst and Marquis 1979) and oak-hickory forests (Myers et al. 1986).

Equations are not available for every species. Species with similar form are grouped together. For example, white ash, cucumber, and basswood use the equation developed for yellow-poplar. For species of unknown form, the beech-birch equations are used.

Veneer is estimated at 15 percent of the grade 1 butt logs.

In all situations, the proportions calculated above are used for trees entered into SILVAH on which grade was not recorded. When grade is recorded, SILVAH considers 100 percent of the butt log to be the grade recorded, while grade distribution for the upper logs (above the first two 8-foot bolts) is calculated as described.

Value

SILVAH assigns values on the basis of the volume within each product and grade, as determined either by actual measurements or by the SILVAH equations.

SILVAH calculates pulpwood, firewood, local bulk product, local sawlog product, and veneer values simply as the volume in that product times the stumpage value for that product entered by the user.

SILVAH evaluates factory grade sawlogs from extensive sawmill recovery data. These data show the average proportion of the various grades of lumber that can be sawn from trees of a given species, dbh, height, and butt-log grade. From these data (equations), SILVAH calculates a tree quality index representing the relative value of the lumber that can be sawn from that tree. That relative value is also a function of the stumpage value entered by the user. To get total lumber value in the tree, the value relative is multiplied by the sawlog volume.

SILVAH then subtracts conversion costs from the lumber value. These costs reflect the average cost of harvesting and transporting the log. They are a function of diameter (it is more economical to harvest and transport larger diameter logs). All these procedures are documented in the SETS equations (Debald and Mendel 1976a, Debald and Mendel 1976b, Mendel et al. 1976).

Since the tree quality index and relative value of a tree (under this procedure) are functions of diameter and merchantable height, the value per MBF is not constant. Instead, it varies from one stand to the next. So, stumpage value for factory logs rarely will be equal to the volume times the stumpage value entered by the user. This is an important advantage to the SILVAH program, as the value calculated reflects the size, height, and quality of the trees in the individual stand.

When entering stumpage values for sawlogs, use a woods run average over many sales. This will be approximately the value for a 16-inch dbh tree.

Chapter 8 - Data File Format

Data File Format

SILVAH data files (.sil) are written in plain ASCII text and can be edited with any text editor or word processor with text mode. However, you must exercise caution if you do edit these files since they require a strict format. It is recommended that you use SILVAH to edit data files since it assures that the format of the file conforms to this standard.

The .sil files are sequentially accessed files with a record length of 16 characters. They contain several different kinds of data, including stand identification information, standard (checkmark) regeneration data, possibly extended regeneration data, overstory data, and possibly nonnative invasive species data.

Tables 1 through 5 summarize the data blocks, records, and fields that occur in .sil files. Each table provides a brief description of each data block, each record within a data block, and each field within a record. Valid field types are either alphanumeric or numeric. Table 1 contains the stand identification and related data.

Table 1.—Stand identification, management information, and inventory settings

Line	Columns	Type	Description
1	1-4	A	SILVAH version number
	5-9	N	Overstory data flag. If this value is 0, no overstory data is in the file. If this value is 999, overstory data is present in the file.
	10-14	N	Extended understory data flag. If this value is 0, no extended understory data is in the file. If this value is 999, extended understory data is present in the file.
2	1-16	-	Blank Line, not currently used
3	1-16	A	Owner/Agency
4	1-16	A	Forest/Property
5	1-16	A	County/District
6	1-6	A	Compartment/Unit
	7-12	A	Stand Number (ID)
7	1-16	A	Remarks, first 16 characters
8	1-16	A	Remarks, characters 17 to 32
9	1-16	A	Remarks, characters 33 to 48
10	1-16	A	Remarks, characters 49 to 64
11	1-4	A	Remarks, characters 65 to 80

continued

Table 1.—Stand identification, management information, and inventory settings cont.

Line	Columns	Type	Description
12	1	N	Species code type (1=mnemonic, 2=user-defined/local, 3=forest survey/FIA)
	2	N	DBH size classes used (1=one inch, 2=two inch)
	3-4	N	Tally month
	5-8	N	Tally year
	9	N	Overstory cruise type (see Appendix A)
	10-12	N	Number of overstory plots
13	1-6	N	Overstory plot size or Prism BAF
	7	N	Understory cruise type (0=none, 1=checkmark, 2=extended)
	8-10	N	Number of understory plots
	11	N	Understory plot size (1=6-ft radius, 2=3.7-foot radius milacre plot)
14	1-6	N	Stand area (acres)
	7-9	N	Actual stand age (calculated; tally year - year of origin)
15	1	N	Cover type (see Appendix A)
	2-3	N	Currently unused
	4-7	N	Currently unused
	8-9	N	Site class (1=high quality, 2=average, 3=low quality)
	10-12	A	Site index species (species code recorded will correspond to species code type, see above)
	13-15	N	Site index
16	1-4	N	Height adjustment (user-entered value between 0.5 and 1.5 inclusive)
	5-8	N	Currently unused
	9-12	N	Elevation
	13-15	N	Aspect (azimuth between 0-360 degrees)
17	1-3	N	Slope (percent)
	4	N	Topographic position (see Appendix A)
	5	N	Operability (1=no limitations, 2=limited)
	6	N	Accessibility (1=road within stand, 2=road at edge of stand, 3=road within 1 mile, 4=no road within 1 mile)
	7	N	Aquatic feature in stand (see Appendix A)
18	1-3	N	Clearcut acreage within 1 mile (acreage between 0-1000 acres)
	4-6	N	Cultivated acreage within 1 mile (acreage between 0-1000 acres)
	7-9	N	Open acreage within 1 mile (acreage between 0-1000 acres)
	10	N	Aquatic feature within 1 mile (see Appendix A)

continued

Table 1.—Stand identification, management information, and inventory settings cont.

Line	Columns	Type	Description
19	1	N	Restrictions on silvicultural system (see Appendix A)
	2	N	Management value (0=not observed, 1=high value, 2=medium value, 3=low value)
	3	N	Deer impact index (see Appendix A)
	4	N	Manager wants to regenerate stand now (0=no, 1=yes only if stand mature, 2=yes regardless of conditions)
	5	N	Manager wants to increase oak in the stand (0=no, 1=yes)
	6	N	Prescription charts to follow (1=northern or Allegheny hardwoods, 2=mixed oak)
	7	N	Manager wants to retain residuals (0=no, 1=yes)

The next block (Table 2) follows the stand identification block and contains regeneration data in standard (checkmark) format. The standard regeneration block is always present in .sil files, even when extended regeneration data is also present in the file. However, when extended regeneration data is present in the file, the fields in the following records will have a value of zero (0).

Table 2.—Standard regeneration data block

Line	Columns	Type	Description (Recorded as number of plots stocked)
20	1-4	N	Black cherry
	5-8	N	Yellow-poplar
	9-12	N	Conifers
	13-16	N	New oak
21	1-4	N	Established oak
	5-8	N	Competitive oak
	9-12	N	Other desirables
	13-16	N	Established desirables
22	1-4	N	Competitive desirables
	5-8	N	Total oak
	9-12	N	Residuals
	13-16	N	Saplings
23	1-4	N	Tall woody interference
	5-8	N	Low woody interference
	9-12	N	Fern
	13-16	N	Grass
24	1-4	N	Any interference
	5-8	N	Grapevines
	9-12	N	Site limits
25	1-16	-	Blank line, not currently used

The extended regeneration data block (Table 3) follows the standard regeneration block in the .sil file when extended regeneration data is input by the user. It consists of a series of repeating records—one record for each non-zero cell in the extended regeneration section of the field tally sheet. The regeneration class codes displayed in the file are derived from the classes displayed on the extended regeneration data input screen and are coded in the following manner:

Understory regeneration codes

BCR - Black cherry
 CNF - Conifers
 COK - Competitive oak
 DUF - Thick duff
 EOK - Established oak
 FRN - Fern
 GRP - Grapevine
 GRS - Grass
 LWI - Low woody interference (species)
 LWC - Low woody interference (percent cover)
 NOK - New oak
 NNS - Nonnative species
 ODR - Other desirables
 ROC - Rocky soil
 RSD - Residuals
 SAP - Saplings
 TOH - Total height of oak seedlings
 TWI - Tall woody interference (species)
 WET - Wet soil
 YPR - Yellow-poplar

Table 3.—Extended regeneration block

Line	Columns	Type	Description
26+	1-3	A	Understory regeneration code (see above for description of codes)
	4-7	N	Understory plot number
	8-11	N	Seedling count, species code, yes/no, or other code

A trailer record with a “-1” in the regeneration code column after all of the regeneration data indicates the end of the extended regeneration data block. This trailer record will appear in the file, even if there is no extended regeneration data.

The overstory data block (Table 4) follows the standard and/or extended regeneration data. It consists of a series of repeating records—one record for each overstory observation. A zero in the species column indicates the end of an overstory plot, and the value that follows in the diameter column is the plot number.

Table 4.—Overstory data block

Line	Columns	Type	Description
26+	1-3	A	Species code (species code recorded will correspond to species code type: 1=mnemonic, 2=user-defined/local, 3=forest survey/ FIA)
	4-5	N	Diameter (any value from 1-40 inches, decimals not used)
	6	N	Quality (see Appendix A)
	7-12	N	Height in 8-foot bolts, or count of observations of same species and diameter
	13	N	Grade (see Appendix A)
	14	N	Percent defect (whole number from 0-9 representing nearest 10 percent, i.e., 9=90 percent, and so on)
	15	N	Crown condition (see Appendix A)
	16	N	Wildlife code (see Appendix A)

A “-1” in the species column indicates the end of the overstory data. This trailer record will appear in the file, even if there is no overstory data.

Following the overstory data is the off-plot nonnative invasive species data (Table 5; plot-based observations are recorded in the extended regeneration data described above). It consists of a series of repeating records, with each record corresponding to one of the species identified as exotic in the plant species module.

Table 5.—Off-plot nonnative species block

Line	Columns	Type	Description
27+	1-3	A	Species code (species code recorded will correspond to species code type, see above)
	4-5	N	Species present within stand (0=no, 1=yes)
	6-7	N	Species present near or adjacent to stand (0=no, 1=yes)

A “-1” in the species column indicates the end of the off-plot nonnative species data. This trailer record will appear in the file, even if there is no data on invasive species.

Appendix A - Codes and Input Definitions

Aquatic Features

These are the features that may occur within the stand or within 1 mile of the stand.

Code	Description
1	spring or seep
2	stream <15 feet across
3	stream >15 feet across
4	marsh
5	swamp
6	pond
7	lake

Deer Impact Index

An estimate of the impact of browsing pressure from white-tail deer on regeneration is essential for proper prescription. Deer impact is a function of deer population and the amount of available food in the one square mile area surrounding the stand in question (Marquis et al. 1992).

Code	Description
0	Unknown
1	Very low - Stand is inside a well-maintained woven-wire deer fence.
2	Low - Desirable regeneration abundant and of varying heights. Herbaceous plants such as Trillium spp., Indian cucumber, and Canada mayflower present and able to flower and fruit. Stump sprouts persist.
3	Moderate - Regeneration present, though height variation may be limited and stump sprouts obviously browsed or absent. Non-preferred browse species such as hay-scented fern, witch-hazel, striped maple, and beech root suckers common.
4	High - Desirable regeneration rare to absent. Non-preferred and browse-resilient vegetation limited in height due to deer browsing. No stump sprouts.
5	Very high - Desirable regeneration absent. Non-preferred species also limited in abundance. Browse line evident.

Land Cover Type

Code	Description
1	forest
2	seedlings
3	open (failed clearcuts, savannahs, other forest lands lacking tree cover)
4	pasture
5	crops
6	wetland
7	water
8	urban
9	other

Overstory Cruise Type

This is a coded value that reflects how the overstory data was collected, including whether you used a prism or fixed area plots, whether you recorded stem counts or merchantable heights, and the tree grading procedure you followed. SILVAH converts your answers into a single code, which is stored in the data (.sil) file as follows:

Code	Description
1	Prism cruise, individual trees, merchantable heights recorded, plots recorded separately. Either record grades for all trees or record grades for none of the trees. See also code 7.
2	Prism cruise, individual trees, stem counts recorded, plots recorded separately.
3	Prism cruise, dot tally, all plots tallied together.
4	Fixed-area cruise, individual trees, merchantable height recorded, plots recorded separately. Either record grades for all trees or record grades for none of the trees. See also code 8.
5	Fixed-area cruise, individual trees, stem counts recorded, plots recorded separately.
6	Fixed-area cruise, dot tally, all plots tallied together (stand table).
7	Prism cruise, individual trees, merchantable heights recorded, plots recorded separately. Record only major products, that is, cull (grade 8) and sawtimber with only pulp volume (grade 6). Similar to type 1, but used where you want accurate volumes and values without grading all trees.
8	Fixed-area cruise, individual trees, merchantable heights recorded, plots recorded separately. Record only major products, that is, cull and sawtimber with only pulp volume. Similar to type 4, but used where you want accurate volumes and values without grading all trees.
0	No overstory data

Restrictions on Silviculture System

It is assumed that timber production is an important goal of management for any stands being prescribed under the SILVAH system. Visual goals are also considered. These codes to indicate restrictions that visual goals may impose on timber cutting activities. Selection of goals 1 or 2 will usually lead to an even-age silvicultural system, and will tend to maximize timber production by maintaining a high proportion of shade intolerant species. Although wildlife goals are not specifically stated, these goals will tend to favor wildlife species that depend on early successional vegetation, and will generally maximize wildlife diversity. Selection of goals 3 or 4 will lead to an uneven-age silvicultural system, and will tend to produce moderate timber yields by favoring a high proportion of shade tolerant species. These goals will also tend to favor wildlife species that depend on late successional vegetation.

Code	Description
1	No restrictions on cutting methods for visual reasons.
2	Either even- or uneven-age silvicultural systems may be used, but clearcutting is not acceptable as a final harvest cutting method for visual reasons.
3	Uneven-age silvicultural systems are desired to maintain mature forest canopy at all times, but maximum timber production feasible under this system is desired.
4	Uneven-age silvicultural systems are desired to maintain a mature forest cover at all times. Timber production is less important than above, and visual goals call for the maintenance of very large trees on the area at all times, and the avoidance of canopy openings.

Topographic Position

Code	Description
1	ridge
2	upper slope
3	mid slope
4	lower slope
5	bench
6	upper flat (plateau)
7	bottom

Tree Timber Quality

Code	Description
1	Acceptable Growing Stock (AGS). These trees are suitable for retention in the stand for at least the next 15-year period. They are trees of commercial species and of such form and quality as to be salable for sawtimber products at some future date. Saplings are especially difficult to judge. Most knots, bumps, and stoppers will be confined to a small core if the sapling actually grows to a larger size, so consider most saplings acceptable. If in doubt about the correct quality class for any tree, consider it acceptable. Many acceptable trees will be removed if a partial cutting is prescribed for the stand, so do not consider the quality determination as a cut-leave tally.
2	Unacceptable Growing Stock (UGS). These trees do not have the potential to make salable sawtimber products in the future. They may be high risk trees —trees with disease, damage, or dieback that threatens their survival—or trees of such poor form that they just have to be removed regardless of the effect that removal will have on stand structure and species composition.
3	Dead. These are standing dead trees.

Tree Product Grade

Factory logs grades are described in Hanks et al. (1980) and Rast et al. (1973).

Code	Description
1	Factory - lumber log grade 1
2	Factory - lumber log grade 2
3	Factory - lumber log grade 3
4	Locally defined log product (such as pallet log, local use log, etc.). Construction log grade.
5	Locally defined bulk product (such as boltwood).
6	Pulpwood (contains a minimum of two contiguous 4-foot bolts with minimum top inside diameter of 4 inches and at least 50% sound).
7	Fuelwood (same as pulpwood, but minimum top inside diameter of 1 inch).
8	Cull. Tree less than 50% sound, or does not qualify for any of the grades or products listed.
9	Veneer log

Tree Crown Condition

Code	Description
1	Healthy. At least 90% of the crown is living.
2	Good. At least 75% but less than 90% of the crown is living.
3	Fair. At least 50% but less than 75% of the crown is living.
4	Poor. Less than 50% of the crown is living.

Tree Wildlife Value

Code	Description
1	Potential den tree - live tree with large dead branch or broken top that represents a potential den cavity, but tree does not now contain a cavity.
2	Existing den trees - live trees with natural or artificially created hole for den (do not include shallow food excavations made by pileated woodpeckers).
3	Snag with potential den - dead or nearly dead trees, but no visible cavities.
4	Snag with existing den - dead or nearly dead trees, but containing an existing den cavity.

Species Codes

Name	FIA	Mnemonic	Local
Other softwoods	1	OSW	2
Other hardwoods	4	OHW	88
Balsam fir	12	BF	2
E. red cedar	68	ERC	2
Larch	70	L	2
Tamarack	71	TAM	2
Spruce	90	S	2
Norway spruce	91	NS	2
White spruce	94	WS	2
Black spruce	95	BS	2
Red spruce	97	RS	2
Pine	100	P	2
Jack pine	105	JP	2
Shortleaf pine	110	SLP	2
Table Mountain pine	123	TMP	2
Red pine	125	RP	2
Pitch pine	126	PP	2
White pine	129	WP	1
Scotch pine	130	SCP	2
Loblolly pine	131	LOB	2
Virginia pine	132	VP	2
Austrian pine	136	AUP	2
Southern pine	170	SP	2
N. White cedar	241	NWC	2
Eastern hemlock	261	EH	6
Maple	310	M	88
Boxelder maple	313	BEM	88
Striped maple	315	STM	99

continued

Species Codes continued

Name	FIA	Mnemonic	Local
Red maple	316	RM	21
Silver maple	317	SVM	88
Sugar maple	318	SM	20
Mountain maple	319	MTM	0
Norway maple	320	NWM	0
Buckeye	330	BUC	88
Devils walking stick	353	DWS	89
Serviceberry	355	SVB	91
Pawpaw	367	PAW	0
Japanese barberry	368	BAR	0
Birch	370	B	50
Yellow birch	371	YB	50
Sweet birch	372	SB	51
Paper birch	375	PB	50
Gray birch	379	GRB	0
Garlic mustard	382	GLM	0
Japanese stiltgrass	383	JST	0
Oriental bittersweet	384	ORB	0
Japanese knotweed	385	JAK	0
Blue beech	391	BB	90
Hickories	400	H	60
Butternut hickory	402	BH	88
Pignut hickory	403	PH	88
Pecan	404	PCN	88
Shellbark hickory	405	SLH	88
Shagbark hickory	407	SGH	88
Mockernut hickory	409	MH	88
American chestnut	421	AMC	0
Allegheny chinkapin	422	ALC	0
Hackberry	460	HAC	88
Yellowwood	481	YW	88
Dogwood	491	DOG	81
Hawthorn	500	HAW	94
Hazelnut	501	HAZ	0
Persimmon	521	PER	88
American beech	531	AB	54
Elaeagnus	534	ELA	0
Autumn olive	535	AUO	0

continued

Species Codes continued

Name	FIA	Mnemonic	Local
Ash	540	A	88
White ash	541	WA	55
Northern catalpa	542	CAT	0
Black ash	543	BA	88
Green ash	544	GA	88
Huckleberry	549	HUK	0
Honey locust	552	HL	88
Kentucky coffeetree	571	KC	88
Witch hazel	585	WHL	0
American holly	591	AH	88
Mountain holly	592	MTH	88
Winterberry	593	ILV	0
Butternut	601	BUT	71
Black walnut	602	BW	88
Sweetgum	611	SG	88
Yellow-poplar	621	YP	59
Bush honeysuckle	635	LON	0
Japanese honeysuckle	636	JHN	0
Tartarian honeysuckle	637	THN	0
Prickly-ash	638	PRA	0
Amur honeysuckle	639	AHN	0
Osage-orange	641	OSO	0
Cucumbertree	651	CUC	84
Mountain magnolia	654	MM	88
Crabapple	660	CRB	0
Tupelo	690	T	88
Water tupelo	691	WT	88
Black gum	693	BG	66
Ironwood	701	OST	92
Paulownia	712	PAU	0
Virginia creeper	715	VCR	0
American sycamore	731	AS	88
Mountain laurel	733	MTL	0
Rhododendron	737	RHO	0
Other woody shrub	738	OWS	0
Aspen	740	ASP	63
Balsam poplar	741	BP	88
E. cottonwood	742	EC	88

continued

Species Codes continued

Name	FIA	Mnemonic	Local
Bigtooth aspen	743	BTA	88
Quaking aspen	746	QA	88
Pin cherry	761	PC	95
Black cherry	762	BC	76
Choke cherry	763	CC	88
Wild plum	766	PLM	0
Sourwood	771	SW	0
Lowbush blueberry	785	LBL	0
Blueberry	786	BLU	0
Oak	800	O	88
White oak	802	WO	40
Swamp white oak	804	SWO	88
Scarlet oak	806	SO	32
N. pin oak	809	NPO	88
S. red oak	812	SRO	88
Cherrybark oak	813	CBO	88
Overcup oak	822	OO	88
Bur oak	823	BRO	88
Blackjack oak	824	BJO	88
Swamp chestnut oak	825	SCO	88
Chinkapin oak	826	CKO	88
Pin oak	830	PNO	88
Chestnut oak	832	CO	48
N. red oak	833	NRO	30
Shumard oak	834	SHO	88
Post oak	835	PO	88
Black oak	837	BO	31
Buckthorn	845	BTH	0
Common buckthorn	846	COB	0
Glossy buckthorn	847	GLB	0
Poison-ivy	867	PI	0
Currant	870	CUR	0
Black locust	901	BL	88
Multiflora rose	905	ROS	0
Rubus	915	RUB	0
Willow	920	W	88
Sassafras	931	SAS	96
Mountain ash	935	MTA	97

continued

Species Codes continued

Name	FIA	Mnemonic	Local
American basswood	951	BAS	58
Elm	970	E	61
American elm	972	AE	88
Slippery elm	975	SE	88
Rock elm	977	RE	88
Nonnative shrub	995	NNS	0
Native shrub	996	NAS	0
Ailanthus	998	AIL	88
Other non-comm.	999	ONC	98

Appendix B - Sample Output

Cruise Information (type, Date, File, Sampling Error)

SILVAH V6.02 - SILVICULTURE OF ALLEGHENY HARDWOODS AND OAK

FILE: newdemo.sil
DEFAULTS FILE: C:\USFS-NRS\SILVAH6\silvah.def
OWNER/AGENCY -- USFS DATE TALLIED: Jul/2002
FOREST/PROPERTY -- Exp For
COUNTY/DISTRICT -- Warren
COMPT - STAND -- Test Sample TYPE: TRANSITION HARDWOOD
ACRES -- 10.00 SIZE: MEDIUM SAW
STAND AGE -- 63 DENSITY: 80 TO 95 %
SITE -- 70 FOR O
SILVAH DEMO AREA - Uncut Stand

OVERSTORY CRUISE INFORMATION

(Feb 26 2014 - newdemo.sil)

Overstory data is from an individual tree tally prism cruise,
using a 10 factor prism, and with trees tallied by
1 inch dbh classes, heights, and pulp & cull grades only.

Overstory data based on 20 plots.

Mean basal area is 115.5 plus or minus 8.6 square feet per acre
at 90 % confidence (7.4 % of mean).
0 additional plots needed to reach 15 % of mean basal area;
0 additional plots needed to reach 10 % of the mean.

Mean net bd-ft volume is 9145.6 plus or minus 908.5 bd-ft per acre
at 90 % confidence (9.9 % of mean).
0 additional plots needed to reach 15 % of mean of net bd-ft volume;
0 additional plots needed to reach 10 % of the mean.

Mean net pulpwood volume is 14.8 plus or minus 1.0 cords per acre
at 90 % confidence (6.4 % of mean).
0 additional plots needed to reach 15 % of mean of net pulpwood volume;
0 additional plots needed to reach 10 % of the mean.

UNDERSTORY CRUISE INFORMATION

(Feb 26 2014 - newdemo.sil)

Data on competitive regeneration, site limitations and understory
is from an extended regeneration tally
using 6-ft radius plots.

Understory data is based on 22. plots.

**Information on Regeneration, Site, and Exotic Species/ Site
Characteristics and Regeneration Summary**

INFORMATION ON REGENERATION AND SITE - ORIGINAL STAND

(Feb 26 2014 - newdemo.sil)

SPECIES OR CATEGORY -----	% OF PLOTS STOCKED -----	VALUE -----
---------------------------------	--------------------------------	----------------

DESIRABLE TREE REGENERATION
-- FIELD INVENTORY:

BLACK CHERRY	0	0	Seedlings/acre
YELLOW POPLAR	0	0	Seedlings/acre
CONIFERS	0	123	Seedlings/acre
NEW OAK	14	15564	Seedlings/acre
ESTABLISHED OAK	0	700	Seedlings/acre
COMPETITIVE OAK	0	0	Seedlings/acre
OTHER DESIRABLES	5	8789	Seedlings/acre
ESTABLISHED DESIRABLES	5	9612	Seedlings/acre
COMPETITIVE DESIRABLES	5	8911	Seedlings/acre
TOTAL OAK	14	16264	Seedlings/acre
RESIDUALS	23		
SAPLINGS	0		

-- SUMMARY VALUES - AMBIENT DEER PRESSURE:

OAK STUMP SPROUTS	0	33	Sprts/ac expected
ANY ESTABLISHED REGEN	5		
ANY COMPETITIVE REGEN	5		
ANY CMP. REGEN OR RESIDS	23		
ALL ESTABLISHED OAK	0		
ALL OAK	14		

-- SELECT SUMMARY VALUES - WITH FENCING/NO DEER PRESSURE:

OAK STUMP SPROUTS	5
ANY ESTABLISHED REGEN	55
ANY CMP. REGEN OR RESIDS	69
ANY COMPETITIVE REGEN	55
ALL ESTABLISHED OAK	14
ALL OAK	60

** Under fencing/no deer pressure, summary regeneration stocking values reflect the contribution of oak stump sprouts, which contribute no more than 20% of total stocking.

FACTORS AFFECTING REGENERATION DIFFICULTY

DEER IMPACT	4	HIGH
SEED SUPPLY	2	Moderate seed supply

Nonnative invasive species were found in this stand, and have the potential to displace native vegetation, including desirable timber species. There are 0 invasives in the overstory, 1 in the understory, and 1 that were found outside the plots.

INTERFERING UNDERSTORY

TALL WOODY INTERFERENCE	70**	
LOW WOODY INTERFERENCE	55	37 Plot average
FERNS	5	2 Plot average
GRASSES	0	1 Plot average
ANY INTERFERENCE	70	
GRAPEVINES	5	1 Vines/acre

WOODY INTERFERENCE FOR REGENERATION

TALL WOODY INTERFERENCE	70**	
DETAILS	# PLOTS	(%) SPECIES
	2	9.09 AB
	2	9.09 TOTAL; All species
LOW WOODY INTERFERENCE	54.5	
DETAILS	# PLOTS	(%) SPECIES
	12	54.55 MTL
	12	54.55 TOTAL; All species
UNDESIRABLE SAPLINGS AND POLES	23	sq.ft/ac basal area

** SILVAH assigns 70% stocking for tall woody interference if there is at least 10 sq.ft./acre of undesirable saplings and poles (tallied separately in the overstory) and there is less than 70% stocking of tall woody interfering species.

SITE LIMITATIONS FOR REGENERATION

SITE LIMITATIONS 0

SITE INFORMATION - ORIGINAL STAND

COVER TYPE	1	Forest
SITE CLASS	2	Med. productivity
SITE SPECIES	0	
SITE INDEX	70	
REL MERCH HT	0.00	
ELEVATION	1800	
ASPECT	90	
SLOPE %	5	
TOPO POSITION	6	Upper flat
OPERABILITY	1	No limitations
ACCESSABILITY	2	4-wh road at stand

STRESS FACTORS

DEER IMPACT 4 HIGH

Information on Regeneration, Site, and Exotic Species/ Exotic Species Present

 INFORMATION ON NONNATIVE INVASIVE SPECIES - ORIGINAL STAND

(Feb 26 2014 - newdemo.sil)

Nonnative invasive (NNIS) species may interfere with management goals and thus require careful assessment of their current extent within the stand and in neighboring stands if possible. It is of critical importance to understand the current/potential impacts of nonnative species prior to any operations in the stand. Specific treatment options should consider the difficulty of control of each species as well as the economic, aesthetic, and ecological value of the areas currently or likely to be infested by nonnative invasive species.

 OVERSTORY

No observations found in the data.

 UNDERSTORY - REGEN PLOTS

SPECIES	# PLOTS	% PLOTS	CODE
GARLIC MUSTARD	1	4.55	GLM
#PLOTS W/NONNATIVE SPECIES		% PLOTS	
	1	4.55	TOTAL; All NNIS species

 INTERERENCE IN THE UNDERSTORY

TALL INTERFERENCE	# PLOTS	% PLOTS	CODE
	0	0.00	TOTAL; All NNIS species
LOW INTERFERENCE	# PLOTS	% PLOTS	CODE
	0	0.00	TOTAL; All NNIS species

 OFF-PLOT OBSERVATIONS IN THE STAND

SPECIES	CODE
GARLIC MUSTARD	GLM

 OBSERVATIONS WITHIN ONE MILE OF STAND

No observations found in the data.

Information on Silvicultural Systems and Wildlife Habitat

INFORMATION ON SILVICULTURAL SYSTEMS AND WILDLIFE HABITAT - ORIGINAL STAND

(Feb 26 2014 - newdemo.sil)

SILVICULTURAL SYSTEMS

NO RESTRICTIONS (EVEN-AGE W/CLEARCUTTING)

Timber production for maximum yield, with high
proportion of shade-intolerant species.

For this system, the stand value is: Medium

WILDLIFE TREES	NO./ACRE
-----	-----
POTENTIAL DEN TREES	0.000
EXISTING DEN TREES	0.000
SNAGS WITH POTENTIAL CAVITIES	0.000
SNAGS WITH EXISTING CAVITIES	0.000
OTHER STANDING DEAD TREES (Not Snags)	0.000

WATER HABITATS WITHIN THIS STAND INCLUDE:

Unknown

HABITAT CONDITIONS SURROUNDING THIS STAND

CLEARCUT ACRES W/I 1 MILE 0.00
CULTIVATED ACRES W/I 1 MILE 0.00
OPEN ACRES W/I 1 MILE 0.00
WATER HABITATS W/I 1 MILE INCLUDE: Unknown

Product Table / Timber Volume and Value x Species

VOLUME AND VALUE OF PRODUCTS IN THE ORIGINAL STAND (per acre)

 (Feb 26 2014 - newdemo.sil)

SPECIES >	ALL SP	RM	NRO	CO	WO	BO	CUC	SO	AB	SVB	SAS
NET LOG VOLUME (INT 1/4" LOG RULE) - MBF PER ACRE											
VENEER	0.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GRADE 1	2.1	0.1	1.2	0.3	0.1	0.2	0.1	0.1	0.0	0.0	0.0
GRADE 2	5.3	0.6	1.7	1.5	0.9	0.4	0.1	0.1	0.0	0.0	0.0
GRADE 3	1.4	0.8	0.1	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0
PALLET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	9.1	1.5	3.2	2.2	1.1	0.7	0.3	0.2	0.0	0.0	0.0
NET BULK VOLUME - CORDS PER ACRE											
BOLTWOOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PULPWOOD	14.8	4.8	3.5	3.5	1.8	0.7	0.2	0.2	0.1	0.0	0.0
FIREWOOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	14.8	4.8	3.5	3.5	1.8	0.7	0.2	0.2	0.1	0.0	0.0
VALUE - DOLLARS PER ACRE											
VENEER	102.7	1.4	89.3	1.6	6.9	1.8	1.4	0.3	0.0	0.0	0.0
GRADE 1	582.0	8.0	506.1	9.3	38.9	10.2	7.8	1.7	0.0	0.0	0.0
GRADE 2	1019.1	33.5	636.9	41.8	285.7	13.9	4.3	2.5	0.5	0.0	0.0
GRADE 3	49.4	21.1	19.9	1.6	6.1	0.0	0.6	0.0	0.1	0.0	0.0
PALLET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	1753.3	64.1	1252.2	54.3	337.5	26.0	14.1	4.5	0.6	0.0	0.0
\$/MBF	0.0	42.8	389.5	25.3	308.5	39.0	54.4	20.3	14.5	0.0	0.0
BOLTWOOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PULPWOOD	29.5	9.7	7.0	7.0	3.5	1.4	0.3	0.5	0.1	0.0	0.0
FIREWOOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	29.5	9.7	7.0	7.0	3.5	1.4	0.3	0.5	0.1	0.0	0.0
\$/CORD	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0
GR.TOTAL	1782.9	73.7	1259.2	61.4	341.0	27.3	14.4	5.0	0.7	0.0	0.0

Overstory Summary (qual, d, age, structure, dens, vol, val)

OVERSTORY SUMMARY ORIGINAL STAND (2002) - LIVE TREES ONLY

(Feb 26 2014 - newdemo.sil)

SPECIES > ALL SP | RM NRO CO WO BO CUC SO AB SVB SAS

COMPOSITION -- BA, % OF BA, TREES

TOT BA	115.5	35.8	28.2	25.8	12.8	5.8	2.0	2.0	1.5	1.2	0.5
SPECIES%	100.	31.	24.	22.	11.	5.	2.	2.	1.	1.	0.
# TREES	185.	100.	16.	30.	12.	3.	2.	1.	8.	11.	2.

QUALITY -- % IN AGS

SAPS	36.	50.	0.	0.	0.	0.	0.	0.	0.	0.	0.
POLES	78.	84.	33.	85.	71.	0.	100.	0.	0.	0.	0.
SM SAW	92.	97.	91.	94.	88.	100.	100.	75.	0.	0.	0.
MED SAW	98.	100.	96.	100.	100.	100.	100.	100.	0.	0.	0.
LG SAW	89.	0.	100.	0.	100.	100.	100.	0.	0.	0.	0.
ALL SIZE	87.	85.	93.	89.	88.	100.	100.	88.	0.	0.	0.

DIAMETERS AND AGES -- INCHES, YEARS

DIAM	14.9	10.2	20.2	15.0	15.1	19.6	17.0	18.6	8.0	4.8	7.0
DIAM MER	15.6	11.1	20.2	15.0	15.1	19.6	17.0	18.6	14.0	6.0	7.0
QUAD DIA	10.7	8.1	18.1	12.6	13.7	19.0	14.4	17.9	5.9	4.6	7.0
YRS MAT	14.	34.	0.	20.	19.	0.	5.	0.	27.	80.	73.
EFCT AGE	87.	56.	101.	100.	101.	131.	85.	124.	93.	40.	47.

STRUCTURE

Q FACTOR	1.33	1.41	0.98	1.10	1.03	0.00	0.00	0.00	0.00	0.00	0.00
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RELATIVE DENSITY -- %

REL DEN	87.	25.	14.	24.	12.	5.	1.	2.	2.	1.	0.
AGS RDEN	74.	20.	13.	22.	11.	5.	1.	2.	0.	0.	0.

VOLUMES AND VALUES - INT 1/4" LOG RULE

GTOT CDS	34.7	8.8	9.9	8.2	4.2	2.0	0.7	0.7	0.1	0.0	0.1
NTOT CDS	27.6	7.0	7.9	6.6	3.3	1.6	0.5	0.6	0.1	0.0	0.0
PULP CDS	14.8	4.8	3.5	3.5	1.8	0.7	0.2	0.2	0.1	0.0	0.0
GRS BDFT	11033.	2542.	3425.	2465.	1256.	713.	294.	241.	96.	0.	0.
NET BDFT	9146.	1497.	3215.	2151.	1094.	666.	260.	223.	40.	0.	0.
DOLLARS	1783.	74.	1259.	61.	341.	27.	14.	5.	1.	0.	0.

Overstory Species x Diameter Tables / Basal Area

SPECIES X DIAMETER ORIGINAL STAND (2002) - LIVE TREES ONLY

(Feb 26 2014 - newdemo.sil)

BASAL AREA - SQ. FT. PER ACRE

SPECIES > ALL	SP		RM	NRO	CO	WO	BO	CUC	SO	AB	SVB	SAS
DIA.												
1	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	2.0		1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
5	5.0		3.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.5	0.0
6	2.8		2.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.2	0.0
7	3.0		2.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
8	4.5		2.0	0.0	2.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
9	4.8		3.2	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0
10	5.8		4.0	0.5	0.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0
11	5.8		2.2	0.5	2.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0
12	10.5		6.5	1.0	2.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0
13	5.2		2.2	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
14	7.5		2.5	1.2	1.8	1.5	0.0	0.0	0.0	0.5	0.0	0.0
15	5.8		2.2	0.8	1.2	0.8	0.5	0.0	0.2	0.0	0.0	0.0
16	9.8		0.8	1.5	4.2	1.5	1.0	0.0	0.8	0.0	0.0	0.0
17	5.8		0.5	1.0	2.5	1.8	0.0	0.0	0.0	0.0	0.0	0.0
18	5.0		0.0	2.0	1.5	1.0	0.5	0.0	0.0	0.0	0.0	0.0
19	5.5		0.0	2.5	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0
20	5.8		0.5	2.5	0.8	0.0	1.5	0.5	0.0	0.0	0.0	0.0
21	5.5		0.0	3.5	0.2	0.0	1.2	0.0	0.5	0.0	0.0	0.0
22	3.5		0.0	2.0	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
23	2.8		0.0	1.8	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0
24	2.5		0.0	2.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
25	3.5		0.0	2.0	0.5	0.0	0.5	0.5	0.0	0.0	0.0	0.0
26	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	1.5		0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.5		0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.5		0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.5		0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.5		0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	7.0		5.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0
POLES	26.5		15.5	1.5	6.5	1.8	0.0	0.5	0.0	0.0	0.2	0.5
SM SAW	44.5		14.8	5.5	12.8	8.0	1.5	0.5	1.0	0.5	0.0	0.0
MED SAW	28.0		0.5	14.2	5.5	2.5	3.8	0.5	1.0	0.0	0.0	0.0
LG SAW	9.5		0.0	7.0	1.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0
TOTAL	115.5		35.8	28.2	25.8	12.8	5.8	2.0	2.0	1.5	1.2	0.5
SPECIES%	100.0		31.0	24.5	22.3	11.0	5.0	1.7	1.7	1.3	1.1	0.4
ACCEPTABLE GROWING STOCK ONLY												
SAPS	2.5		2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLES	20.8		13.0	0.5	5.5	1.2	0.0	0.5	0.0	0.0	0.0	0.0
SM SAW	41.0		14.2	5.0	12.0	7.0	1.5	0.5	0.8	0.0	0.0	0.0
MED SAW	27.5		0.5	13.8	5.5	2.5	3.8	0.5	1.0	0.0	0.0	0.0
LG SAW	8.5		0.0	7.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0
TOTAL	100.2		30.2	26.2	23.0	11.2	5.8	2.0	1.8	0.0	0.0	0.0

Narrative Summary and Analysis of Stand

NARRATIVE SUMMARY AND ANALYSIS OF STAND

(Feb 26 2014 - newdemo.sil)

Nonnative invasive species were found in this stand, and have the potential to displace native vegetation, including desirable timber species. There are 0 invasives in the overstory, 1 in the understory, and 1 that were found outside the plots.

This transition stand is dominated by Red Maple, Red Oak, Chestnut Oak, White Oak, Black Oak, and Cucumber, which together comprise 84 % of the basal area.

This is a medium sawtimber stand, with average diameter of 14.9 inches.

If this stand is managed under an even-age silvicultural system, The several species groups will mature at markedly different times. The average time to maturity (MDM = 18 inches) is 13 years. The manager wishes to regenerate the stand now. Effective stand age is about 87 years.

If this stand is managed under an all-age silvicultural system, the distribution of diameters, proportion of sawtimber, and density of shade-tolerant species would make it difficult to apply selection cutting.

Relative stand density is 87 % of the average maximum stocking expected in undisturbed stands of similar size and species composition. This density is higher than optimum for best individual tree growth. At this relative density, growth rate of the biggest trees is probably moderate, while growth rate of the medium and smaller-sized trees is probably fair and mortality due to crowding moderate.

Thinning to provide more growing space for the better stems is desirable if it will at least pay the cost of harvesting.

Total growing stock amounts to 115 sq. ft. of basal area per acre. Gross total volume in all trees, to a 4-inch top, is 27.6 cords per acre; if divided into pulpwood and sawtimber, the net merchantable volume is 14.8 cords of pulp wood and 9145.6 board feet of sawtimber Int 1/4" log rule. The total stand value is estimated to be about 1782 dollars per acre.

Trees of acceptable quality for future growing stock provide a fully stocked stand by themselves. Non-commercial saplings and poles represent 20 sq. ft. of basal area and may need to be treated prior to final harvest cutting.

Competitive regeneration of all types is insufficient; harvest cuttings at this time will not likely result in a satisfactory new stand.

Undesirable understory plants may interfere with development of regeneration. Undesirable plants in this stand include tall woody interference, and low woody interference.

Central Appalachian Oak Guide

CENTRAL APPALACHIAN OAK GUIDE - ORIGINAL STAND

PROJECTED STOCKING OF OAK SPECIES IN THE THIRD DECADE AFTER HARVEST

(Feb 26 2014 - newdemo.sil)

-- SPROUT-ORIGIN STOCKING: (%)

CHESTNUT OAK	20
RED OAK/SCARLET OAK	16
BLACK OAK	1
WHITE OAK	2
TOTAL SPROUT-ORIGIN STOCKING	40

-- SEED-ORIGIN STOCKING: (%)

ALL OAK SPECIES	16
-----------------	----

-- EXPECTED TOTAL OAK STOCKING: 55

***** CAUTION *****

This estimate of oak stocking is based on data collected in the ridge and valley region of Central Pennsylvania. Please exercise caution when estimating future oak stocking in other regions.

**Prescribed Treatment Information / Treatment description with
marking instructions**

RECOMMENDED TREATMENT

(Feb 26 2014 - newdemo.sil)

FENCE, PREPARATORY CUT, HERBICIDE, RE-INVENTORY

The stand is less than 15 years to maturity.

The manager wishes to begin regenerating this stand now.

Make a PREPARATORY CUT of a shelterwood system to develop the new oak seedlings. Reduce relative density to approximately 70%, by removing suppressed, intermediate, and weak codominant trees of all species. Then, re-inventory in 5-10 years to determine the next course of action.

Current deer levels will likely prevent regeneration developing into a new stand.

FENCING is recommended. A fence can be constructed either before or after treatment. If fencing is constructed after treatment, fencing should be done as soon as possible.

Treat the undesirable understory plants with an application of HERBICIDE during the appropriate part of the growing season. Please refer to the silvicultural guide for details about implementing this prescription.

The volumes to be removed are:

650 bd ft (Int 1/4" log rule) and 2.9 cords.

***** CAUTION *****

This prescription generally produces the desired results, requires an investment, and usually will yield an economic return at the same time. If such investment meets your organization's economic criteria, we recommend it. If not, we recommend NO treatment. In the case of regeneration prescriptions, stands generally will NOT reproduce without the recommended treatment.

MARKING INSTRUCTIONS

LEAVE GUIDES:

Leave 85 well distributed trees per acre that are 6 inches dbh or larger. These trees should be AGS growing in codominant and dominant crown positions. Within the size and quality constraints be low, favor the best trees wherever possible. Try to preserve seed sources of scarce species if they are desired in the regeneration, and strive for uniform spacing among residuals whenever possible.

Spacing among these leave trees should average 23 feet.

Leave 100 sq. ft. of basal area per acre
using the approximate basal area distribution below.

size class	Basal Area (sq. ft.)
SAPLING =	6
POLES =	12
SMALL SAW =	41
MEDIUM SAW =	28
LARGE SAW =	9

CUT GUIDES:

Reduce relative stand density to 71 %.

Remove trees in the size classes shown below.

Cut 1 out of 6 trees from the saps size class.

Cut 1 out of 2 trees from the pole size class.

Cut 1 out of 8 trees from the ssaw size class.

Cut 1 out of 8 trees from the msaw size class.

Cut 1 out of 8 trees from the lsaw size class.

About 59 % of the trees cut will be UGS.

This will result in removal of about 77 % of the UGS in this stand,
and about 100 % of the merchantable-size UGS.

Prescribed Treatment Information / Comparison of original, cut and residual stand data

COMPARISON OF ORIGINAL, CUT, AND RESIDUAL STAND

 (Feb 26 2014 - newdemo.sil)

	ORIGINAL	CUT	RESIDUAL			ORIGINAL	CUT	RESIDUAL
	BASAL AREA - SQ FT/A					SPECIES COMPOSITION - %		
SAPS	7.0	1.0	6.0		% CUC	2.		2.
POLES	26.5	14.0	12.5		% RM	31.		29.
SM SAW	44.5	3.5	41.0		% AB	1.		1.
MED SAW	28.0	0.5	27.5		% NRO	24.		27.
LG SAW	9.5	1.0	8.5		% WO	11.		11.
TOTAL	115.5	20.1	95.4		% CO	22.		22.
					% OTHO	7.		8.
	NUMBER OF TREES - #/A					QUALITY -- % IN AGS		
# TREES	185.	52.	132.		% AGS	87.		96.
	DIAMETERS - IN.					AGES - YRS.		
DIAM	14.9		15.8		YRS MAT	14.		8.
DIAM MER	15.6		16.5		EFCT AGE	87.		92.
QUAD DIA	10.7		11.5					
	RELATIVE DENSITY - %					STRUCTURE		
REL DEN	87.		71.		Q FACTOR	1.3		1.1
AGS RDEN	74.		67.		WEIB C	0.0		0.0
	BD FT INT 1/4", VALUE/A					CORD VOLUME/A		
GR. BDFT	11033.	878.	10155.		TOT CDS	34.7	5.1	29.5
NET BDFT	9146.	654.	8492.		NET CDS	27.6	4.0	23.6
DOLLARS	1783.	87.	1696.		PULP CDS	14.8	2.9	11.9
----- TOTAL STAND -----								
	M BD FT INT 1/4", VALUE					CORD VOLUME		
GR. MBF	110.3	8.8	101.5		TOT CDS	347.	51.	295.
NET MBF	91.5	6.5	84.9		NET CDS	276.	40.	236.
M DOLLAR	17.8	0.9	17.0		PULP CDS	148.	29.	119.

Newdemo.prx

SILVAH V6.02 - SILVICULTURE OF ALLEGHENY HARDWOODS AND OAK

DECISION FACTORS FOR THE PRESCRIPTION RECOMMENDED IN THE FILE "C:\USFS-NRS\SILVAH6\newdemo.prn".

*****RECOMMENDED TREATMENT:*****

FENCE, PREPARATORY CUT, HERBICIDE, RE-INVENTORY
(silvah treatment code: 1663)

-----Beginning Chart A-----
Management goals permit even-age management.
Site Limits do not appear to limit regeneration.
Stand is NOT mature (MDM < 18 in.). At least 35% of relative density is comprised of AGS.
User intends to regenerate the stand now.
Regen data was collected.
User wants to follow the prescriptions for oak/mixed oak ecosystems.

-----Beginning Chart F-----
Competitive oak is NOT adequate on at least 50% of plots.
User wants to increase oak.

-----Beginning Chart G-----
All established oak is not adequate on at least 50% of plots, with or without a deer problem.

-----Beginning Chart I-----
All oak regeneration is adequate inside a fence.
Sunlight is limiting (relative density is greater than 75%).
Interfering plants are a problem. At least 30% of plots have some kind of interfering vegetation.
Deer impact is high (index >= 4).

Newdemo.NNS

SILVAH V6.02 - SILVICULTURE OF ALLEGHENY HARDWOODS AND OAK

DESCRIPTIONS FOR NONNATIVE INVASIVE SPECIES IN THE FILE "newdemo.prn".

GARLIC MUSTARD

Alliaria petiolata (Bieb.) Cavara & Grande

Plant Description:

Upright forb with a shallow, slender taproot. The stem is slightly ridged, light green, with one to several stems from the same rootstock; approximately 2- to 4-foot tall. All parts of the plant emit a garlic odor when crushed. Leaves: At germination, forms a circular cluster of nearly round or kidney-shaped leaves just above the ground, remaining green during first winter. In the second year it produces stems with alternate, heart-shaped or triangular leaves, approximately 2 inches wide with coarsely-toothed margins, sometimes shallow to irregularly toothed. Reproduction: biennial. Flowers in April to May of second year. At tip of stem, tight clusters of small, white, four-petaled flowers; single flower is approximately ¼ inch wide. Flowering progresses up the stem as older flowers bear seeds below. Seeds form in late spring of second year. Four-sided, slender capsule (pod), 1 to 5 inches long, resembling a branch of the main stem. Green, then ripening to tan and becoming papery, exploding to expel tiny black seeds. Plant dies after producing seed.

Plant Ecology:

Shade tolerant. Found under forest canopies, and at forest margins and openings; also in floodplains. Reported to be associated with calcareous soils and intolerant of acidic substrates. Seed pods burst and can expel seeds up to 10 feet. Rodents, birds, and deer may disperse seeds. People distribute seeds on boots, pant cuffs, and by roadside mowing and on cars. May lie dormant for 2 to 6 years before germinating in spring. Experiences year to year variations in population densities. Allelopathic, emitting chemicals that kill surrounding plants and microbes. May occur as isolated plants, expanding to form extensive colonies.

Response to Management:

Large densities of garlic mustard will outcompete and displace native wildflowers and tree seedlings. Disturbed forest and riparian communities are most susceptible to garlic mustard invasion and may dominate the herb strata within ten years. Once established, this plant can be hard to control. It is important to spot small infestations early, when it is relatively easy to manage. Spreads easily by foot traffic, horses, and ATVs.

Additional information is available from the following sources:

<http://www.nps.gov/plants/alien/index.htm>

<http://www.dcnr.state.pa.us/forestry/invasivetutorial/index.htm>

<http://dnr.wi.gov> - invasive species information

"Michigan Trees". Barnes and Wagner. 1981. University of Michigan Press, Ann Arbor

Appendix C - Troubleshooting

Solutions to Common Problems

Some fields in the reports contain *****

The value to be printed is too large for the space available. This usually means there is an error in the data somewhere. Look especially at the cruise type, basal area factor, plot size, or number of plots.

Data values are unreasonable

This could be several things. Your acreage value or number of plots or prism factor or plot size may be in error. Or you may have specified the wrong overstory cruise type. Check these values. Watch for tree heights that have been misinterpreted as counts and vice versa.

All species in reports list as “Other Hardwoods”

You have used the wrong species code type under inventory settings.

Volumes do not agree with those I usually use

You probably use a different log rule, different minimum diameters, and so on. See the topic “SILVAH Calculations” in Chapter 7 for a description of how SILVAH calculates volume. Call us if you want to discuss.

Sawlog stumpage prices shown in the Product Listing do not agree with those I entered in the defaults (.def) file

They are not supposed to. The sawlog stumpage prices reflect species, size, and grade in each stand, and will rarely equal the volume times the stumpage price. See the topic “SILVAH Calculations” in Chapter 7 for a description of how SILVAH calculates sawlog value.

SILVAH calculates pulpwood volumes, but I have no pulpwood market

Change the minimum diameter for pulpwood to 41 inches in the defaults (.def) file.

SILVAH prescribes partial cutting in stands where the volumes to be cut are too small to be economically feasible

Change the minimum volumes required for various types of cuts in your defaults (.def) file.

Appendix D - Tally Sheets

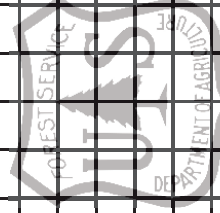
About Tally Sheets

The tally sheets included in this appendix contain all of the inventory variables currently available in SILVAH. Stand characteristics and management criteria are recorded on the understory tally sheet. Two versions of the understory tally sheet are provided to accommodate the mixed oak and Allegheny hardwood forest types. The information on these understory tally sheets is the same, but the order of the variables listed on the 6-foot plot is different.

The overstory tally sheet can be used in any forest type.

If you prefer to use fewer variables, or follow a different arrangement when you are collecting data, you can create your own tally sheets by configuring the data entry screens in SILVAH to match your preferred order. The data entry screens (grids) can be copied into a spreadsheet program, such as Microsoft Excel, where you can perform additional modifications as necessary. See the topic “Configuring data fields on the Grid” in Chapter 3 for further information on arranging the order of inventory variables.

Overstory Inventory

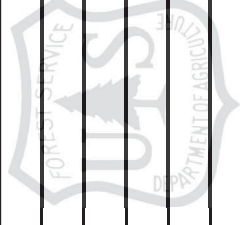
[illegible][illegible][illegible]

Mixed Oak — Understory Inventory

Identification Data			
Owner			
Forest Name			
County			
Compartment			
Stand Area			
Year of Origin			
Deer Impact	unknown	very high	high mod. low very low

Site Index			
Site Index Species			
Site Class			
Restrictions on Silvicultural System?			
None	No clearcut	No even-aged	No multi-tree gaps
Prescription Chart?	No./Allegheny	Hdwd.	Mixed Oak
Start Regenerating?	Yes	Yes, if stand is mature	No
Increase Oak?	Yes	No	Residuals Desired?
	Yes	No	Yes No

Comments:



USDA Forest Service, NRS, Warren, PA

Regeneration & Interference

[illegible]

Glossary

accessibility—A subjective estimate of the ease of access to a stand as it may affect timber and wildlife management. See Appendix A.

acre—A unit of measure describing surface area. One acre contains 43,560 square feet. A football field (without the end zones) is 45,000 square feet—slightly larger than an acre. The inside of a professional baseball diamond is about 1/4 of an acre.

advance regeneration—Seedlings or saplings that develop or are present in the understory.

aquatic features—In SILVAH, the indication of a water course within the stand and/or within one mile of the stand, that may be of value to wildlife. See Appendix A.

basal area—The area of the cross section of a tree's stem at 4 ½ feet above ground, or breast height, in square feet. Basal area of a forest stand is the sum of the basal areas of the individual trees in the stand. It is usually reported in square feet of basal area per acre and is used as a measure of stand stocking, stand density, and stand volume.

black cherry (seedling count)—In SILVAH, the count of all black cherry seedlings that are at least 2 inches tall, with two normal-size leaves. Stems greater than 1 foot tall are counted as two stems.

board-foot volume—The amount of wood products expressed as the number of boards 1 foot wide by 1 foot long and 1 inch thick that are sawn from logs.

bulk wood product—A product made of wood chips or wood fiber, as opposed to boards or lumber. Bulk wood products are most often measured in cubic feet or tons.

clearcut acreage—In SILVAH, the acreage in clearcut areas (stands cut within the past 10 years and still in the process of regenerating to trees) within one mile of a stand.

clearcutting—A method of regenerating an even-aged stand in which a new age class develops in a fully-exposed microclimate after removal, in a single cutting, of all trees in the previous stand.

commercial treatment—Any activity producing forest products that have at least enough value to cover the direct costs of the activity.

competitive oak (seedling count)—In SILVAH, the count of oak stems more than 3 foot tall or with a root collar diameter greater than 0.75 inches. Stump sprouts are tallied as competitive oak regardless of height—up to three stems per stump may be counted.

conifer—Trees, mostly evergreens, bearing cones and needle-shaped or scale-like leaves.

conifers (seedling count)—In SILVAH, the combined count of any eastern hemlock, pine, or spruce seedling with two whorls or at least 6 inches tall. Stems with three or more whorls or that are more than 1 foot tall are counted as two stems.

count (stem count)—In SILVAH, used when merchantable height is not being recorded in the overstory. Count can be used to reduce data entry time. For a given record or row in the grid, count represents the number of stems of the same species, diameter, quality, and other attributes.

county—The county or district in which the property is located, if desired, or other information needed to identify the property in SILVAH.

crop tree—Any tree selected to provide a specific benefit such as mast, dens, veneer, or sawtimber.

crown—The part of a tree or woody plant bearing living branches and foliage.

crown condition—In SILVAH, an estimate of the health of the tree represented as the percentage of the crown that appears healthy. See Appendix A.

cubic-foot volume—The amount of wood products expressed as the number of cubes 1 foot wide by 1 foot long and 1 foot high that are in a log or stem.

cultivated acreage—In SILVAH, the acreage in cultivated farm crops within 1 mile of a stand.

dbh—Diameter at breast height; the diameter of the trunk of a tree measured at 4 ½ feet above ground level. It is measured on the uphill side of the tree. If estimated, it is recommended to record diameter in 2-inch diameter classes.

dbh class—In the SILVAH inventory settings, this specifies how tree diameters were recorded in SILVAH.

deer impact index—An estimate of the impact of browsing pressure from white-tail deer on regeneration in a stand. A function of deer density and available food for deer. See Appendix A.

defect—In SILVAH, the percentage to the nearest 10 percent of the merchantable volume in the tree that is unmerchantable due to decay, sweep, crook, or other deformity.

den tree—A living tree that has holes in the trunk, or stem, from broken branches and decay, or hollow trunks; a cavity tree.

diameter class—An interval of sizes of trees or logs; or the trees and logs themselves that fall into such an interval.

dieback—The death of branch tips and loss of foliage in the upper and outer areas of tree crowns. Trees usually recover in several years by producing new branches. Various damaging agents can cause tree crowns to die back.

elevation—The approximate height of a stand, in feet, above sea level.

established oak (seedling count)—In SILVAH, the count of oak stems and seedling-sprouts that are at least 6 inches tall but less than 3 feet tall, or with a root collar diameter of 0.25 to 0.75 inch.

even-aged stand—A stand of trees containing a single age class in which the range of tree ages is usually less than 20 percent of rotation.

even-aged system—A planned sequence of treatments designed to maintain and regenerate a stand with one age class.

fern—In SILVAH, the estimate of the percent cover of fern on the 26-foot interference plot. The cover of non-rhizomatous species such as wood fern may be divided by two. Sum the total of all fern and record the estimate in 5-percent increments if total cover is less than 50 percent, and in 10-percent increments if total cover is more than 50 percent.

forest name—The name or identification of the property entered in SILVAH. For example: Allegheny National Forest; Elk State Forest; South Woodlot.

grade—Indicates the relative value and merchantability of trees for timber products. See Appendix A.

grapevine—In SILVAH, the number of grapevines rooted in the 26-foot interference plot reaching into the forest canopy.

grass and sedge—In SILVAH, the total combined cover of all grass and sedge species on the 26-foot interference plot. Record 1 percent even if only a trace of grass or sedge is present.

group selection—An uneven-aged silvicultural technique involving the removal of trees in groups usually 1/10 to 2/3 acre in size, but sometimes up to 3 to 5 acres. Group selection can be applied in combination with single-tree selection between groups.

herbicide—Any chemical preparation used to kill or inhibit the growth of certain plants, particularly herbs, or their spores or seeds. This term generally includes arboricides which are specific for trees and other woody plants.

intermediate treatment—Any treatment or “tending” designed to enhance growth, quality, vigor, and composition of the stand after seedlings are established and before mature trees are regenerated. For example, thinning is an intermediate treatment.

land cover type—The general cover type of the property, entered in SILVAH. See Appendix A.

low woody interference—In SILVAH, these are woody shrubs and undesirable trees less than 6-feet-tall that will interfere with the regeneration of species desirable for management objectives. Also included is foliage that occurs in this stratum from taller trees. Record the dominant species of low woody interference on the 26-foot interference plot. Also record an estimate of the combined total coverage of all low woody interfering species in 5-percent increments if total cover is less than 50 percent, and in 10-percent increments if total cover is more than 50 percent.

management value—In SILVAH, the relative value of a stand for the management goal listed. Originally was intended for prescriptions that involved gypsy moth damage. It is not currently used.

merchantable height—In SILVAH, the number of 8-foot bolts in a sawlog-size tree, up to a point where the diameter drops below 10.5 inches inside bark, or the height at which the bole breaks up. Only the sawlog height is recorded. SILVAH does not accept pulpwood heights.

merchantable height adjustment—In SILVAH, a value between 0.5 and 1.5, inclusive, which allows for the adjustment of estimated sawtimber heights when they are not representative of the site. To be used only when merchantable heights are *not* recorded in the field.

medial diameter—The average of the diameter or size-class midpoints of a stand, weighted by the proportion of basal area in each size class or diameter. This is approximately the same as the diameter at the midpoint of the basal area distribution. Medial diameter is favored by some (over both simple average and quadratic mean diameters) because it better reflects the size of the crop trees and is less influenced by small understory trees.

native plant—A species that naturally occurs in a given location where its requirement for light, warmth, moisture, shelter, and nutrients are met.

new oak (seedling count)—In SILVAH, the count of oak stems that are too small to be in the established oak category; less than 6 inches tall.

noncommercial treatment—Any activity that does not produce at least enough value to cover the direct costs of that treatments.

open acreage—In SILVAH, the acreage in pastures, failed clearcuts, and similar openings within 1 mile of a stand.

operability—A subjective estimate of the operability of a stand for timber harvest and other mechanized activities. See Appendix A.

other desirables (seedling count)—In SILVAH, the combined count of all seedlings that are at least 2 inches tall with two normal-sized leaves, that are desirable species not specifically provided for elsewhere in SILVAH (i.e., other than black cherry, yellow-poplar, oak, and conifers).

owner—The person, agency, or corporation entered as the owner of a stand in SILVAH.; limited to 16 characters.

pole—A tree, that is larger than 5 inches dbh and smaller than 11 inches dbh.

poor drainage—In SILVAH, one of three recognized site limitations that can impede stand renewal. The water table persists close to the soil surface during all or part of the growing season.

prescribed burn—The application of fire in forested or other areas, usually under specific conditions of weather and fuel moisture, to control vegetation for silvicultural purposes or to reduce hazards.

prescription—The specific instructions for controlled applications of silvicultural treatments based on information about the stands to which they apply.

rock or thin soil—In SILVAH, one of three recognized site limitations that can impede stand renewal. Occurs when little soil overlays large rocks or bedrock, making shallow-rooted regeneration vulnerable to desiccation.

q-factor—Also called q-ratio. Represents a geometric progression of increasing numbers of trees with decreasing diameters (Smith 1986). For example, using 2-inch diameter classes, if the q-ratio is 1.2, the number of trees in the 6-inch diameter class will be 1.2 times the number of trees in the 8-inch diameter class.

regeneration—The seedlings and/or saplings in a new forest stand or age class. Natural regeneration originated from seeds, sprouts, or root suckers. Also, the act of establishing young trees naturally or artificially.

regeneration method—A cutting method by which a new age class is created. These methods include clearcutting, seed tree, shelterwood, single-tree selection, and group selection; also called reproduction method.

regeneration cuttings—Silvicultural cuttings designed to naturally regenerate the stand by providing for seedling (or vegetative stems) establishment or development, or both. SILVAH includes two even-aged techniques (clearcutting and shelterwood), and two uneven-aged techniques (single-tree selection and group selection).

relative density—An index of crowding for forest stands, also called the tree-area ratio; a measure of the absolute stand density expressed as a ratio to the density of some reference level. The reference level is usually the density of a fully stocked stand for a particular species composition, average tree size, and site.

remarks—Description or identification of the stand entered in SILVAH. Limited to 80 characters.

residuals—In SILVAH, residuals are pole-size (6 to 10 inch dbh) trees that may be retained after a final harvest to meet policy guidelines or for other values. Record the species code in the regeneration plot only if the residual is of a desirable species of good form and vigor. In mixed oak stands, residuals do not count toward regeneration stocking, and in both Allegheny hardwood and mixed oak stands, undesirable tree species of this size may be counted as tall woody interference.

rotation—In even-age systems, the period between regeneration establishment and final harvest.

sapling—A tree, usually young, that is larger than a seedling but smaller than a pole-sized tree, between 1 and 5 inches in dbh. In SILVAH, saplings of desirable species and a distinctly younger age class than the rest of the overstory are recorded on the regeneration plot. Record the species code of the dominant sapling species when the regeneration sample plot meets stocking criteria for saplings. Occasionally, saplings sampled on the regeneration plot will be sampled again during the overstory tally, depending on sapling dbh and basal area factor.

sawlog—A log suitable in size and quality to be milled in to lumber of any size. Usually sawlogs are at least 8 inches in diameter after the bark is removed.

sawtimber—Trees large enough to be cut into sawlogs.

seedling—A tree grown from a seed. Usually the term is restricted to trees smaller than saplings, or less than 6 feet tall or smaller than 1 inch dbh.

shelterwood—A method of regenerating an even-aged stand in which a new age class develops beneath the moderated micro-environment provided by the residual trees, at least some of which are later removed.

silvicultural system—A planned process whereby a stand is tended, and re-established. The system name is based on the number of age classes (for example even-aged or two-aged), and/or the regeneration method used (for example, shelterwood, crop-tree, or selection).

silvicultural treatment—A process or action that can be applied in a controlled manner according to the requirements of a prescription or plan to a forest community to achieve management objectives within a planned silvicultural system.

silviculture—The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.

single-tree selection—A regeneration method of creating new age classes in uneven-aged stands in which individual trees are removed more or less uniformly throughout the stand to achieve desired stand structural characteristics.

site—The combination of biotic, climatic, topographic, and soil conditions of an area; the environment at a location.

site class—In SILVAH, a subjective approximation of site quality for tree growth. Site class can be used as an alternative to site index and species.

site conditions—The site conditions representative of a stand that are sometimes designated by soil factors (parent material, texture, drainage, or soil series), or by direct measurements such as site index.

site index—A measure of actual or potential forest productivity expressed in terms of the average height of a certain number of dominants and codominants in the stand at an index age (50 in SILVAH). In SILVAH, site class can be used as an alternative to site index.

site index species—The species used in determining site index.

slope percent—The slope angle of a stand to the nearest 1 percent.

snag—A standing dead tree without branches, or the standing portion of a broken-off tree. Snags may provide feeding and/or nesting sites for wildlife.

stand - A contiguous group of trees sufficiently uniform in age class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit.

stand ID—The stand number or other means of identification of a stand entered into SILVAH; limited to six characters.

stand structure—The arrangement of trees of different sizes and ages in a stand.

stocking—An indication of growing-space occupancy relative to a pre-established standard. Common indices of stocking are based on percent occupancy, basal area, relative density, and crown competition factor. In SILVAH, stocking includes the adequacy of existing advance regeneration on individual plots to ensure desirable trees in future stands.

tall woody interference—In SILVAH, this includes any undesirable species more than 6 feet tall that will interfere with the regeneration of species desirable for management objectives. Record the species code of the dominant woody interfering species in the regeneration plot.

thick duff—In SILVAH, one of three recognized site limitations that can impede stand renewal. Usually indicated by soil that feels spongy underneath, marked by more than 2 inches of accumulated organic matter in various stages of decay. Often found under conifer-dominated areas or under ericaceous shrubs.

thinning—A silvicultural treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, or to recover potential mortality. In SILVAH, may also be used to enhance acorn production.

timber stand improvement—A silvicultural treatment applied to age classes of trees when they reach crown closure in group openings (group selection) or stands (even-aged systems) prior to achieving merchantable sizes. SILVAH recommends that these prescriptions only be applied when they are required to ensure persistence of desired species.

topographic position—An indication of the relative position of a stand within the terrain; position on slope. See Appendix A.

tree grading procedure—In the SILVAH inventory settings, this specifies how trees were graded in the stand. If you prefer to get accurate volumes without grading all of the trees, select **culls and large pulp** and record grades only trees that are cull (grade 8) or large, sawtimber-size trees that only have pulpwood volume (grade 6).

uneven-aged stand—A stand with trees in three or more distinct age classes, either intermixed or in small groups, growing on a uniform site. These stands generally contain trees of many sizes (seedling through sawtimber) due to the range in age as well as differences in growth rate among species.

uneven-aged system—A planned sequence of treatments designed to maintain and regenerate a stand with three or more age classes.

veneer—A thin sheet of wood of uniform thickness, produced by rotary cutting, slicing, or sawing.

wildlife habitat potential—In SILVAH, the potential of a tree to provide habitat to wildlife in the form of dens and cavities. See Appendix A.

year of origin—The year when a stand originated, entered in SILVAH.

yellow-poplar (seedling count)—In SILVAH, the count of all yellow-poplar seedlings that are at least 2 inches tall with two normal-size leaves. Stems more than one foot tall are counted as two stems. Do not count yellow-poplar on dry sites where there are no dominant yellow-poplar trees in the canopy, as this species is not long-lived on such sites.

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This user's guide for the SILVAH computer program, version 6.2, supersedes the 1992 user's guide (Gen. Tech. Rep. NE-162). Designed for stand-alone Windows-based personal computers, SILVAH recommends a silvicultural prescription for a forest stand based on a summary and analysis of field inventory data. The program also includes a simulator that can be used to project stand growth and development, estimating yields from either prescribed or user-defined treatments. The software is distributed with an online help system and this printed user's manual. The computer program described in this publication is available on the Internet at <http://nrs.fs.fed.us/tools/silvah>

KEY WORDS: silvicultural prescriptions, management guides, regeneration, Allegheny hardwoods, northern hardwoods, mixed oak forest type, decision support system, software.

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