Pre-Suppose: Preprocessor to Suppose

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Abstract—The Pre-Suppose program is designed to help analysts organize inventory data for management planning. Pre-Suppose rapidly generates preliminary statistics on a proposed data group. This provides the ability to quickly evaluate the homogeneity of selected forest strata. Plot attributes can be chosen from a variety of code and range keys to designate a data group. Rapid processing of plot summary values renders important statistical information relevant to the keyed items. Once the user is satisfied with the selected criteria and resultant output, support files can be created that link directly to the Suppose interface for the Forest Vegetation Simulator. Pre-Suppose has been programmed to work dynamically with forest inventory data stored in a Microsoft Access database. A case example using Forest Inventory Analysis data from the Black Hills National Forest in South Dakota is presented to demonstrate program capabilities.

The Suppose (Crookston 1997) interface presupposes that inventory data are available in the proper format for the Forest Vegetation Simulator (FVS) (Dixon 2001). Several computer programs have been written to translate data from stand examination and permanent plot inventories into file formats needed for FVS. However, most translation programs lack the ability to scrutinize data elements prior to export. Users are frequently perplexed regarding how to assemble inventory data items into comprehensive strata needed for further analysis. The Pre-Suppose program addresses data attribute querying in the context of strategic planning for large-scale forest ownerships.

Pre-Suppose was written for the Microsoft Windows operating system using the Visual Basic programming language. "Any application that requires the user to perform a series of steps to arrive at a predetermined result can benefit from a Wizard" (Eidahl 1998). Pre-Suppose adheres to this programming tenet. Like most computer programs, Pre-Suppose has input and output components. The input components are addressed through three steps within the Pre-Suppose Wizard. Once the user chooses the input elements, the proper output reports are generated. Following a brief discussion of relevant forest planning aspects, associated functionality of the Pre-Suppose Wizard will be presented.

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Planning Framework

Quite often, forest planning efforts require developing estimates of conditions and outcomes by *stand type*. A stand type is an aggregation of the physical, vegetative, and developmental characteristics used to identify homogeneous forest strata (Davis and Johnson 1987). Physical attributes describe the site aspects of the forest, such as topography, soils, and habitat type. Vegetative attributes characterize the flora aspects of the forest, such as cover type species, size, and density. Developmental attributes portray the human-use aspects of the forest, such as roads, building, and administrative boundaries. Stand types, by definition, are nonspatial but comprise many geographically identifiable forest stands.

Physical and developmental characteristics are initially addressed by following a land classification scheme. For example, *suitable lands*, according the USDA Forest Service protocols, constitute the land base for determining the allowable sale quantity and the vegetation management practices associated with timber production. Suitable lands must be available, capable, and technically favorable under current management techniques.

Once the land has been classified, *management prescriptions* are formulated. Management prescriptions provide an activity schedule that describes the conditions by which vegetation will be treated to obtain desired outcomes. For example, no treatment is a popular contemporary management option. Similar vegetation types often respond in a predictable manner. Thus, vegetative characteristics are defined by common overstory tree species, of similar size and density. Understory components are increasingly important and add the dimension of plant association or community type. Typically, major forest cover types are derived from life zones, plant biomes, or ecological geography (for example, ecoregions, Bailey 1995). They depict the base vegetation layer.

The Pre-Suppose program can be used to query the physical, vegetative, and developmental attributes within a forest inventory data set. Layout of a schematic flow chart can be easily accomplished by following the intuitive steps of the Pre-Suppose Wizard. The Forest Inventory Analysis (FIA) data set from the Black Hills National Forest in South Dakota will serve as an example.

Forestland Classification

Winnowing the land base constitutes the initial step in the development of stand types to be used in a forest scheduling model. The derivation of the potential timber base is extremely important insofar as it defines the basic units, the building blocks for the analysis. Once the land base is classified and incorporated into a scheduling model, it is extremely difficult to alter. A change in the land

classification scheme could essentially mean starting from the beginning and redoing the analysis.

The 1986 and 1999 measurements of the Forest Inventory Analysis plot grids will be used as the empirical basis for the Black Hills National Forest, Phase II Amendment of its 1997 Revised Land and Resource Management Plan. The FIA plot locations will represent the various stand types within the land classification scheme. This diagram will serve as a flow chart for assigning stand types and associated acreages and plot counts.

Candidate Lands in Timber Base

There are many possible ways to partition a forested area into land classes that form the timber base. Experience has shown that four major breaks need to be described: (1) Administrative Availability – lands that are withdrawn by statutes, regulations, or policies (that is, wilderness areas, cultural, and special-use sites) are identified at the first level of the land class hierarchy; (2) Physical Capability – lands that are physically limited in their ability to sustain commercial stands of timber (for example, extremely dry or wet sites, inadequate growth rate) are separated at the second level of the land class hierarchy; (3) Ecological Suitability – lands that are designated for resource values other than timber production (that is, critical wildlife, watershed protection, visual corridors) compose the third level of the land class hierarchy; and (4) Technical Favorability – lands that are unable to be treated by current technology or restricted by special treatment needs (that is, inaccessible areas, steep terrain, insect, disease, fire areas) are excluded to form the fourth level of the land class hierarchy. Figure 1 provides a delineation of the forestland classification for the Black Hills National Forest. Associated acreages and FIA plot counts are presented for each stand type. Area and inventory estimates are not given for nonsampled strata.

Stand Types Within the Timber Base

Stand types comprise forest land units that have the same combination of physical, vegetative, and developmental

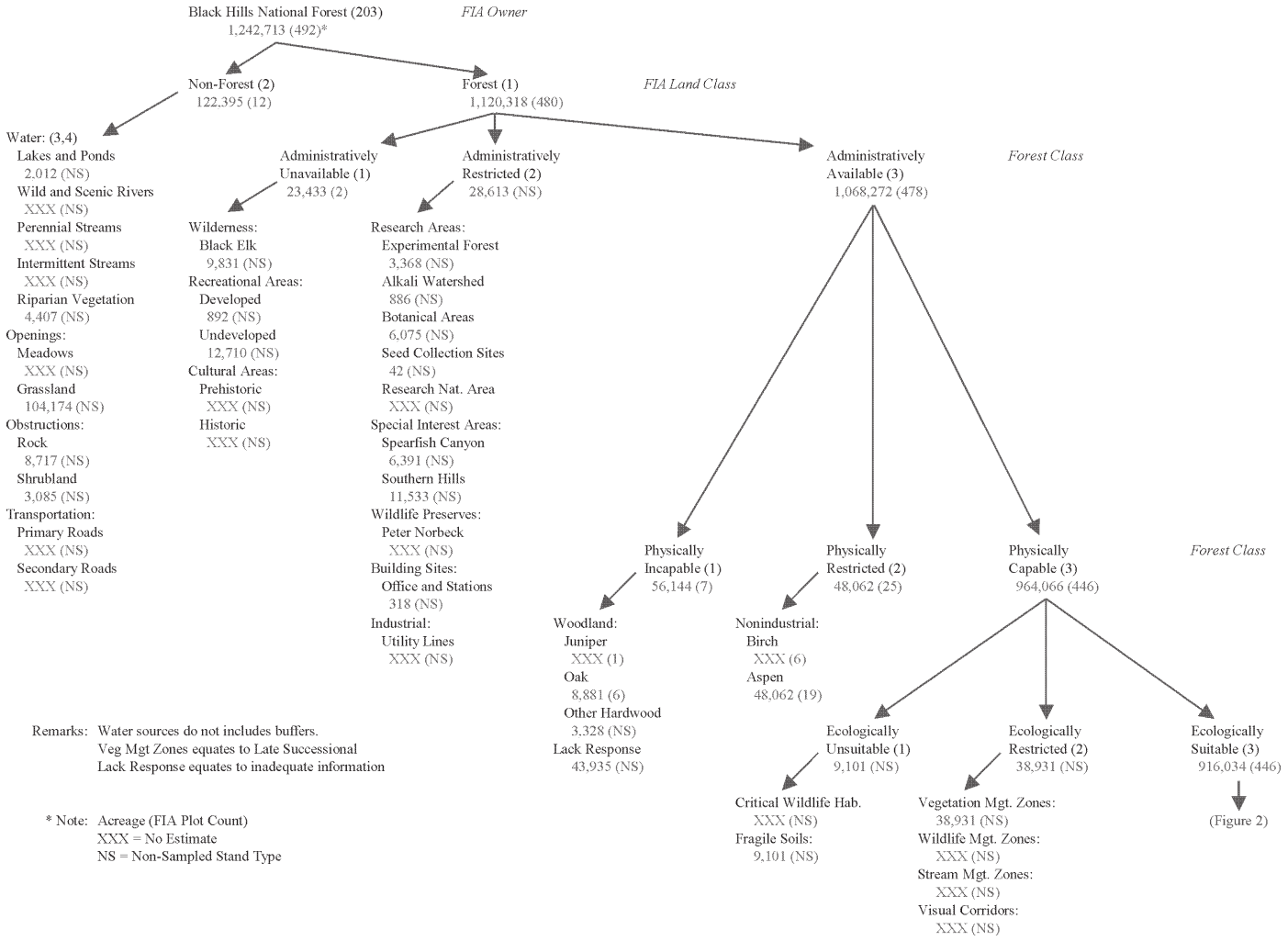

Figure 1—Forestland classification template.

characteristics to stratify as homogenous entities. Developmental and physical attributes have been addressed in defining the resultant "Available – Capable – Suitable – Favorable" forestland base. The vegetative characteristics (type, size, density) can be described by the predominant overstory forest canopy. Figure 2 provides a depiction of the tentatively suitable forest land base for the Black Hills National Forest. Acreage values were derived using Geographic Information System (GIS) software resident at the Black Hills Supervisors Office. The Pre-Suppose program was used to query the FIA data sets to assemble plot counts for the various stand types.

Pre-Suppose Application

Pre-Suppose was developed to assist forest analysts in developing stand types for management planning. The program leads users through a series of three input forms (parameter, plot, and key screens). Upon conclusion, a statistical report is presented to aid evaluation of a proposed data group. A brief description of the processing sequence used by Pre-Suppose follows.

Once the Pre-Suppose program has been invoked, a splash screen is displayed, followed directly by an *open* database dialog window. Pre-Suppose processes information stored in Microsoft Access database files. A listing of internal data tables will be presented during step 1 of the Pre-Suppose Wizard.

The user can choose between any one of several locations or time periods or both. For example, FIA data for the Black Hills National Forest has been assembled in database format from the 1986 and 1999 measurements. During the later, two complementary grids were installed. The primary grid was monumented in accordance with a 5,000 m design. The secondary grid was based on a centroid-hexagon layout. Over time, the hexagon grid will become the principal sampling design. Pre-Suppose easily accommodates the varying data sources as depicted in figure 3. Checkboxes within the listbox window provide the option of selecting the preferred data sets.

Pre-Suppose allows an expanded search beyond the boundaries of a given ownership. Lets say that FIA plot sample size is sparse in a specified locale as is true with many Eastern National Forests. There are numerous cover types represented over the landscape. Plot intensity per cover type is limited. Users could expand their search to FIA plots located in proximity to the National Forest. So long as the treatment and development histories are similar, these plots could be

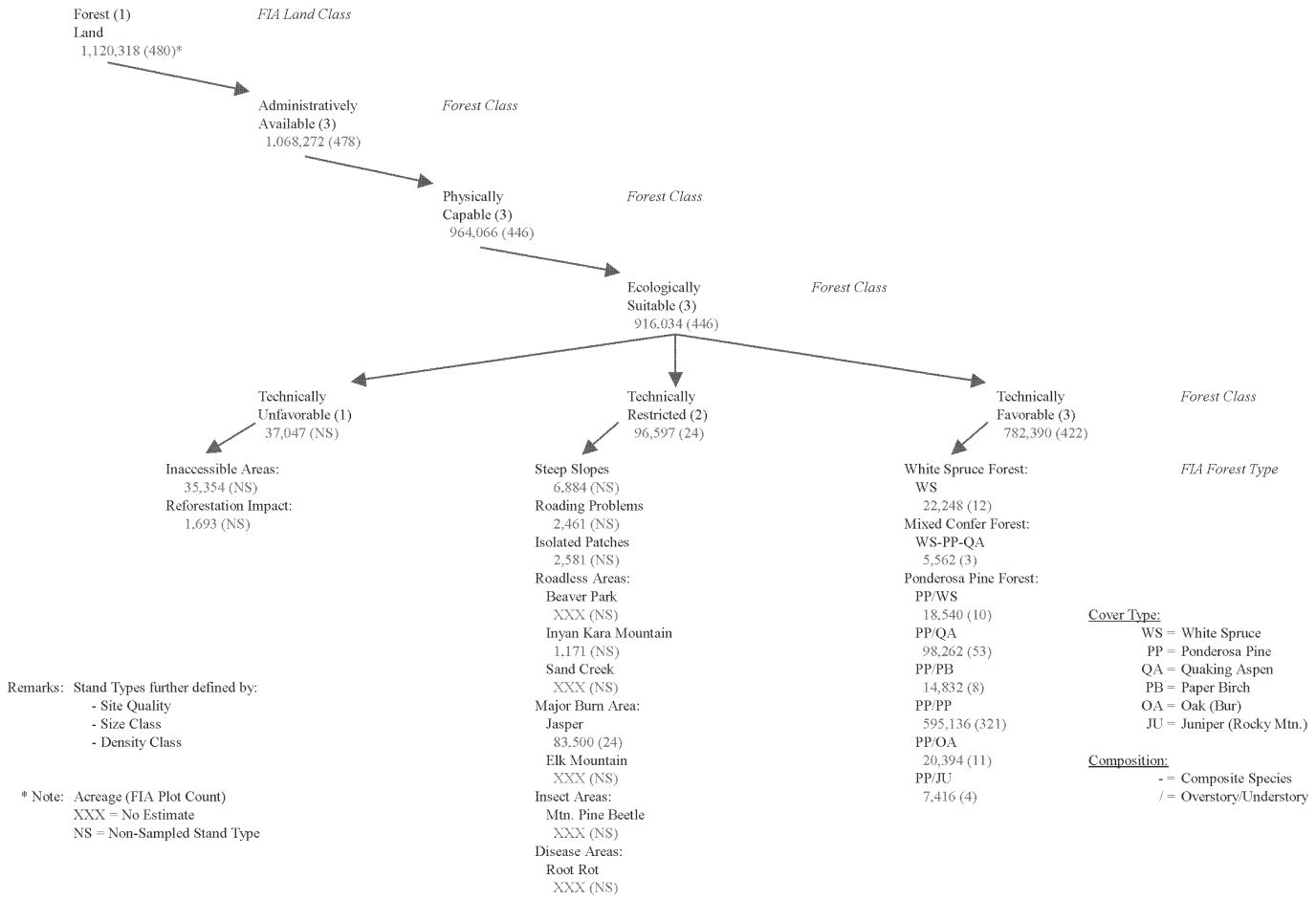

Figure 2—Stand type delineation.

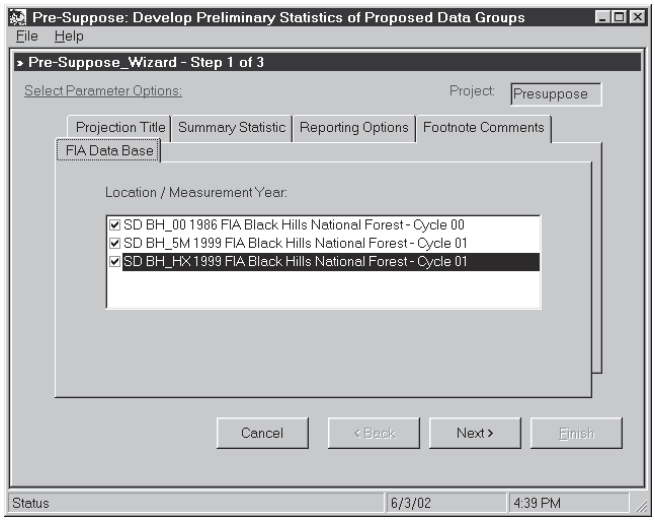

Figure 3—Parameter selection screen.

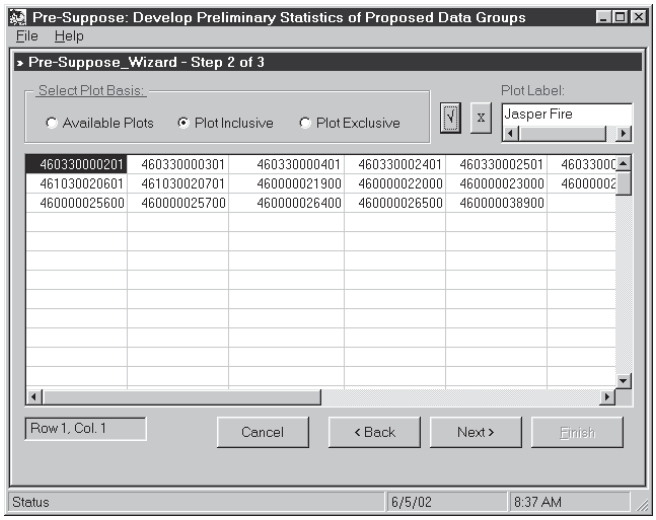

Figure 4—Plot selection screen.

used as *condition class* samples to strengthen the inferences related to the vegetation stand type. All that is needed is for the FIA data to be loaded into the proper database for Pre-Suppose to access.

Step 1 of the Pre-Suppose Wizard is commonly referred to as the *parameter* screen. Input parameters are gathered that inform Pre-Suppose which database tables to use, how to title and footnote the output reports, and which statistical summaries to produce. Plot summary values can be generated for a variety of tree classes (such as live, harvest, mortality trees). Parameter values are retained as defaults for subsequent runs of Pre-Suppose. Thus, following initial set up of the individual tabs, additional runs only require proceeding by mouse clicking the *Next* command button.

Step 2 of the Pre-Suppose Wizard is commonly referred to as the *plot* screen. Plots are specified for inclusion or exclusion from further processing. By default, all "Available Plots" are used in the statistical analysis. However, there are times when noncoded events affect the FIA data set. For example, a recent catastrophic wildfire (Jasper Fire) burned over 80,000 acres of the Black Hills National Forest. The FIA plots within the fire perimeter were identified using GIS software. A text file was generated that could be imported into Pre-Suppose to populate the plot screen. Refer to figure 4. A label can be included for additional identification of the plot set.

Plot counts input through step 2 of the Pre-Suppose Wizard can be used to directly populate the forestland classification diagram. Note that the Jasper Fire was identified as a subclass beneath the *Available – Capable – Suitable – Technically Restricted* forest class. By including only these plots, Pre-Suppose can produce a plot summary statistical report relative to prefire conditions. Pre-Suppose can also provide a direct link of these plots to the Suppose interface. In contrast, in order to properly sort the *Technically Unfavorable* and *Technically Favorable* forest classes, the Jasper Fire plots would need to be excluded from those data run. Pre-Suppose readily handles this task. Mouse clicking the *Next* command button will prompt Pre-Suppose to continue.

Step 3 of the Pre-Suppose Wizard is commonly referred to as the *key* screen. Any data item collected during the field measurement or any value calculated during the office processing can be accessed by the user to form forest strata or stand types. Data items are assigned as either code or range keys. Coded items are generally discrete or qualitative variables. For example, ownership, land class, or forest type are representative of coded data. Range items are generally continuous or quantitative variables. For example, elevation, stand age, or site index are representative of range data.

Keyed data items entered through step 3 of the Pre-Suppose Wizard eases the effort to built stand types as designated in a forestland classification chart. For the Black Hills example, to identify those FIA plots composed of the *Available – Capable – Suitable – Favorable* forest class that are *Ponderosa pine* overstory with *White spruce* understory, the following steps would be used:

Pre-Suppose_Wizard – Step 3 of 3:

1. Add Code Key: Land Class 1 = Forest Land
2. Add Code Key: Forest Class 3333 = Available – Capable – Suitable – Favorable
3. Add Code Key: Forest Type 211 = Ponderosa pine
4. Add Range Key: Forest Sub-Class 3 = White spruce

Figure 5 provides a graphic depiction of the process used to enter the Ponderosa pine overstory code key. The *Data Index* window operates in a similar fashion as the treeview folder pane within the Windows Explorer program. The *Plot Record* branch nodes are derived from the FIA plot record. The Plot Record is further defined as either *Classification Data* or *Summary Data*. Classification data are coded stand measurements. Summary data are computed per acre stand values. The *Tree Record* branch nodes are derived from the FIA tree record. The Tree Record is further defined as either *Measurement Data* or *Calculated Data*. Measurement data are field measured tree attributes. Calculated data are computed per tree values. Mouse clicking the Classification Data branch under the Plot Record node will expand a list of

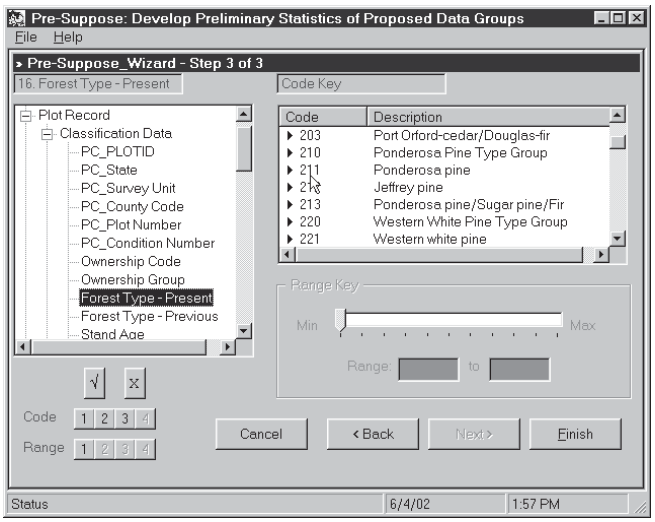

Figure 5—Key selection screen.

available data items. Selecting the *Forest Type – Present* sub-branch will awaken the listview window in the upper right corner of the step 3 window displaying available code items. Mouse clicking the "211" code will designate ponderosa pine as the overstory forest type to be entered into the selection process. The check symbol located in the lower left corner of step 3 will record the query attribute. Clicking the *Finish* command button will prompt Pre-Suppose to continue.

After gathering input through the three steps of the Wizard, Pre-Suppose is ready to generate the output reports. Three text files are produced by Pre-Suppose. The first report, *Plot Summary Statistical Analysis* (PSSA), contains an abbreviated statistical analysis of the specified strata. Figure 6 displays the PSSA output report for the ponderosa pine/white spruce stand type residing within the tentatively suitable forest land base on the Black Hills.

The top of the PSSA report provides identification information such as the database tables used, the plot basis, and

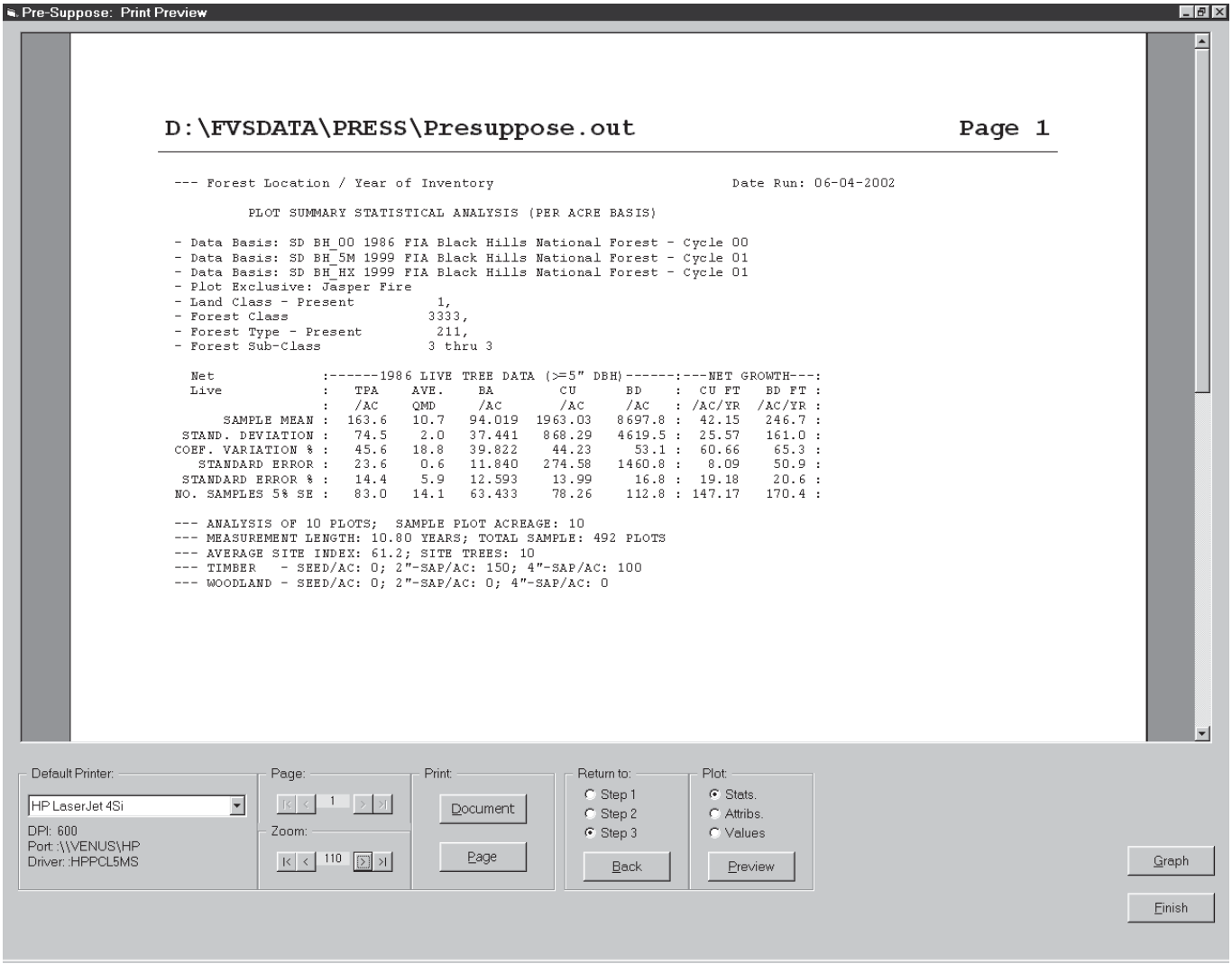

Figure 6—Plot summary statistical analysis report.

the sort key prescribed. The middle section of the report provides a table that lists classical statistical measures for trees per acre, average quadratic mean diameter, basal area per acre, and cubic and board foot volumes per acre. Statistical inferences for volume growth are also displayed. Values appearing in the statistics table are for trees 5 inches and greater in diameter. The bottom of the PSSA report includes information on the number of sample plots rendered by the sort criteria, growth measurement length, average site index for the strata, and a seedling/sapling count distribution.

The second text file produced by Pre-Suppose is called the *Listing of Plot Attributes*. As the name implies, this report sequentially lists plot records that comprise the requested strata. This listing can be used as a permanent record of the plots that compose the data sort. It can also be used to examine data relationships. For example, using the Black Hills data set, there was a need to partition the dominant ponderosa pine overstory by understory tree species components (that is, juniper, oak, birch, aspen, spruce seedling–sapling counts). Using Pre-Suppose to query the database by understory species, a relationship between aspect and elevation was noted. Given that ponderosa pine seedlings and saplings occur on all aspects and all elevations, analysis showed that juniper and aspen composed the understory on southerly aspects. Juniper resided at lower elevations while aspen occurred much higher. On northerly aspects, a progression from low/dry to high/moist was observed. Juniper understory gave way to oak, oak to birch, birch to aspen, and aspen to spruce. Much of this relationship was revealed by close examination of the Listing of Plot Attributes report.

The third text file produced by Pre-Suppose is entitled the *Listing of Plot Values*. A complete listing of plot summary values (trees, quadratic mean diameter, basal area, cubic foot, board foot) is presented on a per acre basis. Values are listed for each plot that met the sort criteria. Annual cubic and board foot volume growth is also included as well as seedling and sapling stem counts. Understories values are listed separately by timber and woodland species.

For visual interpretation of the output, a graphing option is available. Users can pick any set of continuous variables for the data group and produce a scatter plot diagram. Sometimes, visual inspection of the data set can reveal suspicious outliers. Data points can be selected on the graph to identify associated plot numbers. Figure 7 provides an example of this handy feature. Step 2, the plot exclusion feature of Pre-Suppose, can be used to eliminate suspect data points.

The value of the Pre-Suppose program for building stand types is tremendous. As a result of its rapid processing of plot summary records, resultant data group can be quickly generated. Output from trial runs can be evaluated based upon statistical merits to determine if an adequate plot count has been obtained with the input criteria. Building a defendable forestland classification scheme for a strategic forest planning project is a snap with Pre-Suppose.

Additional Features

Suppose Linkage

The ultimate goal of Pre-Suppose is to develop forest strata to relay to the Suppose interface. Pre-Suppose prompts the user to enter titles for the *Suppose.loc* file and for the *Stand List File*. These two files reside in the background to assist Suppose in its operation. For strata that contain many plots, the caption on the Print Preview windows (fig. 6) will indicate which plot Pre-Suppose is currently processing. This aids in determining that Pre-Suppose is still working on the selected strata. Once the data group is available to Suppose, using the "File/Open Locations File" menu option will facilitate locating the newly created Suppose.loc file. The "Select Simulation Stands" window within Suppose will appear. By picking the "Location Title" and "Group Code" as designated in Pre-Suppose, the associated plots will be displayed in the "Available Stands" text box.

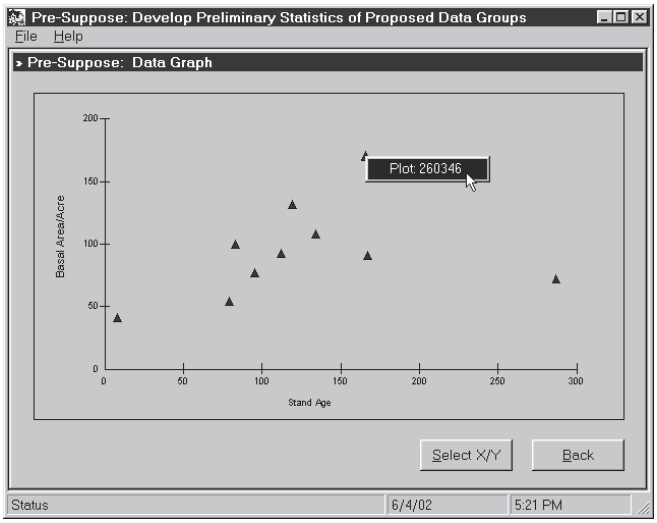

Figure 7—Graphical data display.

Tree Record Queries

Pre-Suppose generates the Plot Summary Statistical Analysis Report based on data in the database plot tables. These tables contain one record per plot. In contrast, the tree tables contain one record per tree. Thus, the plot tables are significantly smaller in size than the tree tables. Processing of the plot tables requires less input/output of records, which allows faster reporting. However, there are situations when a forest analyst needs information at the tree level. In this instance, the Plot Statistical Analysis Report would render an improper result. It displays all tree records, not just the records associated with the specified tree level attribute.

Suppose a particular tree species is threatened or endangered due to insect, disease, or human cause. No longer are plot summary values of interest. Pre-Suppose can be used to query plots that contain the tree species attribute.

Listing of Tree Records—Pre-Suppose produces a complete listing of each tree record that meets the tree level attribute. Tree measurement data are concatenated with tree calculated data to generate this report. This printout can be large. Prior to printing the entire document, careful examination of the number of pages to be printed is warranted. The *Page* frame at the bottom of the *Print Preview* window (fig. 6) will indicate the total pages.

The "Listing of Plot Attributes" and "Listing of Plot Values" reports can be viewed by selecting the respective radio buttons in the *Plot* frame on the *Print Preview* window (fig. 6). These listings contain the plot records with the tree level attribute. These plots can be captured as the default input plot file for step 2 of the Pre-Suppose Wizard.

Data Base Consideration

Four data tables per location per inventory compose the background database for Pre-Suppose:

1. **Plot Classification** (_Plot_Clss)
2. **Plot Summary** (_Plot_Summ)
3. **Tree Measurement** (_Tree_Meas)
4. **Tree Calculation** (_Tree_Calc)

These categories populate the treeview window on step 3 of the Pre-Suppose Wizard. Each forms a branch node that inherently contains the respective data items. These data fields comprise the columns within the data tables.

There are two additional tables that Pre-Suppose uses for operation: one for input, one for output. The *Code_Definitions* table is developed in conjunction with the plot and tree tables. This table provides the link to the other input tables and is the main driver of the Pre-Suppose program. Users can easily add additional data items to the database by modifying the Code_Definitions table. The *Presuppose* table is created internally by the Pre-Suppose program during the processing phase and renders the output records of the requested query.

Help Support

Pre-Suppose has an embedded help utility that has the look and feel of other popular Microsoft products. Help for Pre-Suppose can be invoked by using the *Help* menu option or by simply pressing the F1 function key. Help topics can be searched by contents or by index.

Applications of Pre-Suppose

The Pre-Suppose program has proven to be a valuable tool for forest planning. In addition, Pre-Suppose has been used for several regional assessments. Disturbance agents such as insects, disease, and fire impact the forest landscape. Assessing their potential risk is an important task and aids decisionmakers in their planning efforts. To date, the Pre-Suppose program has been used for the following projects:

1. USFS R-1: Hazard-Risk Assessment for Montana
2. USFS R-2: Forest Plan Revision, Black Hills National Forest, South Dakota
3. USFS R-3: Hazard-Risk Assessment for Arizona and New Mexico
4. USFS R-4: Hazard-Risk Assessment for Idaho and Utah
5. USFS R-8: Forest Plan Revision, Southern Appalachian. National Forests
6. USFS R-9: Forest Plan Revision, Chippewa - Superior National Forests, Minnesota
7. USFS WO: FY-2000 Senate Appropriations Act Request
8. Bureau of Indian Affairs: Forest Plan Revision
9. Bureau of Land Management: Assessment Projects
10. Private: West Virginia Timber Company

USDA Forest Service Intranet Web access has been developed for Region 8 (fig. 8). Immediate intentions are to provide a similar mode of program and data file access for the entire country. Internet links are being developed to facilitate access for all public and private constituents. A collaborative effort between FIA and FVS staffs has commenced to develop links from the FIADB (FIA presentation database) (Miles 2001) to FVS ready input files.

Future Development

Anticipated future developments for the Pre-Suppose program include producing links to the FSVeg database and addressing process methods for stand examination inventory data sets. Conceptual discussions have already begun.

Pre-Suppose Documentation

A User's Guide (Vandendriesche 2001) is available for Pre-Suppose from the author at the address listed on the front-page footnote of this paper. The User's Guide includes a "How to … " section that contains a step-by-step tutorial. A detailed description is given for each of the output reports. The graphing option is more fully described. A rigorous discussion of the process of linking Pre-Suppose output to Suppose input is provided. An example that explains the process of tree level sorting using Pre-Suppose is presented. Consideration regarding the composition of the background database is given along with an explanation on how to dynamically modify its structure. It is an "everything you wanted to know" guide.

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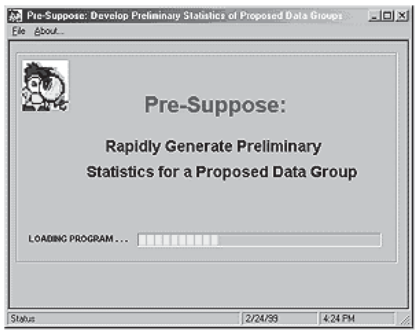
Pre-Suppose

Pre-Suppose is a program we are offering to prepare data for use in Suppose. Pre-Suppose was developed by a member of our FVS staff, Don Vandendriesche. Pre-Suppose is configured to query and sort Forest Inventory and Analysis (FIA) data. The program will prepare the locations and stand list files needed by Suppose to use the pre-sorted data.



The Southern Region's FIA data has been processed to provide the format Pre-Suppose and Suppose need for operation. To download and install Pre-Suppose, follow these instructions:

1. **Download** the setup program file, PressR8p.exe, to a directory on your PC. The folder location is not critical and can be wherever you choose to put downloaded files on your PC.
2. To **install** Pre-Suppose in Windows 95 and 98 (See the NOTE below if you have an existing version of Pre-Suppose installed onyour PC.): Use **Windows Explorer** to go to the downloaded data file. Double-click the file to begin the extraction and installation process. A **WinZip® Self-Extractor** dialog box will appear.
3. Follow the instructions of the setup program. The setup program will ask you into which folder you would like to install the program. Currently, the default is "C:\Program Files\Presuppose". **DO NOT** accept this location!
4. Click the "**Change Directory**" button.
5. Enter into the "Path:" block "**C:\Suppose\Press**". (If you have installed FVS and Suppose on another drive, such as D:\, then change the Path accordingly.) Click the "**OK**" button.
6. Click the setup button to continue with installation.
7. The setup program will complete installation. When it's done, click the "**OK**" button. Pre-Suppose is installed! A shortcut for the program will be installed in your Start, Programs, Suppose menu.

NOTE: If you have installed Pre-Suppose on your PC before, remove it from your PC before installing an updated version:

Done Internet

Figure 8—Web Page link.

Session 2. Reality Check