# Vegetation Dynamics Development Tool
# User's Guide

**Version 4.0**

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Prepared by

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March 1, 2000

*Citation:* **S.J. Beukema and W.A. Kurz.** 2000. Vegetation dynamics development tool user's guide. Version 4.0. Prepared by ESSA Technologies Ltd., Vancouver, BC. 117 pp.

# Acknowledgments

We thank Paul Hessburg, Wendel Hann, Jim Byler, and Al Harvey for supporting the initial idea. We also thank the many users and participants of various workshops who patiently worked with earlier versions of the Vegetation Dynamics Development Tool (VDDT) and who provided suggestions and feedback that helped us to improve the tool. We especially thank Don Long, Kathy Schon-Rollins, and the members of the Insect and Pathogens Working Group for their contributions to the success of this initiative.

We thank Don Long, Jim Merzenich, Sue Hagle, Jim Byler, Andy Taylor, Susan Schilling, and Wendel Hann for ideas and suggestions that led to new features implemented in Versions 3 and 4.

This project was funded from many sources. The main part of the development initially came from the Interior Columbia River Basin Assessment Project. Additional funds have been supplied by the US Forest Service, the Canadian Forest Service, Forest Renewal BC and ESSA Technologies Ltd.

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# 1.0 Introduction

## 1.1 Overview

Projecting changes in vegetation structure and composition over time is an important part of landscape-level analyses. Vegetation can change for a variety of reasons such as human activity, fires, insects, pathogens, mammals, weather, or growth and competition. The interaction of these factors can be quite complex and it can be difficult to project the combined effects over long periods of time. The Vegetation Dynamics Development Tool (VDDT) is a user-friendly computer tool that provides a modeling framework for examining the role of various disturbance agents and management actions in vegetation change.

VDDT allows users to create descriptions of vegetation dynamics in successional pathway diagrams. It assumes that the landscape has been stratified into units with similar successional pathways. In the examples presented here, stratification is based on Potential Vegetation Types (PVT). For each PVT, vegetation states are defined as combinations of the predominant cover type and structural stage, called successional classes. Two types of pathways between classes are defined in the pathway diagram: changes driven by disturbances and changes due to stand dynamics in the absence of disturbance (i.e., regeneration, growth, and self-thinning). Disturbance-related pathways specify, for each class, the type of disturbance, its probability (which defines the return frequency) and its impact on vegetation. Changes due to stand dynamics are defined by the time a stand remains in a structural stage (or cover type) and by the successional class it will move to after this time has passed.

For the model simulations, the landscape is partitioned into a number of pixels (i.e., grid cells), each initially assigned a successional class (i.e., cover type and structural stage) and age. The model simulates the probability of each pixel being affected by one of the disturbance types, and if a disturbance does occur, moves the pixel to the class defined in the pathway diagram. Disturbance probabilities are only dependent on the current state of the pixel, defined by its successional class. They are independent of the state of the neighboring pixels and the disturbance history. Thus, the model does not simulate contagion in space (e.g., wildfire) or time (e.g., insect outbreaks).

VDDT can be used to test the assumptions of disturbance probabilities and pathways. The model simulates changes in landscape-level indicators, such as changes in the frequency distribution of successional classes or structural stages and the area affected by each disturbance type. Results are presented at user-specified time intervals or as average statistics for certain time periods.

The successional pathway diagrams summarize scenarios of vegetation dynamics. Landscape-level vegetation changes can thus be simulated for one or more scenarios and the impacts of changes in disturbance frequency can be assessed. Scenarios can define different assumptions about fire suppression, land management, or the introduction of exotics by assigning probabilities to the applicable successional pathways. In each scenario, changes in the dominant disturbance types and their frequency are the result of changes in the vegetation. For example, the suppression of fires may increase the area in a successional class that is more susceptible to insects. Without changing the probability of insect disturbance in a class, more insects disturbances will occur in the landscape because more pixels are in the susceptible successional class.

Perhaps the most important contribution of this modeling framework is that it provides a common platform for specialists of different disciplines, e.g., entomology, pathology, fire ecology, silviculture, wildlife biology and ecology, to collectively define the roles of various processes and agents of disturbance on landscape-level vegetation dynamics. Moreover, the development tool allows for rapid gaming and testing of the sensitivity of the system to alternative assumptions. It thus provides a tool for learning and communication.

## 1.2 New Features

VDDT has been updated and expanded to contain many additional capabilities. These include (but are not limited to):

- New attribute functions:
  - Attribute values can be based on the occurrence of a disturbance in a class.
  - Attributes can be used to link text with individual disturbances or succession pathways in a class.
- New run options:
  - Run multiple iterations of the same model with a different random number seed.
  - Run a simulation that uses probabilities from different management regions in different years.
  - More timesteps.
- New graphing options:
  - View an individual run or summary information (average, standard deviation, maximum, minimum, etc.) from a set of Monte Carlo iterations.
  - Control the starting and ending points of the graphs.
  - More graph types.
- Other:
  - Load all related files at once as a "project".
  - Change the definition text files without leaving VDDT.
  - Disturbance probabilities can be defined to occur only after another disturbance or set of disturbances has occurred.
  - Disturbances can occur without changing the relative age of a pixel.

Details of these and other options are explained throughout this manual.

## 1.3 Further Information

For further information, questions, model support, or information about training sessions, please contact one of the following people:


| | | |
|---|---|---|
| Jim Merzenich | USFS Strategic Planning<br>Portland, OR | tel: (503) 808-2284<br>email: Merzenich_James/r6pnw@fs.fed.us |
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At the time this version of the model and the manual were released, no definite plans about the future of the development tool had been made. If you are using VDDT and are interested in information about the most up-to-date version, future updates, or have any comments or suggestions about model improvements please send a short note, fax, or e-mail with your name, address and e-mail address and the version number that you are using to Sarah Beukema (at the address above). We plan to keep those on the users' list informed about future developments.

# 2.0 Getting Started

## 2.1 System Requirements

We recommend the following system requirements:

- Windows 95 or Windows NT 4.0 or higher;
- 80486 or pentium;
- VGA or higher resolution color monitor;
- 16 MB memory;
- 5 MB hard-disk space; and
- a mouse.

## 2.2 Installing VDDT

VDDT is installed using a setup program in the downloaded zip file. Users who already have a copy of VDDT installed on their machines should read the notes pertaining to their situation.

VDDT is installed using the following steps:

1. Unzip the file into a temporary directory. It can be deleted when you are done.
2. From the Start Menu, select Run.
3. Click on the Browse button and navigate to the temporary directory.
4. Double-click on SETUP.EXE. Follow the instructions in the setup program.

The setup program will ask you where you wish to put the program files (i.e., the directory in which VDDT should be placed). The default directory is C:\VDDT but users can change this to a directory of their choice. The setup program will place files in this directory and in the \WINDOWS\SYSTEM (or the equivalent) directory. It will also create an item on the Programs menu.

To run the model, simply select VDDT from the Program Menu under the Start button. Online help, an example PVT file and an example scenario file are all included with VDDT to assist beginning users. Details about getting started running the model are given in Section 2.3.

Note that there are five ASCII files which are used by the program and which are placed in the program directory. These are:

- DISTCODE.TXTG
- DISTGRP.TXT
- COVER.TXT
- COVERC.TXT
- STRUCTUR.TXT

Do **not** delete these files. The program will not run without these files. These files are explained in more detail in the Appendix.

☛ Note that if the working directory for VDDT is changed, then the TXT files must also be moved to the working directory.

### *Upgrading an existing version*

There is no specific upgrade version of VDDT. Therefore, users have two options:

1. Install VDDT 4.0 into a new directory, rather than overwrite the existing one; or
2. Install VDDT 4.0 into the same directory as the previous version, making sure that the existing TXT files are copied to other filenames. The installation program will re-install these files and will not check with you before overwriting the existing files.

Under either option, since the TXT file format has not changed from earlier versions of VDDT, once the installation process is complete, you may copy your own TXT files on top of the new ones.

☛ Note that VDDT version 4.0 can read files from all previous versions of VDDT. Some of the files created from version 4.0, however, cannot be read by earlier versions of VDDT.

## 2.3 Using the Model

Several options exist for using the model. These include: using existing files and running basic simulations, changing existing files to examine different assumptions, editing existing files to create files for new vegetation types, and creating new files. Each of these will be described briefly below, and in more detail in the remainder of the document.

VDDT is distributed with a set of existing files that can be used as a starting point or as examples. These files include a ‘new format’ PVT and scenario file (SAMPLE.PVT and SAMPLE.SCN), and files containing lists of disturbances (DISTCODE.TXT), disturbance groups (DISTGRP.TXT), cover types (COVER.TXT, COVERC.TXT), and structural stages (STRUCTUR.TXT). In addition, online help is available from the Help menu or by pressing the F1 function key.

Section 9 of this manual contains a detailed “Trouble Shooting” section. This section gives answers to frequently asked questions about perceived (and real) problems. When questions or problems arise, users are encouraged to see if they are addressed in that section.

### *Running the model from existing files*

If a PVT and scenario file exist, the model can be run in just six steps:

1. Start VDDT by selecting VDDT from the Program Menu.
2. Select “Open files” from the File menu.
   - choose an existing PVT file (such as SAMPLE.PVT, included with VDDT).
   - choose an existing scenario file (such as SAMPLE.SCN, included with VDDT).
3. Select a management region (“Choose a management region” in the Run menu).
4. Set the initial conditions (“Edit initial conditions” in the Run menu).
5. Run the model (“Run” in the Run menu).
6. Look at the results (Results menu).

Steps 5 and 6 can be repeated multiple times to see the effect of the stochastic variation on the results or select “Time definitions” from the Run menu to enter a number of Monte Carlo simulations. The effects of the different probabilities in different management regions or the influence of initial conditions can be examined by making a different selection in Steps 3 or 4.

When done running VDDT, select “Exit” from the File menu.

### *Changing assumptions in existing files*

Users may wish to explore the effect of changing some of the information about the frequency of disturbances that is contained in existing scenario files. To make changes, start VDDT and load an existing PVT and scenario file as described above. Then make changes using one or more of the following options:

- Change the disturbance type or probabilities of one or more pathways that leave a class (Section 4.3).
- Change the disturbance type or probabilities of one or more pathways that enter a class (Section 4.3).
- Use a multiplier to change (permanently or temporarily) all disturbances of a given type or group in one or more management regions (Section 4.4).
- Turn off a group of disturbances during a simulation (but keep the disturbances in the file; Section 5.4).
- Add one or more new disturbance pathways or change an existing pathway (Section 4.3).
- Change the time or destination of a succession pathway, or the ages associated with a class (Section 4.3).
- Add or change the attributes of particular class (Section 8.1).
- Add multipliers that will change the probabilities annually based on a pre-defined sequence of years (Section 8.2).
- Add multipliers that will change the probabilities annually based on the state of the landscape (Section 8.3).

After any change, the model can be run (following Steps 3-5 above) and the resulting graphs can be viewed (Step 6 above).

### *Editing existing files*

Existing files can be changed to create a different PVT, or to add additional information to an existing PVT. Using the Diagram menu, the cover type and structural stage of each class can be changed, new classes can be added, and classes can be deleted (Section 4.5). Pathways, both succession and disturbance, can also be edited, created, or deleted (Section 4.3).

At any point, the new files may be saved (“Save files” in the File menu), or the new information can be applied to a new simulation run (following Steps 3-5 above).

### *Creating new files*

Pathways diagrams can be created without starting from an existing file. Users can add each desired class and pathway. See Sections 4.6 and 4.5 for details.

The TXT definition files define the meaning of many numerical codes used in VDDT. For example, they relate a cover type code to a name. New cover types, disturbances, disturbance groups, and structural stages can be defined by creating a new TXT file or editing the existing TXT files in any editor capable of reading and writing ASCII files. Note that in either case, the model recognizes only the associated numerical code in the PVT and scenario files. Thus if pre-existing PVT and scenario files contain numerical codes whose definition is changed in the new TXT files, the meaning of the disturbances, cover types or structural stages in the pre-existing files may change as defined by the new information in the TXT files. When editing TXT files, care must be taken to maintain consistency with other files already in use. See Section 3.4 for information on loading new definition files.

## 2.4 Terminology Used in VDDT

Different areas within a landscape, particularly a forest landscape, can be summarized as being covered by vegetation that is predominantly of some type (i.e., the main overstory species) and structure. Each of these areas can be called a ***class*** or successional class. VDDT operates on a series of these classes. Each class is a unique combination of cover type and structural stage, where ***cover type*** is the dominant type of vegetation, and the ***structural stage*** relates to the vegetation structure of the area (e.g., high or low grasses, single or multi-storied tree cover, etc.). The classes are defined for a given ***PVT*** (potential vegetation type) or general type of vegetation. VDDT moves ***pixels*** (a unit of area) from class to class based on a set of ***pathways***. These pathways define how the vegetation changes based on ***succession*** (i.e., aging in the absence of any disturbances), and ***disturbances*** (anything that changes the pathway of the pixel such as insects, diseases, grazing, harvesting, severe weather events, etc.). Movement along disturbance pathways is a stochastic event, the likelihood of which is defined by probabilities while movement along the successional pathways is time dependent.

Various ***scenarios*** can be defined in which users make different assumptions about the behavior of the disturbances (i.e., increased fires, decreased harvesting, more grazing, etc.). Within one scenario, different probabilities can be defined for a number of ***management regions***, or areas in which the basic scenario assumption is the same (i.e., more fires), but the probabilities of some disturbance differ (because of differing protection efforts due to land ownership, land designation, etc.).

Disturbances belong to one or more ***disturbance groups***. These groups are broad categories containing disturbances that are of similar types. The grouping allows users to more easily select pathways for drawing, view the effect of the disturbances, disable types disturbances for a particular simulation, or use multiplier to change the probabilities of types of disturbances. Users can define up to 15 groups in DISTGRP.TXT, and can assign each disturbance to one to three groups (see the Appendix for more details).

# 3.0 PVT, Scenario, and Definition Files

## 3.1 File Descriptions

Two types of files are used by the program: PVT files and scenario files. The information about a successional pathway diagram for each potential vegetation type (PVT) is defined in the PVT file. This includes all valid combinations of cover type and structural stage, and all the possible pathways. The scenario file (extension SCN) contains the non-zero probabilities for the pathways in each management region.

Each PVT file must have at least one scenario file (with the disturbance probabilities) associated with it. A single PVT file may be referenced by several scenario files (Figure 3.1), each of which defines probabilities under different scenario assumptions for one or more different management regions (see Section 5.2). In order to run the model a scenario file must be loaded. The program will prompt the user to load a scenario file once a PVT file has been loaded.

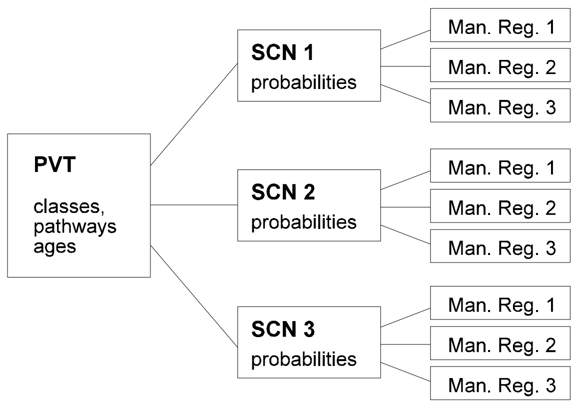



**Figure 3.1:** One PVT file may be associated with several scenario files, each of which contains probabilities for one or more management regions (three regions in the picture).

Most users do not need to know the structure of the PVT and scenario files, but this information is sometimes useful. Example files, with a brief description, are shown in the Appendix.

## 3.2 PVT, Scenario, and Location Files

### *PVT and scenario files*

The PVT and scenario files contain the minimum amount of information necessary to run the model for a specific landscape or situation. As such, they are always loaded and saved together.

#### *Loading*

To load a PVT file, select "Open files" from the File menu. This will read files in one of two formats (described as "Old Format" and "New format" in the Appendix). Details of the differences between the files do not affect how the model operates, just how the files are read.

When one of the two options has been selected, users can select the appropriate PVT file. As soon as the file is read, the program will prompt the user for a scenario filename. The model assumes that the scenario files will be in the same type of format as the PVT file (i.e., old format or new format).

New scenario files may be loaded at any time by selecting “Use new scenario file” from the File menu. Again, the user must tell the model which of the two formats the scenario file uses. Only one scenario file can be loaded at any time, so the new one replaces the previously loaded one as the active file. The program assumes that the loaded scenario file is associated with the PVT in memory.

If there are more than six management regions in the scenario file, the user is given the option to load only the first six. When a scenario file is saved, only those management regions that were read will be saved. For example, if a scenario file contains nine management regions and only the first six are read at the time the scenario file is loaded, these six will be the only management regions in memory. When the scenario information is saved, these six will also be the only regions present in the new file. Six management regions are the recommended maximum number of regions.

As a safeguard against possible operator errors, the program performs a series of error checks while scenario files are loading. It displays a warning message if the scenario file is trying to access a PVT, class (cover type-structural stage combination), or disturbance which is not part of the currently loaded PVT. If any of these are not present in the PVT file, the model will ignore them, and when saved, the new scenario file will not contain this information. Warning messages may be an indication that incompatible PVT and scenario files are being loaded. See Section 9.0, Trouble Shooting, for additional information.

After both files are loaded, the program does some checking of the PVT file to make sure that all information is valid. Warning messages will appear if file contains two classes with the same cover type and structural stage definition, or if some pathways (succession or disturbance) go to non-existent classes. The model may not run with these problems, so users should note the problems and fix them when the pathway diagram is fully loaded.

Warnings about additional discrepancies, such as having a disturbance code or cover type that is not in the current disturbance or cover type file, will also be shown. These warnings are often an indication that the files were created with a different set of the TXT files than those that are currently in memory (see Section 3.4 for fixing this problem).

### *Saving and exporting*

Any changes made to the PVT or scenario files can be saved by selecting “Save files (pvt/scn/loc)” from the File menu. The program saves both the PVT and the scenario files, just in case changes were made to disturbance types, destinations, succession information, or classes. It also saves the location file (see below), if the user has set the class locations manually. Files will be saved in their original format and with their original names, unless otherwise specified by the user using one of the “Save As” option from the File menu.

Two specialized exporting options are included with VDDT: exporting for the CRB Paradox Database, and exporting for TELSA. The CRB Paradox Database format files are two comma and quotation mark delimited files containing the information from the PVT and scenario files, and are in a format that can be directly entered into the database without further processing (see the Appendix for the file format). This option is found by selecting “Export files” from the file menu.

The second export option produces three space-delimited files that can be read by the TELSA interface and imported into the TELSA database (see the Appendix for the file format).

### *Changing assumptions*

Users can change the name and number of new PVTs by selecting "Edit file information" and "PVT name & number" from the File menu. The current PVT number and name are shown, and users can edit these or enter new ones, as desired (see Section 4.6 for details on the format). The new name will appear in both the header for the SPD and in the Status window.

Management region names can also be edited from the "Edit file information" menu (by selecting "Management region names"). A list of management regions is shown, and users can enter the number of the regions whose names are to be changed. Numbers should be separated with commas when they are entered. The program then allows the user to enter a new name for each of the selected management regions. If the name of the current management region is changed, the change will appear in the Status window.

A new management region may be added to the current scenario file by selecting "Add new management region" from the "Edit file information" section of the File Menu. Enter a new name, with no spaces, into the box that appears and click on the "OK" button. The management region will be added to the information in memory, and will be part of the scenario file when it is next saved. Note that this new management region will contain no probabilities at the time it is created. Select "Cancel" from the input window to stop the program from adding a new region.

### *Location file*

The location file contains information about the placement of the classes in the SPD diagram. This information is optional, as VDDT can organize classes using an internal rule-base.

After the scenario file is read, the model will look to see if there is a location file with the same name as the PVT file. If so, the user will be prompted to load the location file as well. The information in the location file will overwrite the default information produced by VDDT. Once a location file is being used for a VDDT session, all new classes must be placed in the desired location.

Clicking on the "Cancel" button when VDDT asks for the location file name will cause VDDT to ignore the location file, and to use the default locations for the classes.

☛ Note that if the location file has a different name than the PVT file, the model will not find the file and will not prompt the user to load it. There is no other method for loading an existing location file.

## 3.3 Project Files

The project file contains a list of all the types of files used by VDDT, as well as various parameter values (such as the number of timesteps, or whether multipliers are turned on, etc.). The project file stores the following information:

- TXT files: disturbance types and groups, cover type names and abbreviations, structural stages
- SPD files: disturbance types and groups, cover type names and abbreviations, structural stages
- Attributes
- Initial conditions

- Between-year variation: YSG definitions, year-type multipliers, time-sequence multipliers, multiplier sequence, normalized multiplier sequence, landscape feedback multipliers, flag for if variation is active
- TSD group
- Graphing times: number of years, start and end graph year, bar graph times
- PVT size: pixels, area

A complete description of the file format is given in the Appendix.

To load a project file, select “Open project” from the File Menu, or, to open the last project file used, click on the file name at the bottom of the File Menu. When a project file is loaded, all files listed in the project file will also be loaded, without the user needing to go through all the individual windows and menus. The status bar at the bottom of the main window will give some indication about the various options that were loaded or turned on by the project file.

Project files are saved by selecting “Save project” from the File Menu.

☛ Note that saving a project does not save the corresponding files.

☛ The project file saves the full pathname of all the files. Thus, manual editing of this file may be necessary when moving the file between computers.

### 3.4 Definition Files

When VDDT loads, it requires that a set of five (5) TXT files are present: DISTCODE.TXT, DISTGRP.TXT, COVER.TXT, COVERC.TXT, and STRUCTUR.TXT. These files contain information about the valid cover types, structural stages, and disturbances that is used throughout the model. Users may customize these files with the information that is appropriate for their system, as long as the file formats conform to the description in the Appendix.

VDDT requires that files with these names are present when it loads. Users can, however, define multiple versions of these files with different names. Once the program is loaded, one or more definition files can be changed.

To change all definition files, select “Use new definition files” from the File Menu, and then select “All files”. The program then warns that all files must be in the same directory, have the same file extension as each other, and must have the prefixes that are listed in the default files. Users can then select one file as an example of the location and file extension, and the program will proceed to load all five files. If any files are not present, they are skipped.

To change a single type of definition file (disturbance, cover type, or structural stage), pick the appropriate item from “Use new definition files” in the File Menu. These files can have any name and any extension. If disturbance or cover type is chosen, two files will be loaded.

In all cases, the diagram and disturbances will be re-labeled with the new abbreviations.

To see which files are currently in use, select “Use new definition files” from the File Menu, and then select “Current filenames”.

Use a project file to group a set of definition files with a PVT. When a project is loaded, it will automatically load the appropriate set of definition files.

# 4.0 Successional Pathway Diagrams

## 4.1 Description

A successional pathway diagram (SPD) defines the successional classes and the pathways between these classes for each potential vegetation type. The information in the PVT file is represented by a collection of labeled boxes and colored arrows (Figure 4.1). Each box is one successional class, and is described by a unique combination of cover type (upper right corner) and structural stage (lower right corner), as shown in Figure 4.2. Each box is also labeled with a letter (assigned according to its position in the PVT file). This letter is used to refer to the class throughout the program.

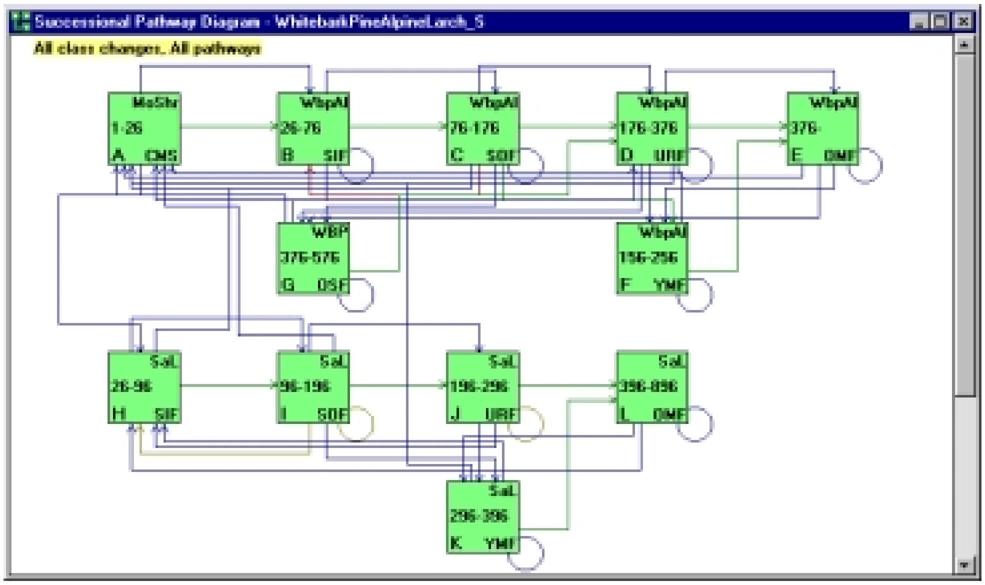



**Figure 4.1:** Example successional pathway diagram. The diagram shows all possible classes (the boxes) and the pathways (the lines and circles) that a pixel could travel to move from one class to another. In each box, the cover type abbreviation is shown in the upper right corner, approximate age range is shown in the middle, and the structural stage abbreviation is shown in the bottom right corner.

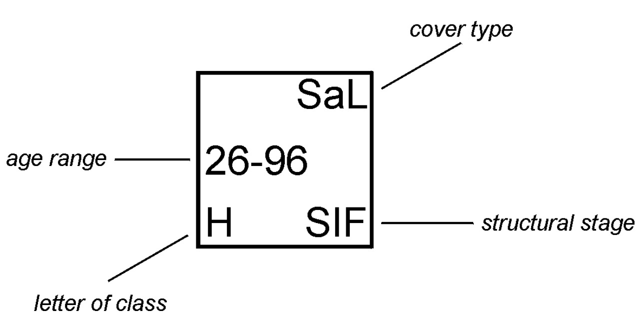



**Figure 4.2:** Class identifiers. The cover type is a short code for the predominant vegetation in the class, and the structural stage is a letter or number code for the structure of the vegetation in the class. The letter of the class is an identifier used within VDDT as a reference for the class. The age range is mostly shown to help users visualize the stands characterized by the class.

The arrows show the pathways between classes, as described in the PVT file. By default, all pathways listed in the PVT file are shown (but see the section “Drawing Pathways” for more information). Arrows are drawn in a variety of colors to help users identify the type of disturbance agent (Table 4.1). Succession pathways start and end on the vertical sides of boxes while disturbance pathways start and end on the top or bottom of boxes.

**Table 4.1:** Line colors used for different disturbance agents. The numbers correspond to the disturbance group of which they are part (as defined in the DISTCODE.TXT file). Note that in many PVT diagrams, pathways for multiple agents overlap and will be drawn in blue (last column).

| **Color** | Green | Yellow | Red | Black | Blue |
|---|---|---|---|---|---|
| **Disturbance group** | Succession<br>9 | 7<br>8 | 10 | 1-3 | All others<br>More than 1 agent |

The window header for the SPD contains the words “Succession Pathway Diagram” and then the name of the PVT. In case users forget which PVT is being used, this information is repeated in the “Status” window in the lower right corner of the screen (Figure 4.3). The status window displays “Unmodified” until any information about the classes, pathways, probabilities, or attributes has been edited. The top left of the SPD also lists what type of disturbances are currently being displayed (see the next section for more details).

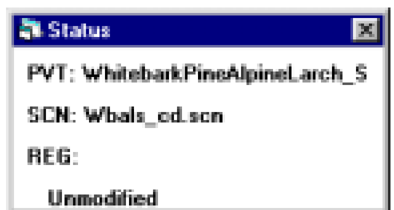



**Figure 4.3:** The status window. This window is found in the lower right corner of the screen and lists the current PVT, scenario file, management region, and whether the file has been modified.

The SPD window can be resized. When the diagram is bigger, the pathways may be easier to trace. If the diagram is too big to fit easily on the screen, a scroll bar will appear, allowing users to change the display and to see the remainder of the diagram.

## 4.2 Drawing Pathways

In most diagrams, it is virtually impossible to actually trace each pathway when all are displayed. The model allows users to display specific pathways: certain disturbances or combinations of disturbances, pathways with or without defined probabilities, or all the pathways to or from a certain class.

### *Selecting the pathways for the entire PVT*

From the Diagram menu, select “Redraw pathways”. A screen will pop-up with all the disturbances listed (Figure 4.4). Users can then pick which disturbance agents to draw, either by clicking on individual agents, or by clicking on “All pathways” (both disturbances and succession) or “All disturbances” (everything except succession). The bottom of the screen allows users to further select pathways based on whether or not a probability has been defined. The options are to draw:

- all pathways which fit the criteria chosen in the upper part of the screen;
- those pathways which fit the criteria and which have a probability defined; or
- those pathways which fit the criteria but which have a zero probability (or no defined probability).

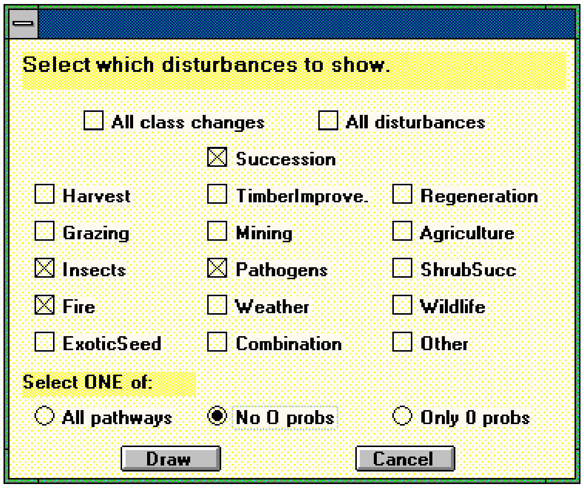



**Figure 4.4:** Screen allowing users to choose which pathways to display. In this example, succession, insects, fire, and pathogen pathways will be shown, provided they have a probability defined in the current scenario file and the current management region. Note that the options in the columns of the window are those groups defined by the user in the DISTGRP.TXT file.

When done, the selected items will be indicated at the top of the SPD window, and only those pathways will be drawn (Figure 4.5). The program will remember this selection until it is changed by the user or until a new PVT file is loaded.

☛ Note that if either of the last two options are selected (those pathways that have a probability or those that do not have a probability), the model will look at the probabilities defined for the current management region only. If no management region has been selected, the probabilities from the first management region will be used.

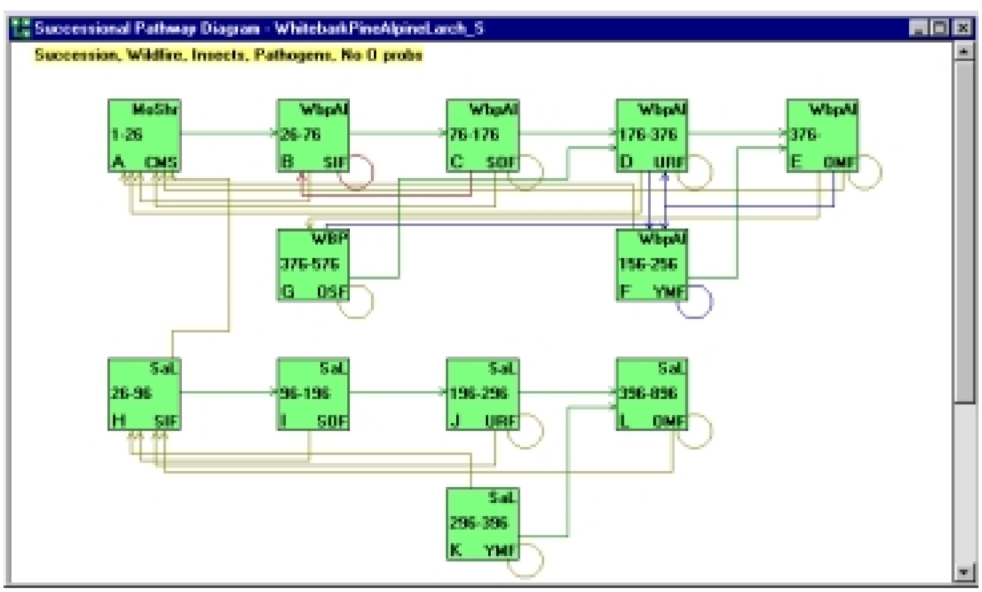



**Figure 4.5:** SPD of Figure 4.1 redrawn with the selected options. Notice the label in the upper left corner now lists the four types of pathways which are being shown, and specifies that only those pathways with a non-zero probability are drawn.

### *Selecting pathways to or from a particular class*

To show all the pathways to or from a particular class, move the mouse to the box of interest and click the RIGHT mouse button. The class will be highlighted (yellow on most computers), all the classes with disturbances going to or from the highlighted class will be in a different color (grey on most computers), and only the disturbances to or from the class will be displayed (Figure 4.6).

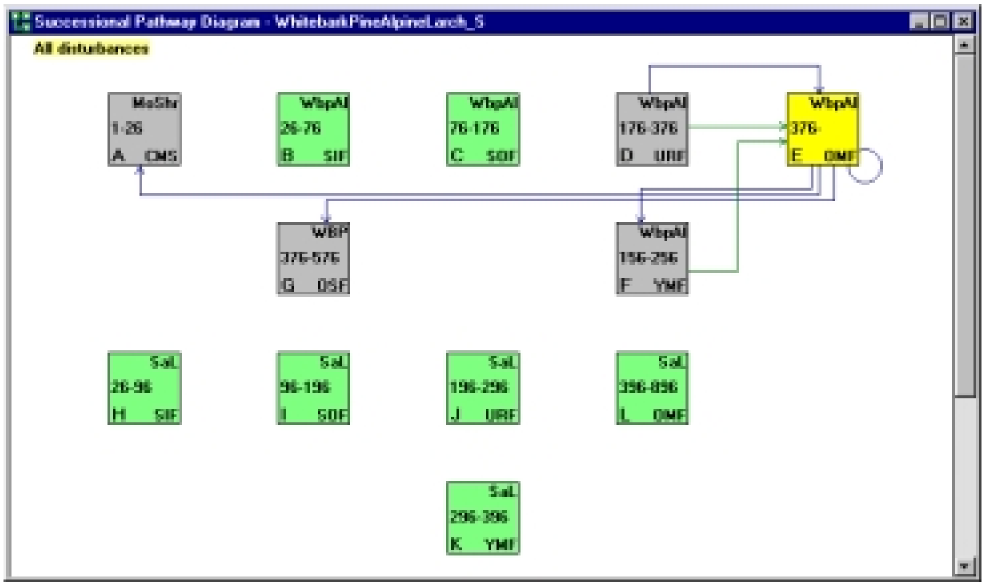



**Figure 4.6:** SPD with box E highlighted. All the pathways going to or from class E are shown. When seen on the screen, box E is yellow and all other boxes with a pathway are grey.

To redisplay pathways from all boxes, either select “Redraw pathways” from the Diagram menu, or resize the window a small amount.

## 4.3 Editing Pathways

Each pathway has an origin, a destination, and either a disturbance probability or a transition period. This information can be changed, and pathways can be added or deleted. This is all done in a single screen which lists all the information about the pathways from a class. (Alternatively, the screen can display all pathways to a specific class.) If any changes are made in this screen, the last line in the Status Window (Figure 4.3) will change to read “Modified”.

### *Loading the screen showing the pathways from a class*

To load this screen:

1. Double-click either mouse button on the box representing the class of interest;

or

2. Select "Change Pathways" from the Diagram menu, and enter the letter of the class of interest.

The screen will appear, showing all the pathways going away from the class.

### *Changing pathway information*

Probabilities, destinations, disturbance agents, relative ages, and succession information may all be changed in the Pathways Screen (Figure 4.7). The screen is divided into two sections. The top section is the succession information and the second section contains a grid showing all the disturbance information.

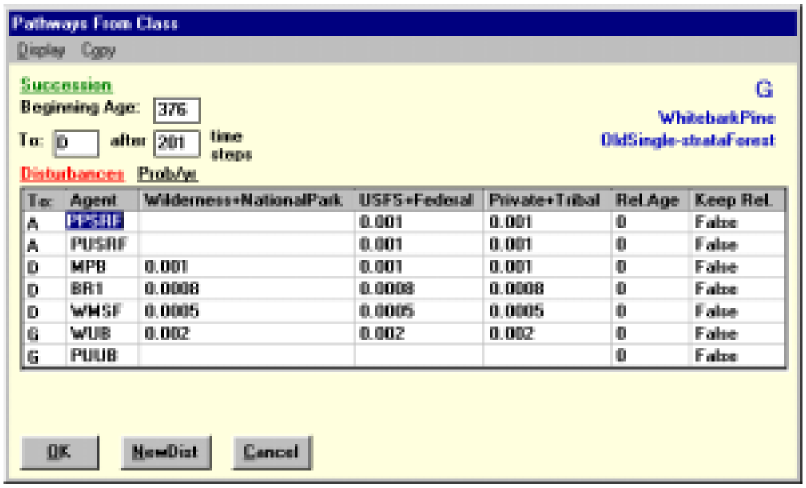



**Figure 4.7:** Screen showing the pathways from class G. Note the two lines just below the class identifier that contain the unabbreviated name of the cover type (Whitebark Pine in this case) and the name of the structural stage (Old Single-strata Forest in this case).

#### *Succession*

The succession part of the screen shows the beginning age of the class, the destination after succession, and the number of years that a pixel would stay in that class in the absence of disturbance. Any of these cells may be edited.

The destination for the succession pathway is the letter identifier of the target class. The program will check to ensure that the letter that is entered is a class that is currently part of the diagram.

☛ Changing the succession destination may change the location of the current class in the diagram (unless the locations are being set manually).

The beginning age of the class is used by the model to provide a value from which to start incrementing the number of years a pixel has been in the class and for determining when each probability is valid. It is also presented as a reference, to help users picture the class and define probabilities.

Each class must go somewhere through succession. If the class is considered an "endpoint", and pixels would only leave that class through a disturbance, it should be given a large number of years to stay in the class, and then should go to itself through succession. For example, if class L is an endpoint, the succession part of the screen could look like:

To L after 900 years

If the beginning age of the class or the number of years in the class are changed, VDDT will ask if the disturbance information should also be updated. If so, it will change the beginning age of all disturbances that had the original class starting age and it will change the ending age of all disturbances that had the original class ending age.

☛ If VDDT does not automatically update the ages of some disturbances, check to ensure that the disturbance age are still within the range of the class. Disturbances with ages outside the class range will not occur.

### *Disturbances*

Each row of the disturbance part of the screen represents a different pathway, sorted in order of destination, disturbance type and age. The columns are as follows (see Figure 4.7):

*To*: Pathway destination. If a different letter is entered into this box, the destination of the disturbance will be changed. To delete a pathway, delete this letter.

*Agent*: Disturbance agent. Unlike the other columns, users cannot type anything into this cell. To change the agent:

- Double-click on the cell. A screen (Figure 4.8) will appear which contains all the disturbance agents listed in the file DISTCODE.TXT (see the Appendix).
- Find the general category of interest (as defined in the file DISTGRP.TXT) and click on the arrow at the right of the box associated with the category.
- Click on the agent.
- Click on the OK button to accept that disturbance agent and to return to the pathways screen.

*Names*: Each management region has a column, with the name of the management region name as the column header. The remainder of each column contains the probability of the disturbance pathway occurring in that management region. Blanks are the same as a zero probability. New values (less than one) can be entered into any of the cells. The model offers the option of copying the probability in the current cell (and associated ages) to all the management regions for that disturbance type. To do this, simply place the cursor one of the cells and enter a value (unless the current value or blank is the one of interest). Then, select “Copy Probs” from the menu. This will write the value of the cell to the other management regions, overwriting whatever value was previously in the cells.

*Rel.Age:* Relative age. Relative age means slightly different things, depending on the type of pathway. In both cases, however, the relative age is a number of years, not an age.

- Pathways starting and ending in **different** classes.

  After this type of disturbance, the model assumes that the pixel enters the new class with an age equal to the beginning age of that class. The relative age tells the model that after this disturbance, the pixel will enter the new class with a higher age (i.e., beginning age plus relative age) and thus will stay in the new class for a shorter period than it would otherwise. Relative ages can only be positive in this case.

- Pathways starting and ending in the **same** class.

  In this case, the disturbance does not change the pixel’s class but it either advances or delays its succession to the next class. A positive relative age shortens the amount of time that the pixel will remain in that class (i.e., succession is moved forward). A negative age allows the pixel to remain in that class longer (i.e., succession is set back).

In both cases, the age of the pixel is bounded by the age limits in that class. A pixel in a class can never be younger than the beginning age of the class, and can never be older than the ending age of the class (beginning age plus the number of years in the class).

*Keep Rel.:* Keep the relative age? If true, when the disturbance occurs, the relative age, i.e., the number of years that the pixel has been in the class, will not change even if the class changes.

☞ This should not be used with disturbances pathways that start and end in the same class because it will cause the disturbance to have no effect.

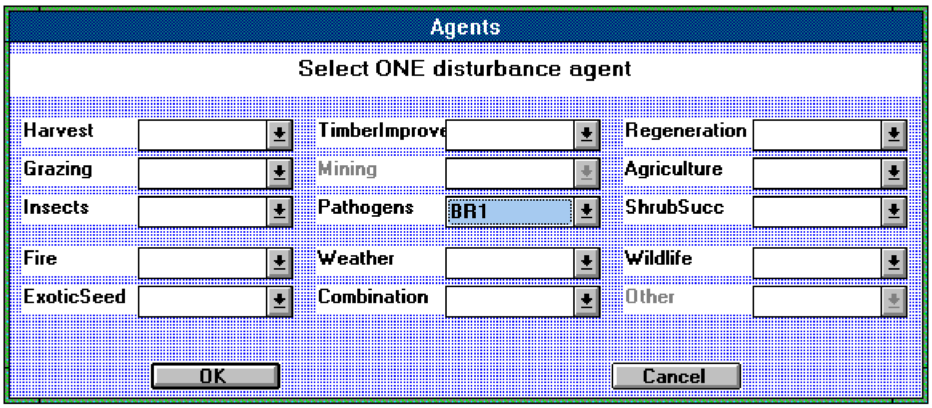



**Figure 4.8:** Window for selecting the disturbance agent. An agent can be chosen by clicking on the down-arrow to see all the agents of a particular group and the clicking on the desired agent. In this example, BR1 has been chosen.

☞ If using two pathways that begin and end in the same class, and are the same disturbance type, do not use different relative ages or a different value for the keep relative age flag. The PVT file saves only one version of the pathway, and will therefore save only one relative age and relative age flag.

The example screen shown in Figure 4.7 shows three management regions (“Wilderness+NationalPark”, “USFS+Federal”, “Private+Tribal”). The screen will show as many management regions as are present in the scenario file. By default, columns will be wide enough to show the entire region name. Columns may be resized to hide part of the name and allow more columns to be visible on the screen without scrolling.

By default, disturbance probabilities apply to the entire class for which they are defined. These probabilities can, however, apply to only a selected range of ages within the class. Thus, different probabilities can be assigned to the same disturbance type, as long as the ages do not overlap. To see the age information (and to allow editing of it), select “Show Ages” from the Display Menu. Several new columns will appear (Figure 4.9):

*MinAge*: The minimum age at which the disturbance can occur. Note that the minimum age cannot be less than the beginning age of the class, and that the age can differ between management regions.

*MaxAge*: The maximum age at which the disturbance can occur. Note that the maximum age cannot be greater than the sum of the beginning age and the number of years in the class, and that the age can differ between management regions.

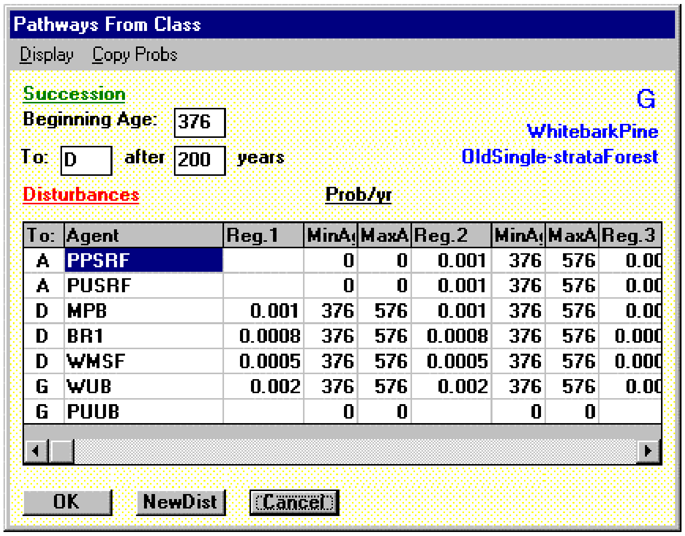



**Figure 4.9:** Screen showing the pathways from class G, with the additional age information. In this example, all defined probabilities will be applied to all ages with in the class (376 to 576).

To hide the age information, select “Hide Ages” from the Display Menu.

The probability of some disturbances occurring may depend on the time interval since a previous disturbance. In VDDT these types of relationships can be defined using the “TSD” (“Time Since Disturbance”) column of the grid. To see this column, select “Show TSD col” from the Display Menu. A new column will appear for each management region. The TSD column allows users to define the number of years that must occur between a disturbance in a specified group (given elsewhere) and the possible occurrence of the current disturbance. For example, a user could define that a stand-replacement wildfire will not occur until 30 years have elapsed since a fuels treatment. The TSD variable may also be used to shift pixels to a different succession class (e.g., from a high to a low risk class) after a pre-determined time span has elapsed without a disturbance.

Multiple “TSD” data lines may be used to portray a more complex relationship. For example following a fuel treatment the probability of a stand replacement fire may be only 0.5% per year. This probability may increase to 1% per year after 15 years without a treatment and 2% per year after 30 years without a treatment. This could be modeled using 3 “TSD” data lines containing the same disturbance type. These lines would have the TSD variables set to 0, 15, and 30 years and the annual probabilities set to 0.005, 0.005, and 1.0, respectively. **When using more than one “TSD” line for a single disturbance type and succession class note that the probabilities are additive.**

To hide the TSD information, select “Hide TSD cols” from the Display Menu.

When finished with all edits, click on the OK button to save all the changes to memory. This does *not* save the changes to the files (see Section 3.3 Saving Files). The “Cancel” button (or the ESC key) allows users to leave the screen and ignore all changes.

☛ All information about disturbances, except the probabilities, the ages to which they apply, and the TSD column information, is saved in the PVT file. This means that any changes that are made to disturbance agents, destinations, or relative ages will affect all scenarios associated with a specific PVT file. When the files are saved, only the current scenario file will contain the new disturbance information. If the changed disturbances are present in other scenario files, those files will need to be edited.

If the OK button is selected, the Status Box will change to Modified, even if no changes have been made.

### *Deleting disturbances*

Disturbances pathways can be removed from the Pathways Screen by deleting the letter of the destination class in the screen defining probabilities (Figure 4.7). The program will ask the user if the disturbance is meant to be deleted. If so, all cells will be emptied or zeroed but the row containing the pathway information will still be visible. The pathway will be removed from the diagram after the Pathways Screen is exited using the OK button. When the Pathways Screen is next entered for that class, one or more blank rows will appear at the top of the list of disturbances. These are placeholders for the deleted disturbances. They will not be saved to the PVT or scenario file, and when PVT file is next read, neither the disturbances nor their placeholders will be present.

An error message will occur if the cell contains a blank rather than being empty.

☛ Disturbances will not occur in a particular management region if the probability is zero. If the PVT file is used with several scenario files (see Figure 3.1), pathways should not be deleted unless they are never used in any of the scenario files associated with this PVT file. A pathway that is not used in a specific scenario should have all probabilities set to zero (but the relative age should not be altered since that is part of the PVT information, not the scenario information).

### *Adding disturbance pathways*

Disturbance pathways can be added in the Pathways Screen by clicking on the New Dist. button at the bottom of the screen. A new, empty row of boxes will appear on the last page of disturbance definitions. Enter the appropriate information into each box following the instructions listed above. The destination box and the agent box **must** be filled in. The remaining cells (disturbance probabilities, the minimum and maximum age to which they apply, and the relative age) may be left blank; blanks or empty cells are interpreted as a zero.

### *Viewing information about disturbance pathways entering a box*

The Pathways Screen shows, by default, all the pathways which originate in a class. The Display Menu at the top of the screen allows users to choose to view the disturbance pathways which lead **to** that class. This choice informs the user about the disturbances and their probabilities that move pixels into this class (Figure 4.10).

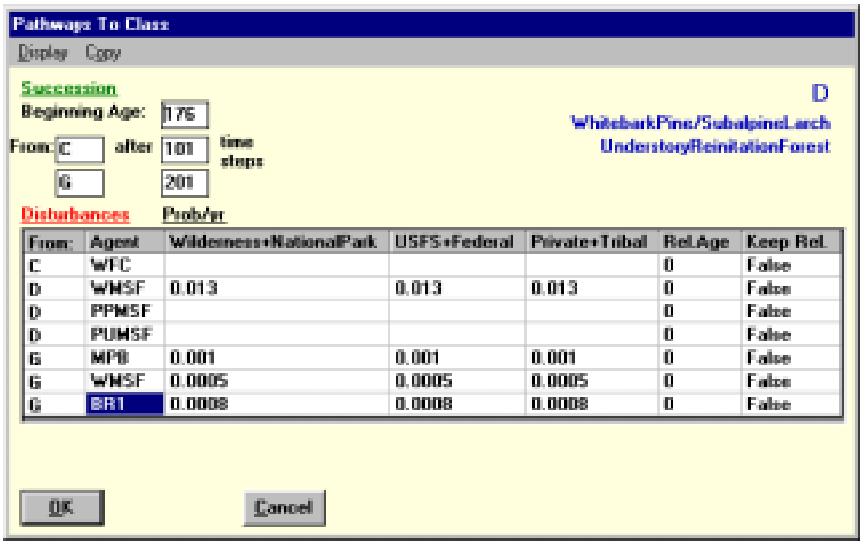



**Figure 4.10:** Screen showing the pathways going TO class D. Notice that two classes (C and G) go to D during succession.

The screen is essentially the same as the one showing the pathways **from** a class. The only differences are:

- More than one succession pathway can go to a single class, and each will be shown.
- The letters in the cells (both succession and disturbance) are now those of the *originating* class (the class *from* which the pathway started).
- New disturbance pathways cannot be added.

Other options, such as changing the disturbance agents, probabilities, or relative ages, or saving the information, can all be done as previously described for the "from" screen.

The Display Menu can be used again to return to the screen which shows all the pathways which leave the class. A message will appear warning the user that any changes that were made in this screen will be lost, and will give the user the option of saving the changes. Note that this warning message will appear even if no changes have been made.

### *Adding descriptors about pathways*

VDDT allows users, optionally, to record assumptions about the disturbance pathways and probabilities, the succession path, or the class ages. To use this feature, a text-type attribute must be defined (see Section 8.1). If a text-type attribute has been defined, the Display Menu will contain a option to "Show Text". Clicking on this item will cause a box to appear at the bottom of the screen, into which the descriptions can be typed. A new box appears for each of the following:

- the succession destination;
- the beginning age of the class;
- the ending age of the class; and
- each disturbance type.

General assumptions about the class can be recorded in the main attribute editing screen (see Section 8.1). This information is saved and loaded with attributes, not with the PVT or scenario files.

## 4.4 Changing Groups of Probabilities

Two methods exist for changing probabilities. The first is described in the previous section using the screen which shows all the pathways going to or from a particular class. In this screen, the probabilities for a particular agent in a single pathway may be changed. This is useful for choosing initial probabilities, setting probabilities which change for different classes, and for making subtle refinements to probabilities.

The second method allows users to change groups of probabilities by disturbance types and management regions. This is a useful feature for testing the sensitivity of the probabilities, or for exploring “what-if” scenarios (such as “what if fires were only half as frequent?”). This option can be accessed by selecting “Change probs for an agent” from the Run Model Menu. A window will appear with a grid containing all the disturbance groups (as defined in DISTGRP.TXT, see the Appendix) which contain at least one disturbance used in the current PVT. The grid also contains a column for listing these disturbance types and cells for entering the multipliers for one or more management regions. By default, no disturbance types and all management regions will be visible. The disturbance types are summarized for each disturbance group on the row containing the name of the disturbance group, and the management regions are summarized in a column labeled “All Regs” (Figure 4.11).

The first column of the grid contains a “+” to indicate that the group contains disturbance types. Clicking on the “+” will cause a list of those disturbance types to appear, allowing disturbance-specific multipliers to be added (Figure 4.12). To see all the disturbance types easily, select “Show All Disturbances” from the Grid Menu. To hide all visible disturbance types, either click on the cell in the first column that now shows a “-” or select “Hide All Disturbances” from the Grid Menu.

To toggle viewing of the individual management regions, select “Show Regions” or “Hide Regions” from the Grid Menu.

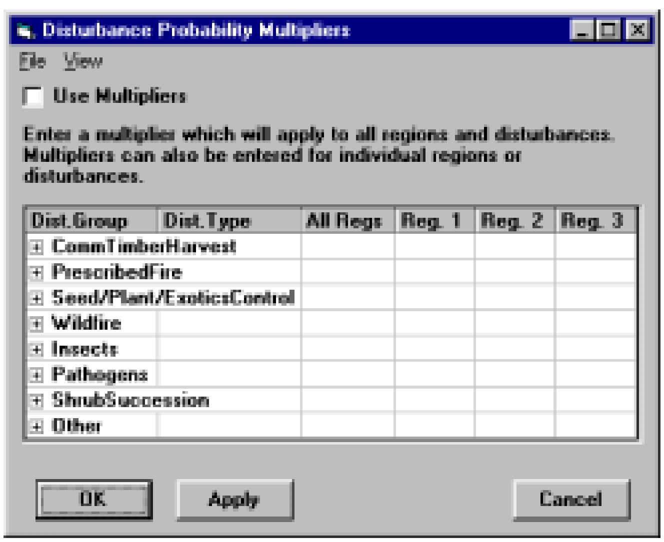



**Figure 4.11:** The window which allows users to enter a disturbance probability multiplier. Only those disturbance groups which are present in the current PVT are visible. The 1 is the default multiplier and, in this example, applies to all disturbance types and all regions.

Three buttons appear on this screen:

OK — Saves the multipliers in memory. These multipliers will be applied to the probabilities during a run if the “Use Multipliers” box at the top of the screen has been selected.

Apply Changes the disturbance probabilities according to the current multipliers. Once this button is clicked, the only ways to return to the original probabilities are to re-load the scenario file or to re-enter multipliers which are the inverse of the ones that were just applied.

Cancel Closes the screen without making any changes to the probabilities, and without remembering any of the multipliers.

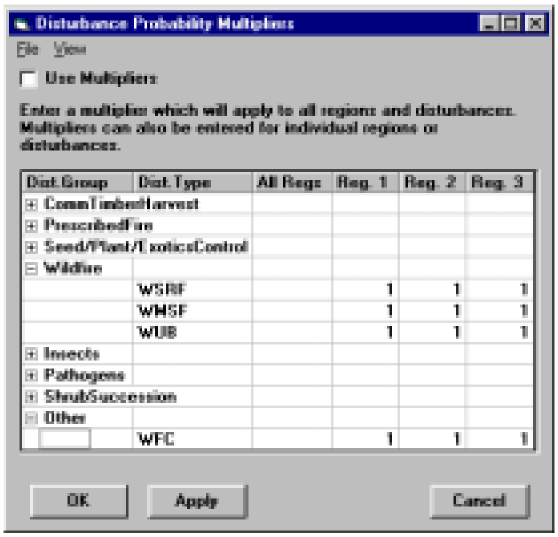



**Figure 4.12:** Disturbance probability multiplier screen with the disturbance group "Wildfire" expanded. Only three disturbance agents are part of this disturbance group and present in the current PVT. Notice that a 2 was entered in the "AllRegs" column next to the disturbance WMSF. This was then applied across all regions. Individual values were entered for WSRF and WUB.

The File Menu allows users to save the multipliers or to read multipliers from a file. This allows users to create a set of multipliers and to use them in different scenario files or PVTs. Multipliers are only saved for those disturbance agents which are present in the PVT. Thus, when saved multipliers are loaded for another PVT, it may be necessary to enter multipliers for those disturbance agents which were not present in the original PVT.

☛ Note that disturbances that are part of more than one group will be affected by the multiplier that is last entered for that disturbance type or group. For example,(to use the groups in the order they appear in Figures 4.11 and 4.12), suppose a disturbance was assigned to both the prescribed fire and the commercial timber harvest groups. If a multiplier of 1 was entered for the commercial timber harvest group and *then* a multiplier of 0.5 was entered for the prescribed fire group, the 0.5 multiplier would be used because it had been entered last.

The distribution of disturbances into disturbance groups can be defined by the user by editing the file DISTCODE.TXT, and disturbance groups can be defined in the file DISTGRP.TXT (see the Appendix for details).

## 4.5 Editing Diagrams

Class information may be changed, and classes may be added or removed from the PVT. The Diagram Menu lists the options for each activity, as described in more detail below.

### *Changing class definitions*

Class definitions (cover type and structural stage) can be changed as follows:

1. Choose "Edit a class" from the Diagram menu. A screen will appear which contains cells in which to enter the class letter, the cover type, and the structural stage.
2. Enter the letter of the class to be edited. The cover type and structural stage of that class will automatically appear in the appropriate cells (Figure 4.13).
3. Change the structural stage, cover type, or both by selecting from the drop-down list.
4. Click on the "OK" button (or hit the Enter key on the keyboard) to save the results or select the "Cancel" button (or the ESC key) to exit the screen without making any changes. The program will give a warning message if the cover type and structural stage combination is the same as an existing class, and a different cover type or structural stage must be chosen.

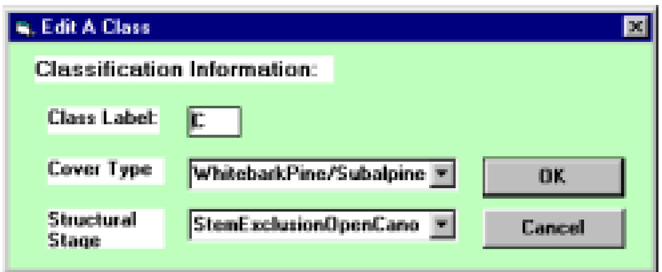



**Figure 4.13:** The window which allows users to change the cover type or structural stage of a class. In this example, the user entered a C as the class label, and the program automatically showed its cover type and structural stage.

The model will re-label the box with the new information.

### *Adding a class*

Classes are added in much the same manner that they are edited. A similar screen is used, but with some additional capabilities.

1. Choose "Add a class" from the Diagram Menu. A screen will appear with cells in which to enter the class cover type, and structural stage of the new class (Figure 4.14). A letter, which will be the assigned label of the new class, will appear in the first cell. This letter is the first letter of the alphabet that is not used in the diagram. Users cannot change this letter.

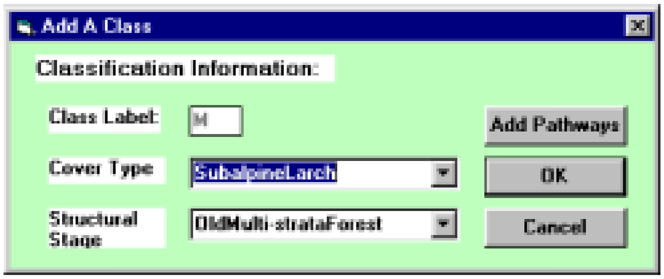



**Figure 4.14:** Window used to add a new class. The program will name the new class M, and the user must add the cover type and structural stage.

2. Enter the cover type and structural stage by selecting from the list.
3. Click on one of three buttons:
    - the "OK" button (or hit the Enter key on the keyboard) to save the results;
    - the "Add Pathways" button, to save the results and go directly to the Pathways Screen to add the succession pathway and disturbances which start in the new class; or
    - the "Cancel" button (or hit the ESC key) to exit the screen without making any changes.

    The program will give a warning message if the cover type and structural stage combination is the same as an existing class, and a different cover type or structural stage must be chosen.

If a new class is created without adding the pathways (i.e., the "OK" button was selected), it will be added to the Successional Pathway Diagram with no pathways. Pathways can be easily added by following the instructions in Section 4.3 Editing Pathways.

### *Copy a class*

New classes can be created by copying an existing class as follows:

1. Choose "Copy a class" from the Diagram menu. Enter the letter of the class to be copied. A screen will appear which contains cells with the new class letter, and the cover type, and the structural stage of the existing class.
2. Change the structural stage, cover type, or both by selecting from the valid options in the pull-down lists.
3. Click on the "OK" button (or hit the Enter key on the keyboard) to save the results or select the "Cancel" button (or the ESC key) to exit the screen without making any changes. The program will give a warning message if the cover type and structural stage combination is the same as an existing class, and a different cover type or structural stage must be chosen.

When a class is copied, all pathways and probabilities associated with the class are also copied, but attributes are not.

### *Deleting a class*

An entire class, and all the disturbances which leave from the class, can be removed from the PVT. To delete a class:

1. Select "Delete a class" from the Diagram Menu.

2. Enter the letter of the class to be deleted. The program will highlight all the pathways going to and from that class. If any of the pathways (disturbance or succession) lead to the class, the program will give a warning message stating that some pathways from another class need to have a new destination.
3. If the Pathways Screen appears, the cells that correspond to pathways going towards the deleted class will be highlighted. The destination on these pathways must be changed. Users may either enter a new destination (by entering a new letter in the cell) or may delete the pathway (by deleting the current letter).
4. Click on the "OK" button to leave the Pathways Screen. The diagram will redraw, with the new pathway destinations. There is no "Cancel" button, so as to ensure that all affected pathways are changed or deleted.

Steps 3 and 4 will be repeated for each class which contains a pathway whose destination is the deleted class. If no such pathways exist, the class will simply be deleted.

☛ A deleted class is not available for any of the scenario files associated with this PVT, thus classes should only be deleted if they are not present in any scenario file.

## 4.6 Creating New Diagrams

Users may create their own PVT file instead of using existing ones. This may be done using the techniques discussed earlier in this chapter for editing diagrams and pathways.

To start, select "New" from the File Menu. An empty diagram will appear and the program will then ask for a series of information (indicated in quote marks below).

1. "Enter a number and a name (separated by a space) that can be used as an external identifier. This information will be printed on the second line of the scenario file." This information is not used within the model, but the model does expect a number and a descriptor. These will be printed on the second line of the scenario file after that file has been created and saved. Since these are not used by VDDT, they can be used by the user to help document or identify the file.

   It is important that there is a space between the number and the name and no spaces within the name (see below for examples).

   The model provides default values of "0 NotUsed", for those users who do not need this information.

2. "Enter the number and name of the new PVT (separated by a space)."

   Enter the number and name of the new PVT, with a space between the number and the name, but no space within the name. For example:

   999 NewPVT

   but NOT:

   999 New PVT

   or

   999NewPVT

The number is used internally in the program to distinguish this PVT from any other PVT. Additionally, when scenario files or attribute files are loaded, the PVT number in those files is checked against the PVT number here. The number may also be used by any post-processing program (such as CRBSum or the Paradox Database) to distinguish this PVT from others. The name is used on the diagram and in the Status screen for users to identify which PVT is currently in use.

The model provides default values of “1” for the PVT number and “NewPVT” for the PVT name.

3. “How many management regions would you like to include? (minimum=1, maximum=6)”

   Enter the number of different regions which will be present in the scenario file (default number is 3). Regions allow the same PVT pathways to be used, but different probabilities may be assigned to the pathway in different regions.

4. “Enter the name of region *x* (with no spaces).”

   This prompt will cycle through the number of regions entered in Step 3 above, asking for the name of each region. The model will only use the name up to the first space, so be sure not to include spaces between words if the region has a multi-word name.

5. At this point, all the initial bookkeeping is done. Add new classes and pathways, as described in previous sections.

6. Save the new PVT and scenario file (under “Save files” (either new or old format) in the File Menu).

An alternative method for creating new PVT files is to edit the classes and pathways in an existing PVT file, and save the newly created PVT with a different name. This method has the advantage that management regions are already present and some pathways already exist, but has increased chance of introducing errors into the files.

The PVT name, PVT number, and management region names may be changed at any point after a file has been created. New management regions may also be added. Each of these options is available by selecting the appropriate item from the “Edit file information” in the File Menu. See Section 3.2 for more information.

## 4.7 Changing Locations

When a class is read from the PVT file, when a new class is created, or when the structural stage or cover type of a class is edited, VDDT determines the class’s location based on its succession pathway. In many cases, especially if there are few cover types, the resulting diagram is readable and usable. Some PVTs are complicated: using many cover types and classes. The resulting diagram in these cases may be quite difficult to read.

To change the locations of one or more classes in the diagram, select “Set Locations” from the Diagram Menu of the main VDDT window. You will be asked how many rows you wish to show in the diagram. The minimum possible number of rows is current number of rows showing. The Successional Pathway Diagram screen will redraw itself and show all the possible locations for classes (given the number of rows that was requested), the current class locations, and the succession pathways.

☞ Note that while many rows are possible, only eight (8) columns can be used. If some of the final columns are not used in the diagram, they will be hidden after all the locations are assigned.

To change the location of a class, click the class whose location is to be changed. Once it is highlighted, then click on the desired location. The class information will move to the new location. This can be done for as many classes as necessary, and classes can be moved more than once.

☞ The succession pathways are not redrawn. Since these are tied to the class and not to the class's location, their information is still correct, and they will be drawn properly after the location setting is done. [If the screen is resized, the pathways may be redrawn, but some of the information may be temporarily lost. The information will be restored after location setting is done.]

The menu item "Set Locations" now has a check-mark next to it. When all classes are in their desired location, simply select "Set Locations" again. The screen will redraw itself into the usual format.

VDDT retains the memory of the class locations. This means that once they have been set for a PVT, they will not need to be set again, unless new classes are added. The information is stored in a file with the extension *.LOC, and this file should be loaded after the PVT and scenario files have been loaded. The model will prompt for the appropriate filename.

# 5.0 Running the Model

VDDT simulates the dynamics of vegetation over time. It assumes that the area in a landscape is stratified into broad vegetation classes, each of which is described by a Successional Pathway Diagram. These diagrams contain definitions of all classes and the pathways between these, as described in the previous sections. To run the model users must therefore pick a diagram, scenario conditions, and a management region. Users then define the initial distribution of classes in the management region in the landscape, define the length of the simulation run, execute the model, and explore the results. The model has been designed as a tool for exploration and learning: repeated iterations of changing the assumptions (including the scenario, management region, and initial conditions) and analyzing the results are easily performed.

## 5.1 Initial Conditions

The model simulates the dynamics of a number of cells or pixels, each of which is assigned one of the classes defined in the PVT. Users must tell the model how to distribute the pixels between classes, and define the total number of pixels to simulate. To do this, click on “Edit initial conditions” in the Run Model menu. A window will appear which allows users to set the initial proportion of pixels in each class, the number of pixels to simulate (Figure 5.1), and the area represented by this PVT.

The first line allows users to set the number of pixels to use in the simulation, and shows the current number of pixels (default 100). Users can change this to be the desired number of pixels (minimum 10, maximum 10,000). Large numbers of pixels make the model slower, but less dependent on the choice of random number. Hence, the random variation in results between successive runs will decrease with increasing number of pixels.

The total area represented by the PVT is also set in the first line. The area can be any value greater than 0 (default 100). Area affects only the value of calculated and numerical attributes (Section 8.1), and each pixel has the same area. VDDT does not do any translation of units, thus it is up to the user to ensure that the units are consistent between the attributes and the area. The area value can also be read from a file (see item 5 below).

The remainder of the window is devoted to setting the proportion of the total number of pixels which is initially assigned to each class. This is done in a grid containing cells of various colors. The colors are to indicate the different types of information. The cells come in four colors:

- Yellow: Proportion of the pixels that are in the class indicated by the green cell to the right.
- Green: Class letter identifier for the yellow cell on the left. Not editable.
- Blue: Total proportion of the pixels that belong in the specified row and column. The blue cell at the bottom right corner of the grid should equal 1. Not editable.
- White: Non-editable areas.

The classes in the grid are organized in the same manner as the classes in the SPD (Figure 5.1). The cells can be resized to make it easier to see the entire number, and the grid can be scrolled to view or edit the initial conditions for classes that do not fit on the screen.

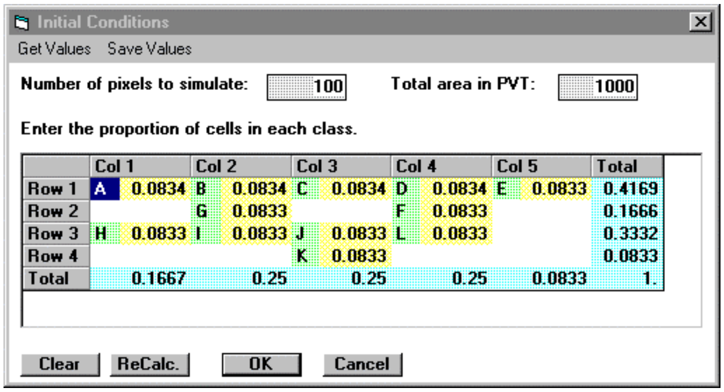



**Figure 5.1:** Initial conditions window. The class letters from the SPD diagram in Figure 4.1 are repeated in the green cells, with each class in the same location as in the diagram. The final row and column, shown in blue, give the row and column totals. The yellow cells give the proportion of the pixels that are in the class listed in green. This initial condition was created using the "ReCalc" button. to distribute the proportion evenly across all pixels.

Users must enter values in the cells before the model will run. This can be done using different methods:

1. To distribute pixels evenly across the classes (as in Figure 5.1):
   - Make sure all cells are empty or have the same number.
   - Click on the "ReCalc" button on the screen.
2. To put all the pixels in one class:
   - Enter a "1" in the cell corresponding to the class.
   - Make sure all other cells are empty or contain a zero.
3. To distribute the pixels in some known pattern:
   - Enter the numbers in the cells either as a proportion or as an absolute number. For example, if classes A, B, and D are to have twice as much area as classes C, E, and F, then enter (in alphabetical order): 2, 2, 1, 2, 1, 1.
   - If the sum of the cells totals is not equal to 1, then click on the "ReCalc" button on the screen. This normalizes the proportions in all cells such that they sum to 1.
4. To use the ending conditions from the previous model simulation that is still in memory:
   - Select "Use Ending Conditions" from the Get Values menu.
5. To use conditions from an existing file (such as initial conditions files or final conditions files written by the model; see the Appendix for file format):
   - Select "Read From File" from the Get Values menu.
   - If the total is not 1, click the "ReCalc" button.

   The file can contain information about the proportion or amount of the landscape that is within a class, within a given age range, and with a given "time-since-disturbance". It also can contain the total area being simulated.

☞ When the file is read, ages that are less than the beginning age of the class are set to the beginning age of the class. Ages that are greater than the maximum age of the class will be set to the maximum age of the class.

- ☛ Currently, if a file is read and then the proportions are edited (other than by the “ReCalc” button), original ratios between the ages will be retained. For example, suppose a file was read in which class A contained 5% of the pixels in ages 1-10, 10% in ages 21-30 and 5% in ages 31-40, for a total of 20% of the pixels. Some editing is done and the proportion of pixels in class A is reassigned to be 40%. The original ratios are retained. So, now 10% of the pixels are ages 1-10, 20% are 21-30, and 10% are 31-40.

The values currently displayed in these cells can be saved to a file by selecting “Save Values” from the Save Values menu.

The current display can be erased by selecting the “Clear” button.

To exit the screen either select “OK” to save the values or “Cancel” to ignore any changes.

If a project file is used (see Section 3.1), initial conditions can be loaded automatically without entering the Initial Conditions window. The status bar along the bottom of the main VDDT window will show whether or not initial conditions have been assigned.

If no initial conditions have been assigned, the model will prompt the user to enter initial conditions before running.

## 5.2 Selecting a Management Region

Scenario files can contain probabilities for more than one management region. The Status window (normally in the bottom right corner of the screen, Figure 4.3) lists the current management region. If no region is listed, users must choose a management region by selecting “Select Management Region” from the Run Model menu, clicking on the region of choice from the list of available regions, and then clicking on the OK button (Figure 5.2).

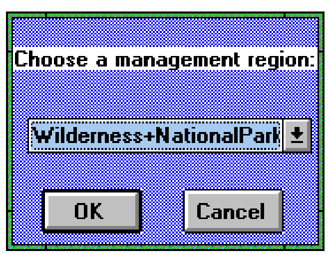



**Figure 5.2:** Screen used for selecting a management region. Click on the down-facing arrow to see the list of available management regions.

The screen defining probabilities (Figure 4.7) just uses numbers for the management regions. Thus, each column of probabilities corresponds to one of the management regions. The regions are numbered in the order they appear in the scenario file, which is the order displayed in the pull down menu in Figure 5.2.

Names of the management regions are defined in the scenario file and can be changed by the user (see Section 4.6).

## 5.3 Time Definitions

By default, the model simulates one 300-year iteration, with a random number seed of 1. Users can change any of these values by selecting “Time definitions” from the Run Model menu.

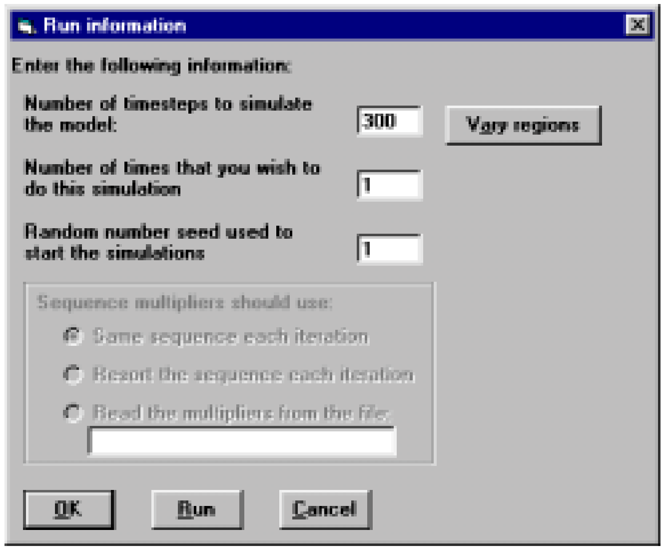



**Figure 5.3:** Time definitions window, showing the default number of years, iterations, and random number seed. Notice that the model can be run from this window by pressing the Run button at the bottom of the screen.

Users can run the model for any number of years between 1 and 1000, and any number of Monte Carlo iterations (see below for details).

To run the model for longer than 1000 years, the maximum time possible, run the model for 1000 years, then ask the model to use the ending conditions to start the next run (see Section 5.1, option 4). Note, however, that the results will only show the last run.

To exit the window, select one of the three buttons at the bottom of the screen:

| | |
|---|---|
| Cancel | Do not save any changes. |
| OK | Save the values. |
| Run | Save the values and run the model. |

### *Running multiple management regions*

Management regions are just collections of probabilities. While these may represent different management regions, they may also represent different management *regimes* in time, such as past and present fire suppression policies. The current version of VDDT allows users to ask the model to run one management region for a number of years, and then switch to a different management region in order to use different probabilities.

To do this:

1. Click the “Vary Regions” button next to the cell for entering the total number of years. A small grid appears.
2. Select a management region from the drop-down list in the first column, and enter the number of years to simulate that region in the second column.
3. Hit the “Enter” button *twice* on the keyboard to add another row to this table.
4. Repeat steps 1-3 for each management region to simulate in order. The same management region may appear multiple times on the list.

If this “batch run” information has already been defined for more than one region, the grid will automatically appear when entering this window.

This information will be saved to the project file.

### *Running multiple Monte Carlo simulations*

A single model run may consist of many iterations or Monte Carlo simulations. Each run starts with a random number seed. Runs starting with the same seed will produce the same results.

The random number seed can be any value from 0 to 1, inclusive. If Monte Carlo iterations have previously been done, a list of the random number seeds from each of the simulations will appear. Thus, a single Monte Carlo run may be repeated by starting a run with the given random number seed.

If using annual disturbance multipliers when doing a run, see Section 8.2 for details about additional options.

## 5.4 Selecting a Time-Since-Disturbance Group

Some disturbances may be defined relative to the amount of time since another disturbance has occurred (Section 4.3). For this option to be activated, users must select a disturbance group for which the accounting is done. For example, if a stand-replacing wildfire is to occur only if it has been at least 40 years since the last underburn, users must pick the disturbance group that contains underburns as the time-since-disturbance (TSD) group.

To do this, pick “Select TSD Group” from the Run Model Menu. A familiar screen will appear containing all the disturbance groups, including the group “None”. Selecting the group “None” will turn off the TSD accounting, while selecting any other group will activate it. Note that if “None” is selected, a warning will appear when starting a model run.

☛ If the TSD accounting is turned off, the disturbance acts like any other disturbance.

## 5.5 Disabling Disturbances

At times, users may wish to run the model without some of the disturbances (e.g., in the absence of any management) or with only a particular disturbance (e.g., with fire only). To do this, select “Disable some disturbances” from the Run Model menu. The disturbance groups are listed, and are turned off by clicking on the box to the right of their name (Figure 5.4). The “OK” button saves the selection while the “Cancel” button (or ESC key) leaves the window without making any changes. The selected disturbances are still present and, although they will not be simulated by the model, the information will be saved in the scenario and PVT files.

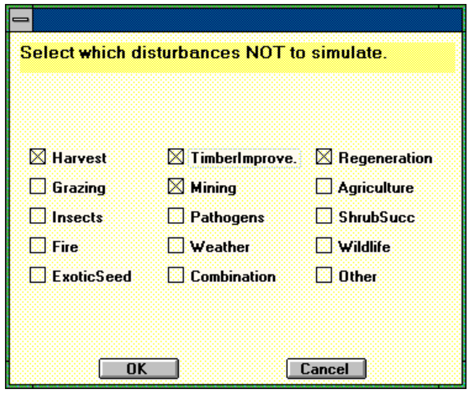



**Figure 5.4:** Screen used to turn off disturbance groups before simulating a specific scenario. In this example, harvest, regeneration, timber stand improvements, and mining have all been disabled.

If a disturbance is part of more than one disturbance group, it will not occur if any of those groups are disabled. For example, a disturbance which is "pine beetle and wildfire" and which is a member of the three groups fire, insects and combination, will not occur if any one of these three groups is turned off for the simulation. Note that the distribution of disturbances into disturbance groups can be defined by the user by editing the file DISTCODE.TXT, and disturbance groups can be defined in the file DISTGRP.TXT (see the Appendix for details).

## 5.6 Printing During a Run

The model produces summary information about runs and multiple iterations, which can be viewed and saved at the end of a simulation (see Sections 6 and 7). To get more information about a run, some detailed information can be generated and saved during the run. The model can produce up to three output files: transitions, classes, or disturbances. The information in each file is printed in every year and iteration of the simulation.

To request one or more of these files, click on the appropriate option in the sub-menu under "Print (during a simulation)" on the Run Model Menu. When the option is on, a check-mark (✓) appear next to the sub-menu item. The model will ask for a filename before writing each file. This additionally reminds the user that the option is on. With no check-mark, of if "Cancel" is selected instead of a filename, the model will not print the file.

### *Transitions*

The transition file shows the details of *every* transition that occurs during the model simulation, including succession and those disturbances in which the pixel does not actually change class but the relative age has been modified. For simulations with a large number of timesteps, multiple iterations, large numbers of pixels, or high probabilities of transitions, this file can become quite large. The file structure is shown in the Appendix.

### *Classes and Disturbances*

The file containing the classes summarizes the percent of pixels that are in each class in each timestep and iteration, while the file containing the disturbances shows the percent of pixels in the landscape that were affected by a particular disturbance group. See the Results file section in the Appendix, for more details about the file structure.

## 5.7 Running the Model

Once all decisions are made about the management region to be used, the initial conditions, the number of years that the model will simulate, and other options (disabling some disturbances and printing the transitions to a file), the model is ready to start the simulation. The model can be started from the menu (select “Run” from the Run Model Menu) or from the screen in which the times are set (Figure 5.3). In either case, the model will first check to ensure that initial conditions are present and that a management region has been selected.

For each time step and pixel, the model draws a random number which is used to decide if the pixel is affected by a given disturbance. Unless specified by the user, all runs start with the same random number, thus ensuring that all differences between runs are solely a result of changes in assumptions, not randomness.

☛ It is highly recommended that runs are done using multiple Monte Carlo iterations, each of which will start with a different random number seed.

## 5.8 Simulating a Sequence of Scenarios

Users may wish to explore how the landscape changes with changing disturbance regimes. This can be done by using different scenario files at different points in time. A sequence of runs could simulate, for example, 300 years of historic conditions, 100 years of current conditions, and another 300 years of a future scenario.

If all the information for these different conditions is in different management regions in the same file, the run may be done by selecting each management region in order and setting the number of years for which to simulate it (see Section 5.3 for more details). The advantage of this approach is that the complete run can be viewed at once, and the model will easily calculate the statistics over multiple Monte Carlo simulations.

The second approach can be used if the information about the various conditions is in separate scenario files. In this case:

1. Load the first, historic, scenario file, and follow the instructions for running the model (Sections 5.1 - 5.4). Choose to run the model for 300 years.
2. Run the model.
3. Save the ending conditions to a file (Section 6.3).
4. Load the next scenario file.
5. From the Initial Conditions screen (Figure 5.1), select “Read from file” from the Get Values menu, and enter the name of the file saved in Step 3. Note that the option “Use ending values” cannot be used in this case because loading the new scenario file has erased the ending conditions from memory.
6. From the Time Definitions screen (Figure 5.3), choose to run the model for 100 years or any desired number of years.

7. Select the appropriate management region (Section 5.2).
8. Repeat Steps 2-7 for the next scenario file.

The results can only be viewed for the current scenario file, but if the results are all saved to a file (Section 6.3), other graphical or statistical programs will be able to show the results for the entire time period. See the next section for more information about viewing and saving results.

# 6.0 Results

## 6.1 Types of Graphs

The easiest way to view the model results is to look at graphs. Two general types of graphs are available in VDDT: bar graphs and graphs over time. Changes in the distribution of classes, cover types, structural stages, or the occurrence of disturbances can be viewed using either bar graphs or time graphs. Other bar graphs include level/group attributes and value attributes, while other time graphs include numerical attributes and calculated attributes. In all cases, the model will show up to four graphs at any time.

### *Bar Graphs*

Bar graphs can be shown for several different groupings, listed either under the "Bar" option or the "Attribute" option on the Results Menu. Each graph shows the percentage of pixels in the given conditions at a particular point in time. The times that are shown are given in the Time Definitions Screen (found under "Time Definitions" in the Run Menu). Different display times can be selected after a run has been executed (see Section 6.2)

- *Class*
  Each bar in the graph represents a different class. Bars are labeled according to the letter of the class (Figure 6.1).

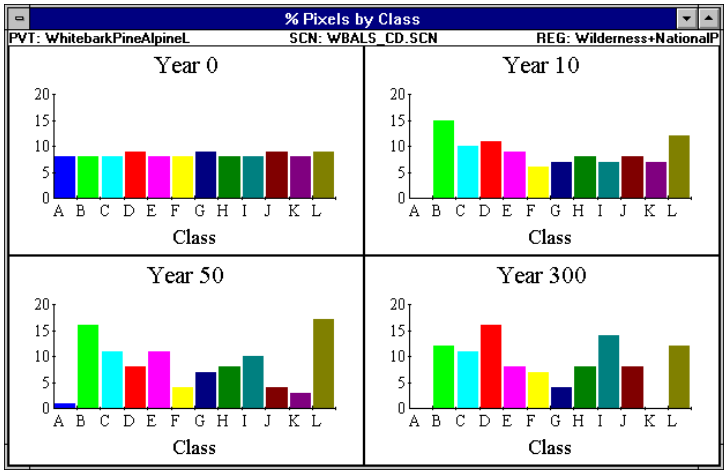



**Figure 6.1:** Graph of the results by class. The y-axis shows the percent of pixels in each class. Labels correspond to the classes in the SPD (Figure 4.1).

- *Cover type*
  Each bar in the graph represents a different cover type (Figure 6.2), and may combine information from several classes. Bars are labeled with the cover type number or with a short code (such as DF for Douglas-fir). Each of the shrub types will be given a separate bar if their cover types are different.

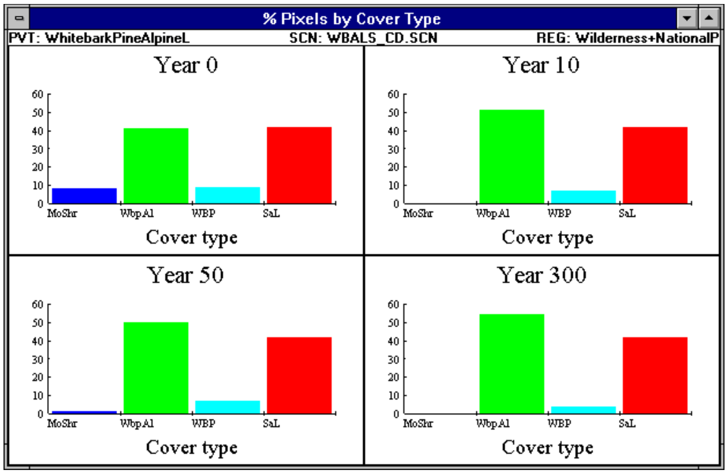



**Figure 6.2:** Graph of the results by cover type. The y-axis shows the percent of pixels in each class.

- *Structural stage*

  Each bar represents a different structural stage, and may combine information from several cover types. Bars are labeled with the number of the structural stage (Figure 6.3).

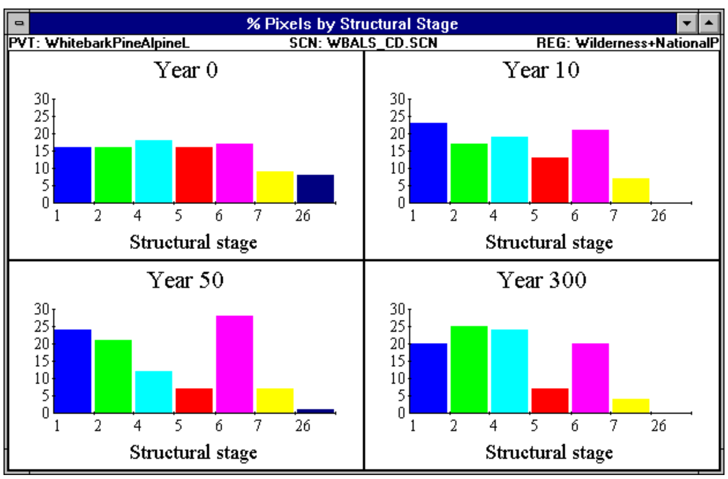



**Figure 6.3:** Graph of the results by structural stage. The y-axis shows the percent of pixels in each structural stage.

- *Disturbance type*

  Each bar shows the proportion of pixels that were disturbed by different groups of disturbance agents, or by succession (Figure 6.4). Users can choose whether they want to view the cumulative average distribution of disturbances, the ten-year average, or just the selected year. For example, the graph of year 50 can show the average disturbances from year 1 to 50, the average of the last 10 years (years 41 to 50), or just the disturbances that occurred that year (year 50).

  The graph of year 0 will always be empty because no disturbances can occur before the model starts its simulation. To avoid showing the empty graph, VDDT will show year 1 instead of year 0 (even if year 0 had been requested).

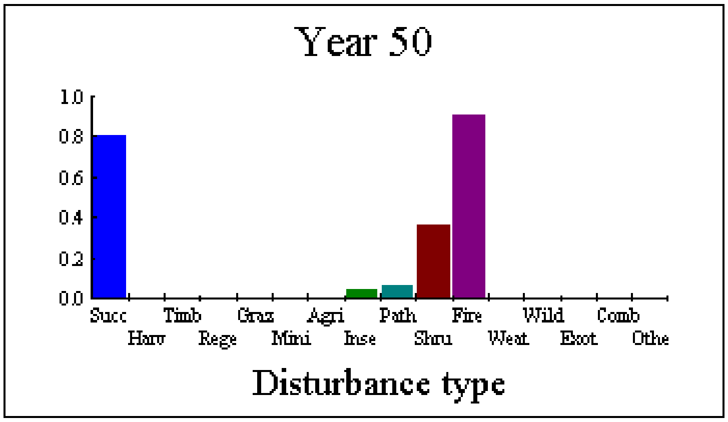



**Figure 6.4:** Example graph of the results by disturbance. Only one graph of the four graphs is shown here. The y-axis shows the percent of pixels that were affected by each disturbance group.

☛ In some cases, a disturbance may be part of more than one disturbance group. For example, a disturbance defined as an “underburn and thin” may be assigned to the “thinning” group, the “fire” group and the “combined” group. If a pixel is disturbed by a disturbance of this type, the pixel will appear as affected in each of the three disturbance groups.

- *Level/group attribute*

  Each bar shows the proportion of all pixels that are in each level or group at the selected times (Figure 6.5). Note that any classes that did not have a level assigned will not be included in the graph.

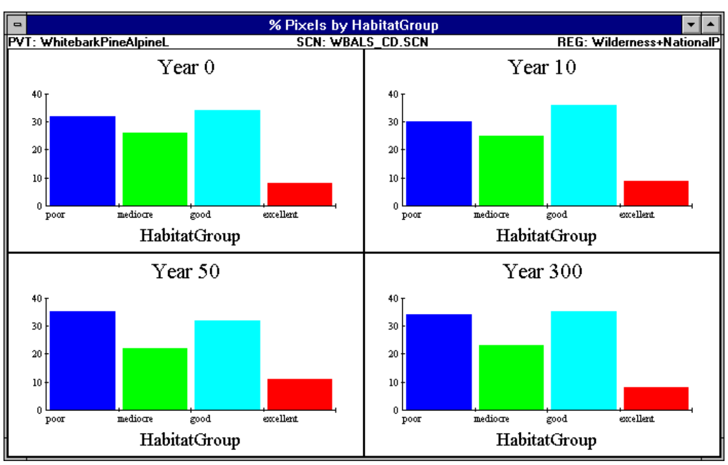



**Figure 6.5:** Graph of the results by one of the group type attributes. As in the other bar graphs, the y-axis shows the percent of pixels assigned to each level.

This option is only available if “level” or “group” type attributes have been assigned to various classes (either by loading an attribute file or by assigning values within VDDT). The user is asked to choose which attribute to graph, if there is more than one available option.

- *Value attributes*

  Several options are available for graphing the numerical attributes:

  1) *By value*

  Each class has been assigned some numerical value. The user can define breakpoints for graphing these values, or may use the values as individual classes (as in the level/group option above). For example, if the numerical values range from 1 to 20, the user may choose to graph the results in equally spaced intervals of 5 (1-5, 6-10, etc). The upper bound of each range is entered into a pop-up screen (e.g., 5, 10, etc.).

  The resulting graph will show the proportion of pixels in each value category at the selected times (Figure 6.6).

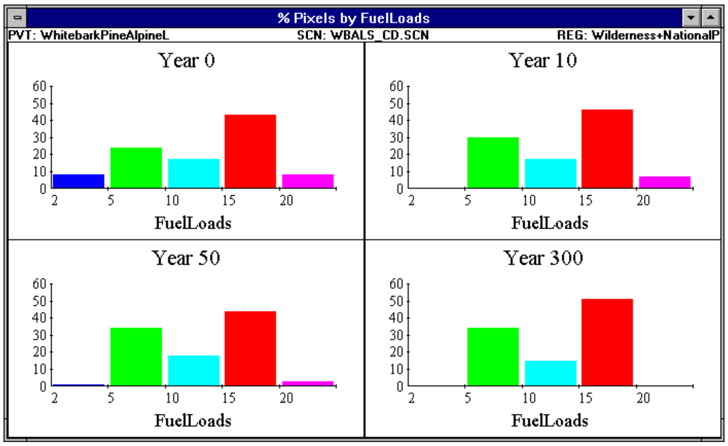



**Figure 6.6:** Graph of the results by one of the numerical type attributes. In this example, the values ranged from 0 to 20 and the user asked the model to divide the pixels up into groups with upper bounds of 2, 5, 10, 15, and 20. As in the other bar graphs, the y-axis shows the percent of pixels assigned to each level.

  2) *By class, structural stage or cover type.*

  The x-axis of the graph will show the appropriate grouping (i.e., class, structural stage or cover type). Unlike other graphs, however, the y-axis will a value, not a percent pixels. The y-axis will show the value per unit area (Figure 6.7). Thus, the graph is independent of the number of pixels being shown or the amount of area being simulated.

These value options are only available if “numerical” type attributes have been assigned to various classes (either by loading an attribute file or by assigning values within VDDT). The user will be asked to choose which attribute to graph, if there is more than one available option.

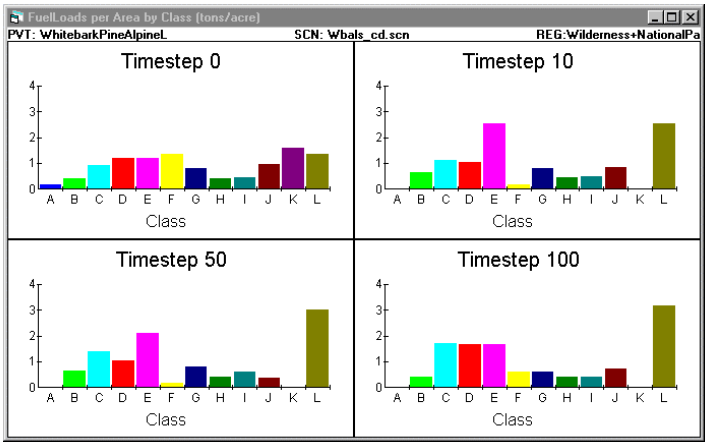



**Figure 6.7:** Graph of the numerical results by class. Note that the y-axis represents the numerical value per unit area in each class, and is independent of the number of pixels or the amount of area being simulated.

### *Time Graphs*

VDDT can show several different types of graphs over time: the pattern of disturbances, the percentage of pixels in a given class, cover type, structural stage, or with a given type of level/group attribute, and the total value of numerical or calculated attributes.

- *Disturbance*

  This shows the percentage of pixels that were disturbed in each time step (selected via the "Disturbance" item in the Time sub-menu). A window will appear with a list of all the disturbance groups, including succession (Figure 6.8). Only those disturbance which have occurred at least once during the simulation period can be selected. All others will be disabled. Users may select up to four items to be graphed. (Items are selected or deselected by clicking on the box to the left of the name.) If more than four items are chosen, only the first four will be shown.

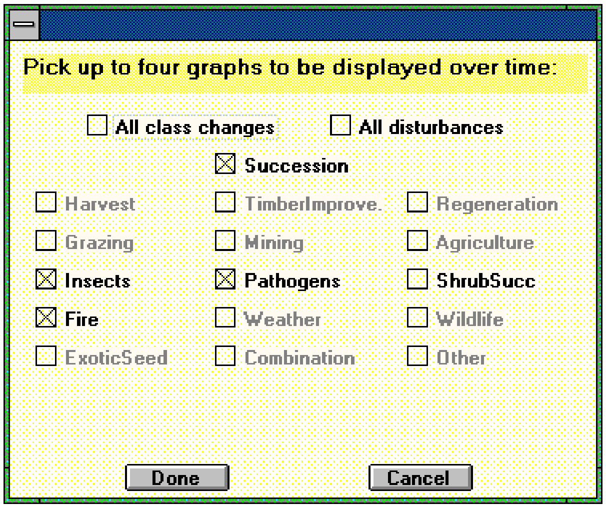



**Figure 6.8:** Screen for selecting the graphs to view over time. In this example, disturbances occurred in only four of the disturbance groups: Insects, Pathogens, ShrubSucc, and Fire. All other groups are disabled. In this example, succession, insects, fire, and pathogens were chosen for graphing.

The graphs show the actual percentage of pixels which were disturbed in each time step (Figure 6.9). The pattern shown in the results depends in part on the number of pixels being simulated. The model is stochastic, which means that the line will not be smooth. Larger numbers of pixels, however, mean that there is a higher probability of some pixel being disturbed, and the line may become smoother (i.e., the variation between years decreases). Also, the larger numbers of pixels means that the peaks shown in the graphs may be less conspicuous. When few pixels are being simulated, if a pixel is disturbed, it represents a large percentage of the total. For example, if 100 pixels are simulated, each pixel is 1% of the total (Insect Graph, Figure 6.9). When 1000 pixels are simulated, each pixel is 0.1% of the total.

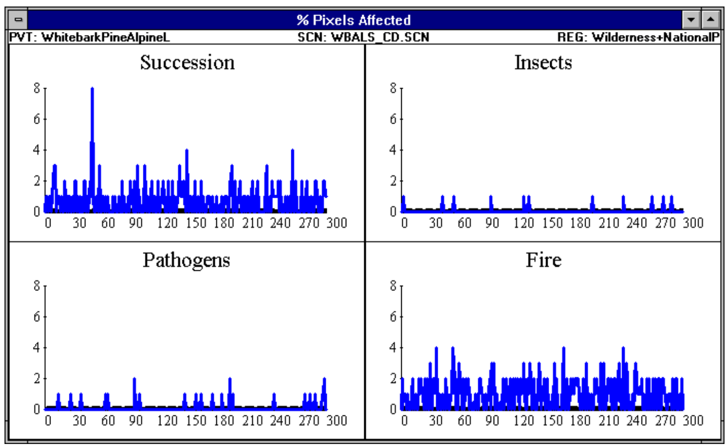



**Figure 6.9:** Graph of the percent of the pixels affected by the given cause over time.

- *Class*

  This type of graph allows users to view the proportion of pixels in any given class over time. When “Class” is selected from the Time sub-menu, a screen will pop-up asking users to enter the letter of the each class to display in the graph (Figure 6.10). These letters must be separated by a comma. If more than four classes are entered, only the first four will be shown. Uppercase or lowercase letters may be used. The four graphs will be shown in the order the letters were entered in the screen (Figure 6.11).

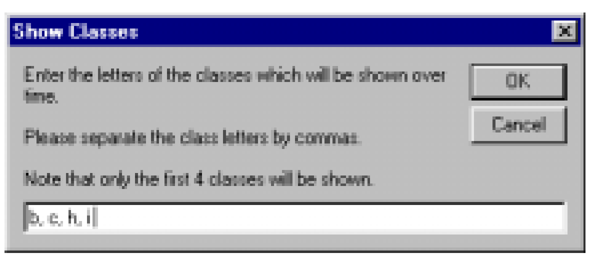



**Figure 6.10:** “Pop-up” screen allowing users to enter letters of the classes to display. Notice that the letters must be separated by a comma, and that they can be entered in lowercase.

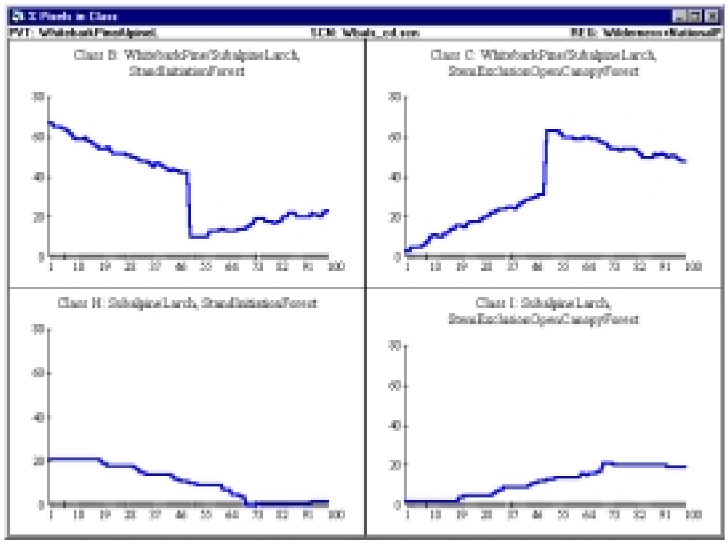


**Figure 6.11:** Graphs of four classes over time. Classes shown are those entered into the screen in Figure 6.10.

- *Cover type*

  Cover type graphs show the proportion of pixels in any given cover type over time. When “Cover Type” is selected from the Time sub-menu, a screen will appear in which users can select, from a list, up to four cover types to be graphed (Figure 6.12). If more than four cover types are selected, only the first four will be shown. The graphs will resemble those in Figure 6.11, except each graph will represent a different cover type.

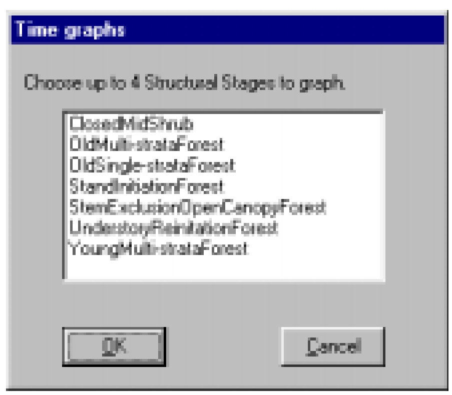



**Figure 6.12:** Window for picking the cover type or structural stage to be graphed. The caption identifies which items are in the list. Users may pick up to four items.

- *Structural stage*

  These graphs show the proportion of pixels in any given structural stage over time. When “Structural Stage” is selected from the Time sub-menu, a screen will a screen will appear in which users can select, from a list, up to four structural stages to be graphed (Figure 6.12). If more than four structural stages are selected, only the first four will be shown. The graphs will resemble those in Figure 6.11, except each graph will represent a different structural stage.

- *Level/group attribute*

  These graphs show the proportion of pixels in a specific value of a single level/group-type attribute. When Level/Group and then Time graph is selected from the Attributes sub-menu of the Results menu, a screen appears with all the level/group type attributes. After picking one of the attributes, a second screen will appear (similar to Figure 6.12) listing all the defined groupings. Up to four items can be picked from this list. If more than four are selected, only the first four will be shown. The graphs will resemble those in Figure 6.11, except each graph will represent a different value from the chosen attribute.

- *Numerical attributes (total or average)*

  These graphs show the value of some numerical attribute over time. The value can be viewed as either the total value in the landscape, i.e., the sum of the attribute over all the pixels in the landscape (Figure 6.13), or the average value in the landscape. Up to four numerical attributes may be shown. Graphs of the total value in the landscape are sensitive to the size of the landscape that is being simulated. Larger landscapes will have higher total values, all else being equal. Neither option is dependent on the number of pixels being simulated.

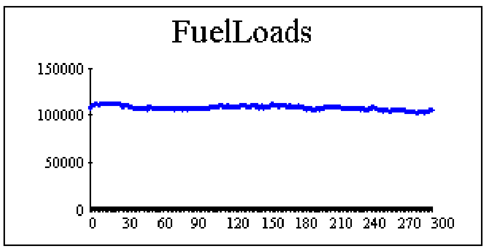



**Figure 6.13:** Graph of the total value of an attribute over time. The graph of only one attribute is shown here. The y-axis shows the sum of the value of the attribute for all pixels. In this example, the fuel load values assigned to each class were very similar so the overall value changes little.

- *Calculated attributes*

  This type shows the results of the calculated attributes, i.e., those that depend on a disturbance to occur. These can be viewed in three ways:

  1. Totals over time: the total value of the attribute in the landscape, e.g., the total amount of smoke emissions each year.
  2. Average (total area): the value of the attribute, averaged over the entire landscape, e.g., the average amount of smoke emission per year per unit area.
  3. Average (affected area): the value of the attribute, averaged over the areas upon which this attribute was calculated, e.g., the average amount of smoke emissions per unit area burned.

Note that for these attributes it is important that the values used in the calculation are based on the same area units as the area defined in the initial conditions screen.

## 6.2 Graph Options

A number of options are available to users to help increase the flexibility of the graphic display. These options are all found under "Graph Options" in the Results Menu. They include: changing the y-axis scale of the graphs, changing the years that are visible (for bar graphs or time graphs), and deciding whether single run or summary statistics will be shown in the graph. Each of these options is described more fully below.

### *Scale*

The four graphs can either be displayed with the same y-axis values or independent y-axis values. Users can choose the appropriate option by clicking on "Same scale" under the "Graph Options" in the Results Menu. If there is a check mark (✓) next to the option, the graphs will be on the same scale, while if there is no check mark, the graphs may use different scales. Any visible graphs will need to be reselected before the option is applied.

### *Time*

By default, the graphs over time display the full simulation period, and bar graphs are shown at years 0, 10, 50, and the last year. These values can be changed in the window that appears after choosing "Graphing years" from the Graph Options item of the Results Menu.

This window (Figure 6.14) allows users to select the starting and ending years for time-based graphs, and the four years to be displayed in bar graphs. Years greater than the last year of the simulation will automatically be changed to the last year of the simulation (without warning). Any visible graphs will need to be re-selected before the option is applied. Unlike previous versions of VDDT, changes in these times will not affect future simulations.

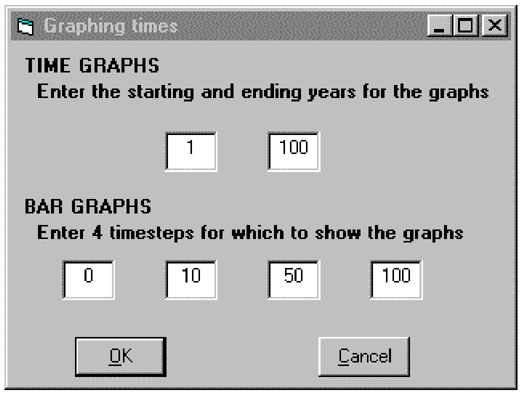



**Figure 6.14:** Window for changing the times displayed in bar and time graphs.

### *Display*

When multiple Monte Carlo iterations are simulated, VDDT automatically creates some summary information about the run. Users can now view this summary information as well as the results of a single run. The three summary options found under the "Graph Options" item of the Results Menu are:

1. Show avg, min, max

   *Line graphs:* This shows a line for the average of the iterations, as well as for the maximum and minimum value over all iterations in the given year (Figure 6.15).

   *Bar graphs:* A point shows the average of the iterations, and a vertical line indicates the range of the values (Figure 6.16).

2. Show avg. & std

   Users are asked for the number of standard deviations to be shown (any number greater than 0).

   *Line graphs:* This shows three lines: average, average + *n* standard deviations, and average - *n* standard deviations (with a minimum value of 0).

   *Bar graphs:* A point shows the average of the iterations, and a vertical line extends from the average - *n* standard deviations (with a minimum value of 0) to the average + *n* standard deviations.

3. Show central tendency

*Line graphs:* This shows three lines: average, average + 0.25*maximum value, and average - 0.25*minimum.

*Bar graphs:* A point shows the average of the iterations, and a vertical line extends from the average - 0.25*minimum to the average + 0.25*maximum.

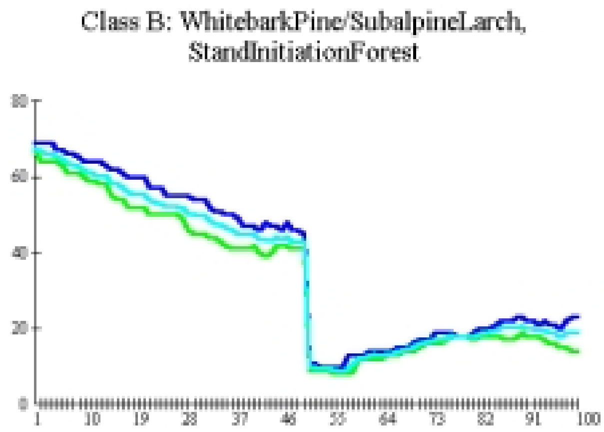



**Figure 6.15:** Example summary line graph. In this example, the lines show the average, minimum and maximum values. Other summary line graphs look similar, but have slightly different meanings for the upper and lower lines.

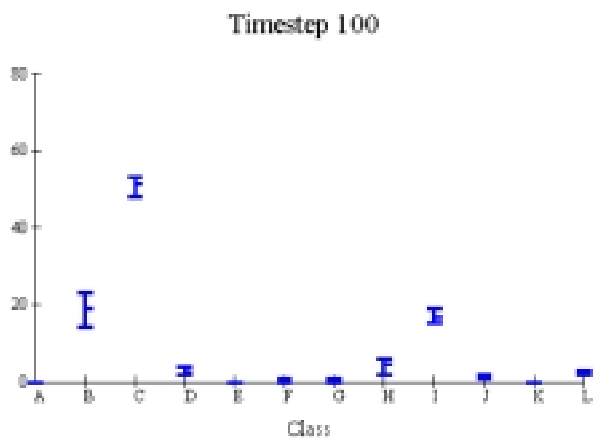



**Figure 6.16:** Example summary bar graph. In this example, the bottom of the line indicates the minimum value, the top of the line shows the maximum value, and the point on the line shows the average value. Other summary bar graphs look similar, but have slightly different meanings for the top and the bottom of the lines.

A check-mark will appear next to one of the items if it is selected. To show the results of the first iteration (default), none of the three options should be selected.

As with the other graphing options, any visible graphs must be re-selected for the option to take effect.

☛ Summary graphs of numerical attributes by structural stage or by value are not available. If this type of graph is requested, the model will issue a warning and only show the results of a single run.

# 7.0 Printing

## 7.1 Printing Diagrams

To print the SPD, select “Print Diagram” from the Diagram menu. The program will maximize the window, change the background of all the boxes to white, and redraw the lines using the currently selected disturbances. This is the diagram as it will be printed. To print different pathways (e.g., all the pathways to or from a class), maximize the window first, then ask it to draw the pathways of interest, then select “Print Diagram”. After printing, the program will send the window back to “normal” size (even if the user had maximized it first).

☛ Note that diagrams printed from a high resolution screen may not fit on a portrait page. If this is a problem, set the default printer settings to landscape.

The program will send the file to the Windows default printer. If the printer is a color printer, the pathways may print in color. The SPD window title (which defines the current PVT) will not be printed, but a small label giving the name of the current PVT (as defined in the Status Window) will be printed in the bottom right corner of the page.

Large diagrams that do not fit on a single screen will be printed in multiple pages. Note that the last printed page may contain lines of overlap with the previous pages. Each page will be labeled with the name of the current PVT.

## 7.2 Printing Graphs

Graphs cannot be printed until the model has been run and the user has looked at one or more graphs of the results. In the Results menu, select “Print” and then “Graphs”. The program will maximize the current graph window, and print the current graph to the Windows default printer. Graphs will always print in black and white, and the graph window title (which identifies the current graph) will not be printed

## 7.3 Printing To A File

Most of the information in the model is saved in external ASCII text files. Each section in the document describes how to read and save the files that contain the relevant information for that part of the model. Other information can be generated by the model to provide output for subsequent processing in graphical or statistical programs, but which will not be used further by the model. These files include:

- the probabilities;
- the final conditions of a run;
- the summarized results by different categories;
- the results by class or disturbance type during a run (Section 5.5); and
- all transitions that occurred (Section 5.5).

A description of how to create the results during a run (class, disturbances and transitions) is given in an earlier section. Methods for creating the remaining ASCII files are presented in the following sections.

### *Probability file*

The probability file is an ASCII file which combines most of the information in the PVT and scenario files into a new file which may be used for examining the pathways and probabilities. VDDT can either save this information as a file or send the information directly to the printer. Both options are under “Print Probabilities” in the File menu. To create a file, select “To file” and name the file. To send the probabilities to the printer, select “To printer”. An example probability file is given in the Appendix. Note that if more than three management regions are used, the default paper type should be set to landscape before printing.

### *Final conditions*

This file is used to save the ending state of a simulation so that it can be used as the initial conditions for a run at some other time. The file can be created by selecting “Print”-“ Final Conditions” from the Results menu, and naming the file.

### *Results*

The results can be saved in a variety of configurations. When “Print”-“Results” is selected from the Results menu, a screen pops up which allows the user to select from several options (Figure 7.1). The user must select:

1. The category of information to print (pick 1)
    - class;
    - cover type;
    - structural stage;
    - disturbance agent;
    - groups or value attributes
    - numerical class totals attributes;
    - numerical landscape totals attributes; or
    - calculated attributes.
2. The years to print (pick 1)
    - those which are currently selected for bar graphs (Section 6.2);
    - every *x* years (default 10); or
    - all years.
3. The type of information to print (pick any number)
    - single run results (for the first simulation only);
    - minimum value across iterations;
    - maximum value across iterations;
    - average value; or
    - standard deviation.

The results will be printed with each row as a year and the categories as columns (see the Appendix).

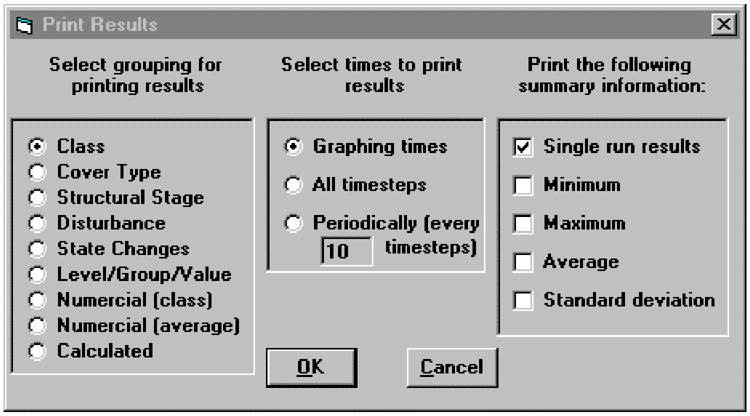



**Figure 7.1:** Screen allowing users to choose how to print the results to a file. One item must be selected from each of the first two columns, and any number of items can be selected from the last column.

# 8.0 Advanced Options

## 8.1 Setting Additional Attributes

Attributes describe additional information about a class. This information does not change in any way inside the model, but the program is able to read external files, match them with the appropriate class, and allow users to access the information for a given class, or, depending on the type of attribute, via graphs of landscape-level attribute summaries.

The program allows users to create some global attributes for the PVT, assign attribute values for each class and save the file. Alternatively, the program can read and edit previously created attribute files. Attribute types can be mixed and more than one of each type can be assigned to a PVT.

Five types of attributes are recognized by the model:

- Group or Level: This is a qualitative descriptor such as "high", "medium", "low" or "excellent", "good", "poor". Graphs of this attribute will show the proportion of pixels at each level. This is a class-based attribute only.
- Values: Values are numerical descriptors with units, e.g., 20 snags/acre. This is a class-based attribute only.
- Calculated: These are attributes that are dependent on the occurrence of a disturbance. Values are assigned to a class and disturbance type, and the final value is "calculated" during a model simulation.
- Text: Text is characterized as a filename of a longer text file. The filename is carried in the attribute file, and then when the attribute is viewed for a specific class, the program searches the file to find the appropriate class, notes on assumptions associated with this class, or any other text.
- Picture: Similar to a text attribute, the picture attribute is saved as the name of a file in one of the following formats: The following formats are accepted bitmaps (*.bmp, *.dib, or *.ico), Windows metafile format (*.wmf), JPEG (*.jpg), enhanced metafile format (*.emf), GIF files (*.gif), or run-length encoded files (*.rle). These can be used to assist in visualizing examples of vegetation conditions typical for a class.

### *Defining attribute structures*

If no attributes are present, users can create their own set of attributes. To do this the user must first define the structure of the attributes, i.e., how many attributes, and what types of attributes will be allowed. This is initially done through the steps below:

1. Select "Define structure" from the Attributes menu. A window will appear which contains columns for defining the attribute information (Figure 8.1).
2. Enter the name of the attribute in the first column (e.g., Habitat Quality). Note that the name may contain letters, numbers, or spaces.
3. Select the type of attribute from the pull-down menu in the second column.

4. If appropriate, enter the units in the third column. These are not used by the model, and are only for informational purposes.
5. If the attribute is a “group” or “level” type, then users may, if desired, list the valid entries in the final column (e.g., low, medium, high, good, bad, etc.). Hit the “Enter” button on the keyboard after each entry, including the last one. If values are entered at this point, they can be easily accessed when assigning the attribute values to individual classes. Any values that are not later assigned to a class will not be remembered after the current VDDT session.

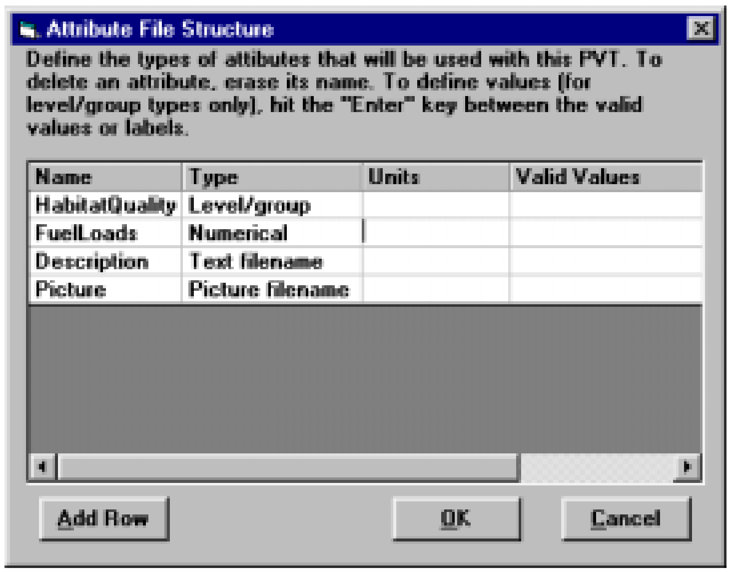



**Figure 8.1:** Screen used for defining or editing the types of attributes. An example of each type of attribute is shown here (row 1 gives an example of a group, row 2 shows a numerical attribute, and rows 3 and 4 are the names of a text file and a picture file, respectively).

No values can be entered in this window. This screen is only for entering the general categories of information (the attributes) for which values will be assigned.

Selecting the “OK” button will save the newly defined structure, while selecting the “Cancel” button will ignore the changes.

### *Edit attribute structures*

If attributes already exist (i.e., they have been defined or they have been read from a file), their structure can be changed. New attributes can be added, existing attribute types, names, or units can be changed, or attributes can be removed. The process to do this is essentially the same as when defining the structure initially:

1. Select “Edit structure” from the Attributes menu.
2. Change, add, or remove any attribute names (first column). If a name is removed, the model assumes that the attribute is deleted.
3. Change or select the type of attribute from the pull-down menu in the second column.
4. If appropriate, change or enter the units in the third column. These are not used by the model, and are only for informational purposes for users.

5. If the attribute is a “group” or “level” type, then users may, if desired, list the valid entries in the final column (e.g., low, medium, high). Hit the “Enter” button on the keyboard after each entry, including the last one. Note that the valid entries may not be edited or deleted, but new entries can be added. Only those values that are actually assigned to a class will be saved to the attributes file, so any mistakes will not be retained.

No values can be entered here. This screen is only for entering the general categories of information (the attributes) for which values will be assigned.

Selecting the “OK” button will save any changes to memory (including deleting attributes if an attribute name was removed), while selecting the “Cancel” button will ignore any changes. See the following section to save the attributes to a file.

☛ Note that changing the type of an existing attribute does not affect any values that have been defined already for the attribute. This can result in errors if the information has already been defined and if that information is incompatible with the new attribute type (e.g., switching an attribute from group to numerical may cause problems).

### *Saving or reading an existing file*

Once an attribute file has been created, with attribute structures and values defined, the file may be saved or read. This file is a comma and “ ” delimited file, suitable for exporting to a database. If no information for a class for a particular attribute is present, the model will simply print an empty set of quotation marks.

- Saving select “Save file” from the Attributes menu, and enter a filename at the prompt.

  If one or more of the attribute types is “text”, the program will ask if the text should be saved as well. If so, it will then ask for a filename for each text type attribute. In this file, only those classes for which text has been entered will be saved (i.e., the file will contain no information for classes without any text). Note that this is the only point at which the text can be saved (i.e., text cannot be saved without also saving the currently defined structure and other attribute values).

- Reading: select “Open file” from the Attributes menu.

  The program reads the attribute file which defines the structure and values of the attributes. Any text files that are present as an attribute are also read at this time. Once the files are read, all attributes are present and may be viewed, graphed, changed, or their structure edited.

The formats for the attributes file and the text file are given in the Appendix.

### *Editing/viewing class-only attributes*

Once the attribute structure is in place (either through defining the structure or through reading an existing attribute file), the attribute values for each class may be viewed and edited. Calculated attributes are edited differently than other attributes and are described later in this chapter.

Two different screens exist for editing attributes. One shows all the attributes for a single class, including the text and picture attributes, and the other shows only the value and the group attributes but for all classes.

### *Editing by class*

Two methods exist to allow users to access the single-class attribute screen:

1. Click ONCE on the box containing the class of choice, and hit the F2 key, or
2. Select “Edit values (by class)” from the Attributes menu, and enter the letter (uppercase or lowercase) of the class of choice.

A screen containing information about the current class (class letter, structural type, and cover type; Figure 8.2), and the current value of each attribute will appear.

The value column for each attribute, with the exception of calculated attributes, may be edited. Each attribute type is represented by a different cell for entering the information:

- Group/level: Cell contains a list of valid entries, accessed by clicking on the arrow next to the cell. Users may select a value from the list or enter a new value (e.g., Figure 8.2, HabitatQuality, row 1).
- Numerical: Numbers may be entered directly into the cell (e.g., Figure 8.2, FuelLoads, row 2).
- Text: If text has already been saved for this attribute, the cell displays the filename which contains the text. (The structure of this file is defined in the Appendix.)

  Clicking on the “View” button or double-clicking on the box (i.e., on the filename) brings up a larger screen which contains the more detailed text (if it exists) and which allows users to enter or edit text.

  ☞ The text shown here applies to the entire class. Text that is specific to a disturbance or succession pathway, or which describes the assumptions about the age boundaries of the class can only be accessed from the screen that shows the detailed pathway information (see Section 4.3).

  Double-clicking on the text or hitting the Close button will close the text entry screen.

  If no filename exists, text can be entered by clicking on the “View” button and typing in the text, or by entering the name of an *existing* file whose contents will be read with the “View” button is selected. Note that in the second case, the filename will not be retained, and the text will be save in the same file as the text from the other classes.
- Picture The cell displays a name of the file which contains the picture. Users may enter a new filename, if desired. The program will prompt the user to enter a filename if none exists or if the existing filename is not valid.

  Clicking on the “View” button or double-clicking on the box brings up the picture. The following formats are accepted bitmaps (*.bmp, *dib, or *ico), Windows metafile format (*.wmf), JPEG (*jpg), enhanced metafile format (*.emf), GIF files (*.gif), or run-length encoded files (*rle).

  Clicking on the picture or hitting the Close button will remove the picture from the screen.
- Calculated: This will always display the words “See calc. atts.”. No changes can be made to this type of attribute in this screen.

Clicking on the “?” at the top of the screen will show a reminder on the type of information required in for each type of attribute.

Selecting the “OK” button will save any changes, while selecting the “Cancel” button will ignore any changes.

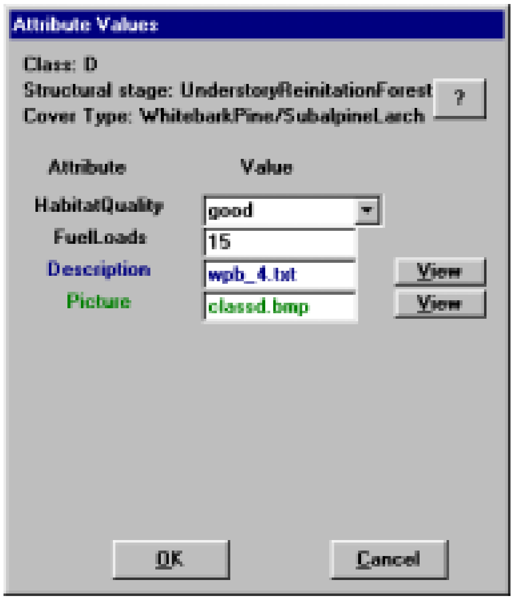



**Figure 8.2:** Screen showing the values for class D. An example of each type of attribute is shown here (row 1 gives an example of a group, row 2 shows a numerical attribute, and rows 3 and 4 are the names of a text file and a picture file, respectively).

### *Editing by attribute*

Group / level and value type attributes can also be edited for all classes in a single screen. This screen may be accessed by selecting “Edit values (by attribute)” from the Attributes Menu.

The screen is divided into two parts (Figure 8.3). The bottom section contains a grid with the classes as rows. The first three columns define the class: class letter, cover type, and structural stage. The remaining columns are used for each of the attributes. Attributes values can be added and edited in these columns.

The top half of the window allows users to filter the grid to show only selected cover types or structural stages. To apply a filter, select one or more items from each list and click on the “Apply Filter” button. The grid will then show only those classes that match the requested cover types and structural stages.

Text, picture, and calculated attributes cannot be edited using this screen.

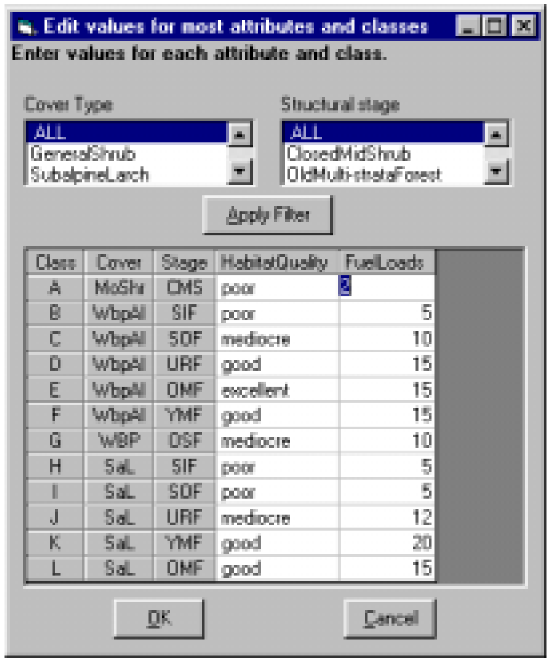



**Figure 8.3:** Screen for editing group and value attributes by attribute.

### *Editing/viewing calculated attributes*

Calculated attributes are those attributes whose value depends on a disturbance event occurring. The attributes may calculated by two different methods:

1. Values are linked to a disturbance type and numerical attribute, e.g., if an underburn occurs, the smoke emissions (the calculated attribute) will be *x* times the fuel loading (a numerical attribute).
2. Values are linked to a specific occurrence of disturbance type and class, e.g., if an underburn occurs in class G the smoke emissions (the calculated attribute) will be *x* while if it occurs in class N they will be *y*.

Calculated attributes can only be edited by selecting “Edit calculated values” from the Attributes Menu.

This screen is divided into three parts (Figure 8.4). The top part of the screen has lists of the cover types, structural stages, and disturbance types that occur in the diagram to allow users to show or hide rows and columns of the grids in the lower part of the screen.

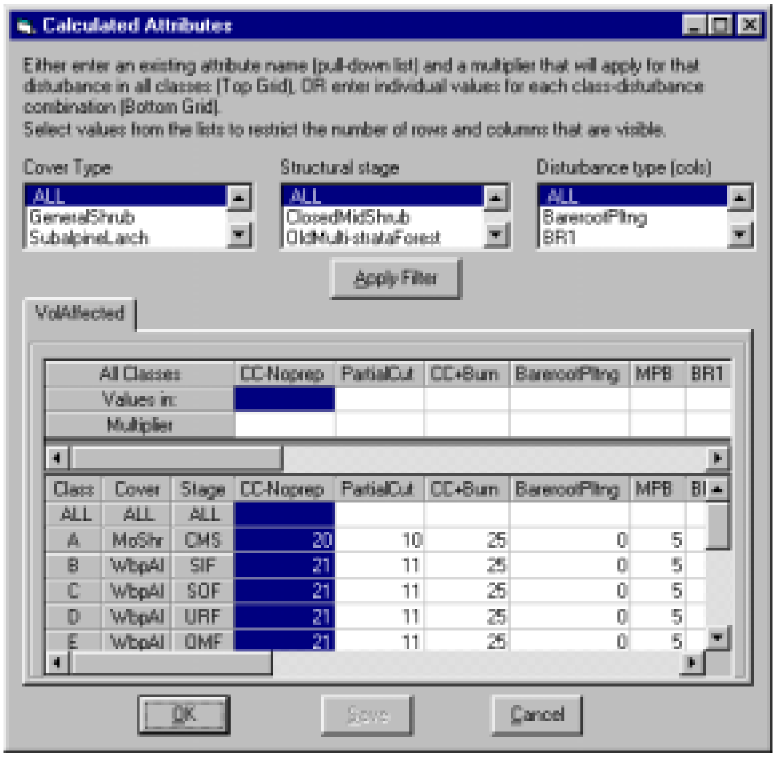


**Figure 8.4:** Screen for editing group and value attributes by attribute.

The lower part of the screen shows one or more tab-pages. Each page corresponds to a single calculated attribute. Two grids appear on each page. The grid at the top of the page is used for calculating the first type of calculated attribute: those that are linked to a disturbance type and numerical attribute. In this grid, the columns are the disturbance types. The first row allows users to pick the attribute upon which the calculations will be based. For example, in the example above, the user would pick "fuel loading". The second row is for the multiplier that will be applied to this attribute value when the disturbance occurs.

The grid at the bottom of the screen is used for calculating the second type of attribute, those that are linked to a disturbance type and class. In this grid, users must enter a value in each combination of disturbance type and class for which the attribute is to be calculated. Blank cells are assumed to be 0. The filters at the top of the window may be used to reduce the number of classes (rows) or disturbances (columns) which are showing. Note that a calculated attribute may not apply to all disturbances.

☛ Note that you should only define one type of calculated attribute for each disturbance type, but different disturbance types can use different types of the calculated attributes. If both types are defined for the same disturbance type, only the first one (calculations based on disturbance type and numerical attribute) will be used during the model run.

☛ Note that calculated attributes based on a numerical attribute may also be based on another calculated attribute. This other calculated attribute must be calculated using the second method (based on disturbance and class).

The "OK" button saves the changes to memory, while using the "Cancel" button causes the model to ignore any changes that were made. The "Save" button will save the changes to a file (but not to memory), and is only activated if any grid cell has been selected or modified.

## 8.2 Between Year Variability

VDDT, through its use of probabilities, inherently generates some between-year variability in disturbances. The area disturbed by an agent in any one year is dependent on the state of the landscape (i.e., the number of pixels in classes in which the agent occurs) and the probabilities defined for the agent in different classes. Thus, if a large amount of the landscape is in classes that have a high probability of disturbance by the agent, the number of pixels disturbed will be higher than if most of the landscape is in classes in which the agent does not occur. Even disturbances that occur in many or all classes will show some minor variation due to random number generation and due to variabilities in the probabilities for different classes.

In the real world, other sources of variation include weather patterns or other factors. For example, several warm, dry years may result in higher than average areas burned or affected by mountain pine beetle. VDDT can capture some of this variation using some user-defined information, described in the following sections.

Figure 8.5 shows a general flow diagram with the questions that must be addressed and steps for using (or not using) between-year multipliers. The first question to be asked is if there is to be between-year variability from external conditions. If so, there are two paths to be followed, depending on whether or not external multipliers are to be used. External multipliers are ones that can be used directly. For example, suppose a user has information that describes stand-replacing fire behavior over a 100-year period. Outside of VDDT, the user determines the average area burned, and than a multiplier for each year to get from the average area burned to the actual area burned. These multipliers could then be placed in a file (in the format described in the Appendix) and used to create between-year variability for stand-replacing fires in VDDT. External files can also be created from saving the between-year multipliers generated in earlier runs of VDDT.

Many users will not have external files, at least not initially. Thus, their first step must be to create groups of disturbances that respond to similar conditions (“year sequence groups” or YSGs). For example, the group could contain disturbances that react to rainfall. Some disturbances (such as fires) may do worse in wet years than in dry years while other disturbances (such as flooding) will have an increased occurrence in wet years. But, since both disturbances respond to rainfall, they can be included in the same group. Once the groups are defined, the next question becomes whether the user wants to control the multipliers that are used. If not, the model can be asked to generate one or more sequences of random numbers.

If users want more control over the multipliers, they can define multipliers for up to five different year conditions for each disturbance type that was placed within one of these YSGs (groups of disturbances). These “year type multipliers” will then be applied to a sequence of year conditions and turned into a stream of multipliers.

The expected methodology is to use annual average probabilities in the pathways table for each succession class. The multipliers represent the ratio of acres disturbed in each year-type as defined in a YSG. For example, if stand replacement wildfires occur every 200 years, the average annual disturbance probability is 0.005. If the ratio of acres burned in low, normal, and high fire years is 1 to 10 to 40, these numbers would be included as the multipliers.

**Multipliers must be normalized when average disturbance probabilities are used.** Normalization is a process whereby the actual values of the multipliers are adjusted, while keeping the relative values the same, to get an overall average multiplier of 1. This process eliminates any inherent bias arising from the use of between-year variation, and ensures that, baring any changes to the state of the landscape, the average area disturbed over the simulation period by different disturbance types is the same whether or not the multipliers are used.

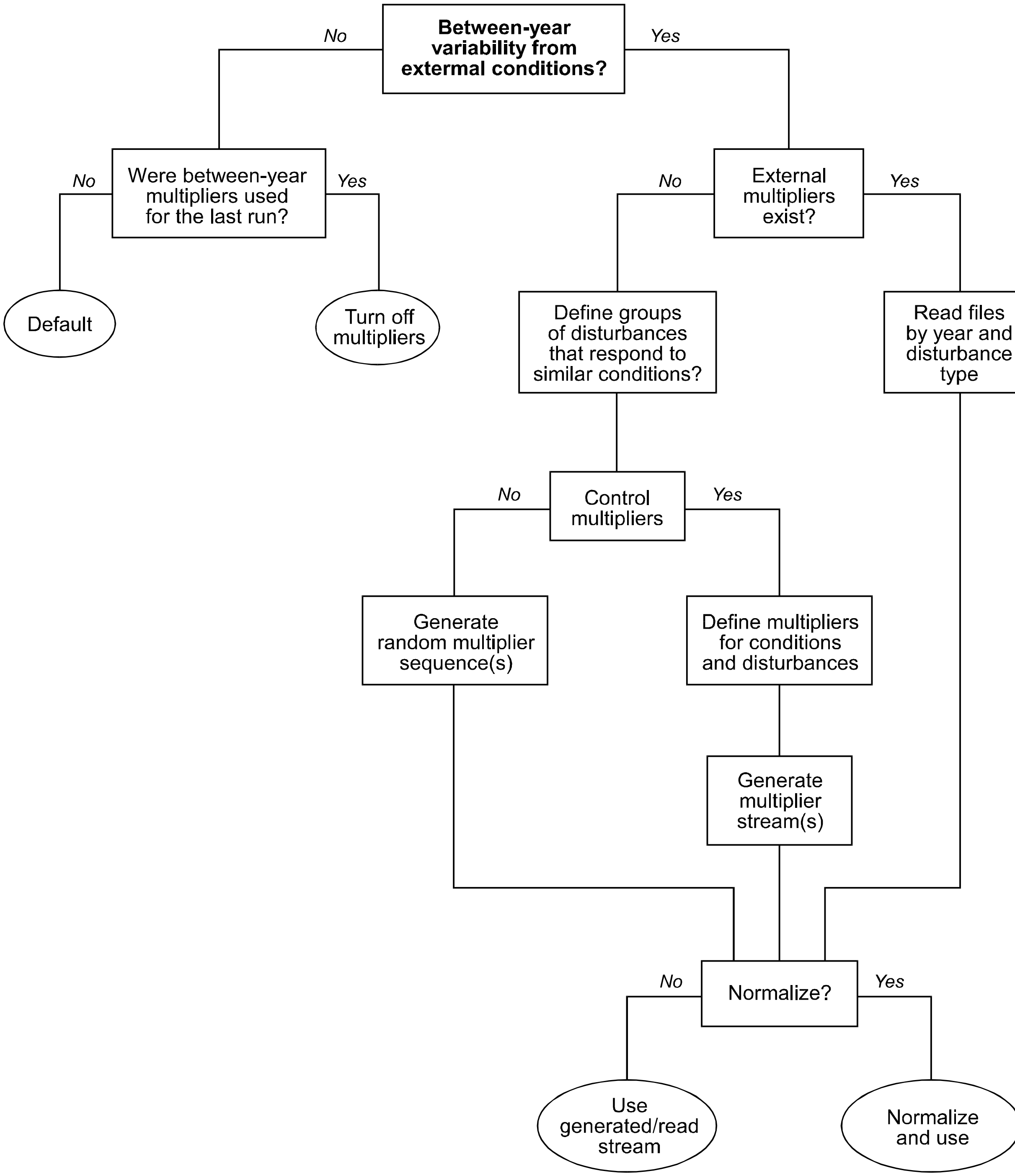



**Figure 8.5:** Questions to ask and steps for using between-year multipliers. Details about each question and how to do the different activities are described throughout this Section.

In some cases the user may have actual disturbance probabilities for each year-type as defined in a YSG. In this instance, the user would put a constant less than or equal to 1 in the pathways tables and put the actual disturbance probabilities in the between-year multiplier table. There would be no need for normalization.

Note that these between-year variability multipliers are not used by default. Multipliers must be generated or read from a file in order for the model to use them during a run. This must be repeated each time a new PVT is used. Once the multipliers have been used for a run for a PVT, all other runs with that PVT (in the same VDDT session) will use the same multipliers unless they are explicitly turned off.

☞ To create multipliers that change probabilities based on landscape conditions (i.e., internal factors), use the landscape condition feedback multipliers described in Section 8.3).

### *Year sequence groups*

At the highest level, users define one or more “Year Sequence Groups” (YSG). A YSG defines a group of disturbances that are all affected by the same conditions. The definition also includes the percentage of the years that are expected to be in each of five different categories.

To define a YSG, select “Define YSG” from the Variation Menu. A window will appear with a grid containing any already defined YSGs (Figure 8.6). If no YSGs have been defined, the grid will contain a blank line. The columns are as follows:

| | |
|---|---|
| YSG (1): | The name of the YSG. |
| Very Low-Severe (2-6): | The percentage of the years in each of the different categories. |
| Total (7): | The sum of the percentages. |
| #Dists (8): | The number of disturbances that have been assigned to this YSG. |

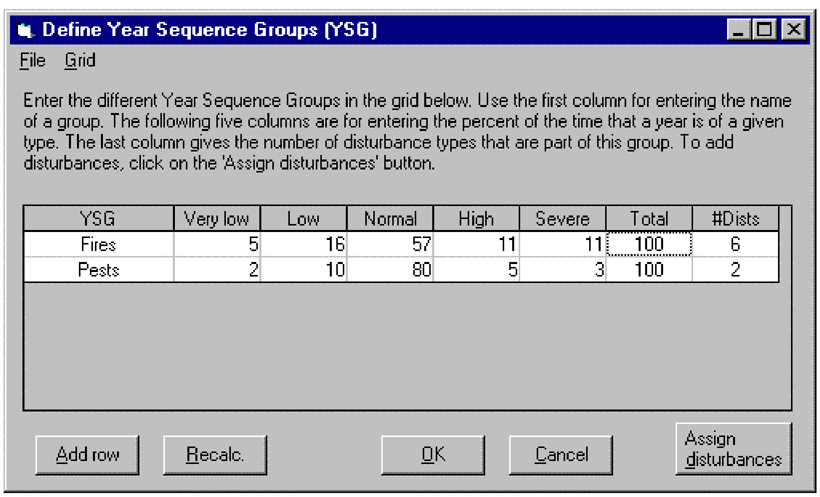



**Figure 8.6:** The main YSG screen. In this example, two YSGs have been defined: Fires and Pests. The YSG “Fires” has six disturbances assigned and the YSG “Pests” has two disturbances assigned. Both have been assigned proportions that add to 100%.

The different types of year conditions are named “Very Low”, “Low”, “Normal”, “High”, and “Severe”. Users can interpret these for their own conditions.

These columns should contain the percent of the time that a year is in that condition. For example, in Figure 8.6 the YSG “Fires” has “Normal” years 57% of the time, “Low” years 16% of the time, “Very Low” years 5% of the time and “High” or “Severe” years each 11% of the time. Clicking on the cell in the Total column adds up the values in the previous five columns. If the result is different from 100, users can either adjust the numbers to make them add to 100 or can click on the “Recalc” button to ask VDDT to recalculate the numbers so that they retain the same relationship to each other but add up to 100%. To recalculate all rows, select “Recalculate All” from the Grid Menu.

The last column of the grid in the main YSG screen shows the number of disturbances that are assigned to the YSG. To get a list of these disturbances, double-click on a cell in the last column. A summary screen will appear (Figure 8.7) listing the disturbances currently assigned to the YSG. To add or remove disturbances, click on the “Assign” button at the bottom of the screen, or click on the “OK” button to leave this screen. Then click on the “Assign Disturbances” button just below the grid.

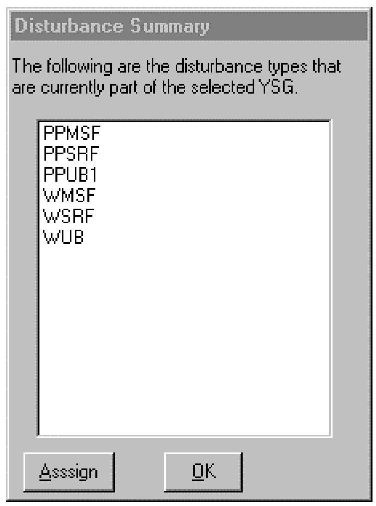



**Figure 8.7:** Screen summarizing all the disturbances currently assigned to a YSG. In this case, the YSG “Fires” was selected. The six disturbances (as indicated in the grid in Figure 8.6) are listed here. Note the “Assign” button which allows users to go to a screen for adding and deleting disturbances.

A second screen will appear that contains two lists (Figure 8.8, left). The first list contains all the disturbance groups that have at least one disturbance defined in the PVT. If one of these disturbance groups is selected by the user, a list of the disturbance types will appear in the second list (Figure 8.8, right). Users can then pick one or more disturbances from one or more lists. Clicking on the “Summary” button will bring up the window that lists all the currently selected items (Figure 8.7). Note when the summary screen is accessed from this window, the “Assign” button will not be visible because the assignment is already in process. The summary window must be closed down (by clicking on the “OK” button) before adding more disturbances.

☞ Note that disturbances may be in up to three different disturbance groups. If the disturbance is selected under one of the groups, it will also be selected in the other groups.

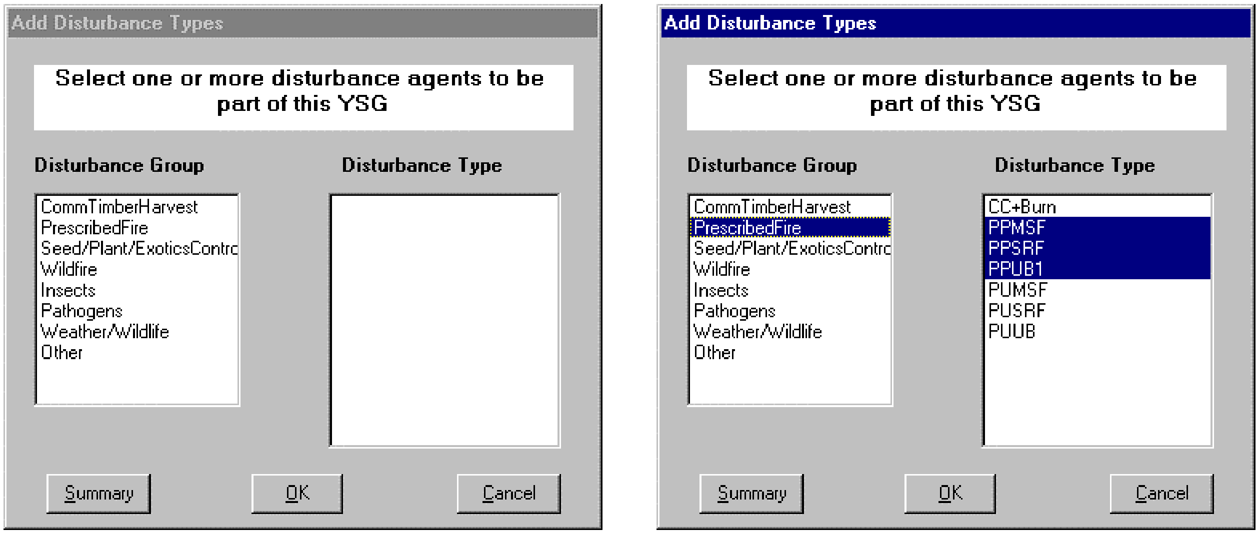



**Figure 8.8:** Screen allowing users to add or delete disturbances from a YSG. The screen on the left shows the screen as it first appears, with the disturbance groups that contain disturbances that are defined for this PVT. The screen on the right shows that three disturbances have been selected in the group "Prescribed Fire".

When done adding disturbances, click on the "OK" button to keep any changes or the "Cancel" button to ignore any changes. In either case, the window will shut down.

☛ Disturbances can belong to only one YSG. If a disturbance is selected that is already in another YSG, a message will appear:

"The disturbance *disturbance name* is already part of another YSG. Do you wish to remove it from that YSG? Note that if the disturbance remains part of that YSG, the disturbance will not be added to the current YSG."

Responding "No" to the message will mean that the disturbance remains part of the other YSG and is not saved as part of the current YSG. Conversely, selecting "Yes" as the response will remove the disturbance from the other YSG and save it in the current YSG.

In the main YSG screen, to add more YSGs, click on the "Add Row" button or select "Add Row" from the Grid Menu. Note that when a YSG is added, it contains no disturbances. To delete a YSG, place the cursor on the row to be deleted and select "Delete Current Row" from the Grid Menu.

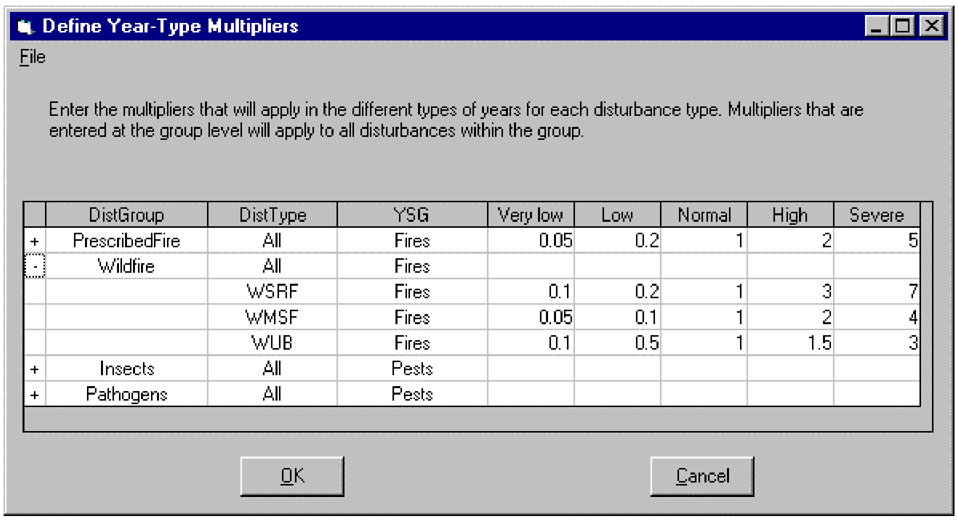
Once done, values may be saved to a file by selecting "Save" from the File Menu. This saves all information contained in the grid: the name of the YSG, the distribution in the different categories, and the associated disturbances. For complete details, see the Appendix. This file may later be loaded by selecting "Load" from the File Menu. Loading a file completely overwrites any values that are currently in the grid. In addition, any disturbance types that are in the file that are not part of the current PVT will not be loaded, and thus, cannot be resaved.

Clicking on the "OK" button saves the information to memory, for use in defining the remaining information required for between-year variation. Clicking on the "Cancel" button closes the window without saving any of the changes that were made.

### *Year type multipliers*

In order for the model to generate annual multipliers, each disturbance that is part of a YSG must have multipliers assigned for each of the five types of years (Very Low, Low, Normal, High, and Severe). In a later step, these multipliers for each disturbance and year type will be combined with information about the YSG to generate annual multipliers.

To assign the multipliers, select “Define Type Multipliers” from the Variation Menu. A screen will appear with a grid containing all the disturbance groups that contain at least one disturbance that is in a YSG (Figure 8.9). As in other grids, clicking on the “+” in the first column of the grid will show the specific disturbance agents in that disturbance group. Clicking on the “-”will hide the disturbance agents, while remembering any values that were assigned in the screen.




| | DistGroup | DistType | YSG | Very low | Low | Normal | High | Severe |
|---|---|---|---|---|---|---|---|---|
| + | PrescribedFire | All | Fires | 0.05 | 0.2 | 1 | 2 | 5 |
| - | Wildfire | All | Fires | | | | | |
| | | WSRF | Fires | 0.1 | 0.2 | 1 | 3 | 7 |
| | | WMSF | Fires | 0.05 | 0.1 | 1 | 2 | 4 |
| | | WUB | Fires | 0.1 | 0.5 | 1 | 1.5 | 3 |
| + | Insects | All | Pests | | | | | |
| + | Pathogens | All | Pests | | | | | |

**Figure 8.9:** Screen for assigning multipliers to each type of year for each disturbance in a YSG. In this example, multipliers have been assigned to apply to all disturbances in the “Prescribed Fire” group. The “Wildfire” group has been expanded to see the individual disturbance types, and multipliers have been entered for each type separately.

Multipliers that apply to all disturbances in a group are entered on the same line as the name of the disturbance group, which is also the line that has “All” in the DistType column (e.g., “Prescribed Fires” in Figure 8.9). When a group multiplier is entered, it automatically overwrites all values for that year-type for all disturbances in that disturbance group. Values can also be entered for individual disturbances (as was done for “Wildfire” in Figure 8.9).

- ☛ Note that if a disturbance occurs in more than one disturbance group, the actual multiplier that is applied is the one that occurs in the last group for which it is defined.
- ☛ If a value for one of the disturbance types is deleted by the user, and if no value is entered that applies to the entire group, the multiplier is assumed to be zero.

The values in the grid can be saved to a file by selecting “Save” from the File Menu. Multipliers can also be loaded from a file by selecting “Load” from the File Menu. Note that if multipliers are loaded, they will overwrite any existing values in the grid. Also, any disturbance types that are not in the file will have no multipliers (or will have a multiplier of 1) and any disturbance types that are in the file that are not defined as part of a YSG will not be loaded. The default file extension is *.YTM (Year Type Multiplier) and the file format is given in the Appendix.

Clicking on the “OK” button saves the information to memory, for use in defining the annual multipliers. Clicking on the “Cancel” button closes the window without saving any of the changes that were made.

### *Annual multipliers*

Annual multipliers are the values that are actually used by VDDT during a model run. In most cases, these will be generated based on the information in the previous two screens (the YSGs and the Year-Type Multipliers). In these cases, for each YSG, the generation routine first creates a stream of types of years based on the proportions defined earlier. Second, for each disturbance type, the model changes the year category into the corresponding multiplier (as defined in the second step of the process). This creates sets of annual multipliers for each disturbance type. These multipliers are then normalized to ensure that there is no inherent bias in their use. Alternatively, multipliers can be read from external files.

To create the multiplier streams, select “Annual Multipliers” from the main Variation Menu.

To turn off all between-year multipliers (but not to remove them from memory), select “Turn off” from the Multipliers Menu, and then click on the “OK” button. The status bar at the bottom of the main VDDT window show whether or not the multipliers are being used.

There are several options available for generating the annual multipliers. In the simplest case, users can click on the “Generate” button, then on the “Normalize” button and then on the “OK” button to save the values, exit the window, and to use the values for the run. Many users, however, will want to have more control over their options, to view the multipliers, or to load or save the multipliers. Each of these is described in more detail below.

#### *Generation Options*

Many of the options can be found by selecting “Options” from the Multipliers Menu. Four categories of options can be set (Figure 8.10):

1. *The disturbance types to generate.*

   Under this option, users can choose whether they want to generate the multipliers for:

   - all disturbance types (default),

   - for the selected YSG, or

   - for the selected disturbance types.

   Most of the time, the default option is the most appropriate. The second option may be chosen if the user likes most of the patterns, but wants to refine the scenario for just one or two YSGs, or if the multipliers were read from a file and some of the disturbances in a YSG were missing. The third option is not recommended for anyone who is using YSG information for generating the multipliers, and should only be used if the third option from the generation criteria (below) is selected.

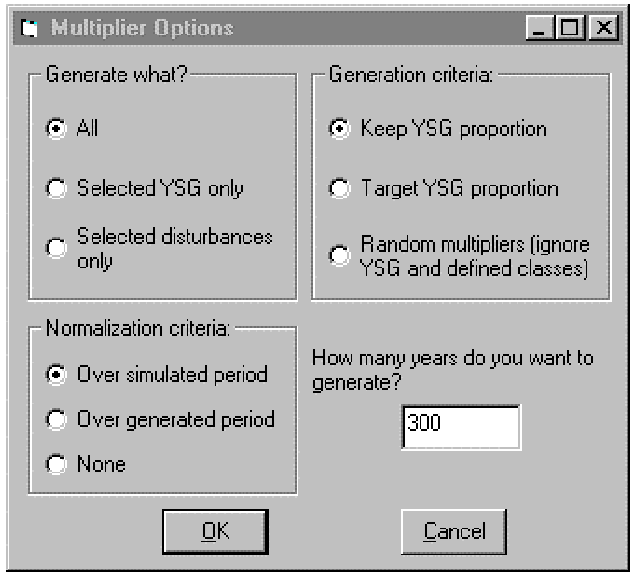



**Figure 8.10:** Options for generating the annual multipliers for the between-year variability. The screen currently shows the default values for each of the options.

2. *Generation criteria.*

The first step of the definition of between-year variability was to define the proportion of years in each of five different types of years. The options basically allow users to decide whether these defined proportions are to be maintained, whether they are just a guideline, or whether they should be totally ignored. Three options exist to control how the generation occurs:

1. Keep the defined YSG proportions for the different types of years;
2. Target the YSG proportions (default); and
3. Ignore all YSG information.

If one of the first two options is chosen, the model will use the information to generate annual streams of types of years for each YSG, based on the proportion of the years that should get the different types. Disturbance multipliers are then generated from this information.

If the first option is chosen, the model will maintain the defined YSG proportions for the different types of years. For example, if the annual probability of a **severe** year is 0.01, exactly 3 **severe** years will be generated in a 300 year simulation.

With the second option (default), the defined YSG proportions for the different type of years are not maintained. With this option each generated year type is based on an independent random draw. Because the number of years in each type is not fixed, this option results in more stochastic variation between runs.

If the third option is chosen, the generation routine will totally ignore the proportions and the defined multipliers and will simply generate a sequence of normally distributed random numbers for each disturbance type (or for each selected disturbance type if that option has been chosen).

3. *Normalization criteria.*

Normalization is a process by which the multipliers retain their sequence and their relative magnitude but are adjusted such that their average over a given period is one. As with the other criteria, there are also three options for normalization.

1. Normalize over the period to be simulated (default).

   This ensures that the multipliers introduce no bias and that the disturbance probabilities remain, on average, as originally defined. If there were no large differences in disturbance probabilities due to landscape conditions (i.e., state classes), the same proportion of pixels would be disturbed with the normalized multipliers and without any multipliers, but the between-year variability would differ.

2. Normalize over the period that was generated.

   This option assumes that the generated period is similar to the one for which the probabilities are defined. Users may only use a fraction of this normalized stream, and may thus alter the average area disturbed.

3. Do not normalize.

   **This option is not recommended.** The primary function of this option is to allow users to enter actual disturbance probabilities for each type of year defined in a YSG.

4. *The number of years to generate.*

   This option is self-explanatory. The default value is 300 years, the same as the default number of years allowed for a simulation run. It is recommended that the number of years generated is the same as the number of years being simulated.

The default values are automatically set, so most users will not have to set or change the options. If options are selected, however, clicking on the OK" button saves the options and clicking on the "Cancel" button ignores the changes. The options are remembered throughout the VDDT session. Thus, once the options are set as desired, they will not need to be changed.

### *Generation Procedures*

To generate the multipliers, simply click on the "Generate" button, or select "Generate" from the Multipliers Menu. If the options specified that only a specific YSG or specific disturbances are to be generated, then these must be selected from the appropriate list. Note that once a YSG is chosen, the related disturbance types are listed and can be selected.

Once generated, the multipliers can be viewed. Select one or more disturbances from a YSG and click on the "Redraw" button. One or two graphs will appear (Figure 8.11). The top graph shows the disturbances. If the default options were chosen, or if the generation was done using YSG information, all the disturbances in the graph should follow the same pattern, although their magnitudes will be different. In addition, a second graph appears below the first. This graph shows the actual percent of the years in each year type and the defined percent of the years in each year type. If the default options were chosen, the two sets of bars will be identical.

The second step of the generation process is to normalize the multipliers. This is not done automatically. To do this, click on the "Normalize" button or select "Normalize" from the Multipliers Menu. No visible change will occur on the screen. The changes can, however, be seen by selecting "Graph normalized" from the Multipliers Menu. A check mark will appear next to the menu item and the graph will be redrawn using the normalized multipliers instead of the original multipliers. The graph will look identical except that the y-axis scale will have changed. Selecting this menu item again will remove the check-mark and will graph the unnormalized multipliers.

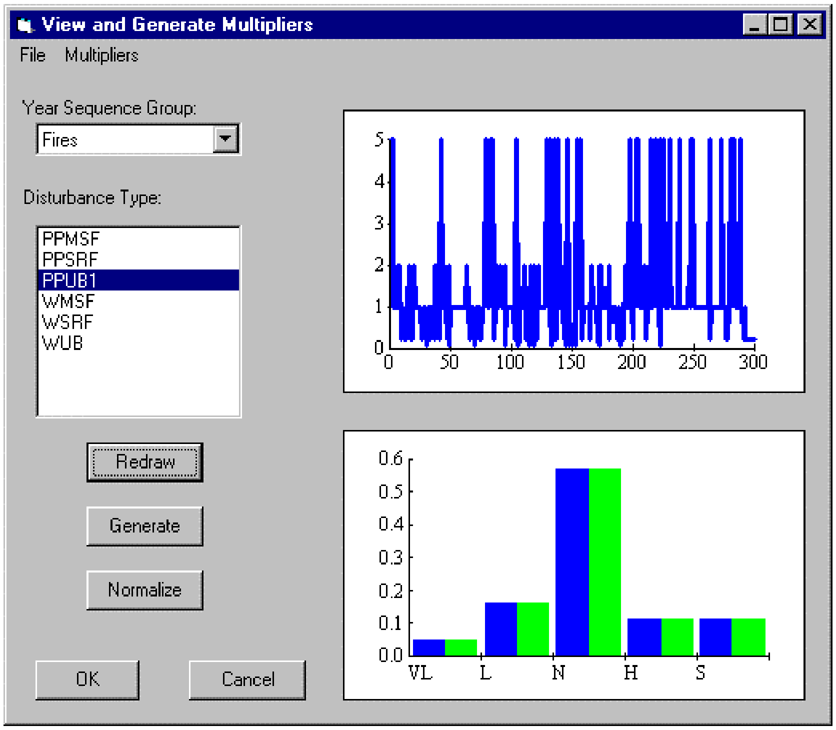



**Figure 8.11:** The main window used for generating the between-year multipliers. In this example, the multipliers have been generated using the default options. The multipliers for the disturbance "WMF" have been graphed. The top graph shows the actual multiplier sequence (unnormalized), while the bottom graph shows the relationship between the actual proportion of years of each condition (left bar) and the pre-defined proportions for that YSG (right bar).

To reset some or all multipliers to one (i.e., eliminate any effect of the multipliers), select "Remove" from the Multipliers Menu. This will reset the multipliers as determined by the options. Thus, if the options suggest generation for only the selected disturbances, the multipliers for the selected disturbances only would be set to one.

Clicking on the "OK" button will save the results to memory and shut down the window. The normalized multipliers (unless otherwise specified) will be applied to all VDDT runs until they are explicitly turned off or until a new PVT is loaded. The "Cancel" button closes the window without making any changes.

### *Saving and Loading*

There are several aspects of the between-year multipliers that can be saved to or read from external files. The most appropriate option depends on the goal.

Goal:

1. *Have the same series of high and low years between runs.*

   This option would be used if the same YSG is being used in a number of situations with different disturbances (because of having different disturbances in different PVTs or because of adding or deleting disturbances from a YSG) or different year-type multipliers. The generation routine in each simulation would then be given the same sequence of years and would generate the annual multipliers based on the defined disturbances and year-type multipliers.

This method has the advantage that, when comparing simulations, the high and low years are in the same place and only the magnitude of the multipliers changes. Also, if a new disturbance is part of a YSG, it will automatically use the same pattern of years as the other members of its YSG.

☛ The annual year-type sequence is regenerated each time the “Generation” button is clicked. Thus, even within a single PVT, the only way to use the same sequence of years for multiple runs is to save the sequence to a file and reload it before generation.

Saving and loading these files is done by picking “Load” or “Save” from the File Menu and then selecting “Year Type Sequence”. The default extension for these files is *.TSE (Time SEquence), and the file format is given in the Appendix.

Note that a *.TSE file can be easily modified or build with a text editor to create any desired sequence of years. In this manner, the user can model the potential effect of cyclic climatic patterns, global warming, etc.

2. *Use identical multipliers between runs*

This option would be used to control for differences in between-year variability. If identical multipliers are used, the differences between runs has more to do with the differences in landscape conditions or defined probabilities than with the annual multipliers.

The main disadvantage to this method is that if any disturbances have been added to a YSG, they will have no multipliers. The multipliers for these disturbances will need to be generated which will likely cause them to have a different pattern of years than the other members of the YSG.

The main advantage of this method is that actual multipliers can be loaded and used. In addition, the multipliers can be reloaded and normalized with a different option before using in the simulation.

Saving and loading these files is done by picking “Load” or “Save” from the File Menu and then selecting “Multiplier Sequence” or “Normalized Sequence”. The default extension for these files is *.MSE (Multiplier SEquence) or *.NSE (Normalized SEquence), and the file format is given in the Appendix.

☛ The “unnormalized” multipliers are not saved when this part of VDDT is exited (unless the routine was specifically asked not to normalize the multipliers). Thus, the only way to use the same set of raw multipliers, even within a single VDDT session, is to save the values to a file and to reload them when next entering this window.

Note also that, since the year types are not saved with the multipliers, the second graph (that compares the defined YSG proportion with the actual) will not be shown.

### *Multiple iterations*

If the annual multipliers are being used in a run with multiple Monte Carlo simulations, users are asked to choose from the following when defining a run:

1. Use the same multiplier sequence for each iteration (default).

Under this option, differences in the results are only a result of differences in picking the random numbers and in the resulting state difference. The same years will have large or small multipliers applied.

2. Use the same set of multipliers in a different order for each iteration.

   Under this option, the high and low multipliers will be applied in different years, adding another source of variation between the iterations. This ensures, however, that each run has exactly the same set of “good” and “bad” years, just varying their order.

3. Read the multipliers from an external file.

   Under this option, each iteration may have a different combination of low and high years, thus allowing for the possibility of simulating rare events.

The first two options require that multipliers have been loaded into memory from the annual multipliers screen. The last option requires only that the annual multipliers have been turned on, and that a file with the appropriate format has been created. This file can be created in the Annual Multipliers window by selecting “Make MC file” from the Multipliers Menu. The user will be asked the number of Monte Carlos to generate and the file name in which to store the results. The model will generate information for all disturbances in the number of years listed in the Options window. Note that the current multipliers stored in memory will be replaced with one of the sets of multipliers generated for the file.

If the third option is chosen for the model run, the user will be asked to supply a filename, with the default being the file created in the Annual Multipliers window. The model will read this file at the beginning of each Monte Carlo. If it reaches the end of the file before all Monte Carlos have been simulated, VDDT will produce a warning, and will read the file again from the beginning.

## 8.3 Landscape Condition Feedback

In VDDT, the area disturbed by a particular agent increases as the proportion of the pixels in the landscape that are susceptible to this disturbance agent increases. For example, if through prolonged suppression of fires, the average age of the pixels in the landscape increases and if older successional classes are more susceptible to mountain pine beetle, then the area disturbed by the beetles will increase. In this example, more area is disturbed because there are more susceptible pixels, but each pixel still has the same probability of being affected by this agent.

For some disturbance agents, the probability of disturbing a particular pixel may be altered by the spatial context of the pixel. For example, a stand that is susceptible to mountain pine beetle has some likelihood of being attacked. It is often thought that this probability is higher if the stand is surrounded by susceptible stands than if it surrounded by non-susceptible stands. Because VDDT is a non-spatial model, contagion processes cannot be represented in detail. Instead, users can define a multiplier that is designed to provide feedback between the probabilities of disturbance and the landscape condition.

The intent of the multiplier function is to either increase or decrease the “average” probability of disturbance based on the proportion of the pixels in the landscape that are in a state that is susceptible to the disturbance agent. To measure the state of the landscape, VDDT compares the current area to be disturbed by the agent with the maximum area that could be disturbed by the agent. The maximum area is the product of the highest probability of disturbance for this agent, times the number of pixels in the landscape. The current area to disturb is the product of the probability of disturbance of each successional class times the number of pixels in each class.

☛ Note that use of the landscape feedback multiplier will slow down the model. This will be especially apparent for PVTs with a large number of disturbances, for runs with large numbers of pixels, and on slower machines.

To set up one or more landscape feedback multipliers, select "Landscape-based multipliers" from the Variation Menu. A window will appear that lists all currently active disturbance groups (Figure 8.12). The columns of the grid are:

*DistGroup:* The name of the disturbance group.

*DistType:* The name of the associated disturbance types. Note that the first line of the group will always contain the work "All" as the type. If the "+" is clicked in the first column of the group, the other disturbance agents will appear.

*Max:* The maximum possible proportion of the landscape that could be disturbed by the given disturbance agent using just the defined multipliers (i.e., no between-year multipliers). This value cannot be edited and is just there as a guide for how much disturbance is possible without additional multipliers. Each year, the potential proportion of the landscape that could be disturbed will be compared to this value.

*0, ..., 100:* These columns are for adding the multipliers that would be used if the potential percent of the area that would be disturbed by a disturbance agent were at the listed percentage. For example, if a "2" were entered in the column labeled "40", and if the maximum proportion of the landscape that could be disturbed in a year were "0.01", then, if the potential amount of the landscape that would be disturbed in the current year were 40% of the .01 (or 0.004), the probabilities for that disturbance agent would all be multiplied by 2.

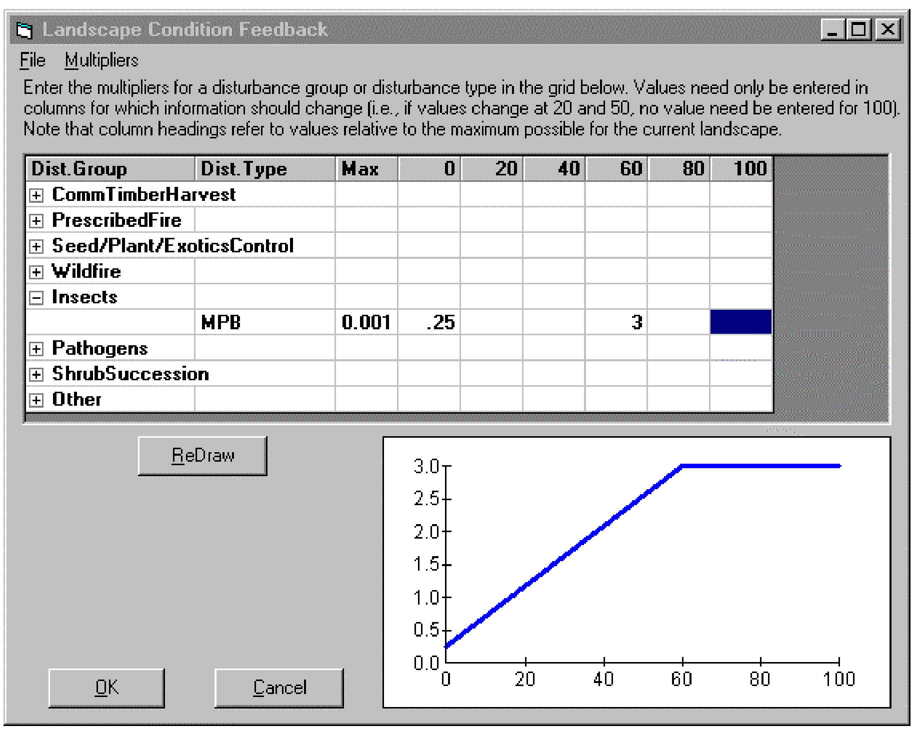



**Figure 8.12:** The screen for defining landscape condition feedback multipliers. In this example, the disturbance group "Insects" has been expanded to show the available disturbance agents, in this case only "MPB". The values shown represent one of the pre-defined sets of multipliers and have been graphed. Notice that only two values are entered into the grid: 0.25 and 3. The model will interpolate between these values for the remaining proportions.

Multipliers can be defined either for the entire group or for individual disturbance types. If values are entered on the top line of the disturbance group, next to the disturbance type "All", they will be applied to the entire group. If the individual types are visible (either by clicking on the "+"next to the group name or by selecting "Show all" from the Multipliers Menu) then values can be entered into the row next to the disturbance agent's name.

In the simplest case, users can assign one of five predefined sets of multipliers (Figure 8.13). To do this, place the cursor on the row to which the values should be assigned and select the appropriate pre-defined function from the menu. Values will be entered into the row, and the function will be graphed. The x-axis in the relationship is the ratio of the maximum to the current area to be disturbed by the disturbance agent. The y-axis describes the value of the multiplier to be applied to the disturbance probabilities. A positive feedback is achieved if the multiplier increases as the proportion of the stands in the landscape that are susceptible increases. No feedback between landscape conditions and the probability of disturbance is obtained with a multiplier of 1. This is also the current default condition. A negative feedback is achieved if the multiplier declines with an increasing proportion of the landscape in the susceptible class. There may be no ecological systems in which this negative feedback exists and the pre-defined condition is only an example.

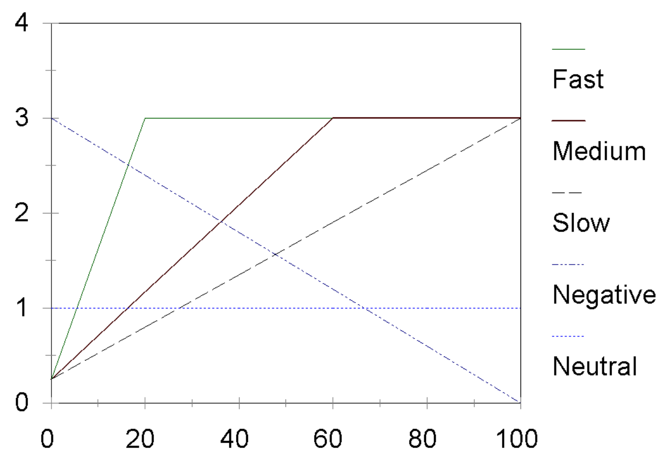



**Figure 8.13:** A summary of the pre-defined landscape condition feedback multipliers.

Users can also define other relationships by entering values directly in the appropriate columns. Values only need to be entered in some of the columns. Thus, to create a curve that increases from 0 to 4, simply enter a 0 in the first column (the *0* column) and a 4 in the last column, and a line will be drawn. During a simulation the model:

- applies the last defined multiplier up to the maximum (100%);
- sets the value in the "0" column to 0 if values have been assigned in later columns;
- interpolates between defined values, unless otherwise specified by the user.

For example, suppose a user puts a 2 in the 40% column, and that is the only column with an assigned value, and the user is using the default option of interpolation. The model will:

- use the 2 for all landscape conditions from 40% to 100% (inclusive);
- use a 0 for 0%;
- interpolate between 0 and 2 for landscapes between 0% and 40% (exclusive).

To graph a user-defined curve, place the cursor on the row to be graphed and click on the "Redraw" button.

The multipliers can be used with or without interpolation between the defined values. The default is with interpolation. With no interpolation, changes happen more abruptly. To use the example above, when using interpolation, the multiplier would change from 1.95 to 2 as the landscape went from 39% to 40%. Without interpolation, the multiplier would change from 0 to 2 with the same change in landscape value. Each type of change is appropriate for simulation different types of effects. Note, however, that the decision of whether or not to use interpolation applies to all disturbances.

These landscape condition multipliers may be saved to a file by selecting "Save" from the File Menu. This saves all values in the grid. Reading multipliers from a file can be done by selecting "Load" from the File Menu. When the file is loaded, multipliers that have been defined for disturbances not currently in the PVT are ignored. All multipliers for disturbances that are in the current PVT and not in the file are left as the last value defined in the model.

☛ The breakpoints for the multipliers have changed from Version 3.0. Thus, a warning will appear if Version 3.0 files are read. The program will attempt to process the file appropriately, but it is important to double-check all values (and save them in the Version 4.0 format).

Clicking on the "OK" button saves the information to memory and tells the model to use the defined landscape condition multipliers (unless explicitly told otherwise). Clicking on the "Cancel" button closes the window and ignores any changes that were made.

Note that defined multipliers can be explicitly disabled for a simulation by selecting "Turn off" from the Multipliers Menu. A check will appear next to the menu item to indicate that the multipliers are not being used, and a warning will occur as when the OK button is clicked.

☛ No normalization is done to these multipliers because it is impossible to anticipate the distribution of successional classes in the simulation run. Thus, the average area disturbed by a disturbance agent that is using these multipliers may be very different than the average area when the multipliers are not used. The amount and direction of the bias depends on the landscape condition and the shape of the curve.

# 9.0 Trouble Shooting

There are generally three types of problems that are encountered by users of VDDT.

1. Those resulting from edits made directly to the input files, i.e., outside of VDDT.

   This is the most common type of problem, simply because it is difficult to manually produce these complex files, error-free. While this is possible to edit the ASCII files directly, it is not encouraged.
2. Those resulting from changing some files and not others.

   These problems occur when, for example, PVT files have been modified without also changing all corresponding scenario files or when TXT files are changed after having created PVT and scenario files. While avoiding some problems of this sort is difficult, using care when modifying files will ensure that these problems are kept to a minimum.
3. Those that are not really problems.

   These pseudo-problems are common with beginners, and usually result from an unfamiliarity with the capabilities of VDDT. These may include such 'problems' as only seeing the pathways going to or from one class, not seeing all the graphs, etc.

Solutions for problems of each of these three categories are given in this section, organized by problem area (not category).

## 9.1 Problems with the Successional Pathway Diagram

### *A class does not show up in the diagram.*

The input file may contain two classes with the same cover type and structural stage (and a warning would have occurred when the files were read). Select "Edit a Class" from the Diagram menu, and enter the letter of the missing class. The cover type and structural stage of the missing class will appear and can be edited. Remember to check all pathways *to* either of the duplicate classes to make sure that they go to the right class.

If there is no duplication of a specific combination of cover type and structural stage, try re-ordering some of the classes in the input PVT file.

Note that only the PVT file needs to be edited; the program does not care what order the classes are in the scenario file (and the classes in the scenario file do not need to be in the same order as in the PVT file).

If a location file is being used, ensure that the missing class occurs in the location file, and that it is in a different position than other classes.

### *Some cover types are listed as numbers (or letters) in the diagram.*

Cover types have abbreviations which are found in the external file COVERC.TXT. These abbreviations show up as the cover type identifier in the box describing the class. Cover types without defined abbreviations show up as numbers. The displayed label format (as numbers or letters) does not affect how any part of the program functions since it only uses the numbers. Note, however, that any cover types that are not in the COVERC.TXT or COVER.TXT files will not show up in any of the graphs by cover type.

To change the display from numbers to letters, add the cover type number to the file COVERC.TXT with a short (3-5 letter) code. Follow the format currently in the file. The full name of the cover type should also be added to the file COVER.TXT. Then, reload the cover type files (File ➔ Use new definition files ➔ Cover types).

#### *Only the lines to/from one class are shown.*

The right mouse button was clicked on one of the boxes. To redraw the previously shown pathways, either resize the screen or select “Redraw” from the Diagram Menu and click on the “Draw” button.

#### *Pathways seem to go off the screen (usually on the left side).*

The number of pathways to or from a class has exceeded program limitations. If fewer pathways are drawn (by selectively choosing some from the “Redraw” window, or right-clicking the mouse over one of the boxes) the lines will likely all be drawn properly. The program limitation on drawing the lines does not affect any other program functions (i.e., the information is all retained and can be edited and saved properly).

#### *Some classes have no succession pathways from them.*

Only succession pathways which move from one class to another are drawn. Therefore, those classes which are an endpoint of succession (i.e., classes that go to themselves through succession) will not have any succession pathway emerging from them.

#### *Some pathways are not drawn in the diagram when they are in the files.*

Check to see what pathways have been requested for drawing (label in the upper left corner of the diagram). If the label specifies “No 0 Probabilities”, then the pathways have not been drawn because no probabilities have been defined for that pathway in that management region. Either request that all probabilities be drawn, select a different management region, or enter a probability. Note that if no management region has been chosen (the label in the Status window is blank), the model is drawing the pathways for Region 1. If one of the boxes is yellow, the pathways are being drawn only to and from that one class. To see other pathways, resize the screen or select “Redraw” from the Diagram menu.

Also check to see if the label which specifies what pathways are being shown is covering some of the disturbance pathways. An easy way to do this is to maximize the diagram window and look again at the pathways.

#### *Classes switch places when the succession pathway is changed.*

By default, VDDT draws the diagrams based on the defined succession pathways. When these are changed, the arrangement of the classes may also change. Class locations can be changed using the “Set Locations” option under the Diagram Menu.

## 9.2 Problems with Pathways

#### *The disturbance name is “UnknownCode”.*

The disturbance is not listed in the file DISTCODE.TXT, and will not occur.

Users may add the numerical code (a four-digit number between 1000 and 3599), the disturbance groups to which it belongs (see DISTGRP.TXT) and the name of the disturbance (with no spaces in the name) to DISTCODE.TXT. Then, reload the disturbance files (File ➔ Use new definition files ➔ Disturbances).

*Note that if the final file is to be used with the CRB Assessment process, new numbers should not be added without checking with Don Long at the USFS Fire Lab in Missoula, MT.*

### *The destination class is @.*

The particular cover type-structural stage combination listed as the destination for this disturbance does not exist in the PVT. Change the @ to the letter of the actual destination.

This error usually occurs when the cover type or structural stage of the destination class was edited.

### *The destination class is some letter which is not in the diagram.*

The cover type and structural stage listed as the destination for this disturbance were both set to zero in the input file. Change the class name (in the pathways window) to the letter of the actual destination.

### *During succession a class goes to itself.*

This could occur for two reasons:

1. The class was an "endpoint" and it would normally go nowhere else in the absence of any disturbances. The model needs some value and so makes the class go to itself after several hundred years.
2. The cover type and structural stage listed in the input file as the destination for succession does not exist in the PVT. By default, the program warns the users when the files are read in and changes the destination to be itself (but does not change the number of years or the age). To fix this, change the destination class.

### *Blank lines occur in the list of disturbances from or to a box.*

The blank lines do not affect the functionality of the program. They correspond to disturbances that were deleted during this VDDT session. When the PVT and SCN files are saved and re-loaded, the blank lines will be gone.

### *The relative age is different from the one entered in the PVT file.*

Relative age, as shown in the model, is calculated in two different ways. If a pathway starts and ends in the same class, the relative age field in the PVT file is used. Otherwise, relative age is calculated from the destination age field in the PVT file, and the beginning age of the destination class.

### *Changes made to the "From" (or "To") screen were forgotten.*

Three possible causes exist:

1. The "Close" or cancel button was used instead of the "OK" or save button.
    - Enter the changes again, and click "OK" to save the changes.

2. Changes were not saved when switching to the "To" (or "From") screen.

- Enter the changes again and click "OK" to save and exit or, if going to the "To" (or "From") screen, reply "YES" to saving the changes.

3. The files were not saved in the previous VDDT session.
   - Save the PVT and Scenario files before exiting or closing VDDT.

## 9.3 Problems with Initial Conditions, Viewing Attributes, or Viewing Results

### *All pixels started in one class.*

Check the Initial Conditions window. The proportion of pixels in each class should be less than one. If this screen shows that more than one class should have values, click on the "ReCalc" button to make sure that all values are less than one, and that they add up to one.

### *The results show the initial distribution is uneven but pixels were supposed to be evenly distributed.*

Each class can only be assigned an integer number of pixels. If the proportion of pixels times the number of pixels does not equal an integer number, the model will approximate it by giving some classes slightly fewer pixels and some classes slightly more. If this is of concern, increase the number of pixels to a multiple of the number of classes.

### *In the graphs over time, some disturbance types cannot be selected.*

The program will only allow the user to select disturbance types which have occurred at least once during the simulation. If for example, pathogens were present but did not occur, fire was present and did occur, and insects were not present (no probabilities had been defined), fire would be the only disturbance that could be selected to be viewed over time.

### *In the disturbance bar graphs, the bars do not add to 100 percent.*

The disturbance bar graphs show the percent of pixels that were *affected* in any year, by either disturbances or succession. Some pixels will not have been disturbed and will not have aged enough to move to another class (i.e., will not go through succession). Thus, the sum of the percent of pixels affected will not add to one.

### *In the disturbance bar graphs, the bars add to more than 100 percent.*

This is a relatively rare occurrence, and it is not an error. This can occur because some disturbances can belong to more than one disturbance group. A pixel that was disturbed, will be accounted for in each group of which it is part. For example, a pixel that is disturbed by a disturbance type that is 'fire and bark beetles' will appear in three different bars: fire, insects, and combination. When disturbance levels are high, and a large number of combination disturbances occur, the sum of the percentages recorded by the bars may be greater than 100.

### *The disturbance is not occurring.*

This error can occur for a number of reasons.

1. The age range for the disturbance is outside the age range of the class. To fix this, change the age for which the disturbance probability is valid (Section 4.3). To prevent this problem from occurring, ensure that VDDT changes the valid ages of the probability when the age of the class is changed.

2. A disturbance group to which this disturbance belongs has been disabled. To fix this, re-enable the disturbance group (Section 5.4).
3. The disturbance multiplier for this disturbance type or group is 0. To fix this, turn off the disturbance multipliers or change the multiplier to a number greater than 0 (Section 4.4).
4. Disturbances in the time-since-disturbance group are occurring regularly. Either turn off the time-since-disturbance option, or change the number of years.

### *The program won't show the picture (in the picture attribute).*

First, make sure to click on the View button to see the picture. If nothing happens, or if an error message appears, the file is probably in the wrong format. Only the following formats are accepted: bitmaps (*.bmp, *.dib, or *.ico), Windows metafile format (*.wmf), JPEG (*.jpg), enhanced metafile format (*.emf), GIF files (*.gif), or run-length encoded files (*.rle). TIF files or Corel Draw files cannot be processed by the model.

### *None of the attributes are a valid view or printing option*

The types of attributes are only activated if they are present. Unlike earlier versions of VDDT, attributes must now be present before a model run in order to be activated. If attributes have been defined, try rerunning the model.

### *The calculated attribute always has a value of 0 in the graph*

Calculated attributes are linked to specific disturbances and classes. Thus, the final amount of a calculated attribute will only be greater than 0 if an applicable disturbance has occurred in the right class. Check to ensure that the disturbance is occurring.

### *The summary line graph only shows one line*

Summary line graphs always have three lines. In some cases, little variation occurs between the different iterations, or only one iteration was done. In these cases, all lines may be drawn on top of or close to each other.

### *How do I see the results from a different iteration?*

The graphs only show the individual results of the first iteration of the model run. The information from the other iterations are seen using the various summary options. To get more information about a single iteration, either repeat the iteration by starting with the appropriate random number seed (in the Run Definitions menu), or print the interim results to a file.

## 9.4 Problems with Input or Output

### *Errors reading PVT or SCN files (created from VDDT).*

VDDT should be able to read files that it has created (provided that they have not been edited outside the program; see below). Most problems arise because the PVT was saved as a different format than it was originally. This causes problems when reading new scenario files that were not being used at the time the format changed. Load the PVT file again, with the scenario file it used at the time. Save them as a different format and see if a different scenario file can be read.

### *Errors reading PVT or SCN files (which may have been edited or created outside VDDT).*

Most errors occur if the files have been created or modified using an editor or a program other than VDDT. These problems are marked with an '*' below. Check several things:

1. Is more than one copy of VDDT running? To find out, hit CTRL-ESC to bring up a list of the programs which Windows thinks are running. If more than one copy is present, close the unused ones by clicking on the "End Task" button.

*2. Does the file contain tabs? If so, remove them.

*3. Does the file have one or more blank lines after the last set of information or within the main body of the file? If so, remove them.

*4. Do any of the text descriptors contain a blank character (e.g., Lodgepole Pine instead of LodgepolePine or Lodgepole_Pine)? If so, remove the blanks.

*5. Is there a single header line before the PVT number and name? If not, put one in.

and, if none of that works,

*6. Have all the lines been counted accurately (i.e., the number of classes, or the number of disturbances in a class)? This error usually occurs if the line containing the error is the first line of a class or management region or the last line of a list of disturbances.

The error message may give some clue about the problem. In many cases, the error message will print a line number. The error may occur in that line or the line on either side.

### *Error reading the project file.*

The most common problem when reading the project file is that it has been moved from its original location. The project file contains the full pathnames of many of the files. If the project file is moved to another computer, or if any of the files have moved, it may not be able to read the files properly.

### *Some disturbance types were not in the PVT file.*

The scenario file has probabilities for disturbance pathways which are not present in the PVT file. This occurs when disturbances have been deleted from a PVT when a different scenario file was in use. The model ignores these disturbances after giving the warning, and when the scenario file is saved, the disturbance will no longer be present.

### *A class was not in the PVT file.*

A class present in the scenario file is not present in the PVT file. This occurs when a class has been deleted, or its cover type or structural stage changed when another scenario file was in use. The model ignores the class in the scenario file (after giving the warning), and when the scenario file is saved, the class and all its disturbance probabilities, will no longer be present. There is no way to tell the model what class it has been changed to.

### *The destination class for succession or a disturbance does not exist.*

This error occurs in two places:

1. When reading the files: Make a note of the originating class and then, when the diagram has been drawn, double-click on the class and edit the appropriate succession or disturbance pathways. The

problem disturbance pathways will be indicated by an @ or a strange letter combination as the destination.

2. When editing the pathways: The problem box will be highlighted.
   a. Check to ensure that the destination letter is one of the classes in the diagram.
   b. Check that location in all pages of disturbances (i.e., a box in the second row might be highlighted but it may indicate a problem with the second row on page 1, 2, or 3) and ensure that the destination is valid.
   c. Look at the diagram. If the labels in the boxes are not all in the corners of the box then click on “Close” (or hit the ESC key). All changes will be lost. Then resize the diagram. If the labels of the boxes are now in the corners, try editing the pathway again.
   d. Make sure that blanks were not entered as well as the destination letter.

### *The graphs or diagram or probability file will not print to the printer.*

Make sure that the desired printer is the default printer in Windows, that a driver exists for it, that it is properly attached, and that the machine knows it is there (which may mean re-booting the machine after the printer is attached).

### *The color printer is only printing black and white graphs.*

The program will allow the diagrams to be drawn in color but the graphs will usually only be printed in black and white.

### *The edge of the graphs or diagram is cut off when printed.*

On some computers, when graphs or diagrams are printed using “Portrait” orientation, their edge may be cut off. Since VDDT uses the default Windows printer and its paper type, change the default paper type to “Landscape” before printing.

### *The disturbance name (in the output files) is “UnknownCode”.*

The disturbance is not listed in the file DISTURB.TXT, and will not occur.

There are two possible fixes for this problem:

1. Load a different DISTURB.TXT file that contains the disturbance. This error occurs when VDDT is reading the wrong file.
2. Add the numerical code (a four-digit number between 1000 and 3599), the disturbance groups to which it belongs (see DISTGRP.TXT) and the name of the disturbance (with no spaces in the name) to DISTURB.TXT. Then, either load the new files (File -> Use new definition files) or when VDDT is next loaded, the disturbance code will have a name within the program, and the disturbance can occur.

*Note that if the final file is to be used with the CRB Assessment process, new numbers should not be added without checking with Don Long at the USFS Fire Lab in Missoula, MT.*

### *The cover type (in the output files) is “UnknownType”.*

The cover type is not listed in the file COVER.TXT. As long as the cover type code is between 1000 and 6999, the program will function as usual (since it only looks at the number, not the name).

There are two possible fixes for this problem:

1. Load a different COVER.TXT file that contains the cover type.
2. Add the code (a four-digit number between 1000 and 6999) and name the cover type (with no spaces in the name) to COVER.TXT, and the code and an abbreviated name (with no spaces in the name) to COVERC.TXT. Then, either load the new files (File -> Use new definition files) or when VDDT is next loaded, the cover type code will have a name within the program.

*Note that if the final file is to be used with the CRB Assessment process, new numbers should not be added without checking with Don Long at the USFS Fire Lab in Missoula, MT.*

## 9.5 Other Problems

### *Garbage fonts.*

The fonts used by VDDT are MS Sans Serif and Roman, both Windows fonts. Experience has shown that when the Adobe Type Manager (ATM) is active, some of the labels in the program will be unreadable, especially the graph labels. Removing the Adobe Type Manager will alleviate these problems.

### *Problems loading VDDT.*

Check to ensure that the five (5) TXT files (Section 2.2) are in the directory listed as the “working directory” in the VDDT icon properties. The default working directory is the directory containing the executable (VDDT32.EXE)

### *The screen for editing pathways and probabilities isn’t drawing properly.*

Depending on your hardware configuration, VDDT occasionally has memory problems. For best results, including helping solve this problem, close out of all other applications which are currently open or running in your Windows session.

# Appendix: Definitions and File Descriptions

## Attribute Files

### *Attribute structure file (*.ATT)*

The attributes are stored in a file that has the format:

Line 1: PVTno, number of attributes, list of the **name** of each attribute (in " ", and separated by commas)
Line 2: PVTno, number of attributes, list of the **type** of each attribute (in " ", and separated by commas)
Line 3: PVTno, number of attributes, list of the **units** for each attribute (in " ", and separated by commas)
Lines by class:

PVTno, ss-ct #, list of the **value** of each attribute (in " ", and separated by commas)

Repeat for each calculated attribute:

Lines for defining calculated attributes:

PVTno, -999, name of calculated attribute
PVTno, "distid", "att", number of disturbance, disturbance numbers

Lines with calculated attribute values:

PVTno, disturbance number, number of attribute that this is based on, multiplier, value for each disturbance type. *Note that each row can contain either the number of the attribute and the multiplier, or values for each disturbance type. If both are present, only the first set will be saved.*

The "ss-ct #" is a combination number of the structural stage and the cover type number, with the structural stage being the first 1-2 numbers and the cover type being the last four numbers. For example, if the ss-ct # was 261015 (see the fourth row of the example), the structural stage would be 26 and the cover type would be 1015.

An example of an attribute file is:

```
999, 4,"Attribute 1", "Attribute 2", "Description", "Calc. attribute"
999, 4,"Level/group", "Numerical", "Text filename", "Calculated"
999, 4,"", "t / acre", "", ""
999, 261015,"low",  10, "C:\VDDT\Sample.des",
999, 12009,"low",  5, "C:\VDDT\Sample.des",
999, 32009,"medium",  10, "C:\VDDT\Sample.des",
999, 42009,"high",  15, "C:\VDDT\Sample.des",
999, 52009,"medium",  15, "C:\VDDT\Sample.des",
999, 62009,"high",  20, "C:\VDDT\Sample.des",
999, -999, "Calc. attribute"
999, "distid", "att", 6,  261015,  12009,  32009,  42009,  52009,  62009
999, 3001, 1, 0.5, 0, 0, 0, 0, 0
999, 3009,  , , 0.25, 0.25, 0.25, 0.25, 0.25, 0.25
999, 3011,  , , 0.4, 0.4, 0.4, 0.4, 0.4, 0.4
999, 3019,  , , 0.1, 0, 0, 0, 0, 0
999, 3029,  , , 0.1, 0, 0, 0, 0, 0
999, 3440,  , , 0.3, 0.3, 0.3, 0.3, 0.3, 0.3
999, 3441,  , , 0.1, 0, 0, 0, 0, 0
999, 3442,  , , 0.1, 0, 0, 0, 0, 0
```

### *Text attribute descriptor file (*.DES)*

The text for the text-type attributes is contained in a file which has the text for the classes in the PVT for which text has been written. The text for each text-type attribute must be in a separate file (i.e., if there are two text-type attributes, there must be two text files). The text file must have the format:

PVTnumber, ss-ct #
"Text"
PVTnumber, ss-ct #, code for pathway type
"Text"
PVTnumber, ss-ct #, code for pathway type
"Text"
PVTnumber, ss-ct # *(If more than one class is in the file)*
"Text"

Notice that the text is surrounded by double-quote marks (" " ). The text may contain any character except the double-quote mark, and may be more than one line.

If the line containing the PVT number and the class identifier has not other information, the text applies to the entire class, and is viewed from one of the options on the Attributes Menu. If the line contains another number, it can be viewed from the window describing the pathways. Numbers 1-3 are for the descriptions relating to succession and age boundaries, while the other numbers are those of the related disturbance type. Note that each disturbance type in a class can only have one description.

For example, a file which contains some text descriptions for the example PVT file would look like:

```
 999, 261015
"This is class contains general low-lying shrubs that will eventually be replaced by a
lodgepole pine forest."
 999, 261015 3
"After six years, the trees are filling in enough that the stand is more like a young
forest than a shrubby field."
 999, 12009
"This class is the stand initiation phase of a predominantly lodgepole pine forest."
 999, 32009
"This class contains a lodgepole pine forest with a closed canopy and no young saplings."
 999, 42009
"New trees are starting in the understory of this lodgepole pine forest."
 999, 52009
"This is a 'young forest' which occurs only through disturbances such as fires and
harvesting. In the absence of these disturbances forests will not enter this successional
stage."
 999, 62009
"The oldest of the lodgepole pine forests, this stage occurs as the young trees (from
structural stage 4) age and become a new stratum under the older forest. In the absence
of any disturbances, this stage will persist indefinitely."
 999, 62009 2
"The class goes to itself after succession. Thus, pixels only leave this class through
succession."
 999, 62009 3
"This is a succession end point, so the years are set to something very large."
 999, 62009 1001
"No harvesting in region 1"
 999, 62009 1021
"No harvesting in Region 1."
 999, 62009 3001
"Stand replacing fire occurs with equal frequency in all regions because each has a
similar fire policy in this scenario."
```

## Between-Year Variability Files

The information about between-year variability is stored in between three and five different files. If information about annual variation is present, only the annual multiplier file is needed. If new annual multipliers are to be generated, year sequence group and year-type multipliers will also be needed.

### *Year sequence group files (*.YSG)*

This file contains all the information relating to "Year Sequence Groups". The first line of the file contains the number of YSGs that are present in the file. Then, the first line of each YSG lists the name of the YSG (in quotation marks), the percentage of the years that are in each type of year ("Very Low", "Low", "Normal", "High", and "Severe"), and the number of disturbances in the YSG. The lines following give the disturbance id numbers for each of the disturbance types in the YSG.

```
 2
"Fires"   16       57       11       11       5       6
 3014
 3011
 3019
 3004
 3001
 3009
"Pests"   10       80        5        3       2       2
 2002
 2101
```

### *Year-type multipliers file (*.YTM)*

This file contains the multipliers associated with each disturbance type and each type of year. Note that in order to load this file, some information about YSGs must already be in memory.

Each line gives a disturbance id number and the multipliers used for that disturbance in each of the five types of years ("Very Low", "Low", "Normal", "High", and "Severe"). Note that only the disturbances that are in a YSG are printed to this file.

```
 3011          0.2  1  2  5  10
 3014          0.2  1  2  5  10
 3019          0.2  1  2  5  10
 3001          0.2  1  3  7  10
 3004          0.1  1  2  4  8
 3009          0.1  1  1.5  3  6
 2002          0.5  1  2  5  8
 2101          0.1  1  2  4  5
```

### *Year-type sequence file (*.TSE)*

This file contains the type of year for each year that was generated (up to 300 years) for one or more YSGs. Each year is given a number from 1 to 5 to represent the different year types:

1 = "Very Low",
2 = "Low",
3 = "Normal",
4 = "High", and
5 = "Severe".

The first line of the file gives the number of years that are listed. The first line of YSG then gives a YSG number (which is the number of the YSG at the time it was saved) and the name of the YSG. Each line following (for that YSG) gives the year and the type of year.

In the example file, only 20 years have been printed.

```
20
1 Fires
1             2
2             3
3             2
4             2
5             4
6             2
7             2
8             2
9             1
10            2
11            2
12            4
13            3
14            1
15            2
16            2
17            2
18            2
19            1
20            5
2 Pests
1             2
2             4
3             1
4             2
5             2
6             2
7             2
8             2
9             2
10            2
11            2
12            2
13            3
14            2
15            2
16            2
17            2
18            2
19            2
20            1
```

### *Multiplier sequence files (*.MSE)*

This file contains a multiplier for each disturbance type for each year that was generated (up to 300 years). The values in this file are the originally generated multipliers that have not been normalized. The file has the format:

| | | | | |
|---|---|---|---|---|
| YSG# | "YSG Name" | # of Disturbances in the YSG | | |
| 0 | Dist1 ID | Dist2 ID | Dist3 ID ... | Dist*n* ID |
| year1 | Mult1 | Mult2 | Mult3 ... | Mult*n* |
| year2 | Mult1 | Mult2 | Mult3 ... | Mult*n* |
| *etc.* | | | | |

```
20
 1 "Fires"  6
 0      3014    3011    3019    3004    3001    3009
 1      1       1       1       1       1       1
 2      2       2       2       2       3       1.5
 3      1       1       1       1       1       1
 4      1       1       1       1       1       1
 5      5       5       5       4       7       3
 6      1       1       1       1       1       1
 7      1       1       1       1       1       1
 8      1       1       1       1       1       1
 9      0.2     0.2     0.2     0.1     0.2     0.1
 10     1       1       1       1       1       1
 11     1       1       1       1       1       1
 12     5       5       5       4       7       3
 13     2       2       2       2       3       1.5
 14     0.2     0.2     0.2     0.1     0.2     0.1
 15     1       1       1       1       1       1
 16     1       1       1       1       1       1
 17     1       1       1       1       1       1
 18     1       1       1       1       1       1
 19     0.2     0.2     0.2     0.1     0.2     0.1
 20     10      10      10      8       10      6
 2 "Pests"  2
 0      2002    2101
 1      1       1
 2      5       4
 3      0.5     0.1
 4      1       1
 5      1       1
 6      1       1
 7      1       1
 8      1       1
 9      1       1
 10     1       1
 11     1       1
 12     1       1
 13     2       2
 14     1       1
 15     1       1
 16     1       1
 17     1       1
 18     1       1
 19     1       1
 20     0.5     0.1
```

### *Normalized sequence files (*.NSE)*

This file contains a *normalized* multiplier for each disturbance type for each year that was generated (up to 300 years). The file format is identical to the multiplier sequence file.

| | | | | |
|---|---|---|---|---|
| YSG# | "YSG Name" | | # of Disturbances in the YSG | |
| 0 | Dist1 ID | Dist2 ID | Dist3 ID ... Dist*n* ID | |
| year1 | Mult1 | Mult2 | Mult3 ... | Mult*n* |
| year2 | Mult1 | Mult2 | Mult3 ... | Mult*n* |
| *etc.* | | | | |

```
20
 1 "Fires"  6
 0      3014    3011    3019    3004    3001    3009
 1      0.947   0.947   0.947   0.96    0.929   0.976
 2      1.895   1.895   1.895   1.921   2.789   1.464
 3      0.947   0.947   0.947   0.96    0.929   0.976
 4      0.947   0.947   0.947   0.96    0.929   0.976
 5      4.737   4.737   4.737   3.842   6.509   2.928
 6      0.947   0.947   0.947   0.96    0.929   0.976
 7      0.947   0.947   0.947   0.96    0.929   0.976
 8      0.947   0.947   0.947   0.96    0.929   0.976
 9      0.189   0.189   0.189   0.096   0.185   0.097
 10     0.947   0.947   0.947   0.96    0.929   0.976
 11     0.947   0.947   0.947   0.96    0.929   0.976
 12     4.737   4.737   4.737   3.842   6.509   2.928
 13     1.895   1.895   1.895   1.921   2.789   1.464
 14     0.189   0.189   0.189   0.096   0.185   0.097
 15     0.947   0.947   0.947   0.96    0.929   0.976
 16     0.947   0.947   0.947   0.96    0.929   0.976
 17     0.947   0.947   0.947   0.96    0.929   0.976
 18     0.947   0.947   0.947   0.96    0.929   0.976
 19     0.189   0.189   0.189   0.096   0.185   0.097
 20     9.475   9.475   9.475   7.684   9.299   5.857
 2 "Pests"  2
 0      2002    2101
 1      0.986   0.992
 2      4.934   3.97
 3      0.493   0.099
 4      0.986   0.992
 5      0.986   0.992
 6      0.986   0.992
 7      0.986   0.992
 8      0.986   0.992
 9      0.986   0.992
 10     0.986   0.992
 11     0.986   0.992
 12     0.986   0.992
 13     1.973   1.985
 14     0.986   0.992
 15     0.986   0.992
 16     0.986   0.992
 17     0.986   0.992
 18     0.986   0.992
 19     0.986   0.992
 20     0.493   0.099
```

## Comma-Delimited Files

The comma-delimited files (created by selecting "Export Files" from the File Menu) consist of two files, one containing the PVT information and one containing the scenario information. These files are in the format expected by the CRB Paradox database.

The comma-delimited PVT file consists of 17 columns which describe the class, its succession destination, the disturbances, and their destination. The columns are: (1) the PVT number, (2) the class identifier as a value with the structural stage in the first one or two digits and the cover type as the last four digits, (3) a disturbance code, (4) the number of classes in the PVT, (5) the number of the current class (the class being described), (6) the structural stage of the class, (7) the cover type of the class, (8) the beginning age of the class, (9) the ending age of the class, (10) the class to which this class goes during succession, (11) a column containing a zero (which is not used), (12) the number of disturbances in the class, (13) the destination for the disturbance as the combined class identifier, (14) the age of the pixel after the disturbance, (15) the age increment of the pixel (used if it stays in the same class), (16) the structural stage of the destination class, and (17) the cover type of the destination class.

```
999, 12009, 3001, 6, 2, 1, 2009, 6, 51, 32009,0, 1, 261015, 1, 0, 26, 1015
999, 32009, 3001, 6, 3, 3, 2009, 51, 91, 42009,0, 8, 261015, 1, 0, 26, 1015
999, 32009, 3011, 6, 3, 3, 2009, 51, 91, 42009,0, 8, 261015, 1, 0, 26, 1015
999, 32009, 3021, 6, 3, 3, 2009, 51, 91, 42009,0, 8, 261015, 1, 0, 26, 1015
999, 32009, 3030, 6, 3, 3, 2009, 51, 91, 42009,0, 8, 42009, 91, 0, 4, 2009
999, 32009, 3106, 6, 3, 3, 2009, 51, 91, 42009,0, 8, 32009, 51, 10, 3, 2009
999, 32009, 1103, 6, 3, 3, 2009, 51, 91, 42009,0, 8, 32009, 51, 20, 3, 2009
999, 32009, 1101, 6, 3, 3, 2009, 51, 91, 42009,0, 8, 42009, 91, 0, 4, 2009
999, 32009, 1001, 6, 3, 3, 2009, 51, 91, 42009,0, 8, 261015, 1, 0, 26, 1015
999, 42009, 1001, 6, 4, 4, 2009, 91, 131, 62009,0, 11, 261015, 1, 0, 26, 1015
999, 42009, 1021, 6, 4, 4, 2009, 91, 131, 62009,0, 11, 52009, 131, 0, 5, 2009
999, 42009, 3001, 6, 4, 4, 2009, 91, 131, 62009,0, 11, 261015, 1, 0, 26, 1015
999, 42009, 3011, 6, 4, 4, 2009, 91, 131, 62009,0, 11, 261015, 1, 0, 26, 1015
999, 42009, 3021, 6, 4, 4, 2009, 91, 131, 62009,0, 11, 261015, 1, 0, 26, 1015
999, 42009, 3009, 6, 4, 4, 2009, 91, 131, 62009,0, 11, 42009, 91, 0, 4, 2009
999, 42009, 3019, 6, 4, 4, 2009, 91, 131, 62009,0, 11, 42009, 91, 0, 4, 2009
999, 42009, 3029, 6, 4, 4, 2009, 91, 131, 62009,0, 11, 42009, 91, 0, 4, 2009
999, 42009, 3483, 6, 4, 4, 2009, 91, 131, 62009,0, 11, 261015, 1, 0, 26, 1015
999, 42009, 2002, 6, 4, 4, 2009, 91, 131, 62009,0, 11, 52009, 131, 0, 5, 2009
999, 42009, 1103, 6, 4, 4, 2009, 91, 131, 62009,0, 11, 42009, 91, 10, 4, 2009
999, 52009, 1001, 6, 5, 5, 2009, 131, 211, 62009,0, 11, 261015, 1, 0, 26, 1015
999, 52009, 3001, 6, 5, 5, 2009, 131, 211, 62009,0, 11, 261015, 1, 0, 26, 1015
999, 52009, 3011, 6, 5, 5, 2009, 131, 211, 62009,0, 11, 261015, 1, 0, 26, 1015
999, 52009, 3021, 6, 5, 5, 2009, 131, 211, 62009,0, 11, 261015, 1, 0, 26, 1015
999, 52009, 3030, 6, 5, 5, 2009, 131, 211, 62009,0, 11, 52009, 131, 0, 5, 2009
999, 52009, 1021, 6, 5, 5, 2009, 131, 211, 62009,0, 11, 52009, 131, 0, 5, 2009
999, 52009, 1103, 6, 5, 5, 2009, 131, 211, 62009,0, 11, 52009, 131, 0, 5, 2009
999, 52009, 3440, 6, 5, 5, 2009, 131, 211, 62009,0, 11, 52009, 131, 0, 5, 2009
999, 52009, 3441, 6, 5, 5, 2009, 131, 211, 62009,0, 11, 52009, 131, 0, 5, 2009
999, 52009, 3442, 6, 5, 5, 2009, 131, 211, 62009,0, 11, 52009, 131, 0, 5, 2009
999, 52009, 2002, 6, 5, 5, 2009, 131, 211, 62009,0, 11, 52009, 131, 0, 5, 2009
999, 62009, 3001, 6, 6, 6, 2009, 131, 1130, 62009,0, 4, 261015, 1, 0, 26, 1015
999, 62009, 1001, 6, 6, 6, 2009, 131, 1130, 62009,0, 4, 261015, 1, 0, 26, 1015
999, 62009, 1021, 6, 6, 6, 2009, 131, 1130, 62009,0, 4, 52009, 131, 0, 5, 2009
999, 62009, 2002, 6, 6, 6, 2009, 131, 1130, 62009,0, 4, 52009, 131, 0, 5, 2009
```

The Paradox-format scenario file consists of 15 columns which describe the scenario and its associated disturbance probabilities. As in the standard scenario file, no disturbances with zero probabilities are included. The columns are: (1) the PVT number, (2) a disturbance code, (3) the class identifier as a combined structural stage (first one or two digits) and cover type (last four digits) value, (4) the management region (as a number), (5) the phase number, (6) an brief description of the scenario, (7) the structural stage, (8) the cover type, (9) a class counter (note that this does not correspond to the class number in the PVT file), (10) the first year of the simulation (usually a 0), (11) the number of years to simulate, (12) the number of disturbances in the class, (13) number of combinations of PVT number and class identifiers in the file (this will usually correspond to the number of classes in the file), (14) the number of management regions, and (15) the probability of disturbance.

```
999, 3001, 12009, 1, 1, "Example", 1, 2009, 1, 0, 300, 1, 5, 3, .006
999, 3001, 32009, 1, 1, "Example", 3, 2009, 2, 0, 300, 3, 5, 3, .002
999, 3021, 32009, 1, 1, "Example", 3, 2009, 2, 0, 300, 3, 5, 3, .001
999, 3106, 32009, 1, 1, "Example", 3, 2009, 2, 0, 300, 3, 5, 3, .0002
999, 3001, 42009, 1, 1, "Example", 4, 2009, 3, 0, 300, 5, 5, 3, .004
999, 3021, 42009, 1, 1, "Example", 4, 2009, 3, 0, 300, 5, 5, 3, .0015
999, 3009, 42009, 1, 1, "Example", 4, 2009, 3, 0, 300, 5, 5, 3, .0001
999, 3483, 42009, 1, 1, "Example", 4, 2009, 3, 0, 300, 5, 5, 3, .0015
999, 2002, 42009, 1, 1, "Example", 4, 2009, 3, 0, 300, 5, 5, 3, .01
999, 3001, 52009, 1, 1, "Example", 5, 2009, 4, 0, 300, 4, 5, 3, .0025
999, 3021, 52009, 1, 1, "Example", 5, 2009, 4, 0, 300, 4, 5, 3, .0025
999, 3440, 52009, 1, 1, "Example", 5, 2009, 4, 0, 300, 4, 5, 3, .0001
999, 2002, 52009, 1, 1, "Example", 5, 2009, 4, 0, 300, 4, 5, 3, .001
999, 3001, 62009, 1, 1, "Example", 6, 2009, 5, 0, 300, 2, 5, 3, .007
999, 2002, 62009, 1, 1, "Example", 6, 2009, 5, 0, 300, 2, 5, 3, .01
999, 3001, 12009, 2, 1, "Example", 1, 2009, 1, 0, 300, 1, 5, 3, .006
999, 3001, 32009, 2, 1, "Example", 3, 2009, 2, 0, 300, 5, 5, 3, .002
999, 3106, 32009, 2, 1, "Example", 3, 2009, 2, 0, 300, 5, 5, 3, .0002
999, 1103, 32009, 2, 1, "Example", 3, 2009, 2, 0, 300, 5, 5, 3, .0125
999, 1101, 32009, 2, 1, "Example", 3, 2009, 2, 0, 300, 5, 5, 3, .0023
999, 1001, 32009, 2, 1, "Example", 3, 2009, 2, 0, 300, 5, 5, 3, .0015
999, 1001, 42009, 2, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .023
999, 1021, 42009, 2, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .002
999, 3001, 42009, 2, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .004
999, 3009, 42009, 2, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .0001
999, 3483, 42009, 2, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .0015
999, 2002, 42009, 2, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .01
999, 3001, 52009, 2, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .004
999, 1021, 52009, 2, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .0012
999, 3440, 52009, 2, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .0001
999, 3441, 52009, 2, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .0001
999, 3442, 52009, 2, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .0001
999, 2002, 52009, 2, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .001
999, 3001, 62009, 2, 1, "Example", 6, 2009, 5, 0, 300, 4, 5, 3, .007
999, 1001, 62009, 2, 1, "Example", 6, 2009, 5, 0, 300, 4, 5, 3, .05
999, 1021, 62009, 2, 1, "Example", 6, 2009, 5, 0, 300, 4, 5, 3, .005
999, 2002, 62009, 2, 1, "Example", 6, 2009, 5, 0, 300, 4, 5, 3, .01
999, 3001, 12009, 3, 1, "Example", 1, 2009, 1, 0, 300, 1, 5, 3, .006
999, 3001, 32009, 3, 1, "Example", 3, 2009, 2, 0, 300, 5, 5, 3, .002
999, 3106, 32009, 3, 1, "Example", 3, 2009, 2, 0, 300, 5, 5, 3, .0002
999, 1103, 32009, 3, 1, "Example", 3, 2009, 2, 0, 300, 5, 5, 3, .0125
999, 1101, 32009, 3, 1, "Example", 3, 2009, 2, 0, 300, 5, 5, 3, .0023
999, 1001, 32009, 3, 1, "Example", 3, 2009, 2, 0, 300, 5, 5, 3, .0015
999, 1001, 42009, 3, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .023
999, 1021, 42009, 3, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .002
999, 3001, 42009, 3, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .004
999, 3009, 42009, 3, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .0001
999, 3483, 42009, 3, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .0015
999, 2002, 42009, 3, 1, "Example", 4, 2009, 3, 0, 300, 6, 5, 3, .01
999, 3001, 52009, 3, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .004
999, 1021, 52009, 3, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .0012
```

```
999, 3440, 52009, 3, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .0001
999, 3441, 52009, 3, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .0001
999, 3442, 52009, 3, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .0001
999, 2002, 52009, 3, 1, "Example", 5, 2009, 4, 0, 300, 6, 5, 3, .001
999, 3001, 62009, 3, 1, "Example", 6, 2009, 5, 0, 300, 4, 5, 3, .007
999, 1001, 62009, 3, 1, "Example", 6, 2009, 5, 0, 300, 4, 5, 3, .05
999, 1021, 62009, 3, 1, "Example", 6, 2009, 5, 0, 300, 4, 5, 3, .005
999, 2002, 62009, 3, 1, "Example", 6, 2009, 5, 0, 300, 4, 5, 3, .01
```

## Cover Type Codes Files (COVER.TXT, COVERC.TXT)

Cover types are defined by a four-digit code between 1000 and 6999.

Two cover type code files are necessary for the model to operate. COVER.TXT gives a long version of the name COVERC.TXT is a file containing 4-6 letter abbreviations for the cover types. These abbreviations are the ones seen in the successional pathway diagram. This appendix lists only the long version of the cover types and their numbers.

This example file is the one distributed with VDDT.

```
1001 Rock/Barrenlands
1002 Water
1004 Grass/Forb
1005 Shrub/Regen
1009 Exotics
1010 PerennialNativeBunchgrass
1013 MountainShrub
1014 HerbShrub
1015 GeneralShrub
1016 MountainShrub(Ceanothus)
1017 BareSoil
2001 Spruce/SubAlpineFir
2002 WhitebarkPine
2003 Douglas Fir
2005 WesternLarch
2006 Grand/WhiteFir
2007 WhitePine
2008 Aspen
2009 LodgepolePine
2010 MountainHemlock
2011 PacificSilverFir
2012 HemlockCedar
2013 ShastaRedFir
2014 Aspen/Poa
2014 Aspen/Exotic
2018 InteriorPonderosaPine
2023 WhitebarkPine/SubalpineLarch
2024 SubalpineLarch
2025 JuniperWoodland
2027 LimberPine
2030 SierraMixedConifer
2031 PacificPonderosaPine
3001 AgropyronSpicatum
3003 Purshia/AgropyronSpicatum
3004 Juniper/Sagebrush/Wheatgrass
3007 MountainMahogany
3010 IdahoFescue/Wheatgrass
3013 Artemisia_tri_tri
3015 SaltDesertShrub
3016 Chokecherry/Serviceberry/Rose
3021 Artemisia/ElymusCinereus
3022 ThreetipSagebrush
4001 ConiferEncroachment/ExoticGrass
4003 ExoticForbs
4013 SeededNativeGrass(AGSP/FEID)
4015 LowprodPerennialGrass
4019 PioneerForbs
4020 SmallPerennialGrass
4021 NativeForbs
4022 ExoticPerennialGrass
4023 ExoticForbs
4024 ExoticHerbaceous
4025 JuniperForest/ExoticHerb
4027 ArtemisArbuscula/NativeForbs
4028 Juniper/LowSage/Shortgrass
4029 Juniper/PoaSecunda
4031 ArtemisiaArbuscula/NativeBunchgrass
4038 ExoticAnnualGrass
4040 SitanionHystrix
4042 PoaSecunda
4043 Poa/PerennialGrass
4047 ExoticGrass(BRTE/ELCA/POSE)
4048 SeededNativeGrass(POSE/AGSP)
4049 FireMaintainedGrass(POSE/AGSP)
4057 PoaPratensis
4058 Salix/Carex
4059 Salix/Grass
4060 Grass/Carex
4079 GravelBar
4080 Populus/Cornus
4081 PopulusTrichocarpa
4084 Populus/PoaPratensis
4087 Cornus/Crateagus
4089 Salix/Calamagrostis
4090 Salix/Carex
4091 Salix/ExoticForbs
4092 Salix/PoaPratensis
4093 ExoticHerbs
4094 DeschampsiaCalamagrostis
4095 ExoticRiparianHerbs
4096 ExoticMoistHerbs
4097 Agropyron/PoaSecunda
4098 PoaSecunda/FestucaOctaflora
4099 Artemisia/PoaSecunda
5001 BromusTectorum
5002 Artemisia/BromusTectorum
5006 SeededExoticAgropyron
5009 ArtemisiaVasy_triden/PerennialGrass
```

5011 ConiferEncroachment/Sage/PerennialGrass
5012 NativePerennialGrass
5013 ArtemisiaVasy_triden/PerrennialHerbs
5014 PerennialNativeHerbs
5016 ArtemisiaVasy_triden/PerennialGrass
5017 ConiferEncroachment/Sage/PerennialGrass
5019 Conifer/PerennialGrass
5021 ArtemisiaVasy_triden/ExoticHerbs
5039 IrrigatedCrop
5040 DrylandPasture/HayLand
5041 IrrigatedPasture/HayLand
5043 UrbanLand
5046 DrylandCrop
5047 DrylandPasture/HayLand
5050 ElymusCinereus
5051 ElymusCinereus/Agropyron
5052 ElymusCinereus/BromusTectorum
5053 AgropyronCristatum
5055 AgropyronCristatum/BromusTectorum
5056 PerennialHerbs
5059 ArtemisiaTriparteta/Exotics
5060 ArtemisiaTriparteta/AgropyronCristatum
5061 AristidaLongiseta
5062 ArtemisiaArbuscula/BromusTectorum
5063 PurshiaTridentata/BromusTectorum
5064 PoaSecunda/PerennialForbs
5066 SarcobatusVermiculatus
5067 Ryegrass
5068 Greasewood/Saltgrass
5069 Greasewood
5070 Juniper/LowSage/Fescue
5072 Phylodoce
5073 Conifer/ExoticHerbs
5074 Juniper/NativeBunchgrass
5075 Juniper/ExoticHerbs
5076 Pinus/Populus/Shrub
5077 Fir/Populus/Shrub
5078 Pinus/Populus/Exotic
5079 Fir/Exotic
5080 WhiteOak/Shrub
5081 MidShrub
5082 WhiteOak/Exotic
5084 CarexRostrata/aquatilis
5085 CarexNebraskensis

## Disturbance Code File: DISTCODE.TXT

This file defines all the possible disturbances that can occur in the model. Each disturbance is given a four-digit code and a short name. In addition, each disturbance can be a member of between one and three disturbance groups (see the disturbance group file description for more details). The numerical code must be an integer between 1000 and 3599. The short name must contain no commas or blanks, should be fewer than 10 characters (although there is no limit), and should be reasonably descriptive.

The file lists the information in five columns:

col 1: the numerical code,
cols 2-4: the number of the disturbance groups to which this disturbance belongs,
col 5: the short description of the type of disturbance.

For ease of reference, the file is printed here in 3 sets of columns. This example file is the one distributed with VDDT and may be edited as needed.

```
1001 1 0 0 CC-Noprep
1003 1 0 0 GrpSelCut
1005 1 0 0 IndSelCut
1006 1 0 0 OSR
1009 1 0 0 SanitationCut
1012 1 0 0 Shelterwood
1014 1 6 0 CC+PlantPP
1015 1 6 0 CC+PlantDF
1016 1 6 0 CC+PlantWL
1017 1 6 0 CC+Plant
1018 1 6 0 CC+PlantWP
1020 1 0 0 PartialCut6
1021 1 0 0 PartialCut
1022 1 5 0 CC+Burn
1023 1 0 0 CC+Sprout
1027 1 0 0 PartialCut1
1028 1 0 0 PartialCut2
1029 1 0 0 OSR1
1031 1 0 0 CC-Noprep2
1035 1 0 0 PartialCut3
1036 1 0 0 PartialCut4
1037 1 0 0 PartialCut5
1040 1 5 0 SW+Burn
1041 1 0 0 SWRsrv
1042 1 0 0 SWRsrv2
1043 1 0 0 SWRsrv3
1045 1 0 0 GrpSelCut2
1048 1 0 0 SWDeadRsrv
1050 1 0 0 SWDeadRsrv2
1052 1 0 0 CCRsrv
1053 1 0 0 CCRsrv2
1055 1 0 0 CCDeadRsrv
1101 1 0 0 CommerThin
1102 4 0 0 PrecomThin
1103 4 0 0 ThinLow
1104 4 0 0 ThinHigh
1105 4 0 0 Thin2
1106 4 0 0 Thin3
1108  4 0 0 ThinLow2
1201  6 0 0 BarerootPltng
1301  7 0 0 UnspecGrazing
1302  7 0 0 LCSCG
1303  3 0 0 LCSMG
1304  3 0 0 LCSAG
1305 13 0 0 LCSNG
1306  7 0 0 BSCG
1307  3 0 0 BSMG
1308  3 0 0 BSAG
1309 13 0 0 BSNG
1310  7 2 0 LCSCG+Exotics
1311  3 2 0 BSCG+Exotics
1313  6 6 0 Herbicide+Seed
1314  6 6 0 MechPrep+Seed
1315  3 0 0 WinterGraze
1317 12 0 0 Erosion
1318 11 0 0 Agriculture
1319  7 0 0 UnspecGrazing2
1320  7 0 0 LCSCGsheep
1331  6 0 0 Seed
1332  6 0 0 VegManipulation
1333  6 6 0 VegManip+Seed
1334  6 0 0 VegPlanting
1335  6 6 0 Herbicide+SeedExotic
1501 11 0 0 Till+SeedAnn+Spray
1502 11 0 0 TillSeed
1503 11 0 0 Irrigation
1504 11 0 0 Development
1505 11 0 0 Till+SdNtv+Spray
1506 11 0 0 Till+SdPer+Spray
2001  9 0 0 DFB1
2002  9 0 0 MPB
2003  9 0 0 WPB
2004  9 0 0 MPB/WPB
2005  9 8 0 WPP+SRF1
2006  9 0 0 BB
2007  9 0 0 SpruceBeetles
2008  9 0 0 BWA
2009  9 0 0 SBW
```

2010  9 0 0 TussockMoth
2013  9 10 0 WPB+RD
2014  9 0 0 Defoliators
2016  9 9 0 DFB+Def
2017  9 0 0 MPB1
2018  9 0 0 MPB2
2020  9 0 0 InsectsGen
2021  9 0 0 BB2
2022  9 10 0 LessI+D
2023  9 0 0 DFB2
2024  9 0 0 MPB3
2025  9 0 0 MPB4
2026  9 0 0 PoplarBorer
2032  9 0 0 BBlow
2033  9 0 0 BBhigh
2035  9 0 0 WPB2
2038  9 0 0 BB3
2044  9 0 0 BB5
2101 10 0 0 BR1
2102 10 0 0 DwarfMistletoe
2103 10 0 0 RootDisease
2104 10 0 0 Canker
2106 10 0 0 StemDecay
2111 10 0 0 BR2
2112 10 0 0 RD2
2113 10 0 0 BR3
2114  9 0 0 LeafDisease
2115 10 0 0 Canker2
2116 10 0 0 RootPathogens
2118 10 0 0 RD3
2119 10 9 0 RD+BB
2120 10 0 0 RD7
2121 10 0 0 RD8
2122 10 0 0 RD9
2123 10 0 0 RD10
2124 10 0 0 BR4
2125 10 0 0 BR5
2126 10 0 0 BR6
2127 10 0 0 RD3
2128 10 0 0 RD4
2129 10 0 0 RD5
2130 10 0 0 RD6
2133 10 0 0 AspenDiseases
2201 12 0 0 Seed1
2202 12 0 0 Seed2
2203 12 0 0 Seed3
2204 12 0 0 Seed4
2205 12 0 0 Seed5
2206 12 0 0 Seed6
3001  8 0 0 WSRF
3002  8 0 0 WSRF2
3003  8 0 0 WSRF3
3004  8 0 0 WMSF
3005  8 0 0 WMSF1
3006  8 0 0 WMSF2
3007  8 0 0 WMFS3
3008  8 0 0 WMSF4
3009  8 0 0 WUB
3011  5 0 0 PPSRF
3012  5 0 0 PPSRF2
3013  5 0 0 PPSRF3
3014  5 0 0 PPMSF
3015  5 0 0 PPMSF1
3016  5 0 0 PPMSF2
3017  5 0 0 PPMSF3
3018  5 0 0 PPMSF4
3019  5 0 0 PPUB1
3020  5 0 0 PPUB2
3021  5 0 0 PUSRF
3022  5 0 0 PUSRF2
3023  5 0 0 PUSRF3
3024  5 0 0 PUMSF
3025  5 0 0 PUMSF1
3026  5 0 0 PUMSF2
3027  5 0 0 PUMSF3
3028  5 0 0 PUMSF4
3029  5 0 0 PUUB
3030 13 0 0 WFC
3032  5 0 0 PPMSF5
3033  5 0 0 PUMSF5
3034  8 0 0 WNonLethal
3035  5 0 0 PPNonLethal
3036  5 0 0 PUNonLethal
3102 12 0 0 DroughtDamage
3106 12 0 0 Snow/breakage
3207 12 0 0 Rodents
3208 12 0 0 Beaver
3306  6 0 0 SeedCrstdWhtgrs
3401  7 2 0 LCSCG+ExoticGrass
3402  7 2 0 LCSCG+ExoticForb
3403  2 0 0 BSCG+ExoticGrass
3404  2 0 0 BSCG+ExoticForb
3406  1 12 0 PartialCut+Wind
3416  7 2 0 LCSCG+Exotics
3417  7 2 0 BSCG+Exotics
3418  9 10 0 RR1
3419  9 10 0 RR2
3420  9 10 0 RR3
3421  9 10 0 RR4
3422  9 10 0 RR5
3423  9 10 0 RR6
3424  9 10 0 RR7
3425 10 0 0 DwarfMistletoe2
3426  9 10 0 RR8
3428  1 7 0 CC+LCSCG
3429  1 7 0 CC+BSCG
3430  5 4 0 PPUB+Thin
3440 10 8 0 RD+WUB
3441 10 5 0 RD+PPUB
3442 10 5 0 RD+PUUB

3446 8 2 0 WSRF+ExoticGrass
3447 5 2 0 PPSRF+ExoticGrass
3448 5 2 0 PUSRF+ExoticGrass
3465 8 7 0 WSRF+LCSCG
3466 5 7 0 PPSRF+LCSCG
3467 5 7 0 PUSRF+LCSCG
3468 8 7 0 WSRF+BSCG
3469 5 7 0 PPSRF+BSCG
3470 5 7 0 PUSRF+BSCG
3483 8 9 0 MSF+BB
3484 9 10 0 RR+DBF
3485 9 0 0 MPB
3490 12 0 0 Flood+Succession
3491 12 0 0 WtrTblDrp+Drought
3492 12 0 0 WaterTableDrop
3493 10 9 12 Decay+BB+Erosion

A more detailed disturbance description of the disturbance types is given below. This listing is not in any of the included text files, and is given here for reference purposes only.

1001 Clearcut - No prep
1003 Group selection cut
1005 Individual selection cut
1006 Overstory removal
1009 Sanitation cut
1012 Shelterwood cut
1014 Clearcut + plant(Ponderosa pine)
1015 Clearcut + plant(Douglas-fir)
1016 Clearcut + plant(Western larch)
1017 Clearcut + plant
1018 Clearcut + plant(White pine)
1020 Partial cut#6
1021 Partial cut
1022 Clearcut + broadcast burn
1023 Clearcut and sprout
1027 Partial cut
1028 Partial cut #2
1029 Overstory Removal #1
1031 Clearcut - No prep #2
1035 Partial cut #3
1036 Partial cut #4
1037 Partial cut #5
1040 Shelterwood cut + burn
1041 Shelterwood w/Reserves
1042 Shelterwood w/Reserves #2
1043 Shelterwood w/Reserves #3
1045 Group Selection Cut #2
1048 Shelterwood w/Dead Reserves
1050 Shelterwood w/Dead Reserves #2
1052 Clearcut w/Reserves
1053 Clearcut w/Reserves #2
1055 Clearcut w/Dead Reserves
1101 Commercial thin
1102 Precommercial thin
1103 Thin from below
1104 Thin from above
1105 Thin #2
1106 Thin #3
1108 Thin Low #2
1201 Bare root planting
1301 Grazing general
1302 Successional change cattle grazing
1303 Successional maintenance cattle grazing
1304 Successional accelerating cattle grazing
1305 Not grazed by cattle
1306 Successional change biggame grazing
1307 Successional maintenance biggame grazing
1308 Successional accelerating biggame grazing
1309 Not grazed by biggame
1310 Success. change cattle grazing + exotics
1311 Success. accel. biggame grazing + exotics
1313 Herb. application + seeding native plants
1314 Mechanical prep + seeding
1315 Winter grazing
1317 Erosion
1318 Unspecified agriculture
1319 Grazing
1320 Successional change sheep grazing
1331 Unspecified seeding
1332 Vegetation manipulation
1333 Vegetation manipulation + unspecified seeding
1334 Vegetation Planting ie willows
1335 Herbicide applic. + exotic seed source
1501 Till + seed annuals + spray
1502 Till + seed
1503 Irrigation
1504 Unspecified development
1505 Till + seed native + spray
1506 Till + seed perennial + spray
2001 Douglas-fir beetle
2002 Mountain pine beetle
2003 Western pine beetle
2004 Mtn pine beetle + western pine beetle
2005 Western pine beetle + stand replacing fire #1
2006 Bark beetles
2007 Spruce beetles
2008 Balsam wooly adelgid
2009 Spruce budworm
2010 Tussock moth
2013 Western pine beetle + root disease
2014 Unspecified defoliators
2016 Douglas-fir beetles + defoliators
2017 Mtn pine beetle #1
2018 Mtn pine beetle #2

2020 Unspecified insects
2021 Bark beetles #2
2022 Less insects + disease than naturally would occur
2023 Douglas-fir beetle #2
2024 Mtn pine beetle #3
2025 Mtn pine beetle #4
2026 Poplar borer
2032 Low intensity bark beetles
2033 High intensity bark beetles
2035 Western pine beetle
2038 Bark beetles #3
2044 Bark beetles #5
2101 Blister rust #1
2102 Dwarf mistletoe
2103 Root disease
2104 Canker
2106 Stem decay
2111 Blister rust #2
2112 Root disease #2
2113 Blister rust #3
2114 Leaf disease
2115 Canker #2
2116 Root pathogens
2118 Root disease #3
2119 Root disease + bark beetles
2120 Root disease taking the stand to Douglas-fir
2121 Severe root disease
2122 Root disease taking the stand to Grand fir
2123 Low intensity root disease
2124 Blister rust #4
2125 Blister rust #5
2126 Blister rust #6
2127 Root disease #3
2128 Root disease #4
2129 Root disease #5
2130 Root disease #6
2133 Aspen diseases
2201 Natural seeding #1
2202 Natural seeding #2
2203 Natural seeding #3
2204 Natural seeding #4
2205 Natural seeding #5
2206 Natural seeding #6
3001 Wild stand replacing fire
3002 Wild stand replacing fire #2
3003 Wild stand replacing fire #3
3004 Wild mixed severity fire
3005 Wild mixed sever. fire #1
3006 Wild mixed sever. fire #2
3007 Wild mixed sever. fire #3
3008 Wild mixed sever. fire #4
3009 Wild underburn
3011 Prescribed-planned stand replacing fire
3012 Prescr.-planned stand replacing fire #2
3013 Prescr.-planned stand replacing fire #3
3024 Prescr.-unplanned mixed severity fire
3025 Prescr.-unplanned mixed severity fire #1
3026 Prescr.-unplanned mixed sever. fire #2
3027 Prescr.-unplanned mixed sever. fire #3
3028 Prescr.-unplanned mixed sever. fire #4
3029 Prescr.-unplanned underburn
3030 Wildfire control
3032 Prescr.-planned mixed sever. fire #5
3033 Prescr.-unplanned mixed sever. fire #5
3034 Non-lethal wildfire
3035 Prescr. planned non-lethal fire
3036 Prescr.-unplanned non-lethal fire
3102 Drought damage
3106 Snow breakage
3207 Rodents
3208 Beaver
3306 Seed Crested Wheatgrass
3401 Succ. change cattle grazing + exotic grass
3402 Succ. change cattle grazing + exotic forbs
3403 Exotic grass
3404 Exotic forbs
3406 Partial cut + wind
3416 Succ. change cattle grazing + exotics
3417 Succ. change biggame grazing + exotics
3418 Insects + disease combination #1
3419 Insects + disease combination #2
3420 Insects + disease combination #3
3421 Insects + disease combination #4
3422 Insects + disease combination #5
3423 Insects + disease combination #6
3424 Insects + disease combination #7
3425 Dwarf mistletoe
3426 Insects + disease combination #8
3428 Clearcut + Successional change cattle grazing
3429 Clearcut + Successional change biggame grazing
3430 Underburn + thin
3440 Root disease + wild underburn
3441 Root disease + prescr.-planned underburn
3442 Root disease + prescr.-unplanned underburn
3446 Wild stand replacing fire + exotic grass
3447 Prescr.-planned stand replac. fire + exot grass
3448 Prescr.unplanned stand replac fire + exot grass
3465 Wild srf + succ. change cattle grazing
3466 Prescr. planned srf + succ. change cattle graz
3467 Prescr. unplanned srf + succ. change cattle graz
3468 Wild srf + succ. change biggame grazing
3469 Prescr. planned srf + succ. change biggame graz
3470 Prescr. unplanned srf + succ. change biggame graz
3483 Mixed sever. fire + bark beetles
3484 Insect + disease combo + Douglas-fir beetle
3014 Prescr.-planned mixed sever. fire
3015 Prescr.-planned mixed sever. fire #1
3016 Prescr.-planned mixed sever. fire #2
3017 Prescr.-planned mixed sever. fire #3
3018 Prescr.-planned mixed sever. fire #4

3019 Prescr.-planned underburn
3020 Prescr.-planned underburn#2
3021 Prescr.-unplanned stand replacing fire
3022 Prescr.-unplanned stand replacing fire
3023 Prescr.-unplanned stand replacing fire
3485 Mtn pine beetle
3490 Flood and succession
3491 Water Table Drop + Drought
3492 Water Table Drop
3493 Decay + Bark beetles + erosion

### Disturbance Group File: DISTGRP.TXT

This file lists the groups of disturbances. These groups are used for:

1. displaying the pathways on the successional pathway diagrams,
2. graphing results,
3. changing probabilities using multipliers,
4. generating between-year variability multipliers or landscape feedback multipliers,
5. selecting the type of disturbance for a new or modified pathway, and
6. disabling disturbances for a simulation.

There can be up to 15 different groupings.

The file must contain two columns: a number from 1 to 15 in the first column and the name of the group (with no spaces) in the second column.

The example file below is the one distributed with VDDT and, like the other TXT files, may be edited.

```
1 CommTimberHarvest
2 Exotics
3 NonImpactGrazing
4 Pre-commThinning
5 PrescribedFire
6 Seed/Plant/ExoticsControl
7 SuccChangeGrazing
8 Wildfire
9 Insects
10 Pathogens
11 Agriculture
12 Weather/Wildlife
13 Other
14 Other2
15 Other3
```

The colors used when drawing the pathways are linked to the group number. The current associations are given in Table A.1.

**Table A.1:** Line colors used for different groups.

| **Color** | Green | Yellow | Red | Black | Blue |
|---|---|---|---|---|---|
| **Group Number** | 9 | 7, 8 | 10 | 1, 2, 3 | All others<br>More than 1 agent |

## Landscape Feedback File

The landscape feedback file (*.LCM) contains all the information necessary to generate a feedback curve that relates the maximum possible proportion of the area disturbed by the disturbance type (in a "normal"year) to a multiplier that may increase or decrease the probabilities based on the current proportion of the landscape at risk. The file lists the disturbance ID and then six values. The six values represent the multipliers to be applied if the proportion of the landscape at risk is at 0%, 20%, 40%, 60%, 80%, or 100% of the maximum possible proportion. Values with a "-1" indicate that no value has been defined for that proportion.

```
1001  1 -1 -1 -1 -1  1
 1021  1 -1 -1 -1 -1  1
 1022  0.25  3 -1 -1 -1 -1
 1201  0.25 -1 -1 -1  3 -1
 2002  3 -1 -1 -1 -1  0
 2101  1 -1 -1 -1 -1  1
 2201  0.25  3 -1 -1 -1 -1
 2202  0.25  3 -1 -1 -1 -1
 3001  0.25 -1 -1 -1  3 -1
 3004  0.25 -1 -1 -1  3 -1
 3009  0.25 -1 -1 -1  3 -1
 3011  0.25  3 -1 -1 -1 -1
 3014  0.25  3 -1 -1 -1 -1
 3019  0.25  3 -1 -1 -1 -1
 3021  0.25  3 -1 -1 -1 -1
 3024  0.25  3 -1 -1 -1 -1
 3029  0.25  3 -1 -1 -1 -1
 3030  3 -1 -1 -1 -1  0
```

Note that LCM files from Version 3.0 have 7 columns rather than 6. VDDT will import these files, but give a warning that they are from the older version. Thus, the multipliers will be offset from their original location.

## Location File

The location file (*.LOC) stores the location of all the classes in a PVT. Once it is created for a PVT, it is required for all future use of the PVT file (unless it is not loaded with the PVT). If the file is deleted, the PVT file will load, but the locations will be set by VDDT.

The columns are: PVT number, the location of the class, the cover type, and the structural stage. Class location is defined by imagining that there are 8 boxes on each row, with the first box labelled 0, and then numbering from left to right along each row. Thus the boxes in the first four rows of the first column will have the location codes 0, 8, 16, 24.

Example:

```
999          0             1015          26
999          1             2009          1
999          3             2009          3
999          4             2009          4
999          6             2009          6
999          13            2009          5
```

## Probability File

The first line is a header line which gives the name of the scenario file containing the probabilities that are printed in this file. The second line gives the number and name of the PVT that is printed. The remainder of the information is divided into three types of lines. The first gives information identifying the class (class letter, structural stage number and name, and cover type number and name). The second line type contains the letter of the class that the pixel would go to through succession, and the number of years that it would take before succession occurred. The third line type lists all the information about a disturbance: the letter of the destination class, disturbance ID, disturbance name, the **probability** associated with the disturbance in each of the three management regions, and the ages for which this probability is applicable.

```
SCN: Sample.scn
 999 SamplePVT
    A    26 ClosedMidShrub 1015 GeneralShrub
       Succession: B        5
    B    1 StandInitiationForest 2009 LodgepolePine
       Succession: C        45
       A    3001 WSRF             0.006  6  51      0.006  6  51      0.006  6  51      0
    C    3 StemExclusionClosedCanopyForest 2009 LodgepolePine
       Succession: D        40
       A    1001 CC-Noprep        0  0  0           0.0015  51  91    0.0015  51  91    0
       A    3001 WSRF             0.002  51  91     0.002  51  91     0.002  51  91     0
       A    3021 PUSRF            0.001  51  91     0  0  0           0  0  0           0
       C    1103 ThinLow          0  0  0           0.0125  51  91    0.0125  51  91    20
       C    3106 Snow/breakage    0.0002  51  91    0.0002  51  91    0.0002  51  91    10
       D    1101 CommerThin       0  0  0           0.0023  51  91    0.0023  51  91    0
    D    4 UnderstoryReinitationForest 2009 LodgepolePine
       Succession: F        40
       A    1001 CC-Noprep        0  0  0           0.023  91  131    0.023  91  131    0
       A    3001 WSRF             0.004  91  131    0.004  91  131    0.004  91  131    0
       A    3021 PUSRF            0.0015  91  131   0  0  0           0  0  0           0
       A    3483 MSF+BB           0.0015  91  131   0.0015  91  131   0.0015  91  131   0
       D    3009 WUB              0.0001  91  131   0.0001  91  131   0.0001  91  131   0
       E    1021 PartialCut       0  0  0           0.002  91  131    0.002  91  131    0
       E    2002 MPB              0.01  91  131     0.01  91  131     0.01  91  131     0
    E    5 YoungMulti-strataForest 2009 LodgepolePine
       Succession: F        80
       A    3001 WSRF             0.0025  131  211  0.004  131  211   0.004  131  211   0
       A    3021 PUSRF            0.0025  131  211  0  0  0           0  0  0           0
       E    1021 PartialCut       0  0  0           0.0012  131  211  0.0012  131  211  0
       E    2002 MPB              0.001  131  211   0.001  131  211   0.001  131  211   0
       E    3440 RD+WUB           0.0001  131  211  0.0001  131  211  0.0001  131  211  0
       E    3441 RD+PPUB          0  0  0           0.0001  131  211  0.0001  131  211  0
       E    3442 RD+PUUB          0  0  0           0.0001  131  211  0.0001  131  211  0
    F    6 OldMulti-strataForest 2009 LodgepolePine
       Succession: F        999
       A    1001 CC-Noprep        0  0  0           0.05  131  1130   0.05  131  1130   0
       A    3001 WSRF             0.007  131  1130  0.007  131  1130  0.007  131  1130  0
       E    1021 PartialCut       0  0  0           0.005  131  1130  0.005  131  1130  0
       E    2002 MPB              0.01  131  1130   0.01  131  1130   0.01  131  1130   0
```

## Project File

The project file stores the full filename of all files that are in use in VDDT at the time that the project file is saved. It is useful for grouping definition files with a PVT, and for loading all files at once without going through multiple windows and menu items.

The file format is generally: code word identifying the type of information, filename or value. The code word must be present, but the area after the ":" can be blank if the relevant file does not exist or should not be loaded automatically.

| | |
|---|---|
| Dists: | disturbance type filename |
| DistGroups: | disturbance group filename |
| LongCover: | cover type names filename |
| ShortCover: | cover type abbreviation filename |
| Structure: | structural stage filename |
| PVT: | PVT filename |
| SCN: | scenario filename |
| LOC: | location filename |
| Atts: | attribute filename |
| ICs: | initial conditions filename |
| YSGdef: | year-sequence group filename |
| YTMult: | year type multiplier filename |
| MSE: | multiplier sequence filename |
| NSE: | normalized multiplier sequence filename |
| MCMults: | filename containing the normalized annual multipliers for multiple Monte Carlo simulations |
| LandMult: | landscape feedback multiplier filename |
| DoVariation: | boolean for whether the variation multipliers are on |
| DoLandscape: | boolean for whether the landscape feedback multipliers are on |
| TSD: | number of the disturbance group used for time-since-disturbance calculations (-1 = none) |
| Times: | number of years to simulate, graph start time, graph end time, four times for each of the bar graphs |
| MC: | number of Monte Carlo iterations to do |
| Size: | number of pixels, area |
| Batch: | the information for running a sequence of regions: number of values, region number, number of years |

Example:

```
Dists: C:\VDDT\distcode.dem
DistGroups: C:\VDDT\distgrp.dem
LongCover: C:\VDDT\cover.dem
ShortCover: C:\VDDT\coverc.dem
Structure: C:\VDDT\structur.dem
PVT: C:\VDDT\sample.PVT
SCN: C:\VDDT\sample.SCN
LOC: C:\VDDT\sample.LOC
Atts: C:\VDDT\sample.ATT
ICs: C:\VDDT\sample.ic
YSGdef: C:\VDDT\sample.YSG
YTMult:
MSE:
NSE:
```

```
MCMults:
LandMult:
DoVariation: True
DoLandscape: False
TSD: -1
Times: 100, 0, 100, 0, 10, 50, 100
MC: 3
Size: 100, 100
Batch:  1 , 1, 100
```

### PVT File (Old Format)

The first line of this file is a line that can be used as a file header or identifier. Any information on this line is not used in the model but will be remembered and written to the file when saved. The second line shows the number of the PVT (999), its name (Sample), and the number of classes in the PVT (6). After that, the file has two types of lines. The first type is those that give the information about the class (its number, cover type, structural stage, beginning and ending age, the cover type and structural stage it goes to after succession, and the number of disturbances which originate in that class). The second line type lists the information about the possible disturbances from that class (disturbance ID, disturbance name, destination structural stage, destination age, destination cover type, relative age at the destination, and (optional) whether the relative age is maintained when the disturbance occurs.).

- ☛ Note that the relative age value shown in the screen with all the pathway definitions is calculated from the destination age and beginning age of the destination class when a pathway changes classes, and from the relative age value when the pathway remains in the same class.

Note that the third line of the file must contain at least one letter in order for the file to be recognized as an old format PVT file.

```
Optional file header/identifier
999 Sample 6
     1     26 CloseLowShrub        1015 Shrubfield       1   6  1  2009  0
     2     1 StandInitiation       2009 Lodgepole        6  51  3  2009  1
      3001 WSRF      26  1  1015  0 False
     3     3 StemExclusionClosed   2009 Lodgepole       51  91  4  2009  8
      3001 WSRF      26  1  1015  0 False
      3011 PPSRF     26  1  1015  0 False
      3021 PUSRF     26  1  1015  0 False
      3030 WFC       4  91  2009  0 True
      3106 Snow/breakage 3  61  2009  10 False
      1103 ThinLow       3  71  2009  20 False
      1101 CommerThin    4  91  2009  0 False
      1001 CC-Noprep     26  1  1015  0 False
     4     4 UnderstoryReinitiation    2009 Lodgepole       91  131  6  2009  11
      1001 CC-Noprep     26  1  1015  0
      1021 PartialCut    5  131  2009  0
      3001 WSRF      26  1  1015  0
      3011 PPSRF     26  1  1015  0
      3021 PUSRF     26  1  1015  0
      3009 WUB       4  91  2009  0
      3019 PPUB      4  91  2009  0
      3029 PUUB      4  91  2009  0
      3483 MSF+BB    26  1  1015  0
      2002 MPB       5  131  2009  0
      1103 ThinLow   4  121  2009  10
     5     5 YoungForest           2009 Lodgepole      131  211  6  2009  11
      1001 CC-Noprep     26  1  1015  0
      3001 WSRF      26  1  1015  0
      3011 PPSRF     26  1  1015  0
      3021 PUSRF     26  1  1015  0
      3030 WFC       5  131  2009  0
      1021 PartialCut    5  131  2009  0
      1103 ThinLow       5  131  2009  0
      3440 RD+WUB        5  131  2009  0
      3441 RD+PPUB       5  131  2009  0
      3442 RD+PUUB       5  131  2009  0
      2002 MPB           5  131  2009  0
```

```
6     6 OldForestMultiStrata  2009 Lodgepole      131  1130  6  2009  4
 3001 WSRF           26  1  1015  0
 1001 CC-Noprep      26  1  1015  0
 1021 PartialCut     5  131  2009  0
 2002 MPB            5  131  2009  0
```

### PVT File (New Format)

The "New Format" is very similar to the "Old Format" but there are a few important differences. The primary difference is the lack of text: new format files do not name every cover type and structural stage. The second main difference is the use of five or six digit numbers to represent the class. These numbers are the combined form of the structural stage (the first one or two digits) and cover type (the last four digits). This number uniquely identifies different classes within a PVT, and will be called the class identifier in the following description.

As in the old format files, the first line of this file can be used as a file header or identifier. Any information on this line is not used in the model but will be remembered and written to the file when saved. The first line shows the number of the PVT (999), its name (SamplePVT), and the number of classes in the PVT (6). After that, the file has two types of lines (also like in the old format case). The first gives information about the class: the class identifier, the structural stage (alone), the cover type, the beginning and ending age, the class identifier for where it goes after succession, a new age (not used, so set to 0), and the number of disturbances which originate in that class. The second line type lists the information about the possible disturbances from that class: disturbance ID, disturbance name, destination class identifier, destination age and the relative age at the destination, and (optional) whether the relative age is maintained when the disturbance occurs.

☛ Note that the relative age value shown in the screen with all the pathway definitions is calculated from the destination age and beginning age of the destination class when a pathway changes classes, and from the relative age value when the pathway remains in the same class.

```
Optional file header/information
 999 SamplePVT  6
     261015  26  1015  1  6  12009  0  0
     12009  1  2009   6  51  32009  0  1
          3001 WSRF          261015  1  0 False
     32009  3  2009  51  91  42009  0  8
          3001 WSRF          261015  1  0 False
          3011 PPSRF         261015  1  0 False
          3021 PUSRF         261015  1  0 False
          3030 WFC           42009  91  0 True
          3106 Snow/breakage 32009  51  10 False
          1103 ThinLow       32009  51  20 False
          1101 CommerThin    42009  91  0 False
          1001 CC-Noprep     261015  1  0 False
     42009  4  2009  91  131  62009  0  11
          1001 CC-Noprep     261015  1  0
          1021 PartialCut    52009  131  0
          3001 WSRF          261015  1  0
          3011 PPSRF         261015  1  0
          3021 PUSRF         261015  1  0
          3009 WUB           42009  91  0
          3019 PPUB          42009  91  0
          3029 PUUB          42009  91  0
          3483 MSF+BB        261015  1  0
          2002 MPB           52009  131  0
          1103 ThinLow       42009  91  10
     52009  5  2009  131  211  62009  0  11
          1001 CC-Noprep     261015  1  0
          3001 WSRF          261015  1  0
          3011 PPSRF         261015  1  0
          3021 PUSRF         261015  1  0
          3030 WFC           52009  131  0
          1021 PartialCut    52009  131  0
          1103 ThinLow       52009  131  0
          3440 RD+WUB        52009  131  0
          3441 RD+PPUB       52009  131  0
```

```
3442 RD+PUUB       52009  131  0
          2002 MPB           52009  131  0
     62009  6  2009  131  1130  62009  0  4
          3001 WSRF          261015  1  0
          1001 CC-Noprep     261015  1  0
          1021 PartialCut    52009  131  0
          2002 MPB           52009  131  0
```

## Scenario File (Old Format

The first line is a simple header line. The second line gives a code for the phase, the name of the phase, the beginning and ending years of the simulation, and the number of management regions which are present in the file. After that, the file is divided into the different management regions. The first line of each management region gives the region number, the region name, and the number of classes in the region. Note that these region names are those that will be used inside the program. The remainder of the information about the region is divided into two types of lines. The first gives information identifying the PVT and class (PVT number and name, structural stage, cover type, and the number of disturbances containing probabilities which originate in that class). The second line type lists the information about the disturbance (disturbance ID, disturbance name, percentage, and TSD value). Note that the values given in this file are a **percentage**, not a probability.

```
Printed from VDDT
 1 PhaseOne 0  300 2
  1 Wilderness+NationalPark  5
     999 Sample    1 StandInitiation 2009 Lodgepole 1
        3001 WSRF            .6   0
     999 Sample    3 StemExclusionClosed 2009 Lodgepole 3
        3001 WSRF            .2   0
        3021 PUSRF           .1   0
        3106 Snow/breakage   .02   0
     999 Sample    4 UnderstoryReinitiation 2009 Lodgepole 5
        3001 WSRF            .4   0
        3021 PUSRF           .15   0
        3009 WUB             .01   0
        3483 MSF+BB          .15   0
        2002 MPB             1   0
     999 Sample    5 YoungForest 2009 Lodgepole 4
        3001 WSRF            .25   0
        3021 PUSRF           .25   0
        3440 RD+WUB          .01   0
        2002 MPB             .1   0
     999 Sample    6 OldForestMultiStrata 2009 Lodgepole 2
        3001 WSRF            .7   0
        2002 MPB             1   0
  2 USFS+Federal             5   0
     999 Sample    1 StandInitiation 2009 Lodgepole 1
        3001 WSRF            .6   0
     999 Sample    3 StemExclusionClosed 2009 Lodgepole 5
        3001 WSRF            .2   0
        3106 Snow/breakage   .02   0
        1103 ThinLow         1.25   0
        1101 CommerThin      .23   0
        1001 Clearcut-Noprep .15   0
     999 Sample    4 UnderstoryReinitiation 2009 Lodgepole 6
        1001 Clearcut-Noprep  2.3   0
        1021 PartialCut      .2   0
        3001 WSRF            .4   0
        3009 WUB             .01   0
        3483 MSF+BB          .15   0
        2002 MPB             1   0
     999 Sample    5 YoungForest 2009 Lodgepole 6
        3001 WSRF            .4   0
        1021 PartialCut      .12   0
        3440 RD+WUB          .01   0
        3441 RD+PPUB         .01   0
        3442 RD+PUUB         .01   0
        2002 MPB             .1   0
     999 Sample    6 OldForestMultiStrata 2009 Lodgepole 4
        3001 WSRF            .7   0
        1001 Clearcut-Noprep  5   0
        1021 PartialCut      .5   0
        2002 MPB             1   0
```

### Scenario File (New Format)

As with the PVT files, the structure of the new and old format files is very similar. The main difference is the use of the class identifier (see PVT New Format description) and the lack of cover type and structural stage descriptors. The first three lines are in the same format as the old format files. The remainder of the information about the region is divided into two types of lines. The first gives information identifying the PVT and class (PVT number and name, class identifier, and the number of disturbances containing probabilities which originate in that class). The second line type lists the information about the disturbance (disturbance ID, disturbance name, percentage, and TSD value). Note that the values given in this file are a **probability**, not a percentage as in the old format.

```
TS
 1 PhaseOne 0  300 2
  1 Wilderness+NationalPark  5
     999 SamplePVT           12009  1
        3001 WSRF            .006   0
     999 SamplePVT           32009  3
        3001 WSRF            .002   0
        3021 PUSRF           .001   0
        3106 Snow/breakage   .0002   0
     999 SamplePVT           42009  5
        3001 WSRF            .004   0
        3021 PUSRF           .0015   0
        3009 WUB             .0001   0
        3443 UnknownCode     .0015   0
        2002 MPB             .01   0
     999 SamplePVT           52009  4
        3001 WSRF            .0025   0
        3021 PUSRF           .0025   0
        3440 RD+WUB          .0001   0
        2002 MPB             .001   0
     999 SamplePVT           62009  2
        3001 WSRF            .007   0
        2002 MPB             .01   0
  2 USFS+Federal             5
     999 SamplePVT           12009  1
        3001 WSRF            .006   0
     999 SamplePVT           32009  5
        3001 WSRF            .002   0
        3106 Snow/breakage   .0002   0
        1103 ThinLow         .0125   0
        1101 CommerThin      .0023   0
        1001 CC-Noprep       .0015   0
     999 SamplePVT           42009  6
        1001 CC-Noprep       .023   0
        1021 PartialCut      .002   0
        3001 WSRF            .004   0
        3009 WUB             .0001   0
        3443 UnknownCode     .0015   0
        2002 MPB             .01   0
     999 SamplePVT           52009  6
        3001 WSRF            .004   0
        1021 PartialCut      .0012   0
        3440 RD+WUB          .0001   0
        3441 RD+PPUB         .0001   0
        3442 RD+PUUB         .0001   0
        2002 MPB             .001   0
     999 SamplePVT           62009  4
        3001 WSRF            .007   0
        1001 CC-Noprep       .05   0
        1021 PartialCut      .005   0
        2002 MPB             .01   0
```

## Structural Stage File

Structural stages are referenced throughout the model by number (although the successional pathway diagram may also show character abbreviations). A label attached to each number is printed to the output file (in the old format) for informational purposes only. The labels and character abbreviations are read from the file STRUCTUR.TXT, contained in the base directory where VDDT resides. Like the other TXT files, the structural stage file can be modified as desired.

The file has the format:

| | |
|---|---|
| column 1 | structural stage number (must be a number from 1-50) |
| column 2 | code to put in the successional pathway diagram (number or 1-3 characters) |
| column 3 | name or description of structural stage (used for informational purposes only, but must not contain any blanks). |

The following is the structural stage file that comes with VDDT.

```
1 SIF StandInitiationForest
2 SOF StemExclusionOpenCanopyForest
3 SEF StemExclusionClosedCanopyForest
4 URF UnderstoryReinitationForest
5 YMF YoungMulti-strataForest
6 OMF OldMulti-strataForest
7 OSF OldSingle-strataForest
11 SIW StandInitiationWoodland
12 SEW StemExclusionWoodland
13 URW UnderstoryReinitiationWoodland
14 YMW YoungMulti-strataWoodland
15 OMW OldMulti-strataWoodland
16 OSW OldSingle-strataWoodland
21 OHB OpenHerbland
22 CHB ClosedHerbland
23 CLS ClosedLowShrub
24 OLS OpenLowShrub
25 OMS OpenMidShrub
26 CMS ClosedMidShrub
27 OTS OpenTallShrub
28 CTS ClosedTallShrub
31 CRP Agricultural
33 URB Urban
34 WTR Water
35 RCK Rock
```

### Transitions File

The file that is printed using the "Print Transitions" option, lists each pixel which was disturbed or which went through succession during the most recent simulation. The file contains a header, and has the format:

Year, DistID, StartCT, StartSS, FinalCT, FinalSS, Time remaining in the class, # years pixel was in the class, Monte Carlo number

where:

DistID is the disturbance number (ID)
CT is the cover type number, and
SS is the structural stage.

Succession is given "0" as a disturbance identifier.

A section from a transition file is shown below.

```
"Year","DistID","StartCT","StartSS","EndCT","EndSS","TimeLeft","YearsInClass","MC"
 1  0  1015  26  2009  1  0  6
 1  3001  2009  1  1015  26  24  27
 1  0  2009  3  2009  4  0  91
 1  2002  2009  4  2009  5  33  98
 1  1001  2009  6  1015  26  322  808
 2  0  1015  26  2009  1  0  6
 2  0  1015  26  2009  1  0  6
 2  0  1015  26  2009  1  0  6
 2  0  1015  26  2009  1  0  6
 2  0  1015  26  2009  1  0  6
 2  0  1015  26  2009  1  0  6
 2  0  1015  26  2009  1  0  6
 2  0  2009  3  2009  4  0  91
 2  0  2009  3  2009  4  0  91
 2  0  2009  4  2009  6  0  131
 2  1001  2009  4  1015  26  28  103
 2  2002  2009  6  2009  5  594  536
 3  0  1015  26  2009  1  0  6
.
.
.
 299  0  1015  26  2009  1  0  6
 300  0  2009  1  2009  3  0  51
 300  0  1015  26  2009  1  0  6
 300  0  2009  1  2009  3  0  51
```

## Initial Conditions File

The initial conditions file has the format (items in [] are optional):

> structural stage, cover type, proportion of pixels with that combination, [minimum age, maximum age, [TSD]]
> [-999, area]

By default, the VDDT model initially spreads the pixels out among the ages associated with each class. The optional minimum and maximum age fields can be used to further define the actual ages associated with each class. The optional TSD field can be used to tell the model how long since the area has been disturbed by a particular disturbance. The last line of the file can optionally include the number -999 and then the area represented by this file.

For example (no ages or TSD, but with area):

```
 26  1015      12
 1  2009       36
 3  2009       20
 4  2009       17
 5  2009       8
 6  2009       7
-999 3672
```

or (with ages but not TSD or area):

```
 26  1015      6   1   6
 26  1015      6   11  20
 1  2009       36  21  50
 3  2009       10 100 110
 3  2009        5 120 130
 3  2009        5 131 170
 4  2009       17 200 299
 5  2009       8  300 450
 6  2009       2  500 510
 6  2009       5  550 560
```

or (with ages, TSD, and area):

```
 26  1015      2   1   6   10
 26  1015      4   1   6   21
 26  1015      6   11  20   0
 1  2009       36  21  50  25
 3  2009       10 100 110   0
 3  2009        5 120 130  20
 3  2009        5 131 170  50
 4  2009        9 200 250 125
 4  2009        8 251 299 175
 5  2009       8  300 450 200
 6  2009       2  500 510 330
 6  2009       5  550 560  41
-999   3672
```

## Results File

The results are printed with each row as a year and the categories as columns. The first line is a simple text header file listing the name of the scenario file and the type of results that are being printed. The second line lists headers for each of the categories:

Results for PVT name by Category.

| Year | cat1 | cat2 | cat3 | etc. |
|---|---|---|---|---|
| year 1 | category 1 | category 2 | category 3 | etc. |
| year 2 | category 1 | category 2 | category 3 | etc. |
| etc. | | | | |

For example:

```
"Results for SamplePVT by Class"
"Year", A261015", A12009", A32009", A42009", A52009", A62009"
0,       16,      17,      17,      16,      17,       17
10,      5,       38,      15,      11,      23,       8
20,      4,       45,      13,      9,       24,       5
30,      4,       49,      12,      6,       26,       3
40,      4,       52,      8,       7,       26,       3
50,      6,       47,      9,       11,      24,       3
60,      4,       35,      23,      11,      24,       3
70,      6,       36,      22,      14,      21,       1
80,      2,       38,      25,      14,      21,       0
90,      4,       40,      24,      16,      5,        11
100,     12,      36,      20,      17,      8,        7
```

When this file is printed for disturbance groups or classes during a model simulation, it contains one additional column, the Monte Carlo iteration number. This file also will not contain the first descriptive header line, but will contain the column headings.

# Index