Research Contribution 43

LAndscape Management Policy Simulator (LAMPS)

Version 1.1

User Guide

by

Pete Bettinger

Marie Lennette

February 2004

Oregon State University
College of Forestry

Forest Research Laboratory

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ABSTRACT

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The LAndscape Management Policy Simulator (LAMPS) model, version 1.1, is a spatial simulation model developed to provide forest landscape planning simulations for the Coastal Landscape Analysis and Modeling Study (CLAMS). It is designed to help policymakers, managers, and planners think through alternative management scenarios and their potential effects on the ecological and economic resources of Oregon's Coast Range forests. LAMPS simulates changes to landscape structure over time, incorporating the management intentions of the four major landowner groups and vegetation dynamics. Socioeconomic and ecological information is used to track and allocate activities across the landscape. LAMPS projects, with relatively high resolution, forest conditions across broad areas, all ownership groups, and a planning horizon of 100 yr. This user guide provides instructions on how to use LAMPS for forest landscape simulations of alternative forest policies for the Coast Range of Oregon.

Keywords: forest landscape planning, spatial harvest scheduling, landscape modeling, policy simulation

CONVERSION/ABBREVIATION TABLE

English units	***Metric units***
1 acre (ac)	0.404 hectare (ha)
1 board foot (bd ft)	0.002 cubic meters (m^3)
1 foot (ft)	0.305 meter (m)
1 inch (in. or ")	2.54 centimeters (cm)
1 mile (mi)	1.61 kilometers (km)

BSU = basic simulation unit
MBF = thousand board feet

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1. INTRODUCTION

This user guide provides step-by-step instructions on how to use the LAndscape Management Policy Simulator (LAMPS) model, version 1.1, for forest landscape simulations in the Coast Range of Oregon.

LAMPS is a spatial simulation model developed as part of the Coastal Landscape Analysis and Modeling Study (CLAMS) to help policymakers, managers, and planners think through alternative management scenarios and their potential effects on the ecological, economic, and social goals desired from the Coast Range's forest resources. Although LAMPS models possible forest management scenarios, it is not designed to provide direct analysis or interpretation of forest management polices. (That's your challenge.) Thus, any conclusions drawn from LAMPS results are clearly the responsibility of the user.

Each chapter of this user guide describes a major theme or window within the LAMPS model, such as ownership group, land allocation, and prescriptions. Each theme or window includes a set of procedures that users can use to modify its parameters.

- Chapter 1. Introduction—introduces the CLAMS project, the LAMPS model, and how to get started using LAMPS
- Chapter 2. Spatial Data Structure and Database Requirements—defines the spatial units used in a LAMPS simulation and describes the input files and how to load data into LAMPS
- Chapter 3. LAMPS Scenarios—explains what a scenario is, how to save a scenario, and how to load a previously saved scenario
- Chapter 4. Information About Landowners—describes what the management options for a landowner group are and how to change them
- Chapter 5. Information About Land Allocations—explains how to specify the land management behavior to be simulated within certain geographic areas of a landowner group. Specifics regarding green-up policies, minimum harvest ages, and regeneration parameters are discussed.
- Chapter 6. Information About Prescriptions—directs the user on how to specify management prescriptions for a landowner group and the regenerated stand type for a clearcut area
- Chapter 7. Miscellaneous Parameters—explains how to adjust the constraints on clearcutting and thinning activities, probabilities that determine the types of forest that clearcuts transition into, and economic analysis parameters needed to value management activities

- Chapter 8. Landowner Group Scheduling Process Parameters—describes the individual scheduling processes for each landowner group
- Chapter 9. Ecological Disturbances—describes the stochastic disturbance processes for upland and riparian areas
- Chapter 10. Outputs—describes the reporting features of LAMPS and provides a brief description of the output files
- Chapter 11. How to Model with LAMPS—portrays eight alternatives to illustrate how LAMPS may be used to examine policy issues
- Chapter 12. Final Notes—lists some model limitations and presents possible directions for further LAMPS development
- Appendix—describes input and output file formatting and interpretation

1.1 Overview of the CLAMS Project

The Coastal Landscape Analysis and Modeling Study (CLAMS) is a joint research effort supported mainly by three organizations: the USDA Forest Service, Pacific Northwest Research Station; College of Forestry at Oregon State University; and Oregon Department of Forestry. The goals of the CLAMS project are to develop and evaluate concepts and tools to help understand patterns and dynamics of provincial ecosystems, such as the Oregon Coast Range, and to analyze the aggregate ecological and socioeconomic consequences of alternative forest policies and strategies across all ownerships. The six major objectives of the CLAMS project are to

(1) characterize the spatial pattern and history of ecological and socioeconomic components of the Coast Range;

(2) develop ecological and socioeconomic models, measures, and linkages;

(3) develop spatial policy evaluation tools and data for use by technical specialists;

(4) project the aggregate effects of current and alternative forest policies on key resources and outputs;

(5) evaluate consequences of alternative fundamental strategies to natural resource management;

(6) synthesize multi-scale assessments and provide information for joint learning among stakeholders.

These objectives will be met through the development of a compatible set of spatial databases, spatial simulation models, and biological and socioeconomic response models (Figure 1.1).

Note: This user guide only addresses the spatial simulation model (LAMPS) associated with the CLAMS project.

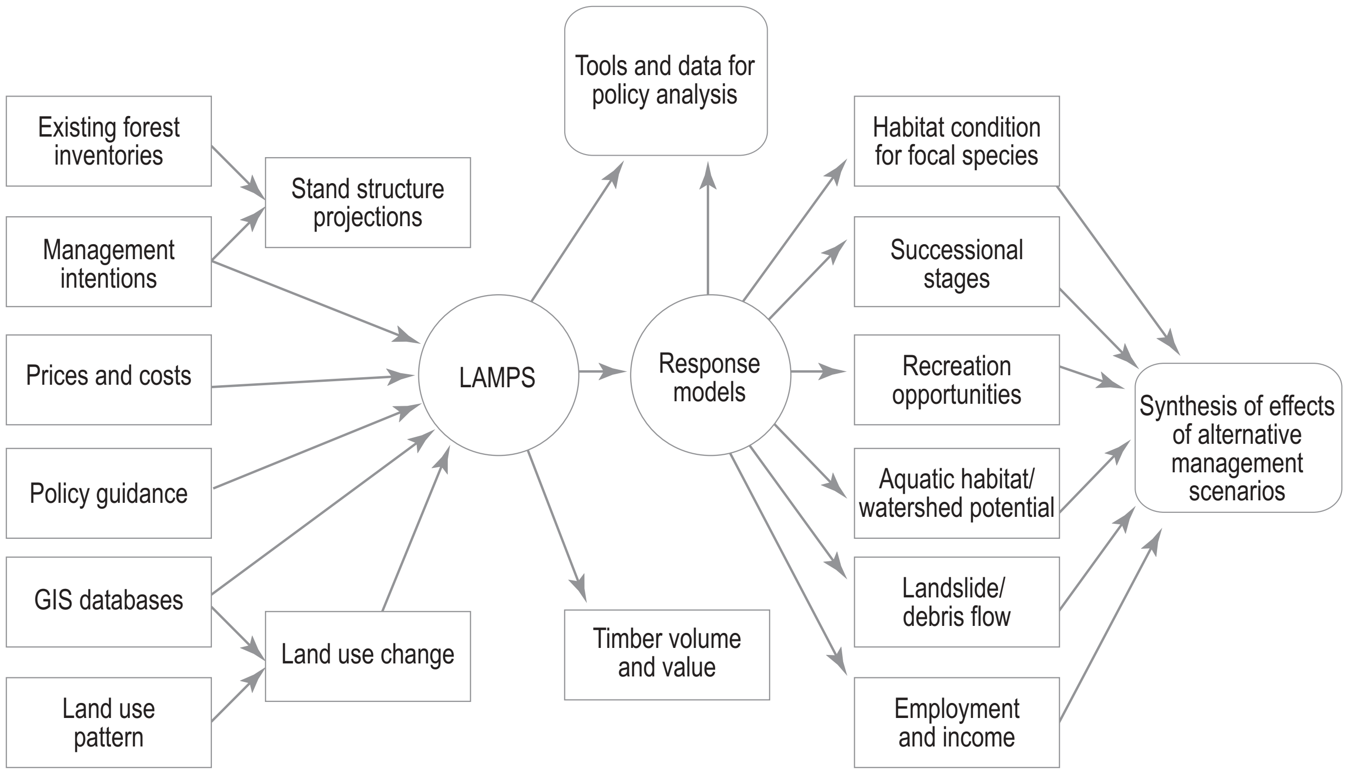


Figure 1.1. CLAMS landscape planning and analysis process.

In addition to providing a multi-ownership perspective on forest management effects across broad landscapes, CLAMS offers insight into multi-province level planning among landowners, indicators and tools for monitoring biological diversity at broad scales, and assessments of the feasibility of using selected Criteria and Indicators for Conservation of Biological Diversity (Montreal Process) at the provincial scale. Some of the processes to be developed include

- coarse and fine scale measures of biodiversity
- habitat suitability models
- aquatic habitat potential measures for salmonids
- indicators of landslide and debris flow
- economic effects
- recreational opportunities
- contingent valuations of biological diversity

For more information regarding the CLAMS project, please visit the CLAMS web site at http://www.fsl.orst.edu/clams/ (Coastal Landscape Analysis and Modeling Study 2001).

1.2 Overview of the LAMPS Model

The LAndscape Management Policy Simulator (LAMPS) models changes to landscape structure over time as a result of management intentions (human-caused disturbances) and vegetation dynamics. Socioeconomic and ecological information is used to track and allocate activities across the landscape. The initial conditions of the landscape are not randomly assigned, as is the case with many landscape simulation models, but instead are estimated from actual conditions based upon a gradient, nearest-neighbor classification of satellite imagery (Ohmann and Gregory 2002).

LAMPS projects, with relatively high resolution, forest conditions across all ownership groups and over a planning horizon of 100 yr. LAMPS simulates the effects of management at a large scale while also tracking small-scale processes and, in doing so, provides a tool for evaluating management strategies employed by different landowners. Thus, LAMPS bridges tactical and strategic planning by incorporating tactical constraints while focusing on long-term, strategic management goals. However, LAMPS should not be used as a tactical planning tool. Rather, LAMPS provides assistance to policymakers, managers, and planners concerned with the long-term effects of alternative forest management policies across multiple ownerships.

The LAMPS simulation program uses a Model I problem formulation (Johnson and Scheurman 1977) that allows regenerated stands to be traced back to their original stands. The spatial allocation of harvests is not stochastic, but rather is tied to the expected behaviors of explicitly recognized landowner groups.

Four landowner groups are identified in LAMPS:

- forest industry
- nonindustrial private
- federal
- state

Guidelines for spatially and temporally placing harvests across the landscape according to landowner behavior patterns were derived from published literature of past management behavior, surveys of current and future management intentions for forest industry and nonindustrial private landowners, and discussions with representatives of the four ownership groups.

In addition to the regulatory policies that affect each landowner group, users can incorporate social or organizational goals that vary by landowner. Examples include minimum harvest ages, regeneration harvest sizes, green-up periods, various riparian management and leave-tree choices, and increasing degrees of clearcut, thinning, and regeneration management intensities. Also, the establishment of vegetation after a clearcut occurs is determined by transition probabilities that are a function of distance from a stream, vegetation class before harvest, and landowner group. Additional details regarding these options are provided in Chapters 5–8.

1.3 Getting Started with LAMPS

1.3.1 Hardware and Operating System Requirements

LAMPS software comprises two parts:

- the interface, where users can develop and modify policies. It is written in Visual Basic using the Microsoft Visual Basic 6.0 compiler.
- the simulation program, which utilizes the information specified by users within the interface. It is written in C and C++ using the Microsoft Developer Studio 6.0 compiler.

To run the LAMPS simulation program, the following components are required:

- IBM-compatible computer with an operating system no older than Windows NT 4.0
- 1.5 GHz or faster processor (recommended)
- 2 GB of RAM
- 1 GB hard drive

Note: Hard drive requirements vary depending on the size of the landscape being modeled. For example, a 1.5-million ac landscape requires approximately 1 GB of hard-drive memory to store the input data files and 1 GB of memory to store the output data files of a single policy alternative. (Zipping the output files into a single Zip file requires about 100 MB of hard-drive space.) The two executable files that comprise the LAMPS model (the interface and the scheduling model) occupy only about 3 MB of disk space.

1.3.2 Software Installation

To install the LAMPS software

(1) Download the installation package from the CLAMS website at http://www.cof.orst.edu/research/lamps/LAMPSdoc.html.

(2) Place the installation package in a subdirectory on your computer.

(3) Unzip the installation package with WinZip.

(4) Double-click "setup.exe" and follow the instructions provided.

Once the installation process is complete, LAMPS is ready for use.

1.3.3 Overview of LAMPS Software

From the Main Menu window, users can choose from five options (Figure 1.2):

- File—to manage the LAMPS session (for example, to save scenarios or load previously developed scenarios)
- Develop a Scenario—to create a management scenario. This drop-down menu contains modifiable parameters described in this guide.
- About—to obtain information about LAMPS and the CLAMS project
- Go—to launch the simulator. Launching the simulator assumes a policy management scenario has been developed and the required input files have been identified.
- Exit—to exit LAMPS

Figure 1.2. Main Menu window.

2. Spatial Data Structure and Database Requirements

This chapter describes

- the spatial data structures recognized in LAMPS
- the input data files required for each LAMPS simulation

In order to perform a landscape simulation, spatial and nonspatial databases need to be acquired and formatted to the specifications of the simulation system. One of the most significant barriers to timely landscape analysis is the development of these databases (Nelson 2001).

To build these databases, the LAMPS model requires socioeconomic and ecological data obtained through inventories, interviews, surveys, and assumptions about various relationships. This information has been collected and synthesized into useable databases, most of which are available on the CLAMS web site (Coastal Landscape Analysis and Modeling Study 2001). The major sources of these data include

(1) Landsat Thematic Mapper (TM) satellite imagery and GIS layers, such as ownership patterns, topography, vegetation, and streams, to build high-resolution spatial models (grain size of 0.1–10 ha). CLAMS personnel developed the vegetation, streams, and management unit GIS databases. The other databases were developed by Atterbury Consultants (Beaverton, Oregon), Oregon Department of Forestry, USDI Bureau of Land Management, and USDA Forest Service.

(2) forest vegetation databases developed using forest inventory plots with tree-level data. These were obtained from USDI Bureau of Land Management, USDA Forest Service, and Oregon State University research plots.

(3) surveys and interviews of forest landowners to determine their expected management intentions (e.g. rotation ages, thinning regimes, and riparian management intensity) under current policies and spatial land-use change models based on retrospective studies. Surveys were conducted by the Oregon Department of Forestry in 1999. To date, the CLAMS project has interviewed >50 industrial, state, and federal land managers.

(4) economic information derived from Oregon State University research including log prices, logging costs, and manufacturing costs

(5) simulation of expected successional changes in forest structure and composition under different management regimes using ORGANON (Hann et al.

1997) and ZELIG (Urban and Shugart 1992; Urban et al. 1999) stand dynamics models

(6) land-use change models based on historical Forest Inventory and Analysis (FIA) data and driven by estimates of population change.

2.1 Spatial Data Structures Recognized in LAMPS

LAMPS recognizes several spatial scales (Figure 2.1). Each scale has a function, from representing basic forest-level structural data to acting as land allocations within which a set of management activities are allowed (or disallowed). The input data files required by LAMPS must be designed to recognize each spatial scale, either directly through some land attribute or indirectly through a spatial relationship, such as knowing which areas of land are adjacent to others.

LAMPS recognizes the following spatial scales:

- basic simulation units (BSUs)—used to track forest conditions. This is the scale at which gap disturbances are modeled.
- parcels—one scale at which management activities are scheduled. Parcels are fixed collections of BSUs.
- harvest blocks—another scale at which activities are scheduled. For certain landowner groups, users can modify the size of harvest blocks.
- land allocations—subdivisions of landowner groups that allow for various management emphases within a particular landowner.
- watersheds—used in conjunction with federal land management constraints that require certain conditions to be present before management activities can be scheduled.
- land owner groups—the largest scale at which an individual landowner's management intentions are modeled.
- megasheds—represent the extent of the analysis area simulated.

Much of the management scenario information is tied to land allocations and landowner groups, and includes such variables as minimum harvest ages, leave-tree requirements, regeneration parameters, and the process used to schedule activities. These variables are described in Chapter 11.

2.1.1 Basic Simulation Units (BSUs)

BSUs are the smallest spatial units recognized in LAMPS (Figure 2.1). They can be as small as a single 25-m pixel (0.15 ac) or as large as several acres. BSUs are aggregations of pixels in a raster database that are contiguous and have exactly the same characteristics (land allocation, distance from stream, ecoregion, watershed, and CLAMS forest inventory plot number). Forest conditions, including stand age, timber volume, average log sizes, and structural class, are assigned to each BSU.

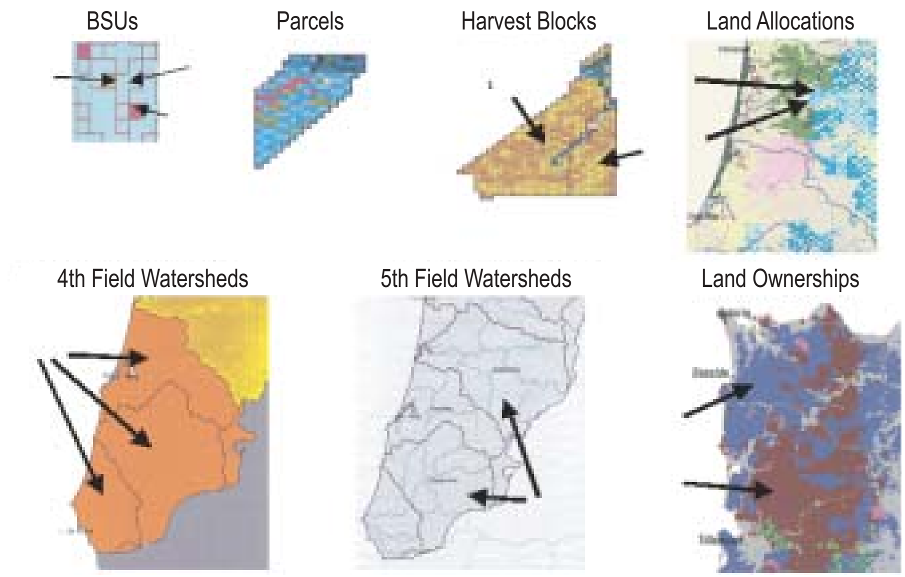


Figure 2.1. Spatial data structures recognized in a LAMPS simulation.

2.1.2 Parcels

Parcels (Figure 2.1) are analogous to management units. They average 15–20 ac in size and are delineated, in part, based on topography, ownership boundaries, and vegetation classes. Within each parcel reside 50–100 BSUs. The collection of BSUs within a parcel can be quite heterogeneous; thus, a summary of the condition through time of each BSU is required.

2.1.3 Harvest Blocks

Harvest blocks are sets of contiguous parcels on forest industry and nonindustrial private lands that are scheduled to be clearcut during the same time period (Figure 2.1). They are not fixed in size or shape and are created dynamically during the scheduling process of the simulation model, using the process described in Bettinger and Johnson (2003).

2.1.4 Land Allocations

Land allocations are subdivisions of landowner groups allocated to certain management emphases, such as reserves or general management areas (Figure 2.1). A maximum of 100 land allocations is allowed during a LAMPS simulation.

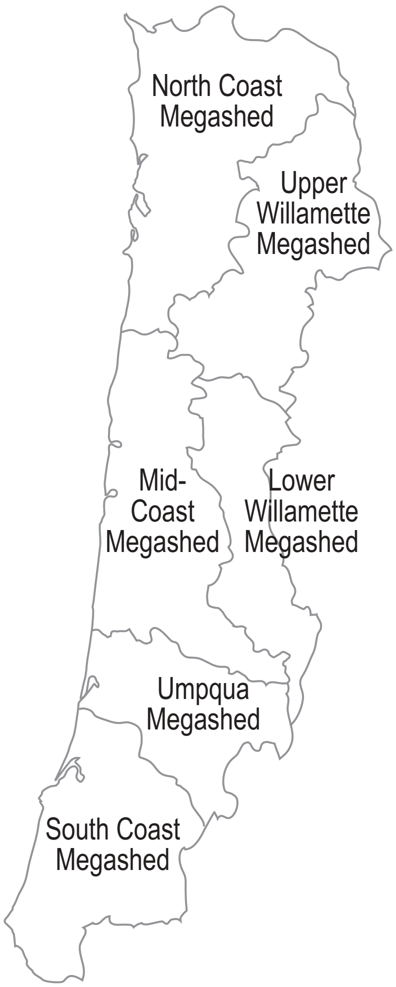


Figure 2.2. CLAMS megasheds developed for the Coast Range of Oregon.

2.1.5 Watersheds

In some instances, such as with the management of federal forests, it is important to recognize watersheds (Figure 2.1) and constrain the amount of activity allowed within them during each time period in a simulation. There are approximately 100 fifth-field watersheds used to describe the Coast Range of Oregon. Although fourth-field watersheds are recognized as well, they are used only in delineating megasheds.

2.1.6 Landowner Groups

Four landowner groups (Figure 2.1) are recognized by LAMPS: federal, state, forest industry, and nonindustrial private land. For a realistic simulation of ownership behavior, the size and spatial arrangement of landowner groups should be as current as possible.

2.1.7 Megasheds

The Coast Range is divided into collections of watersheds called “megasheds” (Figure 2.2). The divisions of these megasheds follow fourth-field watershed boundaries, though more than one fourth-field watershed may be in a megashed.

The average megashed is over 1 million ac. Because of size limitations, LAMPS models each megashed separately. For example, to model a 1.5-million ac land area generally requires almost 6 million BSUs. The computer RAM required to track this many BSUs approaches 2 GB. The upper limit on RAM available for standard workstations is 2 GB. Therefore, it is impossible to model the entire extent of the Coast Range (about 7 million ac) with this version of LAMPS.

2.2 Data Assembly and Editing

File input and output (file I/O) occur constantly throughout a LAMPS simulation. A set of input data files is read into the model at the beginning of a simulation. These data files are essential to describing a policy scenario and the megashed being modeled. (See Chapter 3 for a description of policy scenarios.)

The user must specify two types of information:

- input data files required to describe the landscape and forest conditions
- size of some files in order to define the size of arrays in the scheduling model

All other LAMPS data are output files (whether intermediate files or reports) that are routed to a user-defined location. For a description of output files, refer to the discussion on reports in Chapter 10 and the explanation of output files in the Appendix.

Figure 2.3. File Directory window.

2.3 File Directories and Defining the Problem Size

Several databases and associated files are required by LAMPS for a policy simulation. These files describe the physical area to be simulated and the associated databases used to describe the forest conditions. These files are specified by the user in the LAMPS File Directory.

To specify database files,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select File Directory from the drop-down menu. The LAMPS File Directory window appears (Figure 2.3).

(3) Specify the file by

- typing the path name where the file is located into the textbox—by default, the cursor is located in the first file subdirectory textbox LAMPS C Program File

-or-

- clicking once in the textbox—a browse window appears where the path can be specified using standard Microsoft Windows conventions. Advance the cursor to other textboxes by pressing the Tab key. Be sure to note where the cursor is located before entering a path name.

Note: All file directory textboxes in the LAMPS software operate in this manner.

2.3.1 Compile New Binary File?

To run a scenario, a binary file (called "Megabin" by default in the file directory) must be available. Thus, a new binary file must be compiled at least once for each megashed. LAMPS creates the binary file without any intervention from the user.

Megabin contains all of the spatial database and growth-and-yield information that describes a megashed in binary format, which is faster for the scheduling program to read than are individual files.

To compile a new binary file,

(1) From the Main Menu window, select Develop a Scenario and then File Directory from the drop-down menu. The LAMPS File Directory window appears (Figure 2.3).

(2) Specify the directory locations for the LAMPS C Program File, five Landscape Data Files, and three Miscellaneous Tables. (Each input file is described in Section 2.4.)

(3) Specify the 27 Yield Tables. LAMPS uses three different growth-and-yield systems:

- ORGANON
- ZELIG FOG Zone
- ZELIG INTERIOR Zone

Each of the three systems has nine yield tables for a total of 27 tables. You must specify the yield table files for each of the three systems. To do so, press the button related to a system, and then click each text box and browse your computer to locate the file.

(4) Select Compile new binary file… at the bottom of the window.

(5) Return to the Main Menu window by closing all other open windows and then press Go.

Note: Compiling a new binary file takes approximately 10 min of run time.

To use a previously developed binary file,

(1) From the Main Menu window, select Develop a Scenario and then File Directory from the drop-down menu. The LAMPS File Directory window appears (Figure 2.3).

(2) For the Graphics directory, type the path name or navigate to the Megabin binary file. The Megabin file must already exist. This is the only file that needs to be specified here, as the Megabin contains all of the other files.

(3) Select Use previously developed binary file… at the bottom of the window.

(4) Return to the Main Menu window and press Go.

2.3.2 Set the Problem Size

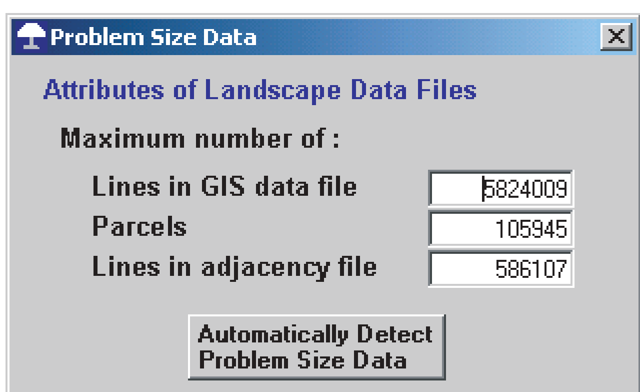
In order for LAMPS to work effectively, a few parameters describing the size of the problem must be indicated.

Note: Prior knowledge of these parameters must be available to do this. If no prior knowledge is available to specify the problem size, press the Automatically Detect Problem Size Data button and disregard the instructions below.

To specify the problem size,

(1) From the Main Menu window, select Develop a Scenario and then File Directory from the drop-down menu. The Problem Size Data window appears (Figure 2.4).

(2) Enter the number of lines in the GIS data file (BSU GIS data file), the number of parcels in the data file, and the number of lines in the adjacency file.



Important: If the data files have not been selected yet, the automatic detection process will not work. If the wrong data files have been selected, inaccurate parameters are likely to be located.

Figure 2.4. Problem Size Data window.

2.4 Input File Description and Format

The following input files describe the policy scenario for a megashed and are required for LAMPS to perform an analysis. Users are prompted to locate these files in the File Directory window (Figure 2.3). A detailed description of the specific format required for each file is presented in the Appendix.

2.4.1 LAMPS C Program File

The LAMPS C program file is the scheduling model itself, compiled in the C program language. Users must specify where this file is located so LAMPS can link to it, as it is not incorporated as an explicit part of the LAMPS interface.

2.4.2 Graphics Directory

Users must specify a graphics directory location (a subdirectory on their computer's hard drive). In this subdirectory, the binary graphics files are stored that allow users to view the landscape vegetation classes after a simulation run. In addition, the binary Megabin, which contains all the data required to describe a landscape, as well as all the growth-and-yield tables, is stored here. Binary graphics files are created by LAMPS; users need not concern themselves with supplying them.

2.4.3 BSU GIS Data File

The GIS file contains information, such as the parcel number, slope class, distance to stream, ecoregion, and acreage, about each BSU. It is commonly called the "combined file", since about 10 GIS databases must be combined to produce a description of a BSU.

2.4.4 BSU Development Zone Data File

The development zone file represents the condition of each BSU over time as it pertains to human development. The time period in which a BSU changes from forested to non-commercial forest, and subsequently to urban, is noted if land-use projections indicate that these changes will take place. It is possible for a BSU never to change from a commercial forested condition.

2.4.5 Parcel Adjacency File

The parcel adjacency file describes the adjacency relationships among parcels. It is required to model green-up policies, aggregate parcels into harvest blocks on industry and nonindustrial private land, and develop interior habitat patches on state land. Algorithms within LAMPS use the adjacency relationships to determine which parcels explicitly touch other parcels.

2.4.6 Parcel Coordinate File

The parcel coordinate file contains the X and Y coordinates of the boundaries of each parcel. It is used to facilitate the display of ownership classes, vegetation classes, and ODF structural stage condition classes on a parcel basis (not on a BSU basis).

2.4.7 Parcel Owl File

The parcel owl file contains the parcel number of each parcel where a spotted owl (*Strix occidentalis caurina* Merriam) nest is centered. Users need to determine where they believe owl nests exist and which parcels represent those locations.

2.4.8 Plot (SEQNO) Master List

The plot master list file contains each of the CLAMS forest inventory plots (SEQNOs) used in a simulation, and the unique numbers used by the simulation model as surrogates for those plot numbers. There are about 600 CLAMS forest inventory plots, represented by values from 1 to 4000, and thus they are generally not consecutively numbered. In order to use a computer's memory efficiently, these numbers are renumbered from 1 to *n* for use in LAMPS.

2.4.9 Plot (SEQNO) Site Index

The site index file indicates the King's 50-yr Douglas-fir site index value for each of the CLAMS forest inventory plots (SEQNOs). Site index values are used to guide the selection of the appropriate regenerated-stand tree list after clearcut activities.

2.4.10 Prescription (RX) Master List

The prescription master list file contains each of the CLAMS prescriptions used in a simulation, and the unique numbers used by the simulation model as surrogates for those prescription numbers. There are about 250 CLAMS prescriptions, represented by values from 1 to 1000, and thus they are generally not consecutively numbered. In order to efficiently use a computer's memory, these numbers are renumbered from 1 to *n* for use in LAMPS.

2.4.11 Growth-and-Yield Databases

Nine growth-and-yield databases are required by LAMPS. Each database represents the condition of a forest inventory plot (SEQNO) managed under each prescription (RX) over 100 yr. Without the growth-and-yield databases, LAMPS is unable to determine the timber volume, age, and structural condition of each parcel. The nine database files are

- softwood standing volume
- softwood thinning volume
- hardwood standing volume
- hardwood thinning volume
- average log size
- regeneration timing
- stand ages
- CLAMS vegetation classes
- Oregon Department of Forestry structural stage classes

3. LAMPS Scenarios

3.1 What is a Scenario?

Each simulation requires the development of a policy scenario, which is created at the megashed level. A scenario incorporates the knowledge of the databases, management information, and ecological assumptions defined by the user. The following user-specified information forms the basis for a policy scenario:

- management options available to each landowner
- land allocation parameters regarding regeneration, minimum harvest ages, green-up periods, and activities allowed
- clearcut and thinning parameters
- economic analysis parameters
- ecological disturbance factors

Policy scenarios may or may not be based on realistic interpretations of organizational or regulatory policies and management behaviors. A policy scenario, for example, might include

Forest industry land management objectives and constraints:

- to achieve the highest nondeclining evenflow of timber harvest volume over time
- to fit clearcut sizes to a user-defined clearcut size distribution
- to harvest in riparian areas to Oregon Forest Practices Act specifications
- to leave two small green trees in clearcut units after harvest
- to utilize a minimum harvest age for clearcuts
- to use a specific green-up period for adjacent clearcuts

Federal land management objectives and constraints:

- to permit clearcutting in a watershed only after 15% of the watershed is composed of older stands
- to allow a maximum of 1% of the federal land base to be clearcut annually
- to restrict thinnings in some land allocations
- to prohibit any activity in other land allocations
- to utilize a minimum harvest age for clearcuts
- to use a specific green-up period for adjacent clearcuts

Nonindustrial private land management objectives and constraints:

- to achieve a timber harvest volume level set by the user
- to fit clearcut sizes to a user-defined clearcut size distribution

- to harvest in riparian areas to Oregon Forest Practices Act specifications
- to leave two small green trees in clearcut units after harvest
- to utilize a minimum harvest age for clearcuts
- to use a specific green-up period for adjacent clearcuts
- to use probabilities of harvest, based on stand age

State land management objectives and constraints:

- to achieve the highest nondeclining evenflow of timber harvest volume over time
- to harvest in riparian areas to Oregon Forest Practices Act specifications
- to leave two small green trees in clearcut units after harvest
- to utilize a minimum harvest age for clearcuts
- to use a specific green-up period for adjacent clearcuts
- to maintain a distribution of interior habitat areas
- to attempt to achieve a proportion of each District area in certain structural conditions

A scenario can be specified, saved, and used at runtime. Alternatively, a previously developed scenario can be modified to develop a new scenario.

The current scenario loaded into LAMPS is displayed at the bottom of the Main Menu window in the **Policy Scenario** text box located between the **Go** and **Exit** buttons (Figure 3.1).

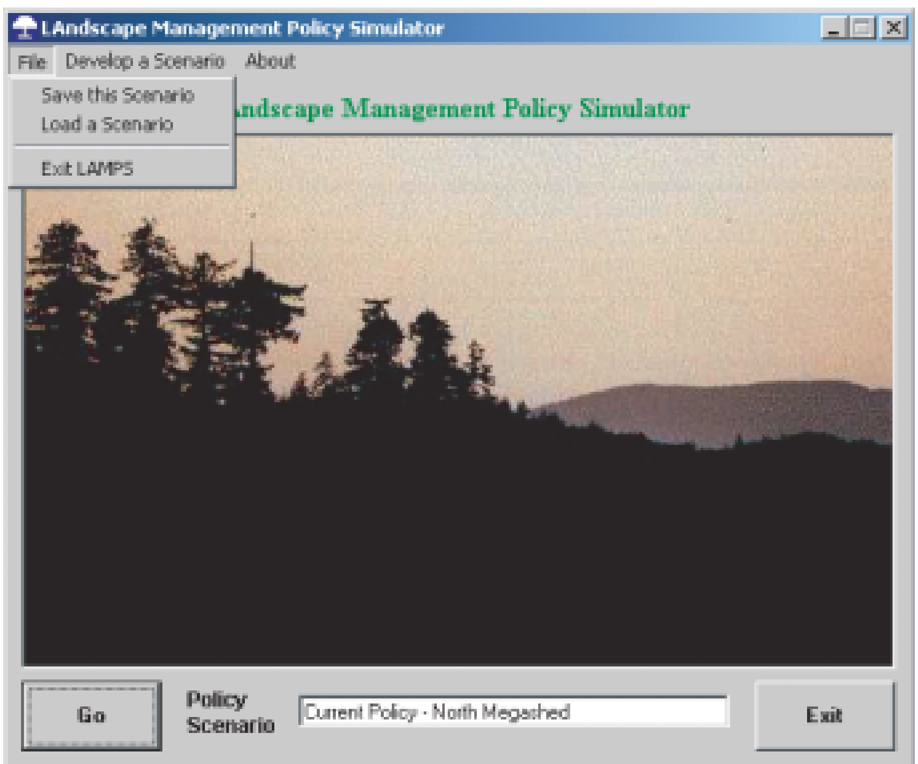


Figure 3.1. Main Menu window, File selected.

3.2 Saving a Scenario

After defining the necessary parameters (described in the remainder of this user guide) for a megashed, a scenario can be saved for use in a future LAMPS simulation.

To save a scenario for future use,

(1) From the **Main Menu** window, select **File** and then **Save this Scenario** from the drop-down menu (Figure 3.1). A standard Microsoft **Save As** window appears (Figure 3.2).

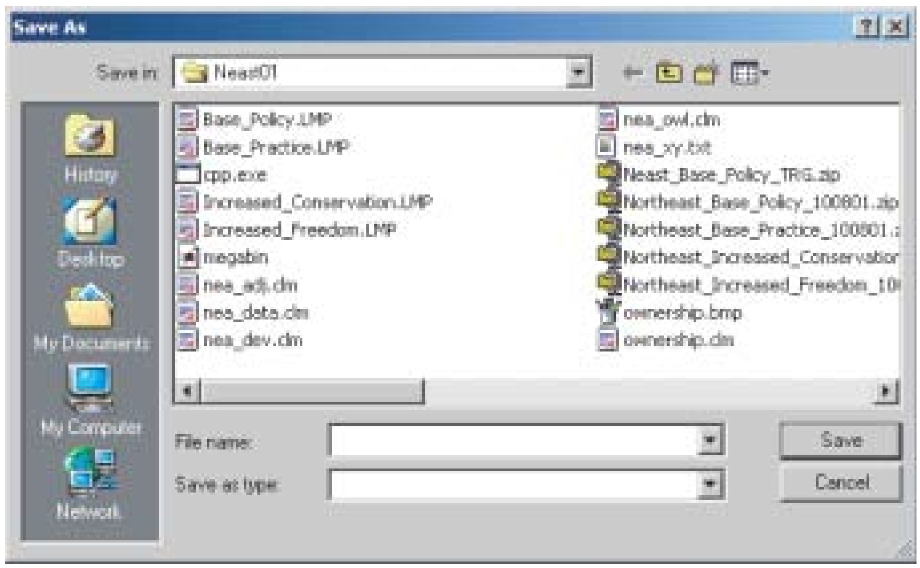


Figure 3.2. Microsoft Save As window for saving scenarios.

(2) Select the directory (or subdirectory) where the file will be saved, and type the name of the file containing the scenario in the **File name**: text box. The file is automatically saved as a text file.

In the event a scenario is not saved, the parameters that describe a scenario may be lost. If a scenario is not saved, but was run with the LAMPS scheduling model, the parameters are automatically saved in the file C:\runLAMPS.txt. The parameters in this file can be loaded back into the LAMPS interface (as described in the next section).

Important: This file is overwritten each time the LAMPS scheduling model is run. See Chapter 10 for more discussion of this issue.

3.3 Loading a Scenario

To load a previously saved scenario,

(1) From the Main Menu window, select File and then Load a Scenario from the drop-down menu (Figure 3.1). A standard Microsoft Open window appears (Figure 3.3).

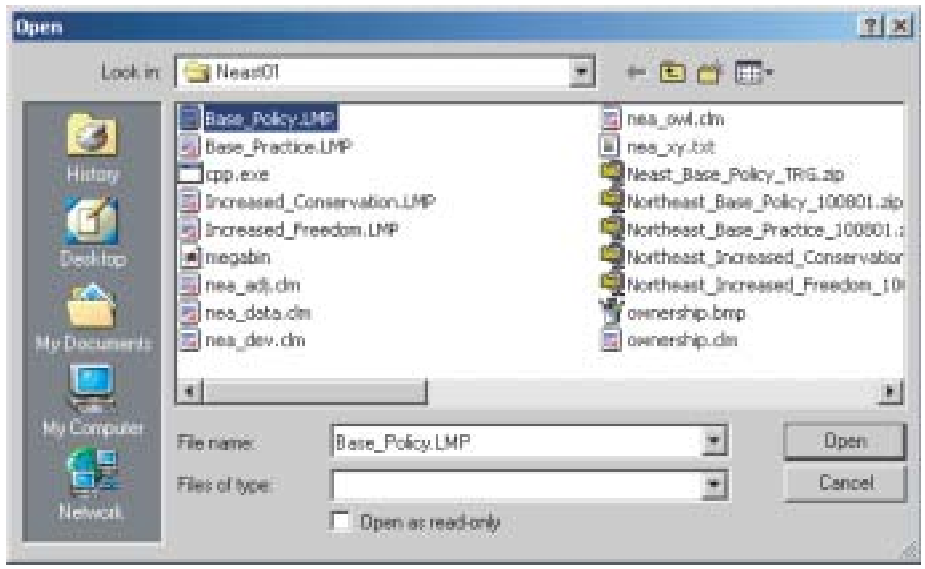


Figure 3.3. Microsoft Open window for loading a scenario.

(2) Select the previously saved scenario by browsing to the saved file location and double-clicking the scenario file name. The scenario is now loaded and listed in the Policy Scenario text box located at the bottom of the Main Menu window.

3.4 Editing a Scenario

A previously saved scenario can be loaded, modified, and saved as a new scenario by changing the name of the text file.

Because scenarios are saved as text files, it is possible to edit them using word processing software. However, it is strongly suggested that users not modify scenarios in programs other than LAMPS. Parameters within these text files must be located in specific positions to allow their proper loading into the interface and scheduling model.

Users may find it useful, however, to view saved scenarios in a word processor in order to examine a scenario's parameters.

4. Information about Landowners

Forest management behavior can vary substantially from one landowner group to the next. Thus, it is appropriate to model the management intentions of each landowner separately. Most modeling parameters in LAMPS are associated with landowner groups (this chapter) or land allocations (Chapter 5), which are one level lower in spatial detail.

Four landowner groups are currently identified in the CLAMS project: federal, state, forest industry, and nonindustrial private. When developing a LAMPS scenario, all land (hence land allocations) must fit into one of these four groups.

Users must make four rather broad assumptions about each landowner:

(1) how to schedule activities

(2) how to manage land around owl nest locations

(3) the starting volume target, assuming a binary search harvest scheduling technique was selected

(4) the volume increment, assuming a binary search harvest scheduling technique was selected

4.1 Modifying Information about Management Options

Each landowner group must be assigned a management option, which describes, in general, the type of process used to schedule forest management activities through time and across a landscape. LAMPS contains four broad sets of management options, each designed to schedule activities according to the objectives of one of the four landowner groups. There are, for example, the federal scheduling process (Options 11–13), the forest industry scheduling process (Option 22), and so on, as we will soon see.

To access the Management Options window,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Information about Landowners from the drop-down menu and then Management Options (Figure 4.1). The Management Options window appears (Figure 4.2).

Four actions can occur within the Management Options window:

- Existing information can be edited.
- A row of new information can be added.
- A row of information can be deleted.
- The entire grid can be cleared.

Figure 4.1. Main Menu window, Information about Land Owners selected.

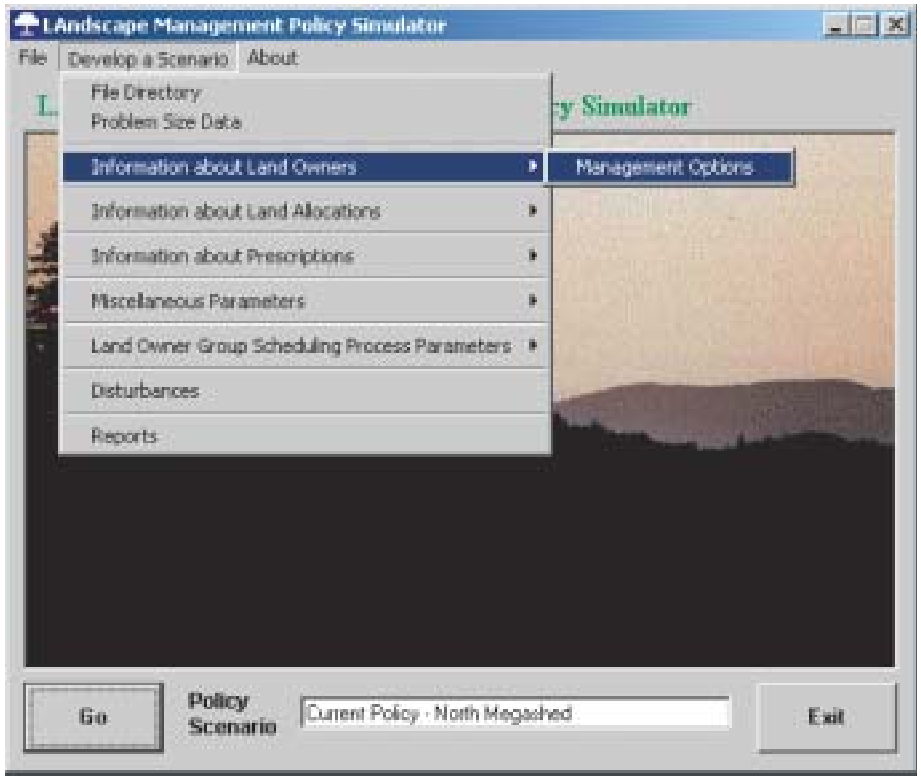
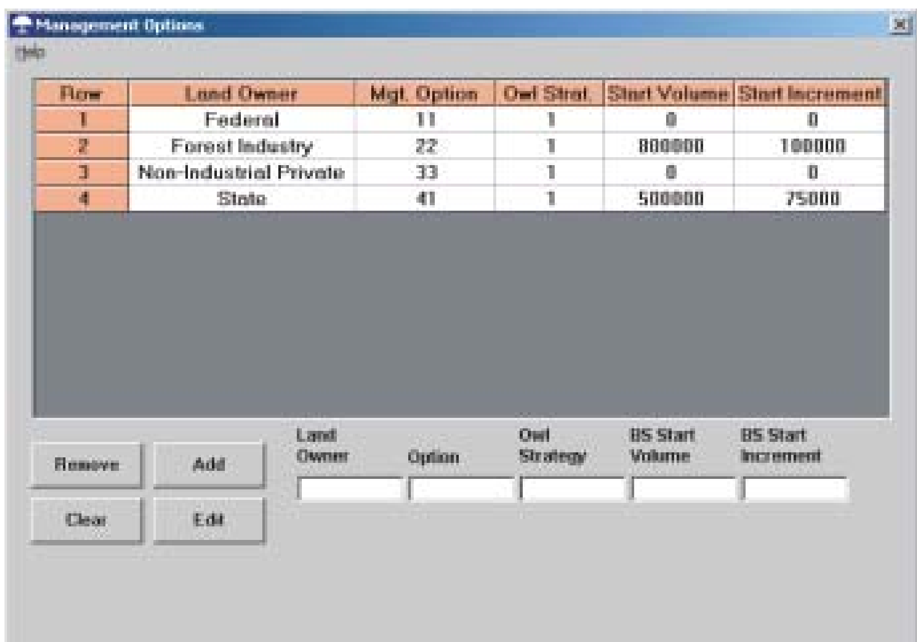


Figure 4.2. Management Options window.



Note: Each of these actions that allows users to edit information in the Management Options window is common to other windows described in subsequent chapters of this user guide. Thus, becoming familiar with the options that are available when editing windows is important. It is also important to understand that there is no Undo button *that allows users to retrace their steps when modifying information within these windows.*

4.1.1. Editing Existing Management Option Information

To edit an existing entry,

(1) In the Management Options window (Figure 4.2), highlight the entry by clicking on any cell in the row of interest.

(2) Click the Edit button at the bottom of the window.

(3) Change the necessary information that appears in the text boxes located at the bottom right-hand corner of the window. When the Landowner, Option, or Owl Strategy text boxes are clicked, a menu appears from which choices may be selected.

(4) When editing is complete, click the Okay button that appeared after the Edit button was pressed. This action saves the changes, which can be verified by examining the appropriate row within the Management Options window.

4.1.2 Adding a New Row of Management Option Information

To add a new row of information about a landowner,

(1) In the Management Options window (Figure 4.2), enter the new information in the text boxes in the lower right-hand corner of the window.

(2) Click Add. The additional information is added to a new row.

Users can add up to 100 rows of information about management options. There are only four landowner groups, however; thus, only four management options (one for each group) are used in any one simulation. If there are multiple rows of management option information, say for federal land, only one of them will actually be used during a simulation. Which one? The last one noted in the grid. Why, then, would one keep more than one row of management options for a landowner group? Perhaps to remember the parameters used in a previous simulation.

4.1.3. Deleting a Row of Management Option Information

To remove *a single row* of information from the Management Options window (Figure 4.2), click any cell in that row and then click Remove.

4.1.4. Clearing the Management Options Window

To remove the *entire set* of information within the Management Options window, click Clear.

Note: Exercise caution when using the Clear *button—all information is deleted. If only one landowner is to be removed, select the row containing that landowner and press* ***Remove.***

4.2 Description of Management Option Attributes

Management options define how forest management activities are scheduled within LAMPS. In this section, we

(1) provide a brief background on management scheduling and simulation techniques that can be employed to develop forest plans with spatial goals, and

(2) describe each of the scheduling techniques used in LAMPS (as portrayed by a management option) and briefly convey the reasoning for selecting each one for use.

The suite of management planning tools available for scheduling or simulating activities on landscapes includes

- traditional mathematical techniques, such as linear and integer programming
- nontraditional techniques, such as nonlinear and heuristic programming, and simulation models

Forest planning efforts that involve spatial goals, such as clearcut green-up (adjacency) restrictions, are combinatorial problems by nature. As the size of the planning problem increases, the potential solution space also increases, yet at a disproportionately greater rate (Lockwood and Moore 1993). Linear programming, mixed integer programming, and integer programming techniques have been used to develop forest plans with green-up concerns, but these techniques have substantive limitations related to problem size when applied to large combinatorial problems (Lockwood and Moore 1993). Nevertheless, some effort has been expended in the last decade to enhance our understanding of how traditional techniques can assist forest planning efforts (e.g., Hof and Joyce 1992; Hof and Raphael 1993; Hof et al. 1994).

Heuristic programming techniques are increasingly used for developing forest plans that prove more difficult to develop with traditional optimization techniques. Monte Carlo simulation, tabu search, and simulated annealing are three of the more popular heuristic programming techniques. Although heuristic techniques do not guarantee that a global optimum solution can be located for a particular problem, they can produce feasible (and often very good) solutions to complex problems in a reasonable amount of time. Tabu search, for example, has been used on several forestry-related problems (Murray and Church 1995; Bettinger et al. 1997, 1998).

Simulation models can also be developed to provide a spatial and temporal context in which policymakers can evaluate strategic alternatives. Simulation models generally are developed to capture relevant features of the dynamic nature of the “target system” under study (Birta and Özmizrak 1996), and their reliability depends highly on how well the models reflect reality (Li et al. 1993). Achieving reliability in a simulation model is not a trivial task; for example, ecological consequences can differ dramatically, depending on the pattern of land-use activities imposed on a landscape (Franklin and Forman 1987). Thus, modeling land-use activities appropriately is quite important. This can require a major collaboration between scientists, planners, managers, and policymakers in order to develop a model with widespread application and acceptance at the appropriate spatial and temporal scales. Recognition of current and future management behavior of landowners increases the credibility and realism of simulations.

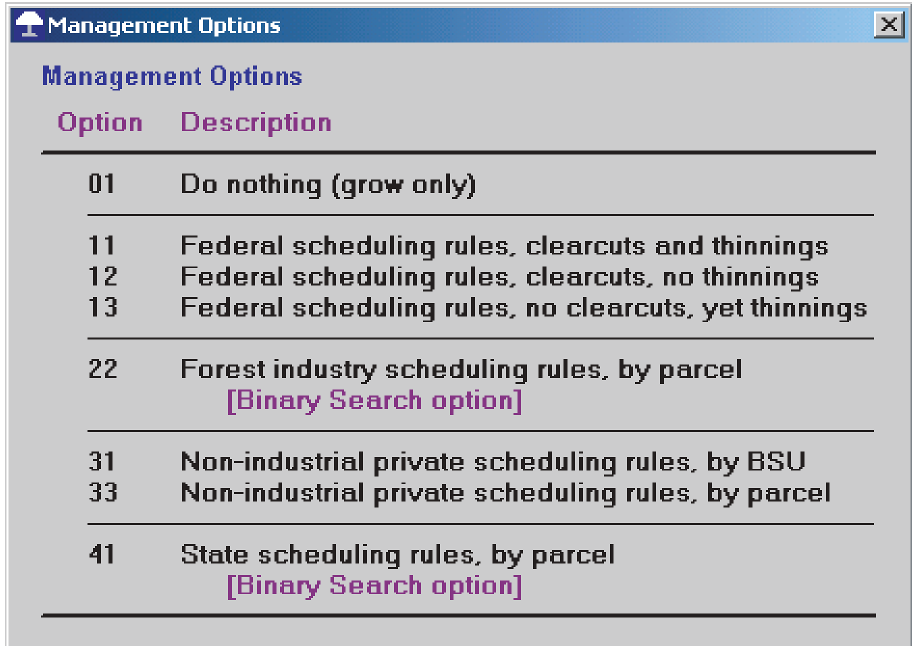
Many simulation models have been developed in the last two decades to model events or behaviors across landscapes. Franklin and Forman (1987), two of the first scientists to simulate the ecological consequences of forest management activities on a landscape, indicated that the pattern of management applied to landscapes can produce various ecological consequences. Others have since developed models that simulate a wide variety of activities or disturbances and spatial and temporal scales for forested landscapes (Turner 1987; Li et al. 1993; Flamm and Turner 1994; Gustafson and Crow 1994, 1996; Wallin et al. 1994; Johnson et al. 1998; Gustafson et al. 2000). Simulation models have been widely used in other natural resource areas as well—for example, disturbances such as gypsy moth outbreaks (Zhou and Liebhold 1995), contaminated land (Salt and Culligan Dunsmore 2000), and landscapes such as grasslands (Gao et al. 1996).

The LAMPS model is most accurately described as a simulation system because it attempts to model management behavior of all forest landowner groups in the Coast Range of Oregon using either simulation or heuristic processes. For example, binary search (as described in Leuschner 1990) and Monte Carlo are examples of simulation and heuristic processes used in modeling landowner behavior in LAMPS.

Eight management options are available in LAMPS for scheduling management activities across space and time. To view a description of the management options available,

(1) From the Main Menu window, select Develop a Scenario.
(2) Select Information about Landowners from the drop-down menu and then Management Options (Figure 4.1).
(3) Select Help in the upper left hand corner of the Management Options window, then List of Management Options. The Management Options help window appears (Figure 4.3).

This window defines each option and the landowner group each option was designed to represent. We say “designed to represent” because users can assign any option to any landowner group. For example, the option designed for forest industry management behavior (Option 22) could be assigned to federal land.



Management Options

Management Options

Option	Description
01	Do nothing (grow only)
11	Federal scheduling rules, clearcuts and thinnings
12	Federal scheduling rules, clearcuts, no thinnings
13	Federal scheduling rules, no clearcuts, yet thinnings
22	Forest industry scheduling rules, by parcel [Binary Search option]
31	Non-industrial private scheduling rules, by BSU
33	Non-industrial private scheduling rules, by parcel
41	State scheduling rules, by parcel [Binary Search option]

Figure 4.3. Management Options help window.

4.2.1 Option 01

Option 01 is a "grow only" management option. No harvesting activities (thinning or clearcutting) are simulated; the stands simply grow through time. In a simulation, however, stochastic disturbances, unless "turned off" (see Chapter 9), continue to occur randomly through space and time to BSUs based on the probability distribution provided by the user.

4.2.2 Option 11

Option 11 schedules management activities according to guidance provided by federal land managers. There is no objective function associated with Option 11. Activities are scheduled within the bounds of the constraints assigned by the user; clearcut and thinning activities are scheduled at the parcel scale.

This option uses a Monte Carlo simulation process to randomly schedule clearcutting activities within land allocations defined as "matrix," subject to the constraints noted in Chapters 5 and 8. Monte Carlo simulation was chosen because the achievement of specific objectives was unclear in our discussion with federal managers. Thus, we schedule activities within the bounds set by the constraints provided through our discussions with the managers and through our interpretation of current federal policies.

4.2.3 Option 12

Option 12 is similar to Option 11, except that no thinnings are scheduled, just clearcuttings at the parcel scale. This option uses Monte Carlo simulation to randomly schedule clearcutting activities, as described in Option 11.

Note: In lieu of using Option 12 on lands modeled using the federal scheduling criteria, users can select Option 11 and then specify the clearcuts allowed within each land allocation.

4.2.4 Option 13

Option 13 is also similar to Option 11, except that no clearcuts are scheduled, just thinnings at the parcel scale. This option uses Monte Carlo simulation to randomly schedule thinning activities, as described in Option 11.

Note: In lieu of using Option 13 on lands that are to be modeled using the federal scheduling criteria, users can select Option 11 and then specify the thinnings allowed within each land allocation.

4.2.5 Option 22

Option 22 emulates the behavior of forest industry landowners. It uses binary search (a simulation process) to schedule forest management activities at the parcel scale, with the total amount of timber harvest volume generated as the objective variable. We chose binary search as the scheduling technique because aggregated harvest levels from industry land in western Oregon indicate that achieving an even flow of timber harvest volume over time is a good measure of landowners' behavior. Binary search is well suited to assist in developing forest plans where even flow is an objective.

The search process within Option 22 can take one of four forms:

- maximize even flow of timber harvest volume
- attempt to achieve user-defined harvest level targets

  If the scheduling model fails to generate the target volume (in any time period) specified by the user, it simply reports the levels that it could achieve and the resulting solution is feasible.

- simulate the pattern of user-defined harvest targets

  If the scheduling model fails to generate the user's target levels, it adjusts downward all targets until harvest levels can be obtained in each time period.

- achieve user-defined targets when possible, and set new targets for time periods where targets are not achieved

  If the scheduling model fails to generate the user's target levels, it adjusts downward only those targets it failed to achieve until harvest levels can be obtained in each time period.

A more detailed discussion of these objectives can be found in Chapter 8. Constraints on Option 22 include fitting the clearcut size distribution to a distribution set by the user, and a number of others specified for each land allocation. These are described in Chapters 5 and 8.

Note: Selecting Option 22 requires users to specify certain harvest scheduling variables. See Section 4.4 for further information.

4.2.6 Option 31

Option 31 uses a Monte Carlo simulation technique to schedule clearcuts and thinnings on nonindustrial private land. Monte Carlo simulation was chosen for two reasons: (1) there are many private landowners in western Oregon, with their own individual management objectives, and (2) harvest levels tend to fluctuate with the associated market demand for wood products, which is not predicted within LAMPS.

The objective function within Option 31 takes one of four forms:

- achieve the highest volume possible in each time period
- attempt to achieve some user-defined harvest level targets

  If the scheduling model fails to generate the target volume (in any time period) specified by the user, it simply reports the levels that it could achieve and the resulting solution is feasible.

- simulate the pattern of user-defined harvest targets

  If the scheduling model fails to generate the user's target levels, it adjusts all targets downward until harvest levels can be obtained in each time period.

- Achieve user-defined targets when possible, and set new targets for time periods where targets are not achieved.

  If the scheduling model fails to generate the user's target levels, it adjusts downward only those targets it failed to achieve until harvest levels can be obtained in each time period.

In each case, probabilities of harvest, derived from the work of Lettman and Campbell (1997) for western Oregon, are used to determine whether a parcel can be clearcut or thinned.

All activities are scheduled at the parcel scale. The scheduling process works in the following way:

(1) Each time period is examined in sequence and, with the harvest volume target for each time period in mind, a parcel is randomly selected to clearcut or thin.

(2) If other constraints associated with the land allocation in which the parcel resides do not prohibit the scheduling of an activity, then the age of the parcel is determined.

(3) The probabilities of harvest are a function of stand age; thus, the probability associated with the selected parcel's age is assessed.

(4) A random number is drawn. If the random number is less than the probability of harvest associated with the parcel's age, the parcel is harvested. The process repeats itself each time period until the user-defined target volumes are achieved or there are no more parcels to examine.

Constraints on Option 31 include fitting the clearcut size distribution to a distribution set by the user, and a number of others specified for each land allocation. These are described in Chapters 5 and 8.

4.2.7 Option 33

Option 33 is similar to Option 31, except the activities are scheduled at the BSU scale, not the parcel scale.

4.2.8 Option 41

Option 41 emulates the management behavior of state-managed land. It uses binary search (a simulation process) to schedule forest management activities with the greatest possible even flow of timber volume as the objective variable measure. State managers suggested even flow of timber harvest volume as an appropriate objective, and binary search is well suited to assist in developing forest plans where even flow is an objective. The objective variable within Option 41 can take the same forms as those described for Option 22 (Section 4.2.5).

All management activities are scheduled at the parcel scale. Constraints on Option 41 that are not common to land allocations in other options include the development of interior habitat areas (patches of older forest), given a desired distribution and an attempt to maintain each state forest district in a distribution of structural sizes. See Chapters 5 and 8 for further information on these constraints.

Note: Selecting Option 22 requires users to specify certain harvest scheduling variables. See Section 4.4 for further information.

4.3 Owl Strategies

Two strategies are available for modeling the behavior of landowners around spotted owl nest locations:

- conservation of a 70-ac core area around each nest site

  This strategy emulates the State of Oregon requirements on private land. The 70-ac core includes the parcel in which the owl nest is located and other contiguous areas within the same ownership group. Parcels that contribute to the owl conservation areas are selected based on stand age (oldest first).

- conservation of a 70-ac core area around each nest site, 500 ac of suitable habitat within 0.7 mi of the site, and 1810 ac of suitable habitat within 1.5 mi of the site

  This strategy emulates the interim guidelines developed by the US Fish and Wildlife Service. The 70-ac core includes the parcel in which the owl nest is located and other contiguous areas within the same ownership group. Areas outside of the owl parcel's ownership group may contribute to the 500-ac and 1810-ac requirements; these areas do not have to be contiguous to the 70-ac core. Parcels that contribute to the owl conservation areas are selected based on stand age (oldest first). Suitable habitat in the 0.7 mi and 1.5 mi buffers is delineated by ranking all parcels in these buffers by age and selecting the oldest first for inclusion in the suitable habitat.

To view a description of the owl strategies,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Information about Landowners from the drop-down menu and then Management Options (Figure 4.1).

(3) Select Help in the upper left hand corner of the Management Options window, then Description of Owl Strategies. The Owl Strategies help window appears (Figure 4.4).

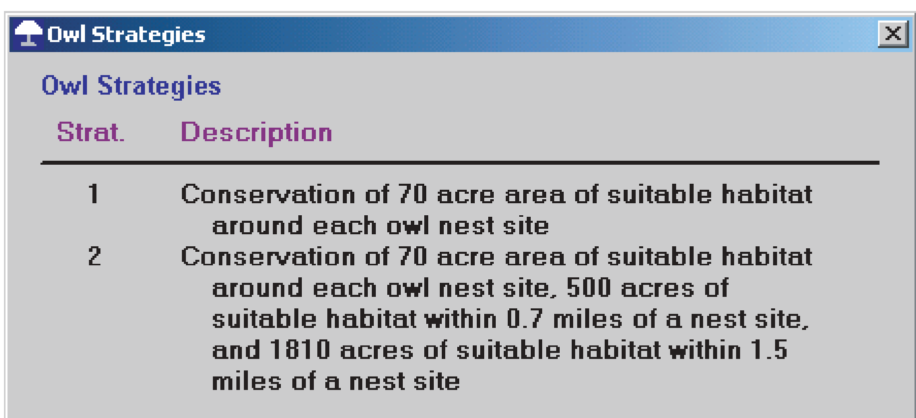


Figure 4.4. Owl Strategies help window.

4.4 Binary Search Criteria

If a scheduling option that uses a binary search harvest scheduling technique is selected, the user must specify certain harvest scheduling variables for each landowner group. The two scheduling options that use a binary search to schedule harvests are Option 22 (forest industry landowners) and Option 41 (state landowners).

To specify harvest scheduling variables,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Information about Landowners from the drop-down menu and then Management Options (Figure 4.1). The Management Options window appears (Figure 4.2).

(3) Select a forest industry or state landowner listed in the Landowner column. Its information will appear in the text boxes in the lower right-hand corner of the window.

(4) Enter values for BS Start Volume and BS Start Increment (binary search start volume and increment) in thousand board feet (MBF) harvested per 5-yr time period in a megashed. For example, enter 800,000 to indicate 800,000 MBF or 800,000,000 bd ft per 5-yr time period (160 million bd ft/yr).

(5) Click Add. The Start Volume and Start Increment columns are updated. BS Start Volume and BS Start Increment only apply to forest industry and state landowners. Any non-zero values entered into these fields for federal or nonindustrial landowners are automatically changed to zero when the Add button is clicked.

Note: Users should take care to consider the appropriate values for the binary search. For example, if a value of "0" is entered for the Start Volume*, a start volume of "0" is used and is incremented by the* Start Increment *after all 20 time periods of the binary search iteration are considered. If the true even-flow volume for a megashed was, say, 1,500,000 MBF per 5-yr time period, it may take quite a while for the scheduling model to arrive at the final solution, given that it needs to start at a volume of 0, and increment upward using volume levels specified by the start increment. An increment of 0 would, in fact, prevent achievement of maximum even flow and only report the start volume achieved, since the binary search process would not increase the volume levels above the start volume.*

5. Information about Land Allocations

In Chapter 4, users learned how to specify the scheduling process applied to each landowner group as a whole. This chapter explains how to specify land management behavior within certain geographic areas of a landowner group.

A landowner group (federal, state, nonindustrial private, industry) can

- be subdivided into numerous geographic areas (land allocations)
- have up to 100 non-overlapping land allocations

Each acre of land must be assigned a land allocation within a landowner group. Each land allocation is then assigned a land management regime. A management regime is defined by green-up periods, minimum harvest ages, riparian management strategies, regeneration intensity, and leave tree requirements (whether to leave scattered, individual trees in a clearcut or to leave clumps of trees).

To access the management regime variables, select one of the following options from the Information about Land Allocations (Figure 5.1) drop-down menu: Description, Activities Allowed, Green-Up Periods, Minimum Harvest Ages, or Regeneration Parameters. These options are described in Sections 5.1–5.5.

5.1 Description

The spatial representation of a landowner group on a landscape is divided into, among other things, land allocations.

To view the land allocations,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Information about Land Allocations from the drop-down menu (Figure 5.1) and then Description. The Land Allocation Descriptions window (Figure 5.2) appears.

Note: All land allocations must be numbered between 1 and 99, but need not be numbered consecutively.

To edit an existing land allocation entry,

(1) In the Land Allocation Descriptions window, highlight the entry by clicking on any cell in the row of interest.

(2) Click Edit at the bottom of the window.

(3) Change the necessary information that appears in the text boxes located at the bottom right-hand corner of the window.

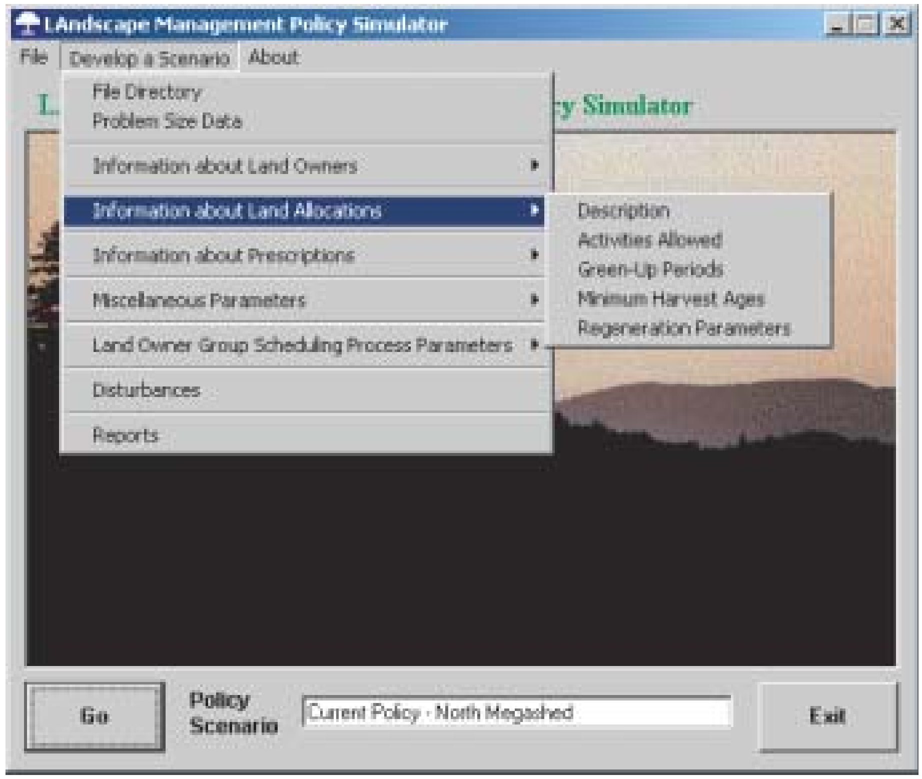


Figure 5.1. Main Menu window, Information about Land Allocations selected.

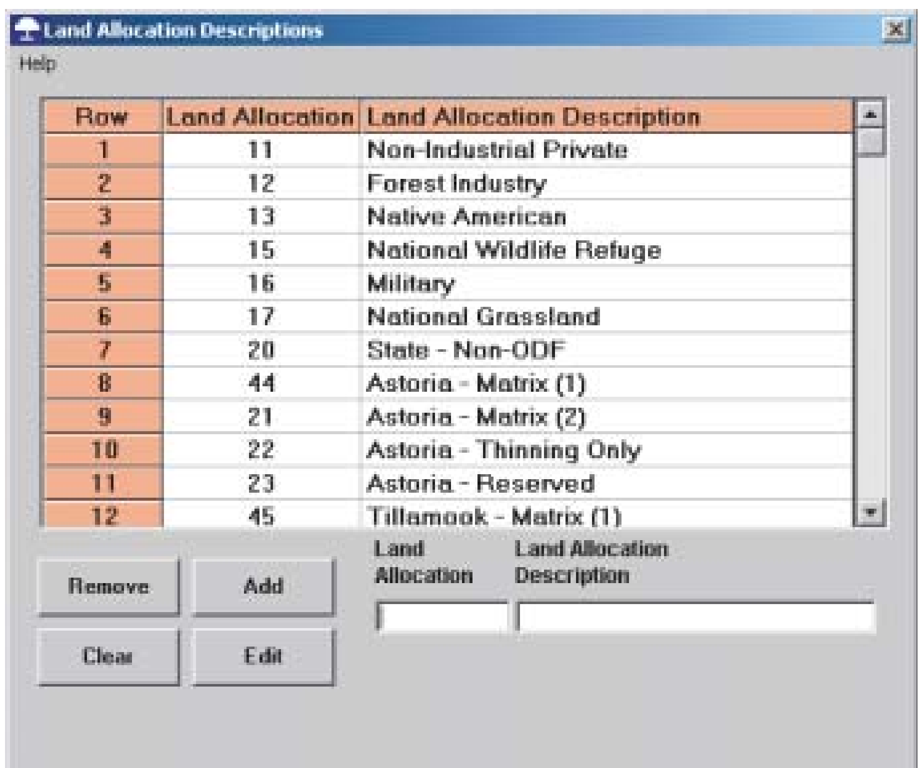


Figure 5.2. Land Allocation Descriptions window.

(4) When editing is complete, click the Okay button that appeared after the Edit button was pressed. This action saves the changes, which can be verified by examining the appropriate row within the Land Allocations Descriptions window.

To add a new row of information about a land allocation,

(1) In the Land Allocation Descriptions window (Figure 5.2), enter the new information in the text boxes in the lower right-hand corner of the window.

(2) Click Add. The additional information is added to a new row and the additions are automatically saved.

Important: (1) New land allocations added in the Land Allocation Descriptions window (Figure 5.2), although saved, are not automatically added to the Activities Allowed in Land Allocations window (Figure 5.3). Therefore, users must enter any new land allocation in both locations. (2) If a land allocation number is used more than once, the LAMPS simulation model does not give a warning; instead, it uses whichever duplicated allocation is listed last.

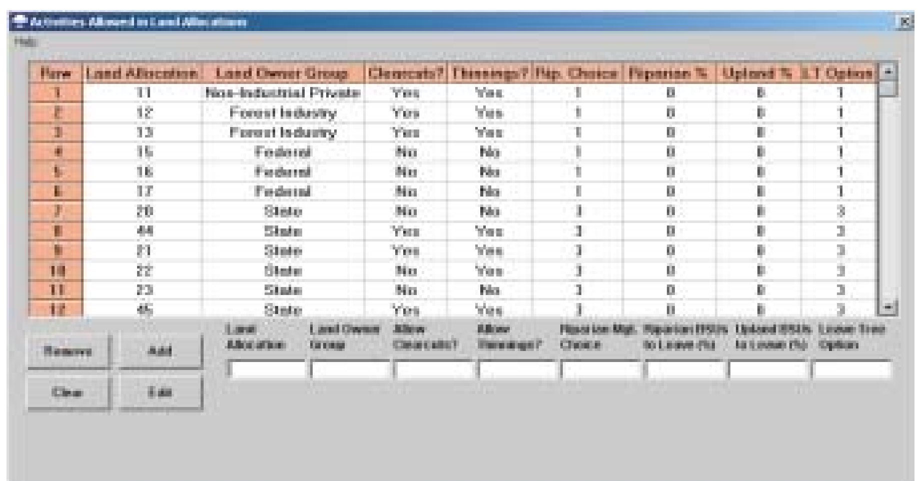


Figure 5.3. Activities Allowed in Land Allocations window.

To remove a *single row* of information from the Land Allocation Descriptions window, click on any cell in that row and click Remove.

To remove the *entire set* of information within the Land Allocation Descriptions window, click Clear.

Note: Exercise caution when using the Clear button—all information is deleted. If only one land allocation is to be removed, select the row containing that land allocation and press Remove.

5.2 Activities Allowed

To choose which activities occur in each land allocation,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Information about Land Allocations from the drop-down menu (Figure 5.1) and then Activities Allowed. The Activities Allowed in Land Allocations window (Figure 5.3) appears.

Each column in the Activities Allowed in Land Allocations window is described below:

- Land Allocation—See Section 5.1 for directions on how to obtain a description of each land allocation.
- Landowner Group—Each land allocation must be assigned a landowner group.

  Important: (1) New land allocations added in the Land Allocation Descriptions window (Figure 5.2), although saved, are not automatically added to the Activities Allowed in Land Allocations window. Therefore, users must enter any new land allocation in both locations. (2) If a land allocation number is used more than once, the LAMPS simulation model does not give a warning; instead, it uses whichever duplicated allocation is listed last.

- Clearcuts?, Thinnings?—Enter "yes" or "no" in each column to indicate whether clearcuts or thinnings are allowed in a land allocation.

  If thinnings or clearcuts are scheduled on a land allocation, a management option that allows those actions must first be chosen for that entire landowner group in the Management Options window (Figure 4.2, Chapter 4). For example, if at least one land allocation in the federal group of land allocations is to allow clearcuts, then the entire federal landowner group must be assigned either Management Option 11 or 12. (These are the federal scheduling rules, either clearcutting with thinning or clearcutting with no thinning.) Then, for any federal land allocation that does not allow clearcutting, enter "No" in the Clearcuts? column.

- Rip. Choice—Select from four riparian management strategies allowed when clearcutting near a stream system.

  To view a description of these four choices,

  Select Help in the upper left hand corner of the Activities Allowed in Land Allocations window (Figure 5.3), then Description of Riparian Management Choices. The Riparian Management Choice Descriptions help window appears (Figure 5.4).

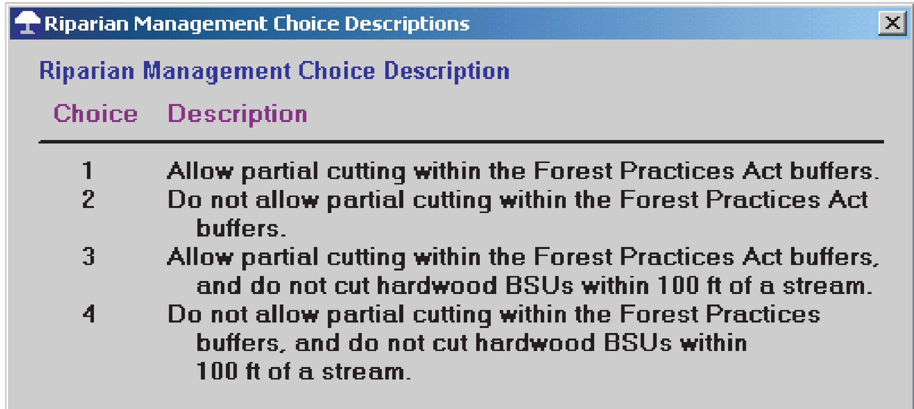


Figure 5.4. Riparian Management Choice Descriptions help window.

- Riparian %, Upland %—Specify a percentage of BSUs in a parcel to remain uncut when a clearcut is scheduled. Allows users to model the retention of clumps of trees within clearcuts.

  If a parcel is chosen to be clearcut, each BSU is examined, and a random number between 0 and 1 is drawn. If the random number is less than the percentage (on a 0 to 1 scale) specified by the user, then the BSU is left uncut as a clump of trees within the clearcut. If the random number is greater than or equal to the percentage, then the BSU is clearcut. Several caveats apply here:

  - If users indicate no clearcutting is allowed in a land allocation, then the Riparian % and Upland % values are set to 100 (indicating all BSUs will be left uncut).
  - If users indicate clearcuts are possible within a land allocation and the Riparian % and Upland % values are less than zero, then the value entered will be treated as if it were zero (no BSUs will be left uncut).
  - If users indicate clearcuts are possible within a land allocation and the Riparian % and Upland % values are greater than 100, then the value entered will be treated as if it were 100 (all BSUs will be left uncut). For example, if "–2" is entered into the Riparian % column and "150" is entered into the Upland column (assuming the Clearcuts? value is "Yes"), then riparian BSUs will be available for clearcutting, but the upland BSUs will be left uncut.

- LT Option—Select from four leave-tree strategies to clearcut parcels:

  Strategy 1: Meets the basic FPA standard of two 11-in. dbh conifer trees. It is the least restrictive and emulates the FPA minimum leave tree requirements.

Strategy 2: Leaves 2 larger trees per acre (TPA). Allows users the ability to model voluntary conservation efforts on the behalf of landowners.

Strategy 3: Leaves 5 TPA. Emulates the Oregon Department of Forestry guidelines for leave trees on state-managed lands.

Strategy 4: Leaves 14 TPA. Like Strategy 3, this strategy emulates the Oregon Department of Forestry guidelines for leave trees on state-managed lands.

Note: Modeling the effects of higher retention levels (or leaving different-sized trees or different tree species) is only possible if the databases that represent regeneration stands have been modified to include those kinds of trees.

The leave trees themselves are present in the tree lists of regenerated stands; thus, stand summaries of regenerated stands include the influence of the leave trees.

To view summaries of the leave-tree strategies,

- Select Help in the upper left hand corner of the Activities Allowed in Land Allocations window (Figure 5.3), then Description of Leave Tree Options. The Leave Tree Strategies help window appears (Figure 5.5).

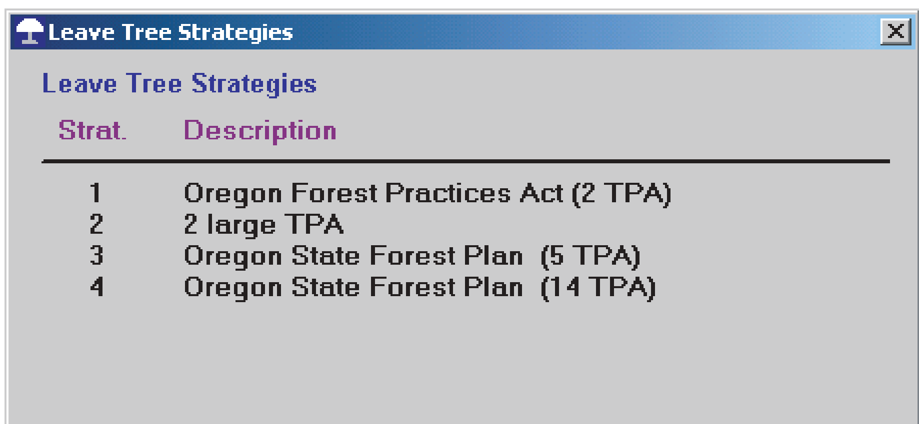


Figure 5.5. Leave Tree Strategies help window.

5.3 Green-Up Periods

The Forest Practices Act (FPA) requires a minimum green-up (adjacency) period of 5 yr between clearcuts. Similar guidance is noted in federal regulations (US Congress 1976).

Green-up periods are assigned by land allocation. The default green-up period is 5 yr but may be adjusted in 5-yr increments.

Note: LAMPS allows adjacent parcels to be clearcut within the 5-yr exclusion period if their combined acreage is less than the maximum clearcut size specified for that landowner in the

Clearcut and Thinning Parameters windows (Figure 7.2, first textbox; p. 55), with some exceptions—notably the clearcut size distributions for forest industry and nonindustrial private landowners (Chapter 8).

To view the green-up period assigned to each land allocation,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Green-Up Periods from the drop-down menu (Figure 5.1). The Green-Up Time Periods window (Figure 5.6) appears.

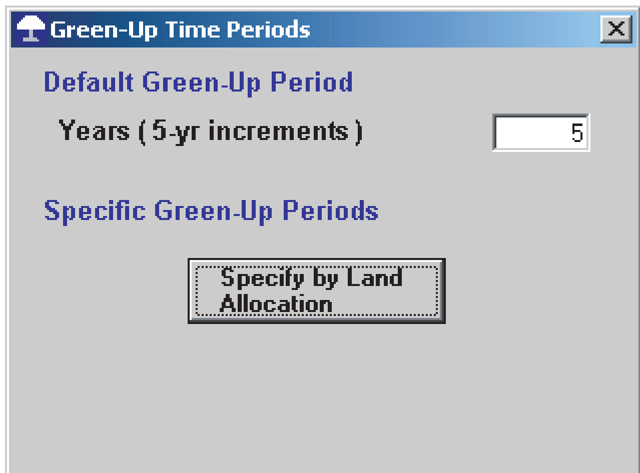
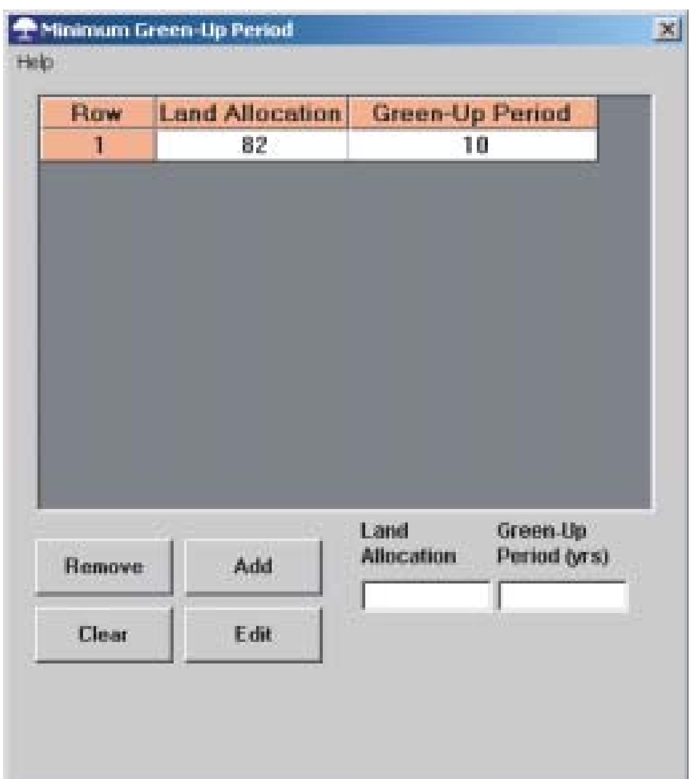


Figure 5.6. Green-Up Time Periods window.



To change the green-up period assigned to *one land allocation at a time*,

(1) From the Green-Up Time Periods window, click the Specify by Land Allocation button. The Minimum Green-Up Period window appears (Figure 5.7).

(2) In the Minimum Green-Up Period window (Figure 5.7), highlight an entry by clicking on any cell in the row of interest.

(3) Click the Edit button at the bottom of the window.

(4) Enter the green-up period information in the text boxes located at the bottom right-hand corner of the window.

Note: If "0" is entered as the minimum green-up period,

Figure 5.7. Minimum Green-Up Period window.

LAMPS still uses 5 yr as the default.

(5) When editing is complete, click the Okay button that appeared after the Edit button was pressed. This action saves the changes, which can be verified by examining the appropriate row within the Minimum Green-Up Period window.

To set the green-up value *for all landowners at once*,

In the Green-Up Time Periods window (Figure 5.6) enter a value in the Default Green-up Period textbox.

5.4 Minimum Harvest Ages

Minimum harvest ages for conifer and hardwood/mixed forest types can be assigned to each land allocation.

To view the minimum harvest ages assigned to each land allocation,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Minimum Harvest Ages from the drop-down menu (Figure 5.1). The Minimum Harvest Ages window (Figure 5.8) appears.

To specify minimum harvest ages for *one land allocation* at a time,

(1) Click Specify by Land Allocation at the bottom of the Minimum Harvest Ages window (Figure 5.8). The Designate Minimum Harvest Ages by Land Allocation window (Figure 5.9) appears.

(2) Enter values, by individual Land Allocation, for Conifer and Hardwood forest types.

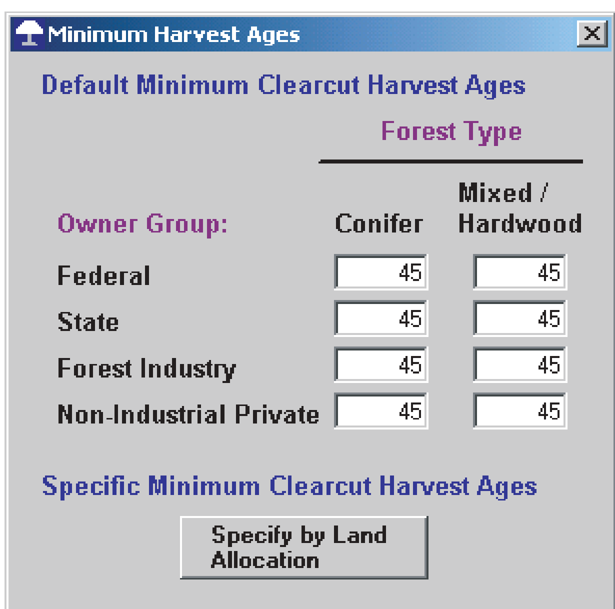


Figure 5.8. Minimum Harvest Ages window.

To specify minimum harvest ages *for an entire landowner group at once*,

Enter values, by Owner Group, for Conifer and Mixed/Hardwood forest types in the Minimum Harvest Ages window.

Note: Ages need not be specified in 5-yr increments. The default minimum harvest age for all landowners is 45 yr.

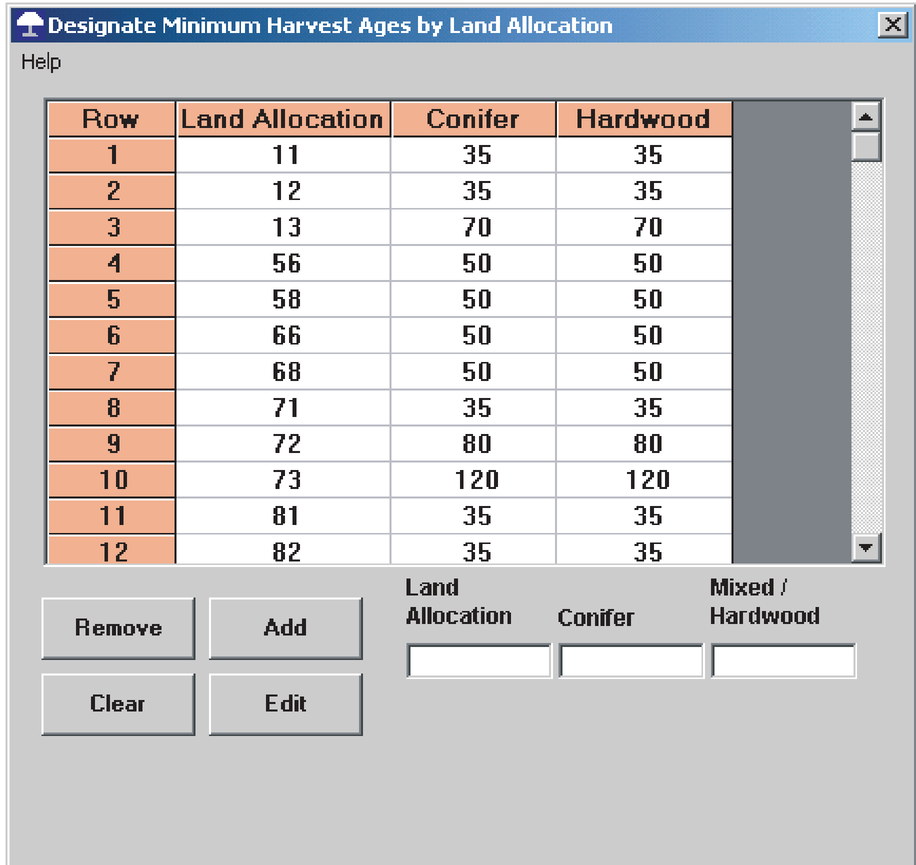


Figure 5.9. Designate Minimum Harvest Ages by Land Allocation window.

5.5 Regeneration Parameters

Users can determine, for each land allocation, which of the following types of regenerated stands appear in clearcut areas:

- Industrial—a typical regenerated stand, fully stocked with Douglas-fir (*Pseudotsuga menziesii*) seedlings
- Special—a stand that includes a mixture of conifer species in addition to Douglas-fir
- Other—a stand designed to emulate the species mix typically found within state, federal, and nonindustrial private clearcuts

The species mix of each regenerated stand is described in Table 5.1.

Users can also select from the following management intensities for regenerated stands:

- "Medium" management intensity—Plant only, perhaps thin. This is the default management intensity.
- Forest industry management intensities—These allow a higher management intensity. See Chapter 8 for a more detailed description of management intensities.

Table 5.1. Species mix of 15-yr old planted stands, on medium sites, using medium management intensities.

Stand type	Hardwood[a]	Douglas-fir[b]	Western hemlock[c]
	– – – – – – trees per acre – – – – – –		
Industry			
Hardwood stands	197	32	13
Mixed stands	222	259	10
Conifer stands	18	347	48
Special			
Hardwood stands	197	32	13
Mixed stands	222	259	10
Conifer stands	18	303	180
Other			
Hardwood stands	197	32	13
Mixed stands	105	161	27
Conifer stands	40	278	35

[a]Includes red alder (*Alnus rubra* Bong.), bigleaf maple, and other hardwood species.

[b]Includes western red cedar (*Thuja plicata* Donn) and sitka spruce [*Picea sitchensis* (Bong. Carr.)].

[c]Includes grand fir (*Abies grandis* Dougl.), ponderosa pine (*Pinus ponderosa* Laws.), lodgepole pine (*Pinus contorta* Grev.), and other conifers.

To assign regeneration groups and industrial management intensities in the regenerated stands,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Information about Land Allocations and then Regeneration Parameters from the drop-down menu (Figure 5.1). The Designate Regeneration Parameters window (Figure 5.10) appears.

(3) Enter a Regen. Group (Special, Industrial, or Other).

(4) Enter “Yes” or “No” in the Industrial MIs? column. “Yes” indicates that the management intensity of regenerated stands comes from the Forest Industry Scheduling Process Parameters window (Figure 8.11, p. 66). “No” instructs LAMPS to use the default medium management intensity.

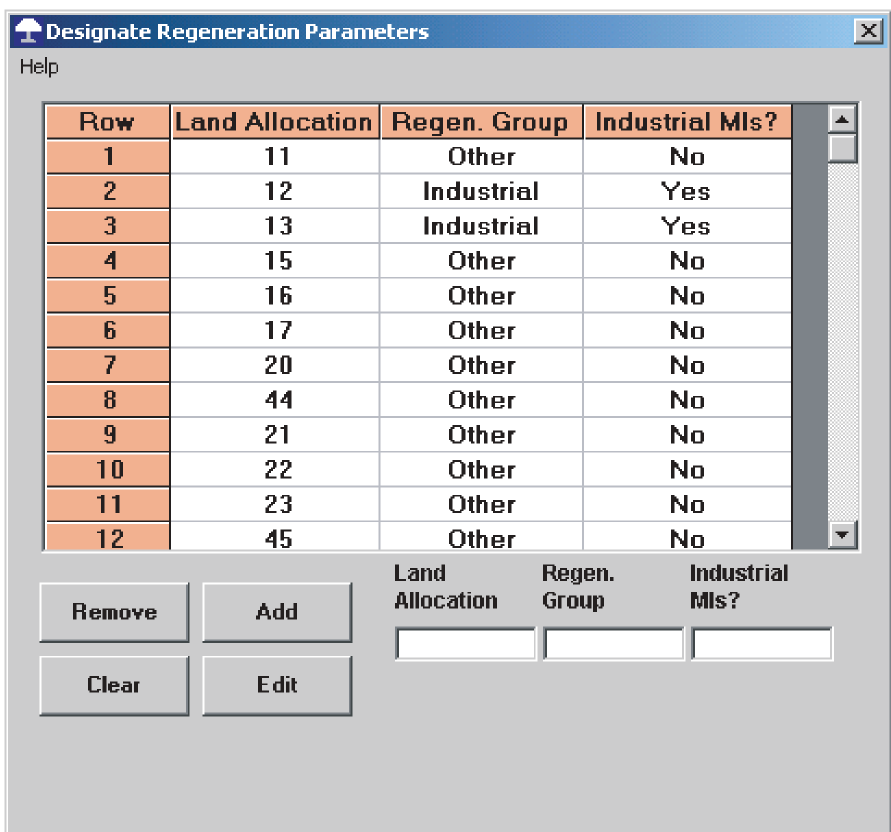


Figure 5.10. Designate Regeneration Parameters window.

6. Information about Management Prescriptions

A number of management prescriptions developed for LAMPS use either ORGANON (Hann et al. 1997) or Zelig (Urban and Shugart 1992; Urban et al. 1999) growth-and-yield modeling systems. Growth-and-yield systems are individual tree models that project the development of forests based on a sequence of management decisions (thinnings, fertilization, etc.) through time.

At this time, LAMPS users cannot directly modify the management prescriptions, as LAMPS does not recognize or utilize alternative prescriptions. Users can, however,

- view the types of prescriptions being used
- specify the type of regenerated stand that represents clearcuts

This chapter is perhaps the most complex to understand and provides users with the least amount of flexibility for modifying LAMPS policy scenarios. We acknowledge the lack of flexibility as an area for improvement and suggest that users gain a significant familiarity with the LAMPS input databases and simulation modeling system before modifying data related to this chapter.

6.1 Description

To view descriptions of the management prescriptions,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Information About Prescriptions from the drop-down menu and then Description (Figure 6.1). The Identifying the Prescriptions (Rx) window appears (Figure 6.2).

Each column in the Identifying the Prescriptions (Rx) window is described below:

- Old Rx Number—A code used in the CLAMS project to describe each prescription.
- Group—Each prescription is assigned to a group based on the type of activities allowed. There are 41 groups. Groups 1–14 are prescriptions for "current" forest stands. Groups 15-41 are prescriptions for regenerated stands.

  To view descriptions of the groups,

  (1) Click Help in the top left-hand corner of the Identifying the Prescriptions (Rx) window (Figure 6.2).

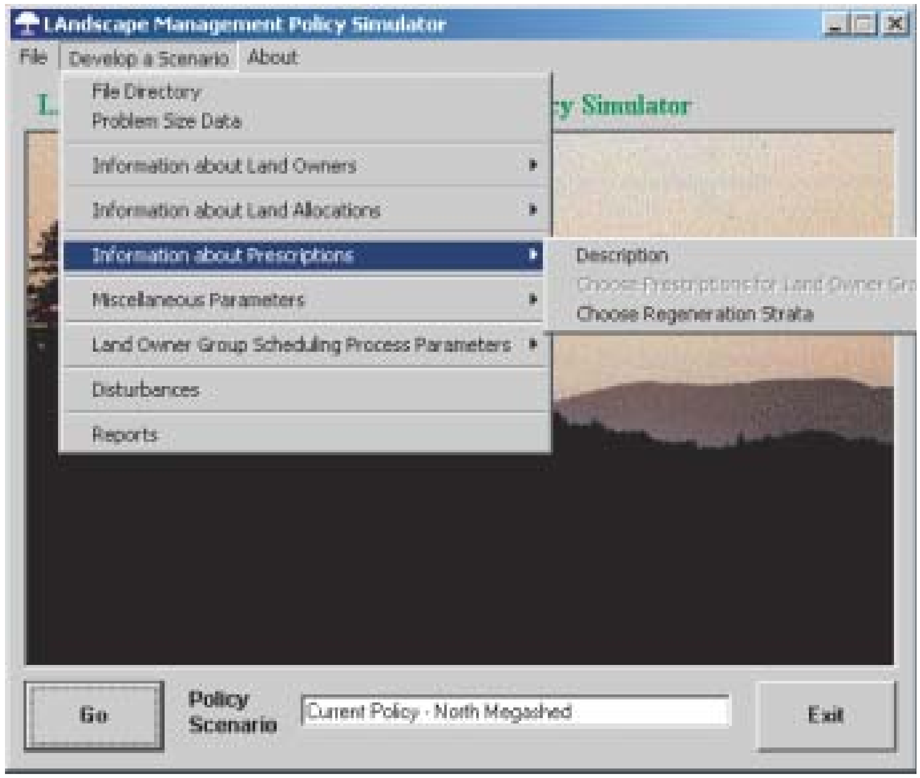


Figure 6.1. Main Menu window, Information about Prescriptions selected.

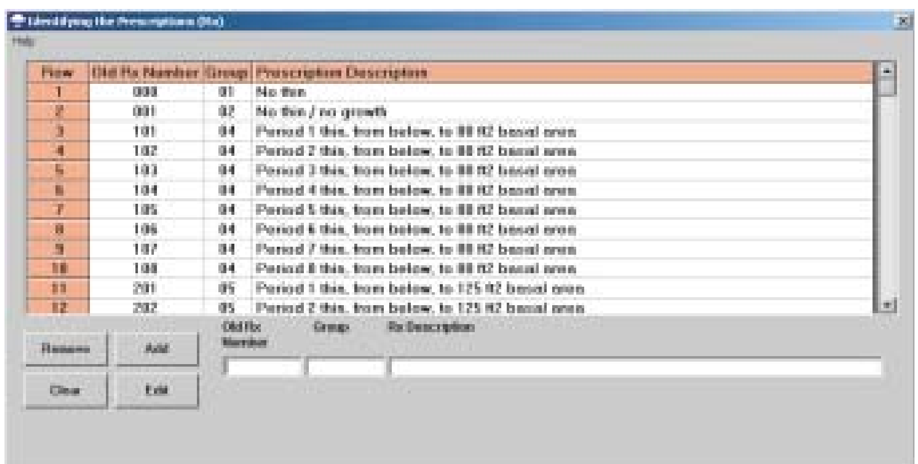
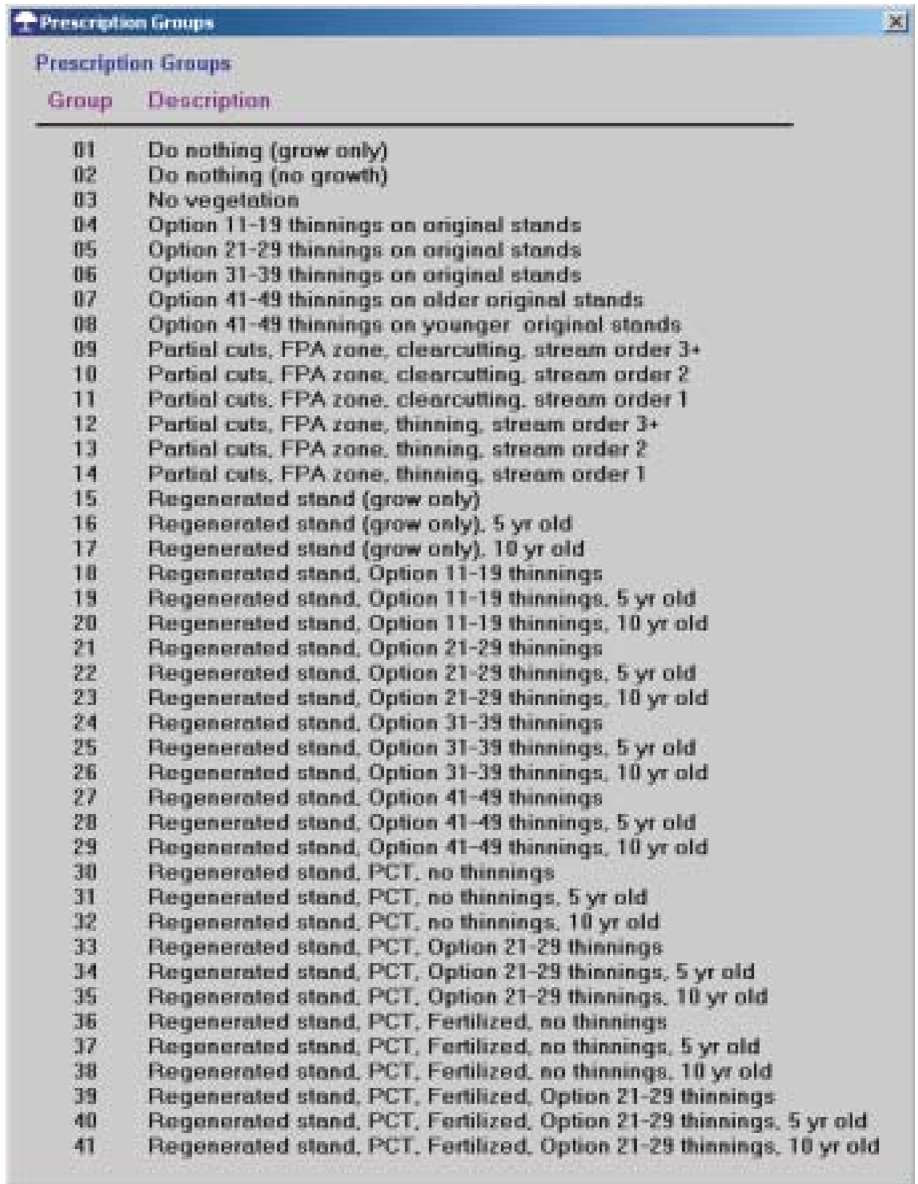


Figure 6.2. Identifying the Prescriptions (Rx) window.

(2) Select Description of Prescription Groups. The Prescription Groups help window appears (Figure 6.3). Prescriptions that are described as relating to an Option are only available to the scheduling processes related to those specific Management Options (see Chapter 4).

The Prescription Description gives a brief description of each prescription, indicating generally when thinnings occur (certain time periods), the method of thinning (select tree from above, from below, or proportional



Prescription Groups

Prescription Groups

Group	Description
01	Do nothing (grow only)
02	Do nothing (no growth)
03	No vegetation
04	Option 11-19 thinnings on original stands
05	Option 21-29 thinnings on original stands
06	Option 31-39 thinnings on original stands
07	Option 41-49 thinnings on older original stands
08	Option 41-49 thinnings on younger original stands
09	Partial cuts, FPA zone, clearcutting, stream order 3+
10	Partial cuts, FPA zone, clearcutting, stream order 2
11	Partial cuts, FPA zone, clearcutting, stream order 1
12	Partial cuts, FPA zone, thinning, stream order 3+
13	Partial cuts, FPA zone, thinning, stream order 2
14	Partial cuts, FPA zone, thinning, stream order 1
15	Regenerated stand (grow only)
16	Regenerated stand (grow only), 5 yr old
17	Regenerated stand (grow only), 10 yr old
18	Regenerated stand, Option 11-19 thinnings
19	Regenerated stand, Option 11-19 thinnings, 5 yr old
20	Regenerated stand, Option 11-19 thinnings, 10 yr old
21	Regenerated stand, Option 21-29 thinnings
22	Regenerated stand, Option 21-29 thinnings, 5 yr old
23	Regenerated stand, Option 21-29 thinnings, 10 yr old
24	Regenerated stand, Option 31-39 thinnings
25	Regenerated stand, Option 31-39 thinnings, 5 yr old
26	Regenerated stand, Option 31-39 thinnings, 10 yr old
27	Regenerated stand, Option 41-49 thinnings
28	Regenerated stand, Option 41-49 thinnings, 5 yr old
29	Regenerated stand, Option 41-49 thinnings, 10 yr old
30	Regenerated stand, PCT, no thinnings
31	Regenerated stand, PCT, no thinnings, 5 yr old
32	Regenerated stand, PCT, no thinnings, 10 yr old
33	Regenerated stand, PCT, Option 21-29 thinnings
34	Regenerated stand, PCT, Option 21-29 thinnings, 5 yr old
35	Regenerated stand, PCT, Option 21-29 thinnings, 10 yr old
36	Regenerated stand, PCT, Fertilized, no thinnings
37	Regenerated stand, PCT, Fertilized, no thinnings, 5 yr old
38	Regenerated stand, PCT, Fertilized, no thinnings, 10 yr old
39	Regenerated stand, PCT, Fertilized, Option 21-29 thinnings
40	Regenerated stand, PCT, Fertilized, Option 21-29 thinnings, 5 yr old
41	Regenerated stand, PCT, Fertilized, Option 21-29 thinnings, 10 yr old

Figure 6.3. Prescription Groups help window.

to the diameter distribution of a stand), and the intensity of a thinning (thin until X square feet of basal area remain).

At this time, we recommend that users not add, remove, modify, or clear the prescription description information. For example, the Old Rx Number and Group Number must remain as noted. This lack of flexibility has been noted by the CLAMS project as an area of concern and an area within which future developmental efforts might be centered.

So what can users control? If users are able to generate a new prescription that is similar to one listed in the Identifying the Prescriptions (Rx) window, and are also able to insert the growth-and-yield information related to the new prescription into the appropriate places in the yield tables (described in Chapter 2), the new prescription will be used by LAMPS. Users can also change the description of the prescription here. Several caveats apply, however:

- The group number must remain the same.
- The total number of rows (243) must not change.
- The timing of treatments in a new prescription must not change.

  For example, in row 3 of the yield tables in the Identifying the Prescriptions (Rx) window, if the prescription is changed, the new prescription must include a thinning in time period 1, and no other thinnings. The user can only control the intensity of thinning and the type of thinning (from below, from above, proportional to the diameter distribution, etc.).
- The type of prescription represented in each group must remain the same. That is, users should not replace "current forest" prescriptions (groups 1-14) with regenerated stand prescriptions (groups 15-41).

6.2 Choose Prescriptions for Landowner Groups

LAMPS does not allow users the flexibility to choose the set of prescriptions available to each landowner group. This lack of flexibility has been noted by the CLAMS project as an area of concern and an area within which future developmental efforts might be centered.

6.3 Choose Regeneration Strata

After a parcel is clearcut, it is assigned a new prescription, called a regeneration stratum. Regeneration strata, numbered from 3200 to 3527, identify the regeneration management intensity of a new stand depending on the following parameters:

- site class
- vegetation type (hardwood, mixed, or conifer)
- leave-tree strategy
- ecoregion (coastal or interior)

After clearcutting, a new stand grows according to these parameters. The regeneration strata management prescriptions are groups 15-41, which are described in the Prescription Groups help window (Figure 6.3). Growth-and-yield information related to these prescriptions is in the LAMPS input yield tables (described in Chapter 2).

To assign a parcel a regeneration stratum, a regeneration group (Industrial, Special, or Other) and ecoregion (Coastal or Interior) must be selected:

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Information About Prescriptions from the drop-down menu and then Choose Regeneration Strata. The Regeneration Strata window appears (Figure 6.4).

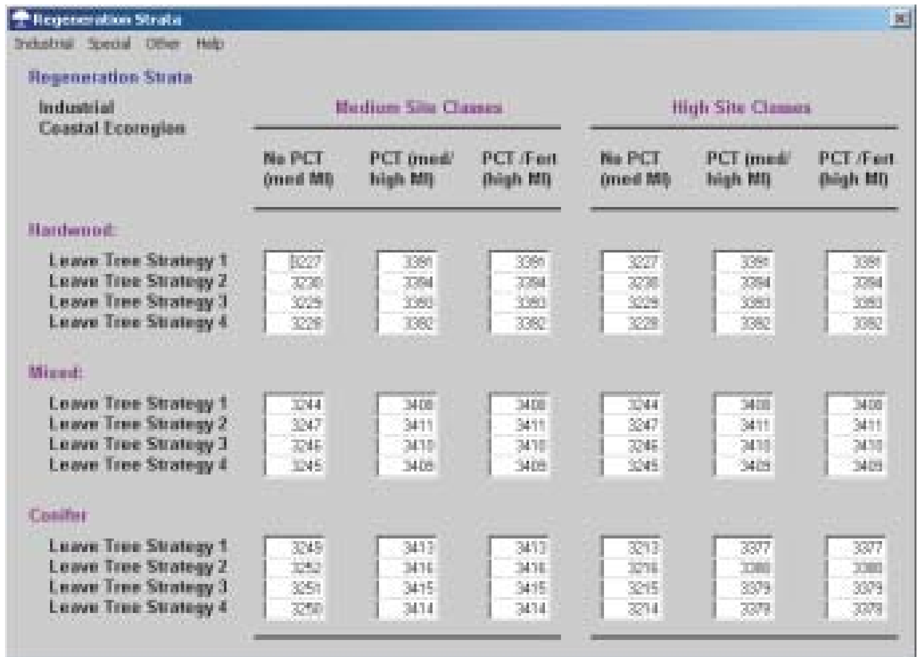


Figure 6.4. Regeneration Strata window.

(3) Select a regeneration group by clicking Industrial, Special, or Other on the menu at the top of the window. A drop-down menu appears.

(4) Select either Coastal Ecoregion or Interior Ecoregion. The regeneration strata (both group and ecoregion) are displayed in the upper left-hand corner under the words in blue text Regeneration Strata.

Default values are provided for each regeneration group and ecoregion. However, users may enter their own strata designations by clicking in a cell, deleting the default value, and entering a new one. Changes are automatically saved.

Note: We recommend that users do not change the regeneration strata. Users need advanced knowledge of each stratum to appropriately change parameters. For example, users need to know the type of prescription used on stratum 3201 before assigning it to one of the categories because it may not have the appropriate site class, treatments, or number of leave trees for the intended category. This lack of flexibility has been noted by the CLAMS project as an area of concern and an area within which future developmental efforts might be centered.

So what can users control? If users are able to generate a new prescription that is similar to one listed in the Identifying the Prescriptions (Rx) window, and are also able to insert the growth-and-yield information related to the new prescription into the appropriate places in the yield tables (described in Chapter 2), the new prescription will be used by LAMPS. Users can also change the description of the prescription here. Several caveats apply, however.

- The group number must remain the same.
- The total number of rows (243) must not change.
- The timing of treatments in a new prescription must not change.
- The type of prescription represented in each group must remain the same.

Further, users must be able to apply a stratum number between 3201 and 3527 to the data generated for the new regeneration prescription and insert the strata number into the appropriate places in the Regeneration Strata window.

7. Miscellaneous Parameters

In the process of developing a LAMPS policy scenario, users need to specify a variety of miscellaneous parameters, including

- clearcut and thinning parameters—when and how to clearcut and thin a parcel
- clearcut transition probabilities—what type of forest BSUs to transition to after clearcutting
- economic analysis parameters—economic data needed to value management activities

7.1 Clearcut and Thinning Parameters

To access the clearcut and thinning parameters,

(1) From the **Main Menu** window, select **Develop a Scenario**.

(2) Select **Miscellaneous Parameters** from the drop-down menu and then make your selection (Figure 7.1).

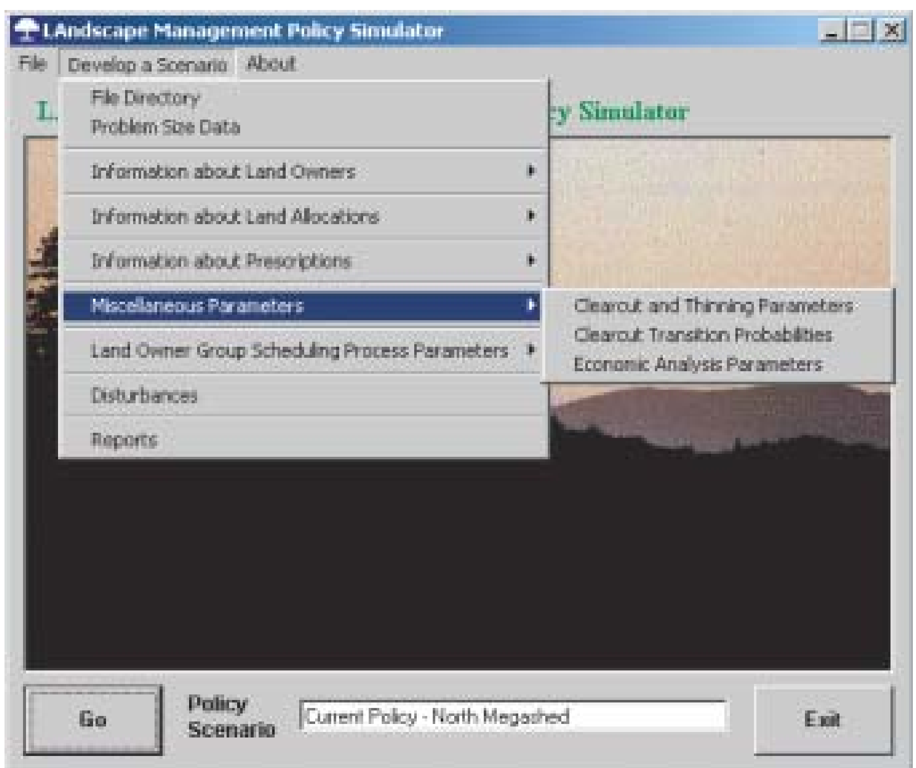


Figure 7.1. Main Menu window, Miscellaneous Parameters selected.

(3) Select Clearcut and Thinning Parameters. The Clearcut and Thinning Parameters window (Figure 7.2) appears.

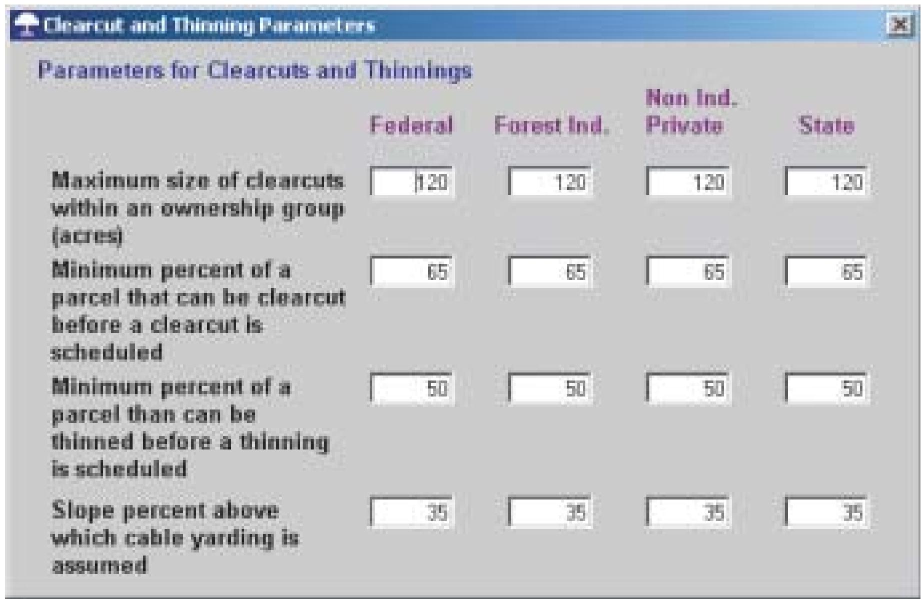


Figure 7.2. Clearcut and Thinning Parameters window.

The following parameters can be set:

- Maximum size of clearcuts within an ownership group—This is the adjacency size restriction that prevents the clearcutting of a parcel within the set time span of green-up limitations if the total acreage of adjacent clearcut parcels is greater than the maximum clearcut size allowed. (See Chapter 5 for more information.) The default setting is 120 ac, the maximum clearcut size under Oregon's Forest Practice Act (Oregon Department of Forestry 2000). This default applies to state, nonindustrial private, and industry land where management units (parcels) can be blocked together for harvest or placed beside other units being clearcut during the same time period (or within the window of the green-up period). The default value can be overridden on nonindustrial private and industry lands (see Sections 8.2.3 and 8.3.3). On federal lands, the minimum clearcut size is a single management unit.
- Minimum percent of a parcel that can be clearcut—Sets the minimum percent of a parcel that must be eligible for clearcut before a clearcut can occur. It is designed to prevent a clearcut when not enough of a parcel meets the requisite conditions (age, land allocation, etc.) for a regeneration harvest. For all landowner groups, the default setting is 65%; at least 65% of the parcel area must meet all conditions noted in Chapter 5 before a clearcut can be scheduled. Experience has shown that values greater than 65% severely restrict the activities allowed in the first several time periods of a simulation because har-

vesting decisions are based on the representation of the landscape derived from satellite imagery and each parcel initially contains a very heterogeneous mixture of BSUs.

- Minimum percent of a parcel that can be thinned—Requires a minimum percent of a parcel to be eligible for thinning before a thinning can occur. It functions in the same manner as the previous parameter. The default setting is 50%.
- Slope percent above which cable yarding is assumed—The default slope is 35% for cable yarding to be the harvest method. Below 35%, ground-based logging is assumed.

7.2 Clearcut Transition Probabilities

Pre-clearcut land is classified as hardwood, mixed hardwood/conifer, or conifer. After a regeneration harvest, land can be classified in the following vegetation classes:

- open/semi-closed
- hardwood
- mixed hardwood/conifer
- conifer

After a regeneration harvest, new vegetation classes are established through the application of transition probabilities. These probabilities are a function of landowner group, ecoregion, management intensity, distance from stream, and previous vegetation class.

To edit transition probabilities,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Miscellaneous Parameters from the drop-down menu and then make your selection (Figure 7.1).

(3) Select Clearcut Transition Probabilities. The Transition Probabilities after Clearcutting window (Figure 7.3) appears.

(4) Select either Coastal Ecoregion or Interior and Foothills Ecoregions from the menu at the top of the window. A drop-down menu appears.

(5) From the drop-down menu, select a landowner group. Federal and state landowners have been grouped together, and industry has been divided into three groups, depending on the management intensity assumed. The ecoregion and landowner group selected are displayed in the upper left-hand corner under the words in blue text Transition Probabilities after Clearcutting.

(6) Edit the default probabilities by clicking in a cell, deleting the default value, and entering a new one. The value in the Total box for each probabilities group must equal 1.00 (it is highlighted in green when the total does not equal 1.00). Changes are automatically saved.

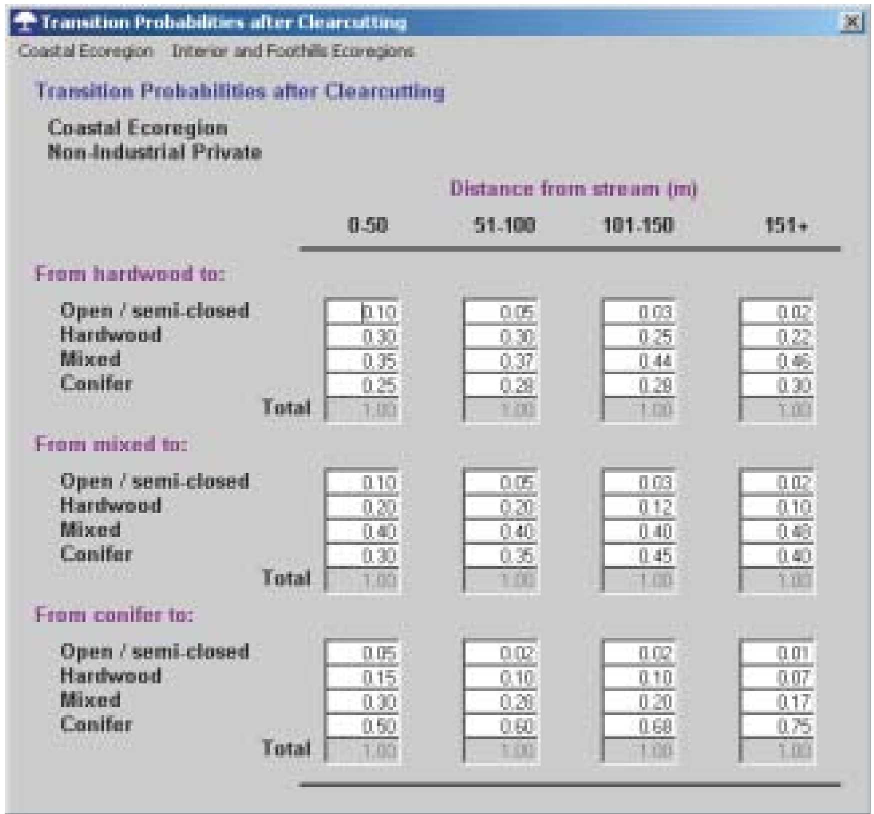


Figure 7.3. Transition Probabilities after Clearcutting window.

7.3 Economic Analysis Parameters

To access the economic analysis parameters,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Miscellaneous Parameters from the drop-down menu and then make your selection (Figure 7.1).

(3) Select Economic Analysis Parameters. The Economic Analysis Parameters window (Figure 7.4) appears.

Users must define the following general economic values and costs for each landowner group:

- economic discount rate to determine net present value of activities simulated
- yield reduction of timber harvest volume due to defect and breakage
- reforestation (planting) cost
- chemical site prep cost
- grass control cost

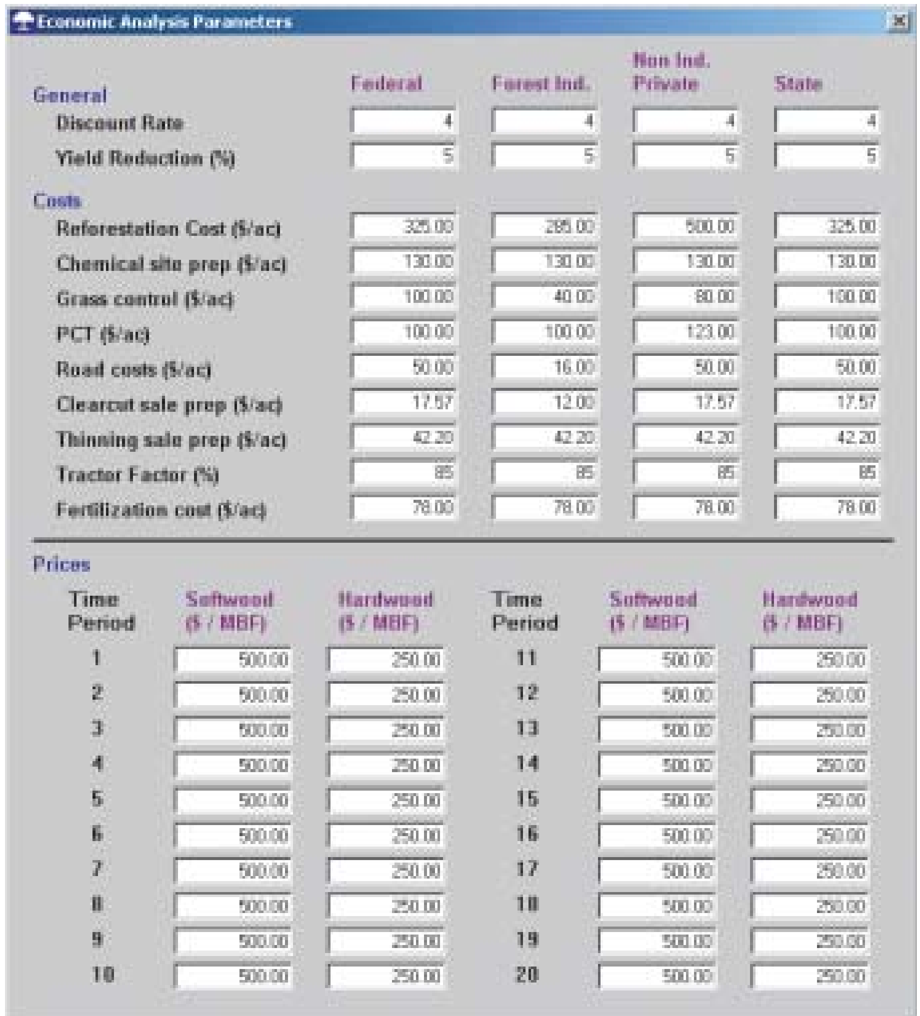


Figure 7.4. Economic Analysis Parameters window.

- precommercial thinning (PCT) cost
- road maintenance cost
- clearcut sale preparation cost
- thinning sale preparation cost
- tractor factor (percent of cable logging cost to represent ground-based logging, since logging costs are not user-defined, and represent cable logging conditions)
- fertilization costs

Note: (1) Although these data are delineated by landowner group, the choice of management intensity determines whether all of these costs are used. (2) Users do not have the ability to adjust the costs by site class.

Users must also determine prices in thousand board feet ($/MBF) for both softwood and hardwood timber volume. These do not vary by landowner or product produced, since forest products (other than total board feet harvested) are not explicitly modeled within the LAMPS model. To arrive at net revenue (or cost), LAMPS applies the yield reductions to harvested stands first, calculates the net revenue using the log prices noted in Tables 7.1 and 7.2, and then subtracts the costs of reforesting and managing each parcel.

Table 7.1. Stump-to-mill thinning logging costs ($/MBF).

	Volume (MBF) Cut/Ac				
Log MBF	0.0–4.0	4.1–7.5	7.6–12.5	12.6–17.5	17.6+
0.00–0.10	339.90	273.42	224.93	206.92	198.25
0.11–0.15	285.47	218.97	169.29	152.45	146.33
0.16–0.20	272.49	210.95	161.25	144.44	135.76
0.21–0.29	270.64	204.13	153.92	137.63	128.95
0.30+	266.80	200.30	150.61	133.78	125.12

Table 7.2. Stump-to-mill clearcut logging costs ($/MBF).

	Volume (MBF) cut/ac	
Log MBF	0.0–50.5	50.6 +
0.00–0.15	139.17	134.81
0.16–0.20	124.71	120.31
0.21–0.29	118.79	114.39
0.30–0.40	113.99	109.62
0.41+	111.50	107.13

8. Landowner Group Scheduling Process Parameters

Users can specify how to simulate each landowner group's management intentions and associated land allocations. The scheduling of activities for each landowner is influenced, in some form or fashion, by the level of timber harvest volume scheduled in each time period. Either users set target volumes to achieve or LAMPS attempts to schedule the highest volumes possible. Six possible scheduling processes are available in total (Figures 8.1–8.6); however, the availability of each process to each landowner group is limited (Table 8.1).

Table 8.1. Scheduling processes available to landowner groups.

	Federal	State	Forest industry	Nonindustrial private
Management option(s)	11-13	41	22	31-33
	– – – – –	Scheduling process	– – – – – –	
Binary		Yes	Yes	
Limited	Yes		Yes	Yes
Iterative (1)			Yes	Yes
Iterative (2)			Yes	Yes
Iterative (3)			Yes	Yes
Monte Carlo	Yes			Yes

The six scheduling processes available (by search method) are

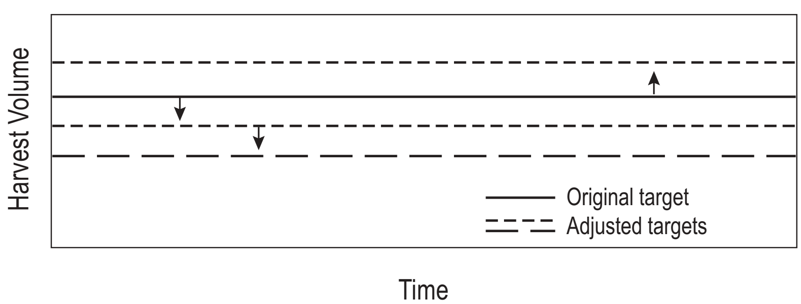


Figure 8.1. Binary search: Achieve highest even flow of harvest volume

- **Binary search**—finds the highest even flow of timber harvest volume over time (Figure 8.1). Target volumes are adjusted upward or downward, depending on whether the target volumes are achieved. Binary search is an iterative process and may utilize 10 or 20 iterations (or more) to settle on the highest even-flow harvest level possible.
- **Limited search**—allows users to set the target volumes for each time period (Figure 8.2). If one or more targets are not met, LAMPS reports that targets were not met and does nothing to adjust them upward or downward.
- **Iterative search** (1)—the process is similar to a limited search. If one or more targets are not achieved, however, targets for the periods in which the targets are not achieved are adjusted downward, and the scheduling process begins anew (Figure 8.3).

- **Iterative search** (2)—allows users to set the target volumes for each time period and specify that, if all targets are met, each target increases and the process begins anew (Figure 8.4). Targets are not adjusted downward if one or more are not met.
- **Iterative search** (3)—allows users to set the target volumes for each time period and specify that, if one or more targets are not met, each decreases and the process begins anew (Figure 8.5). Targets are not adjusted upward if all are met.
- **Monte Carlo search**—schedules activities subject to a set of constraints (Figure 8.6). There is no upper or lower limit on harvest levels that can be achieved; instead, harvests are scheduled within the bounds set by the constraints.

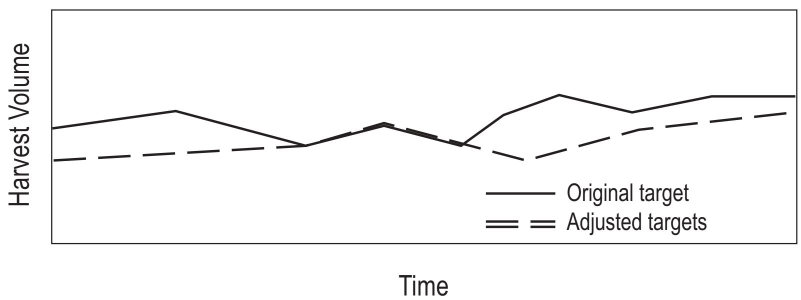


Figure 8.2. Limited search: Harvest levels as close to target as possible

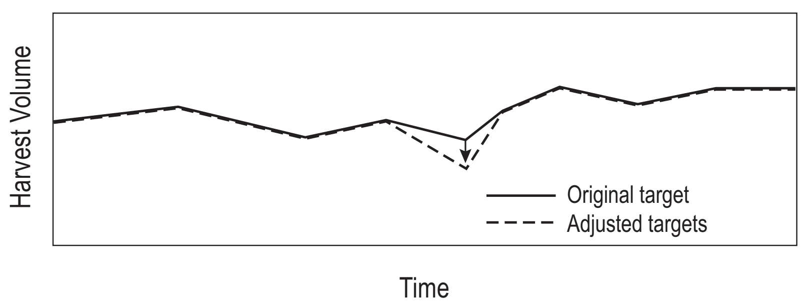


Figure 8.3. Iterative search (1): Reduce harvest volume in periods missed

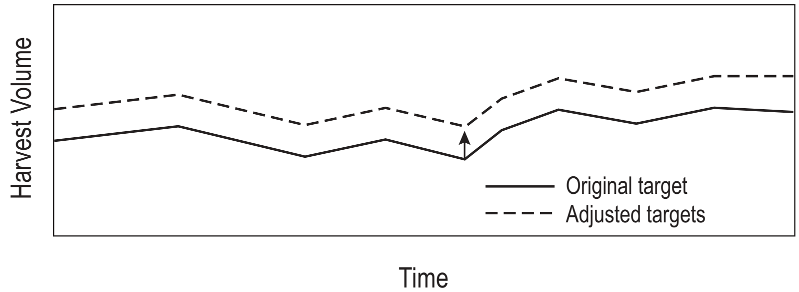


Figure 8.4. Iterative search (2): Increase harvest volume if targets achieved

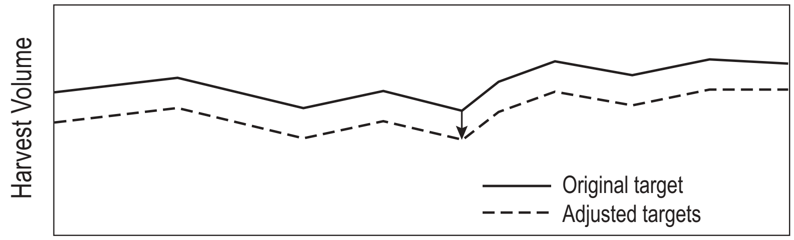


Figure 8.5. Iterative search (3): Decrease harvest volume if targets not achieved

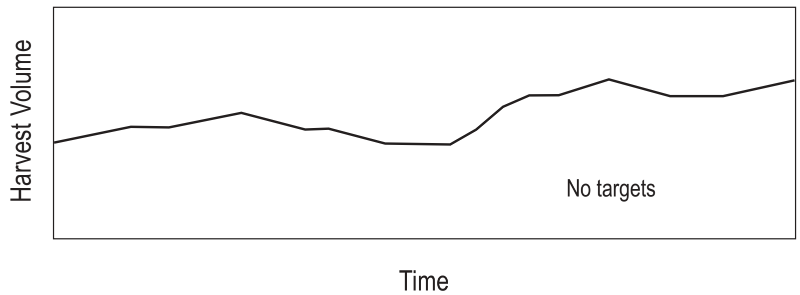


Figure 8.6. Monte Carlo search: Cut as much as possible under constraints

To make changes to the scheduling process of landowner groups,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Landowner Group Scheduling Process Parameters from the drop-down menu and then make a selection (Figure 8.7).

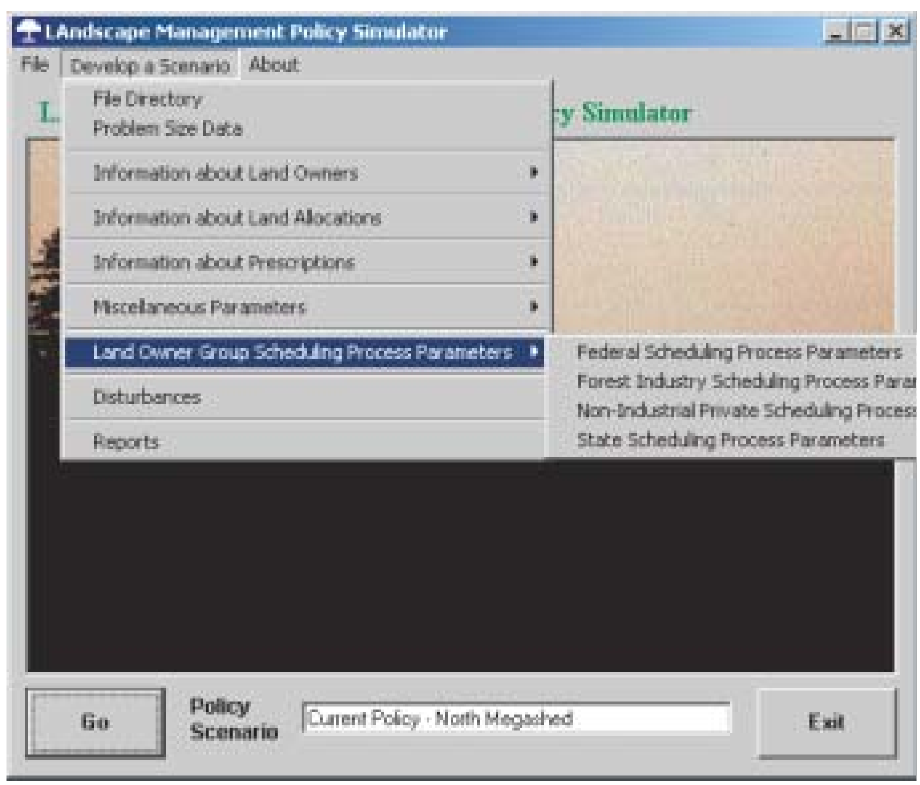


Figure 8.7. Main Menu window, Scheduling Process Parameters selected.

The evolution of these processes was guided by numerous discussions within the CLAMS project and with stakeholders associated with CLAMS. Obviously, greater flexibility may be desired in allowing certain scheduling processes to be associated with certain landowner groups. We recognize this lack of flexibility as an area of concern, and an area within which future developmental efforts might be centered.

8.1 Federal Scheduling Process Parameters

The federal scheduling processes (as portrayed by Management Options 11–13) use a random search technique (Monte Carlo) to schedule activities (clearcuts and thinnings), subject to four potential constraints:

- percent of acreage clearcut each time period (static)
- amount of older federal forest vegetation in a watershed each time period
- acreage specified by the user as maximum levels to be clearcut or thinned each time period (dynamic)
- volume specified by the user each time period (from matrix land allocations only)

Based on discussions with federal land managers and our interpretation of the Northwest Forest Plan, we concluded that no distinct objective (such as maximizing net present value) is used to guide the scheduling of activities. Activities are implemented within the narrow decision space defined by the activities allowed in each land allocation and the forest-wide goals (or constraints).

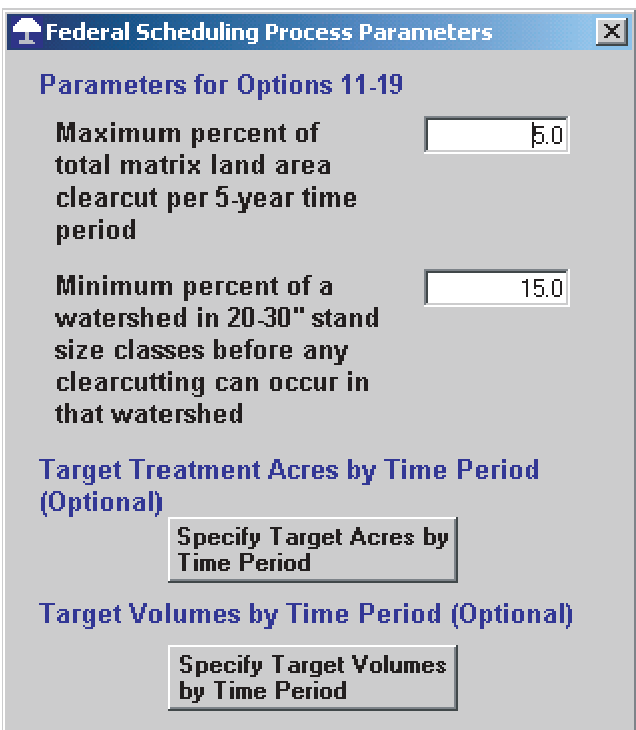


Figure 8.8. Federal Scheduling Process Parameters window.

To modify parameters related to the federal land scheduling process,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Landowner Group Scheduling Process Parameters from the drop-down menu and then select Federal Scheduling Process Parameters. The Federal Scheduling Process Parameters window appears (Figure 8.8). If the user does not enter the required parameters, default values are used during simulation.

8.1.1 Maximum Percent of Total Matrix Land Area Available for Clearcut (Required)

This required parameter places an upper bound on the amount of matrix land allocation area clearcut in any single time period, but does not guarantee that this level will be achieved. The default is 5.0%.

Some points to consider are

- There are 5 yr in a time period, so that if there is a known maximum clearcut area/yr target, that value should be multiplied by 5.
- If the federal policy intent being modeled entails no cutting (clearcut or thinning) on federal land, then the grow-only management option (see Figure 4.2) should be chosen, rather than entering 0.0% for the matrix land area allowed to be clearcut.
- If a management option is chosen that allows thinnings and 0.0% is entered as the clearcut area allowed, then clearcuts will not occur but thinnings will occur.

8.1.2 Minimum Percent of a Watershed in 20"–30" Stand Size Classes Before Any Clearcutting (Required)

This required parameter determines the amount of older forest necessary before a clearcut can be scheduled. It is meant to ensure that the amount of older forest in each watershed is above some minimum level before any clearcutting occurs.

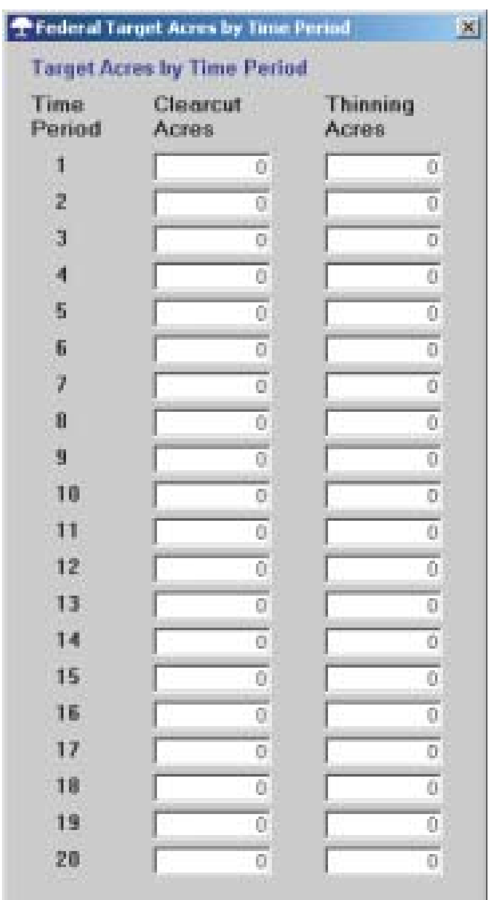


Figure 8.9. Federal Target Acres by Time Period window.

Each watershed is evaluated for the amount of federal land in the 20"+ dbh range in each time period. If the percent of a watershed that is in 20"+ diameter size classes exceeds this minimum percent, clearcutting can occur, but only in matrix land allocations. Thus, stands in this diameter range that are also in reserves count toward the target percentage, but reserves (as well as land allocations assigned with a “No” to clearcutting, as described in Chapter 5) cannot be clearcut.

8.1.3 Target Treatment Acres by Time Period (Optional)

To set the target harvest acres for each time period for clearcutting and thinning,

(1) Click the Specify Target Acres by Time Period button. The Federal Target Acres by Time Period window (Figure 8.9) appears.

(2) Enter target Clearcut Acres and Thinning Acres.

(3) Click the X in the upper right-hand corner of the window to exit. Changes are automatically saved.

For example, the user may want the number of federal harvest acres to decrease over time, thus simulating increasingly restrictive federal regulations. Once these targets have been achieved in a time period, scheduling of the appropriate activities (clearcuts or thinnings) stops. (This process is illustrated in Figure 8.2.) If the target level is too high to be achieved, the model schedules harvests as close to the target level as possible and then stops.

Note: If users do not specify target harvest levels, LAMPS schedules the federal scheduling process activities in a Monte Carlo fashion (illustrated in Figure 8.6), subject to the constraints for land allocations.

8.1.4 Target Volumes by Time Period (Optional)

To set the target harvest acres for each time period for clearcutting and thinning,

(1) Click the Specify Target Volumes by Time Period button. The Federal Scheduling Process Parameters window (Figure 8.10) appears.

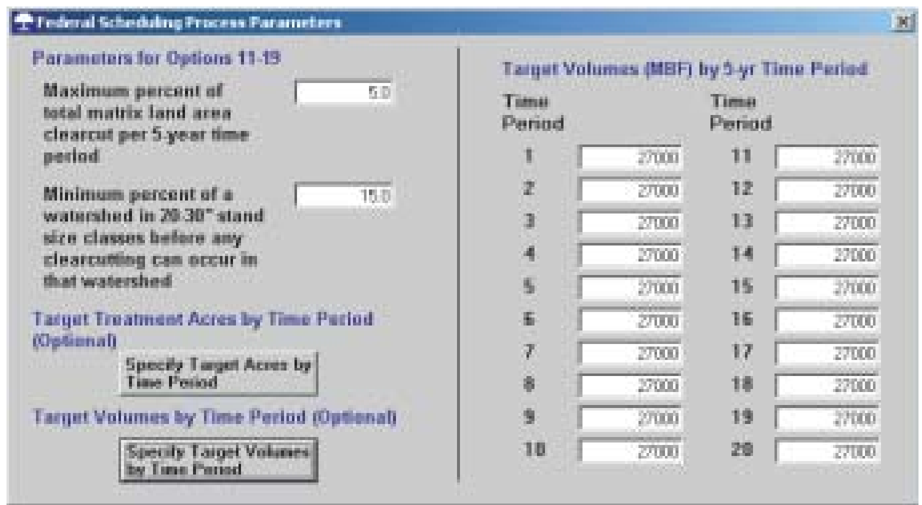


Figure 8.10. Federal Scheduling Process Parameters window with Target (Harvest) Volumes (MBF) by 5-yr Time Period displayed.

(2) On the right-hand side of the window enter values for the Target Volumes (MBF) by 5-yr Time Period. Target harvest volumes are represented in MBF per time period. For example, to set a value of 1 million bd ft, enter “1000” to represent 1,000 MBF.

(3) Click the X in the upper right-hand corner of the window to exit. Changes are automatically saved.

If the harvest volume from matrix land allocations exceeds the amounts noted here, scheduling of activities from matrix lands stops.

Note: If users do not specify target harvest levels, then LAMPS schedules the federal scheduling process activities in a Monte Carlo fashion (illustrated in Figure 8.6), subject to the constraints for land allocations.

8.2 Forest Industry Scheduling Process Parameters

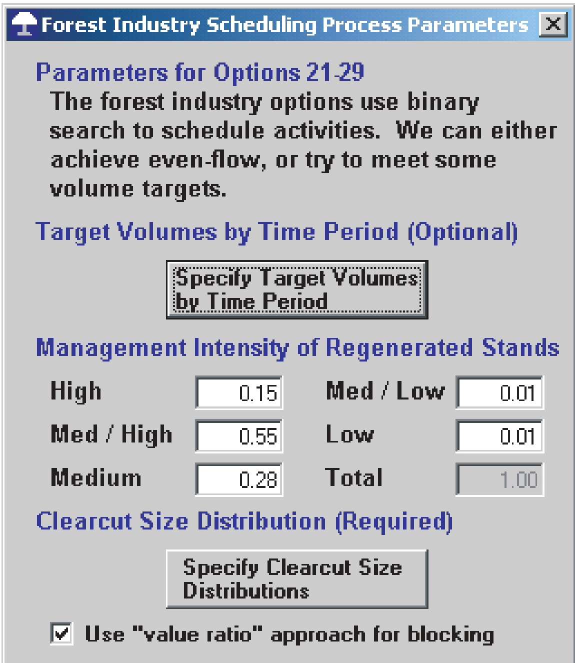


Figure 8.11. Forest Industry Scheduling Process Parameters window.

To modify parameters associated with the forest industry scheduling process (Management Option 22),

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Landowner Group Scheduling Process Parameters from the drop-down menu and then select Forest Industry Scheduling Process Parameters. The Forest Industry Scheduling Process Parameters window appears (Figure 8.11).

8.2.1 Target Volumes by Time Period (Optional)

This optional parameter allows users to specify a distinct target harvest volume to achieve by time period. To specify a distinct target harvest volume,

(1) Click the Specify Target Volumes by Time Period button (Figure 8.11).

The Target Volumes (MBF) by 5-yr Time Period window appears (Figure 8.12).

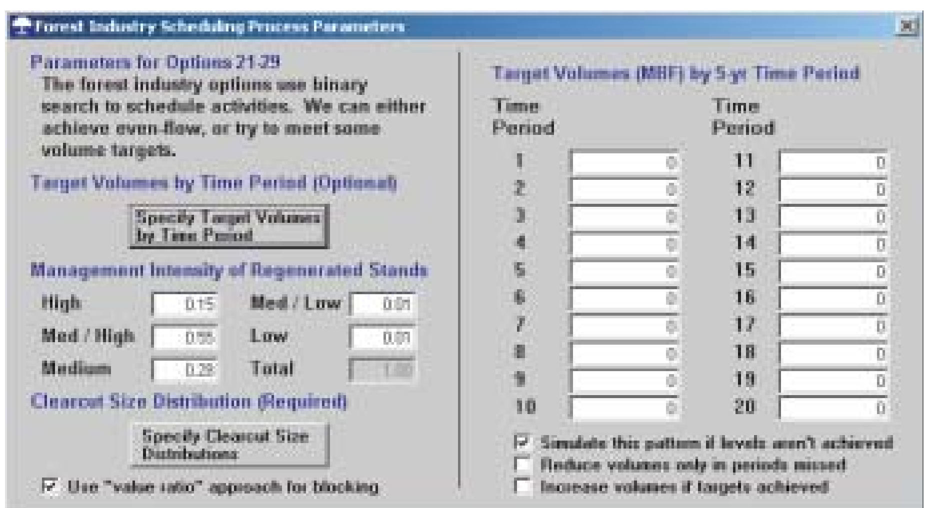


Figure 8.12. Forest Industry Scheduling Process Parameters window with (Harvest) Volumes (MBF) by 5-yr Time Period displayed.

(2) Enter target volumes in the text boxes on the right-hand side of the window. Target volumes are represented in MBF per time period. For example, to set a value of 1 million bd ft, enter “1000” to represent 1,000 MBF.

Note: Specifying target volumes disables target even-flow harvest levels used in the binary search scheduling process and discussed in Chapter 5. Even flow, however, can be achieved by entering the same target volumes for each period, because even-flow targets are static (the same for every time period). In this case, the LAMPS scheduling model attempts to meet the goal set by the user in each time period. If a goal is not met, LAMPS schedules harvests as close as possible to the target level and then stops (Figure 8.2), and the actual volume harvested is reported in the final solution.

(3) (Optional) Select one of the three checkboxes at the bottom of the right-hand side of the window.

Simulate this pattern if levels aren't achieved—If target volumes are too high to be attained, the pattern of these harvests can be simulated. When the LAMPS scheduling model senses a time period missed its target harvest level, it reduces the targets for all time periods by a factor of 0.95. When all time periods meet the adjusted goals, a solution is reported. Otherwise, LAMPS continues to reduce targets by 0.95 (Figure 8.5).

Reduce volumes only in periods missed—If target volumes are too high for one or more time periods, only the targets associated with those time periods are adjusted downward (Figure 8.3). Each time period where the actual harvested volume was lower than the target volume has its target lowered by a factor of 0.95, and the scheduling process repeats anew.

Increase volumes if targets achieved—If target volumes are easily achieved, targets are increased by a factor of 1.05 until target levels can no longer be met (Figure 8.4). If the actual harvested volume in all time periods is higher than the target volumes for those time periods, the targets are raised by 1.05, and the scheduling process repeats anew.

8.2.2 Management Intensity of Regenerated Stands (Required)

The management intensities (MIs) applied to regenerated stands are determined in part by the percentages entered here (see Figure 8.11). The MI with the highest percentage is the one most often assigned to regenerated parcels.

After a clearcut occurs in a simulation, a random number between 0 and 1 is chosen and compared to the MIs entered by the user:

(1) If the random number is less than the High MI, then that MI is assigned to the regenerated parcel. If the random number is greater than the High MI, the random number is next compared to the Med/High MI plus High MI.

(2) If the random number is less than the combined Med/High plus High MIs, then the Med/High MI is assigned to the parcel. If the random number is

greater than the combined MIs, the random number is next compared to the Medium plus Med/High plus High MIs (see note below).

(3) If the random number is less than the combined total of the Medium, Med/High, and High MIs, then the Medium MI is assigned to the parcel. If the random number is greater than the combined MIs, then the random number is next compared to the Med/Low plus Medium plus Med/High plus High MIs.

(4) If the random number is less than the combined total of the Med/Low, Medium, Med/High, and High MIs, then the Med/Low MI is assigned to the parcel. If the random number is greater than the combined MIs, then the regenerated parcel is assigned to the Low MI.

Note: At the time of the writing of this user guide, regeneration tree lists have not been created for the Med/Low and Low MIs. Therefore, there is actually no management intensity below Medium, and all parcels not assigned to Med/High or High MIs are assigned to Medium by default. Any percentages in the Med/Low and Low are applied to the Medium MI.

8.2.3 Clearcut Size Distributions (Required)

Users must specify the range of clearcut sizes for forest industry and non-industrial private harvests.

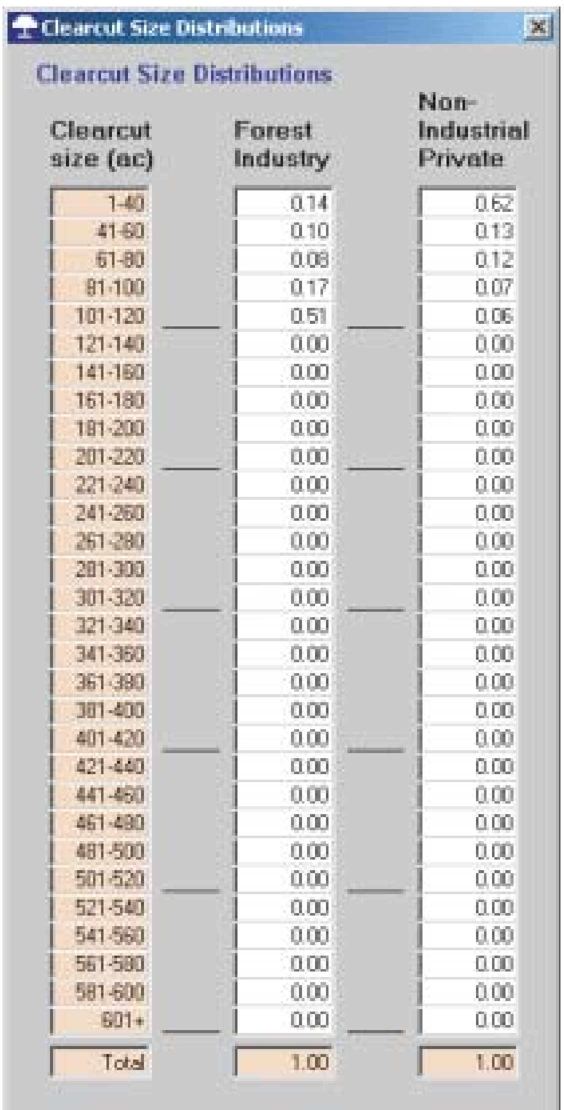
Note: As mentioned in Chapter 7, a default clearcut size distribution is used for federal and state harvest, but not for forest industry or nonindustrial private harvests.

To specify these ranges,

(1) Click the Specify Clearcut Size Distributions button (Figure 8.11).

The Clearcut Size Distributions window appears (Figure 8.13).

(2) Enter target volumes in the text boxes on the right-hand side of the window. The total at the bottom of each column must add up to 1.00 (the Total box is highlighted green when the sum is not equal to 1.00). Although the default clearcut sizes are not set above 120 ac, users may simulate larger clearcuts by adjusting the distribution into larger size categories. The 600+ ac category limits the size of the largest clearcuts to 600 ac.



Clearcut size (ac)	Forest Industry	Non-Industrial Private
1-40	0.14	0.62
41-60	0.10	0.13
61-80	0.08	0.12
81-100	0.17	0.07
101-120	0.51	0.06
121-140	0.00	0.00
141-160	0.00	0.00
161-180	0.00	0.00
181-200	0.00	0.00
201-220	0.00	0.00
221-240	0.00	0.00
241-260	0.00	0.00
261-280	0.00	0.00
281-300	0.00	0.00
301-320	0.00	0.00
321-340	0.00	0.00
341-360	0.00	0.00
361-380	0.00	0.00
381-400	0.00	0.00
401-420	0.00	0.00
421-440	0.00	0.00
441-460	0.00	0.00
461-480	0.00	0.00
481-500	0.00	0.00
501-520	0.00	0.00
521-540	0.00	0.00
541-560	0.00	0.00
561-580	0.00	0.00
581-600	0.00	0.00
601+	0.00	0.00
Total	1.00	1.00

Figure 8.13. Clearcut Size Distributions window.

8.2.4 Use the Value Ratio Approach for Blocking (Optional)

Check the Use “value ratio” approach for blocking box to make the selection of parcels for inclusion into a harvest block a function of the value of each parcel divided by the age of the parcel. The lower the value ratio (for parcels above the minimum harvest age), the higher the priority the parcel has for inclusion into a block.

By ranking stands for inclusion into a harvest block (centered around a high-valued stand) by their value ratio, LAMPS attempts to emulate the behavior of forest managers in the Coast Range of Oregon. Discussions with stakeholders associated with the CLAMS project revealed that harvest blocks, while centered around a high-valued stand, might include older, lower-stocked, lower-valued areas where regeneration would be economically beneficial. The harvesting of these older areas might be delayed a number of years if harvests were scheduled based on the value of each individual stand.

Uncheck Use “value ratio” approach for blocking to instruct LAMPS to add parcels to harvest blocks based simply on the value of each parcel.

8.3 Nonindustrial Private Scheduling Process Parameters

The scheduling process for nonindustrial private landowners is stochastic and based on stand age. The nonindustrial scheduling processes (as portrayed by Management Options 31–33) are modified by specifying

- target volumes by time period
- harvest probabilities by stand age
- distributions for clearcut sizes

To access the nonindustrial scheduling parameters window (Figure 8.14),

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Landowner Group Scheduling Process Parameters from the drop-down menu and then select Nonindustrial Private Scheduling Process Parameters. The Nonindustrial Private Scheduling Process Parameters window appears (Figure 8.14).

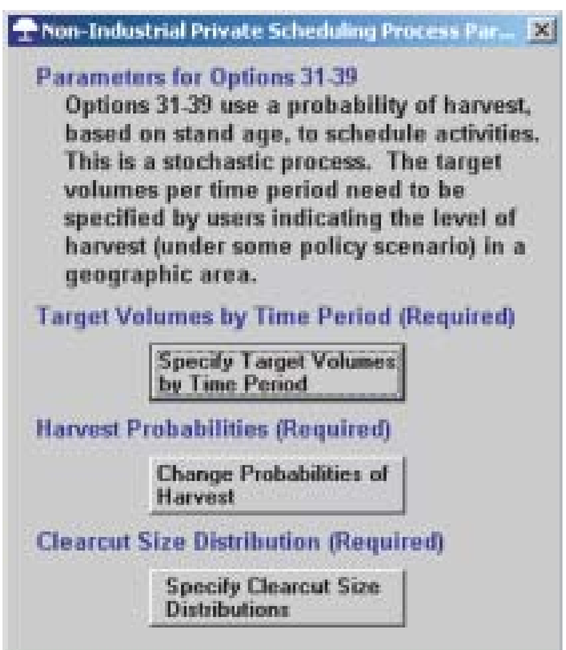


Figure 8.14. Nonindustrial Private Scheduling Process Parameters window.

8.3.1. Harvest Level Target Volumes by Time Period (Required)

The default option for scheduling activities on nonindustrial land uses a Monte Carlo process (Figure 8.6) to randomly schedule activities within the set of constraints for land allocations. However, users can specify target harvest volumes to achieve from nonindustrial private land. LAMPS attempts to achieve the user-specified target volumes through clearcutting or thinning in each time period. If a goal is not met, LAMPS schedules harvests as close as possible to the target level and then stops (Figure 8.2), and the actual volume harvested is reported in the final solution.

To specify a target harvest volume,

(1) Click the Specify Target Volumes by Time Period button (Figure 8.14).

The Target Volumes (MBF) by 5-yr Time Period window appears (Figure 8.15).

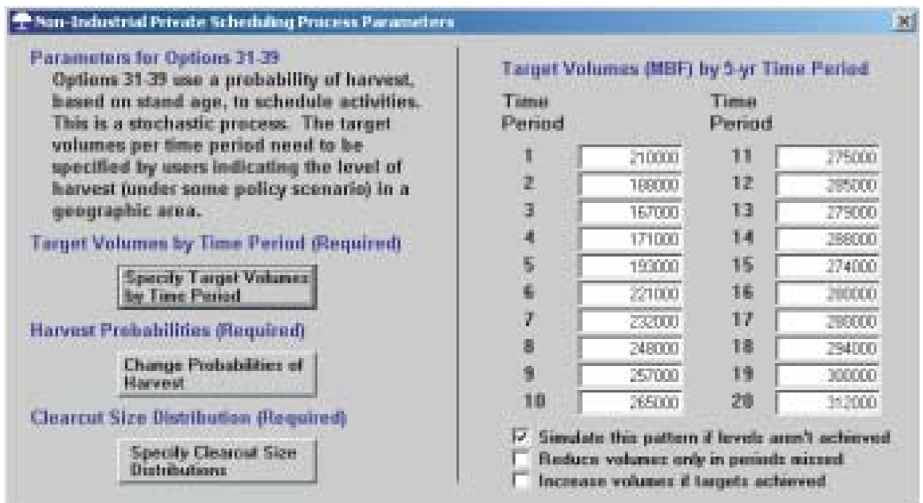


Figure 8.15. Non-Industrial Private Scheduling Process Parameters window with Target Volumes (MBF) by 5-yr Time Period displayed.

(2) Enter target volumes in the text boxes on the right-hand side of the window. Target volumes are represented in MBF per time period. For example, to set a value of 1 million bd ft, enter "1000" to represent 1,000 MBF.

(3) (Optional) Select one of the three checkboxes (described below) at the bottom of the right-hand side of the window to specify target harvest levels. If no target harvest levels are specified, LAMPS randomly examines each parcel in each time period and determines whether to harvest the parcel, based on the probability that the parcel would be harvested (as described in the next section). The actual volumes that result are reported based on this process.

Simulate this pattern if levels aren't achieved—If the target volumes set by the user are too high to be attained, LAMPS reduces the targets for all time periods by a factor of 0.95. When all time periods meet the adjusted goals, a solution is reported. Otherwise, LAMPS continues to reduce targets by a factor of 0.95 (Figure 8.5).

Reduce volumes only in periods missed—If the target volumes set by the user are too high for one or more time periods, LAMPS adjusts the targets associated with those time periods downward (Figure 8.3). Each time period where the actual harvested volume is lower than the target volume is lowered by a factor of 0.95, and the scheduling process repeats anew.

Increase volumes if targets achieved—If the target volumes set by the user are easily achieved, LAMPS increases the targets by a factor of 1.05 until target levels can no longer be met (Figure 8.4). If the actual harvested volume in all time periods is higher than the target volumes for those time periods, the targets are raised by a factor of 1.05, and the scheduling process repeats anew.

8.3.2 Probabilities of Harvest (Required)

During each time period, LAMPS selects nonindustrial private parcels at random, summarizes their ages, and draws a random number to compare to the probability that a stand of that age would be harvested. If the random number is lower than the probability noted, the parcel may be harvested (other constraints may apply, however).

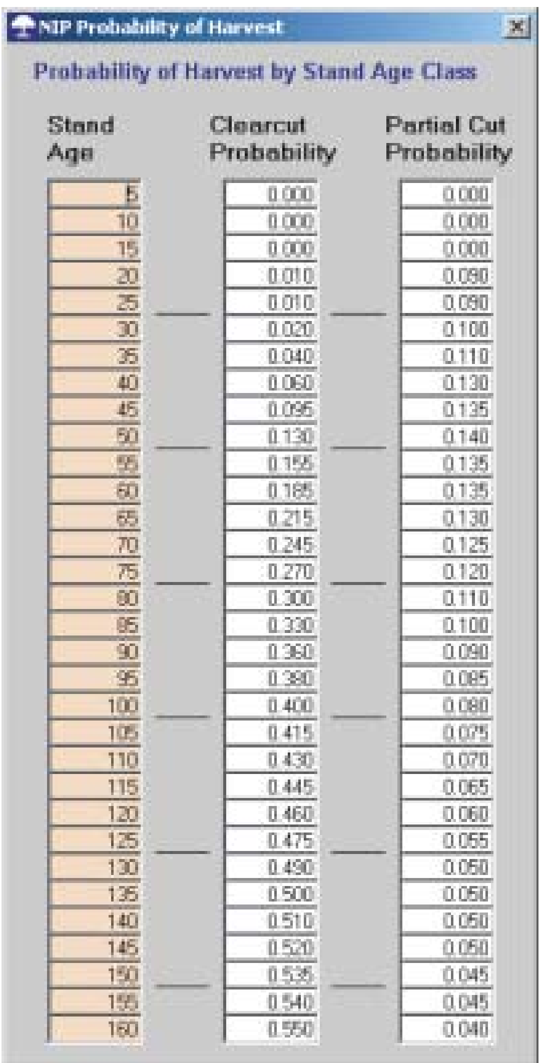


Figure 8.16. NIP Probability of Harvest window.

Note: Parcels over 160 yr in age use the probability of harvest for a 160-yr-old stand.

To enter probabilities of clearcut and partial cut harvests,

(1) Click the Change Probabilities of Harvest button (Figure 8.14).

The NIP Probability of Harvest window appears (Figure 8.16).

(2) Enter clearcut and partial cut probabilities for each 5-yr age group in the text boxes on the right-hand side of the window.

8.3.3 Clearcut Size Distributions (Required)

As mentioned in Chapter 7, a default clearcut size distribution is used for federal and state harvest, but not for forest industry or nonindustrial private harvests. To specify the range of clearcut sizes for forest industry and nonindustrial private lands,

(1) Click the Specify Clearcut Size Distributions button (Figure 8.14). The Clearcut Size Distributions window appears (Figure 8.13).

(2) Enter target volumes in the text boxes on the right-hand side of the window. The total at the bottom of each column must add up to 1.00. (The Total box is highlighted green when the sum is not equal to 1.00.)

The default distributions for nonindustrial lands reflect the tendency of many private landowners to harvest timber in small patches rather than in larger blocks. Users should consider these distributions in reference to the Megashed of interest. As with the industrial landowner group, default clearcut sizes for the nonindustrial landowners are not set above 120 ac, but users may simulate larger clearcuts by adjusting the distribution into larger size categories. The 600+ ac category limits the size of the largest clearcuts to 600 ac.

8.4 State Scheduling Process Parameters

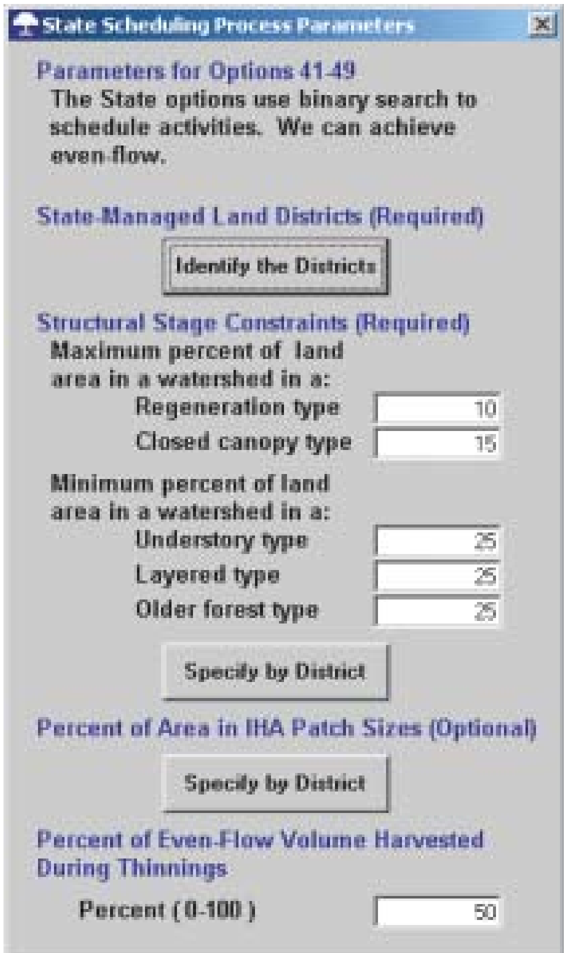


Figure 8.17. State Scheduling Process Parameters window.

To access state scheduling parameters,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Landowner Group Scheduling Process Parameters from the drop-down menu and then State Scheduling Process Parameters.

The State Scheduling Process Parameters window appears (Figure 8.17).

Four actions are required:

- identify the district areas
- define structural goals
- delineate the size and number of interior habitat areas
- set the percentage of harvest volume allowable from thinning activities

User input is required for three of these four areas. The only scheduling process available for state land (Management Option 41) is a binary search process (Figure 8.1), where the highest even-flow of timber harvest volume is achieved given the constraints on management activities noted in Chapter 5 (for land allocations) and those noted below.

8.4.1 Identify District Areas (Required)

To use the state scheduling process, users must identify the state management districts and specify the land allocations in each district (refer to Chapter 5 for a discussion on land allocations):

(1) Click the Identify the Districts button (Figure 8.17). The Identifying the Districts window appears (Figure 8.18).

(2) Enter the numbers for each district and the land allocations that belong in each district. Districts must be identified by number. It is up to the user to decide which land allocations belong in a district.

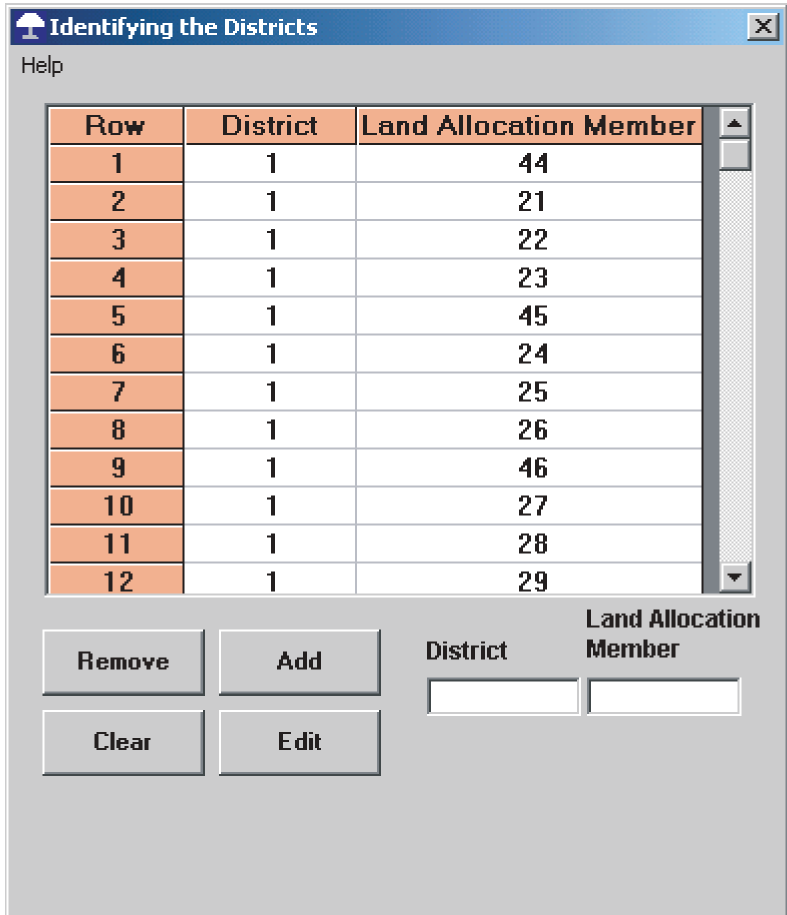


Figure 8.18. Identifying the Districts window.

8.4.2 Define Structural Goals (Required)

Structural goals are used to allocate activities over time and space. Users can place limits on the amount of state lands that is in various structural stages by specifying a set of global default values (as shown in Figure 8.17) or structural goals by district.

Note: If users do not specify values, LAMPS uses the same default values across all districts.

To specify structural goals by district,

(1) In the middle of the State Scheduling Process Parameters window (Figure 8.17) locate the Structural Stage Constraints (Required) section. Click the Specify by District button at the bottom of this section. The State Structural Goals by District window appears (Figure 8.19).

(2) For each district, enter values for the five structural parameters: Regeneration, Closed Canopy, Understory, Layered, and Older Forest.

Note: District numbers entered in this window (Figure 8.19) must correspond with the District numbers used in Identifying the Districts (Figure 8.18).

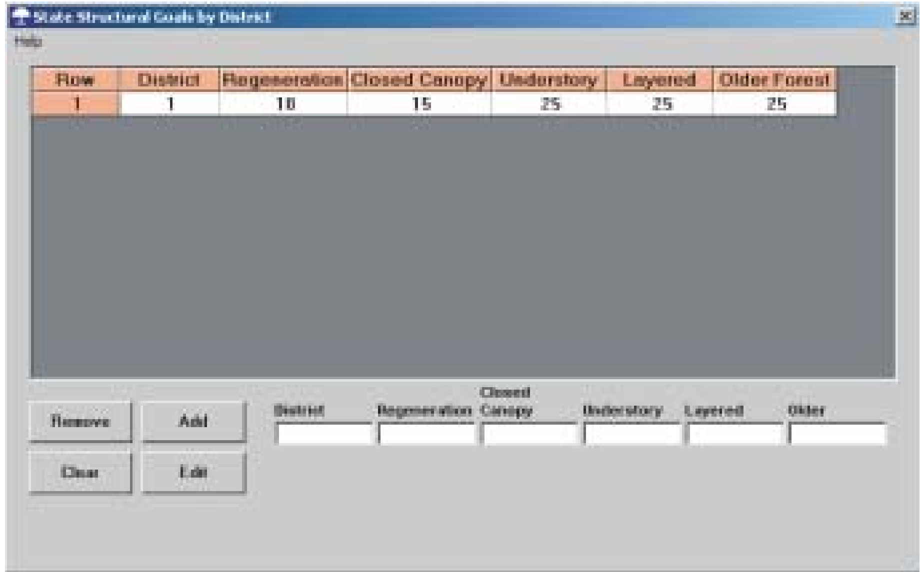


Figure 8.19. State Structural Goals by District window.

8.4.3 Delineate the Size and Number of Interior Habitat Areas (Optional)

When the state scheduling process operates, one of the first processes performed each time period is the development of Interior Habitat Area (IHA) patches. These patches consist of contiguous parcels with structures at or near "older forest." Parcels are ranked in value from highest structure (older forest) to lowest structure (regeneration) and selected to become part of an IHA patch based on their ranking.

To specify the development of interior habitat areas,

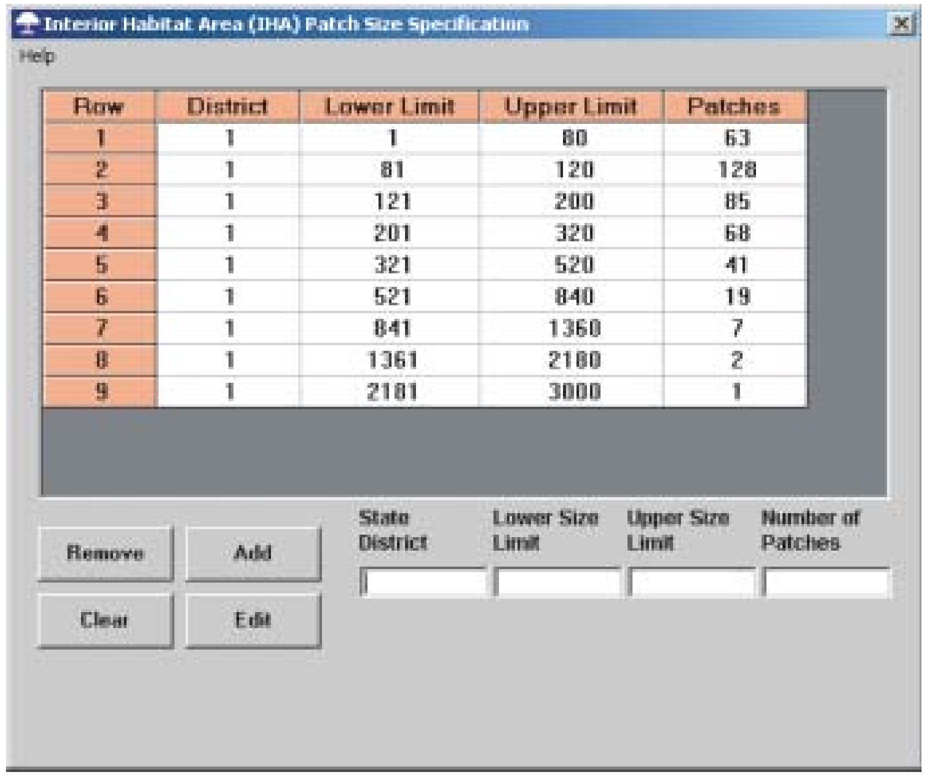
(1) In the lower half of the State Scheduling Process Parameters window (Figure 8.17) locate the Percent of Area in IHA Patch Sizes (Optional) section and click the Specify by District button below it. The IHA Patch Size Specification window appears (Figure 8.20).

(2) For each district, enter values, in acres, for the Lower Limit and Upper Limit patch size and for the maximum number of Patches.

Note: LAMPS limits the user to 100 potential IHA entries.

8.4.4 Set the Percentage of Harvest Volume Allowable from Thinning Activities (Required)

The state scheduling process operates by scheduling all thinning operations and then all clearcutting options through time. This is a binary search process, with the goal of achieving the highest even-flow of volume through time. Given this scheduling process (thinnings



Row	District	Lower Limit	Upper Limit	Patches
1	1	1	80	63
2	1	81	120	128
3	1	121	200	85
4	1	201	320	68
5	1	321	520	41
6	1	521	840	19
7	1	841	1360	7
8	1	1361	2180	2
9	1	2181	3000	1

Figure 8.20. Interior Habitat Area (IHA) Patch Size Specification window.

first, then clearcuts) and the constraints noted here and in Chapter 5, it is possible that the volume generated through thinning could represent a large portion of the even-flow volume obtainable from state land. Therefore, users can decide how much of the even-flow volume target level can arise from thinnings. Once this level is achieved in a time period, no more thinning operations are scheduled for that time period, which limits the percent of total harvest volume obtained through thinnings and allows more regeneration harvests to occur.

To specify how much of the even-flow volume target level can arise from thinnings,

(1) At the bottom of the State Scheduling Process Parameters window (Figure 8.17) locate the Percent of Even-Flow Volume Harvested During Thinnings section.

(2) Enter a number in the Percent (0–100) text box.

9. Ecological Disturbances

Users can model one of two types of natural disturbances:

- disturbances within riparian areas (within 100 ft of the stream system)
- gap disturbances across the landscape

To select a disturbance to model and specify its parameters,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Disturbances from the drop-down menu (Figure 9.1). The Disturbances window appears (Figure 9.2).

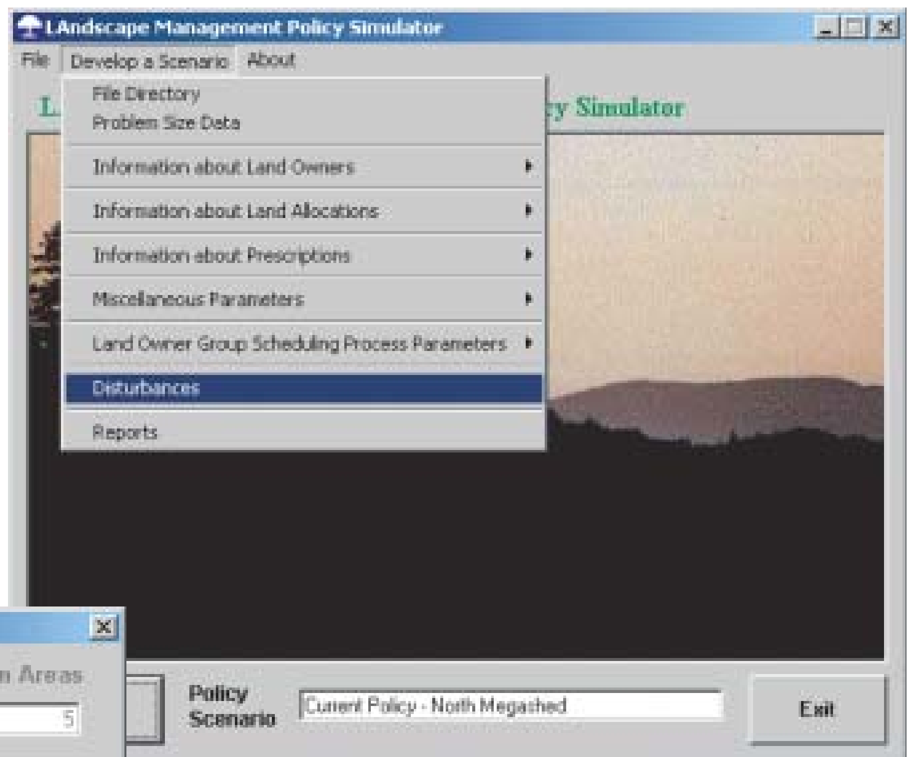


Figure 9.1. Main Menu window, Disturbances selected.

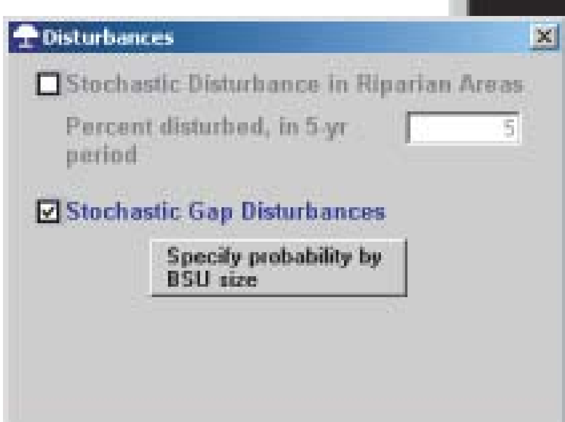


Figure 9.2. Disturbances window.

(3) Choose Stochastic Disturbances in Riparian Areas or Stochastic Gap Disturbances and check the box next to your selection.

Note: Once a selection is made, the other disturbance process cannot be modeled.

9.1 Stochastic Disturbances in Riparian Areas

Stochastic disturbances can occur on any BSU. These disturbances are designed to simulate a localized flood that levels the BSU, which then regenerates. The resulting prescription applied to the BSU, regardless of the prescription prior to the disturbance, is one of the regenerated stand prescriptions and depends on the landowner group the BSU falls within, its distance from the stream, and other factors, as described in the transition probabilities section (Section 7.2).

Note: With this option, users must understand that they cannot model disturbances in the uplands.

Disturbances are modeled using the following process:

(1) A BSU is selected.

(2) A random number between 0 and 1 is drawn.

(3) The random number is compared to the disturbance rate (on a 0–1 scale, for example, 5% is now 0.05).

(4) If the random number is less than the disturbance rate, the BSU is considered disturbed, and it is regenerated using the transition probabilities described earlier. If the random number is greater than the disturbance rate, the BSU is ignored (not disturbed), and the process returns to Step 1 (unless the BSU is the last BSU for the ownership being scheduled, in which case the disturbance process stops.)

The process is repeated each time period before scheduling harvesting activities for an ownership group.

To model a stochastic disturbance in riparian areas,

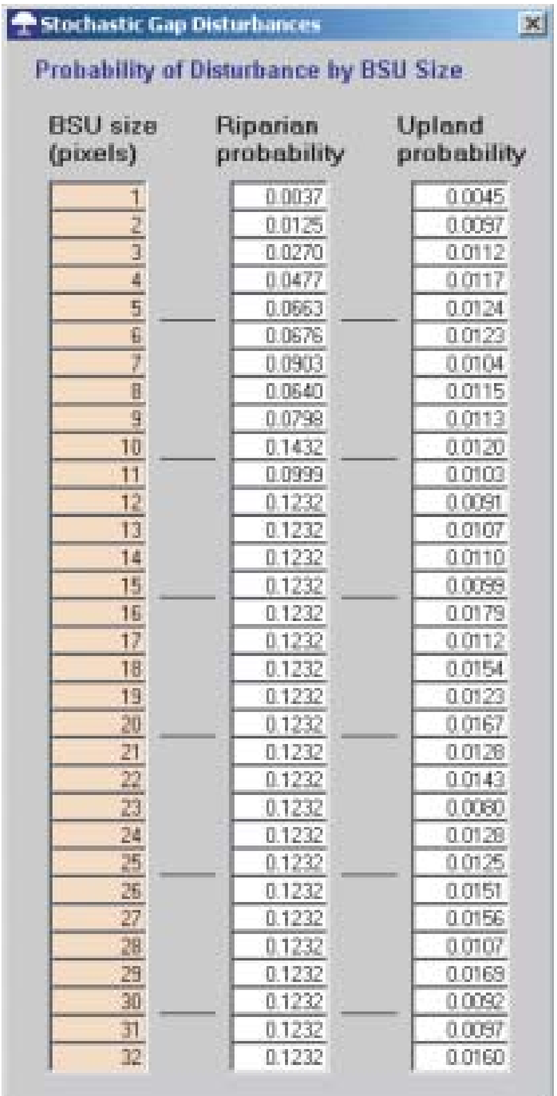
(1) Check the Stochastic Disturbance in Riparian Areas box (Figure 9.2).

Note: Once selected, the other disturbance process (stochastic gap disturbances) is not available.

(2) Enter the percentage of BSUs to be disturbed across the riparian areas during each time period.

LAMPS uses 5-yr time steps; therefore, users should multiply their yearly disturbance percentage by 5. For example, to model a disturbance rate of 1%/yr, enter 5%. A rate of 0%/5-yr eliminates disturbances.

9.2 Stochastic Gap Disturbances



Stochastic Gap Disturbances

Probability of Disturbance by BSU Size

BSU size (pixels)	Riparian probability	Upland probability
1	0.0037	0.0045
2	0.0125	0.0097
3	0.0270	0.0112
4	0.0477	0.0117
5	0.0663	0.0124
6	0.0676	0.0123
7	0.0903	0.0104
8	0.0640	0.0115
9	0.0798	0.0113
10	0.1432	0.0120
11	0.0999	0.0103
12	0.1232	0.0091
13	0.1232	0.0107
14	0.1232	0.0110
15	0.1232	0.0099
16	0.1232	0.0179
17	0.1232	0.0112
18	0.1232	0.0154
19	0.1232	0.0123
20	0.1232	0.0167
21	0.1232	0.0128
22	0.1232	0.0143
23	0.1232	0.0080
24	0.1232	0.0128
25	0.1232	0.0125
26	0.1232	0.0151
27	0.1232	0.0156
28	0.1232	0.0107
29	0.1232	0.0169
30	0.1232	0.0092
31	0.1232	0.0097
32	0.1232	0.0160

Figure 9.3. Stochastic Gap Disturbances window.

Stochastic gap disturbances are modeled in a similar fashion to disturbances in riparian areas, except that users have the ability to model disturbances in the uplands as well.

To model stochastic gap disturbances,

(1) Check the Stochastic Gap Disturbances box (Figure 9.2).

Note: Once selected, the other disturbance process (stochastic disturbances in riparian areas) is no longer available.

(2) Click Specify Probability by BSU size. The Stochastic Gap Disturbances window appears (Figure 9.3).

(3) For each BSU size, enter the probability of disturbance for riparian areas (100 ft from a stream) and uplands (all other areas).

The disturbance probabilities shown in this window are 5-yr rates and are a function of BSU size. Users can enter their own probabilities, set all probabilities to 0 (effectively ruling out disturbances), or use probabilities developed by CLAMS for each megashed. The rates developed by CLAMS use a system keyed off of empirical research performed at the USDA Forest Service Pacific Northwest Research Station in Corvallis, Oregon. This system generates a set of rates based on the number of BSUs in each BSU size class in a megashed. Users interested in the process used to generate these rates should contact the lead author (pbettinger@smokey.forestry.uga.edu).

10. Outputs

A LAMPS simulation generates a number of output files, some more interpretable by novice users than others. This chapter describes the types of information these files contain.

10.1 Reports

Like the input data files discussed in Chapter 2, users need to specify the location on their computer where the output files will reside.

Note: The output files runLAMPS.txt and runLAMPS.log are automatically produced and written to the C:/ drive by LAMPS without user specification.

A maximum of six reports are saved to the specified drive location at the end of a LAMPS run. Output file descriptions and formats are found in the Appendix.

Note: This list of reports does not include the two files, discussed above, that LAMPS automatically saves to the C:/ drive.

[BSU_LRC.out

BSU_RX.out

BSU_SEQNO.out

BSU_TABLE.out

BSU_Vegclass.out

LAMPS_Results.out

To specify which output files to generate and where to save them,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Reports from the drop-down menu. The Reports window appears (Figure 10.1).

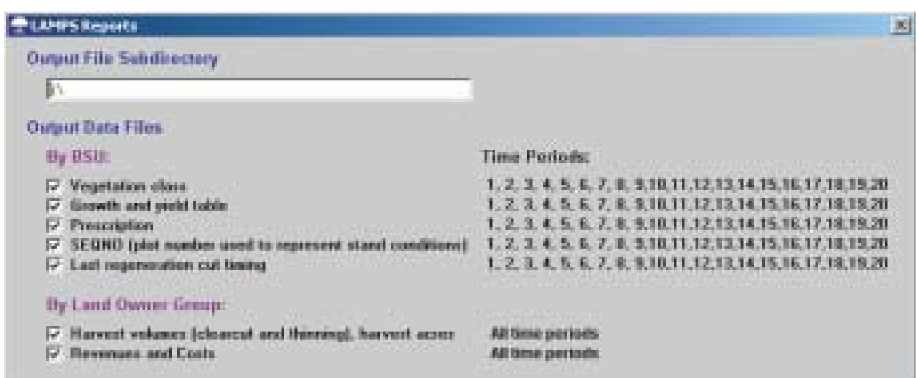


Figure 10.1. Reports window.

(3) Click once in the Output file subdirectory textbox. A browse window appears where the path can be specified using standard Microsoft conventions. All output files, with the exception of runLAMPS.txt and runLAMPS.log, are stored in this output file directory.

Note: The default drive might not be a drive that is available on the user's computer.

(4) Check the box next to each Output Data File that LAMPS should generate.

The default settings for the output data files generate all reports over all time periods. If all six files are selected, the output file directory will contain approximately 1 GB of output.

Users can specify any combination of time periods for BSU output files.

Note: Information requested by landowner group is given for all time periods and cannot be changed by the user. The landowner group reports are relatively small.

To change the time periods reported for BSUs,

(1) Check the box in front of the desired report. If the box is already checked, checking it again turns this reporting option off. Clicking it again turns this reporting option back on. The Pick the Time Periods to Report window appears (Figure 10.2).

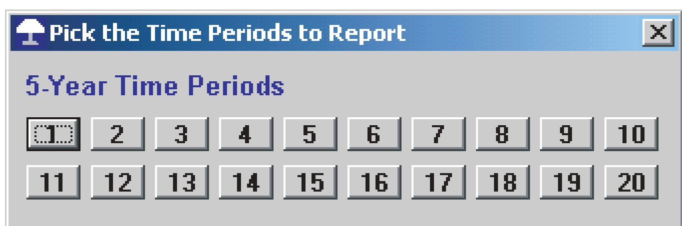


Figure 10.2. Pick the Time Periods to Report window.

(2) Click each time period to report.

(3) Exit the window by clicking the X in the top right-hand corner of the window. The new time periods are saved.

10.2 Output File Description

LAMPS does not warn the user that existing output files are overwritten whenever a new simulation is run. If an output directory already has output files with the names listed below, LAMPS overwrites them and output from the previous simulation is lost. In order to save reports from a simulation, copy each output file and rename and resave it.

10.2.1 runLAMPS.txt

All the assumptions developed by the user for a management scenario are recorded in this file. The scheduling model reads this file and extracts all the policy alternative parameters. This file is produced when the user presses Go on the Main Menu window and is stored directly on the C:\ drive of the computer.

10.2.2 runLAMPS.log

This file records all of the processing steps LAMPS completes—from reading the input parameters to scheduling forest management activities—and it is automatically stored on the C:\ drive of the computer. It can be used to help diagnose potential problems encountered when modeling a policy. For example, a policy with several complex aspects (even-flow, minimum harvest age, green-up requirements, clearcut size distribution, timber volume targets) may not produce the average harvest age desired. Examining the average harvest age reported here can help users understand how LAMPS reacts to changes in assumptions.

10.2.3 BSU_LRC.out

This large ASCII text file lists the last regeneration cut of each BSU during the time periods specified by the user.

10.2.4 BSU_RX.out

This large ASCII text file contains the prescriptions that are applied to each BSU during the time periods specified by the user.

10.2.5 BSU_SEQNO.out

This large ASCII text file lists the forest inventory plot numbers (SEQNOs) used to describe each BSU during the time periods specified by the user.

10.2.6 BSU_TABLE.out

This large ASCII text file reports the growth and yield model (yield tables) used to grow each SEQNO through time under each management prescription.

10.2.7 BSU_Vegclass.out

This large ASCII text file lists the CLAMS vegetation classification for each BSU for the time periods specified by the user. The CLAMS vegetation classes include codes for “open,” “hardwood,” and several classes of “mixed” and “conifer” forest types.

10.2.8 LAMPS_Results.out

The results report provides the basic harvest statistics by landowner and period. Clearcut and thinning volumes are reported as totals and grouped by softwood and hardwood harvests. Harvest volumes are reported in MBF/period and MBF/yr with the yearly figures as a 5-yr average of the period yields.

11. How to Model with LAMPS

This chapter provides a simple example of how to model alternatives to a "base case" scenario. We assume that

- The databases required to run LAMPS have been developed and are available.
- The LAMPS program has been installed on a computer with sufficient RAM to enable its operation.
- Users developed or were provided with a "base case" (current management policy and behavior) scenario.
- Users are familiar with this user guide.

Let's assume that someone was interested in developing a set of policy scenarios for the Coast Range of Oregon. Further, let's assume that this person had no specific agenda and just wanted to see how the results (e.g., timber volume levels, area of land in certain age classes, etc.) might change if the management behavior of certain landowner groups was altered. This person examines several management alternatives:

Alternative 1. A requirement to leave more scattered trees per acre in clearcut harvest units, above and beyond what is required by current regulations.

LAMPS can model four leave-tree options within clearcuts. To do so, the user should

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Activities Allowed in Land Allocations from the drop-down menu. The Activities Allowed in Land Allocations window appears (Figure 5.3).

(3) Set the leave-tree option (LT Option) on the far right side of the window to 4. Strategy 4 models the effects of requiring 14 scattered trees per acre within clearcuts, well beyond the current requirement for most land allocations in western Oregon (with the exception of certain state land allocations.) See Section 5.2 for more information on leave-tree options.

Alternative 2. A requirement to attain a relatively high minimum harvest age for clearcuts on all lands.

LAMPS can model an infinite arrangement of minimum harvest ages for clearcuts. To change the current settings,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Minimum Harvest Ages from the drop-down menu. The Minimum Harvest Ages window appears (Figure 5.8).

(3) To set a single minimum harvest age for each landowner group, click the Specify by Land Allocation button. The Designate Minimum Harvest Ages by Land Allocation window appears (Figure 5.9).

(4) Clear the Designate Minimum Harvest Ages by Land Allocation window. (Minimum harvest ages by land allocation override the defaults for each landowner group.)

(5) Exit the window and return to the Minimum Harvest Ages window (Figure 5.8).

(6) Specify the Conifer and Mixed/Hardwood forest minimum harvest ages for each landowner group. See Section 5.4 for more information.

Alternative 3. A reduction of the minimum harvest ages for clearcuts on all lands.

In the base case, LAMPS models "current policy" (current regulatory and organizational policy) influencing management behavior on a landscape. To examine the effects of changing policies and behavior to lower minimum clearcut age,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Minimum Harvest Ages from the drop-down menu. The Minimum Harvest Ages window appears (Figure 5.8).

(3) To set a single minimum harvest age for each landowner group, click Specify by Land Allocation. The Designate Minimum Harvest Ages by Land Allocation window appears (Figure 5.9).

(4) Clear the Designate Minimum Harvest Ages by Land Allocation window. (Minimum harvest ages by land allocation override the defaults for each landowner group.)

(5) Exit the window and return to the Minimum Harvest Age window (Figure 5.8).

(6) Specify the Conifer and Mixed/Hardwood forest minimum harvest ages for each landowner group. See Section 5.4 for more information.

Alternative 4. An increase in the required green-up period between adjacent clearcuts. LAMPS can model an infinite arrangement of green-up requirements for adjacent clearcuts.

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Develop a Scenario and then Green-Up Time Periods from the drop-down menu. The Green-Up Time Periods window appears (Figure 5.6).

(3) To set a single minimum green-up length for all landowner groups, click Specify by Land Allocation and clear the Minimum Green-Up Period window (Figure 5.7). (Minimum green-up periods by land allocation override the defaults for each landowner group.)

(4) Exit the Minimum Green-Up Period window and return to the Green-Up Time Periods window (Figure 5.6).

(5) Set the green-up value for *all landowners at once* by entering a value in the Default Green-up Period textbox (Figure 5.6). See Section 5.3 for more information.

Alternative 5. Modeling the entire landscape as if it were owned by one landowner group (and therefore managed under a single management system.) To examine the impacts of single ownership, the user should

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Information about Land Allocations and then Activities Allowed from the drop-down menu. The Activities Allowed in Land Allocations window appears (Figure 5.3).

(3) Change each value in the Landowner Group column to the landowner group of interest.

Alternative 6. Examine the effects of modeling changes to the structural stage constraints applied to state-managed lands.

A user may wish to model the effects of alternative structural stage constraints on land assigned to state-managed land allocations. To do so,

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Landowner Group Scheduling Process Parameters and then State Scheduling Process Parameters from the drop-down menu. The State Scheduling Process Parameters window appears (Figure 8.17).

(3) To change the structural stage constraints, click the Specify by District button located in the State Structural Goals by District (Required) section. The State Structural Goals by District window appears (Figure 8.19).

(4) For each district, change the percentages in Regeneration, Closed Canopy, Understory, etc.

(5) Click the X in the upper right-hand corner of the window to exit.

Alternative 7. The application of different gap disturbance rates across the landscape. To vary gap disturbance rates, a user should

(1) From the Main Menu window, select Develop a Scenario.

(2) Select Disturbances from the drop-down menu (Figure 9.1). The Disturbances window appears (Figure 9.2).

(3) Check the Stochastic Gap Disturbances box and click Specify probability by BSU size. The Stochastic Gap Disturbances window appears (Figure 9.3).

(4) Change the probability for riparian and upland disturbance rates for each BSU size.

(5) Click the X in the upper right-hand corner of the window to exit.

Alternative 8. An increase in the size of clearcuts allowed. This scenario can only be modeled on industry or nonindustrial land allocations.

(1) From the **Main Menu** window, select **Develop a Scenario**.

(2) Select **Landowner Group Scheduling Process Parameters** and then either **Forest Industry Scheduling Process Parameters** or **Nonindustrial Private Scheduling Process Parameters** from the drop-down menu. Either the **Forest Industry Scheduling Process Parameters** (Figure 8.11) or the **Nonindustrial Private Scheduling Process Parameters** (Figure 8.14) window appears.

(3) In the **Clearcut Size Distribution** section of the window, click the **Specify Clearcut Size Distributions** button. The **Clearcut Size Distributions** window appears (Figure 8.13).

(4) Modify the percentage of clearcut land area in each different clearcut size class category.

(5) Click the X in the upper right-hand corner of the window to exit.

12. Final Notes

12.1 Model Limitations

While the LAMPS model is quite powerful, allowing users to simulate management behavior of four landowner groups in a variety of manners, it has its limitations—for example,

- the limited number and type of management prescriptions that can be used in version 1.1 of LAMPS
- the limited platforms on which LAMPS runs
- the complex nature of the interface
- the activity scheduling methods

Despite these limitations, conclusions about the relative differences between alternative forest policies may still be reasonably obtained using the LAMPS model.

12.2 Future Development

The LAMPS model, although seemingly complete given the treatment in this user guide, is constantly undergoing revisions based on feedback from its users. Among the more important issues we hope to address in future revisions of the model are

(1) *the incorporation of modules that allow users to model the effects of Swiss needle cast* on the long-term growth and development of forests in western Oregon.

To model the effects of Swiss needle cast, we need to define the mechanisms for appropriately modeling this disturbance agent, develop the yield tables to represent forests with this condition, and write simulation model code to portray the condition through space and time.

(2) *the ability to recognize land-use footprints*

Currently, we recognize two land-use conditions in LAMPS: forested and non-forested (either agriculture, developed, or urban). Forested areas are taken out of commercial forest production once a developed state (80 or more dwellings per square mile) has been achieved. Obviously, there are land-use conditions for forests with 0 and 80 dwellings per square mile that are not in commercial forest production. We hope to model these "land use footprints," or small gaps in the forest land base representing the presence of homes. To do so requires a GIS database that represents an estimate of where these homes occur through time and scheduling model routines that account for the transition from forest to an open condition.

(3) *enhancements to the reporting system*

Currently, LAMPS reports the output of a simulation run through several reporting products (see Chapter 10). As users become accustomed to using the model, other reporting products will undoubtedly be desired. For example, reports detailing the standing inventory volume before activities are scheduled each time period, average clearcut harvest ages for all landowners, and levels of activity (acreage and volume harvested) within individual watersheds may be useful. The evolution of the reporting structure of LAMPS will likely be a function of the amount of requests for other improvements to the model and our project schedule.

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Appendix: LAMPS Input and Output File Structures

Input Files

BSU GIS Data File

This ASCII text file contains information about each BSU. It is commonly called the "combined file" because about 10 GIS databases must be combined to produce a description of each BSU. The file contains information such as the parcel number, slope class, distance to stream, ecoregion, and acreage of each BSU.

Format:

```
BSU number, parcel number, SEQNO, land allocation,
slope class, stream type, distance from stream,
subwatershed, ecoregion, ac
```

where

BSU number	=	a unique number for each BSU in a megashed. Range: 1–7,000,000 (no duplicates, no omissions between other valid numbers; does not have to reach the value 7,000,000, but can end anywhere between 1 and 7,000,000)
parcel number	=	parcel to which a BSU belongs. Range: 1–110,000 (no omissions between other valid numbers; does not have to reach the value 110,000, but can end anywhere between 1 and 110,000)
SEQNO	=	CLAMS forest inventory plot number (or identification number). Range: 1–3600
land allocation	=	allocation given to the BSU. See Section 5.1 for how to view designated land allocations. Range: 1–99
slope class	=	slope of the BSU. Range: 0 or 1. A "0" represents slopes between 0% and 35%; a "1" represents slopes >35%
stream type	=	order of the closest stream to the BSU. Range: 1–5. The smallest streams are order 1 streams; the largest are order 5
distance from stream	=	buffer zone sizes. Range: 1, 50, 100, 200, 300, or 600, where 1 = no buffer; 50 = 0–50 ft buffer zone; 100 = 51–100 ft zone; 200 = 101–200 ft zone; 300 = 201–300 ft zone; and 600 = 301–600 ft zone

subwatershed = 5th-field watershed that a BSU falls within. Range: 1–999

ecoregion = ecoregion a BSU falls within. Range: 1–4, where 1 = fog region (closest to the ocean); 2 = interior region (next region in from the fog region); 3 = foothills region (sloping towards the Willamette Valley); and 4 = valley region

ac = size in ac of BSU

Example:

```
1,1,1318,63,0,1,1,38,2,.46
2,1,987,63,0,1,1,38,2,.15
3,1,994,63,0,1,1,38,2,.15
4,1,987,63,0,1,1,38,2,.15
5,1,1318,63,0,1,1,38,2,.15
```

In this example, BSU 3 belongs to parcel 1 and is represented by SEQNO (CLAMS forest inventory plot number) 994. It also is within land allocation 63, less than 35% slope, closest to a first-order stream, no buffer, within watershed 38 and ecoregion 2, and 0.15 ac in size.

BSU Development Zone Data File

This ASCII text file represents the condition, as it pertains to human development, of each BSU over time. The time period in which a BSU changes from forested condition to non-commercial forest and subsequently to urban, is noted, if land use projections indicate that these changes will take place. It is possible for a BSU never to change from a commercial forest condition.

Format:

```
BSU number, period BSU changes to forested yet noncom-
mercial, period BSU changes to urban
```

where

BSU number = see BSU GIS data file above for description

period BSU changes to forested yet noncommercial = time period in which a BSU is changing to an area of residential use, yet is still mainly forested. No commercial forest use is assumed in these areas. Range: 0–20

period BSU changes to urban = time period in which a BSU changes to an urban (non-forested) condition

Example:

```
83633,2,0
83638,2,14
83639,2,14
83640,2,16
83641,2,0
83642,2,0
```

In this example, BSU 83642 changes to forested, yet noncommercial, use in period 2, and never changes to urban. BSU 83640 changes to urban in period 16. It is possible for a BSU to never change from a commercial forest condition (i.e., both values after BSU number are "0"). A BSU cannot have a "0" for "period BSU changes to forested, yet noncommercial", and a value ">0" for "period BSU changes to urban."

Parcel Adjacency File

This ASCII text file describes the adjacency relationships among parcels. It is required in order to model green-up policies, aggregate parcels into harvest blocks on industry and nonindustrial private land, and develop interior habitat patches on state land.

Format:

```
parcel, adjacent parcel
```

where

parcel number	=	as described in BSU GIS data file above
adjacent parcel number	=	parcel that touches the parcel of interest. Range: 1–110,000 (no omissions between other valid numbers; does not have to reach the value 110,000, but can end anywhere between 1 and 110,000).

Example:

```
1,2
1,4
1,5
1,6
2,1
2,3
2,4
2,12
2,13
2,32
```

```
3,2
3,7
3,13
```

In this example, parcel 1 is adjacent to parcel 2, parcel 1 is adjacent to parcel 4, and so on. Note that parcel 2 is also adjacent to parcel 1. This redundancy is required.

Parcel Coordinate File

This ASCII text file contains the X and Y coordinates for the boundaries of each parcel. It facilitates the display of ownership classes, vegetation classes, and state, structural-stage condition classes, on a parcel basis (not on a BSU basis).

Format:

```
parcel      number of vertices
parcel      X centroid location
parcel      Y centroid location
parcel      X vertex coordinate     Y vertex coordinate
........
parcel      X vertex coordinate     Y vertex coordinate
```

where

parcel number	=	as described in BSU GIS data file above
number of vertices	=	number of points it takes to draw the line that is about to be described
X centroid location	=	a single X-coordinate describing the center of a parcel. See ArcInfo (ESRI 2002) documentation for further description of a parcel centroid
Y centroid location	=	a single Y-coordinate describing the center of a parcel
X vertex coordinate	=	a single X-coordinate describing a point along a line. It represents one-half of an X-Y coordinate pair
Y vertex coordinate	=	a single Y-coordinate describing a point along a line. It represents one-half of an X-Y coordinate pair

Example:

```
5 6
5 424675
5 4990576
```

```
5 424687 4990587
5 424687 4990562
5 424662 4990562
5 424662 4990562
5 424662 4990587
5 424687 4990587
6 84
6 424362
6 4990389
6 424662 4990562
6 424662 4990537
6 424662 4990512
6 424662 4990487
6 424687 4990487
```

In this example, parcel 5 has six vertices. The X centroid location of parcel 5 is 424675 and the Y centroid location is 4990576. The six vertices of parcel 5 follow. Parcel 6 has 84 vertices, only a few of which are shown here.

Parcel Owl File

This ASCII text file contains the parcel numbers of each parcel where an owl nest is centered. Users must determine where they believe owl nests exist and which parcels represent those locations.

Format:

```
parcel
parcel
parcel
...
parcel
```

where

parcel = the number of a parcel that has a known owl nest location

Example:

```
45527
46223
```

Here, parcels 45527 and 46223 are "owl parcels."

Plot (SEQNO) Master List

This ASCII file lists each of the CLAMS forest inventory plots used in a simulation and the unique number used by the simulation as a surrogate for those plot numbers. There are about 600 CLAMS forest inventory plots, represented by values from 1–4000, that are generally not numbered consecutively. In order to efficiently use computer memory, the plot numbers are renumbered from 1 to *n* for use in LAMPS .

Format:

```
unique surrogate number, CLAMS SEQNO (plot) number
```

where

unique surrogate number	=	an ordered number from 1 to *n* that LAMPS uses to reference each plot
CLAMS SEQNO (plot) number	=	number that CLAMS uses to reference the inventory plots that contain tree lists

Example:

```
1,917
2,918
3,921
4,922
5,923
6,924
```

In this example, CLAMS plot 917 is represented as number 1 in the simulation model, plot 918 is represented as number 2, and so on.

Plot (SEQNO) Site Index

This ASCII text file gives the King's 50-yr Douglas-fir site index value for each of the CLAMS forest inventory plots (SEQNOs). Site index values are used to guide the selection of the appropriate regenerated-stand tree list used after clearcut activities.

Format:

```
CLAMS SEQNO (plot) number, site index
```

where

CLAMS SEQNO (plot) number	=	CLAMS reference number for the inventory plots that contain the tree lists

site index	=	King's 50-yr Douglas-fir site index

Example:

```
917,90
918,121
921,102
922,104
923,159
924,134
925,140
928,112
```

In this example, CLAMS SEQNO 917 has a site index of 90, plot 918 has a site index of 121, and so on.

Prescription (Rx) Master List

This ASCII text file lists each of the CLAMS prescription used in a simulation and the unique numbers used by the simulation as a surrogate for those prescription numbers. There are about 250 CLAMS prescriptions, represented by values from 1–1000, that are generally not numbered consecutively. In order to use computer memory efficiently, these prescription numbers are renumbered from 1 to *n* for use in LAMPS.

Format:

```
unique surrogate number, CLAMS prescription number
```

where

unique surrogate number	=	an ordered number from 1 to *n* that LAMPS uses to reference each plot
CLAMS prescription number	=	a number from 0 to 999 that represents the forest management prescription applied to each CLAMS SEQNO

Example:

```
1,0
2,1
3,101
4,102
5,103
```

```
6,104
7,105
8,106
9,107
10,108
```

In this example, CLAMS prescription 0 is represented by the value 1 in the simulation model, CLAMS prescription 108 is represented by the value 10, etc.

Softwood Standing Volume

This ASCII text file describes the amount of softwood volume (bd ft) over time for every SEQNO managed under each prescription. Nine growth-and-yield databases are required by the LAMPS simulation model. Each database represents the condition of a forest inventory plot (SEQNO) managed under each prescription (Rx) over a 100-yr time horizon. Without the growth-and-yield databases, LAMPS is unable to determine the timber volume, age, and structural condition of each parcel.

Format:

Line number, CLAMS SEQNO (plot) number, CLAMS prescription number, $value_1$, $value_2$, ..., $value_{20}$

where

line number	=	is not used by the LAMPS simulation model, but acts as a reference number for a line of data. Range 1–*n*
CLAMS SEQNO (plot) number	=	CLAMS forest inventory plot number
CLAMS prescription number	=	itself
$value_1$	=	softwood standing volume (bd ft) in time period 1, for this plot, managed under this prescription
$value_2$	=	softwood standing volume (bd ft)in time period 2, for this plot, managed under this prescription
$value_{20}$	=	softwood standing volume (bd ft) in time period 20, for this plot, managed under this prescription

Example:

Note: Indented rows will be on the same line as the last nonindented row in the actual growth and yield file.

```
1,917,0,4611.984,5802.03,7140.77,8615.36,10387.83,11968.63,13661.08,
   15328.32,17129.94,18947.86,20845.33,22540.72,24365.56,25925.62,27804.29,29443.39,
   31100.76,32653.89,33970.41,35598.62
2,918,0,4136.262,5565.898,7015.294,8563.489,10178.87,11792.76,
   13664.04,15620.77,17526.63,19634.52,21369.45,23031.26,24810.16,26938.31,28611.99,
   30405.7,31753.82,33244.72,34647.18,36621.7
3,921,0,35614.44,35849.09,36401.86,37241.67,38511.76,39327.34,39362.9,
   40678.93,40973.33,41365.58,42414.34,42655.93,43240.81,44159.65,
   44861.61,46051.17,46567.91,47465,48230.7,47949.12
```

In this example, plot 917, managed under prescription 0, has about 4,611 bd ft/ac in time period 1, and over 35,598 bd ft/ac in time period 20.

Softwood Thinning Volume

This ASCII text file describes the amount of softwood thinning volume (bd ft) over time for every SEQNO managed under every prescription.

Format:

Line number, CLAMS SEQNO (plot) number, CLAMS prescription number, $value_1$, $value_2$, ..., $value_{20}$

where

line number	=	not used by the LAMPS simulation model, but acts as a reference number for a line of data. Range 1–*n*
CLAMS SEQNO(plot) number	=	CLAMS forest inventory plot number
CLAMS prescription number	=	itself
$value_1$	=	softwood thinning volume (bd ft) in time period 1, for this plot, managed under this prescription
$value_2$	=	softwood thinning volume (bd ft) in time period 2, for this plot, managed under this prescription
$value_{20}$	=	softwood thinning volume (bd ft) in time period 20, for this plot, managed under this prescription

Example:

```
122,1398,101,2515.942,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
```

```
123,1399,101,2415.166,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
124,1400,101,3033.654,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
125,1401,101,2600.91,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
126,1402,101,4606.55,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
```

In this example, SEQNO 1398, managed under CLAMS prescription 101, has about 2516 bd ft thinned during time period 1, and no volume thinned during any other time period.

Hardwood Standing Volume

This ASCII text file describes the amount of hardwood volume (bd ft) over time for every SEQNO managed under every prescription. The format and contents of this file are the same as the softwood standing volume file described above.

Hardwood Thinning Volume

This ASCII text file describes the amount of hardwood thinning volume (bd ft) over time for every SEQNO managed under every prescription. The format and contents of this file are the same as the softwood thinning volume file described above.

Average Log Size

This ASCII text file describes the average size of logs (in.) harvested over time for every SEQNO managed under every prescription.

Format:

Line number, CLAMS SEQNO (plot) number, CLAMS prescription number, $value_1$, $value_2$, ..., $value_{20}$

where

line number	=	not used by the LAMPS simulation model, but acts as a reference number for a line of data. Range 1–*n*
CLAMS SEQNO (plot) number	=	CLAMS forest inventory plot number
CLAMS prescription number	=	itself
$value_1$	=	average log size (in.) in time period 1, for this plot, managed under this prescription

value$_2$ = average log size (in.) in time period 2, for this plot, managed under this prescription

value$_{20}$ = average log size (in.) in time period 20, for this plot, managed under this prescription

Example:

Note: Indented rows will be on the same line as the last nonindented row in the actual growth-and-yield file.

```
1,917,0,13.1,13,13.6,14.3,14.9,15.5,16.1,16.6,17.1,17.7,18.2,18.7,19.2,19.7,20.3,
  20.9,21.3,21.7,22.2,22.7
2,918,0,13.9,15.1,16.4,17.4,18,18.7,18.9,18.9,19.1,19.4,19.7,20.1,20.5,21,
  21.5,22.1,22.4,23,23.5,24.1
3,921,0,29.8,30.3,30.8,31.1,31.3,30.8,30.4,29.7,28.8,28.3,28,27.8,27.6,27.7,27.7,
  27.9,27.8,27.9,28.2,28.5
```

In this example, SEQNO 917, managed under prescription 0, has an average log size of 13.1 in. in time period 1, 13 in. in time period 2, 13.6 in. in time period 3, and so on.

Regeneration Timing

This ASCII text file describes whether a BSU can be clearcut during a time period, for every SEQNO managed under every prescription. The timing of thinnings prevents some stands from being clearcut. For example, the period in which a thinning occurs and the period after a thinning are off limits to clearcut harvesting. These are normal, accepted practices in forest management.

Format:

Line number, CLAMS SEQNO (plot) number, CLAMS prescription number, value$_1$, value$_2$, ..., value$_{20}$

where

line number = not used by the LAMPS simulation model, but acts as a reference number for a line of data. Range 1–*n*

CLAMS SEQNO (plot) number = CLAMS forest inventory plot number

CLAMS prescription number = itself

value$_1$ = regeneration timing code in time period 1, for this plot, managed under this prescription, where 0 = cannot be clearcut and 1 = can be clearcut

$value_2$	=	regeneration timing code in time period 2, for this plot, managed under this prescription, where 0 = cannot be clearcut and 1 = can be clearcut
$value_{20}$	=	regeneration timing code in time period 20, for this plot, managed under this prescription, where 0 = cannot be clearcut and 1 = can be clearcut

Example:

```
363,1686,0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
364,1687,0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
365,1688,0,0,0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
366,1689,0,0,0,0,0,0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
367,1690,0,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
```

In this example, SEQNO 1686, managed under prescription 0, is available for clearcut during all time periods, while SEQNO 1689, managed under prescription 0, is unavailable during the first five time periods.

Stand Ages

This ASCII text file describes the age of a BSU over time for every SEQNO managed under every prescription.

Format:

Line number, CLAMS SEQNO (plot) number, CLAMS prescription number, $value_1$, $value_2$, ..., $value_{20}$

where

line number	=	not used by the LAMPS simulation model, but acts as a reference number for a line of data. Range 1–*n*
CLAMS SEQNO (plot) number	=	CLAMS forest inventory plot number
CLAMS prescription number	=	itself
$value_1$	=	stand age (yr) in time period 1, for this plot, managed under this prescription

$value_2$	=	stand age (yr) in time period 2, for this plot, managed under this prescription
$value_{20}$	=	stand age (yr) in time period 20, for this plot, managed under this prescription

Example:

```
1,917,0,43,48,53,58,63,68,73,78,83,88,93,98,103,108,113,118,123,128,133,138
2,918,0,33,38,43,48,53,58,63,68,73,78,83,88,93,98,103,108,113,118,123,128
3,921,0,82,87,92,97,102,107,112,117,122,127,132,137,142,147,152,157,162,167,172,177
4,922,0,193,198,203,208,213,218,223,228,233,238,243,248,253,258,263,268,273,278,283,288
5,923,0,70,75,80,85,90,95,100,105,110,115,120,125,130,135,140,145,150,155,160,165
```

In this example, SEQNO 917, managed under prescription 0, is age 43 during time period 1 and age 138 during time period 20.

CLAMS VEGETATION CLASSES

This ASCII text file describes the CLAMS vegetation class over time for every SEQNO managed under every prescription.

Format:

Line number, CLAMS SEQNO (plot) number, CLAMS prescription number, $value_1$, $value_2$, ..., $value_{20}$

where

line number	=	not used by the LAMPS simulation model, but acts as a reference number for a line of data. Range 1–*n*.
CLAMS SEQNO (plot)	=	CLAMS forest inventory plot number
number	=	CLAMS forest inventory plot number
CLAMS prescription number	=	itself
$value_1$	=	CLAMS vegetation class in time period 1, for this plot, managed under this prescription
$value_2$	=	CLAMS vegetation class in time period 2, for this plot, managed under this prescription
$value_{20}$	=	CLAMS vegetation class in time period 20, for this plot, managed under this prescription

Example:

```
1,917,0,12,12,12,12,12,12,12,12,12,12,12,13,13,13,13,13,13,13,13,13,13
2,918,0,8,8,8,8,12,13,13,13,13,13,13,13,13,13,13,13,13,13,13,13,14
3,921,0,14,14,14,14,14,14,14,14,14,14,14,14,14,14,14,14,14,14,14,14
```

In this example, SEQNO 917, managed under prescription 0, represents CLAMS vegetation class 12 during time periods 1–11 and vegetation class 13 during time periods 12–20.

ODF STRUCTURAL STAGE CLASSES

This ASCII text file describes the Oregon Department of Forestry (ODF) structural stages over time for every SEQNO managed under every prescription.

Format:

`Line number, CLAMS SEQNO (plot) number, CLAMS prescription number,` $value_1$, $value_2$, ..., $value_{20}$

where

line number	=	not used by the LAMPS simulation model, but acts as a reference number for a line of data. Range 1–*n*
CLAMS SEQNO (plot) number	=	CLAMS forest inventory plot number
CLAMS prescription number	=	itself
$value_1$	=	ODF structural stage class in time period 1, for this plot, managed under this prescription
$value_2$	=	ODF structural stage class in time period 2, for this plot, managed under this prescription
$value_{20}$	=	ODF structural stage class in time period 20, for this plot, managed under this prescription

Example:

```
1,917,0,3,3,3,2,3,2,2,2,4,4,4,4,4,4,4,4,5,5,5,5
2,918,0,3,2,2,2,2,2,2,2,2,2,4,4,4,4,4,4,4,4,5,5
3,921,0,4,4,4,4,4,4,4,4,5,5,5,5,5,5,5,5,5,5,5,5
```

In this example, SEQNO 917, managed under prescription 0, represents ODF structural stage class 3 during time periods 1–3, then class 2 during time period 4, then class 3 again during time period 5, and so on.

Output Files

runLAMPS.txt

This ASCII text file is produced when the user presses Go on the Main Menu window and is stored directly on the C:\ drive of a computer. All the assumptions developed by the user in the LAMPS interface are recorded in this file. The scheduling model reads this file and extracts the policy alternative parameters. Thus, this is an intermediate file (i.e., not a true reporting output) that holds all input parameters in a format that is readable to the harvest scheduling component of LAMPS.

An example of the beginning of this file is

```
LAMPS (LAndscape Management Policy Simulator) run parameters
Scenario: Base Policy - Middle West Megashed
12/21/2001
1:45:37 PM
==========================================
0.a.) CPP File:                          f:/Mwest01/cpp.exe
0.b.) Graphics directory:                F:/Mwest01/
0.c.) Make new megabin:                  0
==========================================
1.a.1.) BSU GIS data file:               F:/Mwest01/mwe_data.clm
1.a.2.) BSU Dev Zone data file:          F:/Mwest01/mwe_dev.clm
```

This file is useful because users can verify that all of the data specified in the interface (and saved in runLAMPS.txt) have been successfully entered and are ready to be used by the scheduling model.

This file can also be used in two other ways:

- It can be loaded back into the LAMPS interface, restoring all the parameters in a particular policy alternative. To do this, select File and then Load from the Main Menu window. The same file can also be created by selecting File and then Save from the Main Menu window. In this case, users have the opportunity to store the LAMPS run parameters in a file with the name and location of the file set by the user (and not limited to c:\runLAMPS.txt.)
- Users can modify runLAMPS.txt in a text editor, such as NotePad. We do not recommend that users edit this file in a text editor, as the location of data and number of data items are of critical importance for successful communication between the interface and the scheduling model.

runLAMPS.log

This ASCII text file records all of the processing steps completed by LAMPS, from reading the input parameters to scheduling forest management activities. It is stored directly on the C:\ drive of a computer. The beginning of this file shows all of the data that LAMPS has successfully read from runLAMPS.txt and describes the status of the scheduling model.

An example of this file is

```
Fri Dec 21 13:45:38 2001:  0  LAMPS (LAndscape Management Policy
                               Simulator)
Fri Dec 21 13:45:38 2001:  0  Copyright 2001
                              = = = = = = = = = = = = = = = = = = = = = = = = =
Fri Dec 21 13:45:38 2001:  0  Oregon State University

Fri Dec 21 13:45:38 2001:  0
Fri Dec 21 13:45:38 2001:  1  RUN.c: Set some arrays to null values
Fri Dec 21 13:45:39 2001:  1  RUN.c: Input parameters from LAMPS
                              = = = = = = = = = = = = = = = = = = = = = = = = =
                              interface
Fri Dec 21 13:45:39 2001:  1  Reading Parameters from runLAMPS.txt

Fri Dec 21 13:45:39 2001:  1
Fri Dec 21 13:45:39 2001:  1  CPP file:            f:/Mwest01/
                              cpp.exe
Fri Dec 21 13:45:39 2001:  1  Graphic directory:  F:/Mwest01/
Fri Dec 21 13:45:39 2001:  1  Parcel binary file: F:/Mwest01/XY.bin
```

This file is useful for three reasons:

(1) Users can verify that all of the data specified in the interface (and saved in runLAMPS.txt) have been successfully input into the scheduling model.

(2) The date and time of each portion of a LAMPS run is noted on the left-hand side of each line in the file, helping users understand how long it takes to perform each operation.

(3) Depending on the comments provided during a run, this file can indicate to users potential problems with the policy they are attempting to model. For example, a policy with several complex aspects, such as even flow, minimum harvest age, green-up requirements, clearcut size distribution, and timber volume targets, may not produce the average harvest age desired. Examining the average harvest age reported in this file can help users understand how harvest age reacts to changes in assumptions.

BSU_LRC.OUT

This ASCII text file is the first of five large files that can be created at the conclusion of a run. It lists the last regeneration cut timing of each BSU for the time periods specified by the user.

Format:

BSU, LRC_1, LRC_2, ..., LRC_n

where

BSU	=	BSU number
LRC_1	=	last regeneration cut recognized from the perspective of reported period 1
LRC_2	=	last regeneration cut recognized from the perspective of reported period 2
LRC_n	=	last regeneration cut recognized from the perspective of reported period n

Example:

```
1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,19,19
3,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
4,0,2,2,2,2,6,6,6,6,6,6,6,6,6,6,6,6,6,6,6
5,0,2,2,2,2,6,6,6,6,6,6,6,6,6,6,6,6,6,6,6
```

In this example, the user specified output for all 20 periods (only the first five BSUs are listed). There are no regeneration cuts during the planning horizon for BSU 1 or 3. There is only one regeneration cut in period 19 for BSU 2, and it is reported in period 20 that the last regeneration cut for BSU 2 was in period 19. BSUs 4 and 5 have regeneration cuts in periods 2 and 6. Periods 3 through 5 report that the last regeneration cut was in period 2. Period 6 is listed as the "last regeneration cut" for BSUs 4 and 5 in time periods 6–20 because, from the perspective of the reported time period, that was the last time a BSU was regenerated.

"Reported periods" do not necessarily correspond to actual time periods. For example, while the LAMPS simulation model may operate using 20 5-yr time periods, users may only desire to report a subset of the time period data (for example, periods 5, 10, 15, and 20, or four time periods). In that case, only four pieces of data will follow the BSU number, and these data represent the periods of interest (5, 10, 15, and 20), rather than periods 1–4. Below is an example of this type of file with data that correspond to those shown above:

```
1,0,0,0,0
2,0,0,0,19
3,0,0,0,0
4,2,6,6,6
5,2,6,6,6
```

The file size averages 5 bytes/BSU/time period reported. For example, reporting four time periods of information for 5 million BSUs requires about 100 MB of storage space. Also, the output may show regeneration cuts even though the grow-only management option has been selected; these are stochastic disturbances in the landscape and not clearcuts.

BSU_RX.OUT

This ASCII text file contains the numbers of the prescription applied to each BSU during any given time period. The file size averages 6 bytes of storage space/BSU/time period reported. For example, reporting four time periods with 5 million BSUs requires about 120 MB of storage space.

Format:

$BSU, RX_1, RX_2, ..., RX_n$

where

BSU	=	BSU number
RX_1	=	prescription used during reported period 1
RX_2	=	prescription used during reported period 2
RX_n	=	prescription used during reported period *n*

Example:

```
1,0,900,900,900
2,0,0,0,0
3,0,0,0,0
4,0,0,0,0
5,900,900,900,900
```

In this example, where four time periods have been reported, we find that BSU 1 changed from prescription 0 (grow only) to prescription 900 (a regenerated stand) sometime between the first and second time period reported. This could have resulted from either a clearcut or a stochastic disturbance. Thus, users can use this output file to determine whether a prescription assignment has changed.

BSU_SEQNO.OUT

This ASCII text file lists the forest inventory (SEQNO) plot numbers used to grow each BSU at any time during the planning horizon. SEQNO number 1 is nonforested. SEQNOs ranging from 900 to 3200 are “current stands”, or the initial representation of the landscape. SEQNOs 3200 and above are regenerated stands.

With this file, users can tell which SEQNO describes each BSU in a particular time period being reported. Users can also determine when a BSU becomes regenerated (through a clearcut or a stochastic disturbance).

Format:

BSU, $SEQNO_1$, $SEQNO_2$, ..., $SEQNO_n$

where

BSU	=	BSU number.
$SEQNO_1$	=	inventory plot used to represent the BSU, from the perspective of reported period 1.
$SEQNO_2$	=	inventory plot used to represent the BSU, from the perspective of reported period 2.
$SEQNO_n$	=	inventory plot used to represent the BSU, from the perspective of reported period n.

Example:

```
1,988,3227,3227,3227
2,1318,1318,1318,1318
3,987,987,987,987
4,994,994,994,994
5,3289,3289,3289,3289
```

In this example, BSU 1 changed from a current stand to a regenerated stand sometime between the first and second time period reported. BSU 2 stayed in the initial current stand (1318) for the entire simulation (although the trees in SEQNO 1318 grew during this period of time.) BSU 5 became a regenerated stand sometime between the start of the simulation and the first time period reported. If the first time period reported was time period 5, then the regeneration occurred sometime in periods 1–5. To determine exactly when this occurred, see BSU_LRC.out.

Note: A BSU can go from forest classification into development classification, but not from development back into forest (where an inventory plot number of 1 is nonforest or development classification).

BSU_TABLE.OUT

This ASCII text file reports which growth-and-yield model (or set of yield tables) was used to represent growth of each BSU. The codes for the growth-and-yield models are 1 = ORGANON, 2 = Zelig (fog), and 3 = Zelig (interior). All regenerated stands are grown in Zelig for the first 15 yr, then in ORGANON thereafter. However, the table reported for all regenerated stands is ORGANON (1).

Format:

BSU, $TABLE_1$, $TABLE_2$, ..., $TABLE_n$

where

BSU	=	BSU number.
$TABLE_1$	=	growth and yield table used to represent the BSU, from the perspective of reported period 1
$TABLE_2$	=	growth and yield table used to represent the BSU, from the perspective of reported period 2
$TABLE_n$	=	growth and yield table used to represent the BSU, from the perspective of reported period n

Example:

```
1,2,2,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
2,3,3,3,3,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
3,3,3,3,3,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
4,3,3,3,3,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
5,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
```

In this example, BSU 1 used the Zelig Fog growth-and-yield model for the first two time periods reported and the ORGANON growth-and-yield model afterward. The BSU was probably regenerated via either a clearcut or stochastic disturbance in the third time period reported. To verify this assumption, a user can check the output in BSU_LRC.out.

BSU_VEGCLASS.OUT

This ASCII text file lists the CLAMS vegetation classification (vegclass) of each BSU for requested periods. The CLAMS vegetation class assignment is obtained by examining the tree records in each SEQNO in the appropriate time period (stage of development) and under each prescription being used, and computing the CLAMS vegetation class based on a set of rules (percent basal area of hardwood and conifer, quadratic mean diameter, etc.).

Format:

$BSU, VC_1, VC_2, ..., VC_n$

where

BSU	=	BSU number
VC_1	=	CLAMS vegetation class used to describe the BSU, from the perspective of reported period 1
VC_2	=	CLAMS vegetation class used to describe the BSU, from the perspective of reported period 2

VC_n = CLAMS vegetation class used to describe the BSU, from the perspective of reported period n.

Example:

```
1,13,6,8,8
2,12,12,12,13
3,12,13,13,13
4,14,14,14,14
5,3,12,12,13
```

In this example, BSU 1 is described by CLAMS vegetation class 13 during the first time period reported, vegetation class 6 during the second time period reported, and vegetation class 8 during the third and fourth time periods reported. These classes are large conifer (13), hardwood (8), and medium mixed conifer/hardwood (8), allowing one to imagine or display the structural condition of this BSU over time.

LAMPS_Results.out

This report provides users with basic harvest statistics by landowner and period. Clearcut and thinning volumes are provided as totals and are grouped by softwood and hardwood harvests. Harvest volumes are reported in MBF/period and MBF/yr with the yearly figures being a 5-yr average of the period yields.

Example:

```
Landowner: 1 FEDERAL
==================  CLEARCUT ==================
period ---total---  ---softwood--  --hardwood--- ac/  ac/
(5yr)  MBF/per  MBF/yr  MBF/per  MBF/yr   MBF/per MBF/yr  per   yr
-------------------------------------------------------------
1       45147   9029    41832  8366       3315    663   1423  285
2       15656   3131    14683  2937        973    195    468   94
3       17277   3455    15720  3144       1557    311    704  141
4       14353   2871    13760  2752        592    118    586  117
5       15471   3094    14653  2931        818    164    609  122
6       10990   2198    10327  2065        663    133    400   80
7       16173   3235    14594  2919       1579    316    630  126
8       31021   6204    28965  5793       2056    411   1093  219
9       28210   5642    26478  5296       1732    346    922  184
10      42466   8493    39305  7861       3161    632   1229  246
11      23657   4731    21724  4345       1933    387    783  157
12      33878   6776    30988  6198       2890    578   1094  219
13      34111   6822    31835  6367       2276    455   1016  203
14      45771   9154    43122  8624       2649    530   1180  236
15      45451   9090    43933  8787       1518    304   1102  220
16      34294   6859    32932  6586       1362    272    760  152
17      40740   8148    39565  7913       1176    235    815  163
```

18	28886	5777	28209	5642	676	135	632	126
19	40869	8174	39516	7903	1352	270	671	134
20	42196	8439	41037	8207	1159	232	758	152

================= THINNING :=================

period	---total---		---softwood--		--hardwood--		ac/	ac/
(5yr)	MBF/per	MBF/yr	MBF/per	MBF/yr	MBF/per	MBF/yr	per	yr
1	43604	8721	37458	7492	6146	1229	6832	1366
2	53658	10732	47791	9558	5868	1174	6528	1306
3	73268	14654	66884	13377	6384	1277	6547	1309
4	83453	16691	76187	15237	7266	1453	5681	1136
5	74168	14834	68247	13649	5921	1184	4413	883
6	80611	16122	75383	15077	5227	1045	4308	862
7	81907	16381	77565	15513	4342	868	3702	740
8	81307	16261	77588	15518	3719	744	3359	672
9	4711	942	4459	892	252	50	258	52
10	5113	1023	4873	975	239	48	310	62
11	7419	1484	7155	1431	265	53	388	78
12	6782	1356	6541	1308	240	48	364	73
13	5417	1083	5226	1045	191	38	297	59
14	5256	1051	4938	988	318	64	322	64
15	7326	1465	7065	1413	261	52	385	77

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