

The Landscape Management System (LMS): Using Emerging Technologies in Forestry Applications

Problems facing natural resource managers have grown substantially more complex. Resource managers face the staggering task of assimilating vast amounts of information in many forms while developing harvest scenarios that comply with many new environmental regulations. A major challenge is to coordinate management activities on both temporal and spatial scales. This task is further complicated by frequent changes in natural conditions, public values, and environmental regulations. The Silvicultural Laboratory in the School of Forest Resources at the University of Washington, in cooperation with the U.S. Forest Service, has developed the Landscape Management System (LMS). This computer software system processes vast amounts of information, generates stand-landscape-scale silviculture options, and analyzes the consequences to assist strategic and operational management decisions.

What is the Landscape Management System?

LMS is a tool to evaluate forest management alternatives. It uses standard inventory information to integrate many analyses and predict complex changes in stands and landscapes over time. The Microsoft Windows-based system coordinates the flow of information among existing growth models, computer visualization software, and analysis tools to allow the user to simulate growth of stands and landscapes and view the outcomes using a "point-and-click" system. Output can be viewed as tables, stand and landscape visualizations, charts, and graphs. Outputs can include stand structures (several different classifications), standing and harvested volume (by species, size class, and/or log sort), wind and fire hazard, financial analyses, and habitat suitability indexes. The information can readily be transferred to standard spreadsheets, such as Excel, for further, user-specific analyses. Preferred management scenarios are developed in LMS by evaluating multiple projections that can be done either at the stand or landscape level.

Overview of the System

For maximum flexibility, LMS is designed as a modular system. Landscapes in LMS are organized as portfolios containing forest stand inventories, a growth model, stand boundaries, and a digital elevation model for the landscape. This means that the user can select different growth models or sources of inventory data and insert them in the system without disturbing the overall architecture of the system.

At the individual stand scale, growth models project changes in the stand. Silviculture treatments, such as thinning, regeneration, clearcutting, or selective

harvesting to user-defined specifications, can be modeled. The same process can be applied at the landscape scale. Data can be used to estimate desired conditions resulting from management alternatives. For example, tree "height/diameter" ratios are calculated as part of a stand's "wind hazard" analysis.

How LMS Works: An Example

Consider a forested landscape of 4,200 acres and 160 stands. Stand inventory data, landscape attributes, and GIS information for the landscape are loaded into LMS to create a portfolio. LMS output shows that approximately half of the landscape is composed of young plantations and the remainder is 50- to 70-year old stands. Two management alternatives for the next fifty years include the following plans:

- exclude harvesting
- combine commercial thinning and clearcutting in targeted stands.

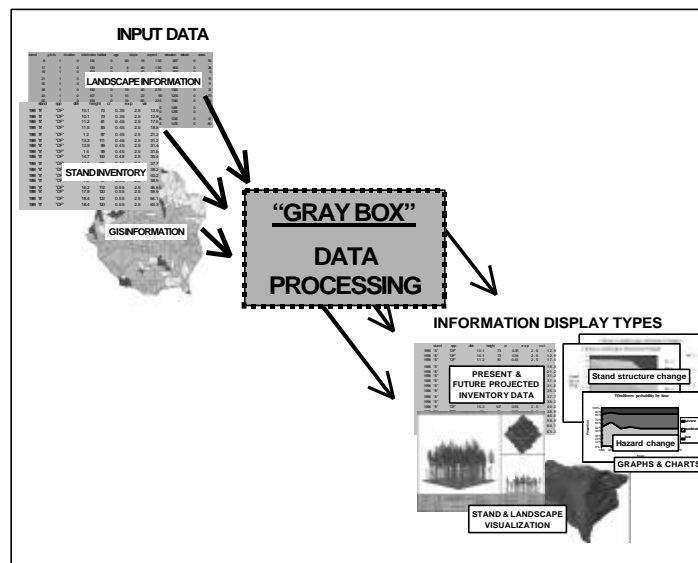


Figure 1. LMS is made up of over 40 programs that link and enhance existing growth models, spreadsheets, data bases, visualization tools, and perform other analyses.

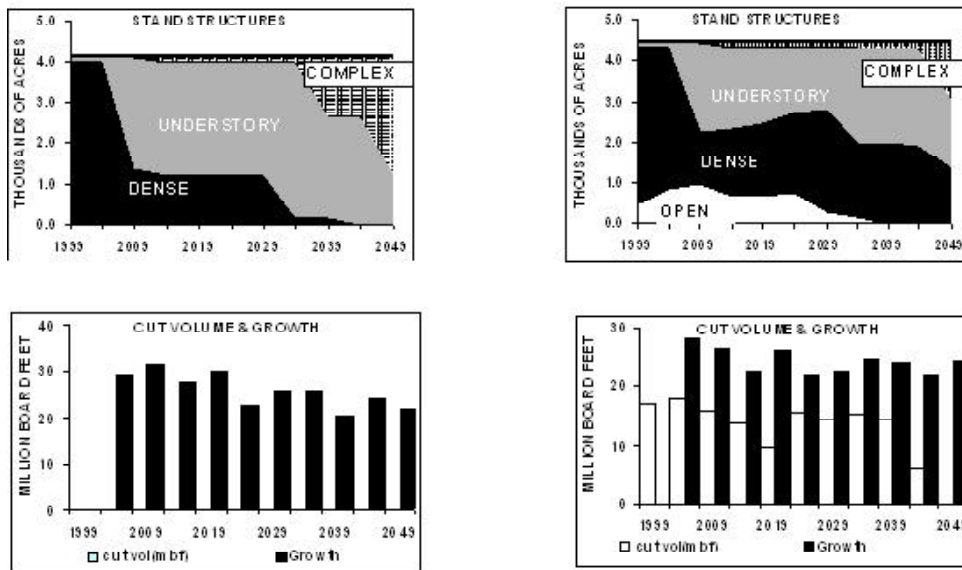


Figure 2. Example comparison of two LMS outputs—area by stand structure over time, and harvested volume and growth over time—from “No Action” alternative and “Thin and Harvest” alternative. Alternatives are described in text. Area consists of 160 stands totaling 4,200 acres. Many other outputs can be generated by LMS.

For simplicity, two of many criteria are shown in order to compare management scenarios:

- wood volume—both standing and harvested
- forest structure classes—savanna, open, dense, understory, and complex (other classifications could be used)

Results

Modeling outputs, including stand visualization simulations, provide users with information to compare a variety of management alternatives. For example as shown in Figure 2, during 50 years, the projected landscape conditions and outputs differ considerably under the two scenarios. Comparisons like these help foresters and the general public understand the tradeoffs associated with forest management for complicated, multiple goals at a scale many times more complex than the simple example shown.

Summary

As demands on forests increase, managers must be able to create and assess innovative management options. LMS offers a tool to assess the impacts of various management plans. It addresses the uncertainty, complexity, and tradeoffs associated with managing forest resources. It synthesizes data from growth models, forest inventories, and GIS databases to implement landscape management. By providing

graphical, tabular, and visual outputs, LMS explores current and projected stand- and landscape-scale conditions and generates a comparative analysis of potential risks and benefits. LMS also provides tools for outreach and classroom education .

Availability

The LMS+ series can be downloaded free of charge from the Landscape Management website (below). It is also available on CD. Tutorial, companion programs, and e-mail “help” address are also listed on the Web site.

LMS runs on most computers capable of running Microsoft Windows as specified below:

- IBM PC 486 running Windows 98 (minimum)
- Pentium II 500mHz running Windows 98/NT/2000 (recommended)
- 32mb RAM required; 64 or greater recommended
- 20mb hard drive space required; data and intermediate files can use more space
- Microsoft Excel and Powerpoint are helpful for further analyses

Contact:

For more information about LMS, visit the University of Washington Silviculture Laboratory Web site at: <http://silvae.cfr.washington.edu/index.html>.