Computer Technology Helps Family Forest Owners in Pennsylvania and Washington

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ABSTRACT

The use of computer technology in managing family forestlands is increasing. Growth, treatment, and visualization models can facilitate better understanding and communication of sustainable forest management concepts. Learning to use these tools can be challenging, and the technology has not been widely adopted at the landowner level. The Landscape Management System and associated Inventory Wizard have made these technologies easier to use and more accessible to landowners. Programs in Pennsylvania and Washington are promoting the use of this system by family forest owners.

Keywords: technology, growth models, visualization, family forests

Many stakeholders involved in the forestry profession are aware that sustainable forest management decisions on family forests are critical. These lands are important for ecological and social services and the renewable raw material they provide for wood-related industries. Helping family forest owners achieve sustainable forest management goals has long been a challenge for foresters. The reasons are many, but one of the key issues over time is that of communication (Jones et al. 1995). Sometimes our failure to communicate effectively relates to an inability to set aside biased beliefs (Jones et al. 1995) and other times it is likely a failure to translate our experience and knowledge into "pictures" that convey meaning to the intended users.

Computer technology has revolutionized communication in forestry. Growth models, treatment models, and visualization software can be used to better communicate management options and outcomes. The Landscape Management System (LMS) and associated Inventory Wizard have made

these technologies more accessible to a wider range of users. Programs in Pennsylvania and Washington State are promoting broader use of these technologies among family forest owners.

Pennsylvania Experience

With more than half a million individual owners controlling nearly three-quarters of the state's forests, Pennsylvania serves as an excellent example of issues associated with managing diverse ownerships. Few of these owners cite timber production as the primary reason for owning land, but nearly half will harvest trees during their tenure (Birch 1996). Communicating the concepts and approaches of sustainable forest management to these owners is complicated. The sheer number of people, tenure of ownership, and the highly variable and complex concepts of forest ecology and silviculture often confound the situation. Since 2001, Cooperative Extension in the School of Forest Resources at Penn State University has been using visualization software to help

communicate the short- and long-term impacts of harvesting decisions.

A recent study evaluated the use of the visualization software to increase the understanding of commonly used forest management concepts. The study showed that the computer-generated images communicated management concepts that were easy for adult learners to understand (Roth 2003). Thus, a new approach for communicating concepts once conveyed by using stand and stock tables or perhaps a traditional slide show has a colorful visual twist, which captures the audience's attention while conveying critical resource management information (Roth 2003).

Washington Experience

In Washington, family forest owners own 3.1 million acres, accounting for 19% of the forestland in the state (Ballinger et al. 1997). Family forest owners have many different management objectives and face increasing demands for public values and increasingly complex regulations. Washington State University Extension forest stewardship educational programs help family forest owners meet their unique management objectives while helping them make decisions that are ecologically sound, economically sustainable, and socially acceptable (Baumgartner et al. 2003, Creighton et al. 2002, 2004). New computer technology and the Rural Technology Initiative (RTI) partnership with the University of Washington are providing innovative and useful tools to help

landowners make more informed management decisions (Hanley et al. 2002).

The Rural Technology Initiative (RTI) was established in 2000 as a partnership between the University of Washington College of Forest Resources and Washington State University Extension to facilitate better implementation of technology in rural, forest-based communities across the state. RTI has worked to both encourage and train landowners and foresters to use available forest technologies. Funding is provided by Congressional appropriation through USDA Forest Service Cooperative Programs.

Technology

One of the key technologies that RTI has promoted is the LMS. The LMS was first developed by the Silviculture Laboratory at the University of Washington College of Forest Resources, which continues to develop it in cooperation with the Yale School of Forestry and Environmental Studies. LMS integrates publicly available growth, treatment, and visualization models (McCarter et al. 1998, 2001). These models include, among others, the Forest Service's Forest Vegetation Simulator (FVS), which has geographic variants covering most of the nation (Wykoff et al. 1982, Wykoff 1986), and the Stand Visualization System (SVS), which generates realistic images of forest stands (McGaughey 1997). Programs such as these have been available independently for years. They often have been DOS-based applications with command line interfaces that can be challenging even for advanced computer users. LMS has brought these programs together under a single, Windows-based (Microsoft, Redmond, Washington), user-friendly graphical user interface (GUI). This allows users to "point and click" their way through the system with LMS seamlessly transferring data between different models behind the scenes.

LMS has been used in Washington to communicate forest management concepts with landowners, while in Pennsylvania SVS has been used as an output of Suppose, a stand-alone GUI for the FVS model, to provide images from growth projection software. In both states, the complex process of entering forest inventory data into the system has discouraged broader adoption of the technology among family forest owners. In response to this, RTI developed a new program called the LMS Inventory Wizard, which makes it easy for users to load their forest data into LMS (Zobrist et al. 2004).

Figure 1. Example of LMS Inventory Wizard's on-screen forms, which guide users through the data entry process.

Since the conclusion of Roth's study (Roth 2003) and the development of the LMS Inventory Wizard, Cooperative Extension at Penn State University has advocated the use of LMS at the landowner level to accomplish stand visualizations and other modeling tasks.

Forest inventory data at the stand level are necessary to run LMS. The Inventory Wizard guides users through the entire inventory process. For users who plan to collect field data, the Inventory Wizard determines data needs based on geographic location and provides customized inventory forms to collect the data. For users who have existing inventory data, these same features can serve to organize data and prepare it for entry into the LMS system. Once data are ready for computer input, the Inventory Wizard provides a series of intuitive, on-screen forms with drop-down menus and contextual help that guides users through each entry field (Figure 1). The Inventory Wizard then will format the data and load it into LMS in one step, at which point users can begin working with SVS, FVS, and all the other tools included in the system.

Facilitated Learning

LMS and the Inventory Wizard are particularly well suited to address adult learning needs. Andragogy, a concept of adult learning, was introduced by Knowles (1984) and focused on adult learning styles. It suggests that adult learners have motivations and ex-

pectations that differ from younger people. Adults learn with a purpose; they have specific interests and seek information to answer their questions. Adults also learn well from pictures; often, long and protracted discussions do not meet their needs. Finally, combining these two ideas, adults want information that relates to their situation or context. Broad, generalized ideas, such as theoretical silviculture applications, are not as helpful as examples drawn from their knowledge or even their own land (Knowles 1984).

Using LMS and the Inventory Wizard, it is possible to construct localized examples of forest conditions. In fact, data can be collected easily during a brief field visit. This generally includes attributes such as species, dbh, height, and status (alive or dead) of trees on one or more plots. This information can be loaded quickly into LMS using the Inventory Wizard so that images can be generated that reflect conditions participants have just seen. This often removes some doubts participants may have about the system's capabilities. Then, by using the integrated growth and projection component of the system, we can impose treatments and demonstrate impacts on the forest stand relative to desired future conditions and timber sustainability. It is one thing for participants to be told that diameter-limit harvests will shift species composition; it is another thing to see how a poorly designed harvest will shift species composition in a mixed species
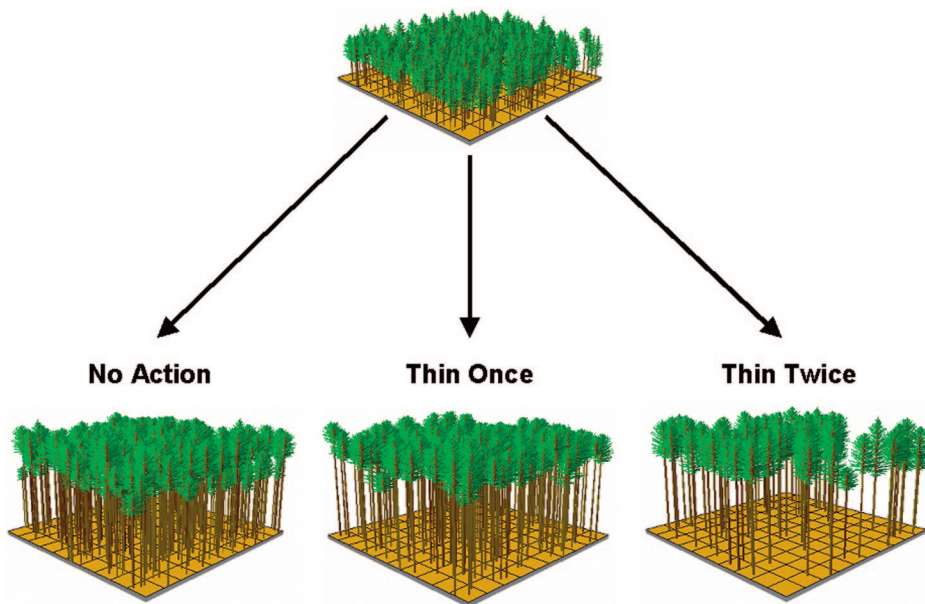
Figure 2. Images generated by LMS can help communicate the implications of different management alternatives. In this case, a 20-year-old Douglas-fir plantation is shown in the present and projected 30 years in the future under three alternatives: (1) no action, (2) thin now to 200 trees per acre (TPA), and (3) thin now to 200 TPA and again in 20 years to 75 TPA.

hardwood stand. Roth (2003) found that participants understood concepts conveyed with the visualization models and the images and projections are even more convincing when shown with data participants helped collect.

The Inventory Wizard is a critical innovation for transferring computer technology to the individual landowner level. It is critical for two reasons. First, it allows them to collect and enter data either from their land or from the local forest, which empowers them with a sense of ownership. That is, they collected the data, have a sense of understanding, because they were in the forest, and saw the actual conditions—the situation is real and not contrived. Second, when the data are then "grown" or projected into the future, with a base scenario of "do nothing" or with a given silvicultural prescription, their interest is piqued (Roth 2003) because the system shows them their future forest and the immediate and long-term impacts of their decision. Participants acknowledge satisfaction to watch their decision change the forest, learn how it changed it, and have the opportunity to "put trees back on the stump" and consider other options. Running realistic simulations on the computer takes away some of the risks and apprehensions associated with managing a forest. It also makes for easy visual comparisons between different management

options as shown in Figure 2 where three potential management pathways for a 20-year-old Douglas-fir plantation have been generated using LMS. Another output possibility, a landscape view of mixed oak forests produced by *Envision* (McGaughey

2004) shown in Figure 3 presents the stand's geographic location and permits, through SVS, evaluation of each stand using one or more management scenarios.

Our experience working with landowner audiences in Pennsylvania has revealed a need to exercise care when delivering this technology to groups. Educators should focus on one of two topics: (1) what the programs can show participants about forest management decisions in their area or (2) how to run the programs and the intricacies and shortcuts involved. Much of the time, it is easier said than done. An intrigued participant can ask a technical question about how the program produced a particular result, and an extended digression on an often-complex topic can leave other participants lost or confused. Attempting to blend the two topics is not recommended, although because of the constraints of outreach activities, one may feel compelled to attempt it. When designing a program on visualization, it is critical to assess your course objectives, state the intended purpose, and stick to it! Invite those interested in learning more details to ask questions at the conclusion of the discussion or to attend another meeting focusing on how to actually run the program.
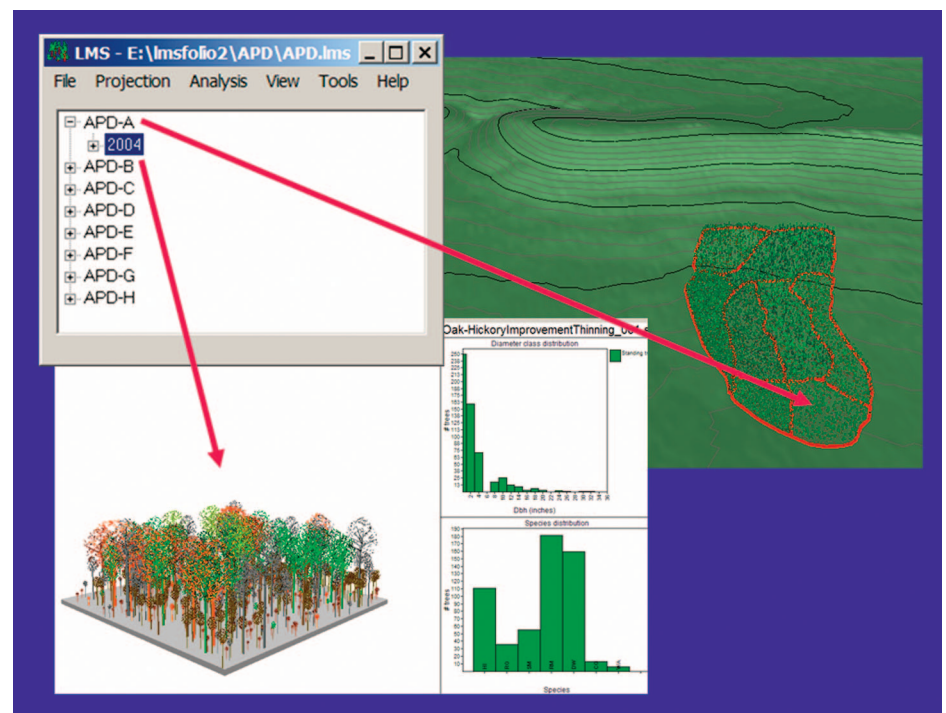

Figure 3. The LMS user interface with inventory data, a landscape view of a mixed oak forest in central Pennsylvania generated by *Envision*, and the stand level visualization generated by SVS.

Outreach

Pennsylvania and Washington are continuing to emphasize and refine this technology as an educational tool. In Pennsylvania, extension outreach programs are offered to landowners and resource professionals around the state, including industry professionals, foresters with the Pennsylvania Department of Conservation and Natural Resources (DCNR) Bureau of Forestry, private consultants, and natural resource educators. Special training seminars have involved the statewide Pennsylvania Forest Steward volunteers, who participated in daylong in-service training where they collect inventory data, load it into LMS using the Inventory Wizard, and generate visualizations. For the past two summers, high school students involved with the Pennsylvania Agricultural Governor's School participated in data collection and visualization generation. Those students were fascinated by the forestry lessons they gleaned from the morning-long workshop. Currently, projects to expand the application of visualization software are underway with the state Forest Stewardship Program, The Nature Conservancy, and the DCNR Bureau of Forestry.

Similarly, in Washington, RTI offers multiday training courses in the use of LMS and the Inventory Wizard for professionals. In addition to these intensive courses, RTI also is promoting the technology at forestry education seminars, family forest field days, and similar events, where it has received a very positive response from landowners and foresters. Use of LMS and the Inventory Wizard has been incorporated into Forest Stewardship Coached Planning short courses that are offered through Washington State University Extension. All these programs are enhancing interest in the technology and furthering dialogue about forestry and natural resource management. It is our hope that interest in this technology will continue to expand beyond Pennsylvania and Washington. The application of the visualization software to communicate sustainable timber management is new and evolving. Audiences indicate encouraging levels of understanding, retention of ideas and concepts, and convey enhanced acceptance of silvicultural concepts (Roth 2003). In the case of forest owners in Pennsylvania, program participants indicate a higher likelihood of hiring a forester and avoiding nonsustainable practices such as high grading and diameter-limit harvesting. Future evaluations will have to occur to learn if intent translates into action.

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