

Technology Transfer from Research to Forestry Applications: Using the Landscape Management System (LMS)

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Natural resource professionals face the staggering task of assimilating vast amounts of information to determine the future impacts of forest management and other disturbances. LMS was designed to integrate the best available science in projecting a comprehensive array of both ecological and economic outputs. It is a Microsoft Windows® software application, developed at the University of Washington, that coordinates the flow of information among growth models, computer visualization software, and analysis tools for forest management planning. LMS enables users to understand the complex impacts of treatments and disturbances and the tradeoffs between different outcomes in order to select strategies that produce the most desirable future conditions. This Fact Sheet summarizes who has been using LMS and their applications.



The Rural Technology Initiative (RTI), a UW/WSU technology transfer center, has used LMS to address a number of forest management issues:

- Ten case studies on the impact of the Washington Forest and Fish Regulations (FFR) on smaller-parcel private owners in western Washington revealed that the economics are not viable for some owners, that land conversions represent an increasingly high risk, and that alternative management plans to the FFR regulations are needed to sustain forest management. LMS has been used to create templates for alternative management plans that are easily implemented by landowners regardless of computer skills.
- Nine case studies on the impact of the FFR on family forestland owners in eastern Washington demonstrated high economic costs and management constraints that will lead to forest health problems in riparian areas. LMS supported the develop of alternate plans that improved forest health while providing sustainable cash flows. Findings became a part of the governor appointed Forest Health Working Group's report.
- WSU Extension agents are using LMS in Coached Forest Stewardship Planning short-courses to help small, private owners collect inventory data for their tree farm and simulate future economic, ecological, and aesthetic conditions.
- For the development of a multi-owner Habitat Conservation Plan (HCP), LMS was used to simulate many alternative thinning treatments and assess their potential to meet the regulatory objective to provide old-forest functionality to protect species at risk. Alternatives that provide both old-forest function and viable economic returns can be used as templates for easy application by small owners and better understanding by regulators.

- At a mothballed nuclear power plant site (Satsop, WA), Fish and Wildlife Department (FWD) Habitat Evaluation Procedures were used with LMS to develop management plans for habitat protection as measured by Habitat Suitability Indices. The project demonstrated that FWD evaluation procedures could be reliably simulated with LMS leading to the selection of a preferred management plan.
- Forest fuel removal analysis for the Okanogan and Fremont National Forests demonstrated thinning strategies that can reduce fire risk at low cost. The analysis included impacts on habitat and carbon sequestration model links that show enormous potential for carbon storage by treating stands to avoid fires (600 million tons per forest). Using LMS to design treatments that reduce fire risk made it possible to directly assess the many avoided costs that resulted from reducing fire risk, including fire fighting costs, fatalities, facility losses, regeneration costs, timber and habitat losses etc., justifying fire risk reduction treatments as a good investment with a quick payback.
- Carbon storage was modeled for King County Government showing expected increases in storage under current management paradigms.
- The impact of treatments designed for more acceptable aesthetics were evaluated for several local governmental agencies with LMS, showing the cost of treatments for comparison with aesthetic perceptions and other outputs.

Tribes: Quinault Nation, Makah Nation, Yakama Nation, Confederated Tribes of Colville, The Spokane Tribe, The Lummi Tribe, The Nooksack Tribe, The Stillaguamish Tribe, The Yurok Tribe (CA) and attendees to the Intertribal Timber Council Meetings have received training on LMS.

The Consortium for Research on Renewable Industrial Materials (CORRIM, a non-profit consortium of 15 research institutions evaluating Life Cycle analysis) used LMS for evaluating the impact of management alternatives. Their research findings used LMS to track carbon storage in the forest, in products with fossil fuel displacement through co-generation, and through product substitution. CORRIM findings demonstrate that accounting for product carbon storage is very important and if used with carbon credit incentives can promote intensive forest management, which would in turn substantially increase the carbon pool in construction while also displacing fossil fuel intensive products and reducing subsequent green house gas emissions, a critical impact not yet recognized by the Kyoto protocol.

Washington DNR land managers participated in a training exercise using LMS to achieve a wide-array of desired future conditions/objectives resulting in a better understanding by the managers of the requirements needed for success in achieving objectives. LMS is also used for evaluation and display in the timber sales program.

Community College educational users: Green River Community College, Spokane Community College, Peninsula Community College, Heritage College, NW Indian College (all in WA), Mt Hood Community College (OR), Central Oregon Community College (OR), Chemeketa Community College (OR) have used LMS in order to more efficiently educate students on causal affects in forestry. LMS is an integrated part of courses in at least four of these colleges.

USDI BLM used LMS to develop long-term management plans in several regions.

PNW Research Station has used LMS to compare the impacts of regulations across several states and to compare tree list simulation methods to other methods for broad regional assessments.

Four thousand copies of the LMS software have been downloaded from the web by users or distributed by request on CD-ROM. Since LMS is available on the web, and is in use by educational institutions, there are many users outside of Washington. A partial list of other organizations/places where LMS is used is provided below:

- USDA FS Olympic, Gifford Pinchot, Mt. Baker-Snoqualmie, Colville, Okanogan, Wenatchee - all national forests in Washington; Fremont, Blue River forests in Oregon; Bent Creek Experimental Forest in Asheville; a trial landscape on the Tongas National Forest in Alaska; the Allegheny National Forest; and Bridger-Teton National Forest.
- Washington DNR research projects (Skagit, Capital, and Olympic Experimental State Forests, The Stewardship Forestry Program and the Small Forest Landowner Office)
- Oregon Department of Forestry used LMS research in developing their structure-based management plans for state forests.
- Higher Education users: U of Washington, U of Maine, Yale University, Michigan Technical Institute, Pennsylvania State University, U of Missouri, West Virginia U, U of Massachusetts, Brevard College NC.
- Continuing Education: WSU Extension (coached forest stewardship planning short courses to help small forest landowners build forest plans).
- Economic Development and Conservation users and applications: Columbia Pacific Resource Conservation and Economic Development District (WA), Lakeview Resource Council (OR), Okanogan Land Trust (WA), Satsop Forest (WA).
- Rural Communities and Utilities: City of Colville, Bremerton Municipal Watershed, Family Forest Foundation (Programmatic Habitat Conservation Plan for small forestland owners).
- Olympic Natural Resources Center, Forks (WA).
- Pack Forest (UW's research and demonstration forest) and Yale-Meyers Experimental Forest.
- Washington Forestry Consultants (20+ can be listed, many more are likely).
- Washington tree farmers (many).
- Pennsylvania tree farmers (many supported by Pennsylvania State University Extension use of LMS).
- Recent use by Yale and other eastern universities have resulted in new applications: InterForest Consulting for the Lyme Timber Co. in New Hampshire; Waynesville Watershed of Haywood County, North Carolina; an experimental watershed by Potlatch in Idaho; Mead Westvaco Experimental Forest, West Virginia; Yale and the USDA Forest Service Laboratory in Stoneville, Mississippi have applications in Yazoo National Wildlife Refuge, Delta National Forest in Mississippi, and Dewey Wills Wildlife Management Area, Louisiana.
- Doris Duke Charitable Trust research projects are applying LMS for certification/sustainability analysis on: Seven Islands Land Co., Maine; New Hampshire Fish and Game Dept.; Fort Lewis Army Base, WA; Collins Pine Timber Co., OR; Pt. Blakely Timber Co., WA; Oregon Dept of Forestry.

Why use LMS?

LMS uniquely and efficiently provides multiple outputs from simulations of forest disturbances or treatments and is available from the web so that any consortium of interested groups, large or small, have easy access without incurring prohibitive development costs.

Outputs of key interest based on simulated stand growth across landscape scales include tree lists, log sorts from treatments, costs, revenues, economic measures such as forest and land value, habitat measures, wind throw risk, fire risk, insect risk, carbon pools from the forest through to markets, visual characteristics, and more. LMS provides a suite of programs that supports a comprehensive analysis of forest management alternatives complete with tabular, graphical, and visual displays of the consequences of forest disturbances or treatments. Extended public benefits from prior investments in many USFS developed programs such as the Forest Vegetation Simulator (FVS), the Fire and Fuels Extension (FFE), Envision, and others are realized from public distribution of LMS. FVS variants exist for all regions in the US. Other growth models are available and/or can be included.

LMS also uses visualization software developed by USFS for stand or landscape visualizations and links to FFE, a fire risk estimation program developed by USFS. LMS runs under Windows® and links tabular output to Excel® spreadsheets for easy analysis and transfer to other programs. LMS functionality is enhanced by filters that have been designed to accommodate inventory and GIS data in many formats. It includes a log bucking model to feed the financial analysis. It incorporates the best science available for modeling habitat suitability and biodiversity index models; carbon sequestration models; fire risk, wind risk, and economic models; and can easily be modified to incorporate new or better models as they become available. LMS incorporates the best available science for ecosystem management modeling under a program control system that is easily managed by forest managers and planners. LMS additionally serves as an attractive educational tool for teaching cause and effect relationships between management and outcomes.

Key software programs used by LMS include FVS, Organon (DLL version), SPS, SVS, EnVision, bucktree (internal log bucking), cwdsim (internal snag/log simulator), fvsfilter (FVS interface), RegenEditor (internal regeneration editor), str_class (internal structural stage classification program), CORRIM's carbon accounting program, an optimum log-cutting algorithm and links to FFE. An Inventory Wizard simplifies inventory data collection and input. An Economatic program offers simple analysis of forest and land values, cash flow (costs and revenues), and other economic measures.

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