ESTIMATING RESPONSES OF WILDLIFE TO SILVICULTURAL TREATMENTS USING THE LANDSCAPE MANAGEMENT SYSTEM

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INTRODUCTION

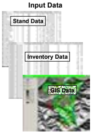
Wildlife species and habitats have become increasing public concerns because of perceived negative effects of forest management activities on wildlife through habitat changes. One example is converting mature and "old-growth" forests to intensively managed plantations that provide different habitats for different species. Developing wildlife habitats in young stands and maintaining habitats in older stands through alternative silvicultural manipulations may be necessary to ensure the sustainability of wildlife and forest management.

Tools exist in the forest management and wildlife biology fields to model both forest growth and wildlife populations and habitats. The tools that each field has at their disposal have common features, specifically tree-based measures - such as tree species, sizes, and densities - as inputs and outputs, although they are not frequently used together. Integration of the forest growth models and wildlife habitat models within the Landscape Management System (LMS) allows land managers and planners to simulate alternative silvicultural treatments and estimate current and future effects on wildlife prior implementing treatments on the ground.

LANDSCAPE MANAGEMENT SYSTEM (LMS)*

LMS is an forest growth and management simulation system which integrates forest inventory, stand, and GIS data, forest growth models, visualization systems, and analysis programs.

Input Data



Inventory Data

Simulation Systems

Forest Growth
- USFS Forest Vegetation Simulator (FVS)
- ORGANON

Silvicultural Treatments
- Thinning
  - Defined by TPA, BA, SDI, or % left after thinning
  - Diameter and species-specific treatments available
- Regeneration
  - Planting
  - Natural ingrowth

Simulated Inventory Data

Analysis Programs

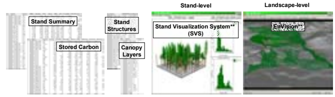
Several analysis programs are available within LMS. These programs perform calculations on current and future inventory data, as projected by growth models, and stand data. Resulting summary data ranges from standard forestry metrics, such as average diameter of the stand or total volume of the stand, to ecological metrics, such as canopy layers and carbon stored in the stand. Analysis programs are easily modified or created using the Python interpreted scripting language.

Output Summary Data

Outputs of Current and Simulate Future Conditions

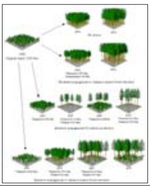
Tabular Summaries | **Visual Summaries**

Stand-level | **Landscape-level**



SILVICULTURAL TREATMENTS

Many realistic alternative silvicultural pathways can be quickly and easily simulated. Users define treatments with LMS. LMS then modifies current inventory tree records to represent current treatments in the current simulation period. Stands are then grown using forest growth models. Treatments in future periods are simulated modifying projected future inventory tree records. Using the treatment and growth simulation systems within LMS many alternative silvicultural treatments can be quickly and easily assessed for current and future values.



WILDLIFE MODELS

Custom analysis programs can be created for LMS using the Python scripting language to answer questions that are currently not addressed by the current analysis programs. Questions regarding wildlife habitat and populations are not answered directly with basic LMS analysis programs. To address these questions existing models relating to wildlife habitats and populations were found in the literature and converted into algorithms within LMS for habitat and population response analyses.

Four classes of wildlife models have been implemented within LMS. All use predominantly tree-based measures on a stand-by-stand basis that can be summarized for landscape-level analyses.

1. Forest Structure

   Estimates forest structures which have been defined as habitats for specific species.
   - Wildlife Habitat Relationships for Oregon and Washington (Johnson & O'Neil, 2001)
   - WA State DNR Northern Spotted Owl Habitats (WAC 222-16-085)

2. Presence/Absence

   Defines stands as "Habitat" if all criteria are satisfied or "Non-habitat" if any one criteria is not satisfied for species guilds or individual species. From work provided by Doug Runde of Weyerhaeuser Company.
   - Aquatic salamander & conifer nester guilds
   - Beaver, northern goshawk, and hermit warbler individual species

3. Habitat Suitability Index (HSI)

   Rating habitat quality on a 0.0 – 1.0 scale. All models are from US Fish and Wildlife Service. Implemented as part of a Habitat Evaluation Procedure for Satsop Forest in southwest Washington State (Marzluff, *et al*. 2002, Ceder 2001)
   - Pileated woodpecker, southern-red-backed vole, Cooper's hawk, spotted towhee

4. Population Response

   Relationships between stand attributes and potential population densities for individual species
   - 17 bird species relationships from Hansen, *et al*. (1995)
   - Roosevelt elk (Ceder & Comnick 2001)

* More information on LMS is available at http://lms.cfr.washington.edu

** SVS and EnVision were developed by Bob McGughey of the Cooperative for Forest-Systems Engineering (FORSYS), a partnership between the USDA Forest Service, Pacific Northwest Research Station and the University of Washington, College of Forest Resources.

References:
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- Hansen, A. J., et al. (1995). "Bird habitat relationships in natural and managed forests in the west Cascades of Oregon." Ecol Appl 5(3): 555-569.
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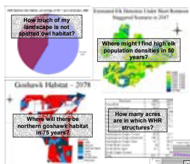
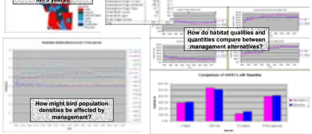
HABITAT ANALYSIS OUTPUTS

With the wildlife habitat and population response models implemented in LMS questions regarding the effects of silviculture and harvesting on wildlife habitat and populations can be answered. This is especially important in the context of evaluating alternative silvicultural pathways prior to implementation. Output from LMS is in tabular form that can be further analyzed using other tools such as Microsoft Excel™ for charting or ESRI ArcView™ for mapping.





CONCLUSIONS

With more demands being put on our forests to ensure sustainable forest management, tools are needed to explain results of proposed forest management, including alternative silvicultural pathways, in new ways. An example of this is estimating potential future wildlife habitats and/or populations using current and proposed alternative silvicultural pathways.

Tools can be created to better explain the results of proposed forest management and experiment with new silvicultural pathways. These need not be created from scratch. Tools exist in many fields relating to forests to perform many types of analyses. Two examples are forest managers using growth models and wildlife managers having wildlife and habitat models. These tools often have common inputs and can be brought together resulting in new science-based tools.

Using tools such as the Landscape Management System alternative silvicultural pathways can be developed, the results of the treatments projected into the future, and outputs examined prior to pathway implementation. Analyses from many perspectives, ranging from harvest volume output, to jobs created, to atmospheric carbon sequestered, to wildlife and habitat values helps to assess many aspects of sustainable forest management. Assessing many outputs from the forest will help ensure forests are managed in a sustainable manner and avoid many unintended consequences.