RTI FACT SHEET **#27**

Rural forest community issues *January 2004*

Wildlife Habitat Modeling and Assessment using LMS

Rural Technology Initiative

Forests of the Pacific Northwest are the home for a multitude of wildlife species. Society is placing increasing demands on forest managers to provide wildlife habitat for a wide diversity of both game and non-game species. To meet these demands, many types of wildlife habitat models have been developed that can estimate both habitat quality and quantity based on existing forest inventories. As natural resource issues become more complex, the effects of forest management on wildlife habitat, and associated trade-offs between management alternatives, modeling, assessing and communicating across multiple disciplines will become increasingly important. To meet assessment and communication needs, the Landscape Management System (http://lms.cfr.washington.edu,) which links the habitat models with current and future forest inventories, projected with forest growth and yield models, to give current and potential future habitat conditions created by forest growth and management, was used. Two case studies using LMS demonstrate that providing wildlife habitat and harvest revenues within a forest management framework are not mutually exclusive. The second case also indicates that maintaining forests in a high-risk condition for wildfire may put wildlife habitat at risk.

Case Study 1: Satsop Forest

The first case study uses a Habitat Evaluation Procedure (HEP, USDI 1980) within LMS to meet the requirements of a wildlife mitigation agreement on Satsop Forest in southwest Washington (Ceder, 2001, URL: http://silvae.cfr.washington.edu/satsop-plan). The agreement focused on the habitat needs of 5 species, using previously defined Habitat Suitability Index (HSI) models. The species were chosen to track changes in a variety of habitat types: with the spotted towhee tracking changes in brush habitats; the Cooper's hawk tracking changes in mixed hardwood conifer forests; southern red-backed vole tracking changes in closed canopy forests; the pileated woodpecker tracking changes in mature forests; and black-tailed deer, a habitat generalist, tracking overall changes.

Twenty potential management alternatives for Satsop Forest were developed ranging from 'no harvest' to 40-year clearcut rotations with varying amounts, timings and levels of thinning between these extremes. Assessments of each alternative determined the amount of habitat and wood volume that could be produced over an 80-year planning horizon. Results indicate amounts of available habitats, similar to no management or passive management, could be created through active management (Figure 1). Through multiple thinnings, which tree size and develop multi-storied stands, harvest increased from 1.4 MMBF under the current mitigation agreement to 5.4 – 30.1 MMBF with active management. Some species may not be sensitive to forest management, even under the highest level of harvesting. Cooper's hawk, southern red-backed vole, and spotted towhee habitat values changed little as harvesting increased. In contrast, habitat available for the pileated woodpecker, which is associated with older forest structures, decreased with higher harvest levels.

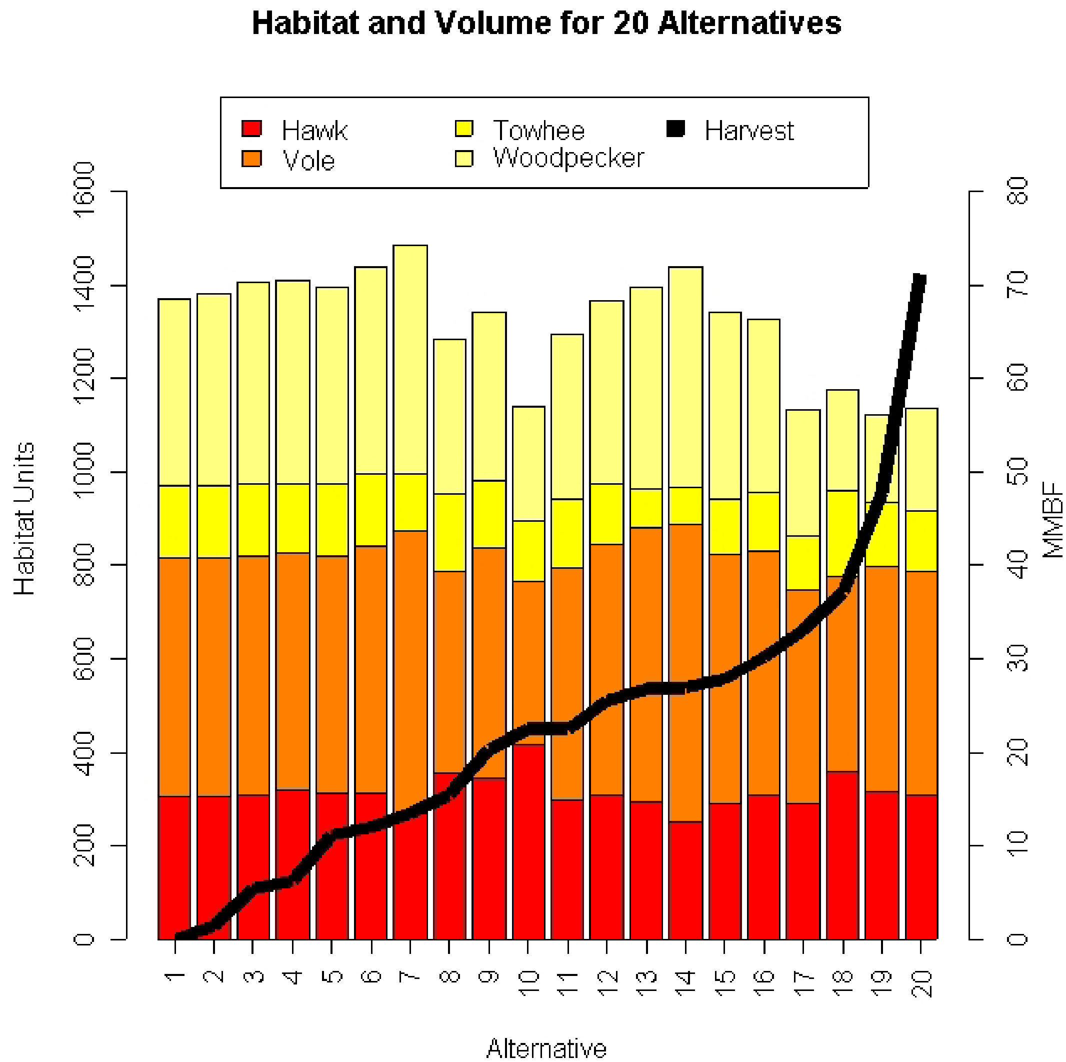

Figure 1: Habitat and volume production for 20 potential 80-year management alternatives for Satsop Forest.

Case Study 2: Fuel Removal Strategies for Fremont and Okanogan National Forests

Habitat modeling using LMS was included in the Investigation of Alternative Strategies for Design, Layout and Administration of Fuel Removal Projects (Mason, and others 2003). This project examined effects of five fuel removal treatments and a wildfire simulation using data from the Fremont and Okanogan National Forests. Changes in wildlife habitat were assessed for northern goshawk, Lewis woodpecker, white-headed woodpecker, and Williamson's sapsucker using HSI models, while the wildlife habitat matrices in the ICBEMP report were used for the Canada lynx, grizzly bear, pileated woodpecker, northern flying squirrel, and Townsend's big-eared bat were assessed using the . Assessments of lynx and grizzly were done only for the Okanogan National Forest, as they do not occur on the Fremont National Forest.

Initial habitat and fire risk relationships showed that stands with high and moderate risk provided more habitat for the majority of the species than the low risk stands on both forests. This was particularly evident in species that are associated with older forest structures such as the northern goshawk, pileated woodpecker, and northern flying squirrel on both forests and the lynx and grizzly on the Okanogan (Figures 2 and 3).

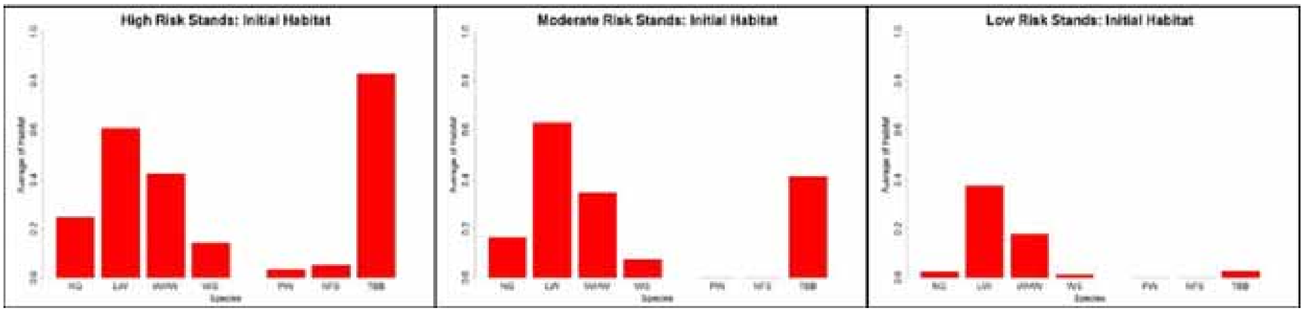

Figure 2: Habitat levels for High, Moderate, and Low risk stands on Fremont NF. Wildlife species, left to right in each graph are: Northern goshawk, Lewis woodpecker, white-headed woodpecker, Williamson's sapsucker, pileated woodpecker, northern flying squirrel, and Townsend's big-eared bat.

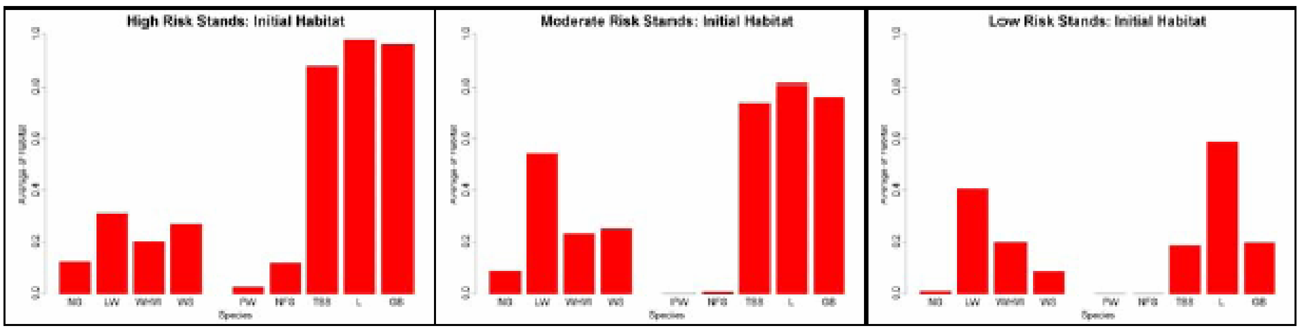

Figure 3: Habitat levels for High, Moderate, and Low risk stands on Okanogan NF. Wildlife species, left to right in each graph are: Northern goshawk, Lewis woodpecker, white-headed woodpecker, Williamson's sapsucker, Pileated woodpecker, northern flying squirrel, Townsend's big-eared bat, Canadian lynx, and grizzly bear.

Response to treatment from species varied among species and treatments. Species are associated with older forest structures had habitat levels more severely impacted by the treatments than species associated with open forest structures. As stands were opened more through thinning, habitat decreased, when compared with no the no action alternative, for most species. One exception was the Lewis woodpecker, which thrives in open forests. When regeneration was included available habitat increased, but still remained lower than no action. Grizzly habitat on the Okanogan, though, which was originally reduced by the thinning, returned to levels higher than no action after 30 years. All treatments that reduced fire risk also reduced habitat levels. Wildfire simulations greatly reduced or eliminated habitat for all species associated with older forest structures. Both forests are in fire regime condition class 2 or 3 (FRCC, Hann, and others 2003), meaning that the fire regime has diverged significantly from historical conditions. With this in mind, questions can be asked about historical habitats for some of the species now present in the dry interior forests: Are current habitat levels, because of fire exclusion and suppression, reflective of historical levels? If forest managers perform fuel treatments to reduce the current fire risk, how will habitat availability for old forest species be effected? And, if habitats for some species are at high risk and need to be preserved, what are the most effective methods of creating low risk fuel and fire breaks to protect the high risk areas from wildfire?

Discussion and Conclusions

HEP, HSI, and the ICBEMP WHR matrix models implemented in LMS are only the beginning of the possibilities for habitat analysis. Other WHR approaches are the Johnson & O'Neil (2001) WHR matrices and the California Wildlife Habitat Relationships (CWRH, URL: http://www.dfg.ca.gov/whdab/html/cwhr.html) with forest structures quantified by forest inventory measures. Empirical models can derived from tree measures, as with the bird population models of Hansen (1995), who generated regression models relating trees per acre in specific diameter classes to bird population. The Washington State Department of Natural Resources quantified Nesting, Roosting and Foraging (NRF) habitats for the northern spotted owl based on tree and snag measures (WAC 222-16-085). Implementation of all these examples, and other models based on tree and snag measures, is possible within LMS and give managers and planners the ability to analyze many alternatives quickly and easily while holding all assumptions constant. This consistency in assumptions provides uniform comparability between simulations so relative tradeoffs between alternatives can be assessed.

Limitations to this approach are the lack of understory models that are compatible with forest growth models and the need to field verify the habitat models. Understory vegetation is a key component for many wildlife species and associated models. Local understory/overstory relationships can be developed, as in the Satsop Forest project, which derived mean values for understory measures for each forest cover type, but it will increase the cost and complexity of an analysis. Until regional models of understory/overstory relationships are developed, the number models that can be implemented in LMS is limited. Many of the available habitat models are theoretical and have not been field verified. Without field verification, outputs from habitat models may be suspect. With these limitations in mind, habitat analysis using habitat models implemented in LMS, or other forest simulation tools, can be a very useful tool to assess habitat availability, risks to habitat, and communicate the potential tradeoffs between management regimes.

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