ESTIMATING HISTORICAL RANGE AND VARIATION OF LANDSCAPE PATCH DYNAMICS WITH SIMULATION MODELING

Russell A. Parsons and Robert E. Keane
USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, P.O. Box 8089, Missoula, MT 59807

Paul F. Hessburg
USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, 1133 North Western Avenue, Wenatchee, WA 98801

ABSTRACT

Landscape patterns in the northwestern United States are mostly shaped by the interaction of fire and succession, and conversely, vegetation patterns influence fire dynamics and plant colonization processes. Historical landscape pattern dynamics can be used by resource managers to assess current landscape conditions and develop target spatial characteristics for management activities. The historical range and variability (HRV) of landscape pattern can be quantified from simulated chronosequences of landscape vegetation maps and can be used to 1) describe temporal variation in patch statistics, 2) develop limits of acceptable change, and 3) design landscape treatment guidelines for ecosystem management.

Although this simulation approach has many advantages, the limitations of this method have not been explored in detail. To demonstrate the advantages and disadvantages of this approach, we performed several simulation experiments using the spatially explicit, multiple pathway model LANDSUM (a LANDscape SUccession Model) to quantify the range and variability in six class and landscape pattern metrics for four landscapes in the northwestern United States. First we applied the model to spatially nested landscapes to evaluate the effect of landscape size on the HRV pattern metrics. Next we averaged the HRV pattern metrics across maps generated from simulation time spans of 100, 500, and 1,000 years and intervals of 5, 10, 25, and 50 years to assess optimal output generation parameters. We then altered the elevation data layer to evaluate effect of topography on pattern metrics, and cut various shapes (circle, rectangle, square) from a landscape to examine landscape shape and orientation influences. Then we altered the input vegetation maps to assess the influence of initial conditions on landscape metrics output. Finally, a sensitivity analysis of input fire probabilities and transition times was performed. Results indicate that landscapes should be quite large to simulate a realistic fire pattern. Landscape shape and orientation are critically important to quantifying patch metrics. Simulation output need only be stored every 20–50 years, but landscapes should be simulated for long time periods (>1,000 years). All landscapes are unique, so conclusions generated here may not be entirely applicable to all western U.S. landscapes.

Citation: Parsons, R.A., R.E. Keane, and P.F. Hessburg. 2004. Estimating historical range and variation of landscape patch dynamics with simulation modeling [abstract]. Page 246 *in* R.T. Engstrom, K.E.M. Galley, and W.J. de Groot (eds.). Proceedings of the 22nd Tall Timbers Fire Ecology Conference: Fire in Temperate, Boreal, and Montane Ecosystems. Tall Timbers Research Station, Tallahassee, FL.