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Simulation of Burn Probabilities and Fire Size Distributions for the Western United States

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This simulation research was conducted on behalf of five U.S. land management agencies in order to develop a fire risk assessment system for the contiguous land area of the United States. The requirements included generating burn probabilities, characterizing fire behavior variation, and providing a means to evaluate sensitivity to both fire suppression and fuel treatment effects.

This paper presents the methods and results of wildland fire size distributions and burn probabilities that were simulated for large units of land that together comprised the entire western United States. The outputs of these simulations are compared with historic data from Federal lands. The methods involved simulating fire ignition and growth for 10,000 to 20,000 "years" of artificial weather. The fire growth simulations were based on previously published methods (Finney 1998, 2002) and, when run repeatedly with different weather and ignition locations, produce fire behavior distributions at each landscape location (e.g. a "cell"). The artificial weather was generated using 1) a time-series analysis of recorded fire danger rating indices for each land unit that served as a proxy of daily and seasonal variation in fuel moisture, and 2) distributions of wind speed and direction from weather records in each unit. The simulations also required spatial data on fuel structure and topography which were provided by the LandFire project for the study area (http://www.landfire.gov). The occurrence and frequency of ignitions were simulated stochastically using empirical relationships that predicted the probability of large fire occurrence from the fire danger rating index. Fire suppression was represented using a modeling analysis of 453 large fires that was used to predict the probability of fire containment (by suppression forces) based on independent predictors of fire growth rates and fuel type. Fuel treatments were implemented into the fuel structure of the landscape to evaluate how these affected both burn probabilities and the fire behavior variation. Comparisons reveal that the simulation produced fire size distributions with slopes similar to the observed fire size distributions (on log-log axes). This is interpreted to mean that the actual fire size distributions are a function of the joint distributions of spatial opportunities for fires to grow to different sizes (dependent on fuels and ignition location) and the temporal variability in the length of conducive weather sequences. Burn probabilities compare well to observed patterns of high and low probabilities across the western U.S. that span two orders of magnitude. Simulated values generally came within a factor of 2 or 3 of observed values. The interesting part of this research is the practical aspect of performing fire simulations at very broad scales for purposes of operational planning and perhaps ecological research.

Finney, M.A. 1998. FARSITE: Fire Area Simulator – model development and evaluation. USDA For. Serv. Res. Pap. RMRS-RP-4. 47p

Finney, M.A. 2002. Fire growth using minimum travel time methods. Can. J. For. Res. 32(8):1420-1424.