Wildfire Risk Assessment and Wildfire Simulation in Southeastern United States

Mountainous Areas: Great Smoky Mountains National Park

ABSTRACT

The Great Smoky Mountains National Park (GRSM) encompasses 520,191 acres (210,521 ha) of protected forest located along the North Carolina – Tennessee border in the southeastern United States. The Park is 95% forested and contains over 100 different species of trees which constitute the most extensive collection of virgin hardwood forest in the eastern United States. It is one of the most visited National Parks in the U.S. with over 9 million visitors annually.

From 1942 to 2009 there were 795 unintentional, reported fires within the Park. Even with the significant amount of wildfires in GRSM and the Southern Appalachian Mountains, research concerning wildfire risk and behavior in these areas is limited. For this thesis, a wildfire risk assessment was conducted for the Park and, for areas found to be at the highest risk, potential wildfire behavior was modeled using the FARSITE fire area simulator software.

Wildfire risk was assessed using spatial and statistical analysis of historic wildfire locations relative to common variables generally found to be influential in wildfire ignition: elevation, aspect, slope, vegetation type, and distance to human structures. Wildfire risk was found to be highest in the northwestern and southwestern portions of the Park with lower risk in the eastern portion due to higher elevations and their associated vegetation types.
Wildfire modeling showed that fires within the highest risk areas produced relatively lower rates of fire spread (relative to fires in the Western U.S.) and that vegetation type, wind speed, and wind direction appear to be the key factors influencing fire spread. Wildfire simulations also revealed that many natural barriers located in the Park may inhibit potential fire growth.