National Forest Fire Susceptibility Assessment using the EOSD

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Abstract

Fire is the main natural disturbance of the boreal forest and an important driver of ecosystem dynamics. Increased fire activity of both natural and anthropogenic origin is expected with changing climate scenarios. The focus of this research is to create a fire susceptibility assessment for Canada that will identify areas of risk based on fire history and landscape composition. Earth observation for sustainable development (EOSD) data will be used as a baseline representation of landscape structure in the year 2000. Forest fire information from 1970 to 2008 will be used to identify fire event areas. We will develop fire expectations by Canadian ecozone with respect to specific aspatial and spatial fire characteristics such as size, frequency, and spatial pattern. These results will provide Canada with a nationwide fire risk assessment to be used by forest fire managers. Preventative efforts can then be focused on anticipated problem areas.

Background and Relevance

Fire is the dominant natural disturbance in Canadian forests (Johnson, 1992). It is a critical factor in driving many ecological processes in addition to shaping the landscape composition and carbon cycling. Forest fire activity is expected to increase under changing climate (Flannigan *et al.* 2005) and while number of fire ignitions have decreased in recent years, three of the top four seasons for largest area burned have occurred within the 1990s (Stocks *et al.* 2002). Continuation of these trends will cause changes in natural forest regimes and increase the ~2 million ha of forest burned annually (Stocks *et al.* 2002). Future forest management requires expectation estimates of which ecozones, habitats, and landscapes will be at highest risk for fire ignition and spread. Additionally, the spatial nature of fire size, pattern, and convergence needs to be characterized for prospective model input (Wimberly 2004). The goal of this research is to create a national forest fire susceptibility assessment to identify areas of risk based on fire trends from 1970 to 2008.

Methods and Data

Landscape characteristics for Canada are represented circa 2000 by the EOSD. This cover map is based upon a compilation of over 480 Landsat scenes focusing on the forested area of Canada (Wood *et al.* 2002; Wulder *et al.* 2003). Land cover is classified similar to the hierarchical NFI land cover classification system and differentiates by vegetation type and vegetation density (Wulder and Nelson, 2001). Forest fire event polygons will be used to represent area burned by fire from 1970 until 2008. Fires are identified using satellite detected hotspot data from two sensors, the Moderate Resolution Imaging Spectroradiometer (MODIS) and the Advanced Very High Resolution Radiometer (AVHRR) (De Groot *et al.* 2007).

We will develop fire expectations and distributions by Canadian ecozone with respect to specific local aspatial and spatiotemporal fire characteristics such as size, frequency, and spatial pattern. This may be used as a baseline for an early warning system of uncommon fire years. Spatiotemporal pattern will be quantified for use in fire risk models. We will also compare these spatial and aspatial characteristics to land cover to determine how topography and forest fragmentation affect forest fire. Pre fire landscape conditions will be examined to summarize fire-susceptible topography whereas post fire landscape will describe successive growth.

Results and Conclusions

A national fire susceptibility assessment will be created to identify areas of wildfire risk in Canada's forest. Forest fire managers may use this product as a means to anticipate problematic locations and work to prevent or mitigate detrimental effects with increasing fire activity. Climate change and carbon flux modelers may use this assessment to add fire expectation into their spatial models.

This is the first step towards spatial-temporal analysis of fire ignition and spread patterns. It is important to obtain current measurements of fire size, pattern, spread rate, and convergence by ecozone for comparison with future datasets. Expected evolution of fire dynamics can eventually be incorporated into the fire susceptibility assessment.

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