CHARACTERIZING VARIABILITY IN CROWN FIRE SPREAD USING GRIDDED THERMOCOUPLE DATA

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ABSTRACT

Rate of spread is a key fire behavior characteristic. Spread rate is thought to accelerate after ignition to an equilibrium value, then vary over the burning period due to variation in wind speed and direction, and fuel conditions. Using data from gridded thermocouples, we mapped the progress of the fire front and characterized variation in fire spread rate through the International Crown Fire Modelling Experiment test plots, Northwest Territories. Thermocouple–datalogger instruments were placed at 45 grid points in the test plots prior to ignition and recorded temperatures throughout the fires. Fire arrival times were determined from the time–temperature traces, and surface-fitting techniques in ArcView Spatial Analyst software were used to determine time surfaces. Contours or iso-chrons of the time surface represent the fire front location over time, while the inverse slope of the time surface represents the fire spread rate. We found that the use of gridded thermocouple data coupled with spatial analysis is a very efficient, reliable, and low-cost means of characterizing fire front shape, position, and spread rate over time, although, depending on the density of the grid, some detail is lost due to smoothing. In addition to characterizing variation in fire spread and identifying periods of equilibrium spread, the data allowed us to determine the fire position in relation to other instrumentation over the progress of the fires.

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FIRE-INDUCED SHRUB AND TREE MORTALITY IN BOREAL FOREST CROWN FIRES

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ABSTRACT

Current methods for predicting fire-induced mortality in shrubs and trees are largely empirical. These methods do not exhibit a wide range of applicability and are not readily linked to duff burning, soil heating, and surface fire behavior models. New models for duff burning and soil heating are currently available and a new physics-based surface fire model is expected within the year. This study presents a methodology for quantitatively characterizing the heating of a plant stem in a fire. We also present data and simulations based on a one-dimensional model of the heat transfer within the stem. These data and models are being developed with the objective of completing a system for predicting shrub and tree mortality caused by heating of the roots and/or bole by surface fires and smoldering duff fires as a function of biological and environmental conditions. Such a system will provide information needed by land managers to accurately evaluate fuel management alternatives prior to applying fire to the landscape.

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