SOIL HEATING ASSOCIATED WITH CROWN FIRES

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ABSTRACT

Soil heating associated with large-scale crown fires is of great concern to land managers. The relationship between crown fire intensity and fire severity is not clear. Crown fires have been linked to varying degrees of soil heating and changes in soil properties such as fertility, soil seed bank viability, and hydrophobicity. This study focused on improving our understanding of soil temperature changes that resulted from the short-duration, high-intensity, radiant-energy pulse characteristic of crown fires. This work was conducted as part of the International Crown Fire Modelling Experiment, Northwest Territories, Canada.

Burning units were established on the Northwest Territories study site and burning was conducted from 1996 to 2001. The canopies of the burn units were dominated by jack pine (*Pinus banksiana*) with a variable understory of black spruce (*Picea mariana*). The units had negligible slope. Duff thickness ranged from 0 to 5.0 cm. We established 10 × 10-m plots in each burning unit and each plot was instrumented with thermocouples and heat flux sensors. Soil temperature profile measurements were taken at 1.0-cm depths in the duff and mineral soil. Radiant heat flux measurements were taken from the forest floor viewing up through the canopy on paired exposed and duff-covered surfaces.

Peak heat flux measurements ranged from 80 to 200 kW/m^2, and preliminary analysis showed that the peak flux measured at the soil surface were consistent with peak fluxes measured at various heights in the canopy by other researchers. The soil temperature profiles showed there were limited soil heating changes of <20 °C in the upper 1.0 cm directly associated with crown fires. Soil temperature modeling using the radiant flux data was consistent with measured temperature profiles and predicted only limited temperature change.

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