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Spatial variability of peatland depth of peat burn following wildfire in relation to latent energy fluxes using lidar and thermal IR imagery

Laura Chasmer (1), Linda Flade (1), Chris Hopkinson (1), Richard Petrone (2), and Kevin Devito (3)

(1) Dept. of Geography, University of Lethbridge, 4401 University Drive, Lethbridge Alberta, Canada (laura.chasmer@uleth.ca, linda.flade@uleth.ca, c.hopkinson@uleth.ca), (2) Dept. of Geography and Environmental Management, University of Waterloo, 200 University Ave. West, Waterloo, Ontario, Canada (rich.petrone@uwaterloo.ca), (3) Dept. of Biological Sciences, University of Alberta, Edmonton Alberta, Canada (kdevito@ualberta.ca)

Landscape changes in the hydrological characteristics of wetlands in some parts of the Boreal region of Canada are occurring as a result of climate-induced feedbacks and anthropogenic disturbance. Peatlands are largely resilient to wildfire, however, natural, climatic and anthropogenic disturbances can change surface water regimes and predispose wetlands to greater depth of peat burn. Over broad areas, peat loss contributes to significant pollution emissions, which can affect community health.

In this study, we a) quantify depth of peat burn and relationships to modelled latent energy fluxes derived from thermal infrared imagery within boreal peatland environments and transition zones found in the Boreal Plains ecoregion of western Canada; and b) examine the impacts of wildfire on post-fire ground surface energy balance to determine how peat loss might affect local hydro-climatology and surface water feedbacks. High-resolution optical imagery, pre- and post-burn multi-spectral lidar and coincident airborne thermal infrared imagery are integrated to identify multiple complex interactions within peatlands. Lidar-derived depth of peat burn varies between 0.01 and 0.08 cm (average; stdev = 0.08 to 0.14 m) compared with measured, demonstrating the utility of lidar change detection for depth of burn, especially as depth of peat burn increases. Greatest depth of burn occurs along riparian margins and treed peatlands (average = 0.23 and 0.19 m), with loss of peat biomass to a depth of up to 0.9m. Evaporative fluxes also vary significantly between land cover types, where treed and open peatlands have the greatest magnitude of pre-to post-fire differences in latent energy exchanges and ET fluxes (0.23 and 0.21 mm per hour, respectively) during periods of high evaporative demand. Land cover surface temperature differences between burned and unburned peat are up to 30 deg C, illustrating that the scorched land surface affects the partitioning of sensible and latent heat from hydrologically sensitive peatland environments.