Cross-scale controls on carbon emission from boreal mega-fires

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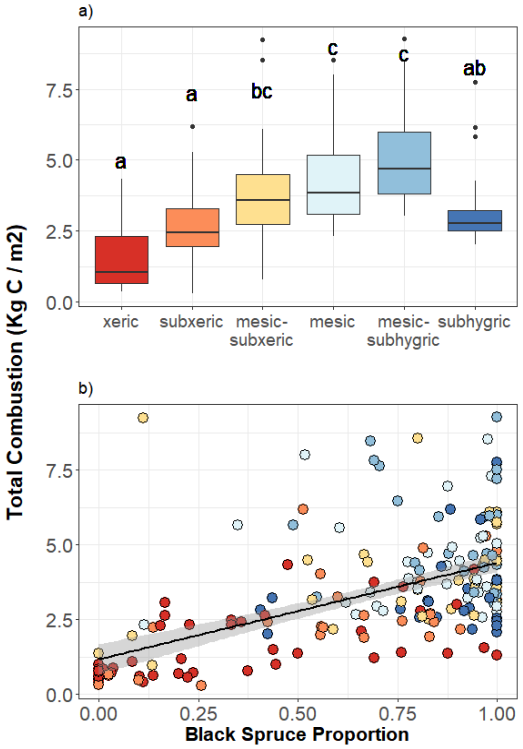
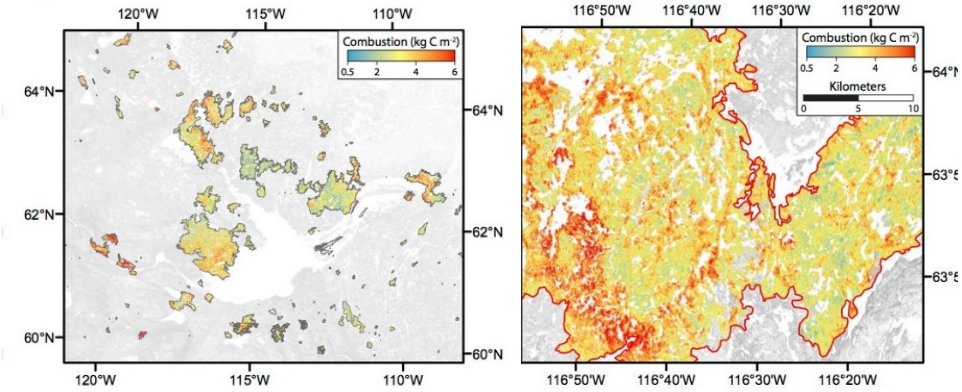
Background: Changes to the boreal forest fire regime are expected to strongly increase combustion emissions of carbon (C) which could alter regional C balance and positively feedback to climate warming. In order to accurately estimate C emissions and thereby better predict future climate feedbacks, there is a need to understand the major sources of heterogeneity that impact C emissions at different scales.

Analysis: We assessed both aboveground and soil organic layer C combustion at 211 burned plots in the NWT, Canada after an unprecedentedly large area burned in 2014. Our goal was to determine the major drivers in total C emissions, as well as to develop a high spatial resolution model using remote sensing to scale emissions in understudied regions of the boreal forest.

Significance: Our results highlight the need for regionally specific calibrations that account for spatial heterogeneity in order to accurately model emissions at a continental scale.





Findings

Field Data

Black spruce stands located at landscape positions with intermediate drainage contribute the greatest to C emissions relative to other stands types and/or landscape positions.

Remote Sensing

We estimated a total of 94.3 Tg C emitted from 2.85 Mha of burned area across the entire 2014 NWT fire complex. This mega-fire year in the NWT offset half of Canada's annual terrestrial Net Ecosystem Production.