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Ecosystem Carbon Emissions from 2015 Forest Fires in Interior Alaska

Abstract.

In the summer of 2015, hundreds of wildfires burned across the state of Alaska, and consumed more than 1.6 million ha of boreal forest and wetlands in the Yukon-Koyukuk region. Mapping of 113 large wildfires using Landsat satellite images from before and after 2015 indicated that nearly 60% of this area was burned at moderate-to-high severity levels. Field measurements near the town of Tanana on the Yukon River were carried out in July of 2017 in both unburned and 2015 burned forested areas (nearly adjacent to one-another) to visually verify locations of different Landsat burn severity classes (low, moderate, or high).

Results: Field measurements indicated that the loss of surface organic layers in boreal ecosystem fires is a major factor determining post-fire soil temperature changes, depth of thawing, and carbon losses from the mineral topsoil layer. Measurements in forest sites showed that soil temperature profiles to 30 cm depth at burned forest sites increased by an average of 8° - 10° C compared to unburned forest sites. Sampling and laboratory analysis indicated a 65% reduction in soil carbon content and a 58% reduction in soil nitrogen content in severely burned sample sites compared to soil mineral samples from nearby unburned spruce forests.

Conclusions: Combined with nearly unprecedented forest areas severely burned in the Interior region of Alaska in 2015, total ecosystem fire emission of carbon to the atmosphere exceeded most previous estimates for the state.