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Fire caused changes in CO_2 and CH_4 fluxes in Siberian permafrost forests.

Egle Köster (1), Frank Berninger (1), Kajar Köster (1), Heidi Aaltonen (1), Xuan Zhou (1), Huizhong Zhang-Turpeinen (2), Anatoly Prokushkin (3), and Jukka Pumpanen (2)

(1) Institute for Atmospheric and Earth System Research/Forest Sciences, University of Helsinki, Helsinki, Finland, (2) Department of Environmental and Biological Sciences, University of Eastern Finland, Kuopio, Finland, (3) V.N. Sukachev Institute of forest SB RAS, Krasnoyarsk, Russia

About 70% (more than 520 million ha) of the world's boreal forests are situated in Russian Federation. It is estimated that these forest contain about 119 Pg of carbon, of which about 75% is stored in soils and forest floor material. This gives a significant role to the boreal forest of this region in global C balance. Generally these high latitude ecosystems are C sinks, as they absorb atmospheric carbon dioxide (CO_2) through photosynthesis, and methanotrophic microorganisms of these well-drained and dry soils consume methane (CH_4).

Climate change induced rising air temperatures and precipitation rates in boreal ecosystems are changing the fire regimes (intervals, severity, intensity, etc.). Main impacts of the fire to the forest ecosystems are reported to be the changes in soil physical and chemical characteristics, vegetation stress, and degradation of permafrost and increased depth of active layer. Changes in these characteristics should consequently have an impact on the dynamics of CO_2 and CH_4 fluxes.

We have studied the changes in CO_2 and CH_4 fluxes in boreal forest areas in central Siberia with permafrost base. The main aim was to estimate how time since the last forest fire influences the soil CO_2 and CH_4 fluxes in permafrost areas. We compared the fire chronosequence of areas (last fire occurred in 2015, 1993 and 1960) to a control area that had no fire for at least 100 years. We estimated the significance of experimental factors such as time since fire, soil temperature, soil moisture, depth of active layer, living and dead tree biomass and biomasses of grasses and mosses to influence the GHG fluxes across a fire chronosequence.

The soils in our study acted as source of CO_2 and sinks of CH_4. The Obtained results confirm that the impacts of a forest fire on CO_2 and CH_4 fluxes are long-lasting in Siberian boreal forests – lasting even more than 50 years.