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Pumpanen, Jukka

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## Long term effects of fire on carbon and nitrogen pools and fluxes in the arctic permafrost and subarctic forests (ARCTICFIRE)

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Boreal forests, which are to a large extent located on permafrost soils, are a crucial part of the climate system because of their large soil carbon (C) pool. Even small change in this pool may change the terrestrial C sink in the arctic into a source with a consequent increase in CO<sub>2</sub> concentrations. About 1% of boreal forests are exposed to fire annually, which affects the soil and permafrost under them. Thawing of permafrost increases the depth of the active layer containing large C and N stocks. In addition to temperature, the decomposition of soil organic matter depends on its chemical composition which may also be affected by fires. Part of the soil organic matter is turned into pyrogenic C and N resistant to decomposition.

We studied the effect of forest fires on soil greenhouse gas fluxes (CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O) and biogenic volatile organic compound fluxes using portable chambers. The amount of easily decomposable and recalcitrant fractions in soil organic matter were determined with water, ethanol and acid extraction, and the natural <sup>13</sup>C and <sup>15</sup>N abundances as well as chemical quality with Fourier Transform Infrared Spectroscopy (FTIR) were studied. Also, changes in microbial community structure and composition were analyzed with next generation pyrosequencing. Our preliminary results indicate that soil CO<sub>2</sub> effluxes were significantly decreased immediately after the fire, and the recovery to pre-fire level took several decades. Soils were a small sink of CH<sub>4</sub> and a source of N<sub>2</sub>O in all age classes, and the CH<sub>4</sub> uptake was increased and N<sub>2</sub>O fluxes decreased still 20 years following the fire. A clear vertical distribution was observed in the amount of extractable soil organic matter the amount of extractable organic matter being highest in the soil surface layers and decreasing with depth. The natural <sup>13</sup>C and <sup>15</sup>N abundances and FTIR spectra and changes in microbial community composition are still under analysis.