Geophysical Research Abstracts
Vol. 19, EGU2017-13341, 2017
EGU General Assembly 2017

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

Jukka Pumpanen (1), Kajar Köster (2), Heidi Aaltonen (3), Egle Köster (4), Xuan Zhou (5), Huizhong Zhang-Turpeinen (6), Jussi Heinonsalo (7), Marjo Palviainen (8), Hui Sun (9,10), Christina Biasi (11), Viktor Bruckman (12), Anatoly Prokushkin (13), and Frank Berninger (14)

(1) University of Eastern Finland, Department of Environmental and Biological Sciences, Kuopio, Finland (jukka.pumpanen@uef.fi), (2) University of Helsinki, Department of Forest Sciences, Helsinki, Finland (kajar.koster@helsinki.fi), (3) University of Helsinki, Department of Forest Sciences, Helsinki, Finland (heidi.m.aaltonen@helsinki.fi), (4) University of Helsinki, Department of Forest Sciences, Helsinki, Finland (egle.koster@helsinki.fi), (5) University of Helsinki, Department of Forest Sciences, Helsinki, Finland (xuan.zhou@helsinki.fi), (6) University of Eastern Finland, Department of Environmental and Biological Sciences, Kuopio, Finland (huizhong.zhang@uef.fi), (7) University of Helsinki, Department of Food and Environmental Sciences, Helsinki, Finland (jussi.heinonsalo@helsinki.fi), (8) University of Helsinki, Department of Forest Sciences, Helsinki, Finland (marjo.palviainen@helsinki.fi), (9) Nanjing Forestry University, Collaborative Innovation Center of Sustainable Forestry in Southern China, College of Forestry, Nanjing, China (hui.sun@helsinki.fi), (10) University of Helsinki, Department of Food and Environmental Sciences, Helsinki, Finland (hui.sun@helsinki.fi), (11) University of Eastern Finland, Department of Environmental and Biological Sciences, Kuopio, Finland (christina.biasi@uef.fi), (12) Section for Mathematics and Natural Sciences, Austrian Academy of Sciences, Vienna, Austria (viktor.bruckman@oeaw.ac.at), (13) V. N. Sukachev Institute of Forest, Russian Academy of Sciences, Krasnoyarsk, Russia (prokushkin@ksc.krasn.ru), (14) University of Helsinki, Department of Forest Sciences, Helsinki, Finland (frank.berninger@helsinki.fi)

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_2 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_2, CH4 and N2O)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 13C and 15N 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_2 effluxes were significantly decreased immediately after the fire, and the recovery to pre-fire level took several decades. Soils were a small sink of CH4 and a source of N2O in all age classes, and the CH4 uptake was increased and N2O 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 13C and 15N abundances and FTIR spectra and changes in microbial community composition are still under analysis.