Geophysical Research Abstracts
Vol. 20, EGU2018-13998, 2018
EGU General Assembly 2018


# Flooding-induced $CO_2$ and CH4 fluxes from an experimental grey alder forest: from ground to tree level

Kaido Soosaar (1), Thomas Schindler (1), Kateřina Macháčová (2), Dmitrii Krasnov (3), Iuliia Burdun (1), Ave Suija (1), Veiko Uri (4), Ülo Niinemets (3), Gunnar Morozov (4), and Ülo Mander (1)

(1) Institute of Ecology and Earth Sciences, Tartu, Estonia (kaido.soosaar@ut.ee), (2) Lab. of Ecological Plant Physiology, Global Change Research Institute CAS, Brno, Czech Republic, (3) Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences, Tartu, Estonia, (4) Institute of Forestry and Rural Engineering, Estonian University of Life Sciences, Tartu, Estonia

Estimation of the carbon storages and fluxes in different forest ecosystems under different environmental conditions is essential to understand their capacity of carbon sequestration. Grey alder is a fast growing tree species with a great potential for short-rotation forestry in the Nordic and Baltic countries and its stands are considered as carbon accumulating ecosystems. Grey alder stands are also most common in riparian buffer zones. In order to estimate forest ecosystems response to flash flood and its effect on $CO_2$ and CH4 fluxes from soil and through tree stems, a flooding experiment was conducted in a hemiboreal deciduous forest stand. The study is a part of FluxGAF ("Biogeochemical Fluxes in a Grey Alder Forest") experiment which is carried on in a 40-yrs old grey alder (Alnus incana) forest grown on former agricultural land (Umbric Planosol) in Estonia. Two study plots were established in 2017: a flooded plot (40×40 m) where water was pumped using a fire truck and an irrigation pipe system (2 weeks, each day 55–70 m3), and a control plot (20×20 m). The study period was divided into three: pre-flooding (8–7 August), flooding (8–21 August) and post-flooding (22 August–7 November).
Inside flooded plot, eight microsites were equipped with dynamic automatic $CO_2$, CH4, N2O soil chambers (Picarro 2508), static tree stem chambers ($CO_2$, CH4, N2O; 0.1, 0.8 and 1.8 m from the ground), piezometer, automatic water level data logger, soil temperature and moisture sensors (0-10 cm). In control plot, four analogous microsites with the same setup were established. From stem chambers, during 25 campaigns (three times per week; nightly once per week) $CO_2$ flux was measured by portable analyser. CH4 and N2O gas samples (0, 30, 60, and 120 min) were collected manually and analysed in lab. From each microsite, during seven campaigns (three at flooding period), composite soil samples from 0–10 cm were taken for physical and chemical analysis.
The results showed that soil $CO_2$ emission significantly decreased during the flooding and post-flooding period, whereas there was no significant impact of flooding on tree stem $CO_2$ flux, which was more dependent on soil temperature. Soil CH4 fluxes acted on opposite way and showed the similar pattern with tree fluxes, being elevated during the flooding and the post-flooding period. During the post-flooding period stem CH4 flux was significantly higher at all measurement levels compared to pre-flooding period, but decreased with the stem height.
Our results show that stem fluxes of $CO_2$ and CH4, especially during extreme events such as flash flood, significantly contribute to forest C cycles and must be included in relevant models.