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Contrasting impact of forestry-drainage on CO_2 balance at two adjacent peatlands in Finland

Annalea Lohila (1), Kari Minkkinen (2), Timo Penttilä (3), Samuli Launiainen (4), Markku Koskinen (2), Paavo Ojanen (2), and Tuomas Laurila (1)

(1) Finnish Meteorological Institute, Atmospheric Composition Research, Helsinki, Finland (annalea.lohila@fmi.fi), (2) University of Helsinki, Department of Forest Sciences, Helsinki, Finland, (3) Finnish Forest Research Institute, Vantaa Unit, Vantaa, Finland, (4) Finnish Forest Research Institute, Joensuu Unit, Joensuu, Finland

Fate of carbon in peatlands after drainage has been a subject of many studies, particularly at agriculturally managed sites, but also at sites prepared for forestry. In general, the drainage of peatlands has been considered to trigger the decomposition rate of peat and to cause carbon dioxide (CO_2) emissions from the peat into the atmosphere. However, there is not yet full consensus on what are the main regulating factors of the carbon balances in forested peatlands, and do all the forested peatland even act as a source of carbon into the atmosphere.

In this study we compare the CO_2 exchange rates at two adjacent peatland sites in southern Finland, drained for forestry about 40 years earlier. The pair of sites with similar climatic conditions offer an excellent case for studying the mechanisms controlling the carbon balances of forestry-drained peatlands. The sites differ from each other only by fertility, which has an impact on, e.g., tree growth rate. At both sites, CO_2 and energy fluxes have been measured with the eddy covariance method over the course of 4 years, but not simultaneously. We have also built at both sites an automatic system consisting of six transparent closed chambers which collect data on the CO_2 exchange of the forest floor vegetation (including tree roots) and soil around the year. This enables us to quantify the carbon uptake potential of the ground layer and the peat decomposition rates and helps us to understand the differences between the sites.

The results show that the pine and dwarf-shrub-dominated site (nutrient-poor) is a large CO_2 sink. The site with a mixture of spruce, birch and pine and lesser ground vegetation (nutrient-rich), on the contrary, has a close-to-neutral CO_2 balance, despite the much higher tree growth rate there. In this presentation we will compare the general dynamics and climatic responses of CO_2 exchange at the sites, compare the magnitude and factors causing interannual variation, and discuss potential reasons for the different carbon balances.