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Plant diversity affects GHG fluxes in an ecological engineering experiment in a disturbed Sphagnum peatland (La Guette, France)

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Many Sphagnum peatlands are experiencing vegetation change caused mainly by hydrological disturbances. In this, greenhouse gases (GHG) fluxes are affected by peat oxygenation, changes in litter composition (and thus decomposition) and rhizospheric processes. This could lead a C sink system to switch to a source. To restore peatland functioning, ecological engineering works can be undertaken. Our study site, La Guette peatland (central France) is invaded by Molinia caerulea because a drain at the output decreased the water table depth. It was shown that it functioned as a source of C. In 2014, hydrological works were undertaken: 8 dams were installed, ditches were dug perpendicular to the water flow and back-filled with a mixture of shales and bentonite. In addition, a biodiversity experiment with 2 identical experimental stations was implemented: "downstream", close to the hydraulic works (relatively wet), "upstream", (relatively dry), with 3 types of vegetation plot (2m x 2m, n=4): 1) "control": intact vegetation (Molinia caerulea, Erica tetralix), 2) "bare" peat: vegetation and 5cm of peat were removed, 3) "Sphagnum": bare peat+Sphagnum. Our study aims to assess the effect of the vegetation treatment on the GHG fluxes. CO_2 (ecosystem respiration or ER, Gross Primary Production or GPP, and Net Ecosystem Exchange) and CH4 fluxes (manual accumulation chamber), air and soil temperature, water table level, soil moisture were measured. After 18 months, half of the surface of "bare" and "Sphagnum" plots were covered by vegetation (Eriophorum angustifolium, Rynchospora alba, Trichophorum cespitosum). With time, as succession unfolds in these 2 types of station, ER and GPP increased. The sensitivity of ER to temperature increased sharply in "bare" and "Sphagnum" plots with years and became higher than the sensitivity in "control" plots. GPP increased with the total vegetation percentage cover, especially in "bare" peat plots. NEE were still lower in the "bare" and "Sphagnum" peat plots than in "control". However, the difference tends to decrease. In November 2015, the "sphagnum" peat plots were still functioning as a sink of C, whereas the other plots functioned as a source. As a conclusion, the "bare" and "Sphagnum" treatments, after 3 years, were not able to store C as much as the control during the daytime measurements undertaken. C budget for each treatment still have to be calculated to determine the sink or source functioning of the different treatment.