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

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A: Aim of the study

Sphagnum peatlands are huge carbon (C) stores, participating in the regulation of the global climate. Their C sink function is under threat because of global changes. In addition to their direct effects on ecosystems functioning, these perturbations induce vegetation change toward increasing vascular plant abundance. To reduce vegetation modification, hydrological restoration can be done to reduce water table fluctuations. Furthermore, ecological engineering actions can be undertaken to promote species efficient in storing C.

The aims of this study were to set up an in situ experiment to test the effect of different vegetation treatment on the C fluxes in a disturbed peatland.

B: Study site

La Guette peatland is in the Centre region, 100 km south of Paris. It is an acidic fen invaded by Molinia caerulea, Betula spp and Pinus sylvestris. Typical peatland vegetation consists of Sphagnum (e.g. S. rubellum, S. cuspidatum and S.J. Eriophorum angustifolium, Rhynchospora alba, Gentiana pneumonanthe, Erica tetralix).

C: Hydrological disturbance / restoration

Water table depth monitoring in the piezometer close to the outlet

D: Vegetation restoration experiment

Vegetation treatment that could promote biodiversity and C storing

GPP increases faster with vegetation % cover in CONTROL and BARE PEAT plots than in SPHAGNUM plots.

E: Vegetation and C fluxes dynamics

Monitoring of vegetation % cover in C fluxes measurement plots

Vegetation in CONTROL is stable with time. Eriophorum angustifolium and Trichophorum caespitosum colonized the BARE PEAT whereas only the former was present with the moss in SPHAGNUM plots.

F: Sensitivity of ER to temperature and GPP to vegetation % cover

G: Discussion

The results suggested that:

- When no Sphagnum were added, the colonizing vegetation may be more sensitive to temperature than control vegetation. Increased CO₂ emissions in early colonisation stages can be a negative point of the vegetation restoration.

- Although Sphagnum GPP is less sensitive than other plots to vegetation % cover, the plots were the most efficient to store C in winter.

- Also, the BARE PEAT and SPHAGNUM treatments tended to increased CH₄ emissions compared to CONTROL. This is due to the fact that as peat was removed, the water table was higher, promoting CH₄ production and limiting its consumption.

As a conclusion, BARE PEAT and SPHAGNUM treatments promote plant diversity, but their positive effect on C fluxes are still not observable after 2 (CH₄) and 3 (CO₂) years of monitoring. However, the addition of Sphagnum is advised as it may restore C storing functioning faster than when colonisation is left free to proceed such as in the BARE PEAT plots.