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Methane emissions from a rewetted bog – diurnal cycles, impact of vascular plants and role of plant functional groups

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Natural raised temperate bogs are characterized by *Sphagnum*-dominated vegetation, facing increasing threats by vascular plant encroachment in the recent past. The VESBO-project is investigating the influence of this shift in vegetation composition on the water and carbon cycle in a rewetted bog in north-west Germany. Two study sites were established in close proximity on the same former peat extraction area, one showing near-natural *Sphagnum*-dominated vegetation and one exhibiting an increasingly dense birch stand and *Eriophorum vaginatum* cover, low in *Sphagnum* density.

As methane (CH_4) emissions from rewetted bogs are of strong interest regarding the greenhouse gas balance, one focus of our project is to disentangle how vascular plant encroachment is influencing total ecosystem CH_4 emissions and to quantify the contribution of different plant functional types, especially in relation to the different peat water levels on both sites. Besides this, little is known about the diurnal cycle in CH_4 emissions and which bio-meteorological parameters are its drivers.

We used closed chambers in combination with the Picarro GasScouter G4301 to measure methane fluxes on-site. The measurements were performed every 3-4 weeks over one year and on multiple plots equipped with different chamber designs: soil chambers which were located either on hummocks (*Eriophorum*-dominated) or hollows (*Sphagnum*-dominated) and branch/leaf chambers for *Betula*-branches and *Eriophorum*-leaves. In order to more precisely quantify the influence of birch roots on the gas exchange, the soil plots were further divided into plots located in close proximity and separated from birch trees.

The campaigns included transparent and opaque measurements over the course of the day to cover both the diurnal and annual ranges of soil temperature and photosynthetic active radiation, as well as to capture net ecosystem exchange and respiration.

We will show the preliminary results of the methane fluxes from September 2020 to October 2021. They indicate that the methane fluxes increased strongly with soil temperature and water level. Further analysis will relate the CH_4 emissions to plant functional groups and flux-driving parameters.

In conclusion, the available data will provide valuable information on the contribution and the drivers of methane emissions to the greenhouse gas emissions in bogs, which is particularly important for planning and reporting of rewetting and restoration activities in peatlands.