Tracking changes in methane emissions from a restored peat meadow in North Holland

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Restored wetlands, despite covering a smaller area of pristine wetlands globally, are interesting cases for the study of greenhouse gas (GHG) exchanges with the atmosphere since they are the result of human intervention and require the optimization of management practices enabling to conjugate the conservation of natural habitats with carbon sequestration or at least to minimize climate altering emissions (Herbst et al. 2010).

We report on methane (CH_4) fluxes over a restored peat meadow at Horstermeer (NL). The site was retired from agricultural use in the mid '90s and subsequently kept under renaturalization by raising the water table to 10 cm from the soil surface. After 10 years since land use change, the assessment of the GHG budget and the establishment of vegetation specific emission responses to environmental factors were completed (Hendriks et al. 2007, 2008), however with the progression of the ecological succession, vegetation composition and spatial distribution have further evolved.

In July 2014 a new phase of methane flux monitoring at the site was started including: i) the analysis of atmospheric methane concentration spatial variability at the canopy level by coupling high frequency spectroscopic measurements with GPS geolocation in order to individuate CH4 emission hot spots; ii) a botanical survey to detect changes in vegetation composition and distribution relative to earlier known stages; iii) chamber based flux measurements with an experimental design accounting for the diversity of vegetation types. Observations in July and September 2014 showed a mean CH_4 flux of 5.2±12.1 $mgCH_4$ $m^{-2}h^{-1}$ with peaks in water saturated areas dominated by Typha latifolia (9.4±11.2). Preliminary results do not seem to indicate changes in vegetation specific flux rates, nevertheless the fractional cover of Glyceria and Typha spp., species associated to the higher range of methane emissions, appears increased suggesting virtually a larger amount of methane released compared to 8 years before. The inclusion of flux data collected during the ongoing summer campaign 2015 will help to better elucidate the spatial and temporal variations of CH_4 fluxes.

Herbst et al. AFM (2010)
Hendriks et al. AFM (2009)
Handriks et al. BG (2007)

Preliminary results indicate CH4

- flux rates in the range of what already observed 8 years before

Previous studies
have found that the atmospheric greenhouse gas exchange changes slowly after the restoration and remains different from that of pristine wetlands over many years (Tuittila et al., 2000; Waddington and Day, 2007).
The speed of change depends on the water table height, the vegetation type before restoration and on management activities such as cutting the vegetation or introducing target species (Drösler et al., 2008) that are relevant for the ecological function of the upper peat layer (Pfadenhauer and Grootjans, 1999).

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