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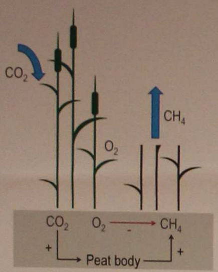
Does biomass harvesting alter the GHG balance of a rewetted fen?

A. Günther*, V. Huth, G. Jurasinski, S. Glatzel

Introduction

Peatlands are important parts of global greenhouse gas (GHG) cycles through their potential to emit methane (CH_4) while storing significant amounts of carbon dioxide (CO_2). The influence of vegetation on CO_2 and CH_4 balances of these systems is complex (see figure below). Consequently, the GHG balance of peatland ecosystems may change significantly if vegetation is removed for agricultural purposes.



The influence of emergent vegetation on GHG balances

Common reed (*Phragmites australis*) is an attractive substrate for bioenergy and insulation material. It also seems to be a key species with a particularly large impact on peatland gas balances due to high rates of active gas transport (Brix et al. 1992) and peat formation (Richert et al. 2000).

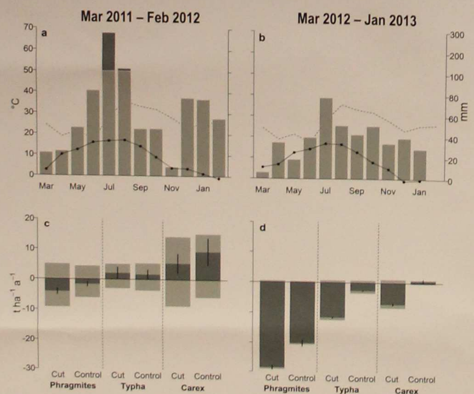
The influence of repeated harvesting on GHG emissions from common reed or plants such as cattail or sedges is unknown. We therefore currently investigate the impact of biomass harvesting on greenhouse gas emissions (CH_4, N_2O, and CO_2) of dominance stands of these species in a rewetted fen.

Methods

Measurements have been conducted over almost two years in a rewetted fen in NE Germany. We investigate dominant stands of the potential crop plants common reed (*Phragmites australis*), cattail (*Typha latifolia*) and lesser pond sedge (*Carex acutiformis*). The vegetation of half of our measurement spots is harvested once per year (during winter in the *P. australis* and *T. latifolia* stand; during summer in *C. acutiformis*). We estimate GHG fluxes using flexible closed-chambers (see below). During the closure time of 40 minutes we take five air samples for analysis by gas chromatography. CO_2 exchange is estimated with transparent chambers and an infrared gas analyzer (EGM-4).

CH_4 and N_2O flux estimation in the harvested reed stand in March 2012

Results and Discussion



Environmental conditions (a, b) and GHG balances in CO_2-Equivalents (c, d) during the two study years. Panels a and c show the period from March 2011 to February 2012; panels b and d show March 2012 to January 2013. GHG balances (dark grey bars) are calculated as difference between CH_4 emissions (light grey bars, > 0) and CO_2 uptake (light grey bars, < 0), and depicted with 1 SE. In the upper panels monthly precipitation sums (grey bars) are shown in comparison with the long-term mean (dashed line; data from 1981 – 2010, German Weather Service). Mean monthly air temperature is represented by the black line and circle symbols. Note the condensed scale for precipitation over 100 mm.

Preliminary results indicate a net uptake of CO_2 in both years irrespective of dominant vegetation or treatment. The GHG balances differed significantly between the study years probably due to large differences in environmental conditions (one extraordinary wet and one dry summer, see figure on the left). CH_4 emissions were larger during the wet year. The highest emissions were found in both years in the *Carex* stand. Fluxes of N_2O during both years lay below the detection limit.

Harvesting seems to have no significant effect on CH_4 emissions of all vegetation stands. However, the harvested sites of *Phragmites* and *Carex* sequestered slightly more carbon than the controls. It has to be noted that indirect emissions resulting from the harvested biomass were not included in the balances.

Conclusion

Biomass harvesting seems to have no direct effect on the GHG balance of a rewetted fen. Due to the positive effects of rewetting in terms of GHG balances, agriculture on wet organic soils may provide a good alternative to traditional usage of drained peatlands.

References

Brix H, Sorrell BK, Orr PT (1992) Internal pressurization and convective gas flow in some emergent freshwater macrophytes. Limnology and Oceanography 37(7), pp. 1420–1433.

Richert, M.; Dietrich, O.; Koppisch, D.; Roth, S. (2000): The influence of rewetting on vegetation development and decomposition in a degraded fen. Restoration Ecology 8(2), pp.186–195.

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University of Rostock, Justus-von-Liebig-Weg 6 | 18059 Rostock, Germany
*Contact author: anke.guenther@uni-rostock.de