Geophysical Research Abstracts
Vol. 18, EGU2016-16346, 2016
EGU General Assembly 2016

Redox processes in the rhizosphere of restored peatlands - The impact of vascular plant species on electrochemical properties of dissolved organic matter

Svenja Agethen, Franziska Wolff, and Klaus-Holger Knorr
Institute of Landscape Ecology, University of Münster, Germany (s.agethen@uni-muenster.de)

Restoration of cut over peatlands in Central Europe is challenging in a landscape overused for agriculture. Excess nutrient availability by excess fertilization triggers uncharacteristic vegetation that is one key driver for carbon cycling. Those nutrient rich systems are often dominated by graminoids, and were often found to emit substantial amounts of methane. Plants grown under nutrient rich conditions provide more labile carbon in rhizodeposition and litter that fuels methanogenesis. Such species often have aerenchyma that facilitates direct CH_4 emissions to the atmosphere and therefore impair the climate cooling function of bogs. On the other hand, aerenchymatic tissue supplies oxygen to the rhizosphere, which may reduce methanogenesis or stimulate methane oxidation, as methanogenesis is a strictly anaerobic process. Which of the effects prevail is often unclear.

Therefore, the aim of this study was to test the impact of different vegetation on rhizospheric redox conditions and methanogenesis, including aerenchymatic vascular plants that are dominant in restored cut over peatlands. As ombrotrophic peat is poor in inorganic electron acceptors (EAs) to suppress methanogenesis, we analyzed the electron acceptor (EACs) and electron donor capacities (EDCs) of dissolved organic matter (DOM) in the rhizosphere to understand the impact of vegetation on anaerobic organic matter degradation.

We planted *Juncus effusus*, *Eriophorum vaginatum*, *Eriophorum angustifolium*, *Sphagnum* (mixture of *S. magellanicum*, *S. papillosum*, *S.* sec. *acutifolia*, 1/3 each) plus non-vegetated controls; six replicates per batch; in containers with untreated homogenized peat. The plants grow under constant conditions (20°C, 12h diurnal light cycles and 80% RH). Anoxic conditions were achieved by keeping the water table at +10 cm. For monitoring, the rhizosphere is equipped with suction and gas samplers. We measure dissolved CO_2 and CH_4 concentrations, inorganic EAs (NO_3^-, Fe(III), and SO_4^{2-}) and organic EDCs and EACs via mediated electrochemical reduction/oxidation. We also characterize DOM with fluorescence spectroscopy and monitor the growth of above ground biomass as proxy for photosynthetic activity and potential DOM source.

Preliminary results showed after initially equal magnitude of EACs and EDCs in all batches an increase in total electron exchange capacity (Σ EAC, EDC) four weeks later, but EACs increased significantly higher for rooted plants (fivefold vs. threefold in *Sphagnum* and controls). Subsequently, higher CH_4 concentrations were found for *Sphagnum* and the controls. In our ongoing study we will also try to relate the effect of vegetation on rhizosphere redox conditions to root and shoot biomass and photosynthesis.

First results indicate that oxidation of organic EAs occurs for all tested graminoid species. The analysis of EACs and EDCs in the rhizosphere of dominant species may improve our understanding under which conditions methane production and emission is stimulated or reduced by presence of vascular, aerenchymatic plants.