MOBILIZATION OF PHOSPHORUS, DISSOLVED ORGANIC CARBON AND RELEASE OF GREEN HOUSE GASES IN AN EARLY STAGE OF REWETTED FENS AS A FUNCTION OF THE DEGREE OF PEAT DECOMPOSITION

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Several reason, such as global warming, eutrophication of surface waters, and loss of biodiversity lead to the demand of rewetting of fens. However, due to physical and chemical changes of peat during drainage, it can expect that a revitalization of their original ecological functions is not possible in a short time period. For instance, there exists a high risk that rewetted fens do not act as nutrient sinks: pore water concentrations of dissolved organic carbon, phosphorus, and ammonia can be one to three orders of magnitude larger than in more or less natural fens. This leads to the assumption that mineralization processes are still intensive despite a fast establishment of unfavourable anoxic conditions. Only little knowledge exists on the reasons and the intensity of the mineralization and nutrient release processes in rewetted fens.

In a laboratory study, the rewetting was simulated in a short-term incubation experiment with peat of a drained fen. The peat from three different horizons (highly, moderately and slightly decomposed) was incubated under water saturated conditions. The experiment was carried out under steady-state conditions at darkness and a temperature of 20°C. Pore water was sampled by permanent installed dialysis samplers every two weeks in the beginning and later monthly to follow concentration changes of phosphate, sulfate, dissolved organic and inorganic carbon, ammonia, calcium, and ferrous iron. Additionally, the release of green-house gases (CO_2, CH_4, and N_2O) was studied using the chamber method.

Highest release rates of phosphorus, dissolved organic and inorganic carbon, iron, and ammonia and high net sulfate consumption occur in the highly decomposed peat. Also the release of carbon dioxide was higher in this peat. Release of nitrous oxide could only measure at the beginning of the experiment and methane production could not be observed yet. Furthermore, the initial sulfate concentrations exceeded 500 mg/L. Obvious intense oxidation processes during decades of drainage of the sampling site lead to changes of refractory bounded phosphorus and other substances to more labile forms. It is concluded that both high sulfate concentrations and the increased availability of phosphorus and organic matter in decomposed peats are responsible for intense mineralization and nutrient releases under anoxic conditions.

These results provide a basis for restoration management strategies and modelling processes in recent rewetted fens.