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Effects of different land management strategies on greenhouse gas emissions from pre-alpine fens under grassland use.

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In Germany, 90% of peatlands are drained and mostly used for agriculture. As a result, carbon storage and water retention capabilities are mostly lost. Instead, drained peatlands are significant sources of greenhouse gases. The comprehensive gain of near-natural peatlands and thus their restoration has increasingly come into focus in recent years. Until now, it has very rarely been possible to directly measure and investigate the changes in greenhouse gas emissions during rewetting. We have the unique opportunity to investigate the rewetting of two drained pre-alpine fens used as grassland in southern Bavaria with chamber measurements of CO_2, CH_4 and N_2O.

The first one in Karolinenfeld (60 km south-east from Munich) has an intensive management (with three cuts per year, application of manure/fertilizer and a really low water-table: mean value around 90cm). The other one in Benediktbeuern (60 km south-west from Munich) has an extensive management (with two cuts per year, no use of manure/fertilizer since 1990, and mean water-table around 30cm). For each study sites, we have several plots, which have significant different water-table depths. Since December 2019, CO_2, CH_4 and N_2O emissions are measured with closed chambers method. Climate data are monitored and recorded every half hour (as ground temperatures, air temperature, photosynthetic photon flux density, water-table depth, air pressure ...). We also collected data of environmental parameters with biomass analyses, vegetation description, soil analyses, and we measure regularly vegetation indexes (NDVI and LAI).

During the first year of measurement, we already noticed a significant difference between the two study sites. The depth of the water table seems to be the major explanatory parameter for the different emissions. Moreover, the impact of the cuts on CO_2 emissions is notable, whereas we did not measure any difference after the application of fertilizer.

At the end of 2020 the Karolinenfeld has been rewetted while keeping the management types unchanged. Benediktbeuern will be rewetted during the year 2021. In order to achieve this goal, water management practices have been introduced using the existing drainage pipes in combination with a pumping system for subsurface irrigation. We expect to gain insight into the greenhouse gas exchange of peatlands according to water management and agricultural activities and to highlight the short-term effects of the transitional stage during and after rewetting. We also would like to determinate the key factors who drive the greenhouse gases emissions on grasslands according to different water management and land-use.

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