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The methane fraction of the carbon balance in restored temperate peatlands

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We investigate the relation between carbon and methane fluxes in several temperate peatlands restored from agricultural drainage or peat extraction. Restoration often turns peatlands from a net carbon source into a net carbon sink but increases CH_4 emissions.

We derive indicators of the “naturalness” of the restored system by analysing the relationship between photosynthesis, ecosystem respiration, net carbon uptake by the ecosystem and the amount of sequestered C released as CH_4. This “natural” CH_4 can be interpreted as the unavoidable trade-off of restoration in the context of climate change. Methane emissions above the natural conditions can be related to transient restoration effects or inadequate water management. However, the high CH_4 fluxes observed in a long-term restored fen cannot be explained by the dynamics of dissolved and particulate organic carbon and CH_4 concentrations in the soil pore space. Obviously, high CH_4 fluxes are derived from processes at the soil surface. Here the interaction between high-productive sedge species, easily degradable C compounds in the rhizosphere, quantity of aerenchyma and the water-table seem to determine the level of the CH_4 emissions.

We will show that the restoration of productive fen peatlands is not necessarily climate friendly but requires careful management of the vegetation and water table.