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1 Drivers and patterns of greenhouse gas fluxes in peatlands along European climate and land use gradients

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Peatlands represent important carbon pools and play a vital role in the terrestrial GHG-exchange. In their natural status peatlands act as significant Carbon sinks, while emitting CH_4. Management can change and alter both the magnitude and direction of the fluxes of CO_2, CH_4 and N_2O with important impacts on the climatic relevance of peatlands and potential shifts from sinks to sources.

The presented study is based on an intensive review of published and unpublished European flux data. Data were submitted to the two lead-authors in response to a questionnaire of GHG-fluxes and explaining variables. For the analysis just the annual data on GHG-exchange could be used, as seasonal fluxes were not comparable in terms of representation of similar time windows and averaging procedures.

The objectives were to

1. derive annual GHG budgets of European peatland sites by literature synthesis,
2. identify drivers (climate, site, land use) and model the response of the flux-components to these drivers

3. develop scaling rules for national / European GHG budgets
4. calculate European peatland GHG budgets.

This study goes beyond the approach of calculating budgets by mean emission factors multiplied with area estimates (see e.g. Byrne et al. 2004). Here we identified the underlying drivers (e.g. mean WT, climate parameters coming from the REMO-model like net surface radiation in the snow-free period, site factors like C/N-value and pH, a.s.o) for GHG-fluxes (GPP, NEP, RECO, CH_4 and N_2O) via correlation matrices and assessed the relationships between drivers and fluxes by single and multiple non-linear regressions. The equations were further used in the development of scaling procedures for GHG-budgets.

We show that the database is unevenly distributed along climate and degradation gradients over Europe, and that the distribution and land use bias is different in annual flux-data from bogs and fens. We show that therefore the scaling via regression approaches may lead to more robust GHG-budgets. Knowledge gaps and further research needs will be shown.