

Emissions of methane from northern peatlands: a review of management impacts and future implications

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Northern peatlands constitute a significant source of atmospheric methane (CH₄). However, management of undisturbed peatlands, as well as restoration of disturbed peatlands, will alter the exchange of methane with the atmosphere. The aim of this literature review and meta-analysis was to collate and analyse recent literature to improve our understanding of the impacts of management on CH₄ emissions from northern peatlands i.e. latitude 40 to 70° N. Results show that CH₄ emissions from natural northern peatlands range from 0 to 154 g C m⁻² yr⁻¹ and the overall annual average (mean ± standard deviation) is 11.7 ± 21 g C m⁻² yr⁻¹ with the highest emissions from fen ecosystems. Drainage significantly ($p < 0.05$) reduces CH₄ emissions to the atmosphere, on average by 84%. However, restoration by rewetting of peatlands and application of N fertilizer both significantly ($p < 0.05$) increase the emissions compared to the original pre-management CH₄ fluxes. Methane emissions are mainly controlled by water table (WT) depth, plant community composition and soil pH. Although temperature is not a good predictor of CH₄ emissions by itself, the interaction between temperatures, plant community cover, WT depth and soil pH is important. According to short-term forecasts of climate change, these complex interactions will be the main determinant of increased CH₄ emissions from northern peatlands. However, to fully evaluate the net effect of management practice on high latitude peatlands both net ecosystem exchange (NEE) and carbon exports needs to be considered.