GHG emissions from peatlands: Effects of rewetting and land use

Jurasinski G, Günther A, Huth V, Glatzel S, Couwenberg J

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Annual GHG exchange is mainly driven by mean annual water level.
Data on GHG exchange in temperate wetlands

- 52 studies (incl. unpublished data sets)
- 594 data points (CO$_2$: 161, CH$_4$: 261, N$_2$O: 171)
- Closed chamber (542), eddy covariance (25), other (27)
- Recorded from 1992 to 2012 (relatively evenly distributed)
- In Fens (380), Bogs (156), Others (58)
CO₂ exchange is driven by water level across peatland types
Drainage increases CO₂ emissions and rewetting effectively stops them.

![Graph showing the relationship between mean annual water level and CO₂ emissions]

- Circle: Bog
- Square: Fen
- Dashed line: all
- Dashed dot line: drained
- Dotted line: rewetted
- Solid line: pristine

The graph plots the mean annual water level on the x-axis against g CO₂ m⁻² y⁻¹ on the y-axis, with different symbols and lines representing different categories of peatland conditions.
CH₄ exchange is driven by water level across peatland types

- Hochmoore
- Niedermoore
- sonstige

Mittlerer Wasserstand [cm]

kg CH₄ ha⁻¹ a⁻¹

t CO₂-eq ha⁻¹ a⁻¹

Couwenberg 2008
CH$_4$ exchange – also with more data the –20cm switch remains apparent
CH₄ exchange: the –20cm switch gets blurry when zooming in – a lower fit seems more appropriate

- Mean annual water level
- g CH₄ m⁻² y⁻¹
- Bog
- Fen
- Other

Couwenberg 2008
Very high CH$_4$ emissions may occur shortly after flooding hypertrophic fens

1–2 years after flooding, excluded for dotted fit line
High CH$_4$ emissions after rewetting are reported from hypertrophic German fens
Omitting very high CH$_4$ emissions that occur shortly after rewetting hypertrophic fens leads to better fit.
N\textsubscript{2}O emissions higher from Fens – an optimum model can be fit to the data
From the literature – land use may influence GHG emissions from rewetted peatlands

- Data regarding land use effects on rewetted peatlands are sparse (but there are some from pristine peatlands)
- No or a small positive effect of biomass harvest on GHG emissions of sites
- Small or sometimes considerably negative effect of grazing (without incl. the emissions from ruminants) on GHG emissions
CO₂ emissions are lower at same water levels under biomass harvest compared to no use.
High methane emissions from not used sites because most rewetting does not involve land use.
Experimental cut in VIP project – Cutting does not increase GHG emissions

2011/03 – 2012/03

NEE

CH4

GWP

2012/03 – 2012/12

see also Posters of Günther et al. and Huth et al.
N$_2$O emissions higher under grazing and arable land

Mean annual water level
GWP of temperate peatlands in relation to water table depth – Omit flooding when rewetting
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Rewetting reduces GWP of peatlands – Biomass harvest does not affect GWP negatively
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- Biomass harvest does not affect the GWP of peatlands negatively
- Grazing seems to influence GWP slightly negatively, but needs to be further investigated
Thank you for your attention

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