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Estimation of GHG emissions based on vegetation changes after rewetting in Drentsche Aa brook valley

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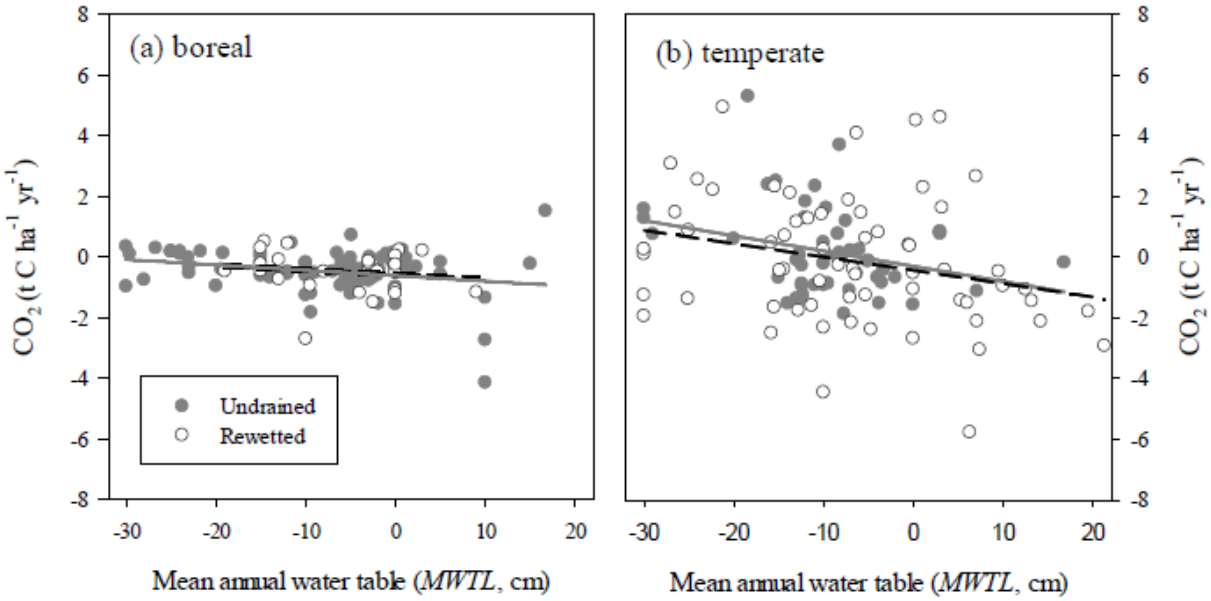
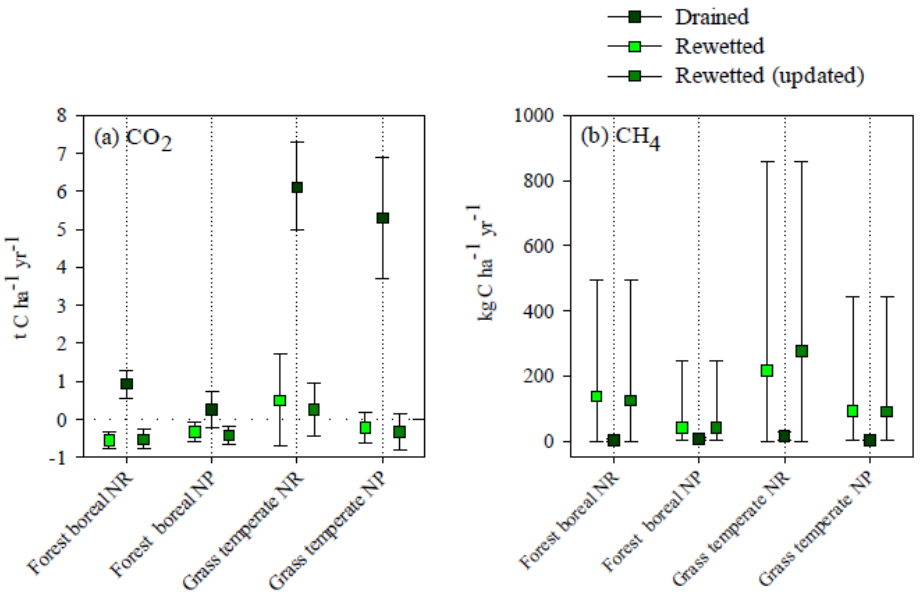
Introduction – Rewetting

The accumulation of studies have shown that **rewetting** has an positive net effect of **emissions reduction.**



Relationships between CO2 and mean water levels for undrained & rewetted organic soils. *(Wilson et al., 2016)*



Annual emission factors for IPCC land categories. *(Wilson et al., 2016)*

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Introduction - Aims

› **Starting point:** Rewetting, as an effective measure, needs estimation tools for accounting of its effects.

› **What's available:**

- *IPCC Guideline – emission factors for larger-scale accounting.*
- *Proxies – water level; vegetation…*
  - *GHG Emission Site Types (GESTs) - bioindication for water level classes + emission factors.*

› **Aims of this work:**

- *Combining proxies: bioindication of vegetation for water level values + correlations between water levels & GHG fluxes?*
- Whether this approach will provide valid estimates and spatial explicit information?

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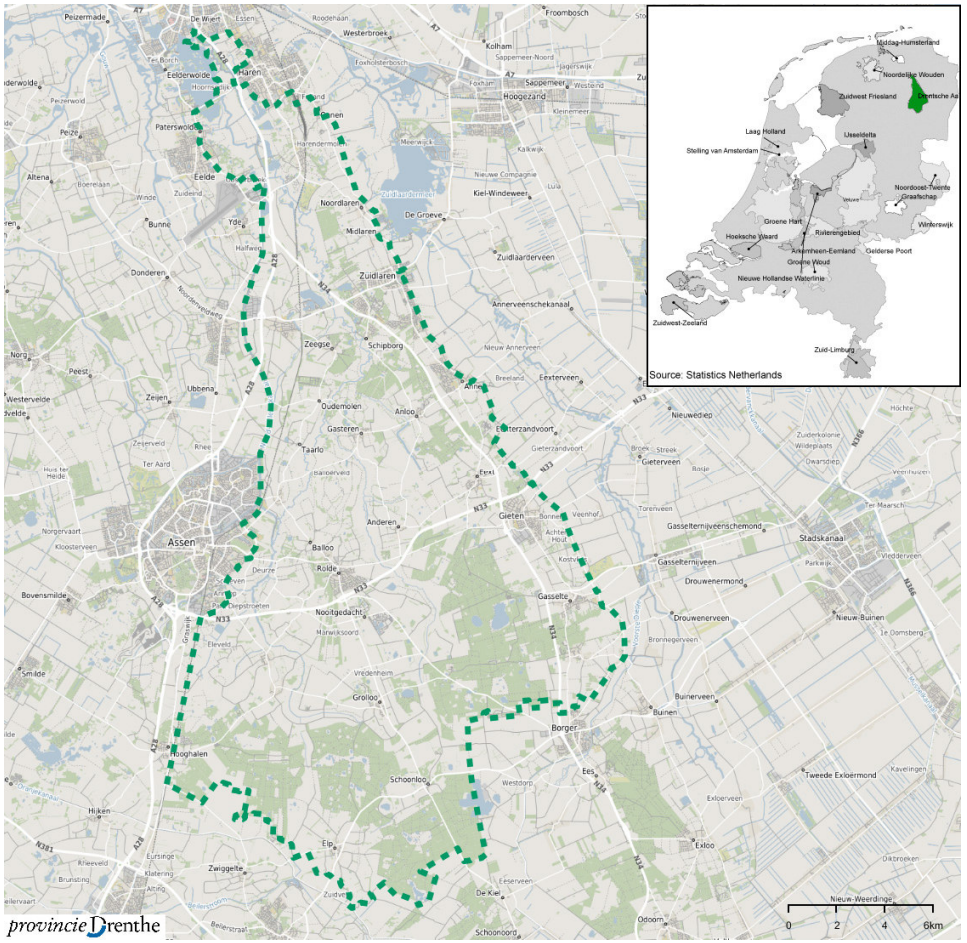
Introduction – Drentsche Aa

- **Drentsche Aa Brook Valley**
- Previously drained for intensive agriculture.
- Conservation since 1965 & rewetting since 1996 to recover rich fen vegetation.
- Continuous vegetation mapping for biodiversity monitoring.
- *Emissions reduction as co-benefit of biodiversity conservation?*



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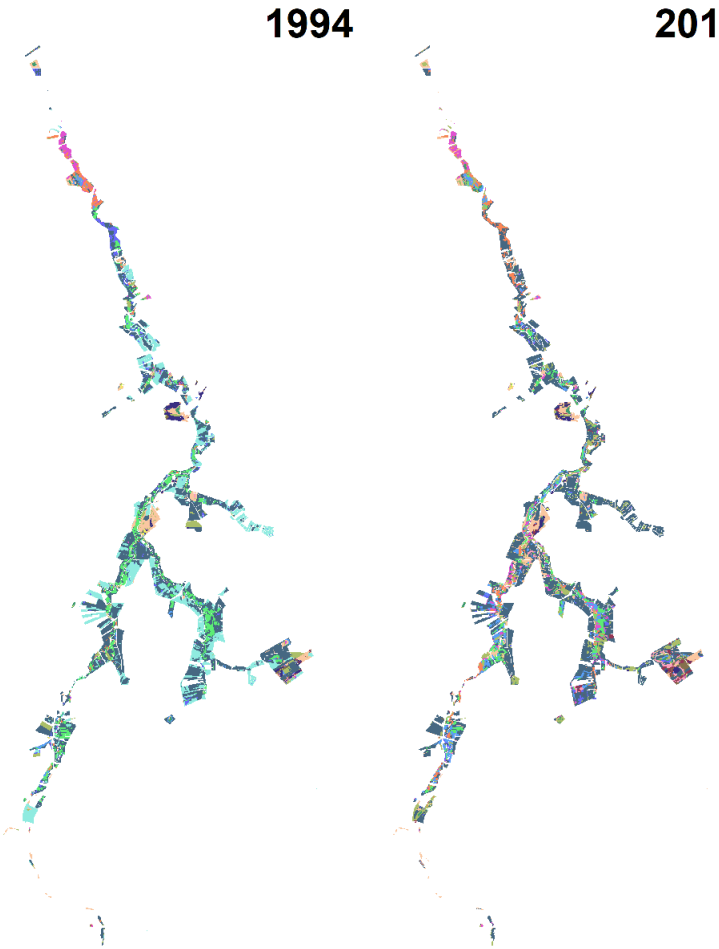
Methods - Data

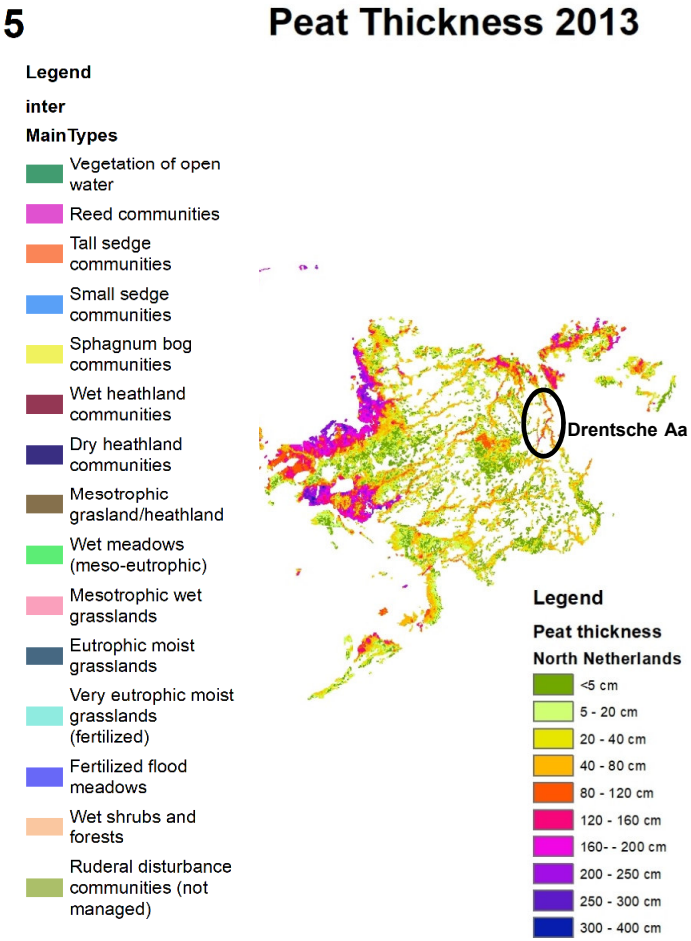
1) Maps of two rounds vegetation surveys *(provided by Everts & de Vries).*

- 1994-1996, covers 2143 ha.
- 2015-2016, covers 2481 ha.
- Matched areas, 1102 ha.

2) Peat thickness map for north Netherlands 2013 *(de Vries et al. 2014).*

- Peat areas, 561 ha.





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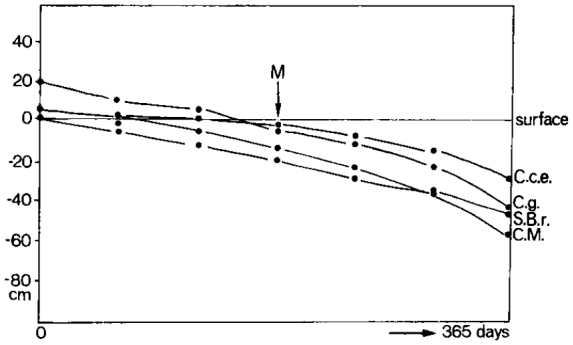
Methods – water level values

> Build vegetation – water level relations *(Grootjans, 1980)*

Statistical analysis of water level fluctuation measurements



(Woody communities not included)

Annual mean water level values for plant communities

Extrapolate to similar plant communities without data

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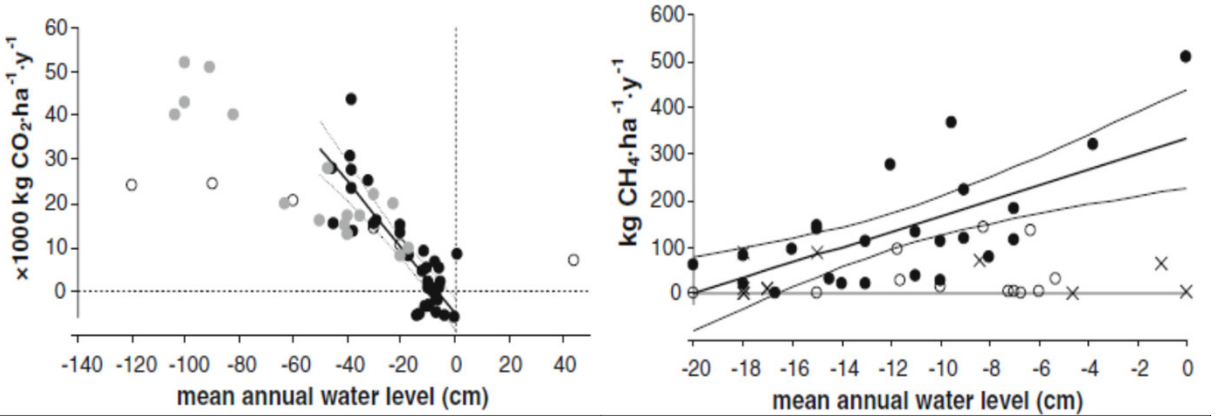
Methods – GHG fluxes

› Fluxes & emission reductions

Linear regression models
(in Couwenberg et al., 2011)



CO_2 fluxes $(\text{kg ha}^{-1}\ \text{yr}^{-1}) = -752 \times \text{MWL(cm)} - 4750$	CH_4 fluxes $(\text{kg ha}^{-1}\ \text{yr}^{-1}) = 16.7 \times (\text{MWL(cm)} + 20)$

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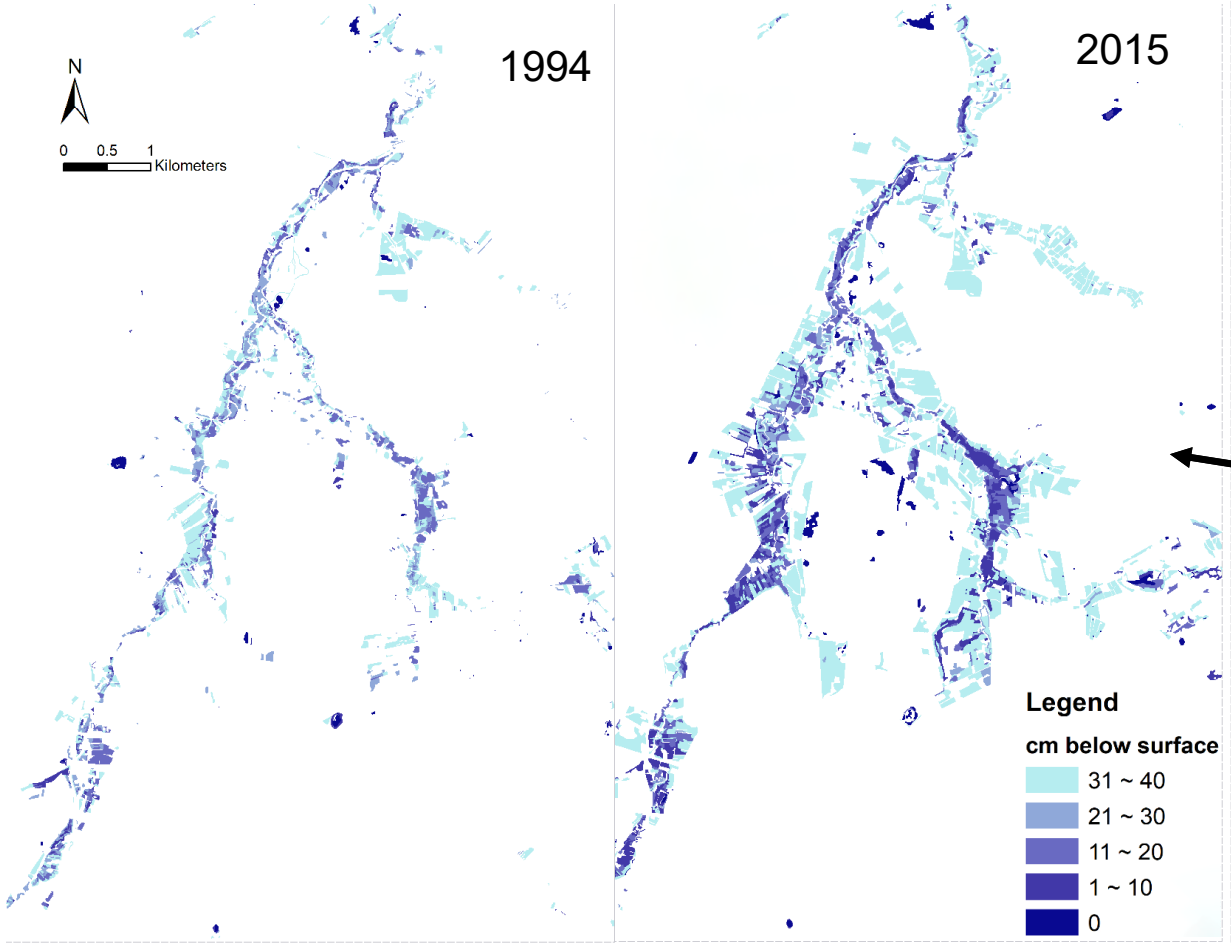
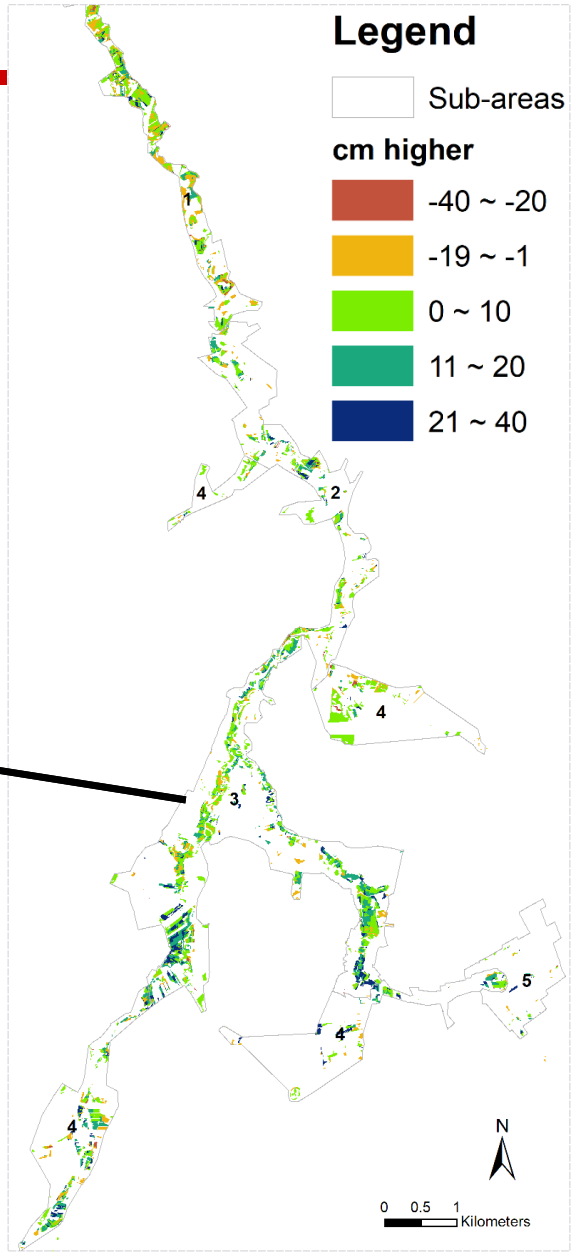
Results – water level changes

	Mean water level change (cm higher)
1 Downstream	0.73
2 Transition down – middle stream	5.43
3 Middle stream	**9.25**
4 Transition middle- upper stream	6.05
5 Source	5.79
Average	**5.48**

(in 250 ha area)





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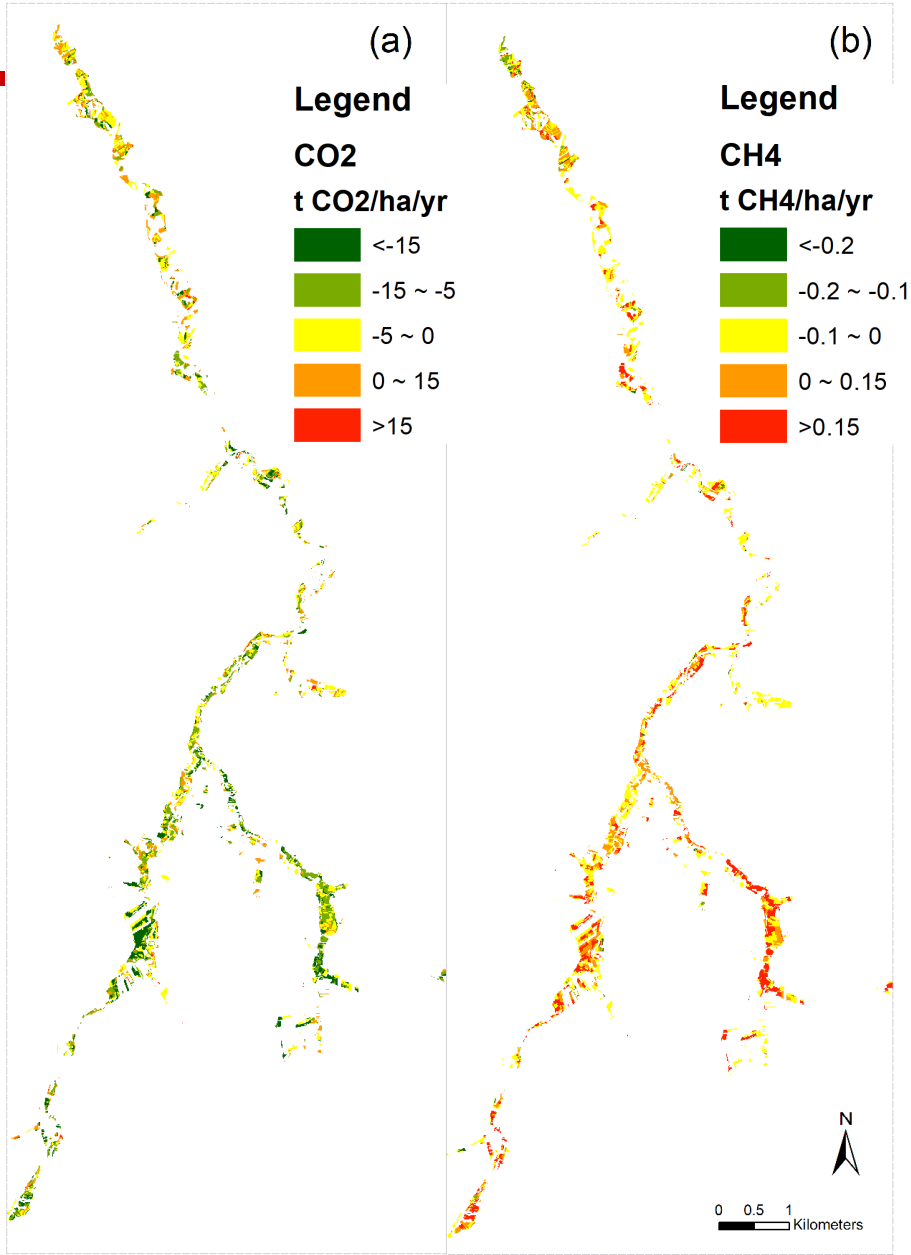
Results – GHG fluxes Changes

	Annual Mean fluxes		
	CO2 (t ha-1 yr-1)	**CH4 (kg ha-1 yr-1)**	**GWP (t CO2-eq ha-1 yr-1)**
Before	14.39	30	15.10
After	9.60	90	11.88
Changes	-4.79 (-33%)	+60	-3.22 (-21%)



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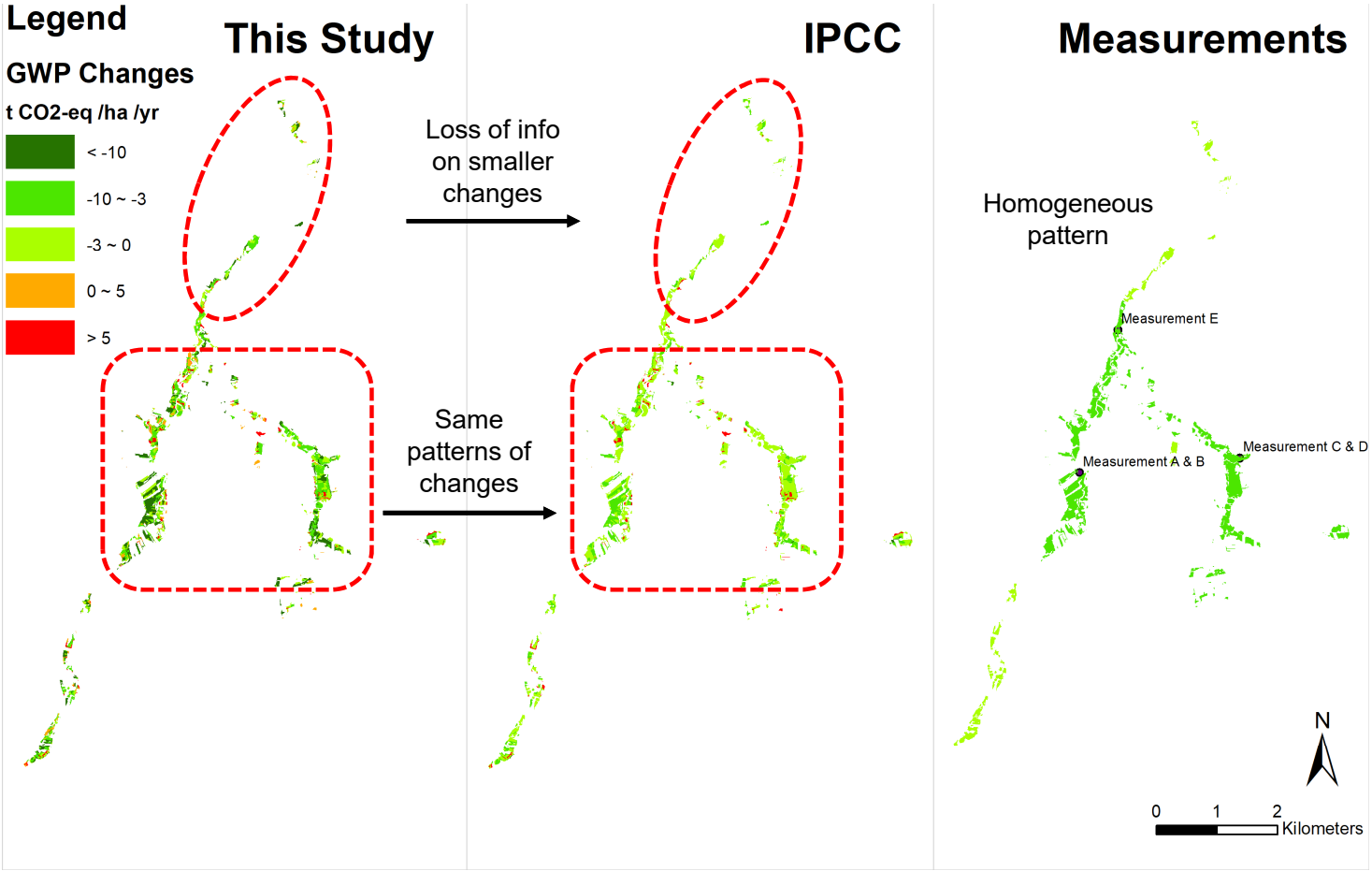
Results – GHG fluxes - Comparison

	Approaches		GWP Changes (t CO2-eq /ha /yr)
IPCC, 2013	Emission factors per land-use category.	deep-drained (>30 cm)	-2.07
		shallow-drained (0~30 cm)	
		rewetted	
Hoetz, 2013	Extrapolation of water level measurements & regression models.	3 measure-ment locations	-3.92
This study	Water level indication & regression models.	WL values per vegetatio n type	-5.05



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Discussion

› Uncertainties:

- Vegetation - Water level.
- Regression models.

› Emissions reduction as co-benefit of biodiversity restoration.

› Added values of fine-scale spatial patterns by using vegetation maps.

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Prospects

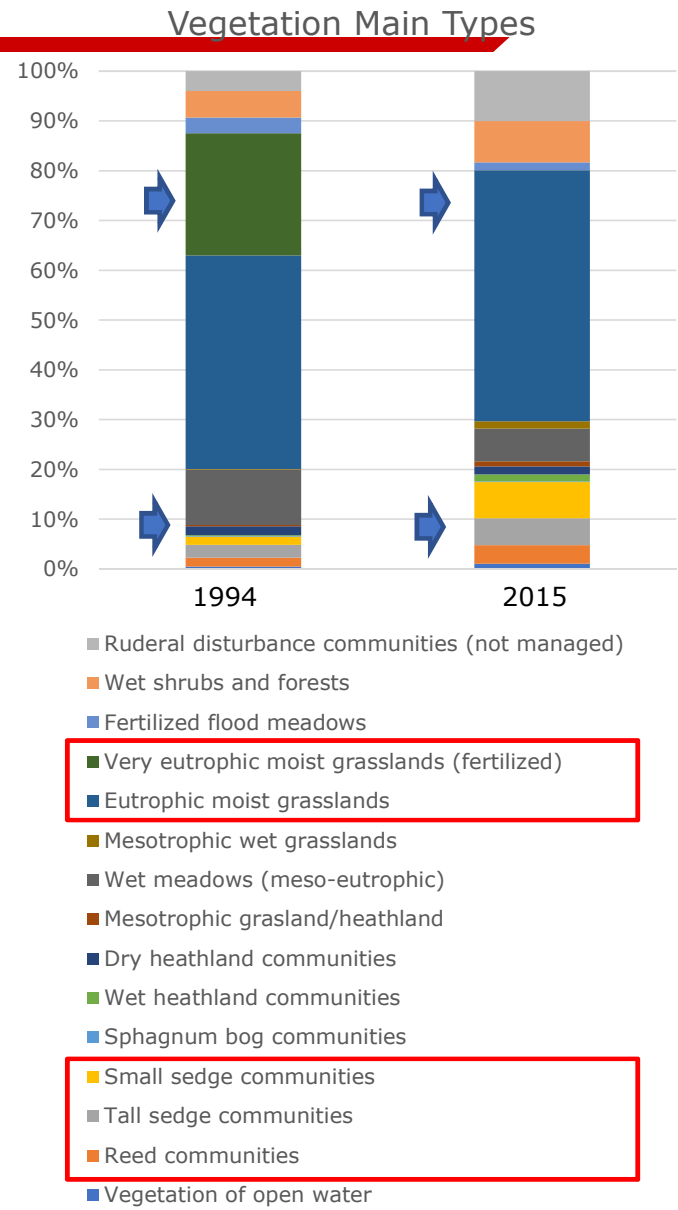
› Besides the emissions reduction,

› Based on the vegetation maps, Incorporating:

- Biodiversity changes
  - Allocate into 15 main types based on wetness & nutrient level;
  - Quantify biodiversity *by richness, rareness, conservation targets, etc.*
- Productivity
  - Biomass production & usage *(materials, fodder, etc. Will largely change the system and its total emission)*

Ecosystem services perspective -

- tradeoffs? synergies?



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Thanks for your attention!

Oudemolen, Drentsche Aa