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Effects of spatial variation in land cover on N_2O emission of Dutch fen meadow systems

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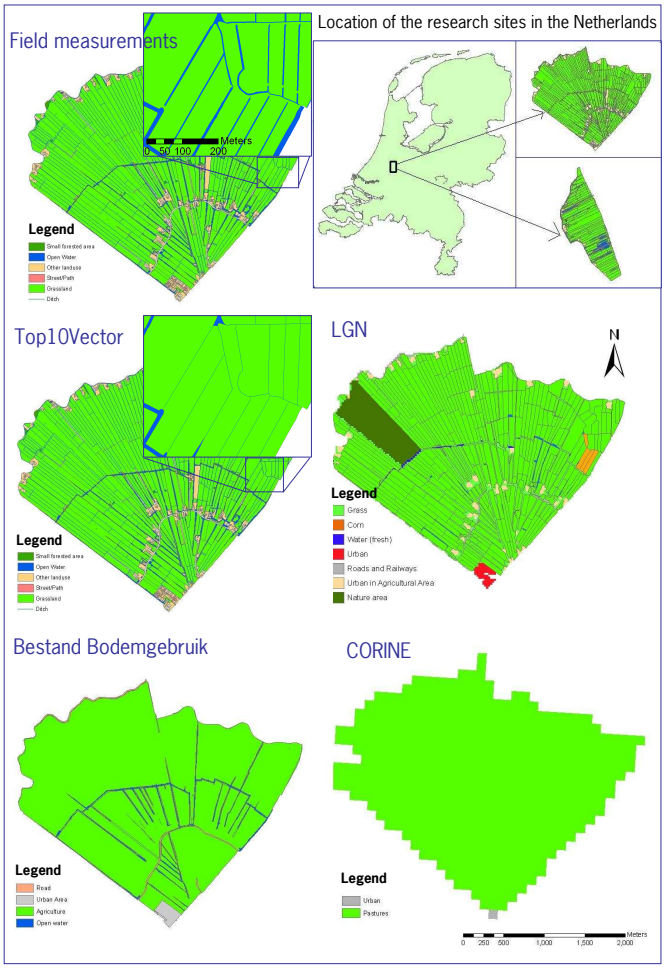
1.Objective

Land cover is a key driver for the emission of greenhouse gasses. This research has two objectives:

- to identify the **effect of land cover** on the N_2O emission from Dutch fen meadows by means of comparing different representations of land cover data.
- to analyse how these different representations propagate in upscaling methods for regional N_2O emission estimation



Five different representations of land cover for the Zegveld study site.

2. Material and Methods

→Two polders with different cultivation histories were assessed: the **Zegveld** and **Oukoop** study sites. For each site the area occupied by water was estimated based on field measurements and using different land cover databases.

→ The N_2O emission was estimated with the IPCC Tier2 method (emission factor approach).

3. Results

→ All land cover databases underestimate the water area and overestimate the grassland area (see table 1).

→ The actual estimates of N_2O emission for agriculture based on Top10Vector data overestimate the emissions with **8 to 10%**.

→ Differences between various land cover data sources are also substantial and cause profound differences in N_2O emission.

Table 1: Area water and area grassland between measurements and land cover data.

	Polder Zegveld		Polder Oukoop	
	% water	% grass	% water	% grass
Field measurements	10.5%	81.5%	20.7%	74.7%
Top10Vector	4.5%	87.6%	11.2%	84.2%
LGN	1.2%	93.6%	4.6%	92.6%
Bestand Bodemgebruik	2.8%	91.8%	9.0%	90.5%
CORINE	0.0%	100.0%	0.8%	99.2%

Table 2: N_2O emission (kg N_2O yr^{-1}) estimated with the IPCC Tier2 method for agriculture.

	Polder Zegveld 670 ha	Polder Oukoop 180 ha
Field measurements	18693	6989
Top10Vector	19402	7270
LGN4	18651	7861
Bestand Bodemgebruik	20372	7488
CORINE	20782	7595

4. Future Research

The emissions of N_2O will also be estimated using a simulation model (IPCC Tier3 level). The effects of different levels of model complexity and input data quality on site-scale N_2O emission will be quantified and compared. This will provide insight into whether resources should be spent on model improvement or improved data collection.

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climate changes spatial planning

ME1 Effect of land cover data on N_2O inventory in fen meadows

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Objective

The objective of this study was to analyze how different land cover representations influence results of regional N_2O emission inventories.

Material & Methods

Surface areas of grassland, ditches, and ditch banks were estimated for two polders in the Dutch fen meadow landscape using five land cover representations: four commonly used databases and a detailed field mapping, which is closest to reality.

These estimated surface areas were scaled up to the Dutch Western fen meadow landscape. Based on the estimated surface areas agricultural N_2O emissions were estimated using different inventory techniques.

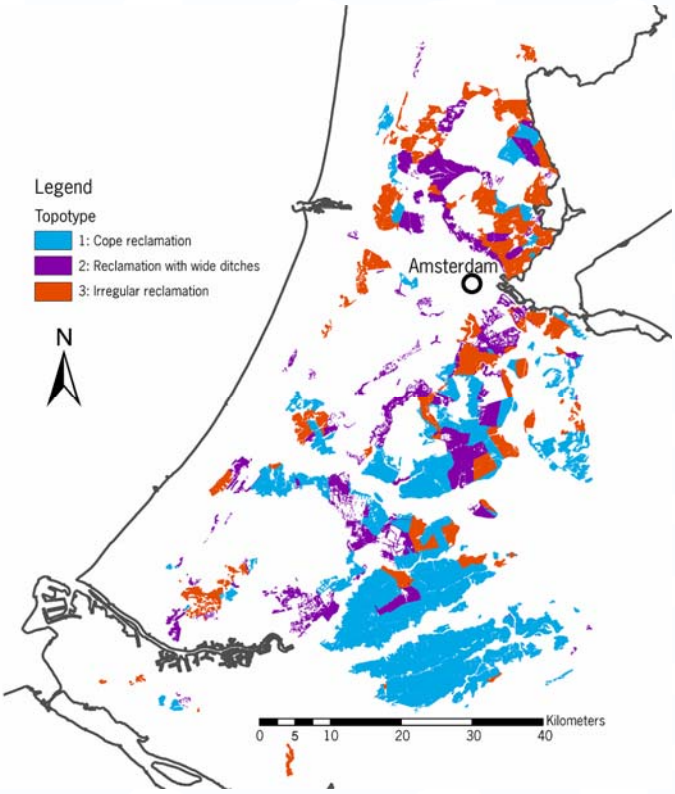

Figure: Reclamation types in the Western fen meadow system

Table: N_2O emission estimated for the Western fen meadows using the IPCC Tier 1 and Tier 2a method.

	N_2O Emission	
Database	Tier 1	Tier 2a
	10^6 g N_2O yr^{-1}	
Field mapping	1517	1685
Top10Vector	1725	1910
CBS Soil use	1747	1979
LGN4	1788	1987
CLC2000	1902	2106

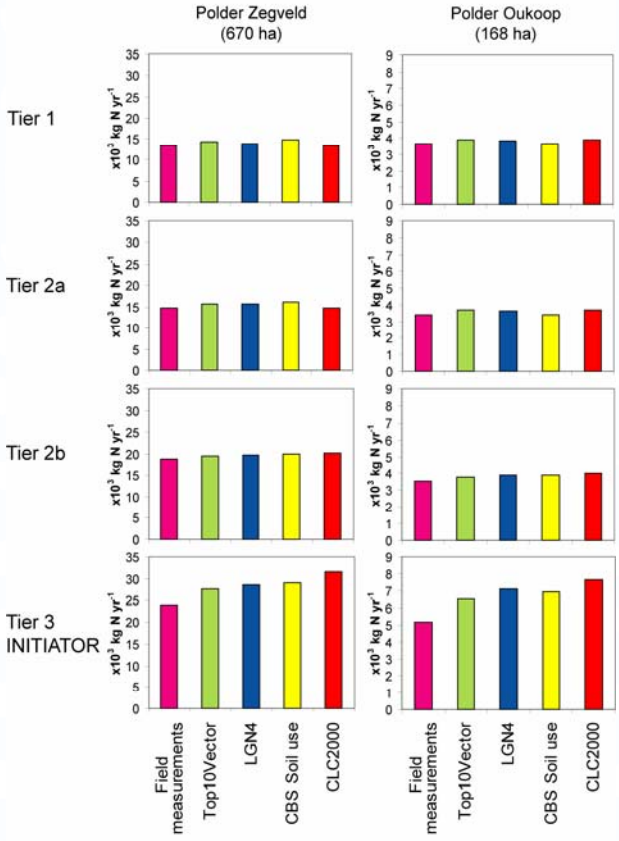

Figure: N_2O emissions (kg N_2O ha^{-1} yr^{-1}) estimated with different inventory techniques and different land cover data

Results

All four common databases overestimated the grassland area when compared to the field mapping. This caused considerable overestimation of agricultural N2O emissions, ranging from 9% for more detailed databases to 11% for 13 the coarsest database.

Conclusions

The effect of poor land cover representation was larger for an inventory method based on a process model (INITIATOR) than for inventory methods based on simple emission factors. Although the effect of errors in land cover representations may be small compared to the effect of uncertainties in emission factors, these effects are systematic errors (i.e., bias) and do not cancel out by spatial upscaling. Moreover, bias in land cover representations can be quantified or reduced by careful selection of the land cover database. The results indicate that for improved emission inventories and quantification of the uncertainties countries should pay more attention to accurate assessment of land cover data.

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