

Veenweide ,

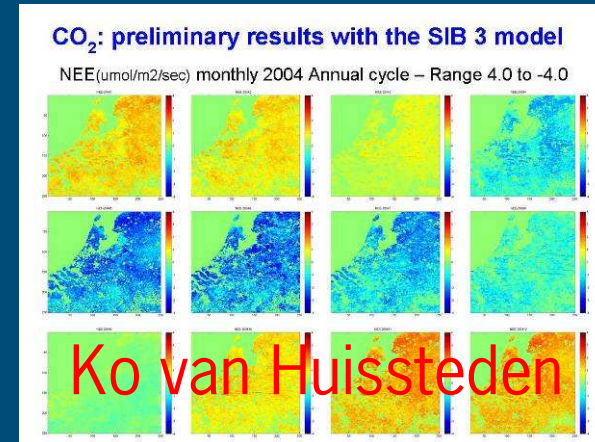
Carbon balance and greenhouse gas fluxes in intensive and extensive managed grasslands on peat

Elmar Veenendaal, Ko van Huissteden
Arina Schrier-Uijl, Petra Kroon,
Dimmie Hendriks, Peter Leffelaar,
Arjan Hensen, Han Dolman, Frank
Berendse

Elmar Veenendaal



Modellen



Ruimte en Natte gebieden

The effect of the spatial arrangement of wetlands on water quality improvement and carbon sequestration (ME5)
Jan Vermaat, Fritz Hellmann, Bart Hoorens, Rien Aerts

Two components:

1. water quality [Vermaat, Hellmann, IVM-VU]
2. Carbon sequestration and greenhouse gas emission [Hoorens, Dias, Aerts, IEW-VU]

Overarching Question: will the landscape pattern of these Veenweide polder wetlands affect their effectivity as nutrient-filters and C-sequesters?

Jan vermaat

klimaat voor ruimte
climate change spatial planning

vrije Universiteit amsterdam 3555



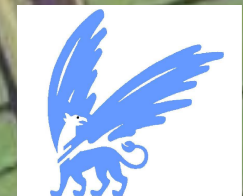
Brug functie & Rapportage



Discussie

Carbon balance and greenhouse gas fluxes in
intensive and extensive managed grasslands
on peat

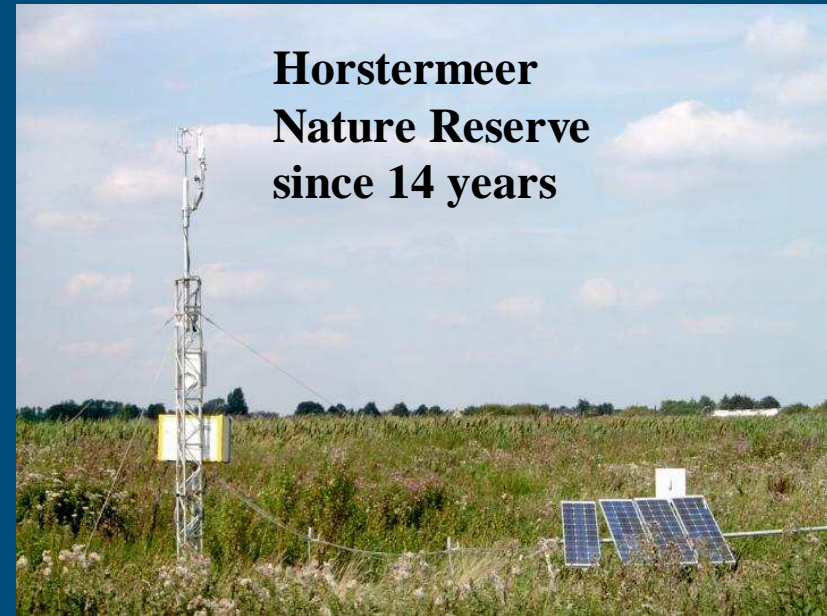
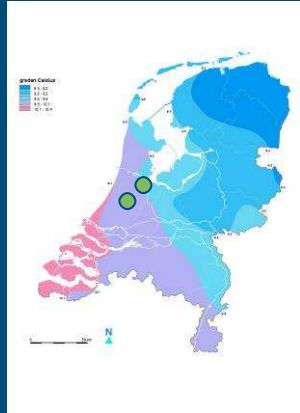
**Elmar Veenendaal, Ko van Huissteden
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Berendse**



Veenweide experiment

- Hoe zat het ook al weer. Landschapschaal experiment (2004 –2008) locatie and Instrumentatie
- Koolstof Balans en GHG's . Wat voor resultaten

Eutrophic fen meadow sites: Netherlands



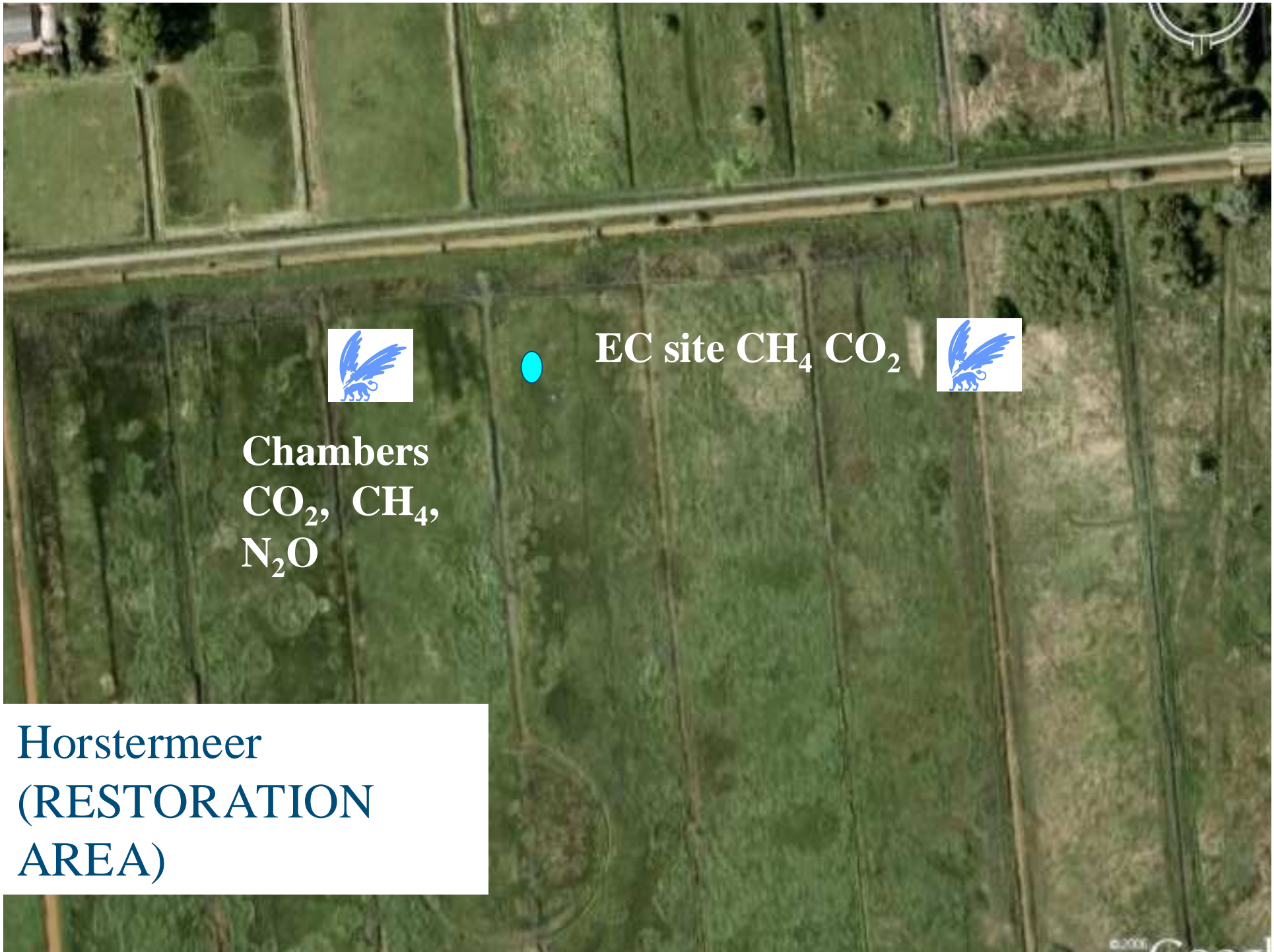
**Horstermeer
Nature Reserve
since 14 years**



**Oukoop
Intensive dairy farm**



**Stein
Meadow bird reserve**



Chambers
CO₂, CH₄,
N₂O



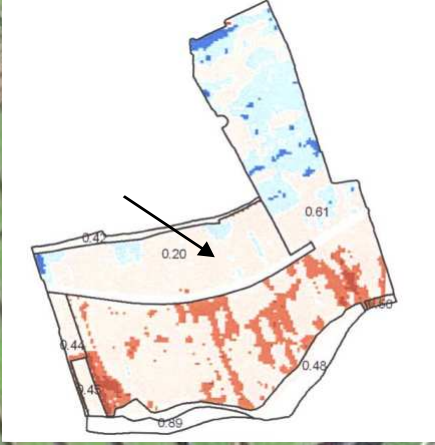
EC site CH₄ CO₂



Horstermeer
(RESTORATION
AREA)



Stein: Meadowbird
reserve
(EXTENSIVE
MANAGEMENT)



Oukoop; Dairy farm
(INTENSIVE MANAGEMENT)

Chambers

CO₂, CH₄, N₂O



Oukoop



Intensive site

EC site CO₂

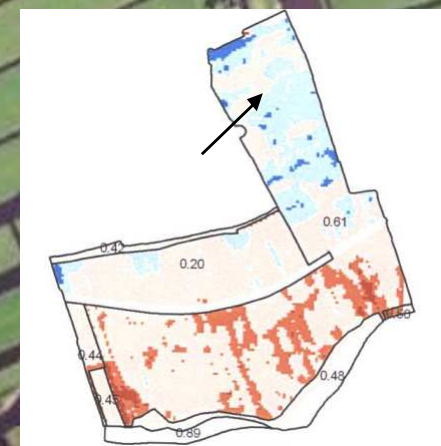


EC site N₂O/CH₄

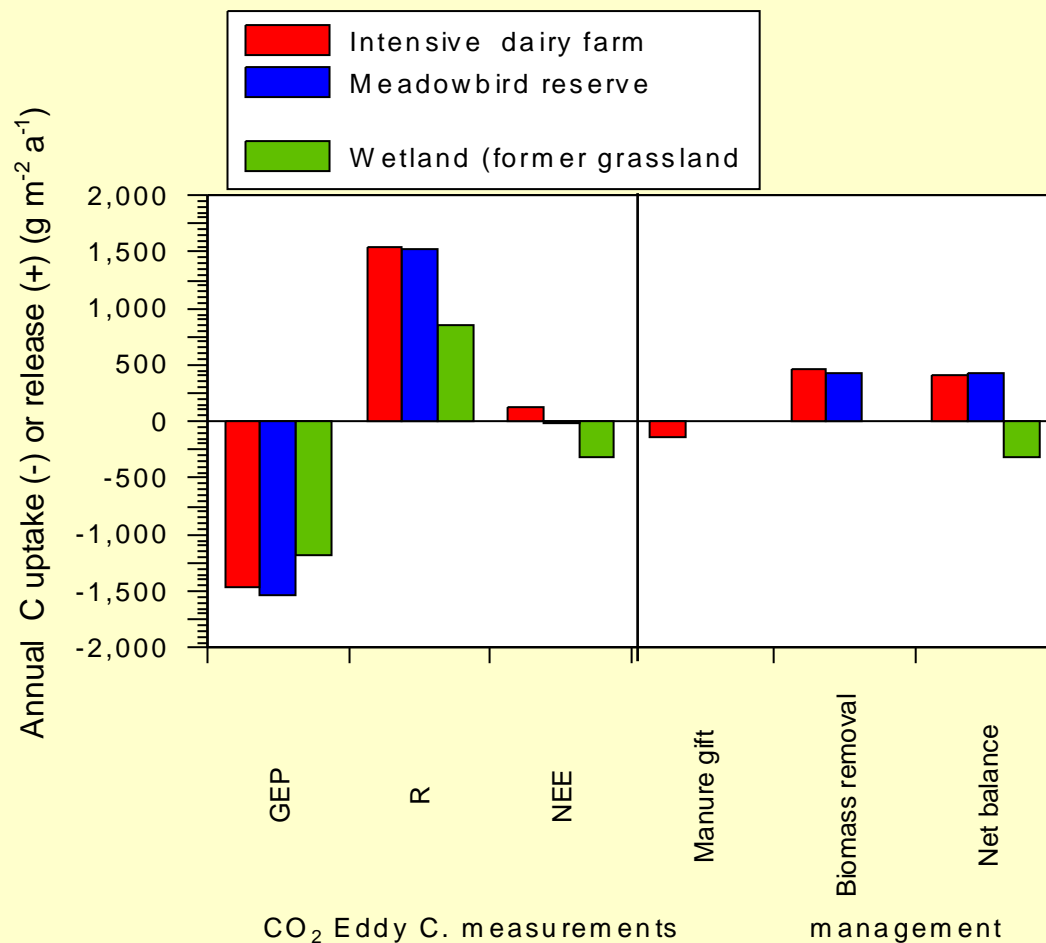


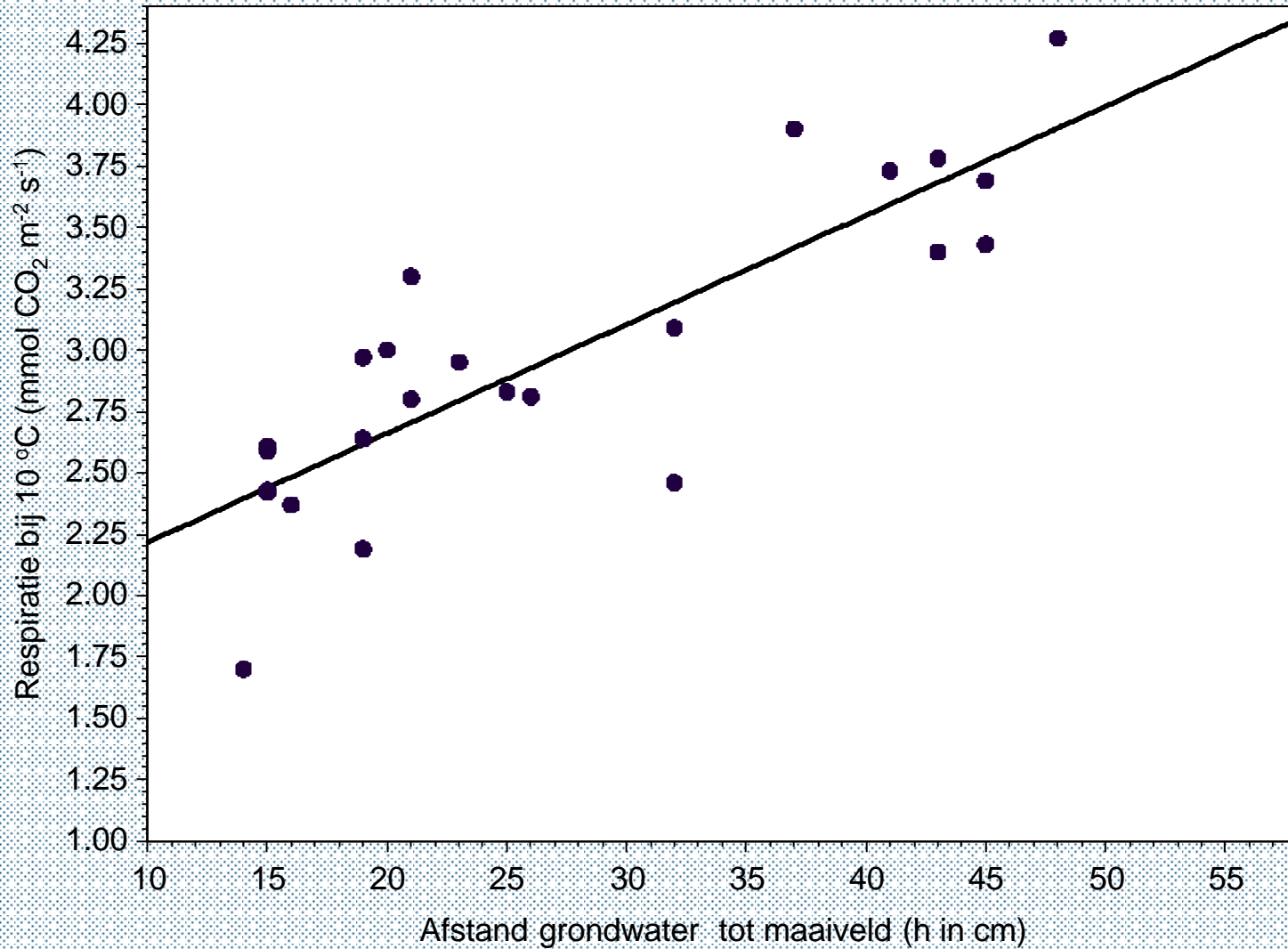
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Image © 2006 Aerodata International Surveys



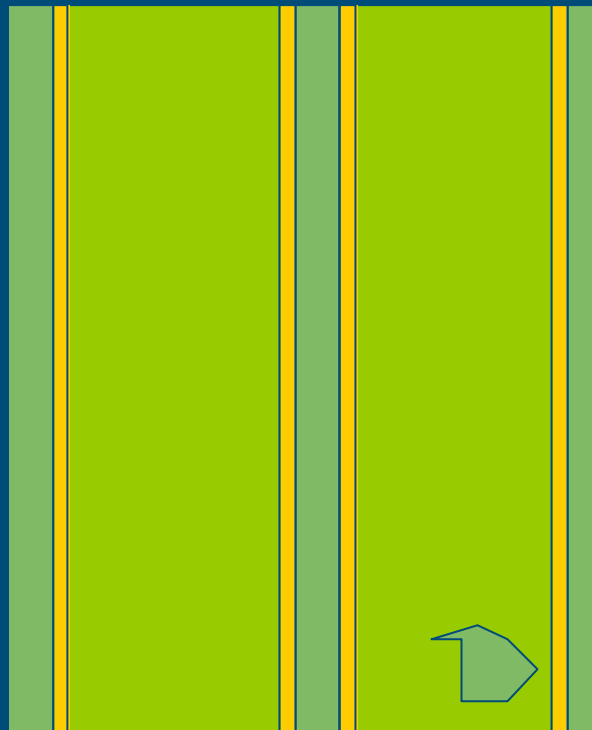
Summary of management effects on Carbon Balance





**Grondwaterstand en Respiratie (R10) Stein en Oukoop
(2005 – 2007)**

Land elements and emissions



Subdivision

Landforms:

- Ditches and open water: ca. 20% (Saturated water edges: ca. 5%)
- Land: ca. 75%

Linda Nol et al (2008)



Fig. 2. The projection of the footprints of the EC masts clockwise, averaged over: 16 March, Aug-Nov 2006, 12 July and 8 Nov estimated by the model of Kormann and Meixner (Kormann and Meixner, 2001; Neftel et al., 2007).

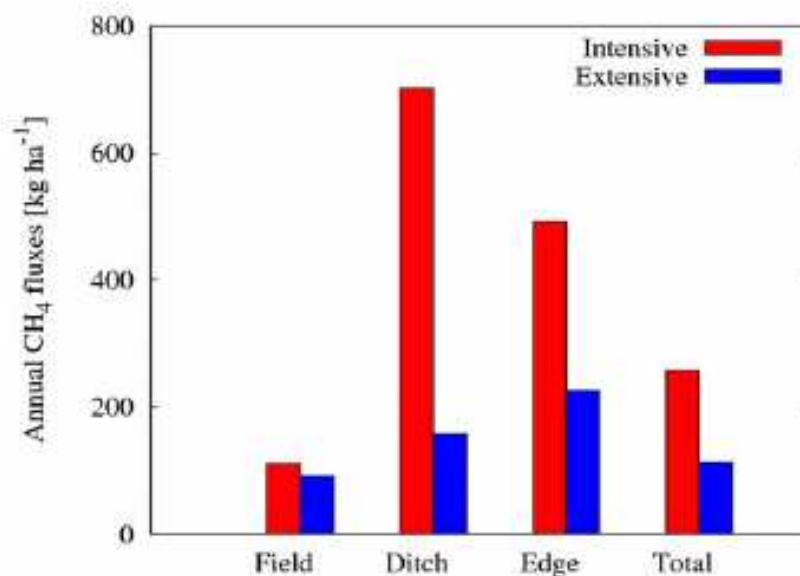
Schrier- Uijl & Kroon et al

Background: Lack of accurate annual sums

Due to spatial variation



Top view Reeuwijk site in the Netherlands



(Based on Schrier et al., 2008)

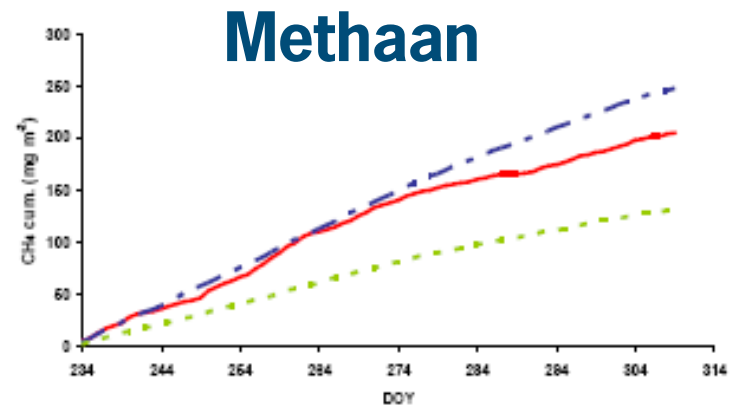
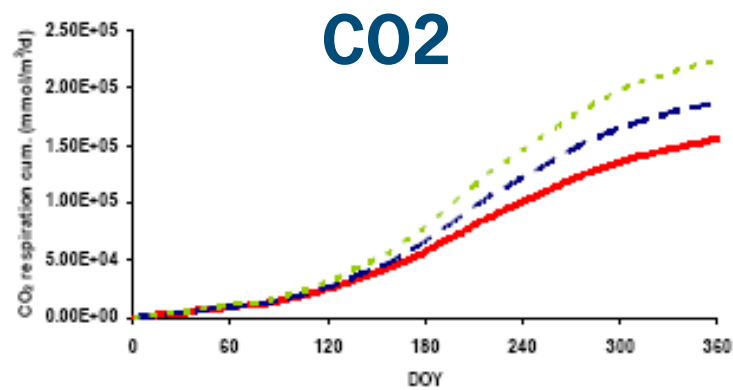
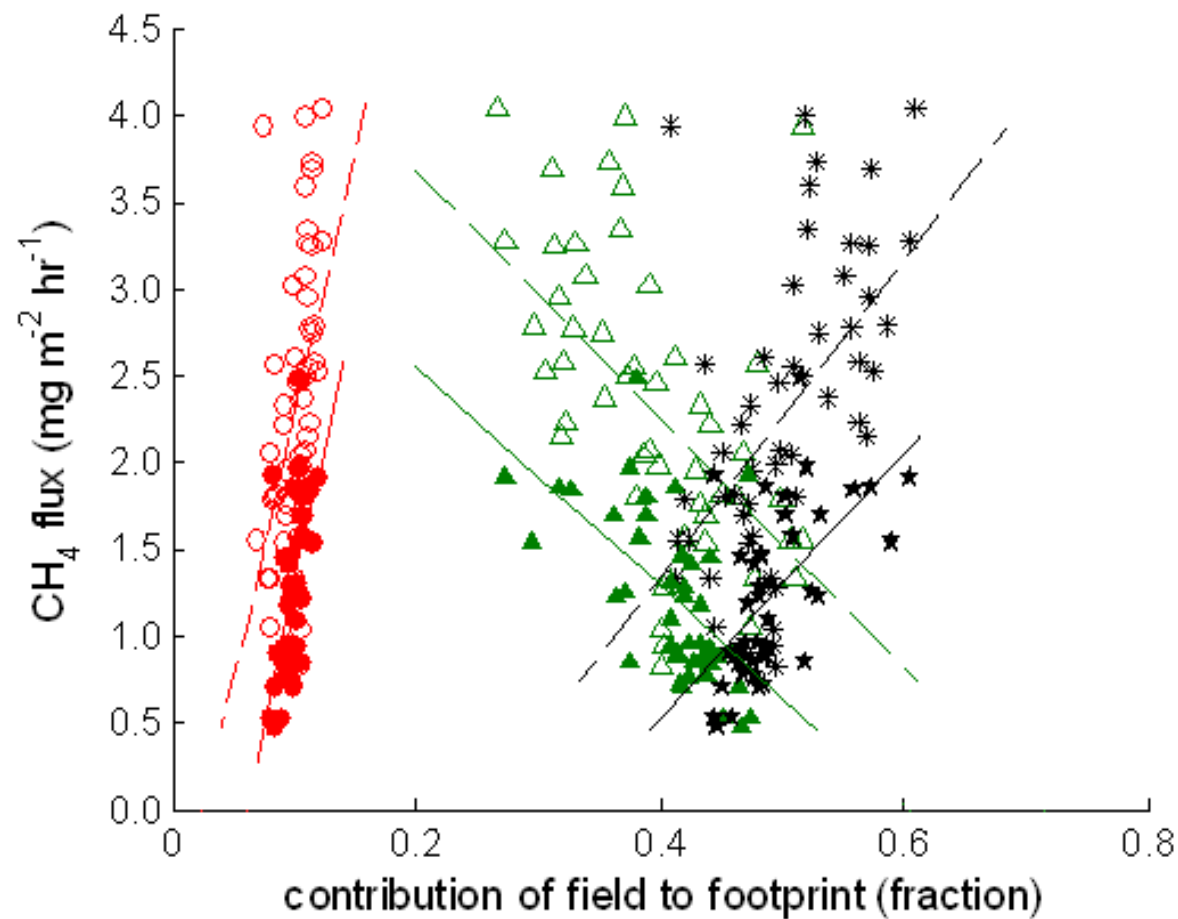
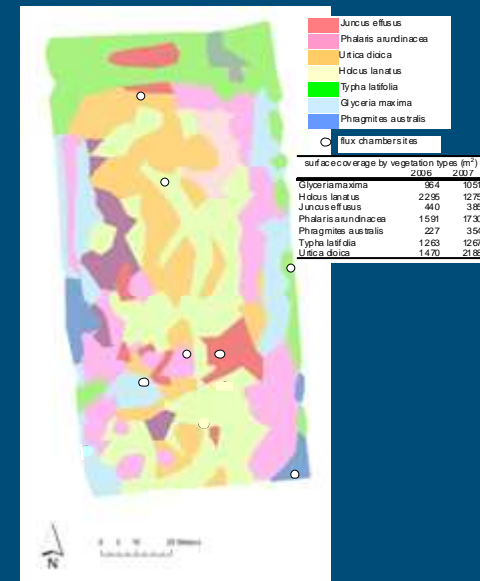


Fig. 5. Cumulative CO₂ respiration (left) and CH₄ emission (right) over one year and three months, respectively. The blue dashed line (first scenario) is the model based on chamber measurements and weighted for the landscape elements, the red solid line shows the EC results and the green dotted lines show the cumulative values based on upscaling from field measurements (second scenario)



- △ dry land (day time)
- ▲ dry land (night time)
- * wet land (day time)
- ★ wet land (night time)
- ditches and borders (day time)
- ditches and borders (night time)



Hendriks et al

Output

veenweide experiment
scientific papers
(12 published or in ms.)
integration of results
- Carbon balance
- GHG
mostly in 2009



In 2009; Few measurements planned

EC measurements have ~~Reeuwijk~~ discontinued

Petra Kroon (ECN), Dimmie Hendriks (VU), Arina Schrier-Uijl (WUR-NCP)

MODEL GROUP



Models results and plans

Juan F. Garcia Quijano (VU) SIB3 - CO₂, latent heat

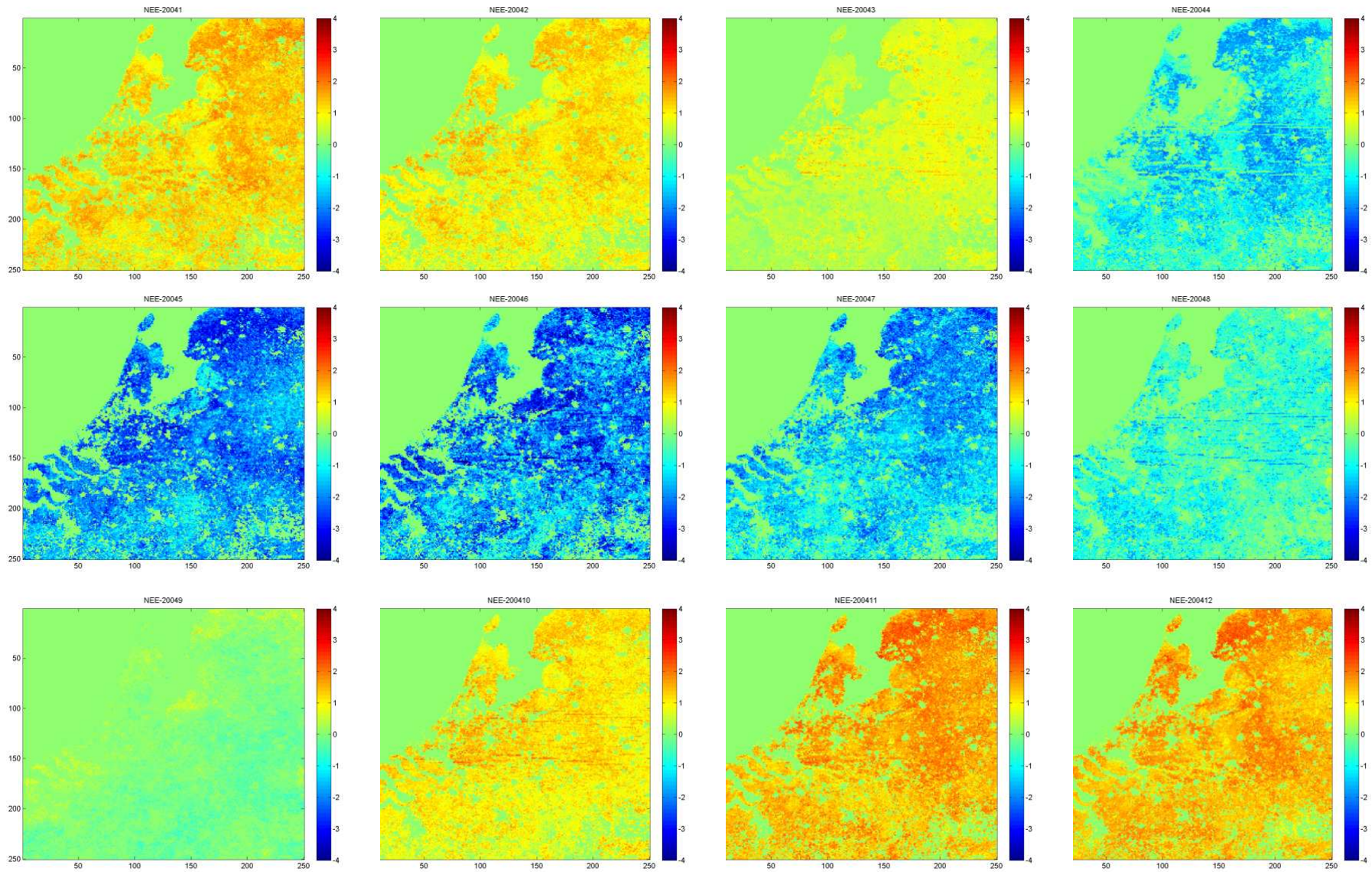
Ko van Huissteden (VU) PEATLAND-VU, CH₄

Linda Nol (WUR) INITIATOR, DNDC N₂O model comparison

Petra Stolk (WUR) N₂O SWAP-ANIMO

CO₂: preliminary results with the SIB 3 model

NEE(umol/m2/sec) monthly 2004 Annual cycle – Range 4.0 to -4.0



CH₄ PEATLAND-VU

Sensitivity tests PEATLAND-VU CH₄ model:

GLUE (generalized likelihood uncertainty estimation) method

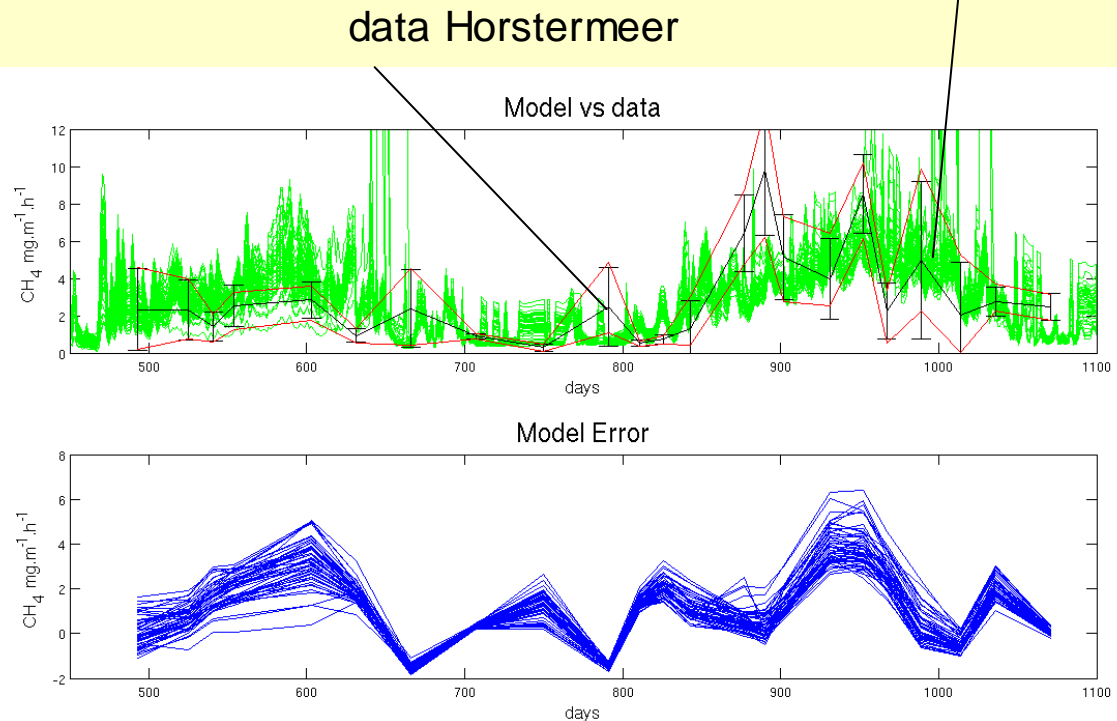
- comparatively low sensitivity for soil parameters
- 'manageable' sensitivity for vegetation parameters

Wich means: green light for upscaling of fluxes

best model runs from
GLUE sensitivity tests

Modelling of site fluxes:

- very good model fit for Ruwiel semi-natural grass
- reasonable for Horstermeer
- Oukoop, Stein: to be done

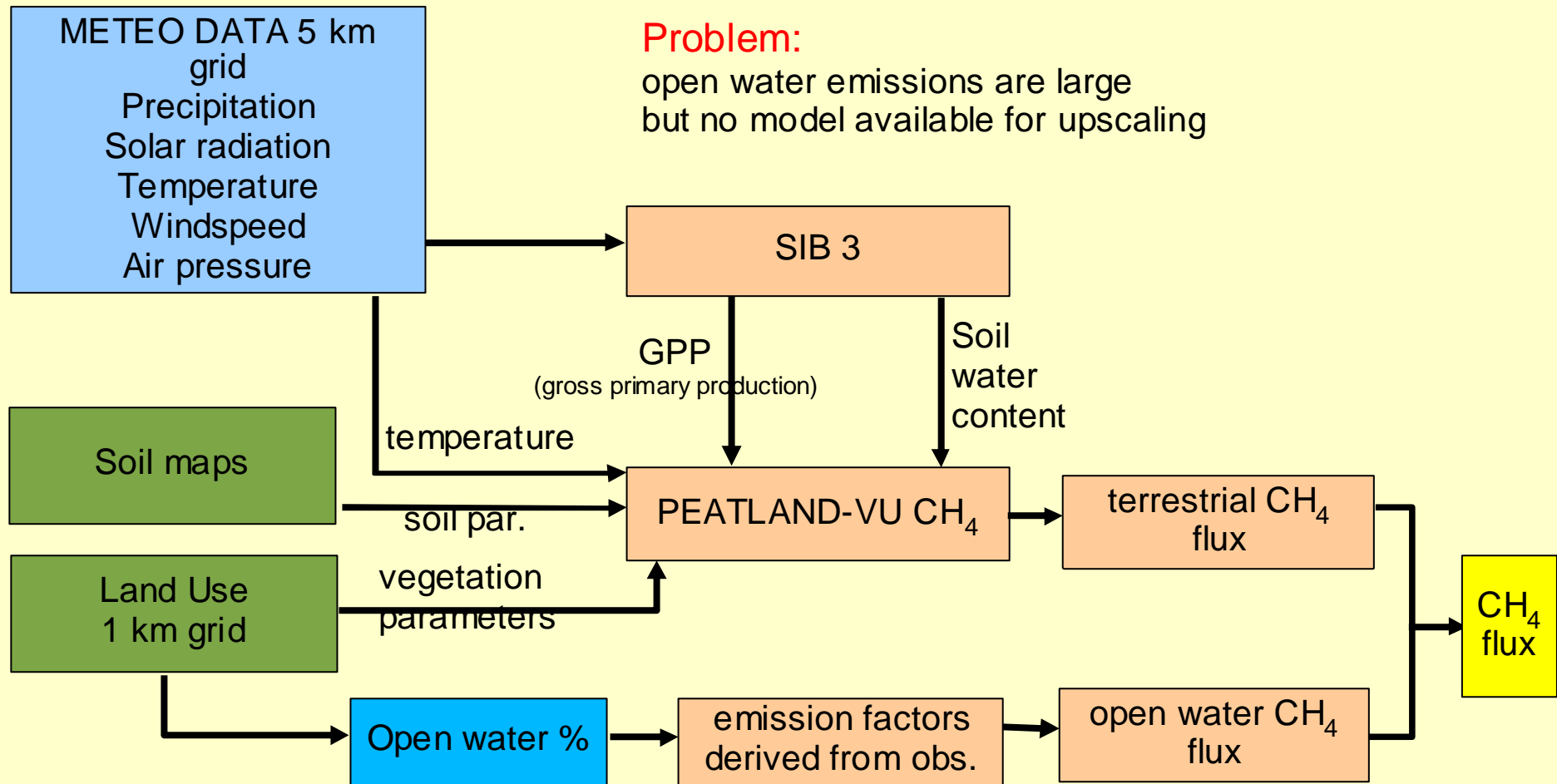


Country-wide upscaling CH₄ fluxes with PEATLAND

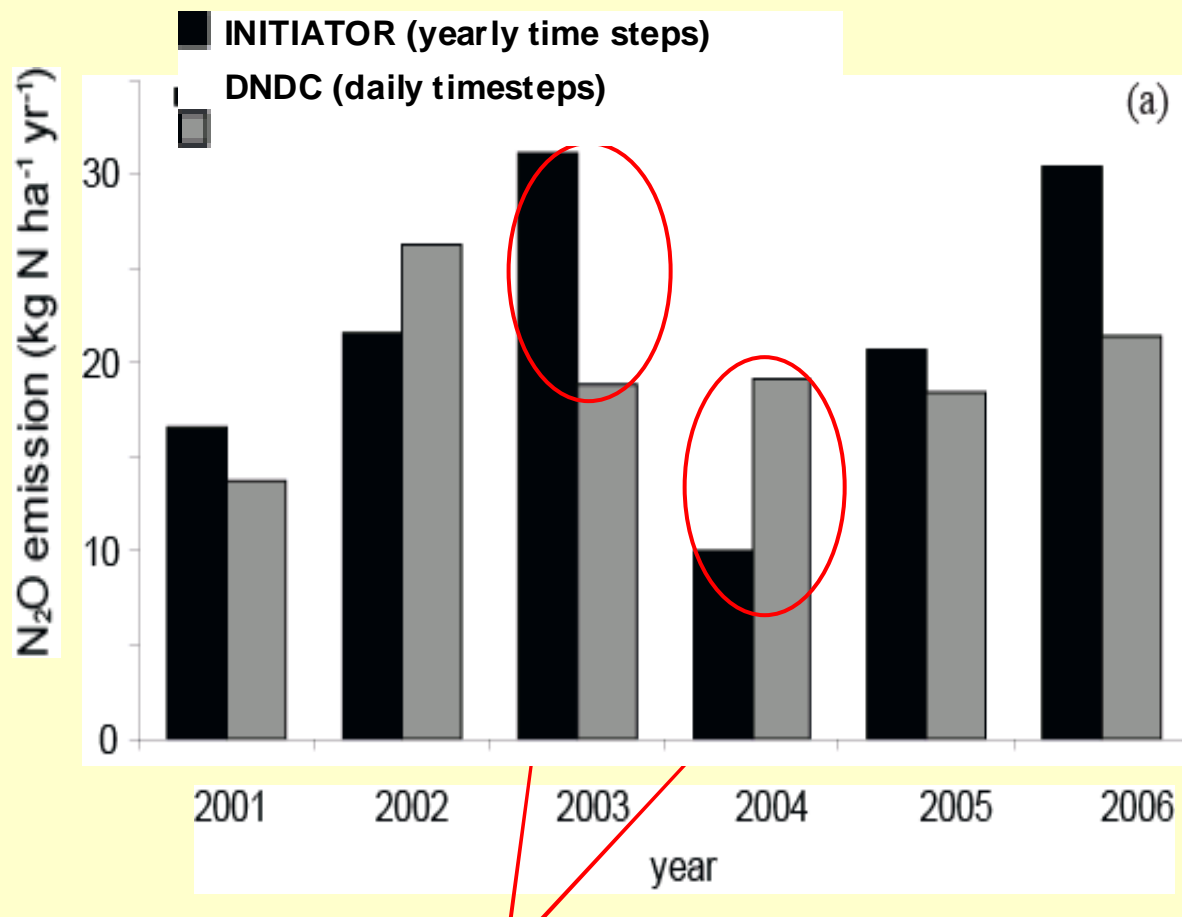
- Tested for Drenthe
- Coupled to SIB 3 model
- Planned march-june 2009

Problem:

open water emissions are large
but no model available for upscaling

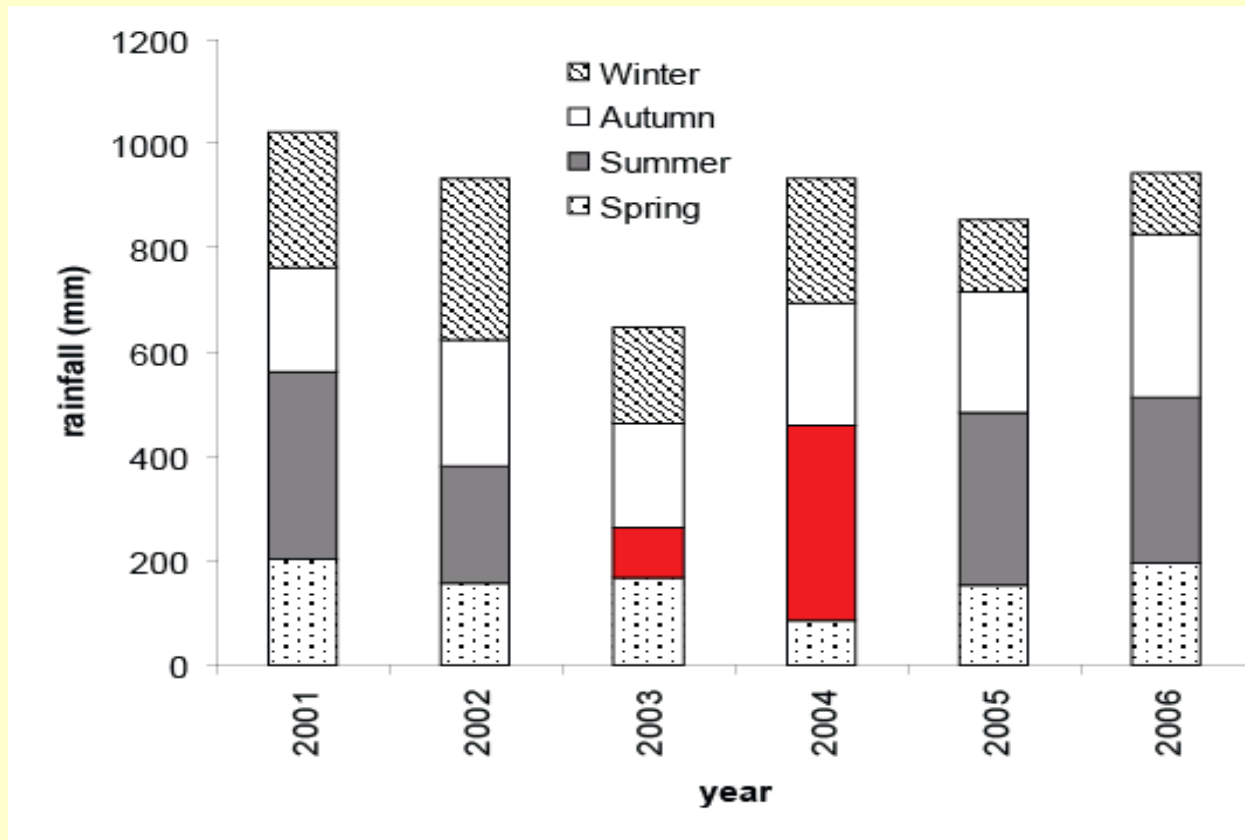


Simulated N₂O emission from an intensively managed grassland on peat (Zegveld)



Where do these differences come from?

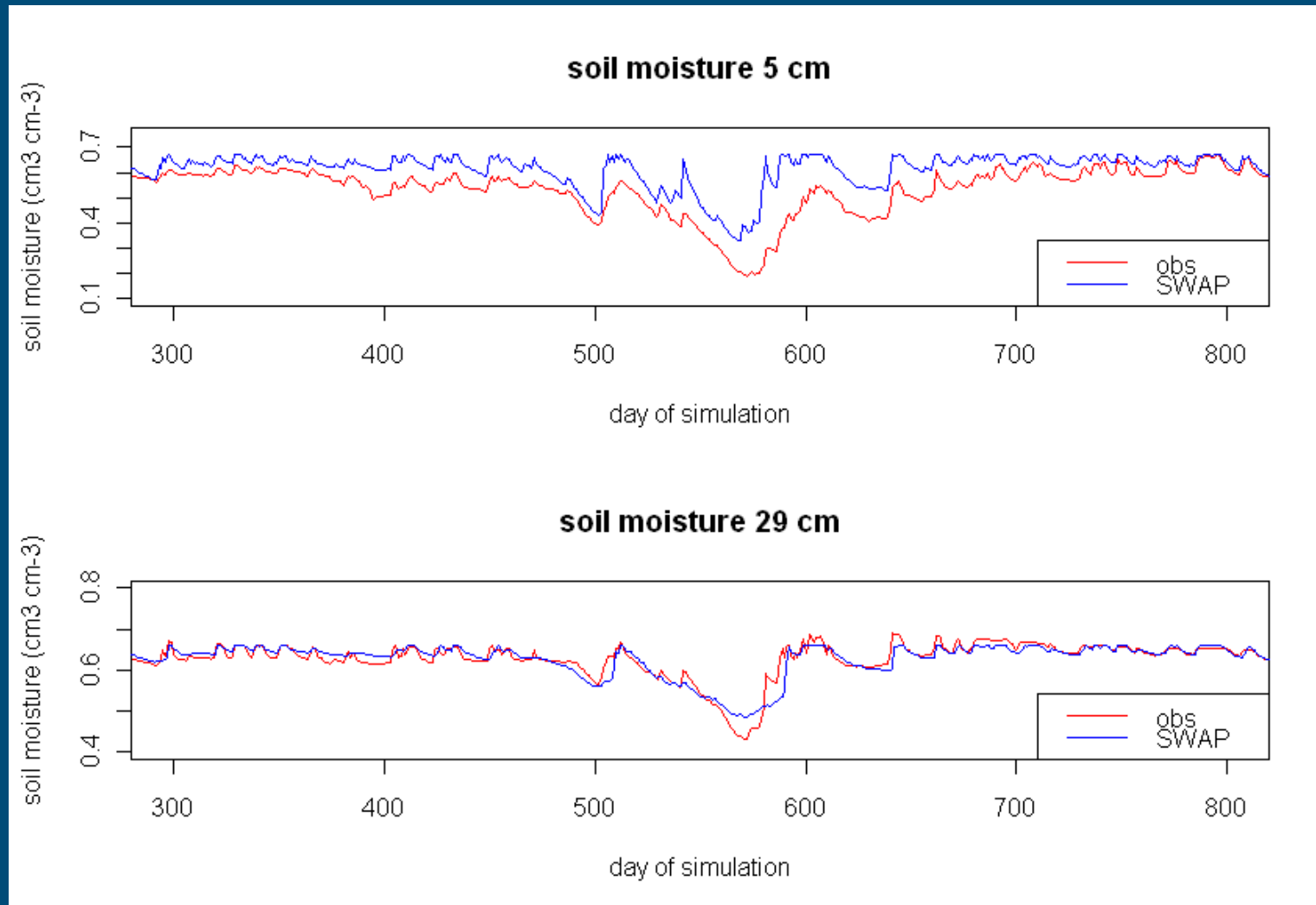
Rainfall distribution (mm) with a low summer rainfall in 2003 and a high summer rainfall in 2004



Low temporal inventory models such as INITIATOR may be improved for intensively managed grasslands on peat soils by adjusting N_2O emission estimates for years with relatively dry summers and wet summers

Preliminary results SWAP-ANIMO (WUR)

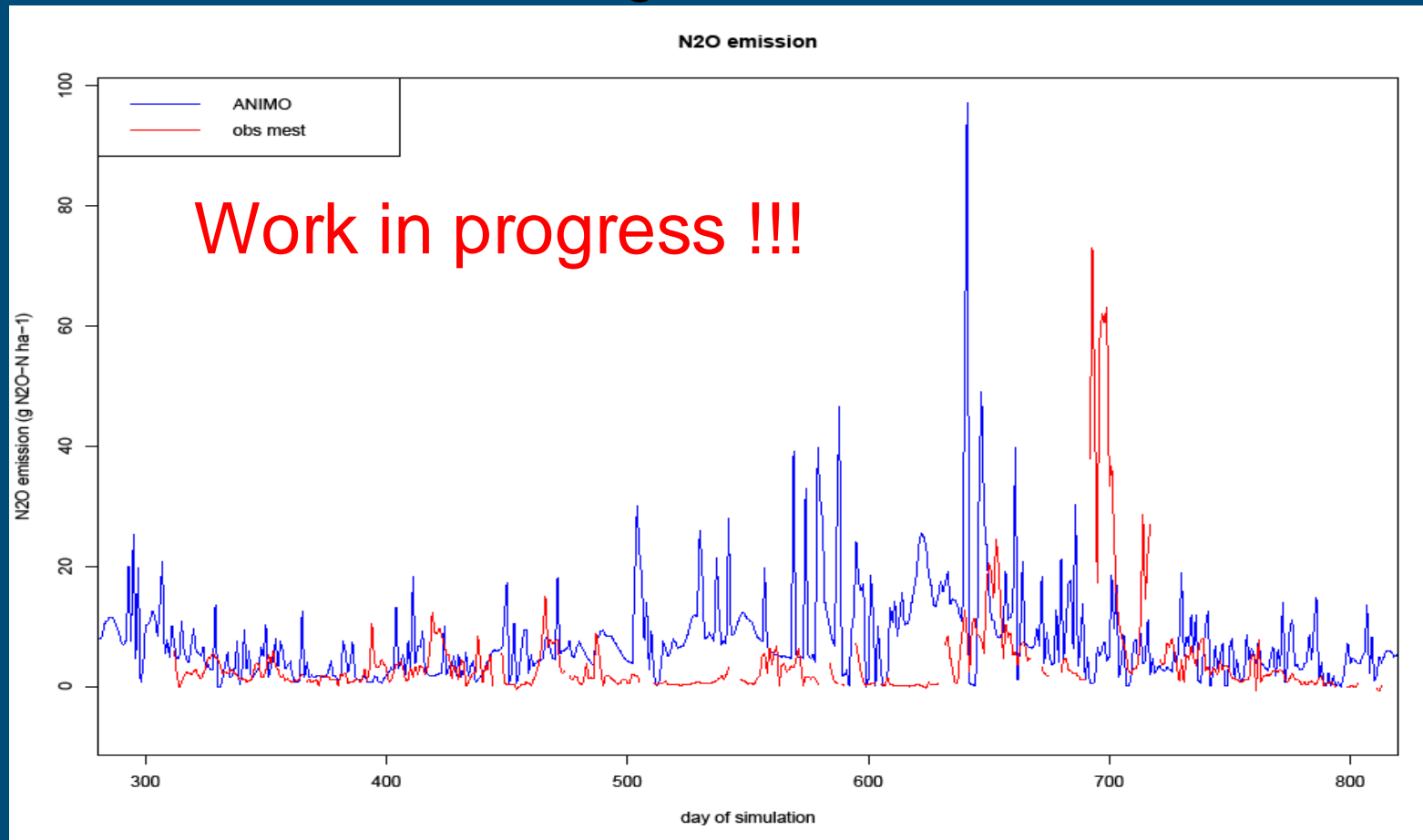
Stein (TNO) Sep 05 – Mar 07



Preliminary results SWAP-ANIMO (WUR)

Stein (TNO) Sep 05 – Mar 07

Lachgas emissie



The effect of the spatial arrangement of wetlands on water quality improvement and carbon sequestration (ME5)

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Two components:

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Overarching Question: will the landscape pattern of these Veenweide polder wetlands affect their effectivity as nutrient-filters and C-sequesters?

Approaches

Water quality

1. Multivariate and comparative: many polders; construct water and nutrient mass balances for each in a common template
2. Modelling these polder in SOBEK, to allow KNMI and IPCC-SRES scenario-runs

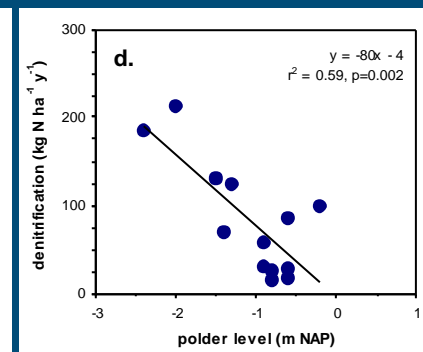
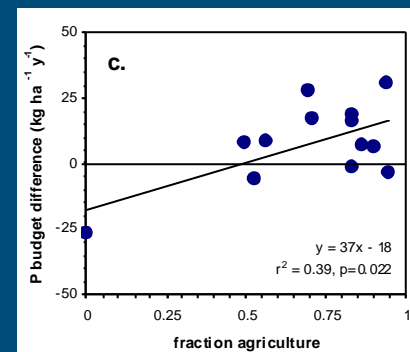
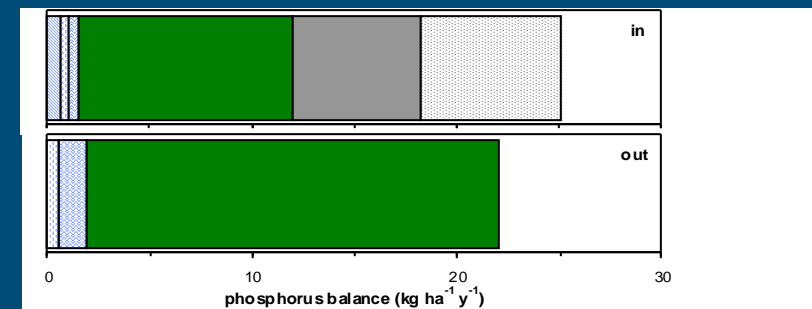
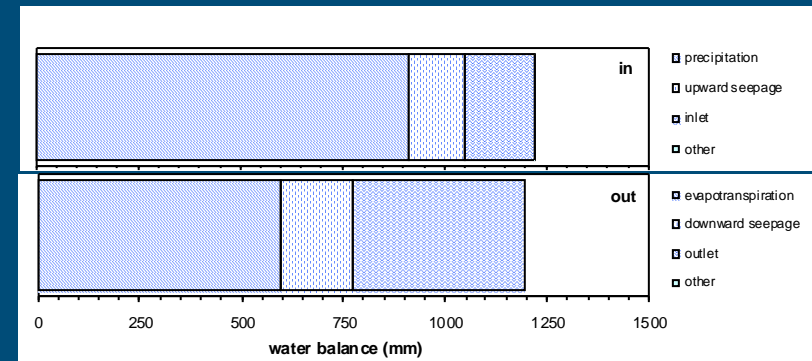
Greenhouse gases

Quantify time series of in situ greenhouse gas emissions from different herbaceous veenweide fen habitats and ditches along a hydrological and land-use gradient in Nieuwkoopse Plassen and Guisveld (Zaandam)

Results water quality

Part 1: paper almost submitted

- Balances are acceptable
- Agricultural land use is major forcing factor of nutrient budgets; urbanisation/openness is a second factor, together they explain 54% (PCA)
- Retention takes mainly place in the peat soil, but all fluxes together cause dynamic steady state. No effect of ditch pattern
- Balance surplus of P fits well with observed increase in P content of soils
- Denitrification is highest in the lowest polders (vs NAP)



Results SOBEK modelling

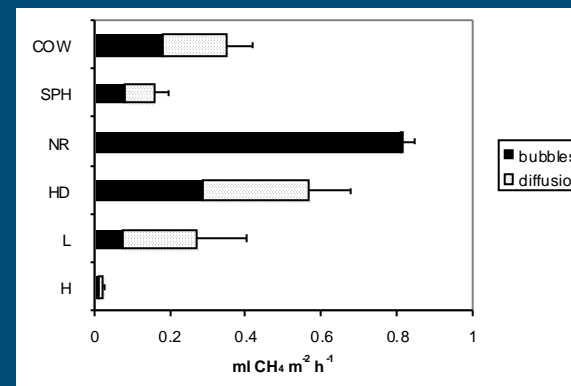
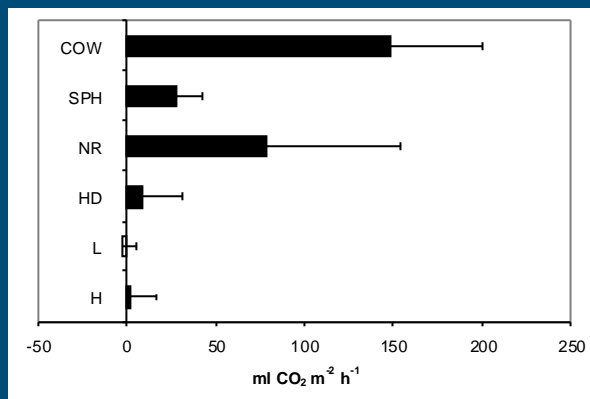
Progress

- Chloride budgets and concentrations in order.
- Nutrient results on-going now
- Synthetic polder will be designed in March 2009
- KNMI and IPCC –SRES scenarios decided upon: we will use



Results greenhous gas emissions

- Measurements on-going: two more series in 2009
- Hoorens left for Tauw, replaced by Dias
- Flux measurements from open water: variation! CO₂ >> CH₄; bubbles can be important; shaded nature reserve ditches respired ...



Final products



1. Scientific papers (tentative titles)

- Vermaat et al. (~submitted) Water and nutrient balances of Dutch polders, what governs nutrient retention? Water Research
- Hoorens et al. (in prep) Greenhouse gas emission rates from Dutch fen habitats along land use intensity gradients
- Hellmann et al. (in prep) Dynamic modelling of the water and nutrient budgets of Dutch polders, what are the consequences of climate and socio-economic scenarios?
- Vermaat et al. (in prep) Methane and carbon dioxide fluxes from ditches and lakes in Dutch peatland polders

Handbook

practical, for water manager and spatial planner: discuss with
“Leven met Water”

Joint work across ME1-6: for discussion

Some additional spin-off

Vernooij & Vermaat (2009) What happens if we stop pumping? A GIS analysis of water level rise in 5 Dutch polders. Landschap (accepted)

Maatschappelijke en beleidsrapportage en Brugfunctie

- Rapporten naar (deel) opdrachtgevers bijv:
- Provincie Drente
- Provincie Noordholland

BOEK Initiatief?

BOEK?

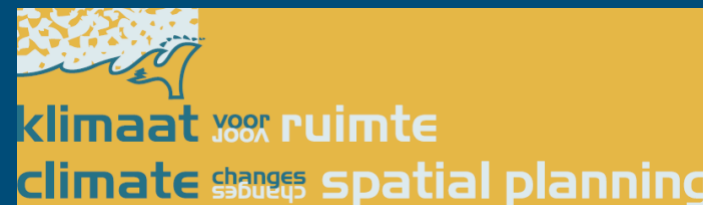


Boek: waarheen met het veen wordt geschreven door publicist

- Inleiding
- 1 Probleem
 - 1.1 Veenweide
 - 1.2 Bodemdaling
 - 1.3 Conclusie: Veenbodem of veenweide?
- 2 Praktijk
 - 2.1 Verhalen van gebruikers en beheerders
 - 2.2 Verhalen van beleidsmakers en bestuurders
 - 2.3 Conclusie: Kennis en belangen
- 3 Oplossingen
 - 3.1 Beschikbare oplossingen
 - 3.2 Combineren is integreren
 - 3.3 Conclusie: Kosten en baten
- 4 Toekomst
 - 4.1 Beleid
 - 4.2 Organisatie en bestuur
 - 4.3 Ruimtegebruik
- 5 Conclusie
 - 5.1 Doorkijkje in de toekomst
 - 5.2 Kennis



Broeikasgassen en koolstof balans toevoegen?





Bottleneck is timing?

Achtergrondstukken aanleveren: Juni 2009

Haalbaar voor veenweide (ME1)

Haalbaar voor ME5?

**Voordeel: Meedoen in een succesvol initiatief
en brugfunctie**

**Nadeel : Eigen zichtbaarheid van ME1 en ME5
en klimaat voor Ruimte gewaarborgd**

