

# Five years of transition – atmospheric C-exchange dynamics of a coastal fen after rewetting by flooding

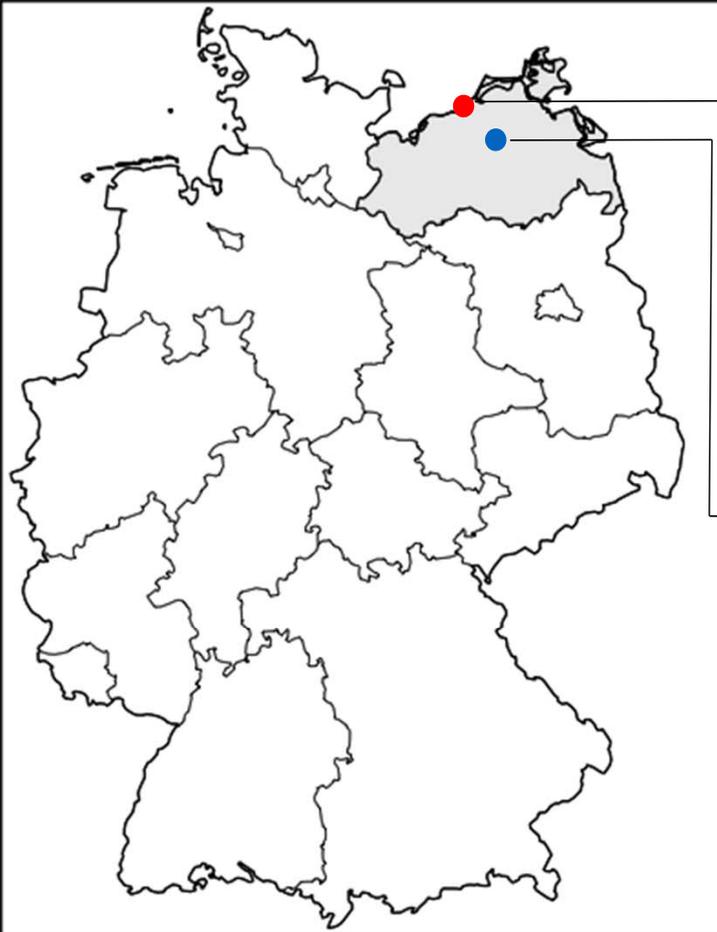
Jurasinski G<sup>1</sup>, Koebisch F<sup>2</sup>, Koch M<sup>1</sup>, Koch S<sup>1</sup>,  
Koehler S<sup>1</sup>, Hahn J<sup>1</sup>, Glatzel S<sup>1</sup>

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<sup>2</sup> GFZ, German Research Centre for Geosciences

TERENO 2014 :: Bonn, Germany

# Rewetted peatlands in the TERENO North Eastern Lowland Observatory



**Hütelmoor**  
University of Rostock & GFZ  
(Oral presentation of F. Koebsch on Wednesday in Session S8)

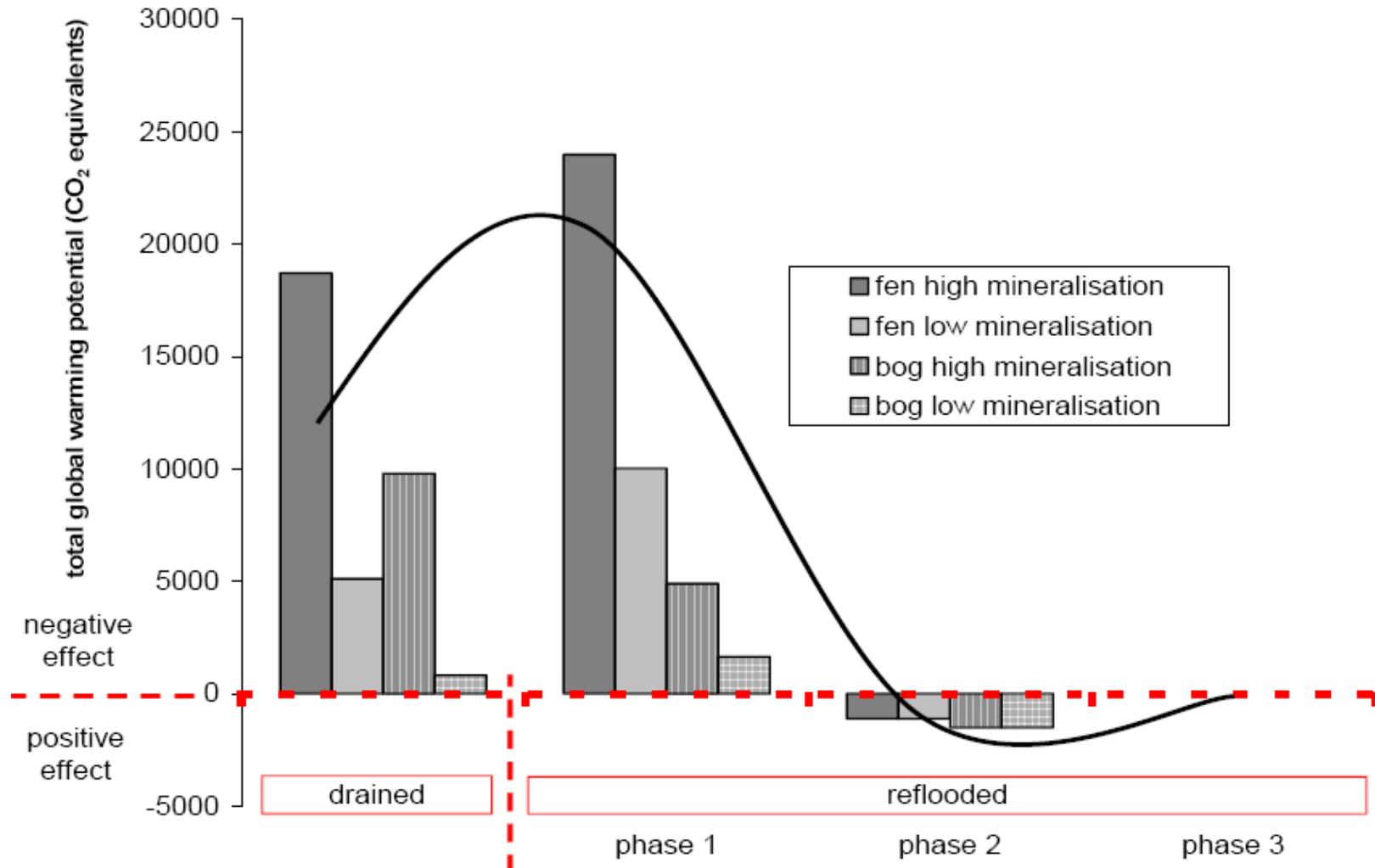


**Polder Zarnekow**  
GFZ & ZALF  
(Poster presentation of D. Franz on Wednesday: P3-09)

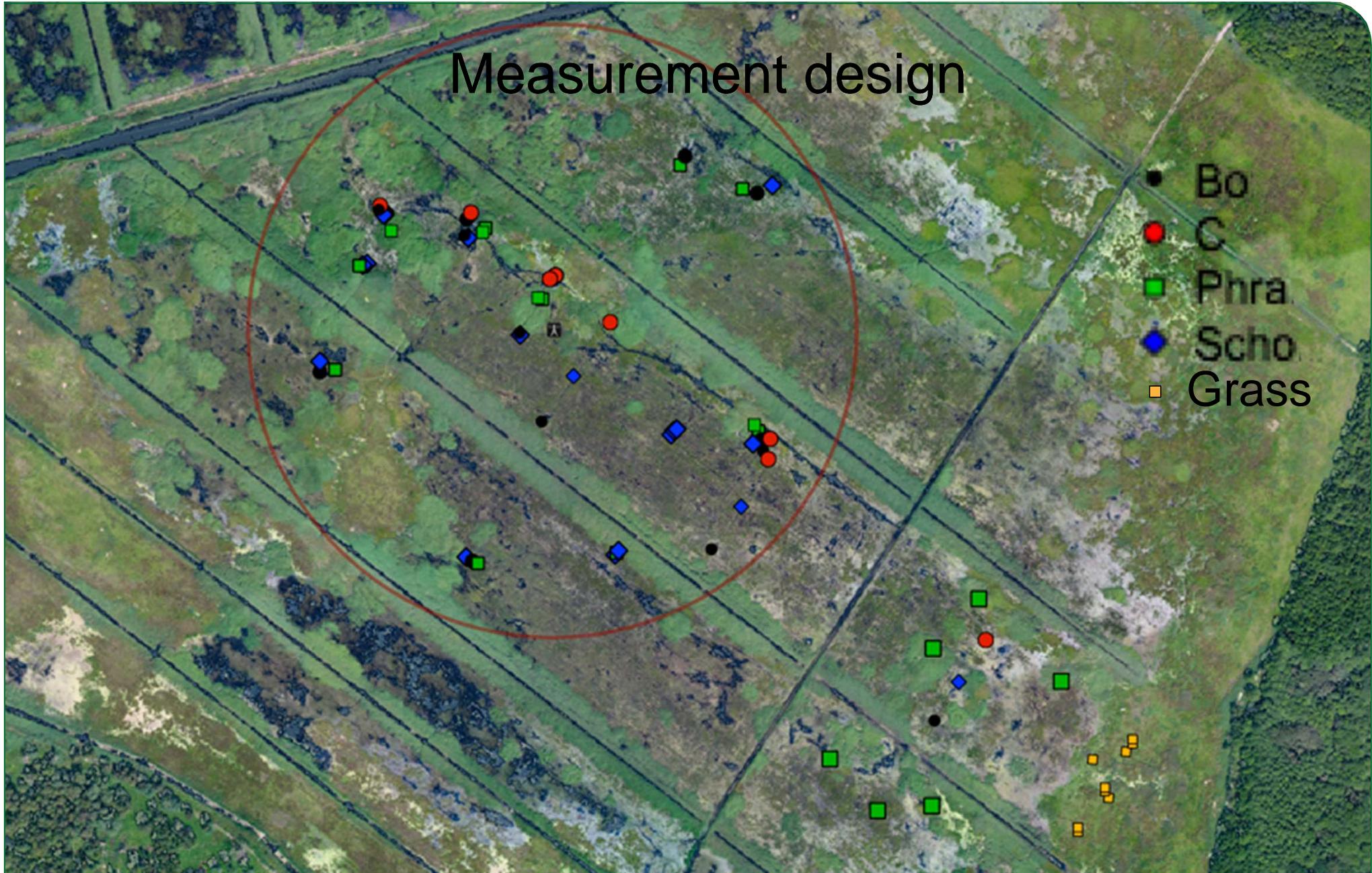




# Methane emissions may be high after rewetting



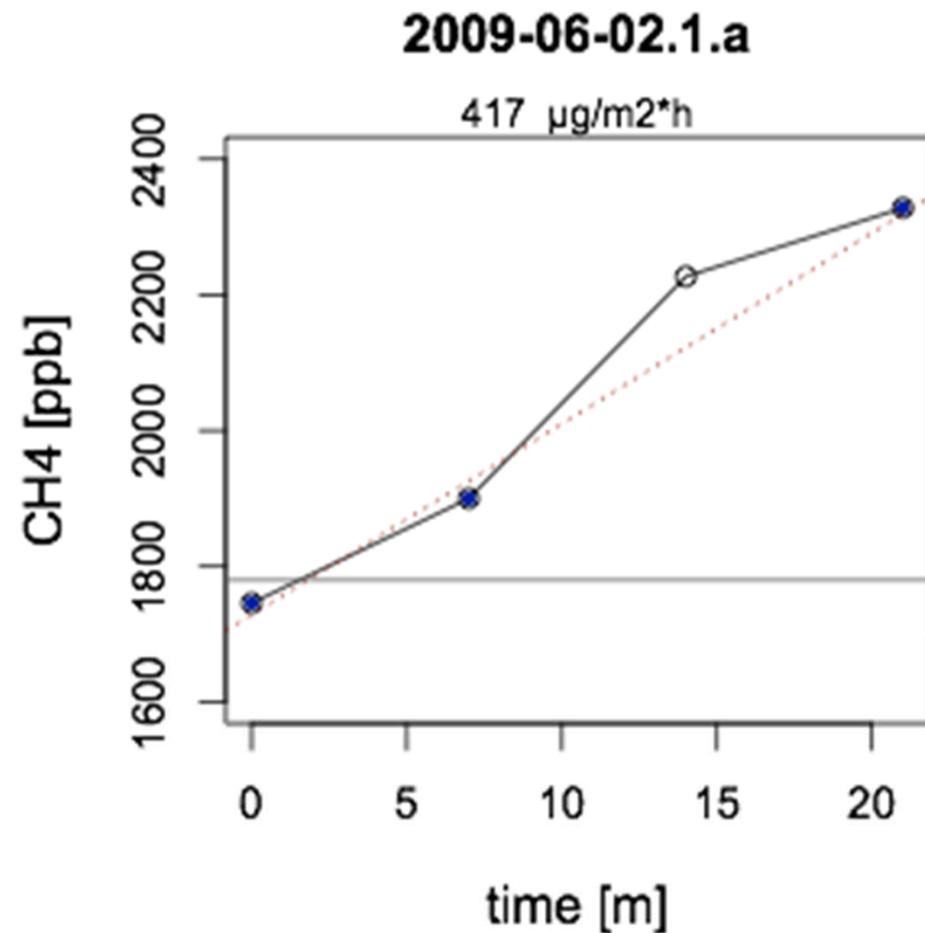
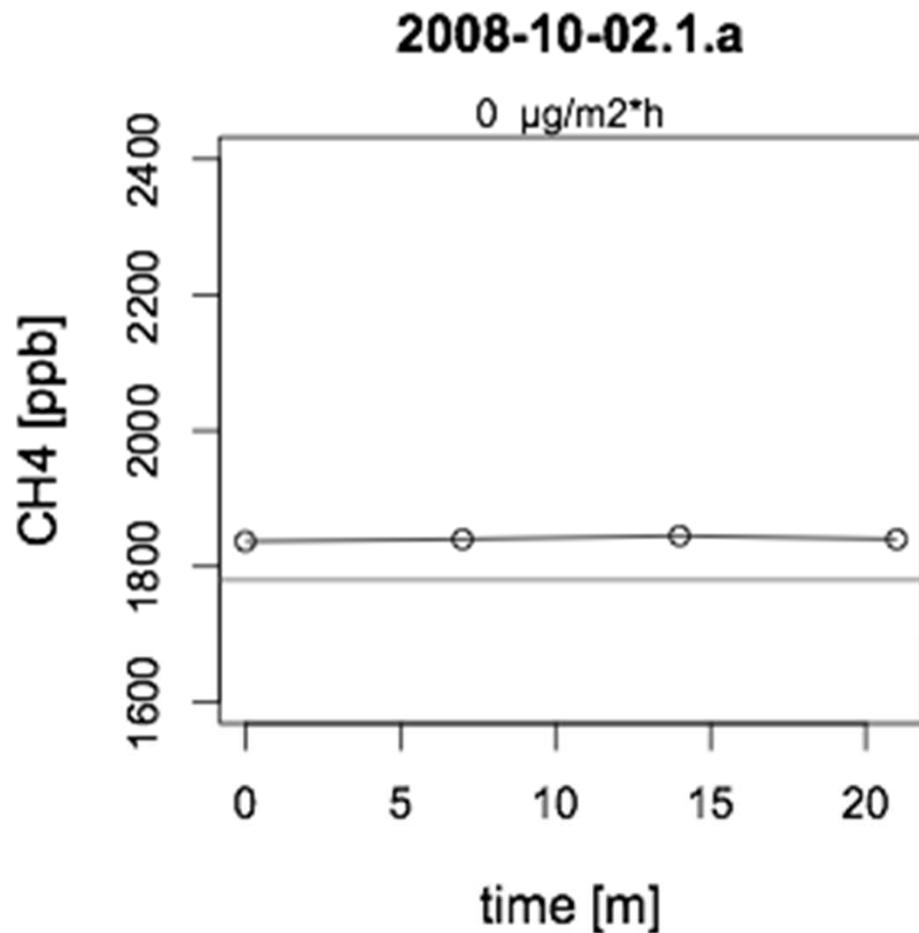
Augustin & Joosten (2007) IMCG Newsletter



Custom development: Flexible,  
height adjustable chambers



## Flux estimation with R package *flux*\*

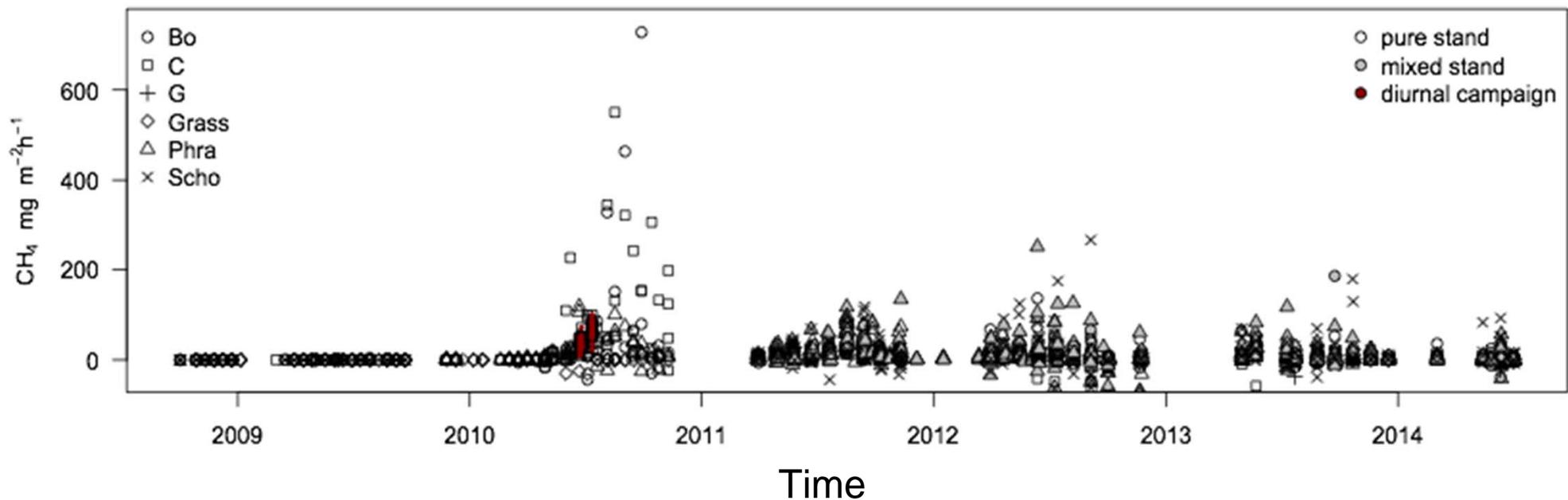


\*Jurasinski et al. 2014 flux, available on CRAN

## Getting reliable estimates of annual emission sums in the absence of proper models: *auc.mc* in *flux*

- Simple averaging (coarse estimate, especially not suitable when fluxes show pronounced seasonality)
- Integrate the area under curve (better estimate, but some high fluxes or missed fluxes may have a strong influence)
- Bootstrapped or „leave-some-out“ integration (good estimate, allows for estimating an error of the total emission)

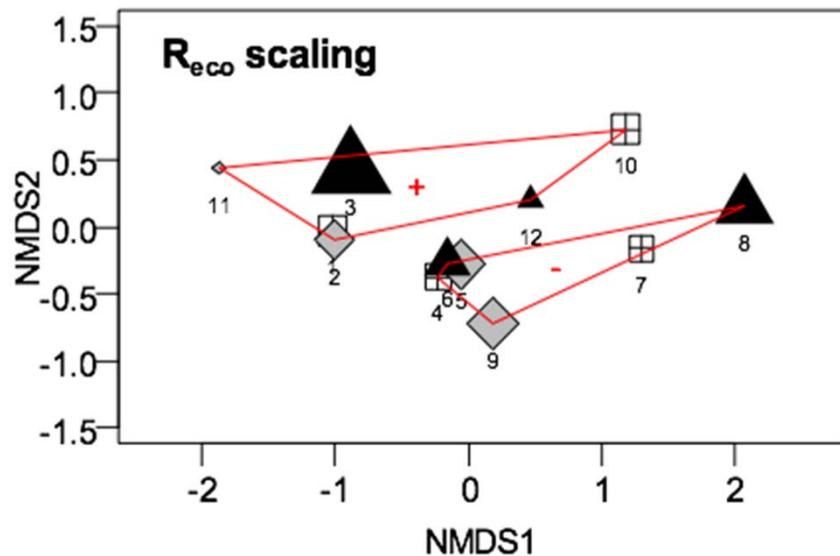
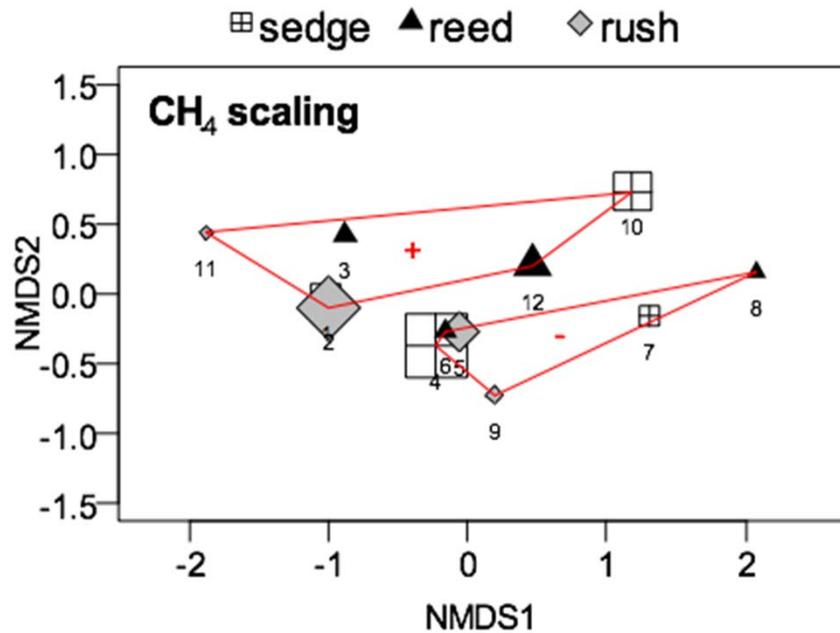
# Methane exchange at the Hütelmoor from 2008-10-02 to 2014-07-02





# After the installation of the ground sill in winter 2009/2010: Shallow-lake-conditions





## De-stabilization of the ecosystems reflected in chaotic reaction of the environment after flooding

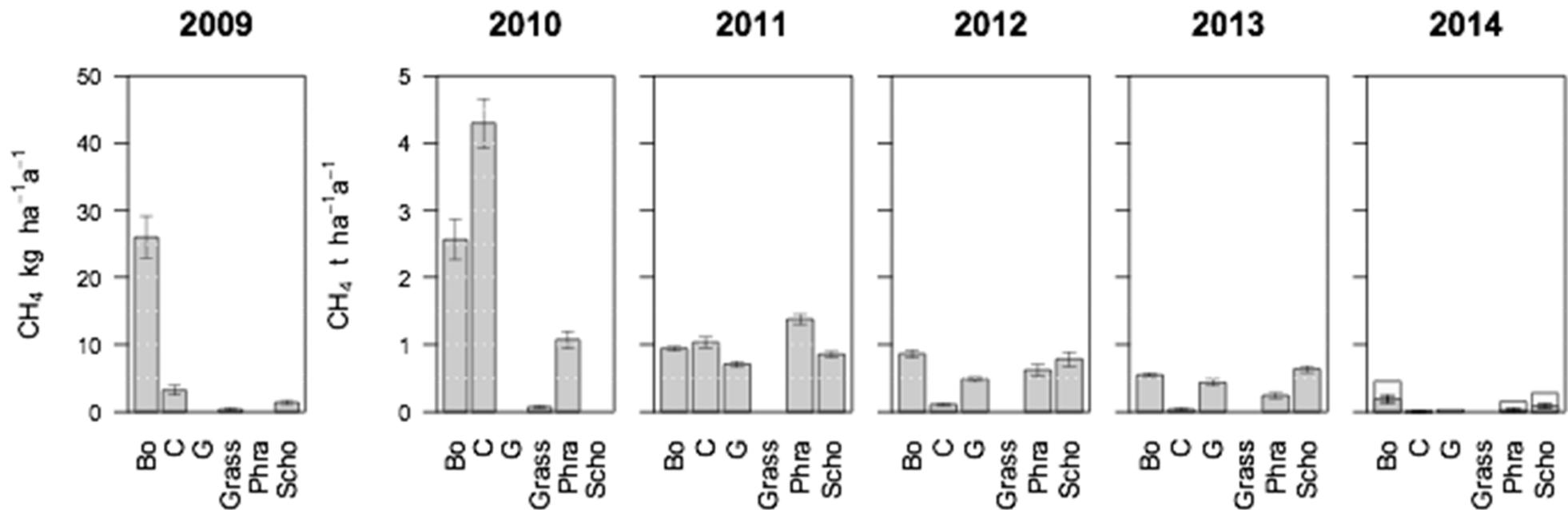
porewater: water level, TOC, TNb, Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>

general: cover of dominating vegetation, median annual water level, peat temperature

peat: C, N, S, P, K, Ca, Na, Mg, Fe, dry bulk density, %dry weight, SOM

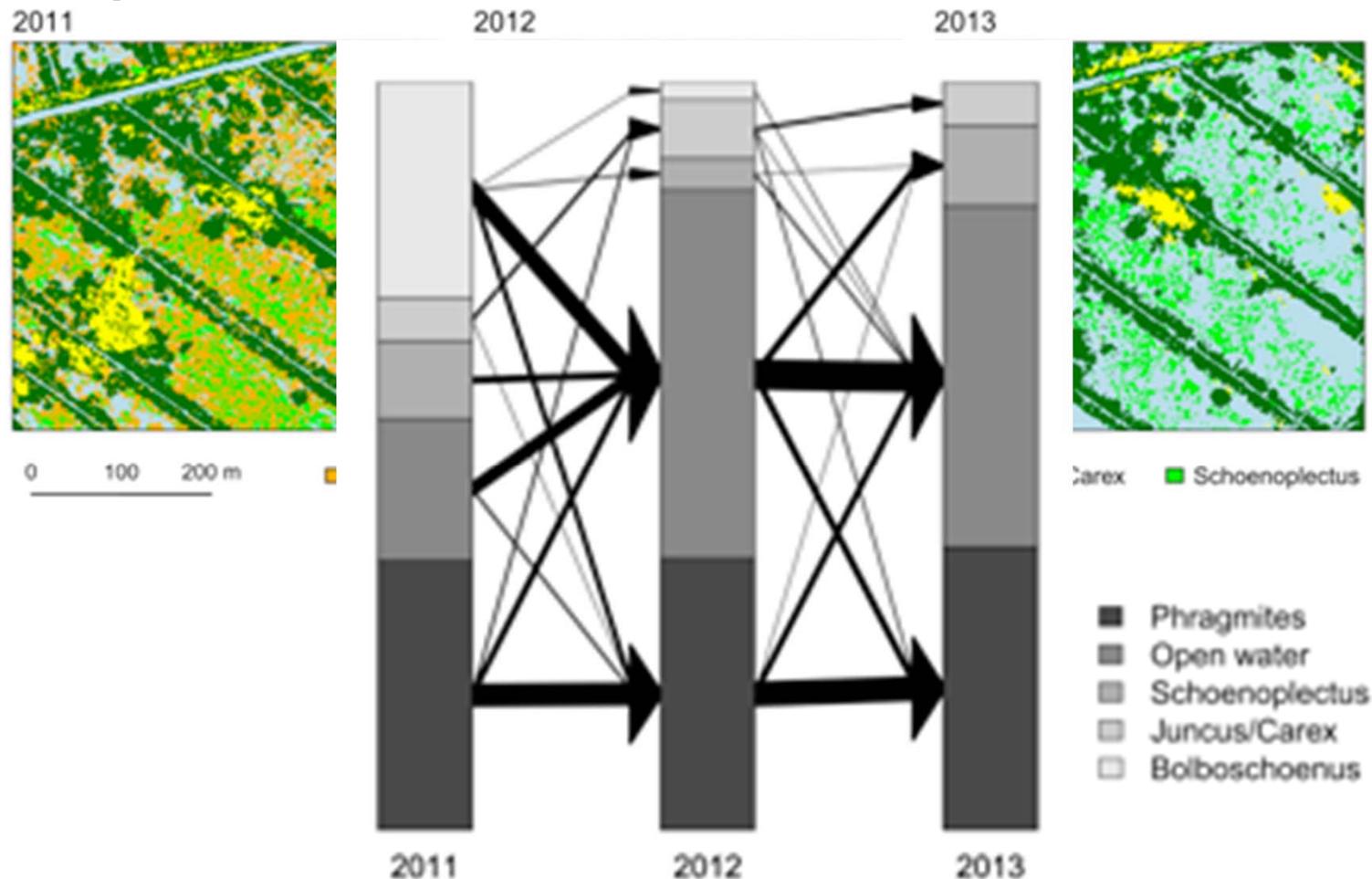
Hahn et al. (submitted) EOS

# Strong variation between vegetation types decreases with time



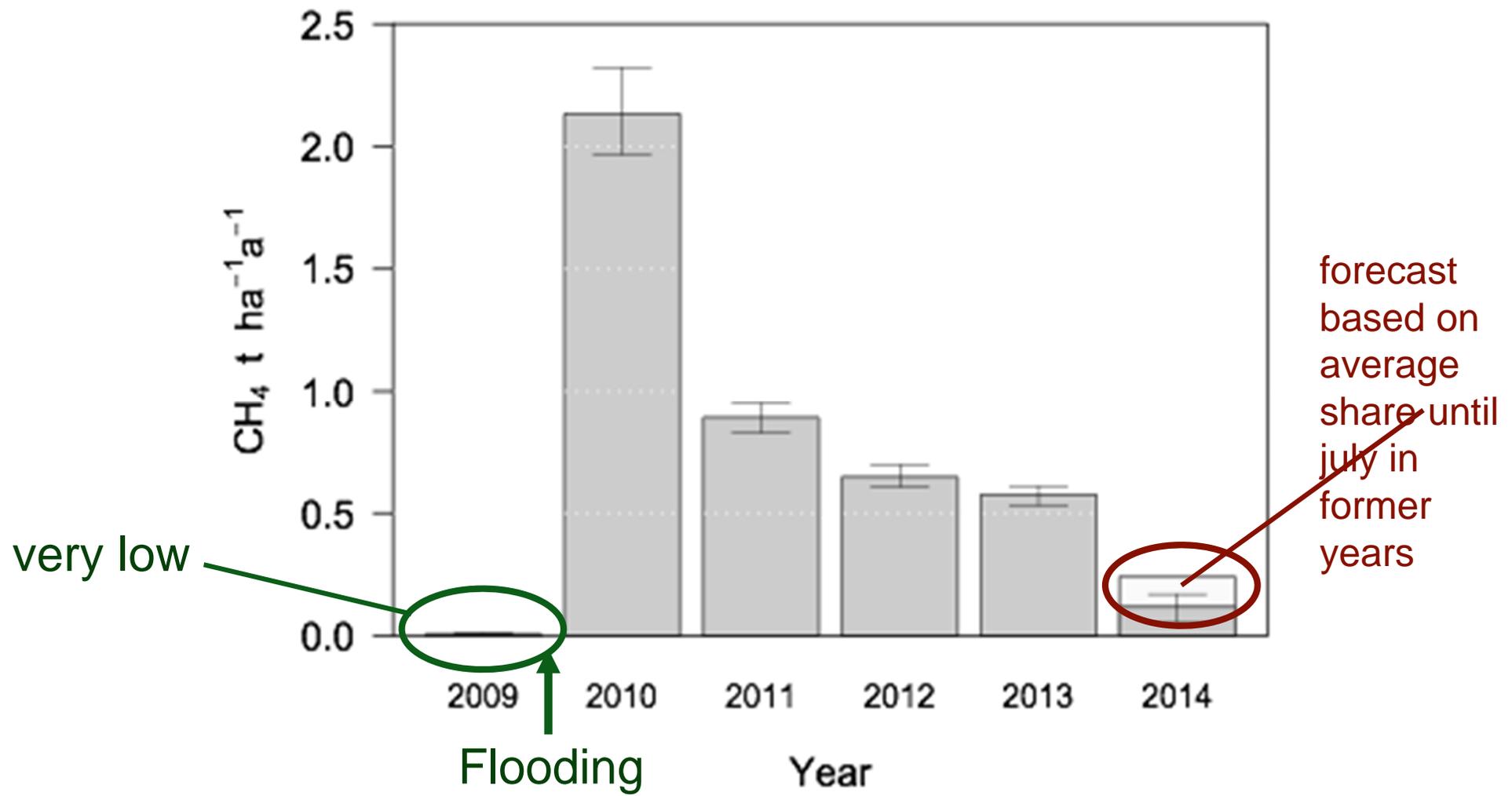
Koebisch et al. 2013  
Wetl. Ecol. & Manage.

# Fast succession after flooding leads to compact reed stands, *Bolboschoenus* suffers

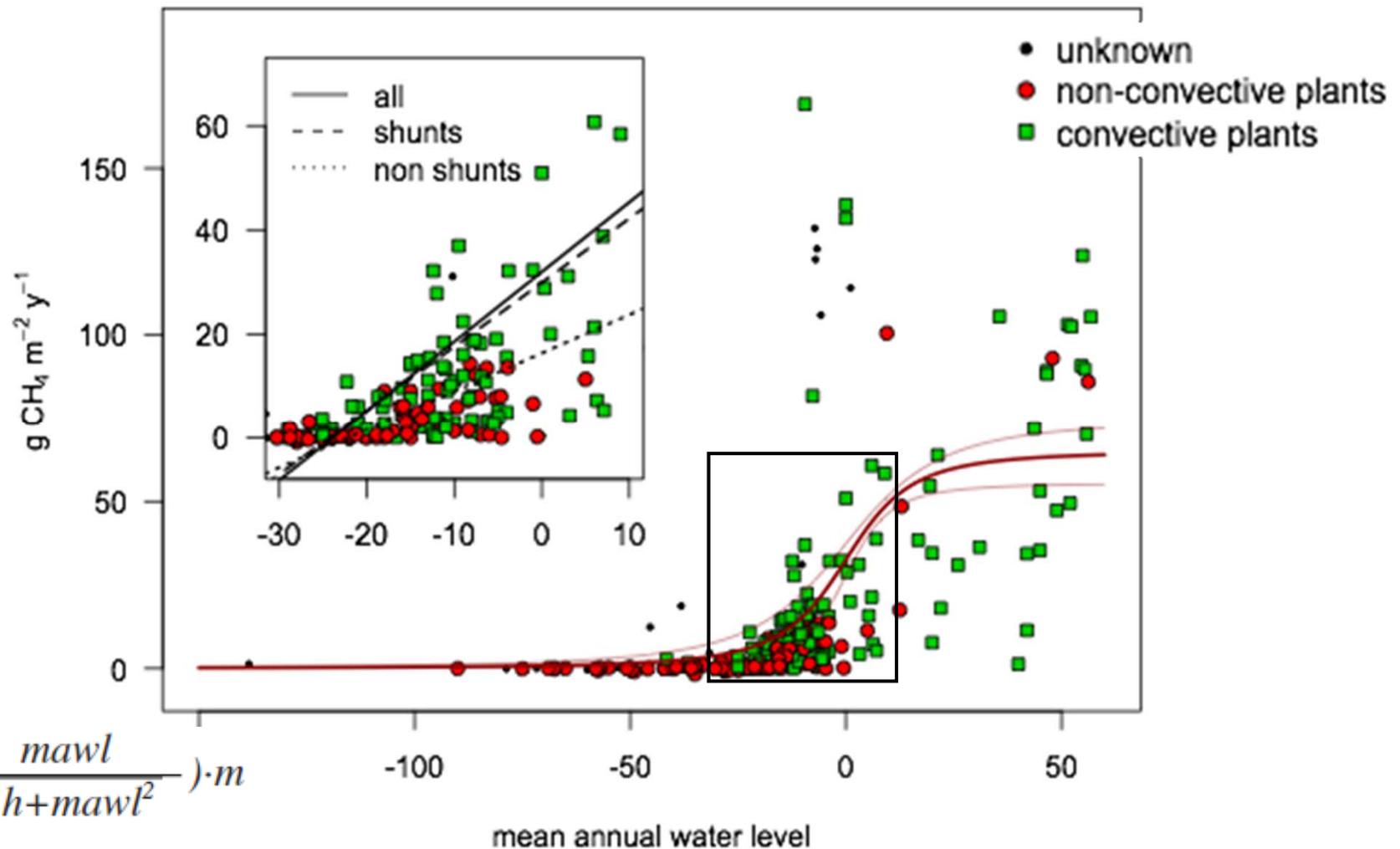


Koch et al. (submitted) Restoration Ecology

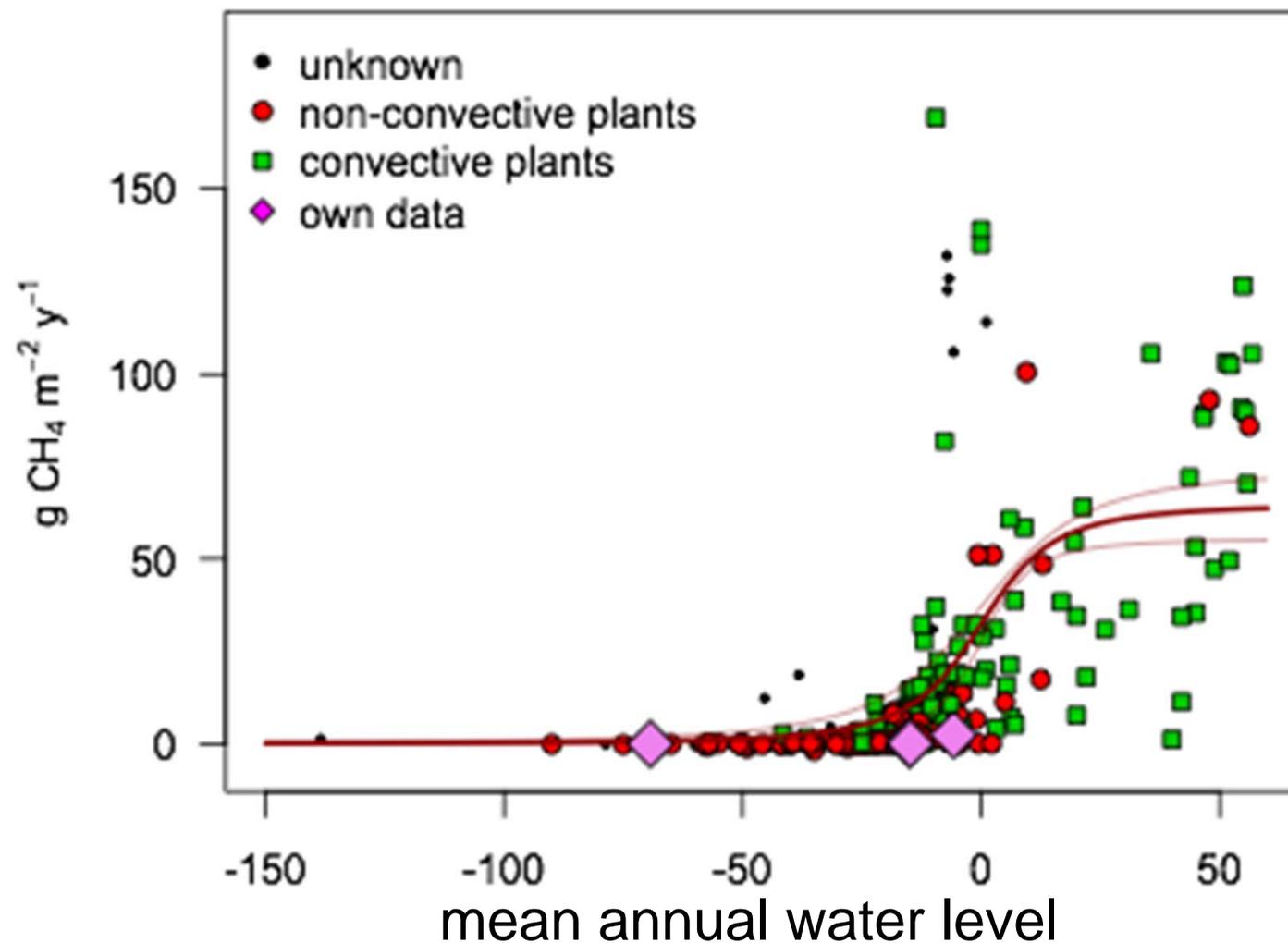
# Strong increase in methane emissions after flooding (x100), followed by (asymptotic) decrease



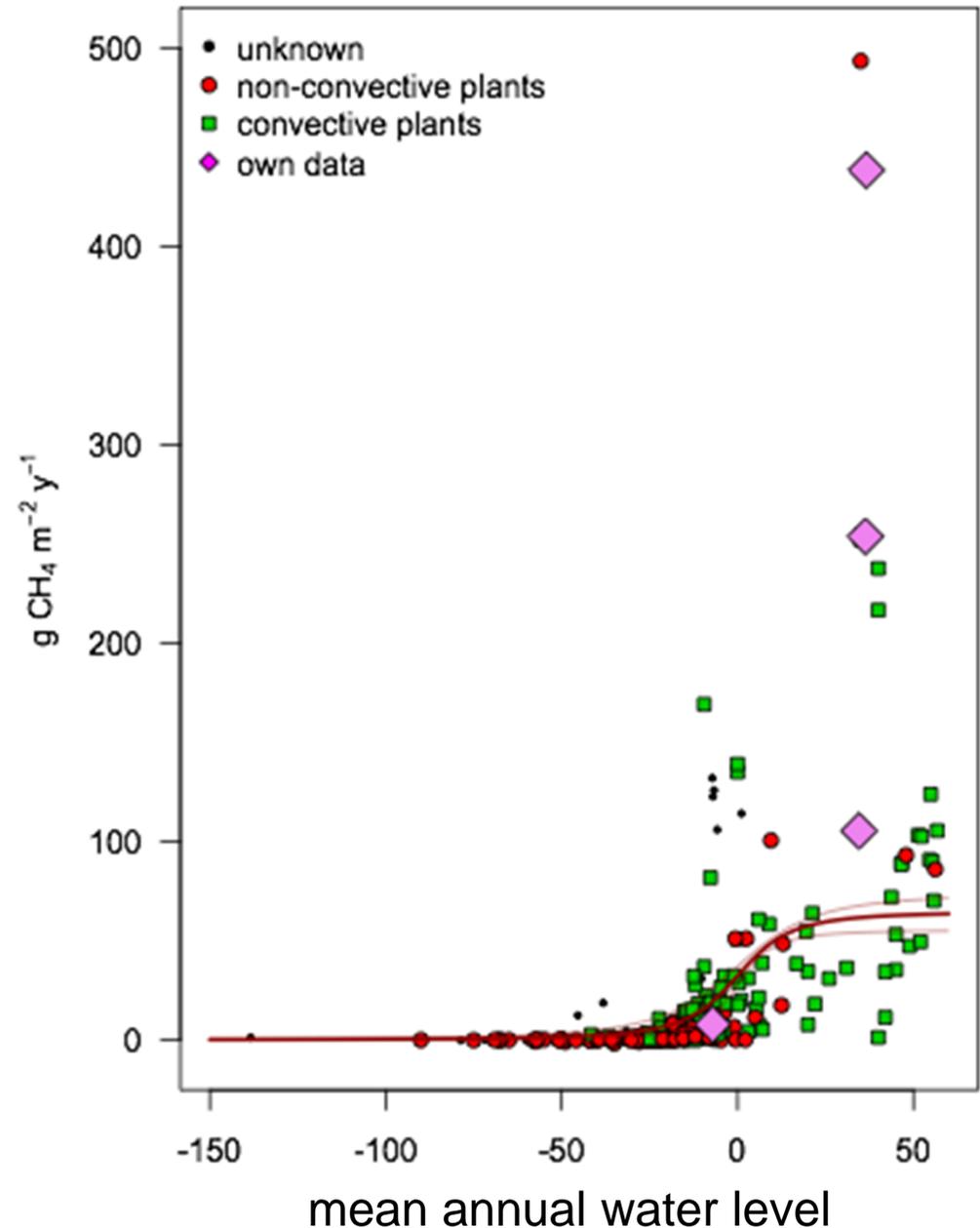
# Meta-analysis of available data on annual CH<sub>4</sub>-exchange vs. mean annual water level (33/298)



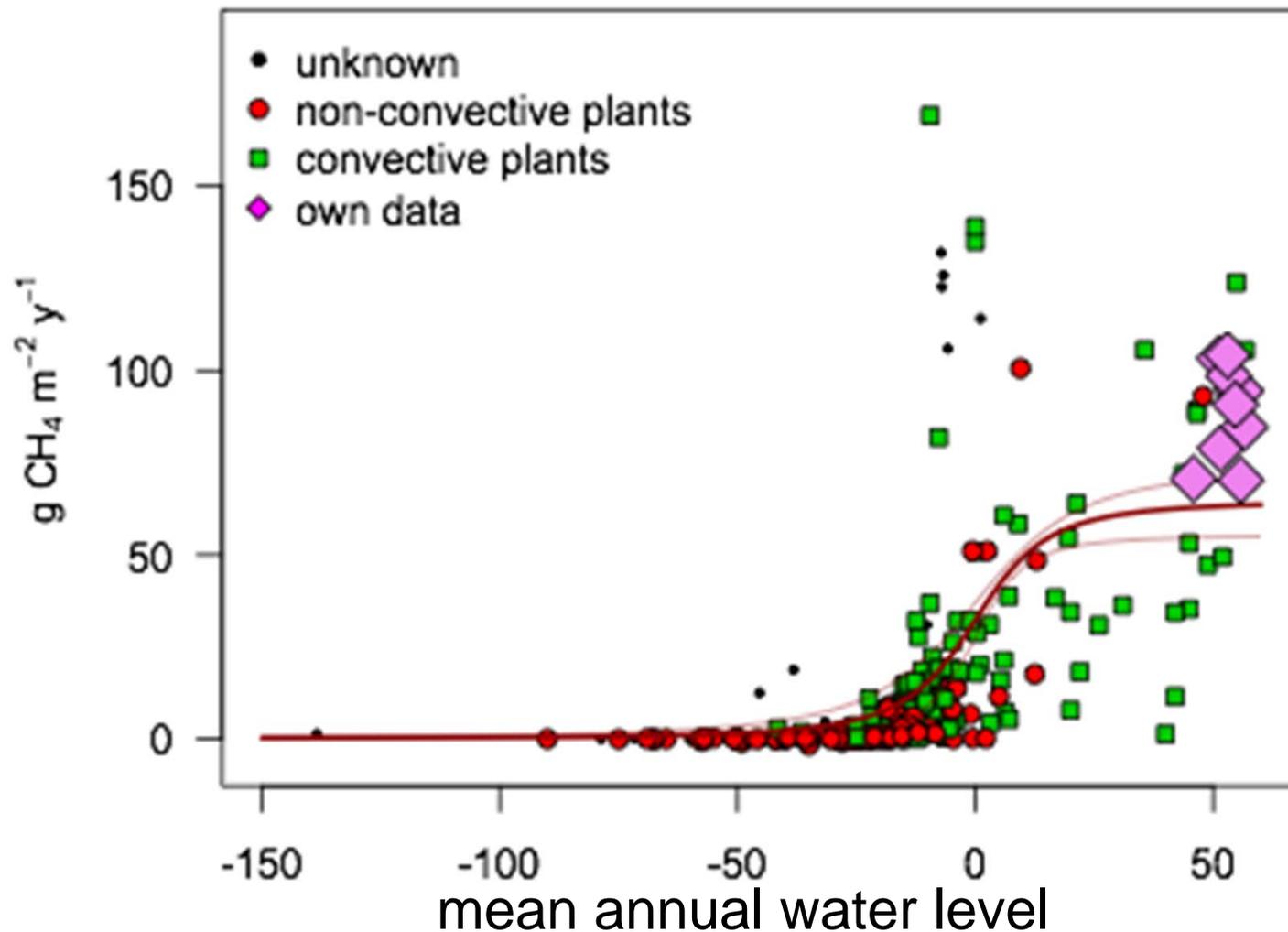
## The 2009 data from the Hütelmoor (pre-flooding) fit quite well



2010 data: We have to increase y-scale to fit our data into the plate

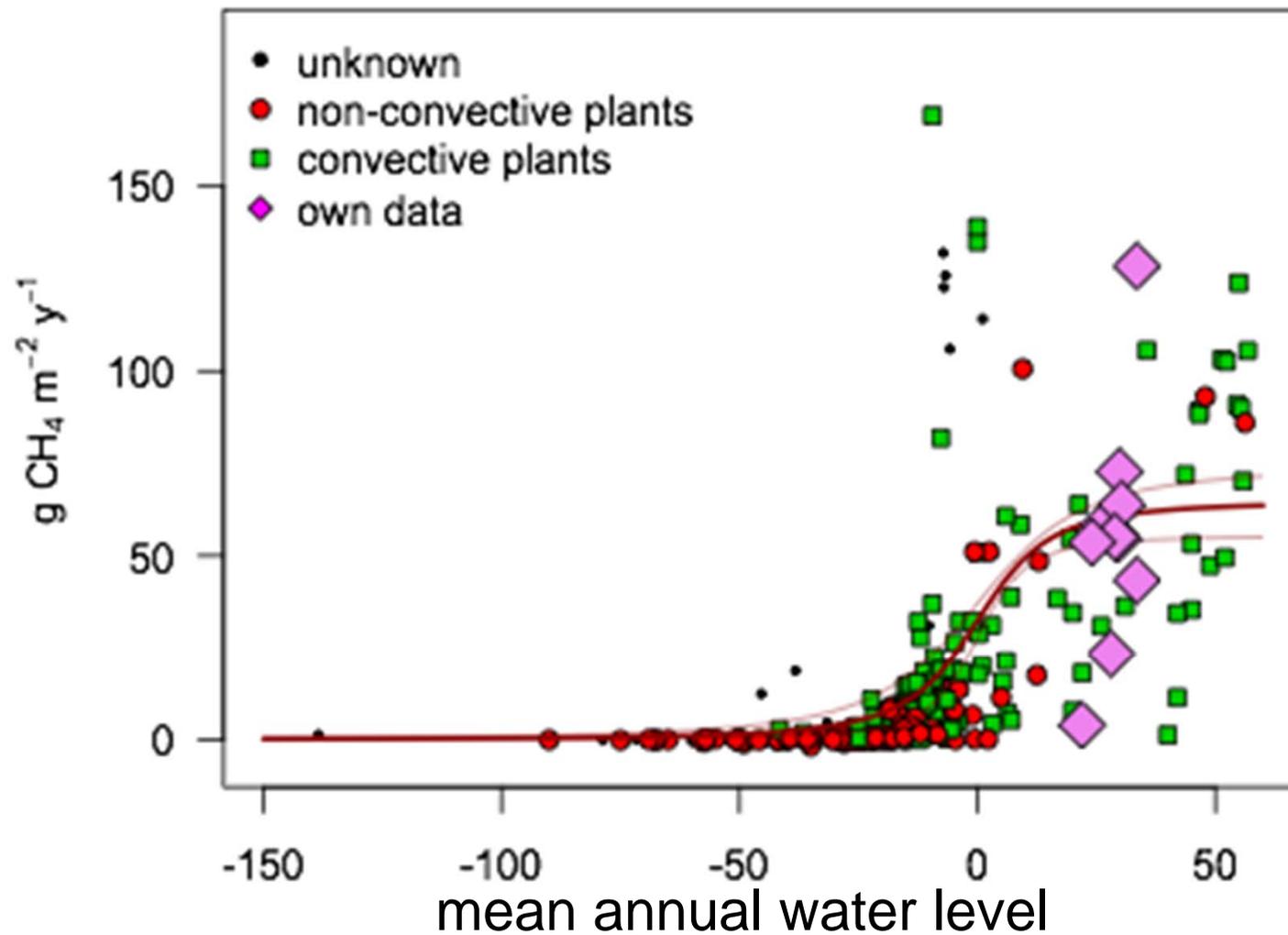


In 2011 already lower – quite well within the distribution – and less variation between stands





## Similar situation in 2013



## Shallow lakes should be avoided when rewetting for climate effect

- High methane emissions after rewetting (flooding) seems to be driven by massively decaying plant material (and by flooding with fresh water)
  - Biomass removal before flooding
  - Non-flooding rewetting measures (summer water levels should be below ground surface)
- Massive peak seems to be restricted to a short time (year) after rewetting (at least in our case)
- Future: Upscaling with classified and continuous maps, temporal dynamics of methane and sulphate, processes

# Thank you for your attention

- Parts of the research are funded by DFG (JU 2780/4-1)
- People:
  - Stephan Glatzel (Professor)
  - Franziska Köbsch (Master student, PhD student, Postdoc)
  - Stefan Koch (PhD student)
  - Marian Koch (PhD student)
  - Juliane Hahn (PhD student)
  - Patricia Ruiz de Viñaspre (PhD student)
  - Achim Hofmann (Technician, Eddy-Tower)
  - Birgit Schröder (Botanist)
  - numerous students that helped in the field

# Post flooding the vegetation collapses: both $R_{ECO}$ and GPP decreases but NEE is not affected



Koebisch et al. 2013b JGR Biogeosciences