

# Modelling and assessing effects of N-deposition in forest ecosystems in Germany

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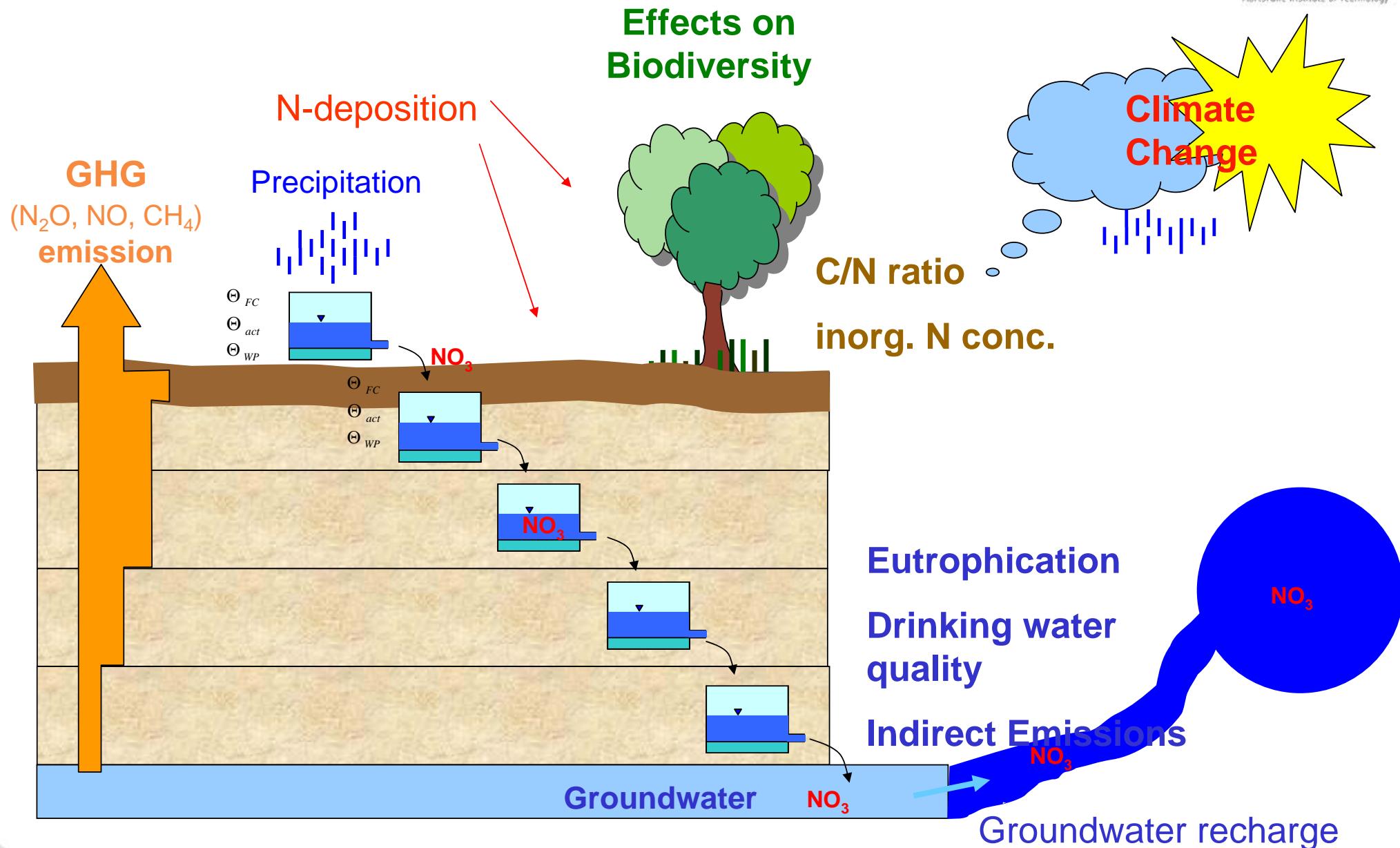
<sup>2</sup> ÖKODATA

<sup>3</sup> Waldkundeinstitut Eberswalde

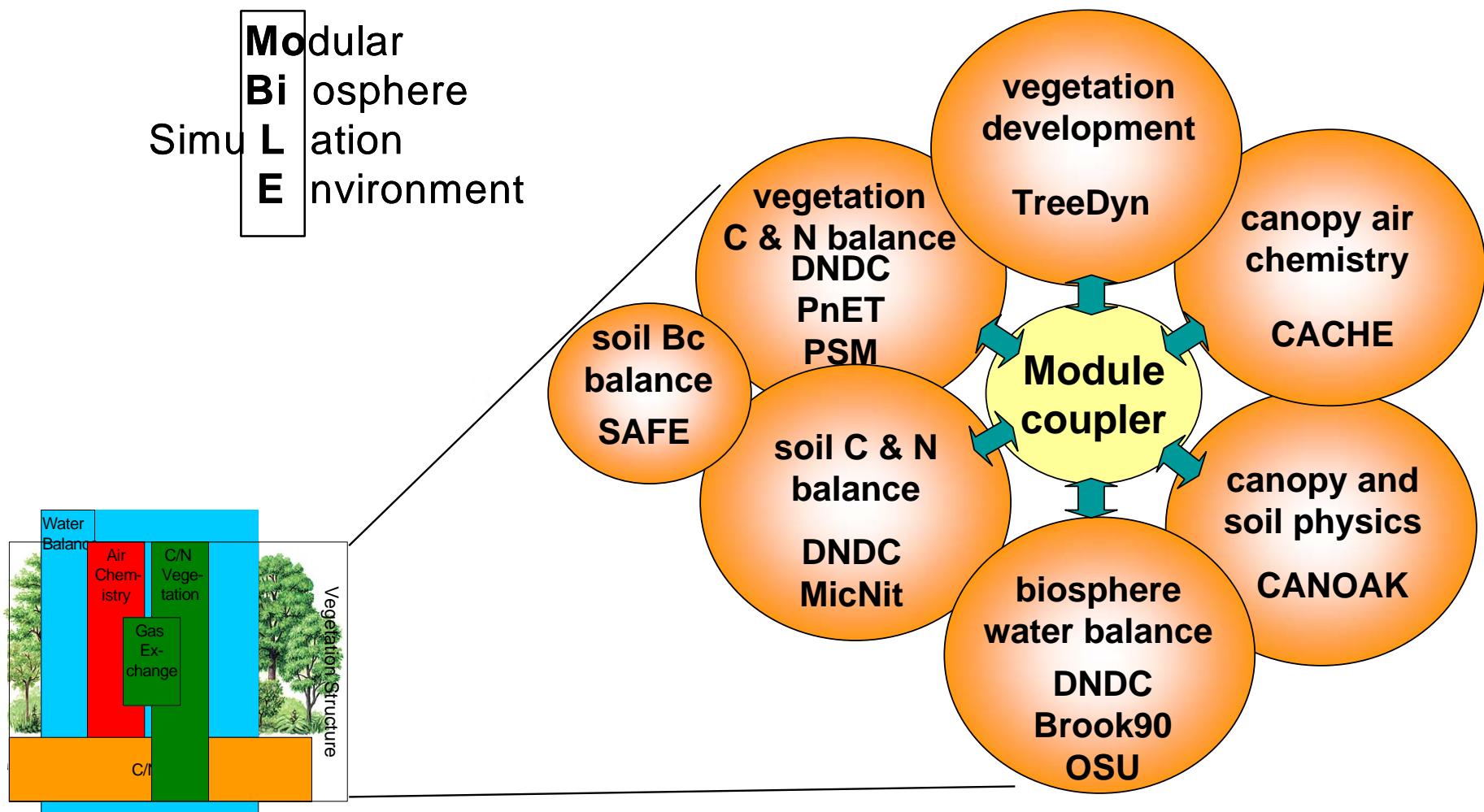
<sup>4</sup> University Giessen



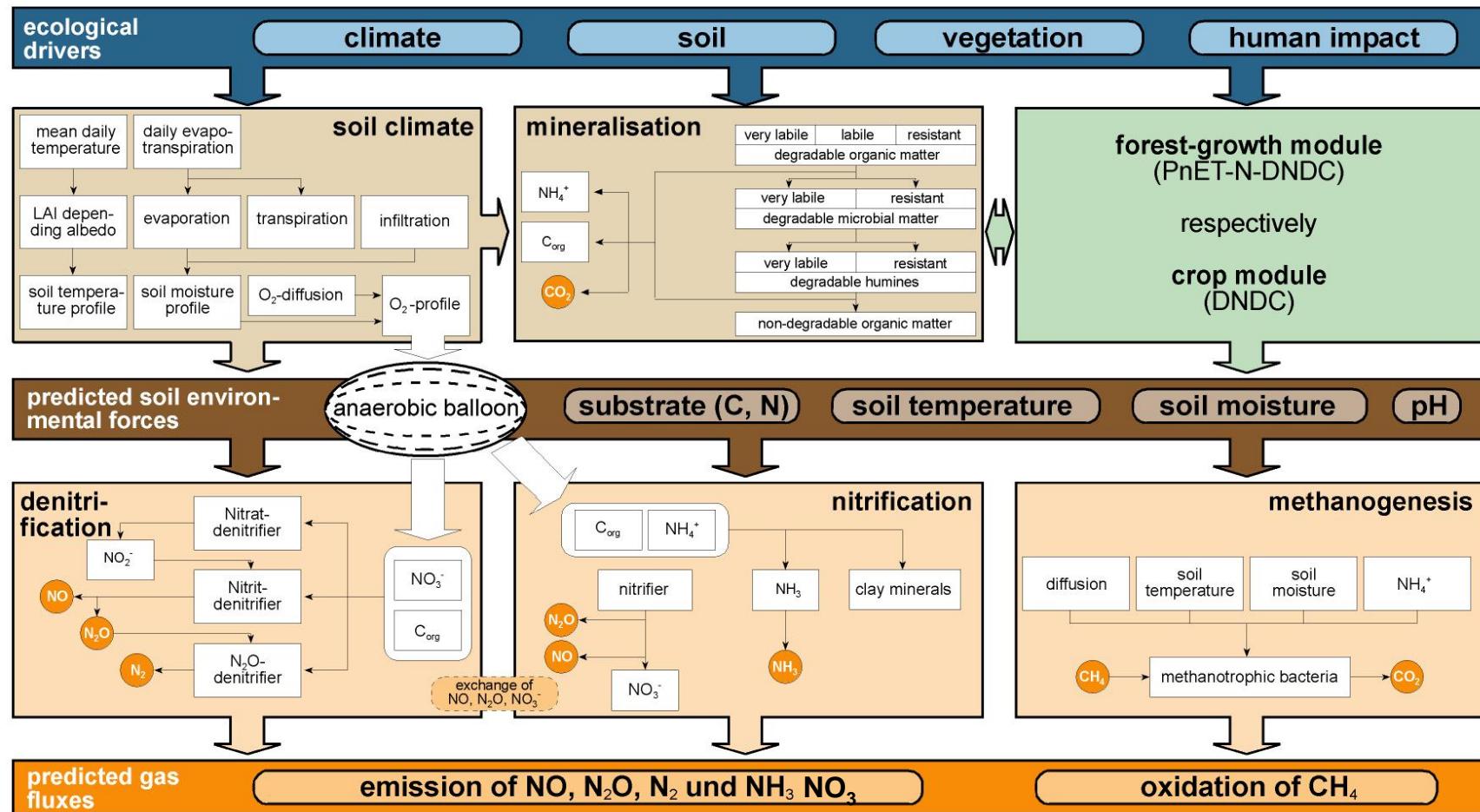
# The Trouble



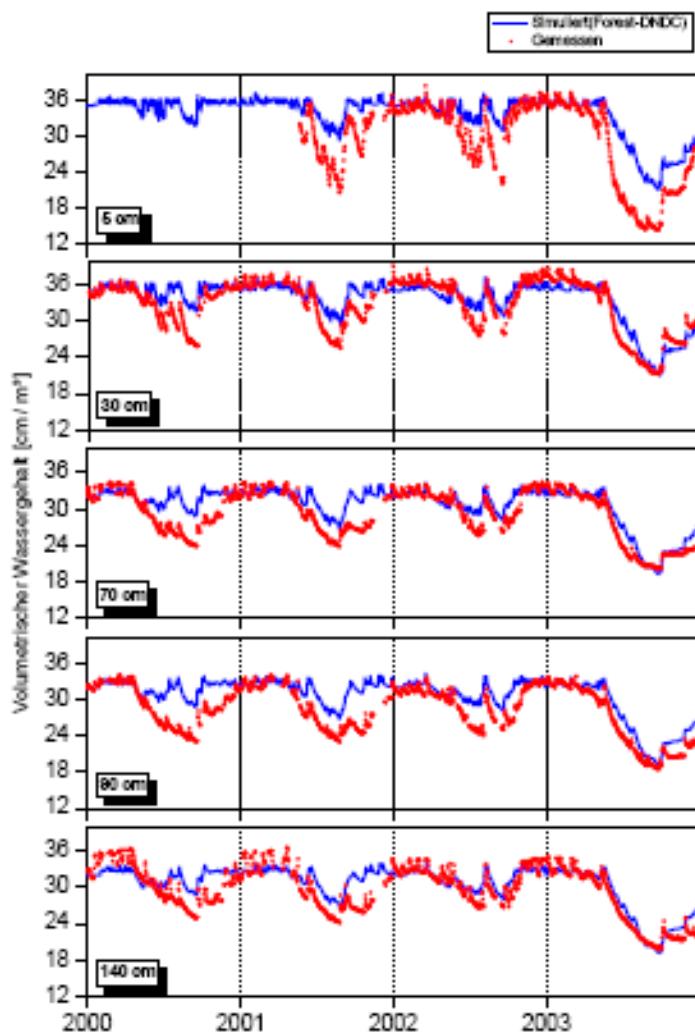
# Modelling framework



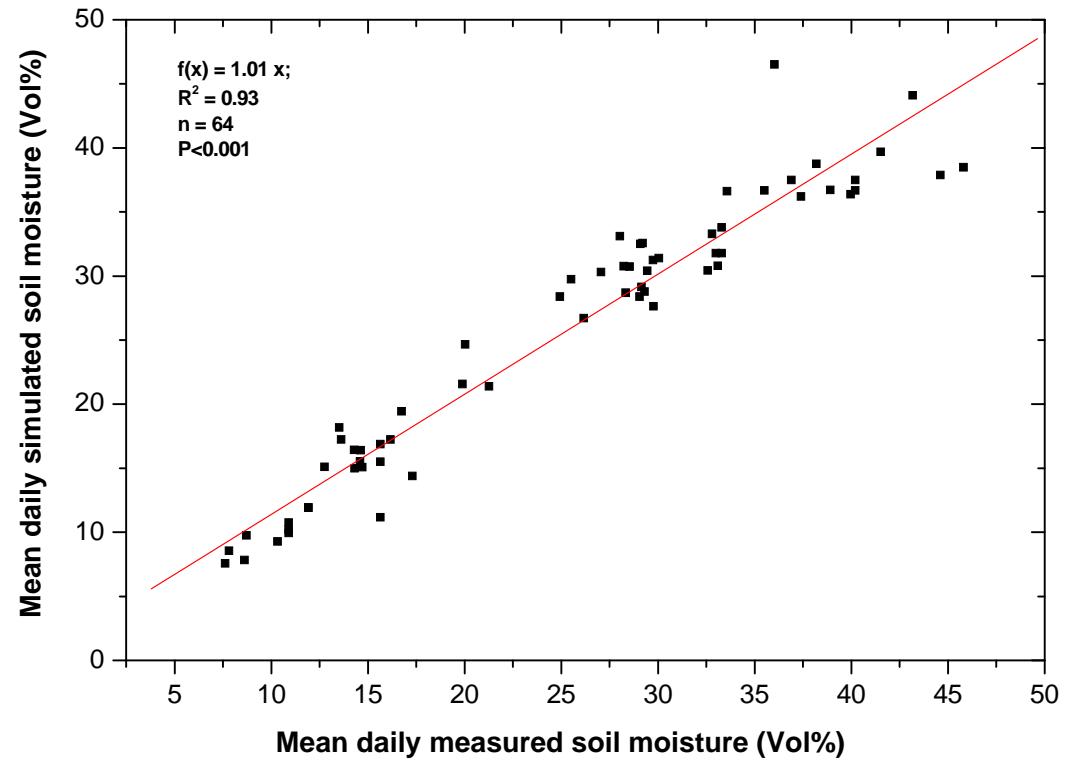
# Realisation: Forest-DNDC



# Model testing – soil hydrology

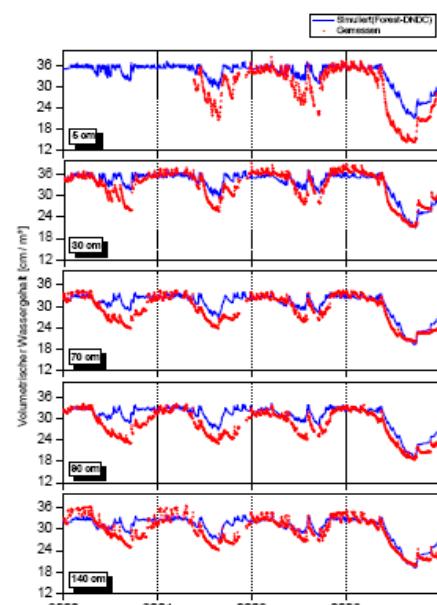


Level II site Mitterfels, Bavaria

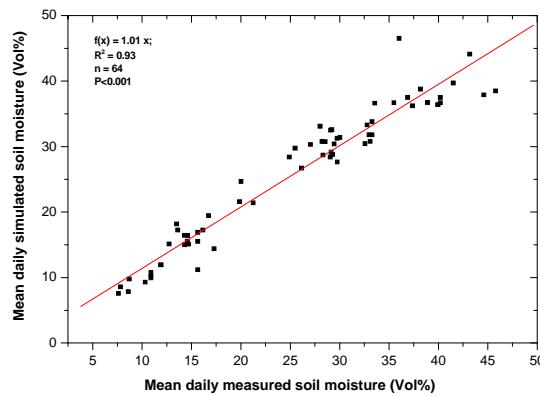


5 Level II sites, Bavaria

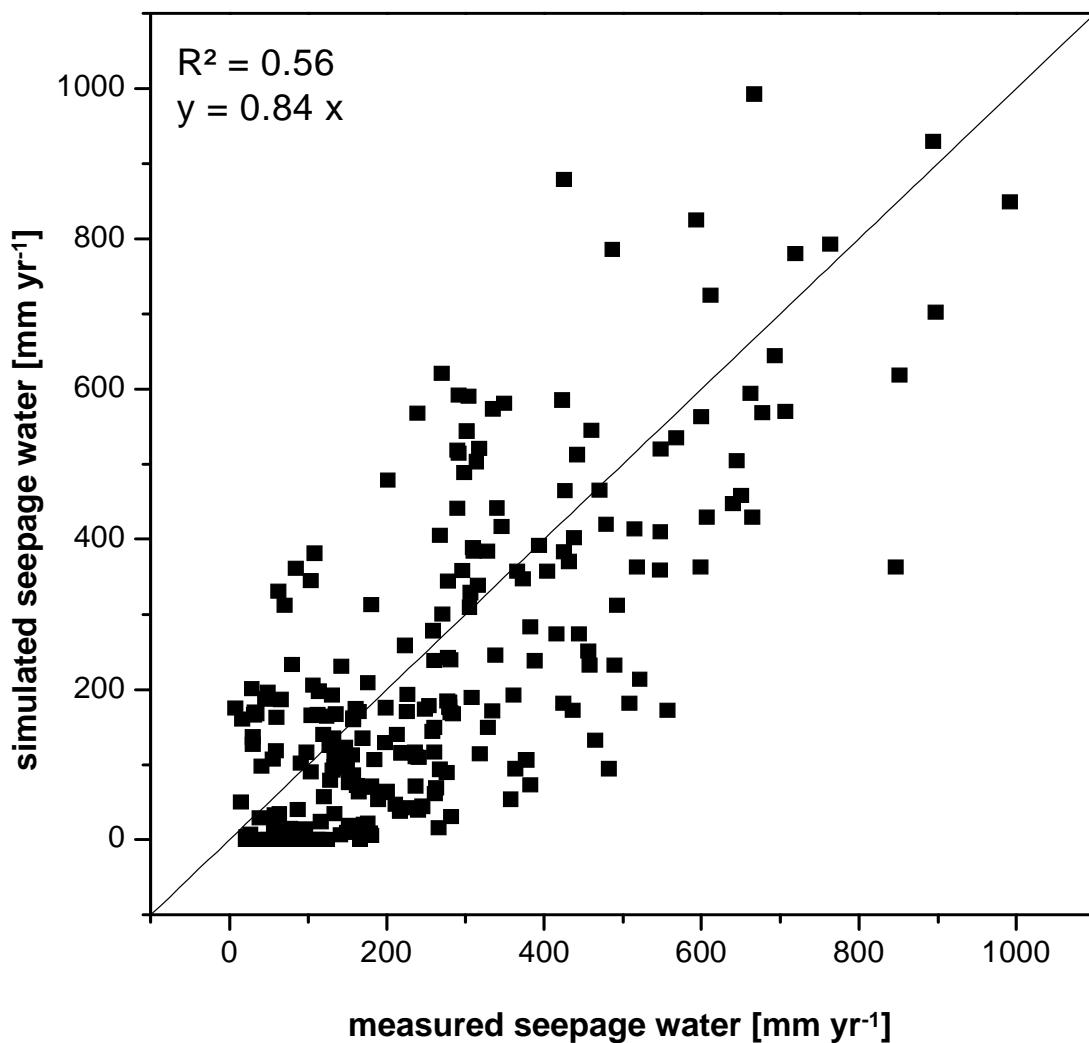
# Model testing – soil hydrology at site scale



Level II site Mitterfels, Bavaria

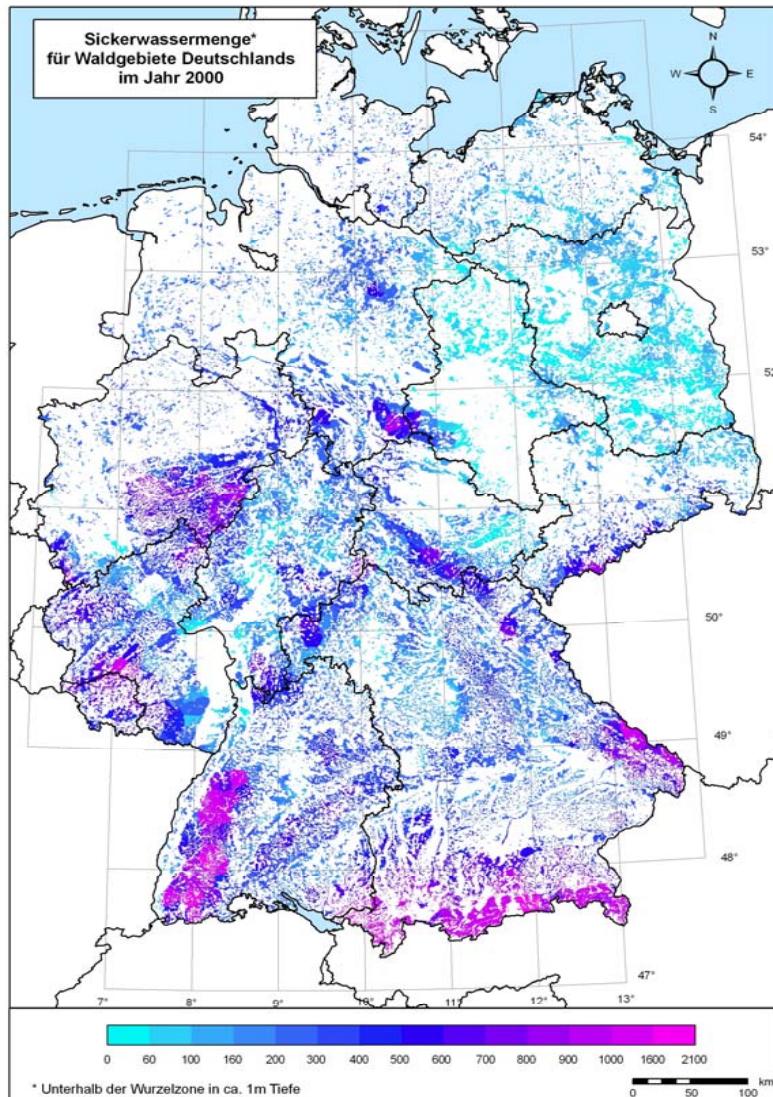


5 Level II sites, Bavaria



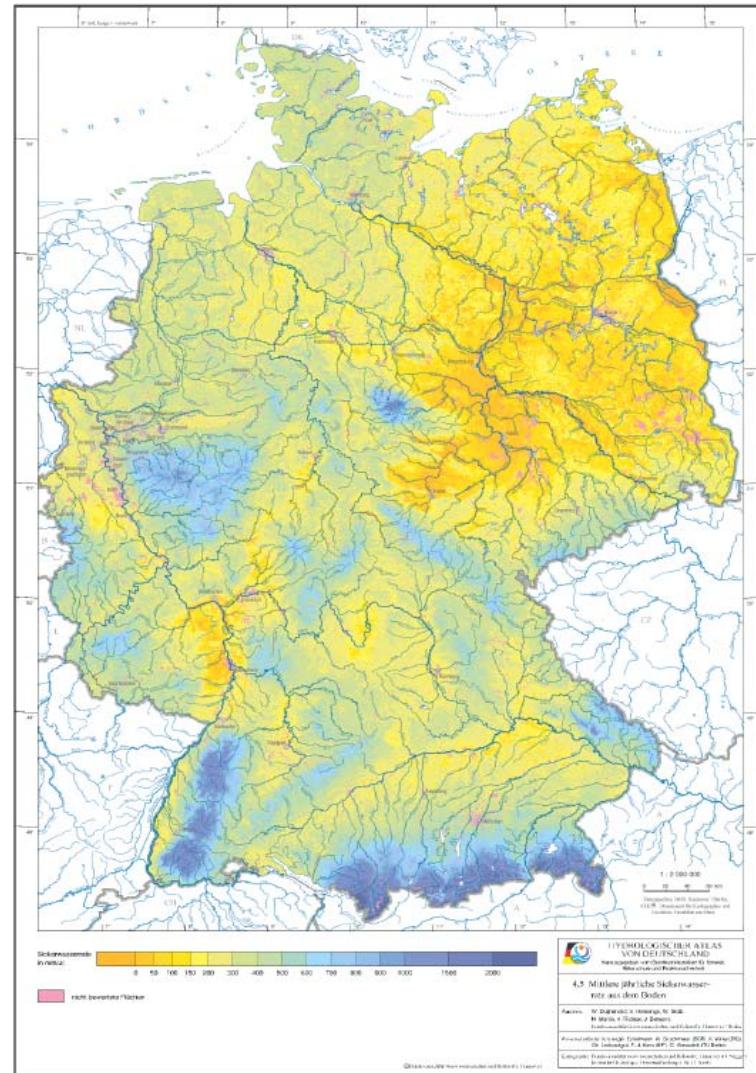
Level II sites, Germany

# Model application – seepage water at regional scale



**simulated seepage water  
MOBILE Forest-DNDC**

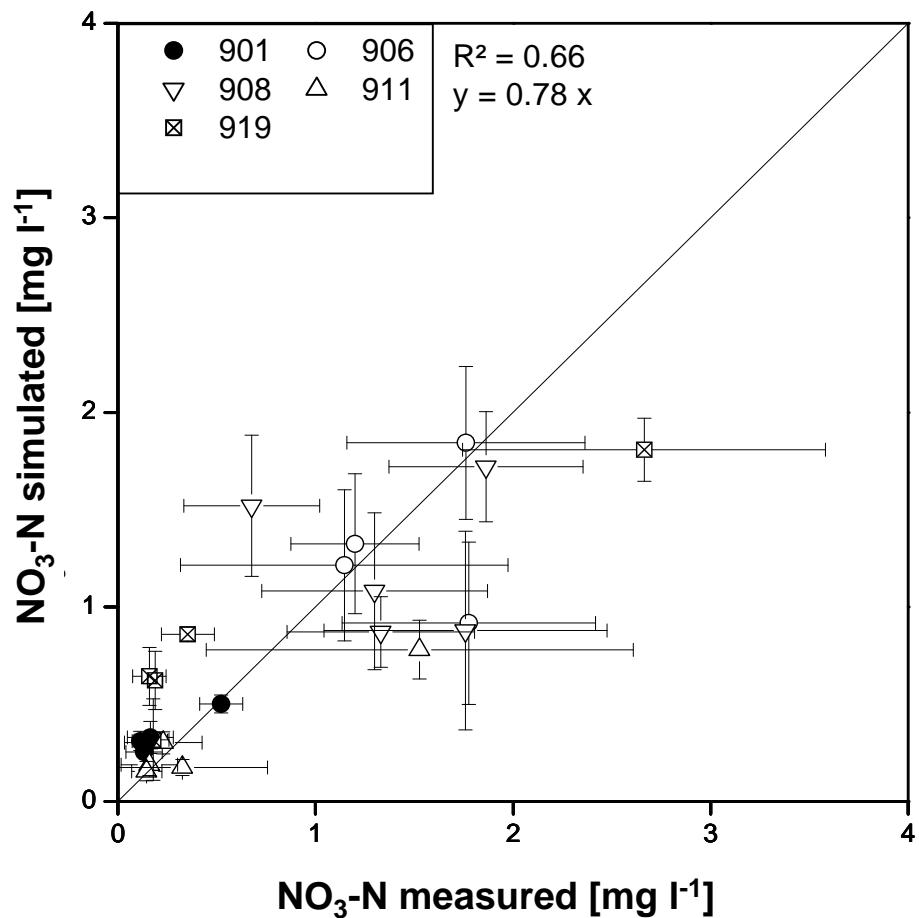
Institut für Meteorologie und Klimaforschung IMK-IFU (Garmisch-Partenkirchen)



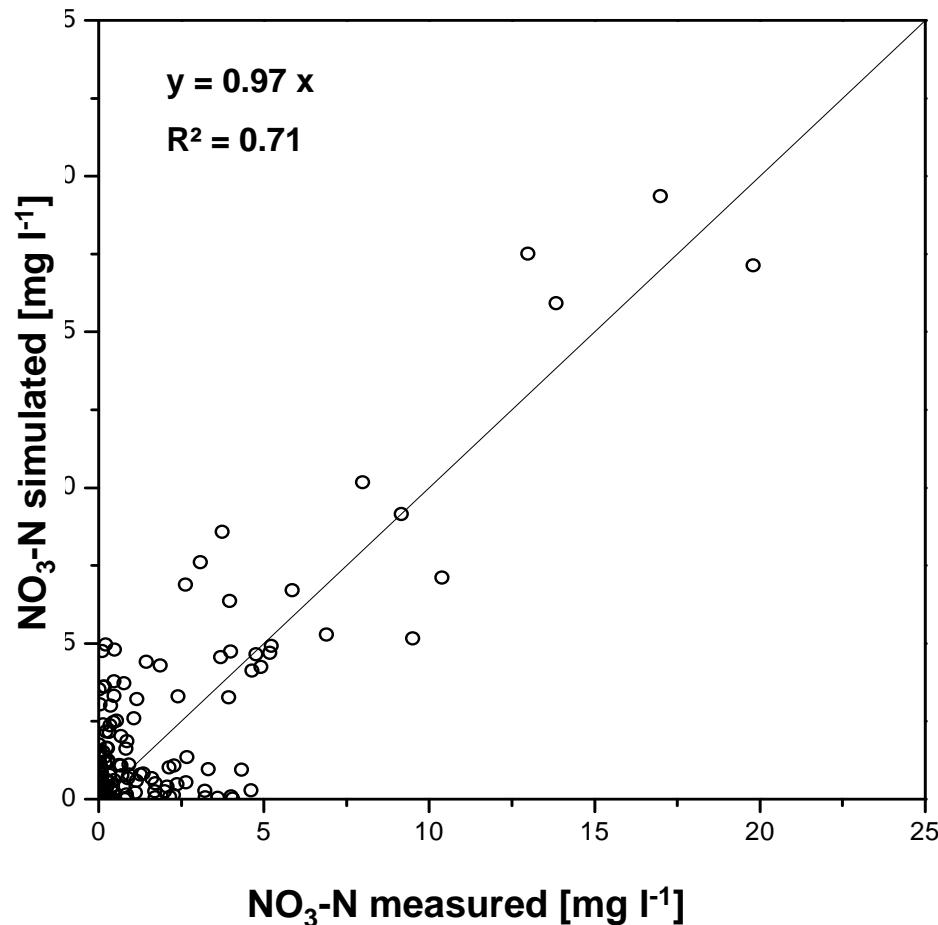
**simulated seepage water hydr.  
Atlas Germany**

KIT – die Kooperation von  
Forschungszentrum Karlsruhe GmbH  
und Universität Karlsruhe (TH)

# Model testing – nitrate at site scale



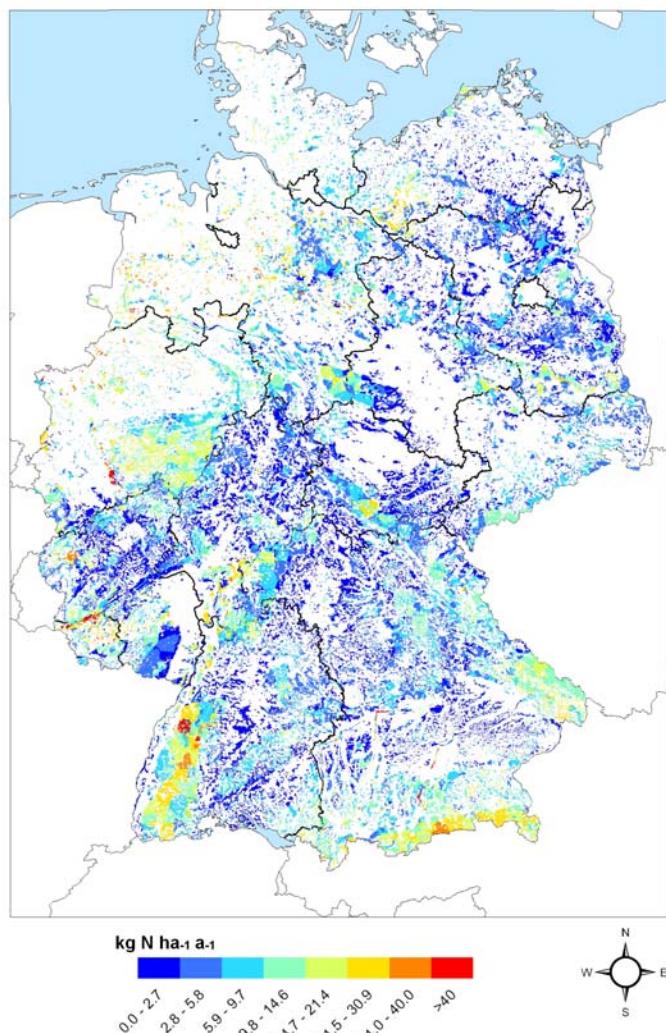
5 Level II sites, Bavaria



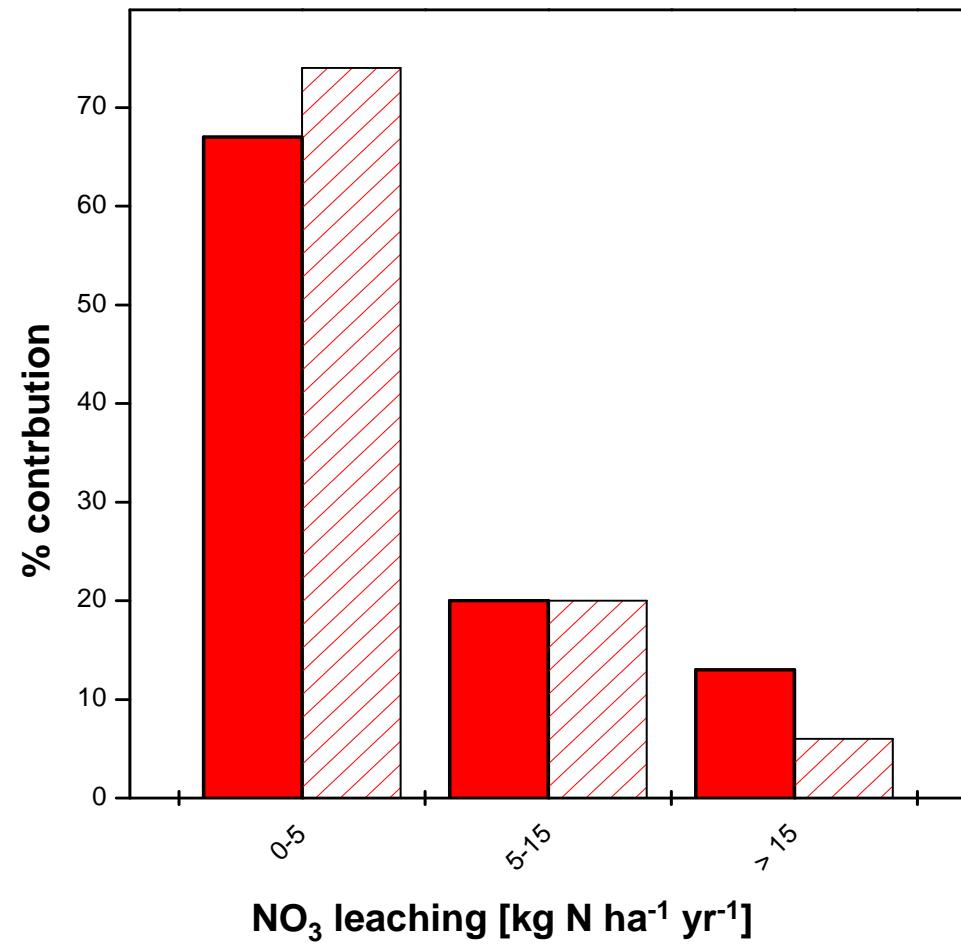
Level II sites, Germany

# Model application – nitrate leaching at regional scale

NO<sub>3</sub> Leaching

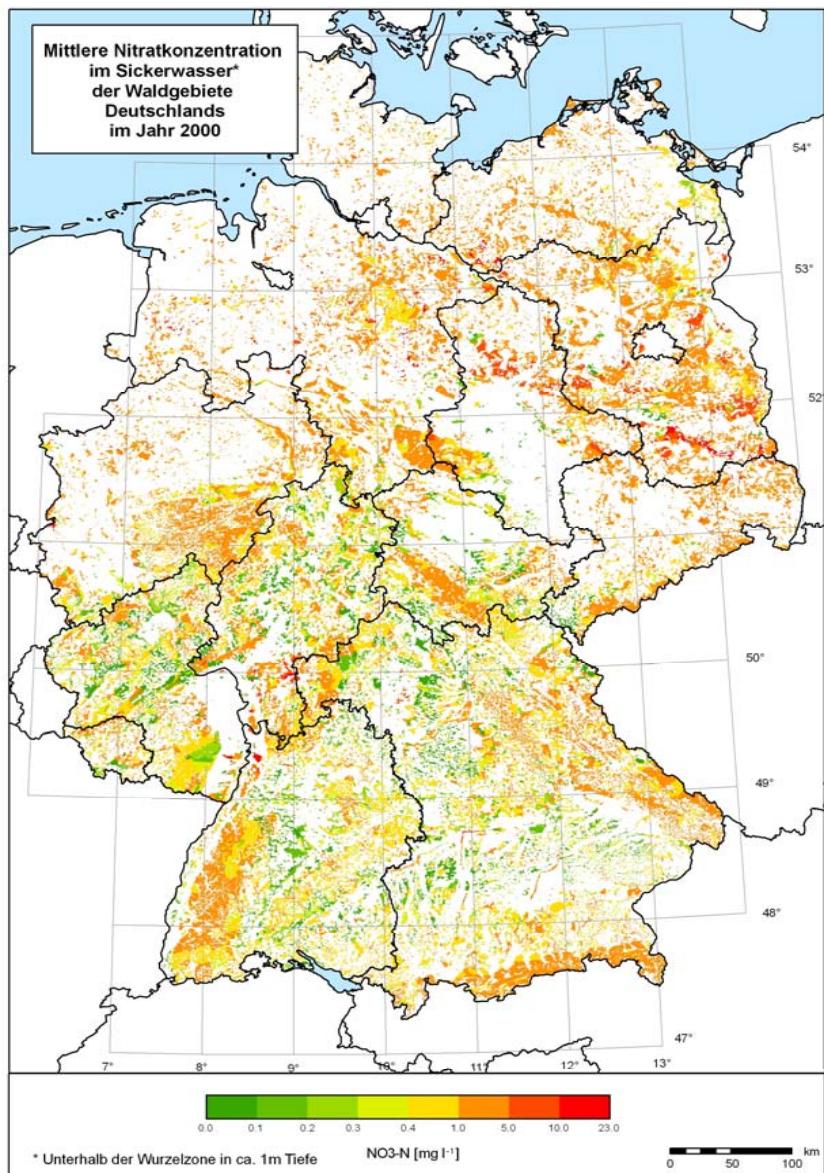


nitrate leaching study bavaria



Mellert et al., 2005

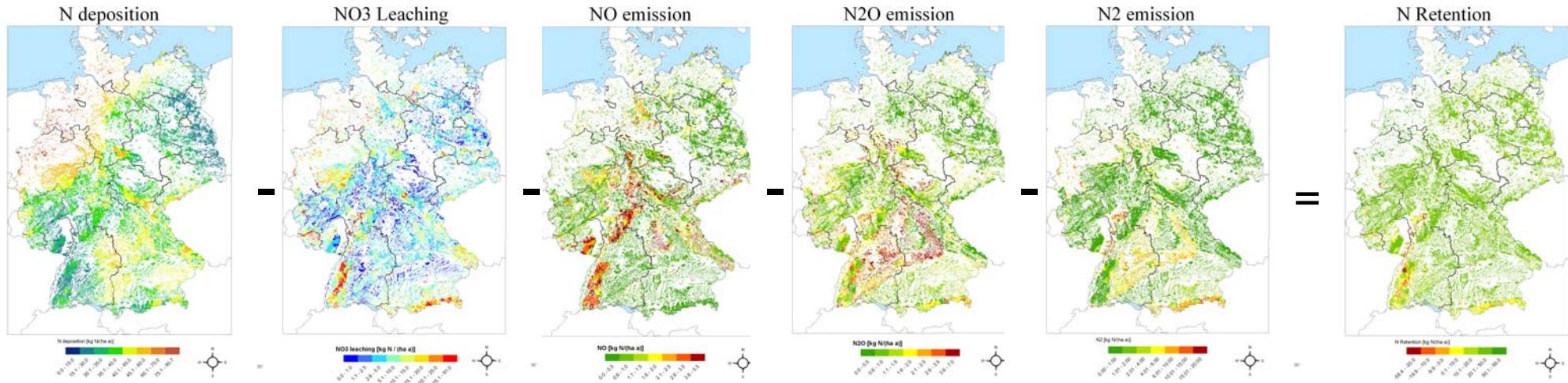
# Model application – mean nitrate concentration at regional scale



Impact	Critical N concentration (mg N l <sup>-1</sup> )	
	UN/ECE (2004)	This study
Vegetation changes in Northern Europe		
- Lichens to cranberry (lingonberries)	0.2-0.4	0.2-0.4
- Cranberry to blueberry	0.4-0.6	0.4-0.6
- Blueberry to grass	1-2	1-2
- Grass to herbs	3-5	3-5
Vegetation changes in Western Europe		
- Coniferous forest		2.5-4
- Deciduous forest	-	3.5-6.5
- Grass lands		3
- Heath lands	-	3-6
Other impacts on forests		
- Nutrient imbalances	0.2-0.4	-
- Elevated nitrogen leaching/N saturation	-	1
- Fine root biomass/root length	-	1-3
- Sensitivity to frost and fungal diseases	-	3-5

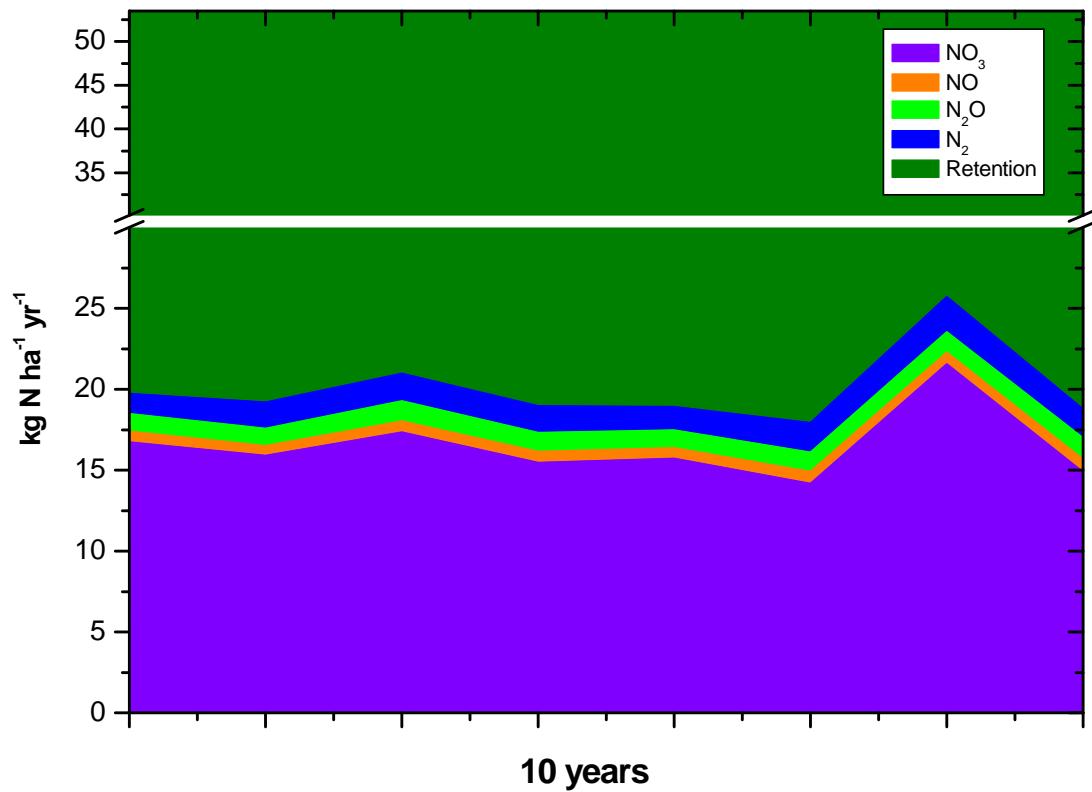
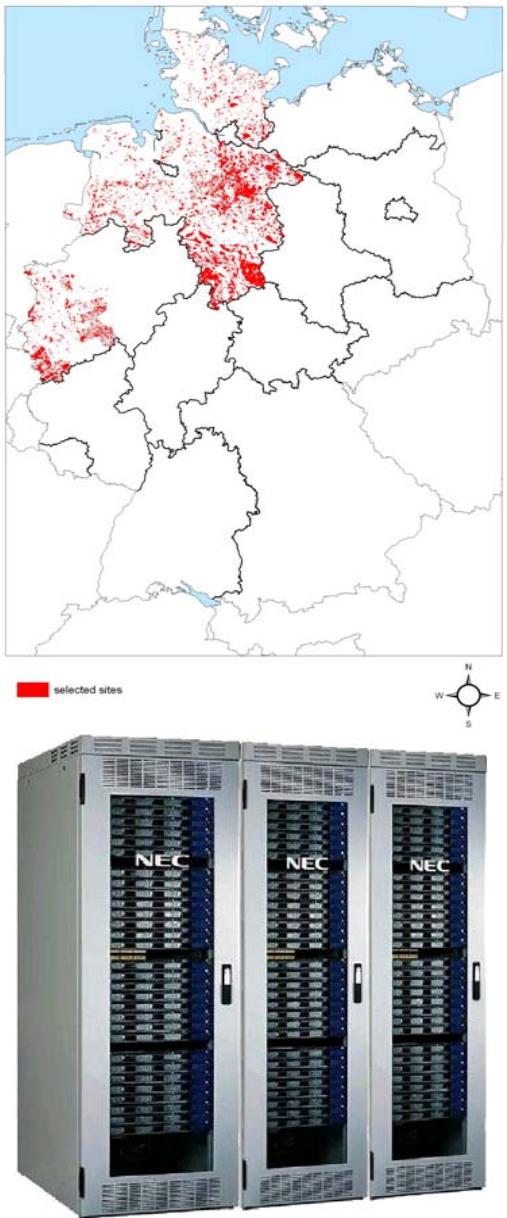
CCE report, 2007

# Model application – regional N balance

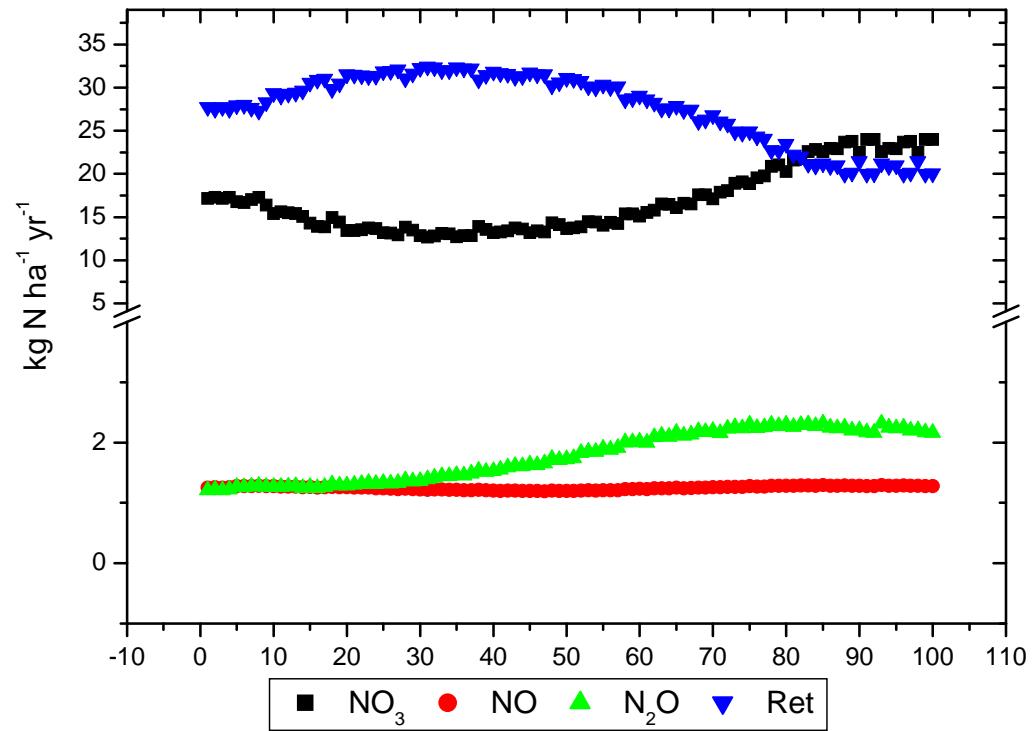
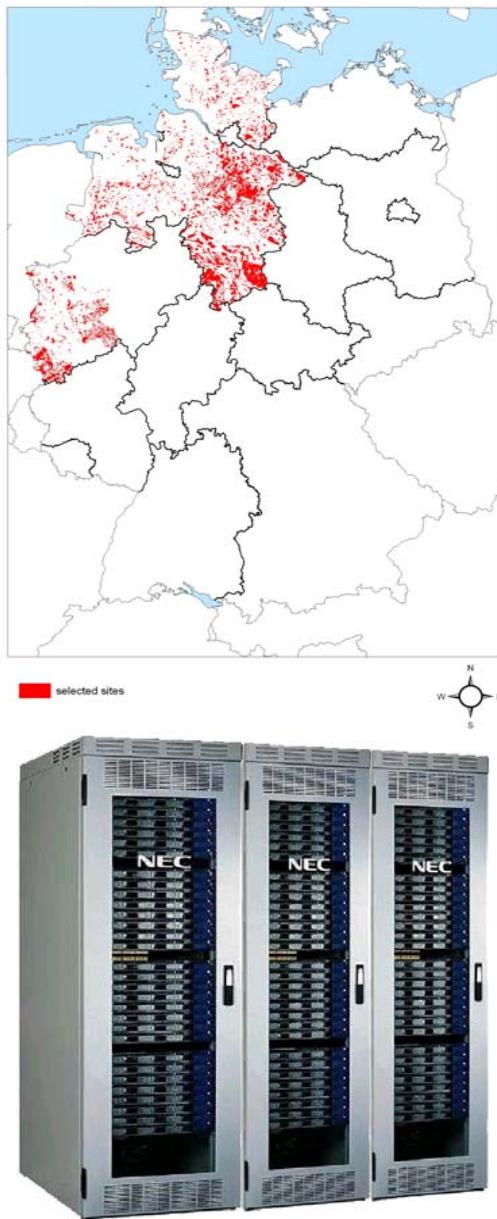


area weighted means in kg N ha<sup>-1</sup> yr<sup>-1]</sup>

# Long term (10 years) at regional scale

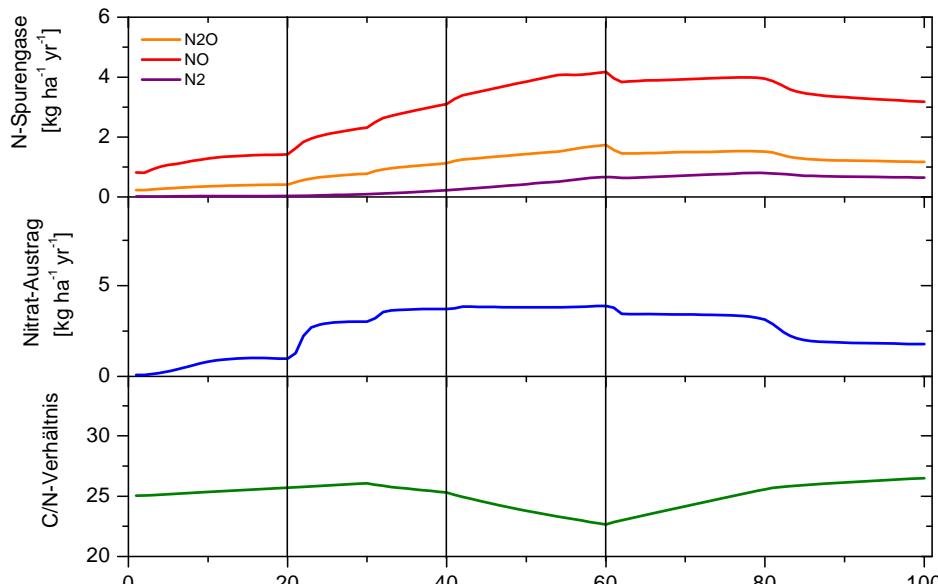


# Long term (100 years) at regional scale

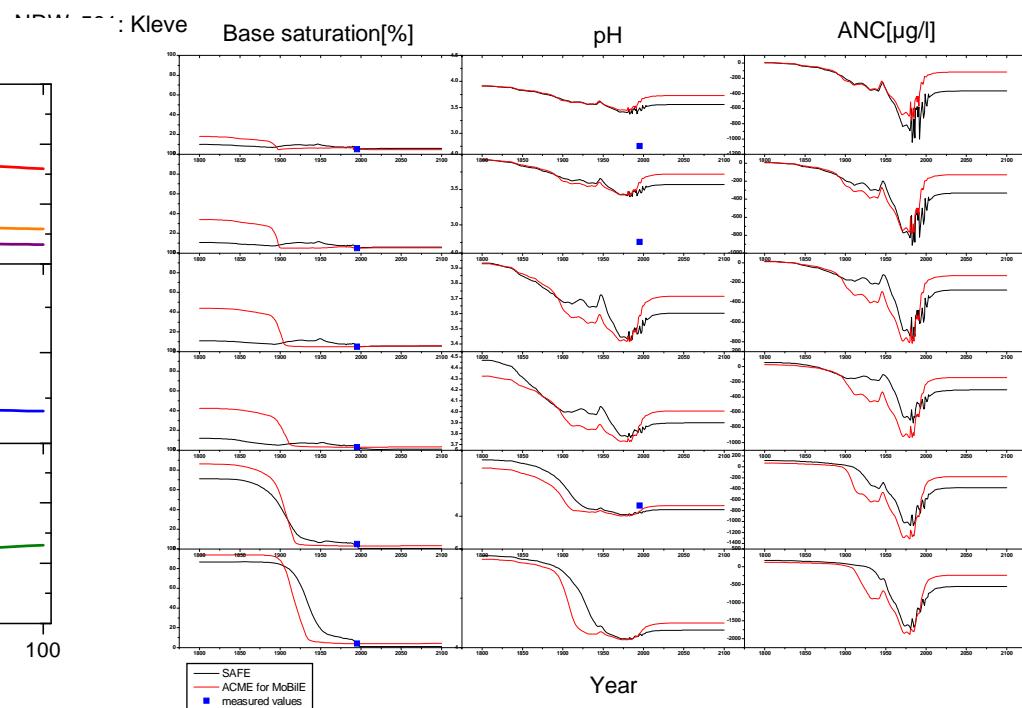


## Main drivers

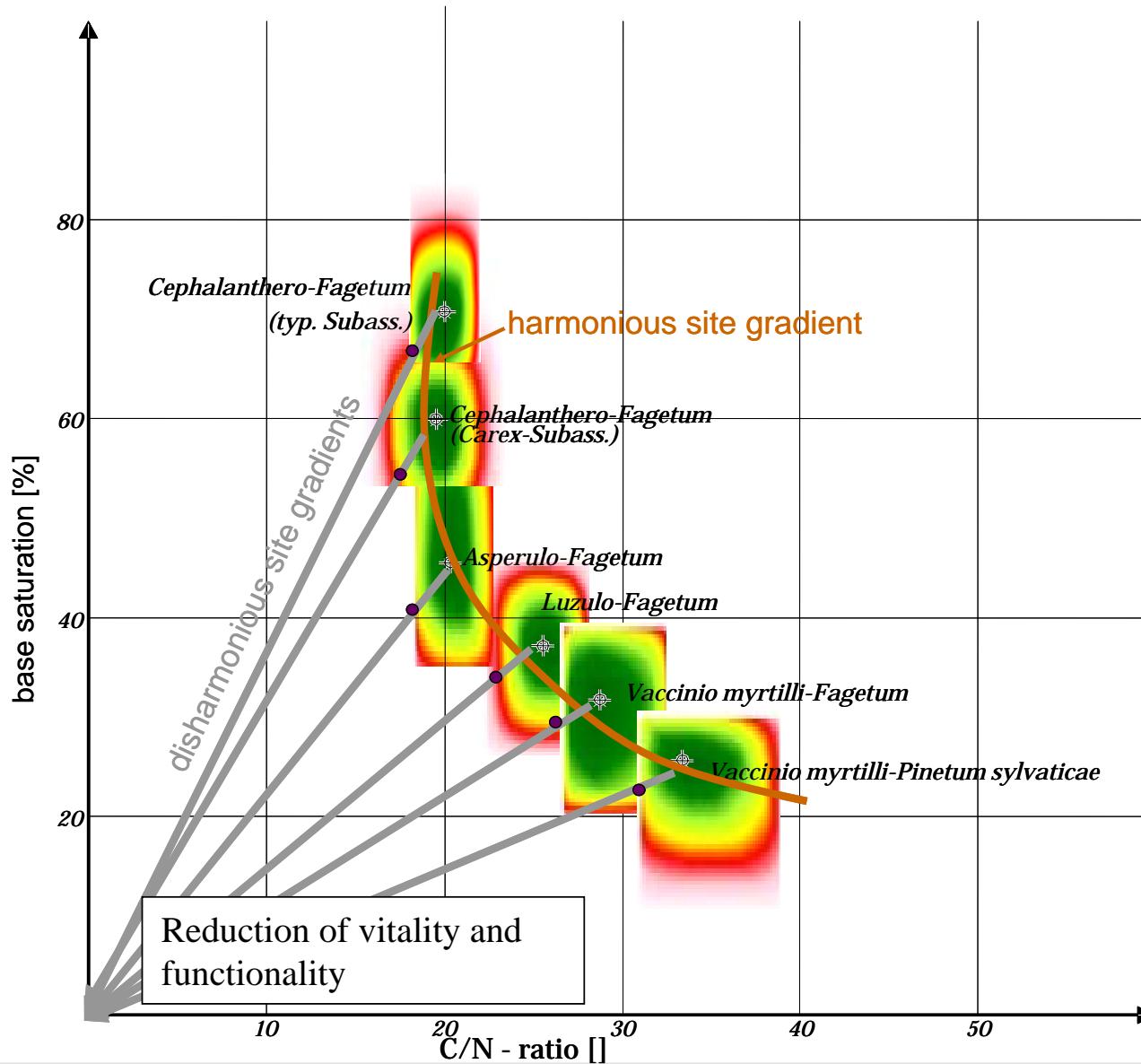
### C/N ratio/ mineral N content



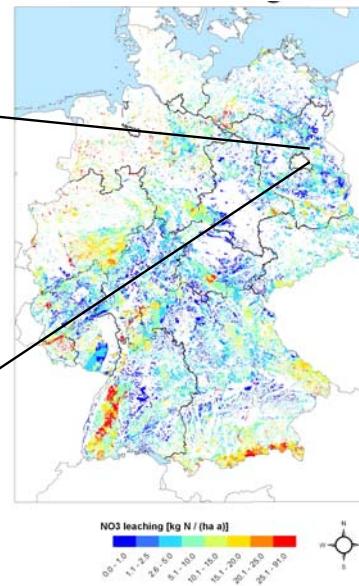
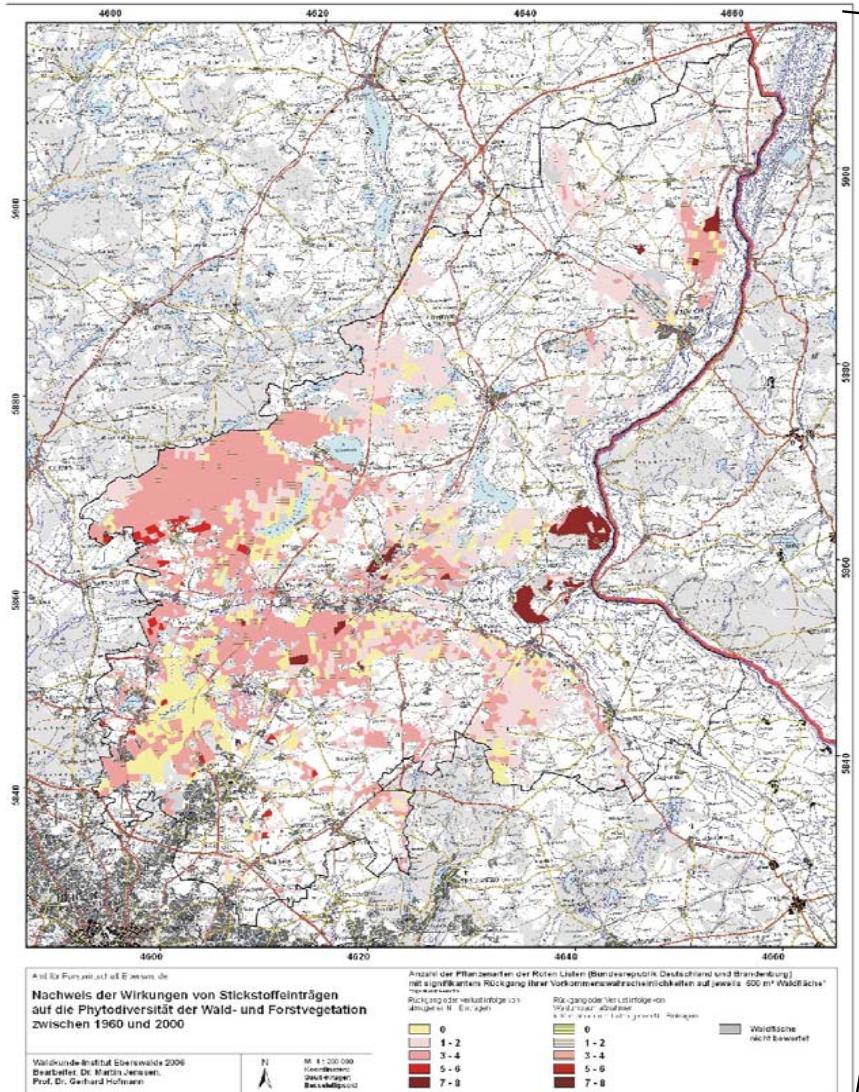
### Base saturation/ pH



# N-Deposition and Biodiversity – BERN model (ÖKODATA)



# N-Deposition and Biodiversity (Waldkunde-Inst. Eberswalde)

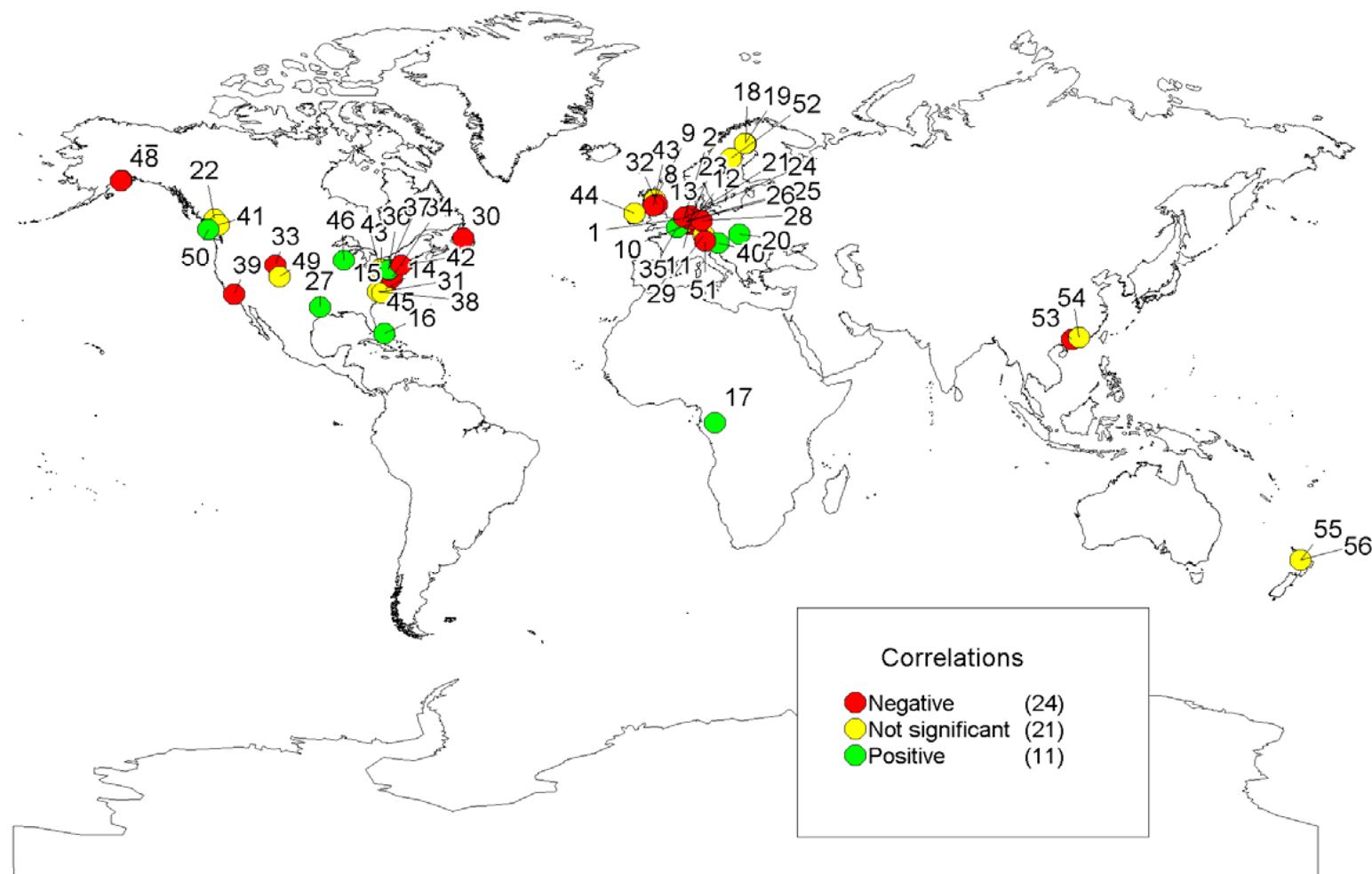


## Monitoring study of Waldkundeinstitute Eberswalde

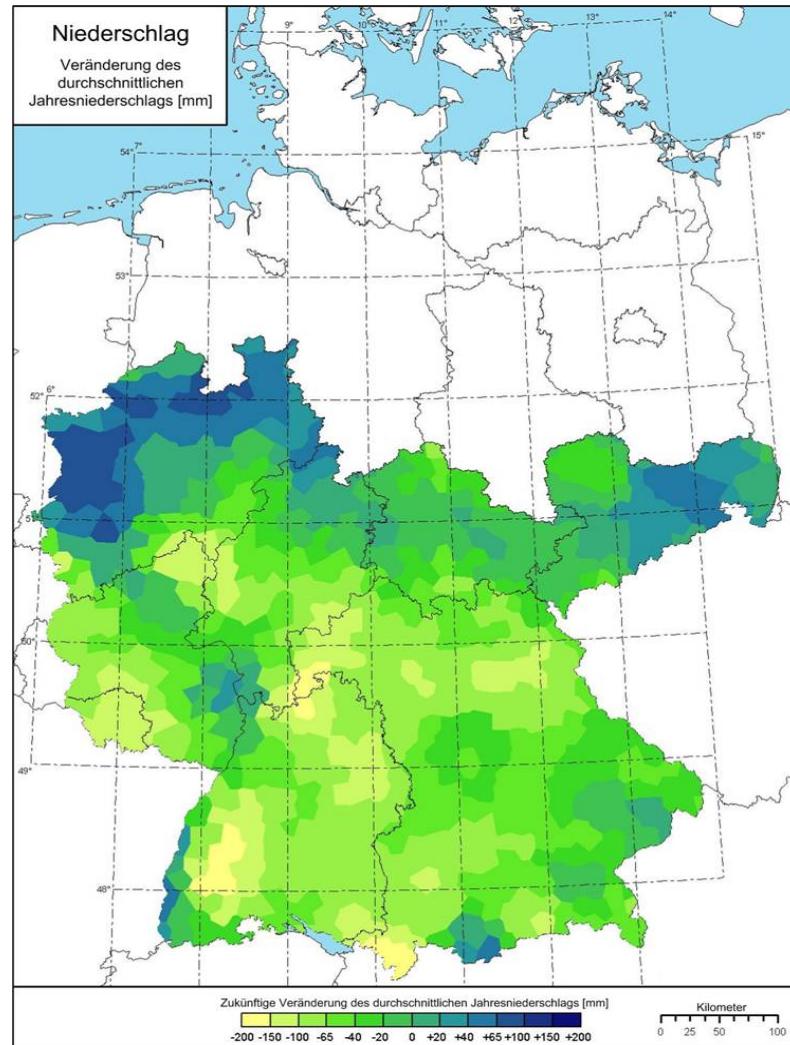
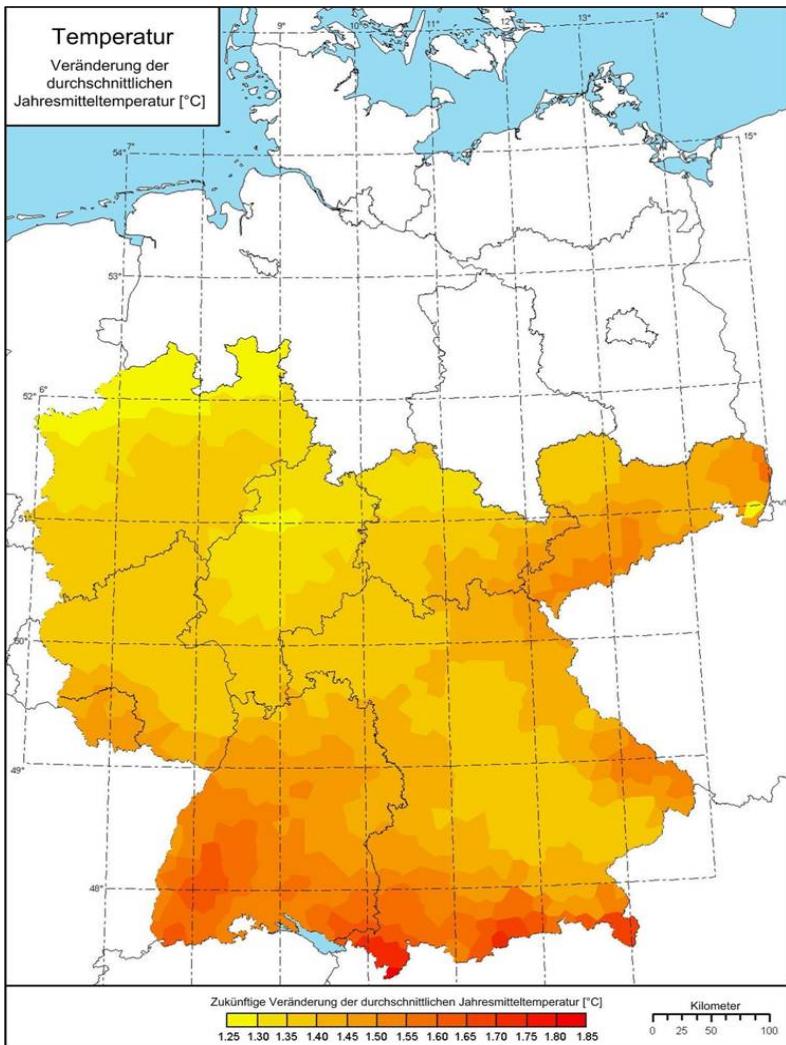
Significant decline of altogether 16  
protected plant species

Evidence of causal relationship to N  
deposition follows from fertilization  
experiments (1964 - 1970)

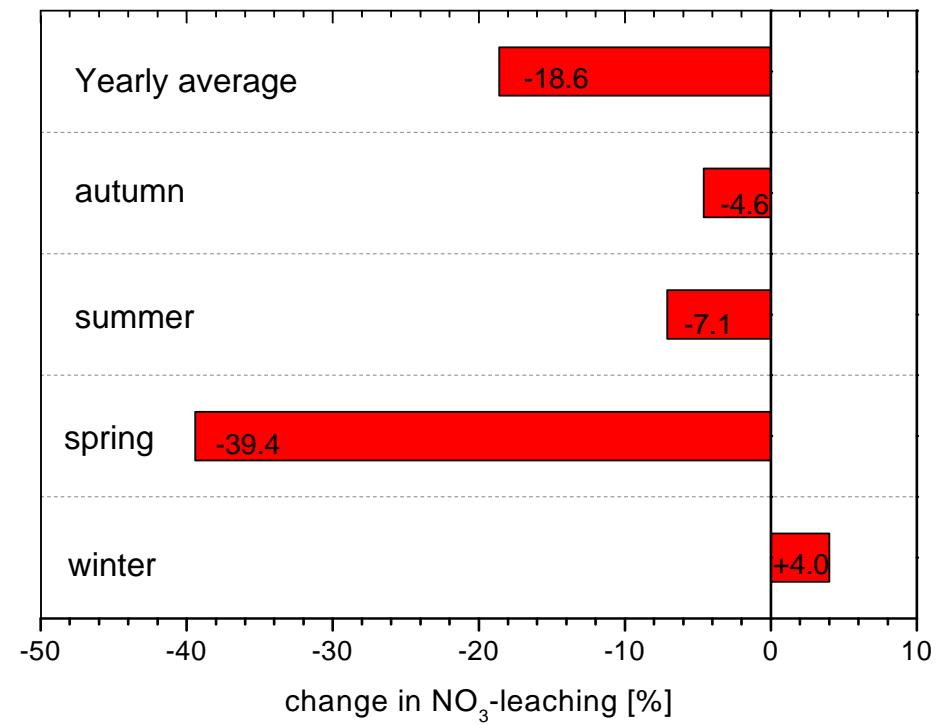
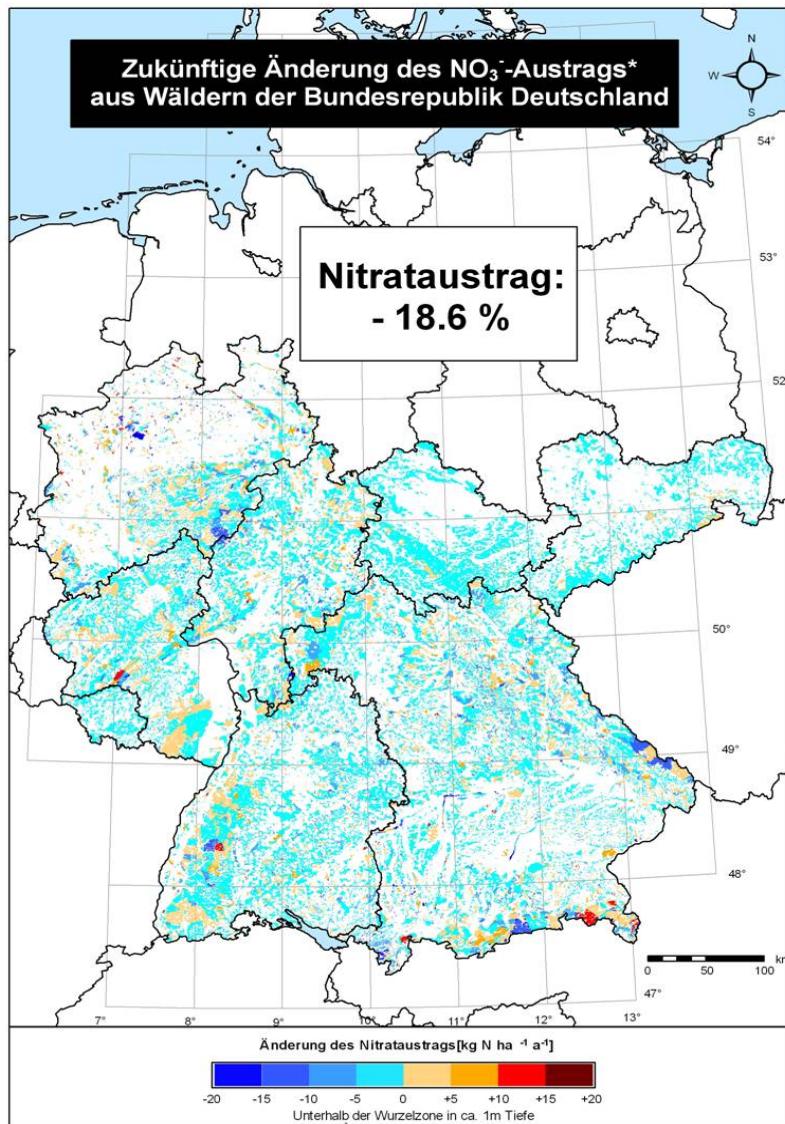
# N-Deposition and Biodiversity (University of Giessen)



# Climate change 1991-2000 versus 2031-2039



# Climate change induced changes in NO<sub>3</sub>-Leaching



# conclusions

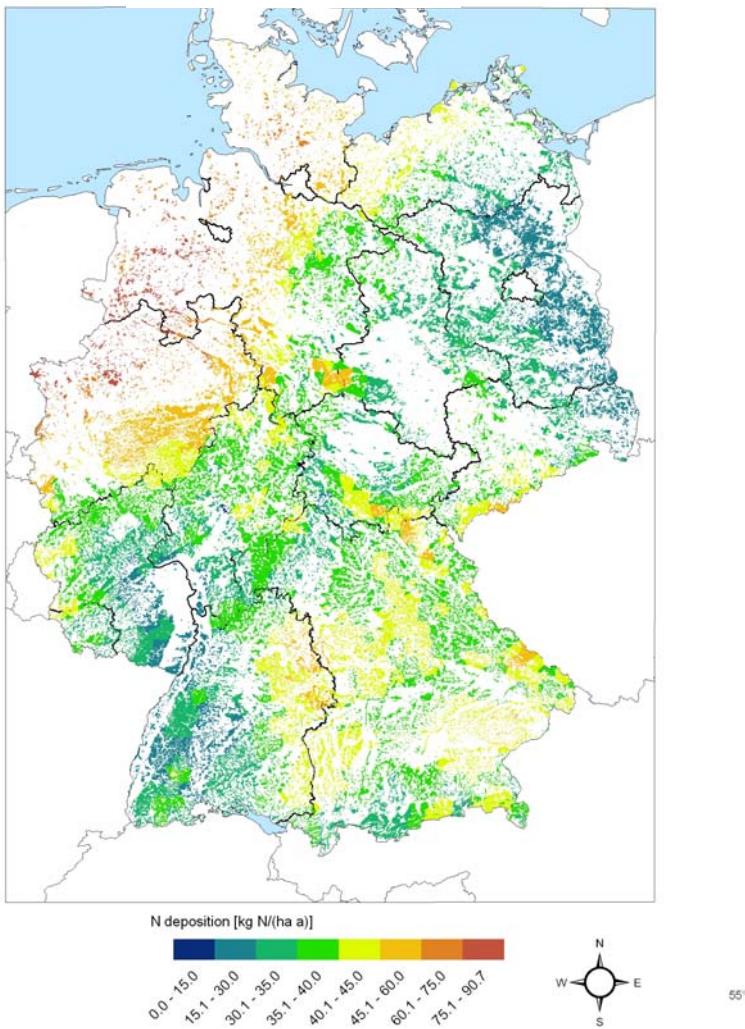
**Mechanistic biogeochemical models are capable to simulate N turnover and associated losses in forest ecosystems**

**In combination with biodiversity models they are promising tools for assessing long term impacts of N-deposition on forest ecosystems**

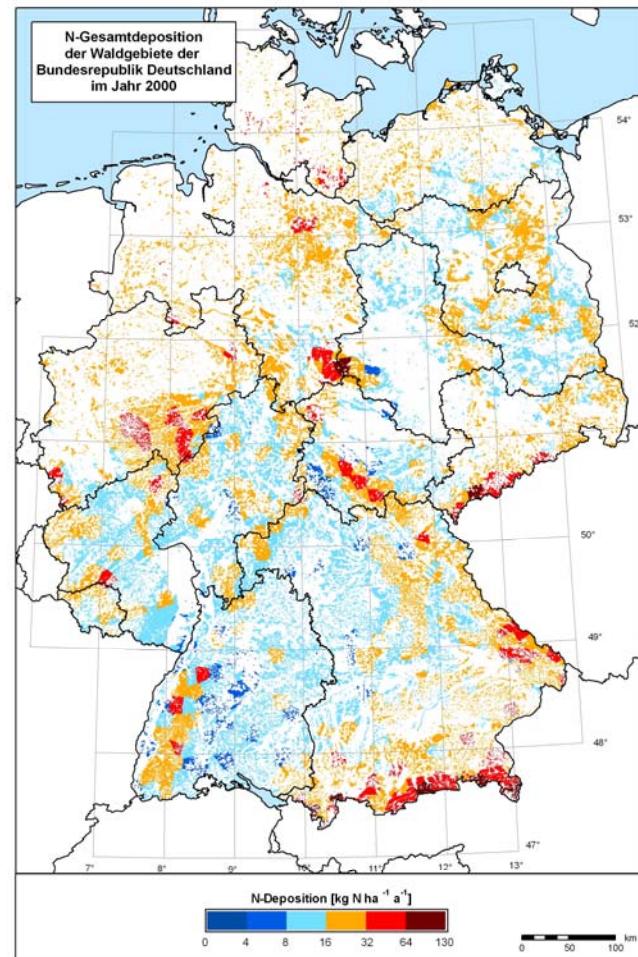
**However, there is a need for monitoring studies measuring the complete N balance to allow further improvement of the models**

**Thank you**

# N-Deposition situation forest ecosystems in Germany



Gauger et al, 2007



Gauger et al, 2001

