Integrated assessment of atmospheric emissions of ammonia and green house gasses, and nutrients at a landscape level

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Environmental ambitions Noordelijke Friese Wouden

Aim study

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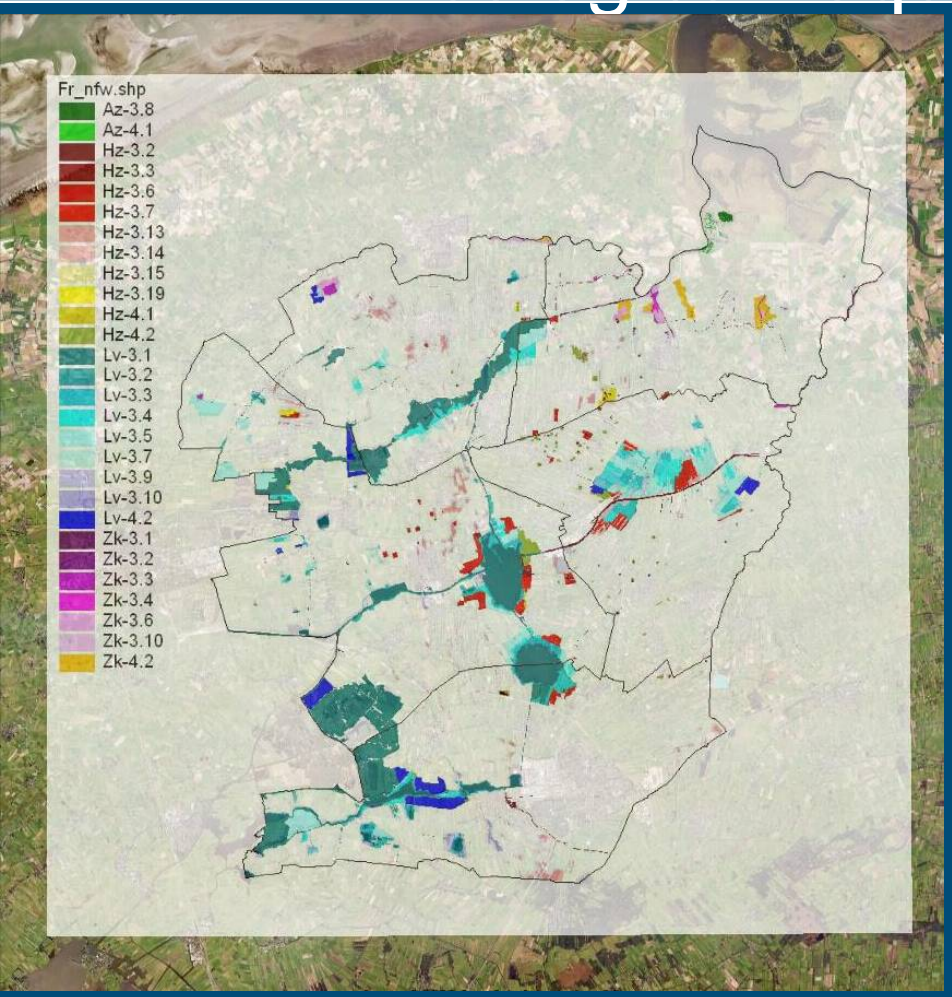
Noordelijke Friese Wouden (NFW)

- Farmers joined in an environmental cooperative
- Agreement with government to achieve environmental targets at landscape level
- Targets to be reached in 5 -10 years
- Freedom regarding measures as long as the environmental targets are attained

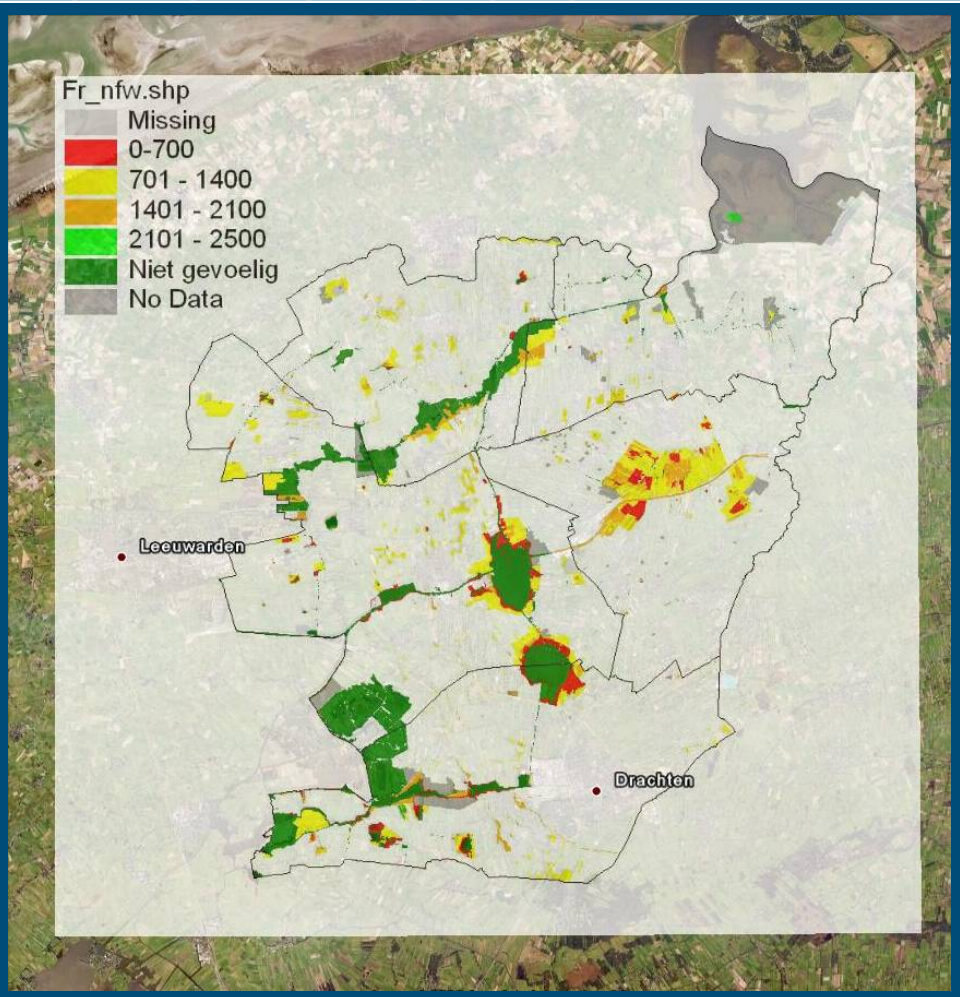
Environmental ambitions NFW related to N

- Ground- and surface water
  - NO_3 ground water < 50 mg l^{-1}
  - N in surface water < 2.2 mg l^{-1}
- Nature
  - Emission ceiling of 2 kton NH_3-N derived from the NEC of NH_3 and the present ratio of NFW versus national emissions (2010)
  - Only 10% exceedance of critical N loads per nature target type; 90% protection of nature (2030)

Ecological requirements nature



Nature target types



Critical N loads (mol N ha^{-1} jr^{-1})

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Aim study

- A model (INITIATOR2) based integrated assessment of the
  - Environmental status of the NFW area for the year 2004
  - Impacts of alternative management measures on the environmental status

- NitroEurope-IP task
  - Deliver detailed agricultural input data for NitroScape
  - Model comparison (Initiator2 – Integrator – NitroScape)

Model calculations to assess present (year 2004) environmental status

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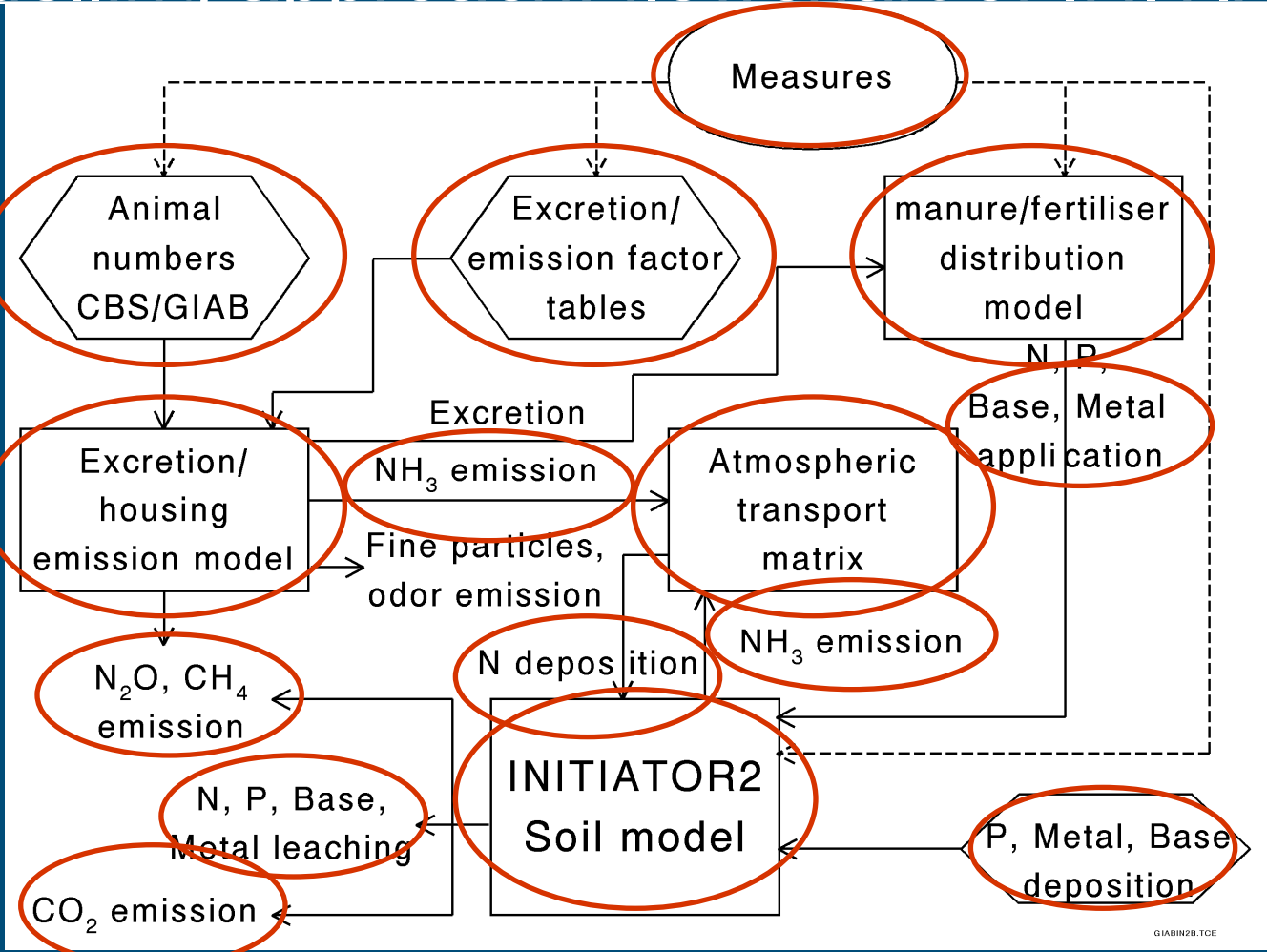
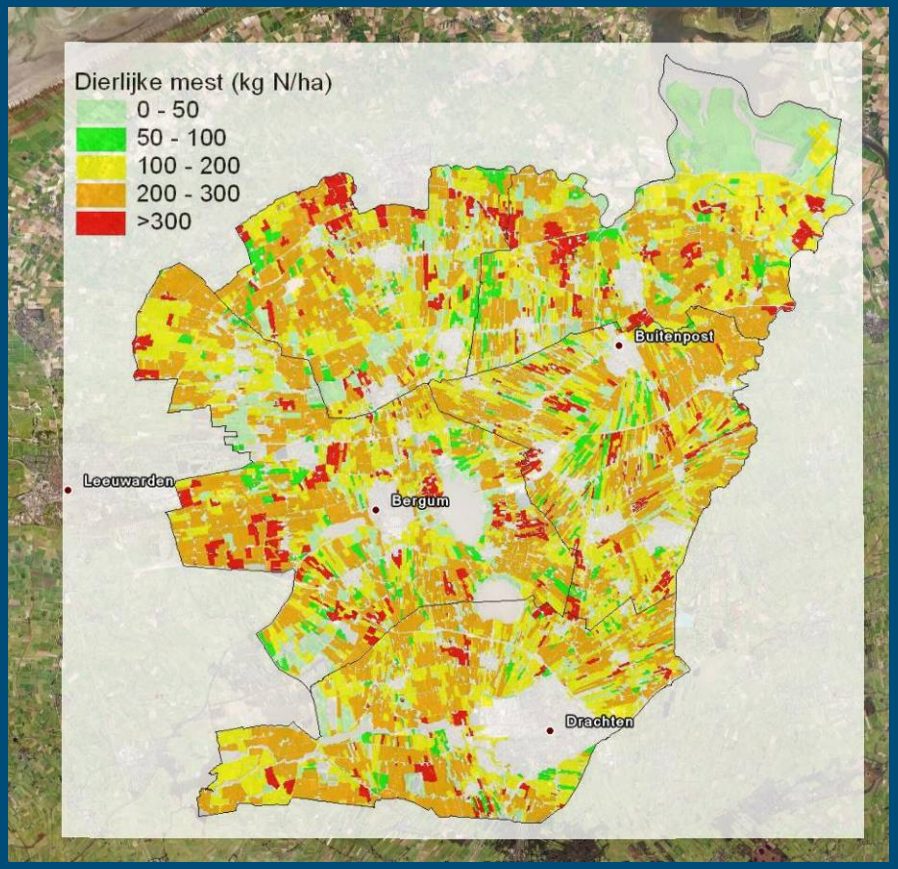
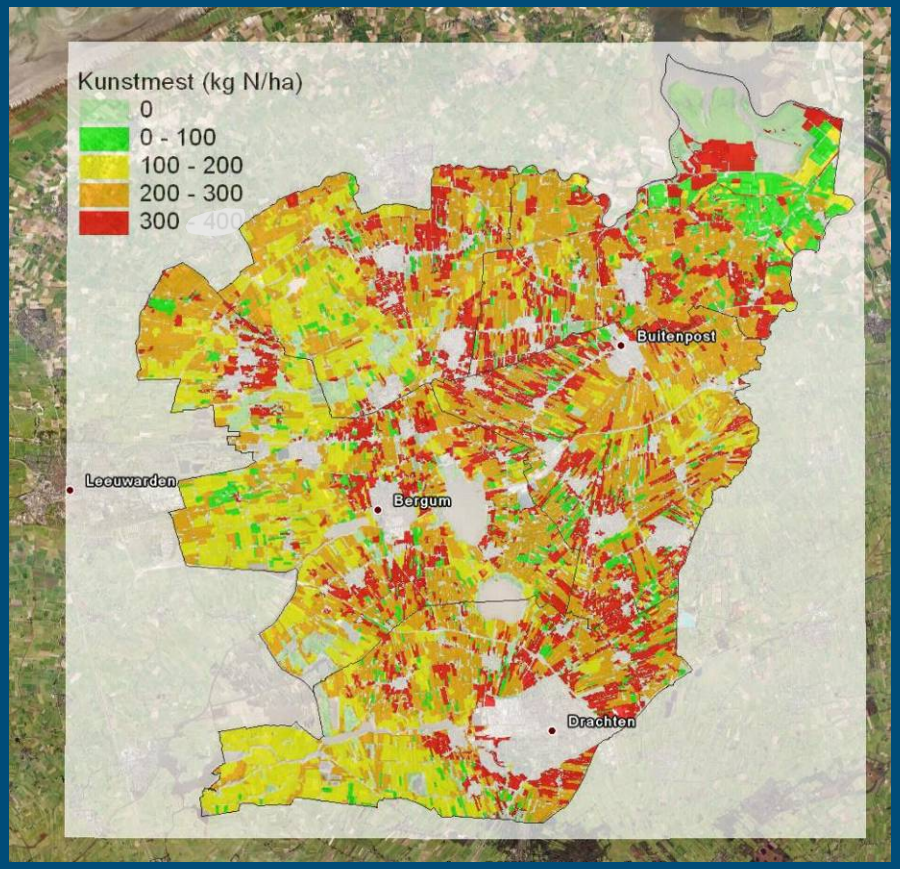
Modelling approach: flowchart of INITIATOR2



N application by manure and fertilizer 2004



N in Animal manure



N fertilizer

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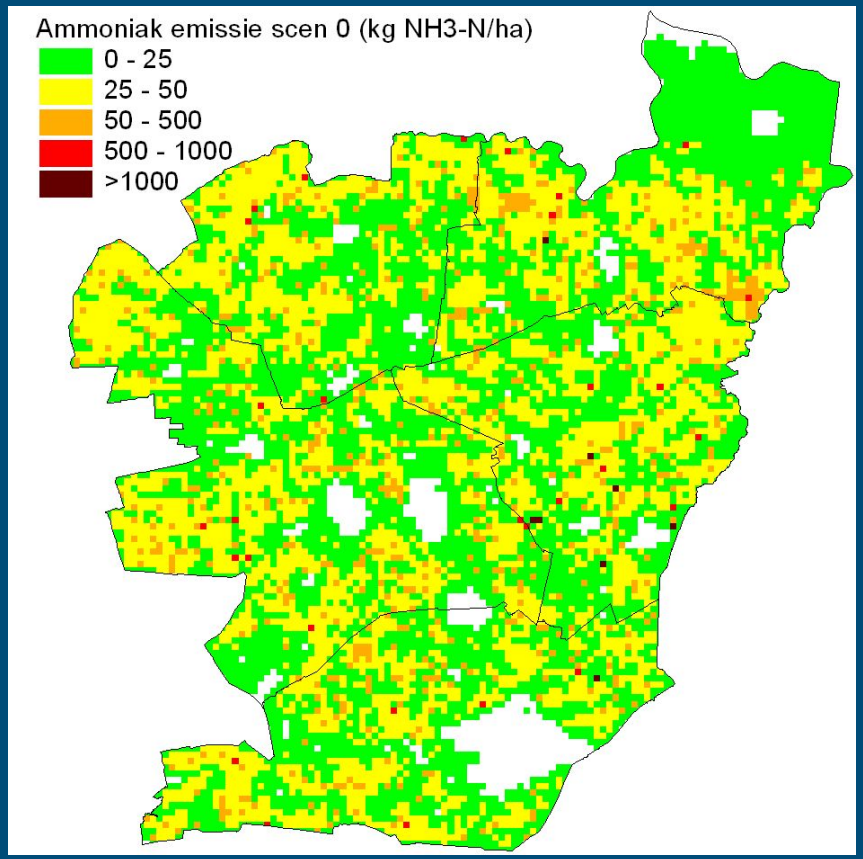
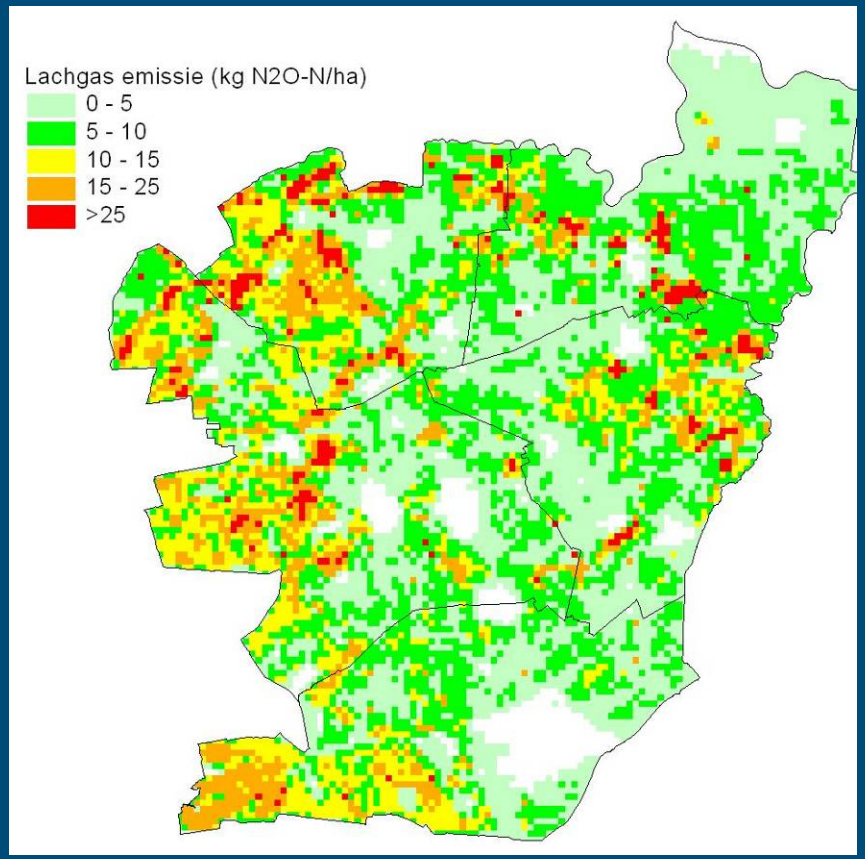
Emission of ammonia and nitrous oxide 2004





NH_3 emission (kg NH_3-N ha^{-1})

N_2O emission (Kg N_2O-N ha^{-1})

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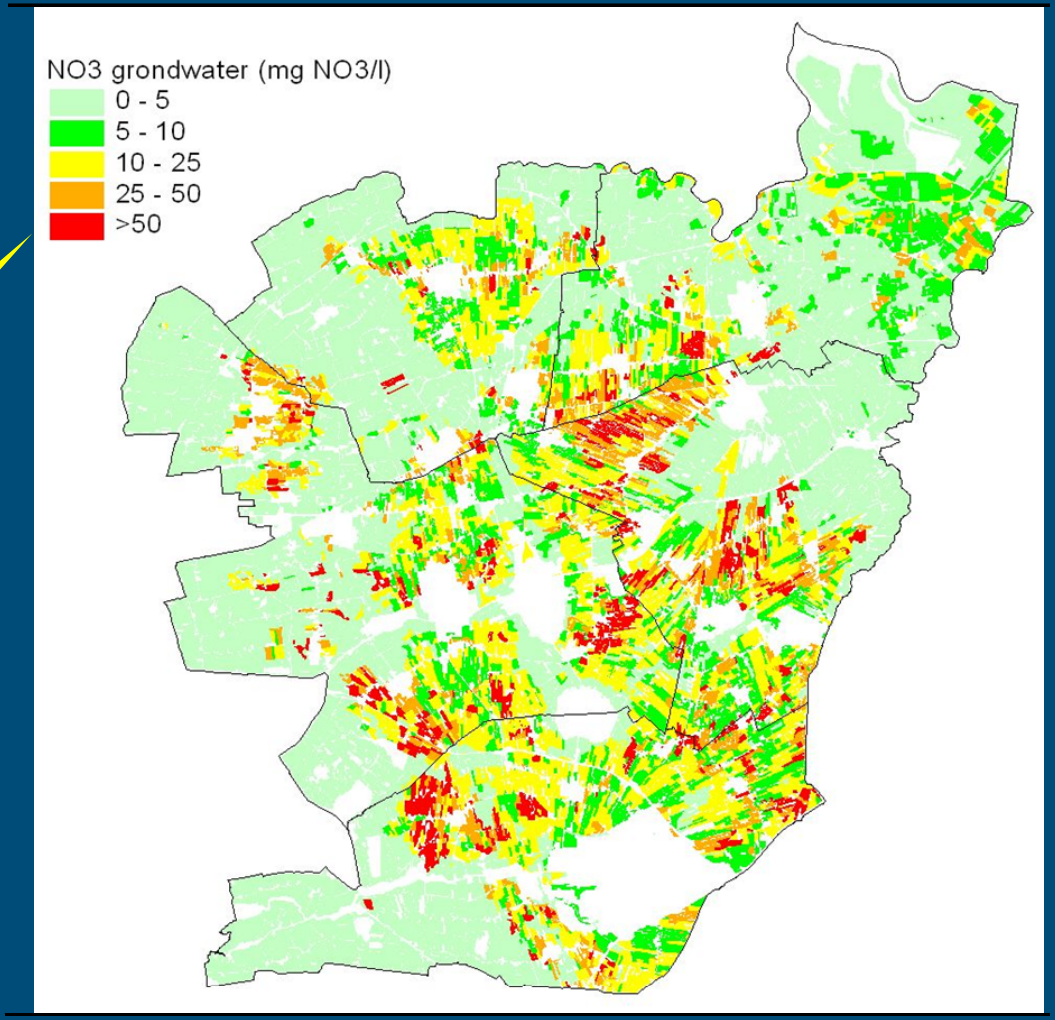
N concentrations in groundwater



6%

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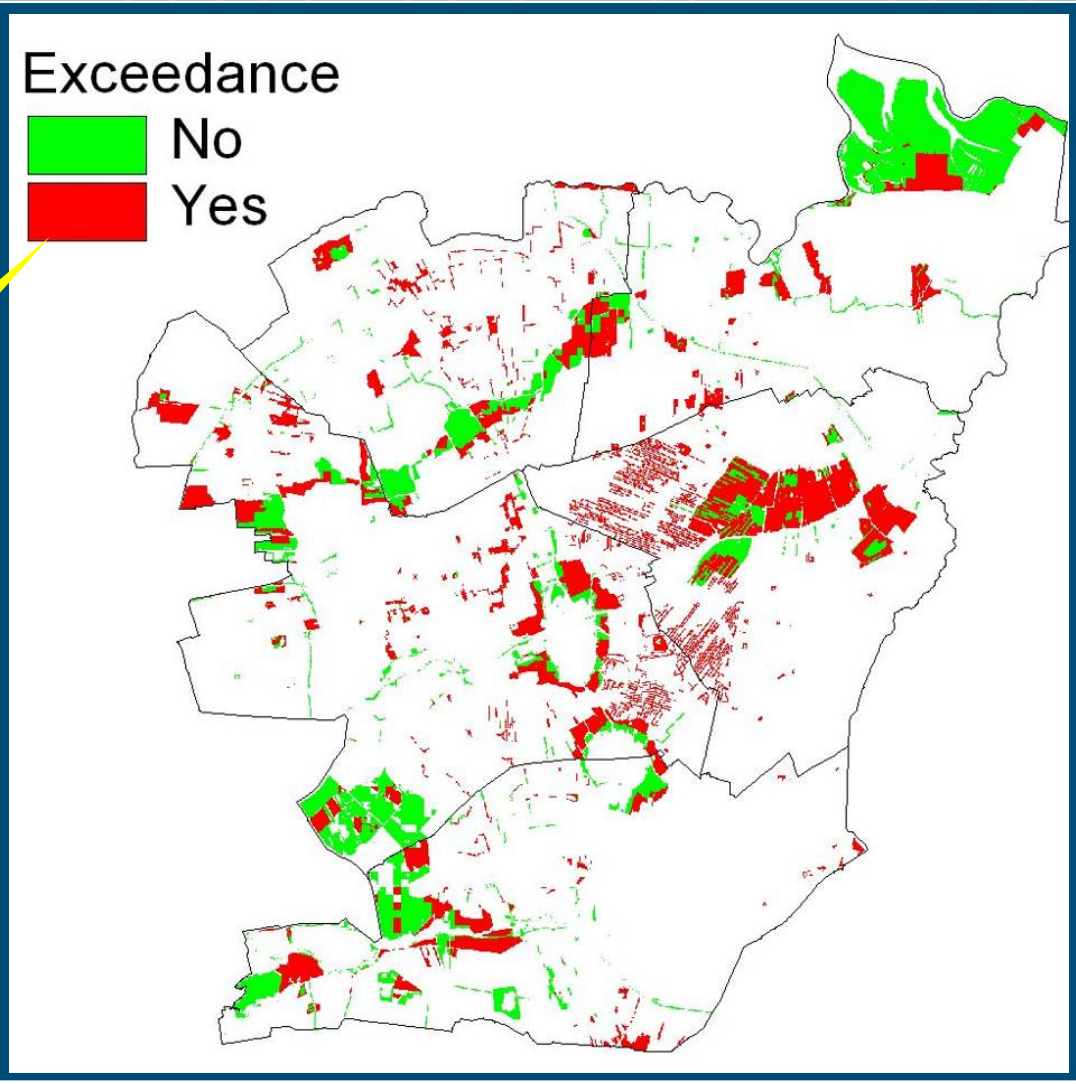
Exceedance critical N loads



39%

Effects of measures

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Measures

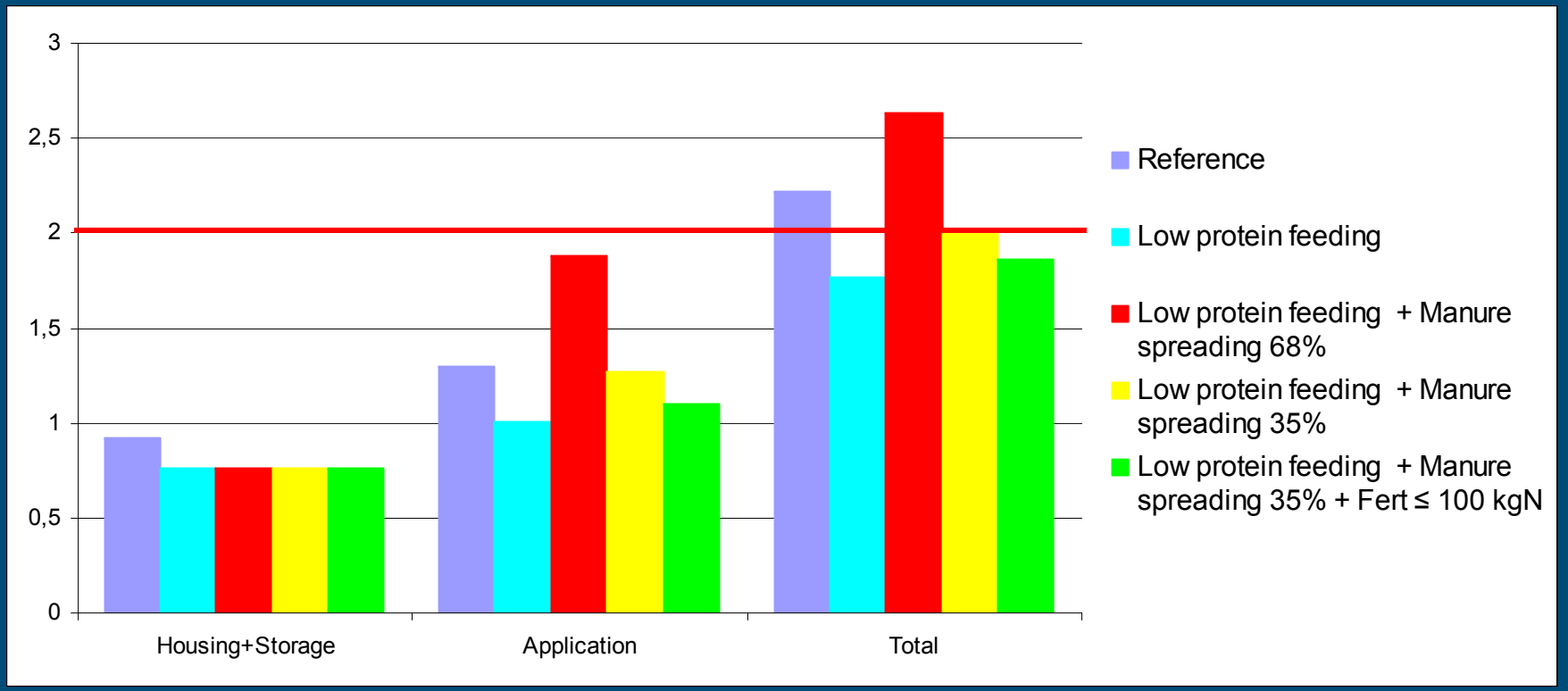
- Reluctance to the application of injection of animal manure, because of its negative impacts on soil fauna and soil structure

- Alternative, the –presently forbidden- use of above ground manure spreading:
  - Under favourable weather conditions
  - In combination with low protein feeding
  - Reduced use of N fertilizer

Scenarios

0	Reference (2004)
1	Low protein feeding
2	Low protein feeding + Manure spreading 68%
3	Low protein feeding + Manure spreading 35%
4	Low protein feeding + Manure spreading 35% + ≤ 100 kg N fertilizer

Effects of measures



NH_3 emission in kton NH_3-N

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Effects on the exceedance of critical N loads

	Deposition N Mol N /ha	Exceedance %
Present situation	1687	39.1
Low protein feeding+ manure spreading 35%	1657	39.1
Low protein feeding+ injection 10-12%	1562	38.0
NH_3 emission NFW = 0	1260	**12.0**

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Effects on NH_3 and N_2O emissions and NO_3

Aspect	Present	Low protein feeding and manure spreading 35%
NH_3 emission (kton N)	2.2	2.0
N_2O emission (kton N)	0.46	0.35
Exceedance NO_3 limit (%)	5.7	2.7

Future work within NitroEurope

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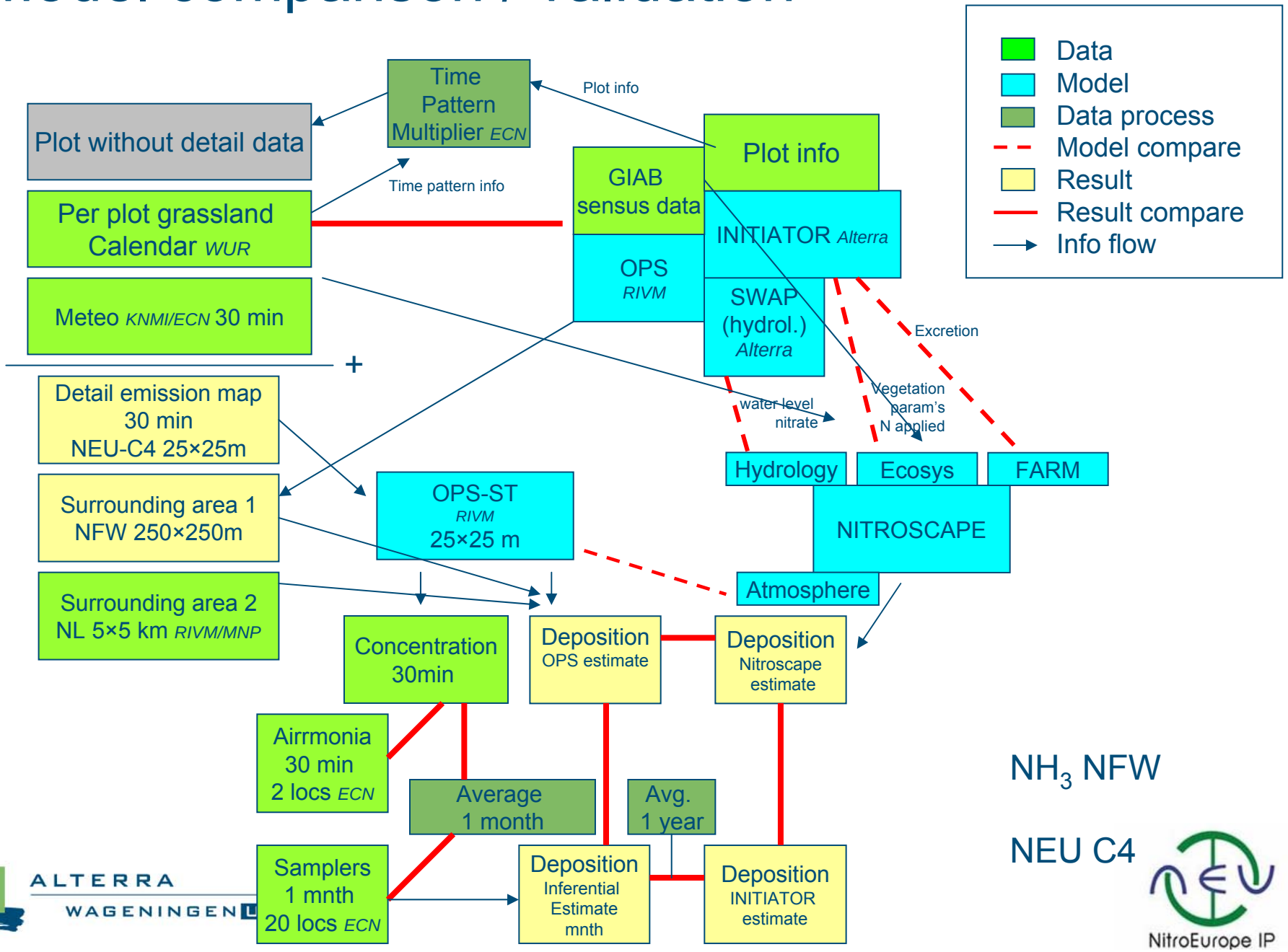
Model comparison / validation



NH_3 NFW

NEU C4

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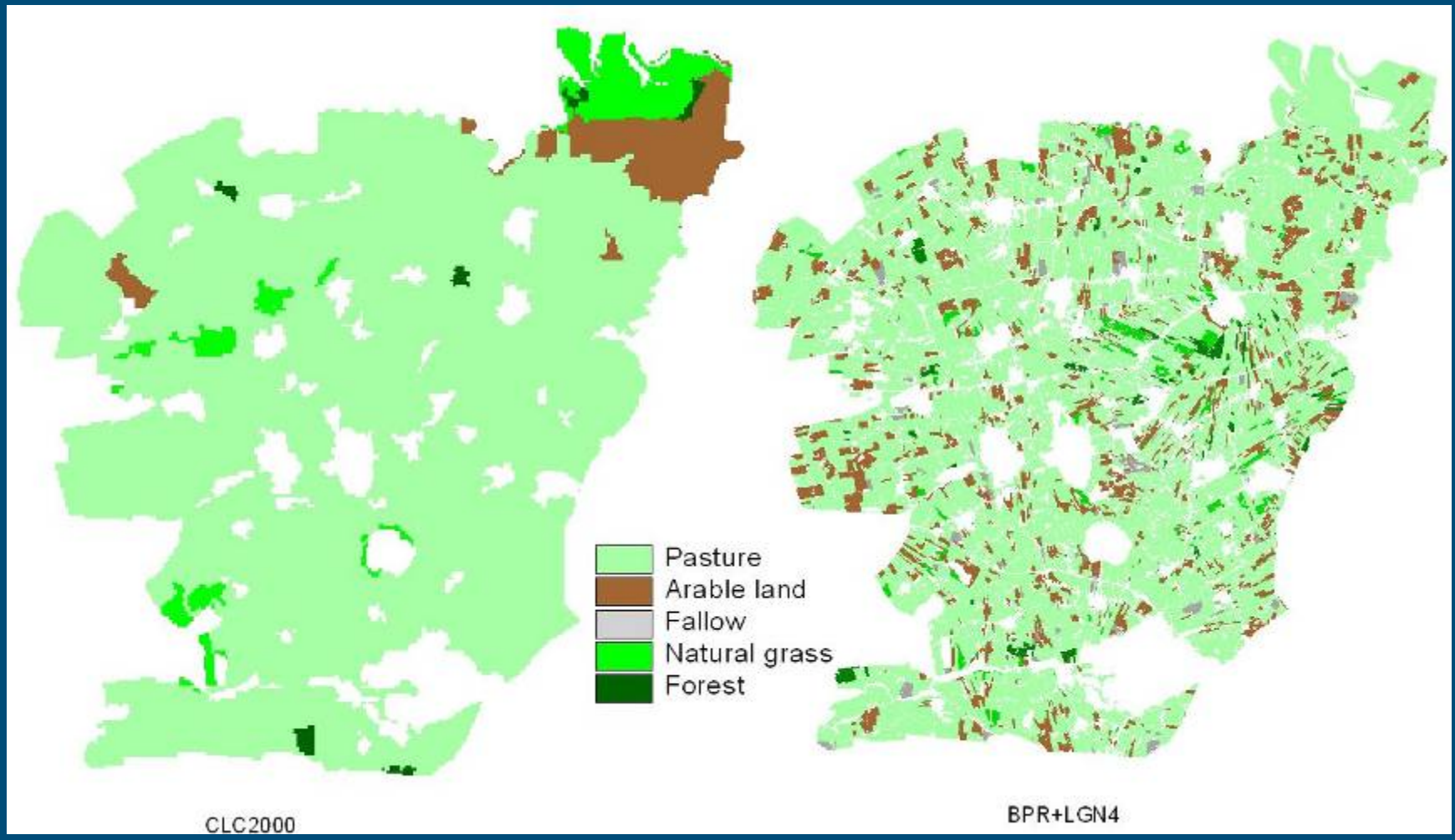
Effect of using low resolution data



Conclusions

- Present situation:
  - NH_3 emissions exceed NFW target for 2010: 10%.
  - Area exceeding NO_3 concentration: 6%

- Low protein feeding and above ground spreading under favourable weather conditions lead to slightly lower NH_3 emissions close to NFW target for 2010

- Measures also lead to a reduction in N_2O emissions and N leaching/runoff to ground and surface water

Conclusions

- Exceedance critical N deposition is presently 39% of the area
- Low protein feeding hardly reduces this area (38%), even though NH_3 emission is reduced by 20%!
- At no NH_3 emissions in NFW the target of 10% exceedance is not achievable (12%)
- “Spatial abatement” strategies, such as buffer zones in the landscape or effect oriented measures are needed to reach the goals

Thank you

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