The impact of the Nitrates Directive on nitrogen emissions from agriculture in the EU-27 during 2000-2008

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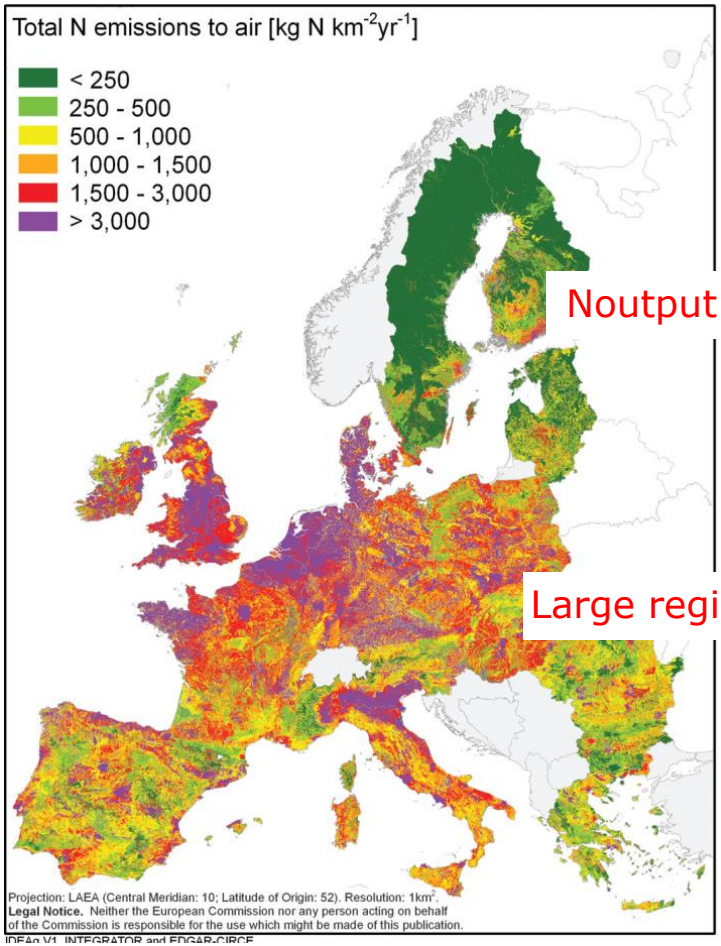
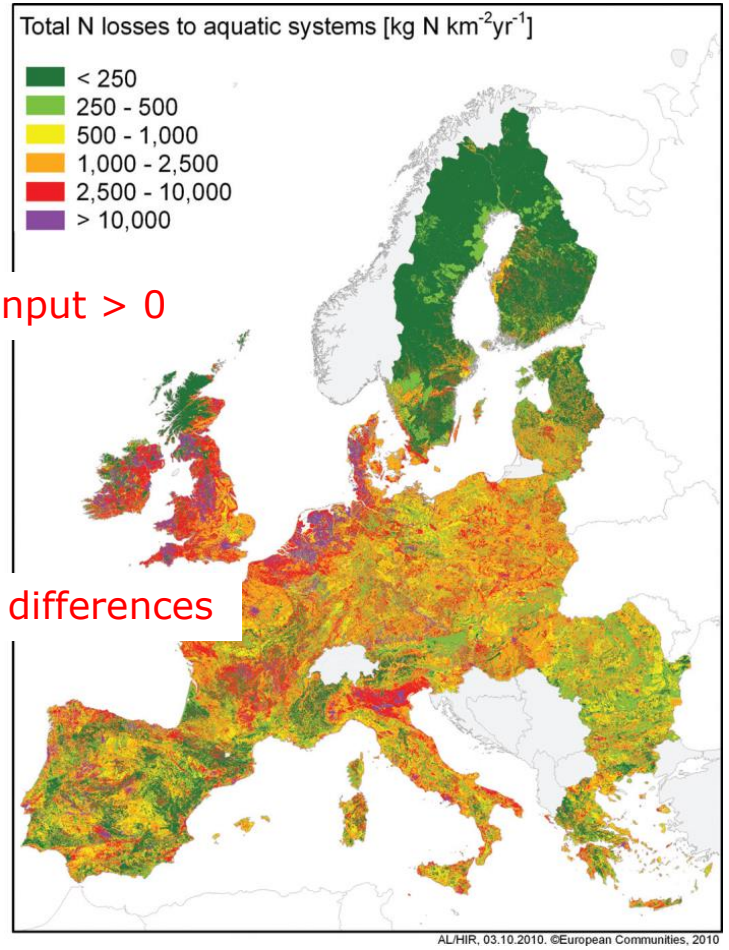
High N emissions and losses in EU-27, but large regional differences among countries of the EU-27

Emission to air



Losses to groundwater and surface water



Noutput – Ninput > 0

Large regional differences

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Sutton et al. (2011)

Outline

- Background and aim
- Quantification N emissions
- Data and scenarios
- Results
  - Trend in N losses
  - Scenarios with and without Nitrates Directive
- Conclusions

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Objective Nitrates Directive

- Reduce water pollution caused or induced by nitrates from agricultural sources
- Prevent further pollution through:
  - Nitrate leaching Vulnerable Zones (NVZs)
  - Good agricultural practices
  - Action programmes (NVZ or whole country):
    - Limited periods fertilizer application
    - Balanced N fertilization
    - Limit to manure nitrogen application
    - Limitation to N fertilizers (on sloping soils, during wet conditions, and near water courses)

Aim and approach

- Quantify the effects of the implementation of the ND on:
  - NO_3 leaching and runoff
  - Emissions of NH_3, N_2, N_2O, and NO_X
- Effects of ND measures on N use were estimated
- N losses were calculated for 2000-2008:
  - With ND measures
  - Without ND measures

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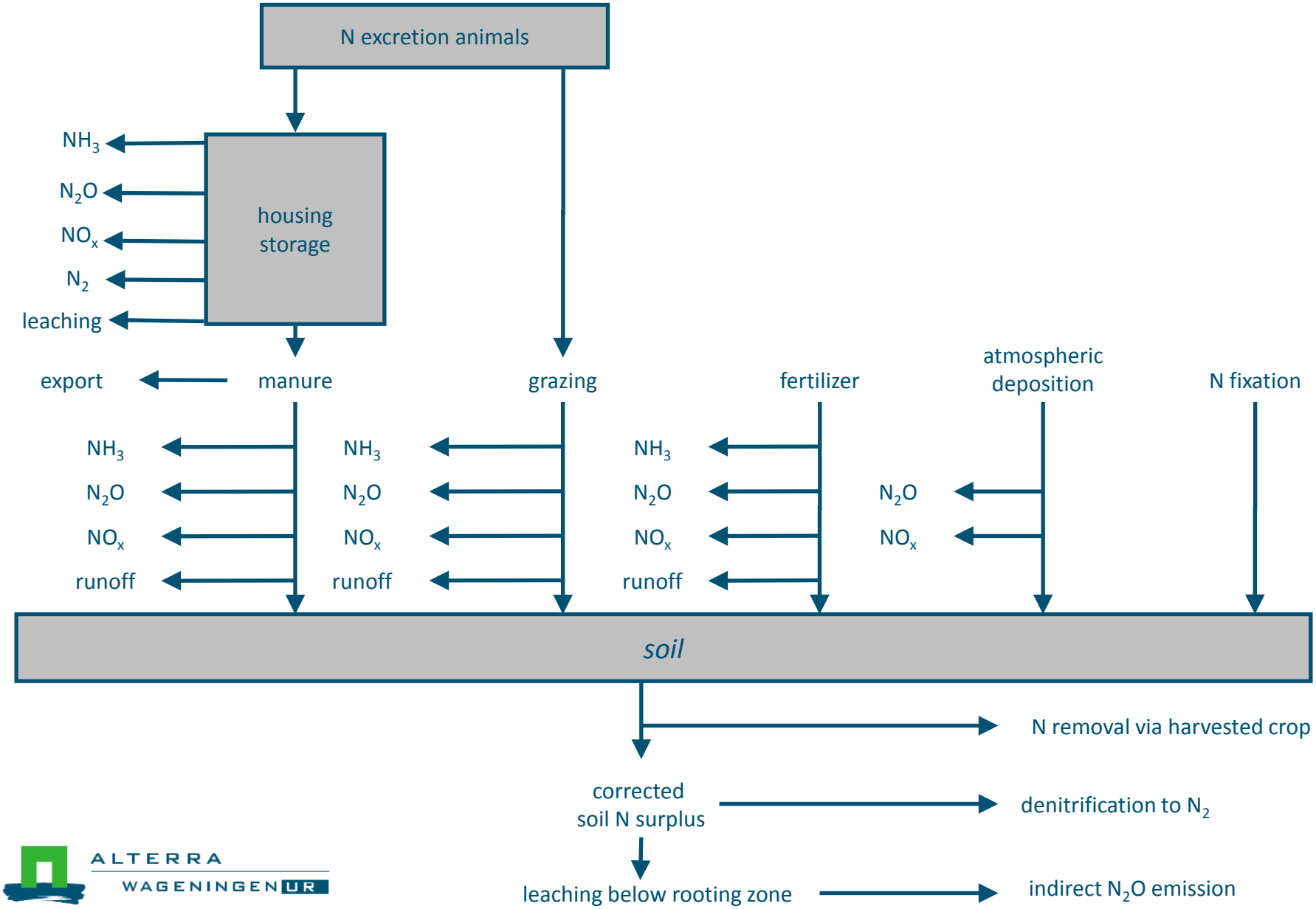
Miterra Europe model

- A simple model to assess the impact of measures on:
  - Leaching and runoff of N to groundwater and surface waters
  - Emissions of NH_3, N_2O, N_2, and NO_x to the atmosphere
- Consisting of:
  - A database with activity data, emission factors and measures to mitigate N emissions and N leaching
  - A calculation and output module
- Calculating:
  - Annual fluxes, while assuming a steady state
  - At country level and regional level (NUTS2)

(Lesschen et al., 2011; Velthof et al., 2009).

Miterra Europe model



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Nitrates Directive scenario

- Assumed that ND measures are reflected in the statistics of Eurostat and FAOstat of fertilizer use, animal numbers, crop yield etc.
- N emissions calculated using the existing statistical data include the effect of ND implementation

	1991	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU 15	ND	E									
Ext EU25							A			E	
Ext EU27										A	

ND	Nitrates Directive adopted
A	Accessed the EU
E	ND effective

ND effective

ND not effective

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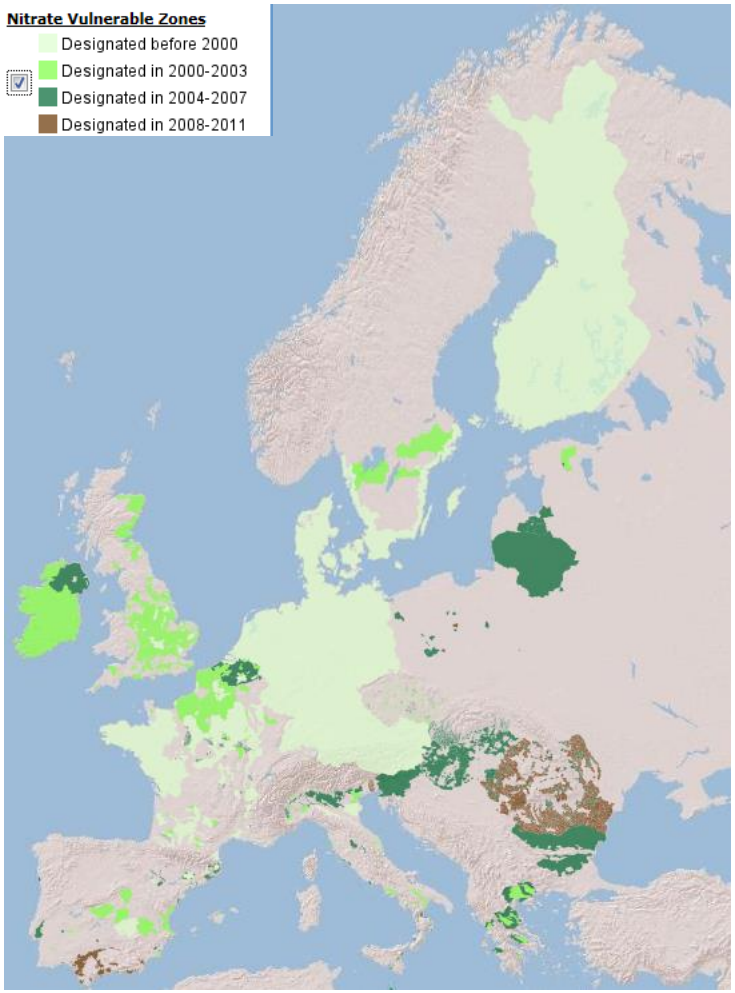
Without Nitrates Directive scenario

- Estimate the effect of ND measures on activity data
- Outside NVZ: Good Agricultural Practice affect farms outside NVZ:
  - A decrease by 2% per year in mineral N fertilizer use in EU-15

    Nfe(without ND)=Nfe(FAO_stat)×1.02
- Within NVZ: corrections based on Action program
  - 'Correct' the statistics for the years in which the ND is effective

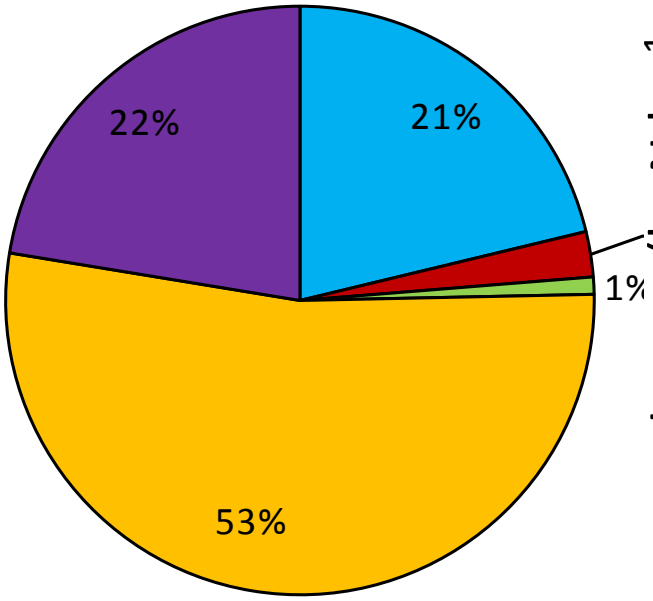


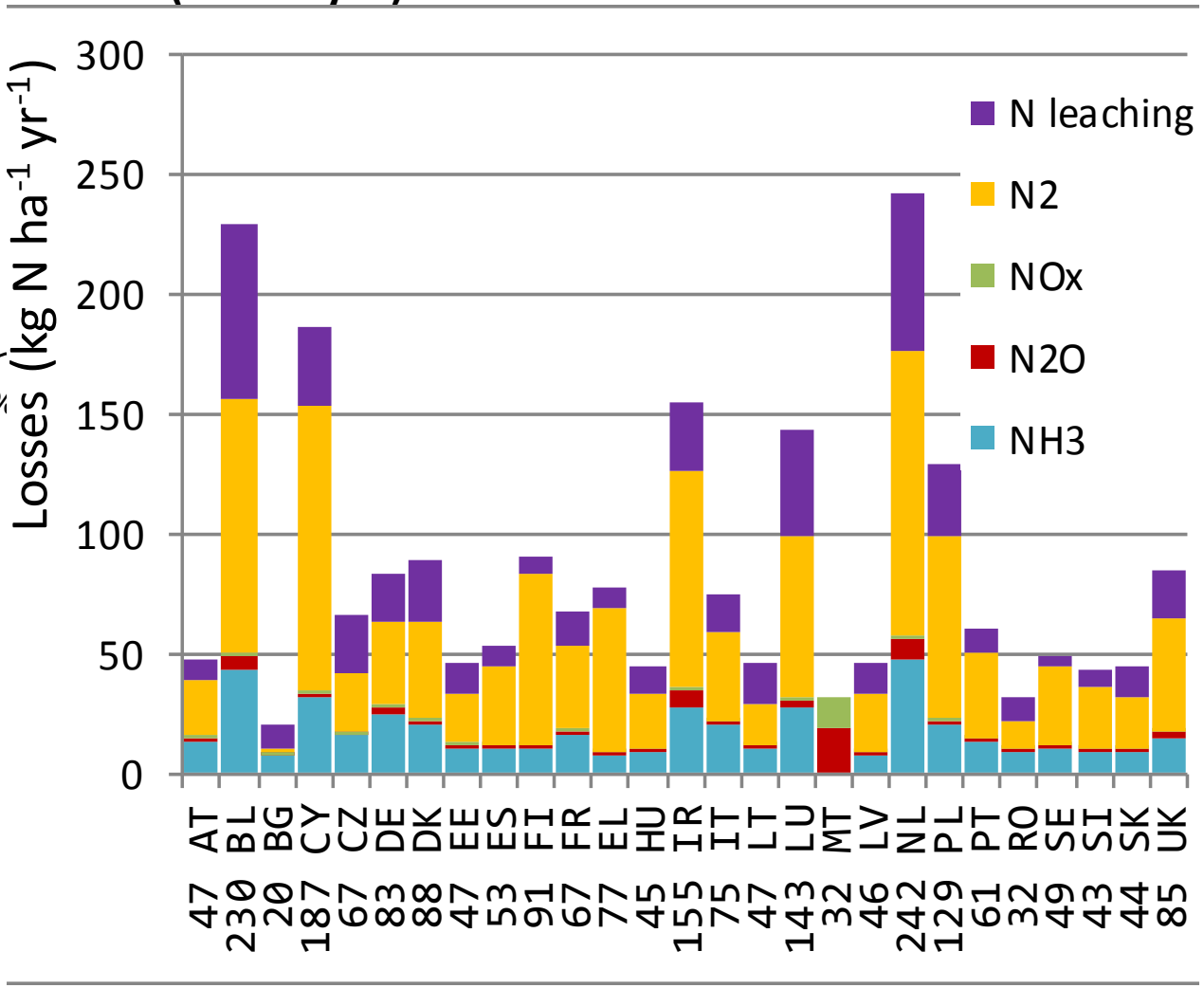
(Source: JRC)

Without ND scenario: Action program corrections

ND affects	Correction without ND scenario
Chemical fertilizer inputs	N_{fe}(Stat, t) × Nfe(pre ND)/Nfe(NDeff)
N excretion	Dairy cattle = f(Ninput) Pigs, poultry and beef cattle: no change
Animal numbers	1% more animals for farms in NVZ with > 1.3 LSU / ha
Area of productive agricultural land:	
- buffer strips	Extend area with 20m buffer near surface waters in NVZ
- sloping soils	Allow N fertilisation/manure application on steep soils
N losses due to:	
- closed periods man/fert appl.	NH_3 emission factor: $EFNH_3$ ×1.1 for slurry application N leaching: increase in leaching fraction

N losses in 2008 for the EU-27 and per MS





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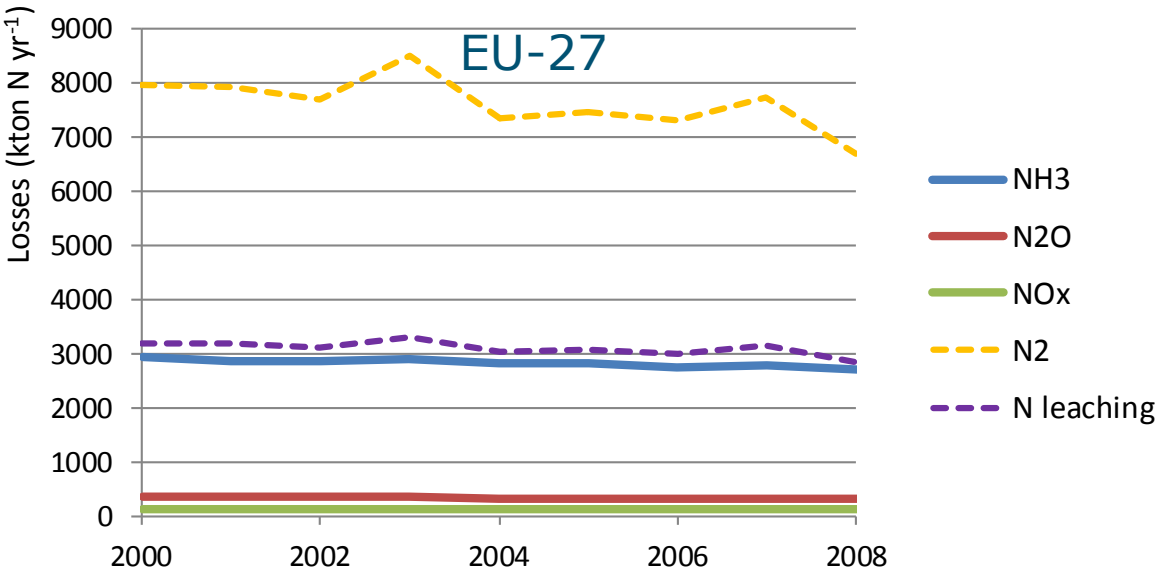
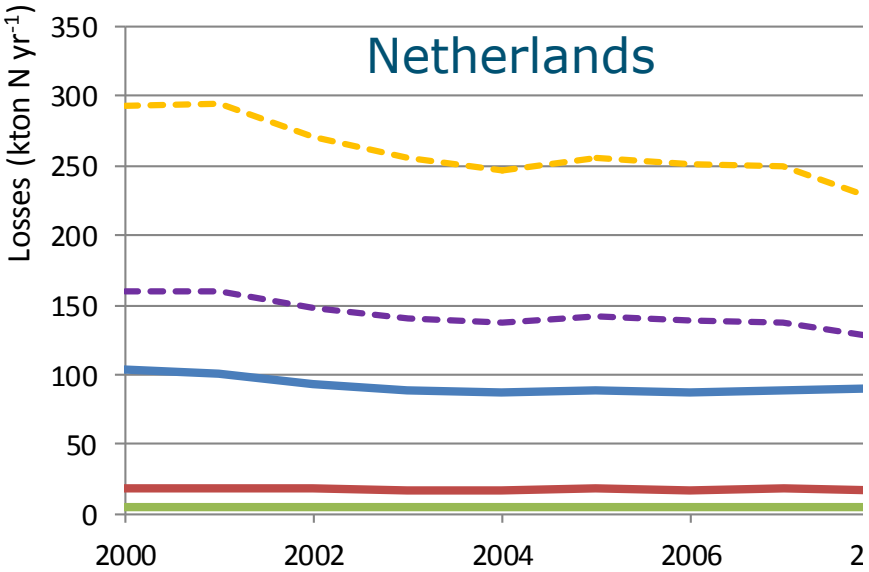
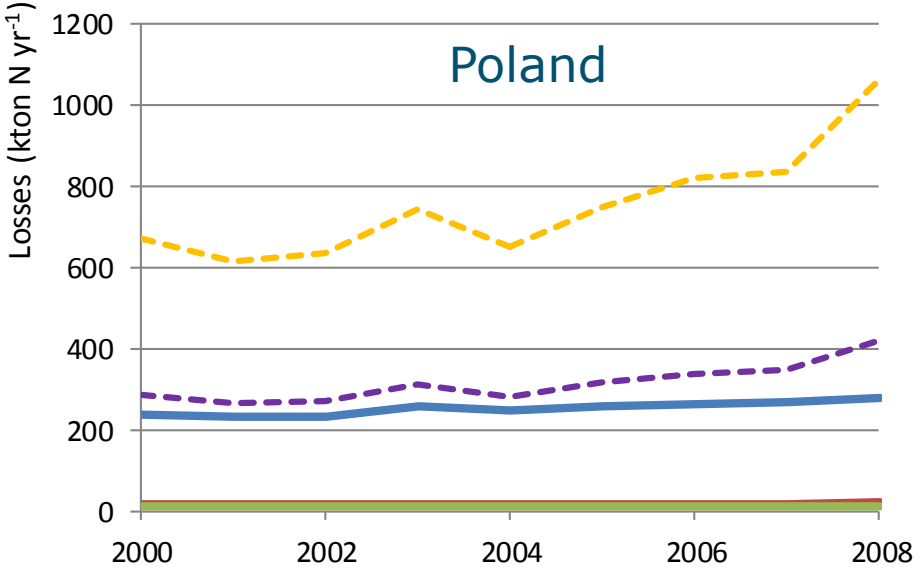
Results – trend in N losses







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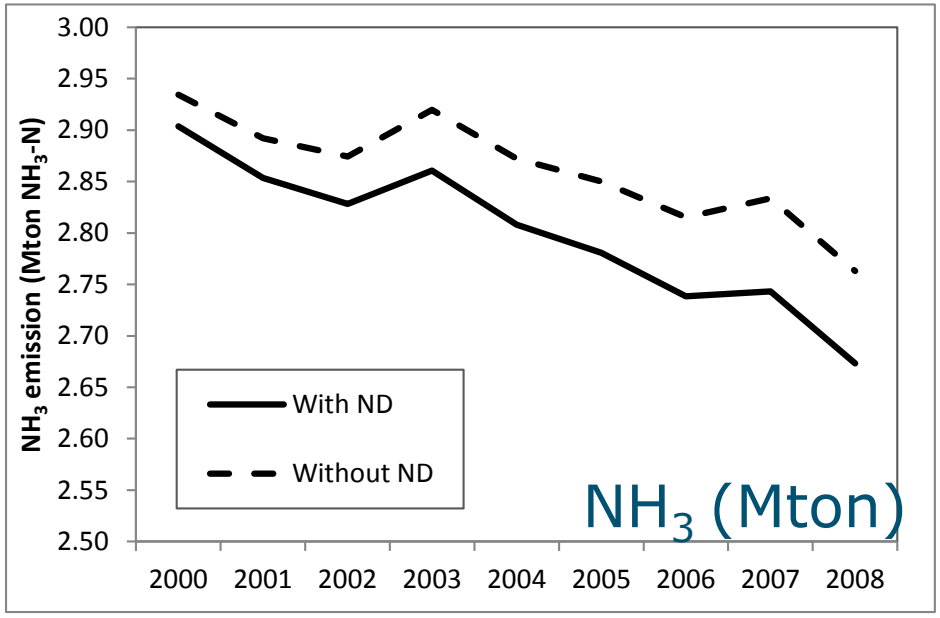
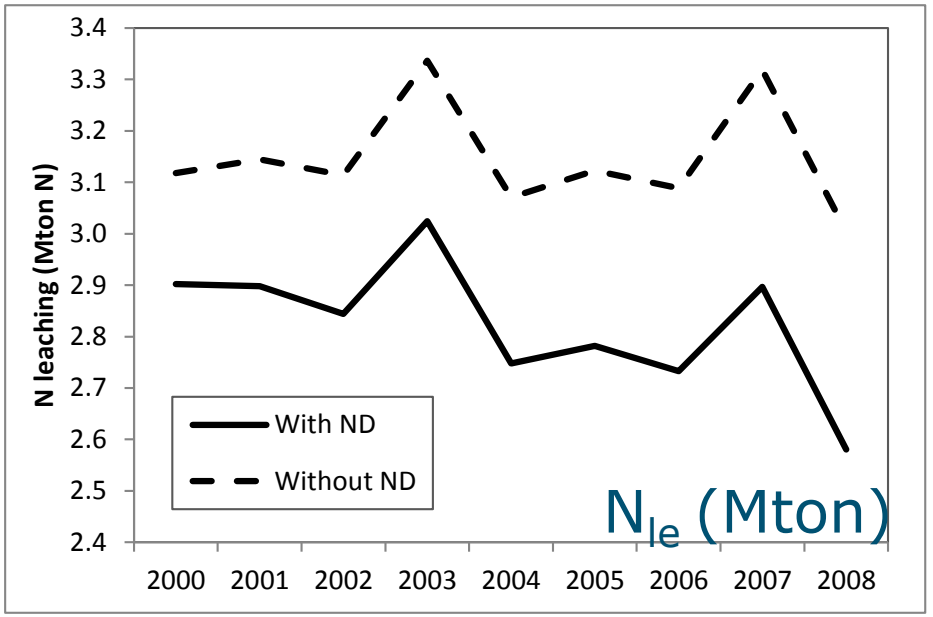
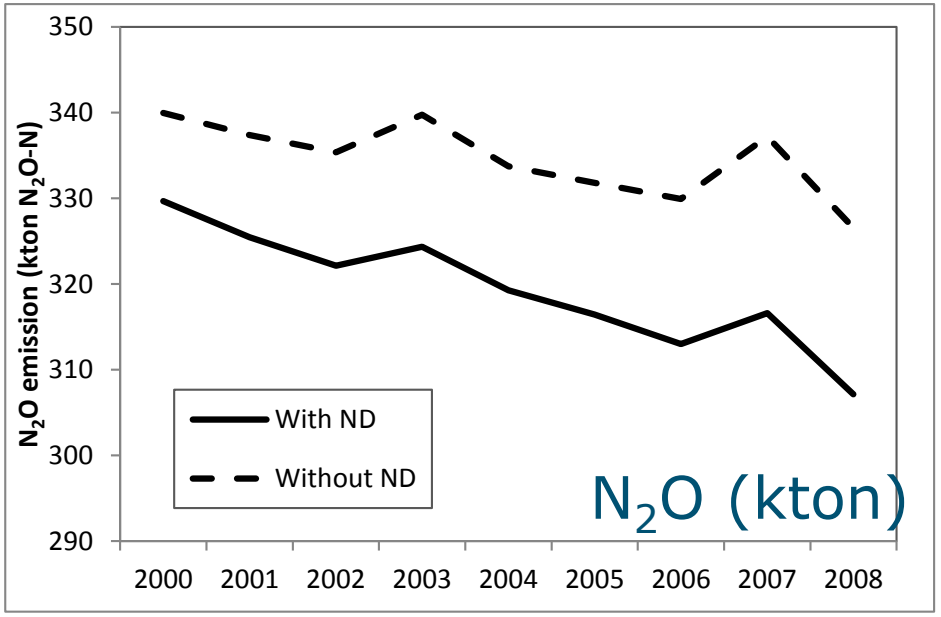
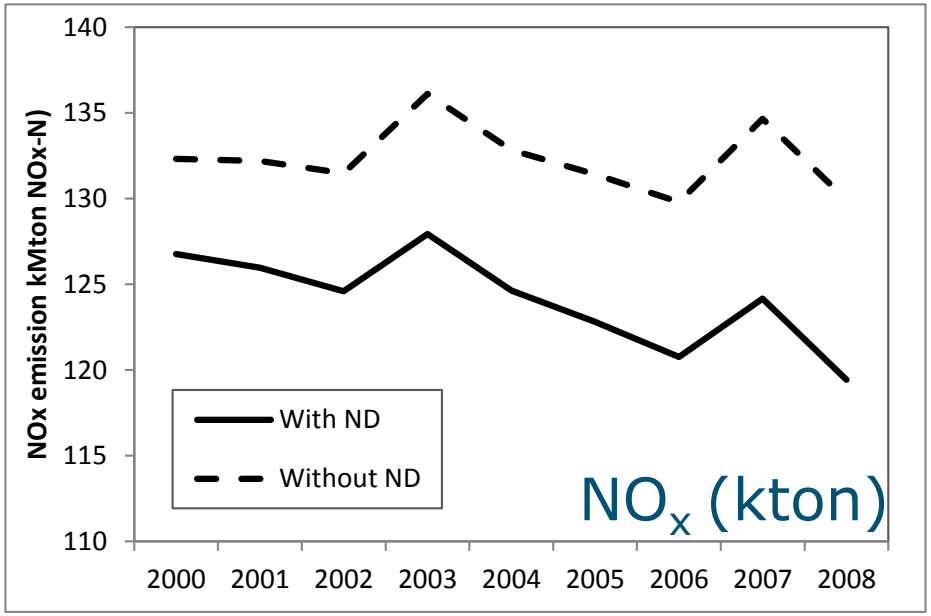
Effect of ND on N emissions and N leaching EU-27

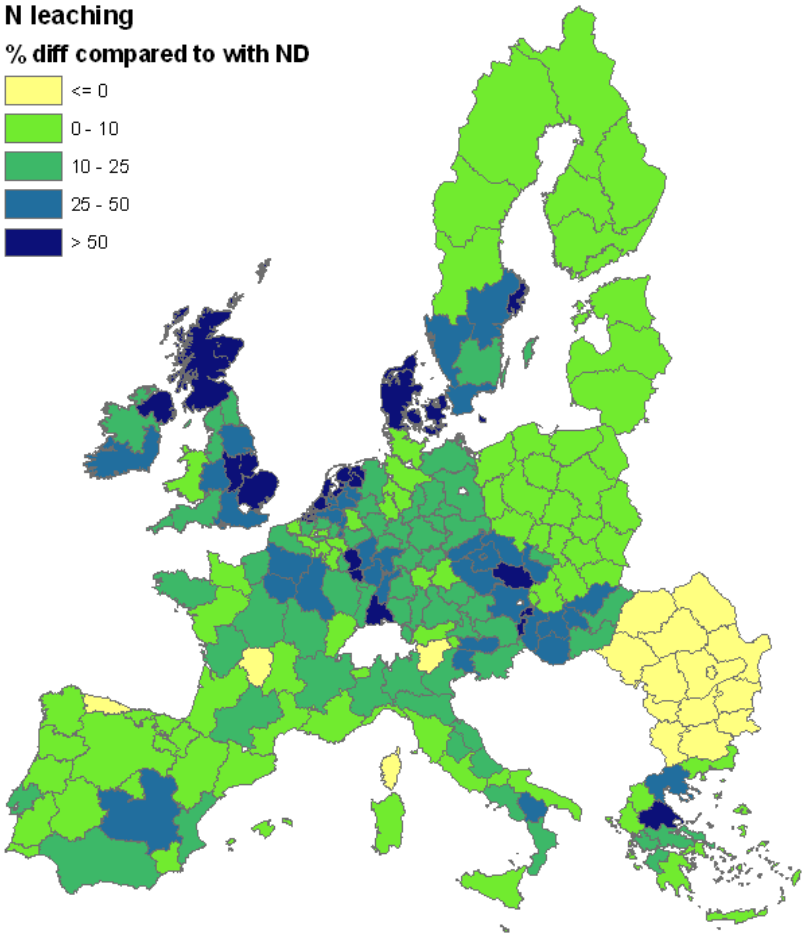


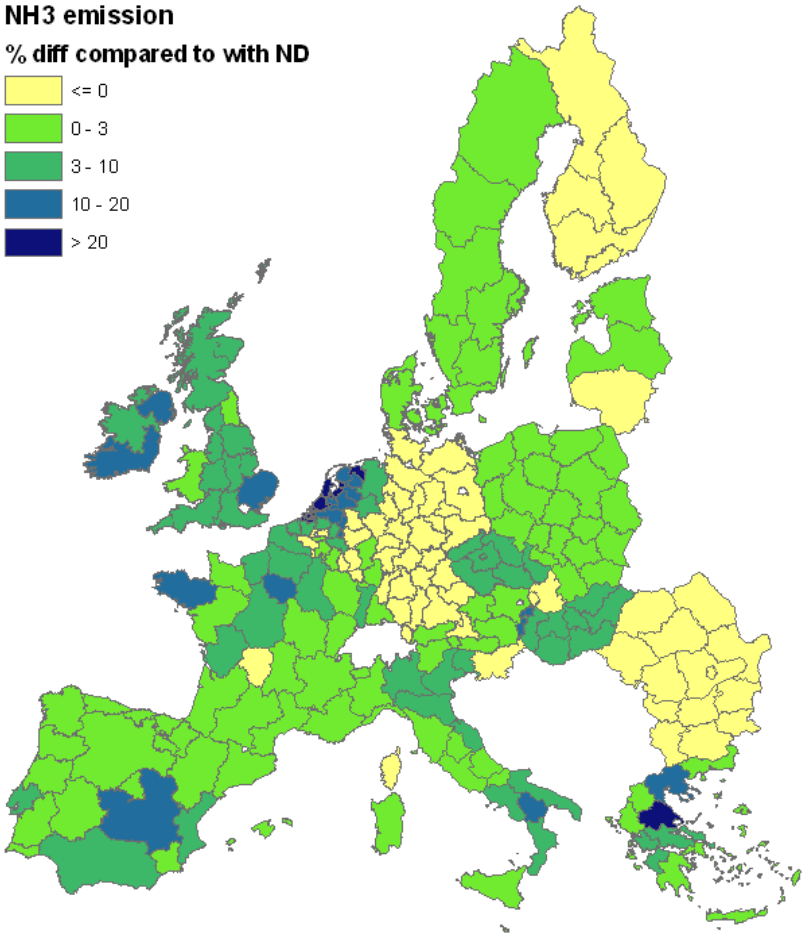






Relative change in N emissions from agricultural land due to ND implementation





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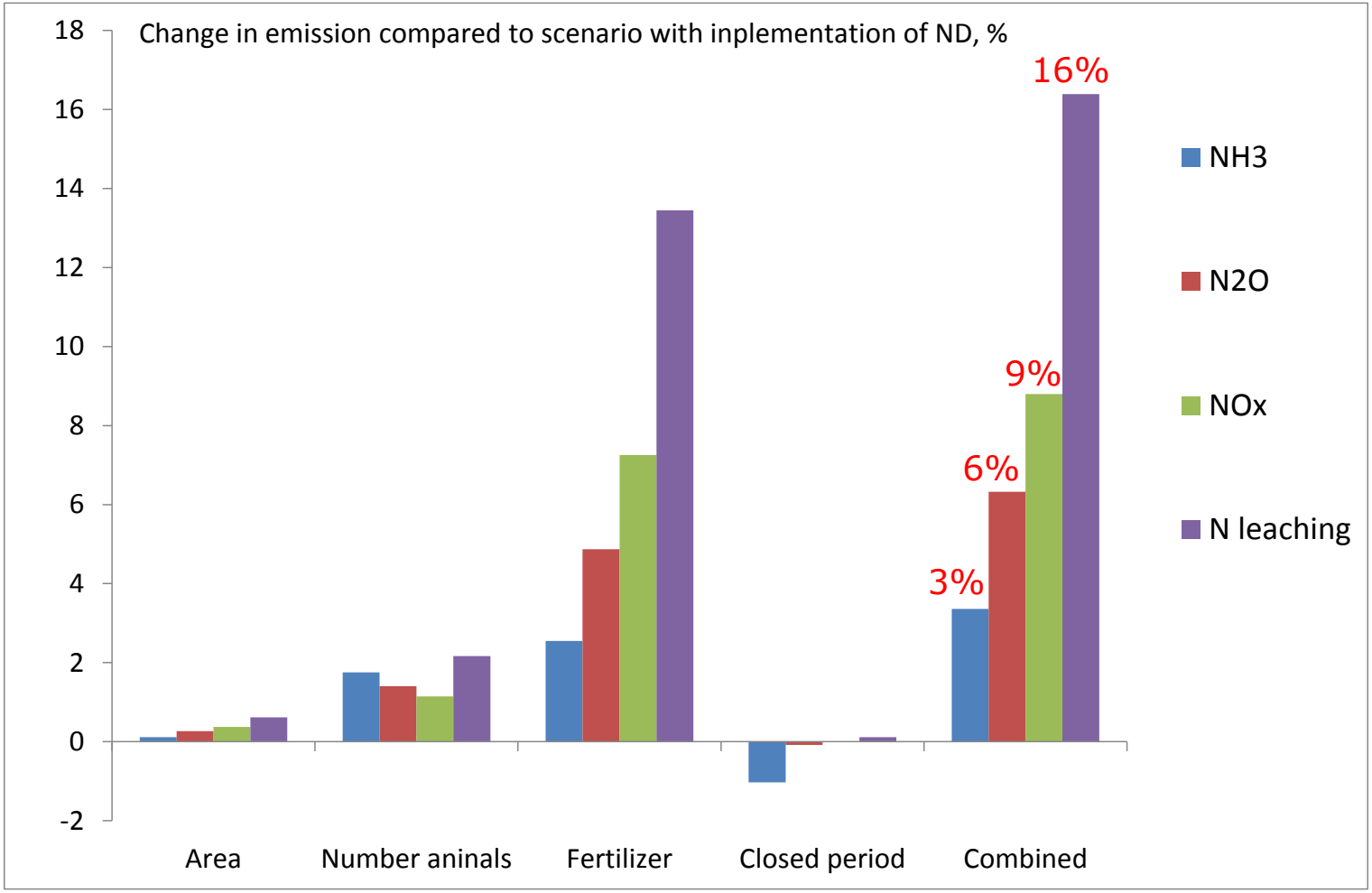
Effect of ND measures on N losses in 2008



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Conclusions

- Trends and level of N losses clearly differ per EU country
- ND implementation within EU-27 has decreased N losses in 2008 by: 16% for N leaching, 3% for NH_3 emission and 6% for N_2O emission
- But much larger effect in countries with intensive agricultural: N leaching: 36-60%, NH_3: 12-16%, N_2O: 12-20%
- Decrease in chemical fertilizer use has the largest effect on N losses
- A further decrease in N emissions in the near future is expected due to increase in ND implementation and stricter Action Programmes

Thank you

Further reading:

- Velthof G.L., J.P. Lesschen, J. Webb, S. Pietrzak, Z. Miatkowski, M. Pinto, J. Kros & O. Oenema, 2013. Science of the Total Environment, http://dx.doi.org/10.1016/j.scitotenv.2013.04.058
- Velthof et al. (2011). http://ec.europa.eu/environment/water/water-nitrates/pdf/Final__report_impact_Nitrates_Directive_def.pdf

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"The impact of the Nitrates Directive on gaseous N emissions. Effects of measures in nitrates action programme on gaseous N emissions".

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