Integral assessment of effects of policies on N and GHG emissions from agriculture in EU 27 using MITERRA EUROPE

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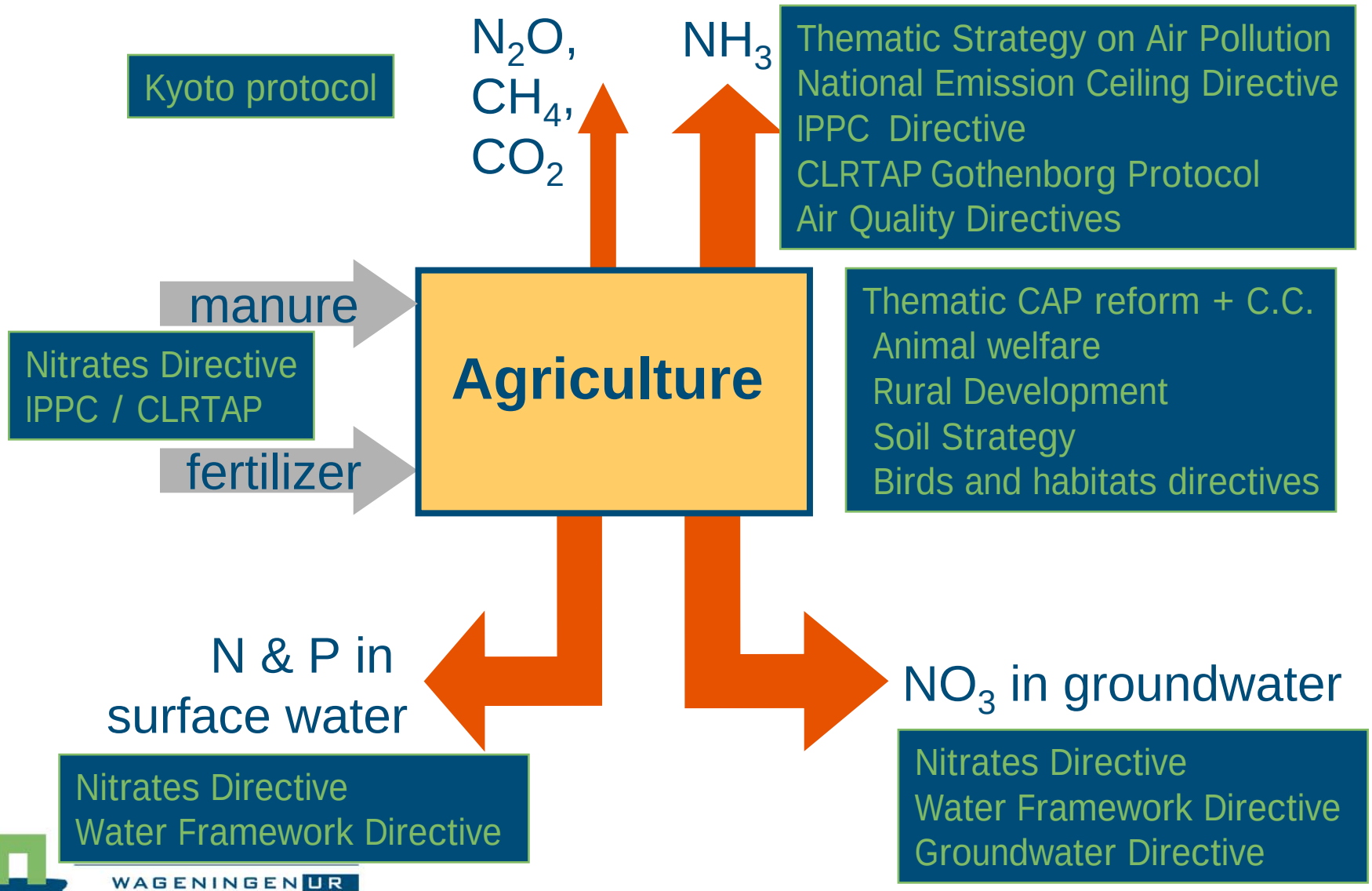
EU: environmental legislation



MITERRA EUROPE

- A tool for integrated assessment of N emissions from agriculture at regional, country, and EU 27 levels
- Emissions
  - Gaseous: NH_3, N_2O, NOx, and CH_4
  - Leaching of N to groundwater and surface water
  - Nitrogen and phosphorus surpluses
- Based on existing data bases and models (CAPRI and RAINS), supplemented with a new leaching module
- Packages of measures to mitigate NH_3 and NO_3 emissions
- Developed for the European Commission (DG Environment)
  http://ec.europa.eu/environment/air/cafe/activities/ammonia_en

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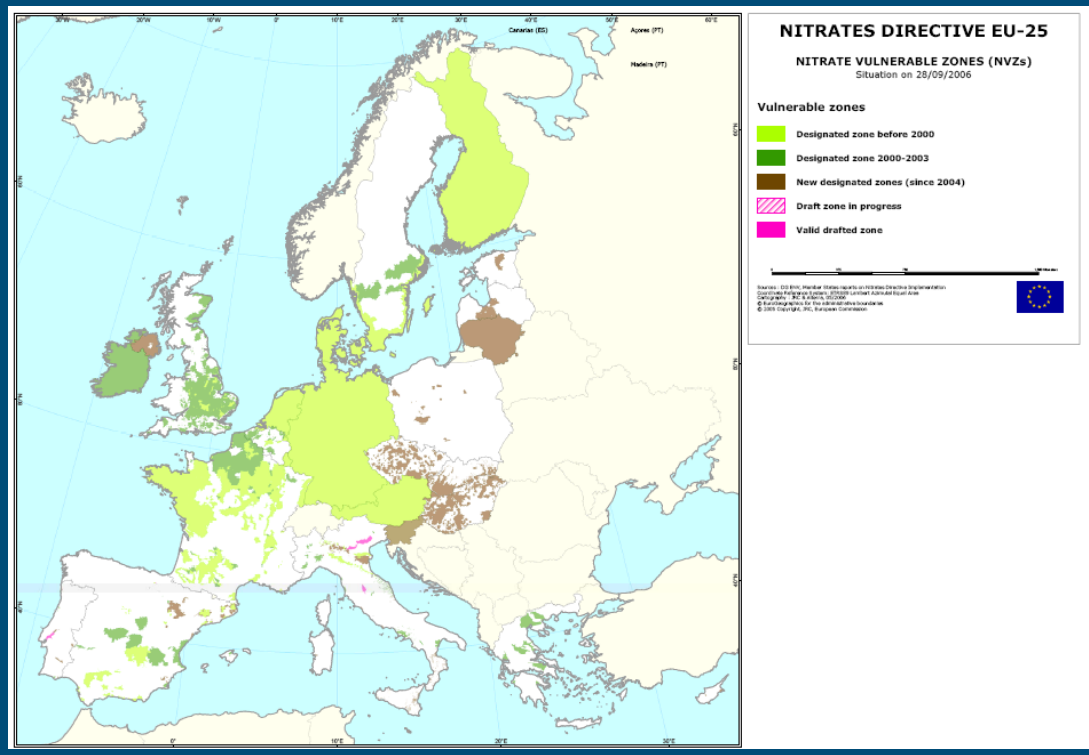
Scale of calculation with MITERRA EUROPE

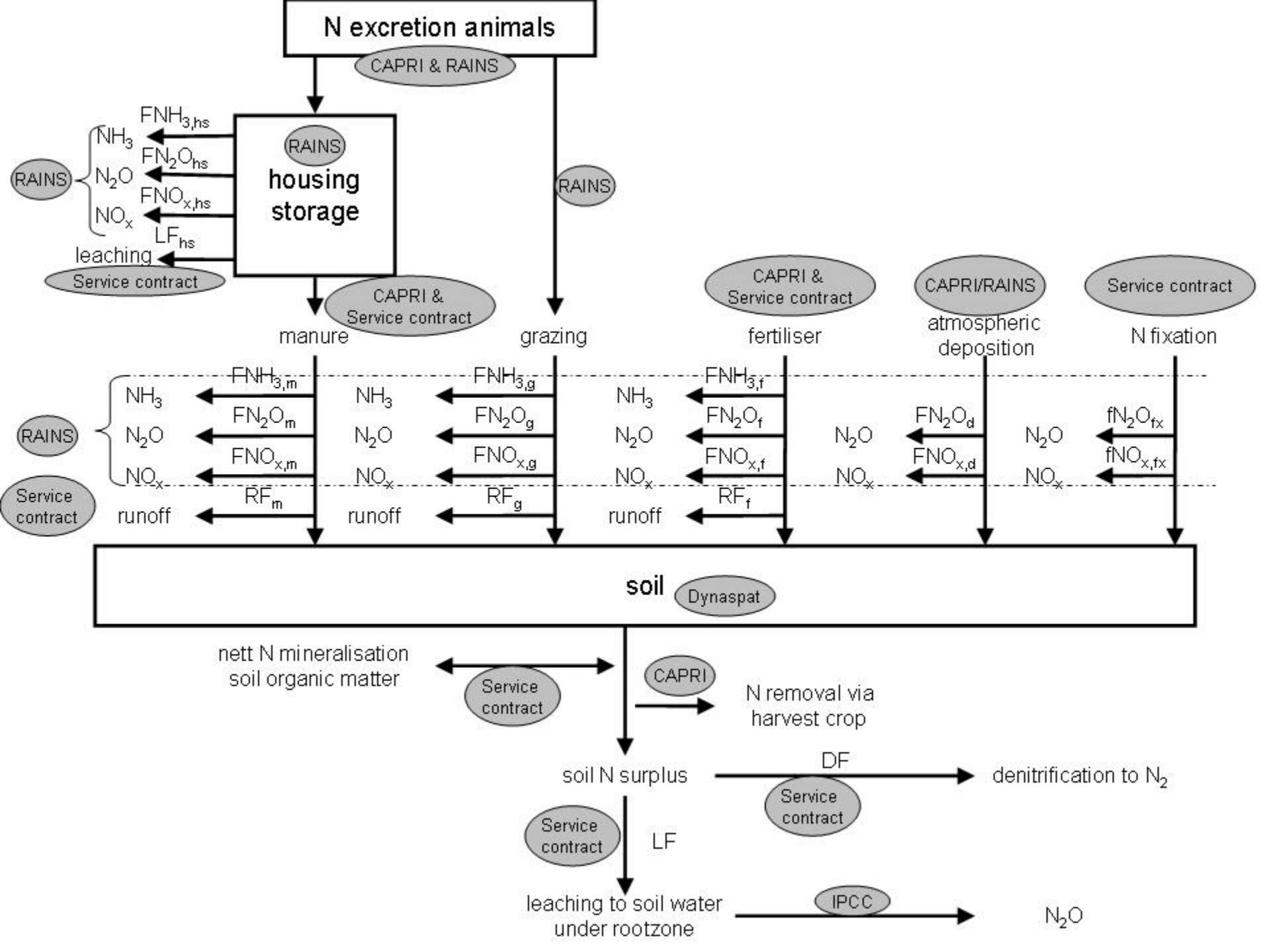
- Spatial:
  - 27 member countries
    - Regions: Nuts 2 level
    - Nitrate Vulnerable Zones
      - Current
      - Predicted for 2020
    - Country level
- Temporal
  - yearly



Input and methods of calculation

- Input data (area, crops, yields, animal number, excretion, soil data, etc.):
  - RAINS, CAPRI ,FAO, Eurostat, JRC + literature

- Methods of calculation:
  - Fertilizer and manure distribution: MITERRA
  - N and P surplus: MITERRA
  - Emission of NH_3 and NOx: RAINS
  - Emission of CH_4 and N_2O: GAINS/IPCC
  - Leaching: MITERRA


N excretion animals
CAPRI & RAINS
RAINS
housing storage
RAINS
RAINS
$FNH_{3,hs}$
NH_3
FN_2O_{hs}
N_2O
$FNO_{x,hs}$
NO_x
LF_{hs}
leaching
Service contract
CAPRI & Service contract
manure
grazing
CAPRI & Service contract
fertiliser
CAPRI/RAINS
atmospheric deposition
Service contract
N fixation
RAINS
Service contract
$FNH_{3,m}$
FN_2O_m
$FNO_{x,m}$
RF_m
runoff
$FNH_{3,g}$
FN_2O_g
$FNO_{x,g}$
RF_g
runoff
$FNH_{3,f}$
FN_2O_f
$FNO_{x,f}$
RF_f
runoff
FN_2O_d
$FNO_{x,d}$
fN_2O_{fx}
$fNO_{x,fx}$
NH_3
N_2O
NO_x
soil
Dynaspat
nett N mineralisation soil organic matter
Service contract
CAPRI
N removal via harvest crop
soil N surplus
DF
Service contract
denitrification to N_2
Service contract
LF
leaching to soil water under rootzone
IPCC
N_2O

Ammonia measures (from RAINS)

- Low Nitrogen Fodder (dietary changes)
- Stable Adaptation by improved design/construction of floor
- Covered Manure Storage
- Biofiltration (air purification)
- Low Ammonia Application of Manure
- Substitution of urea with ammonium nitrate
- Incineration of poultry manure

- Parametrization + implementation: RAINS

Selected nitrate measures from Nitrate Directive

- balanced N fertilizer application
- maximum manure N application rate
- no N application in winter and in wet periods
- limitation to N application on slopes
- manure storage with low risk of runoff and seepage
- appropriate N application techniques
- winter crops
- bufferstrips near water courses

- Parametrization + implementation: MITERRA

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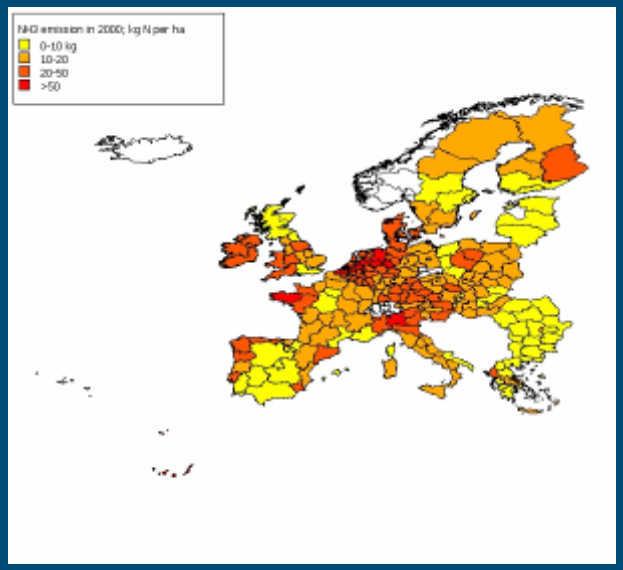
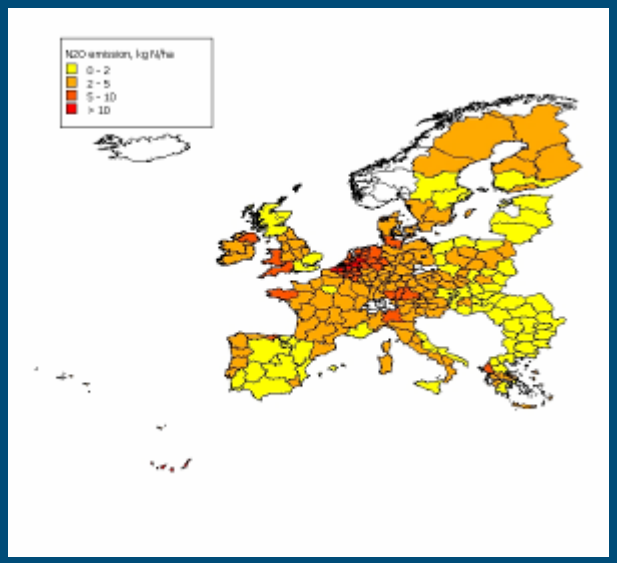
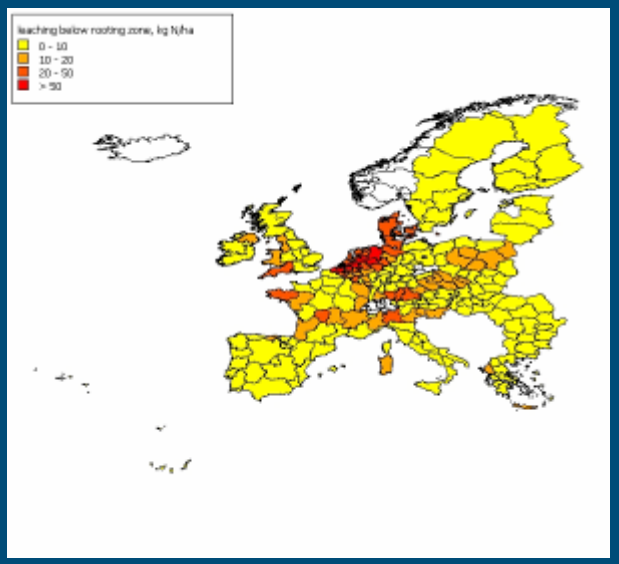
Large differences in EU 27



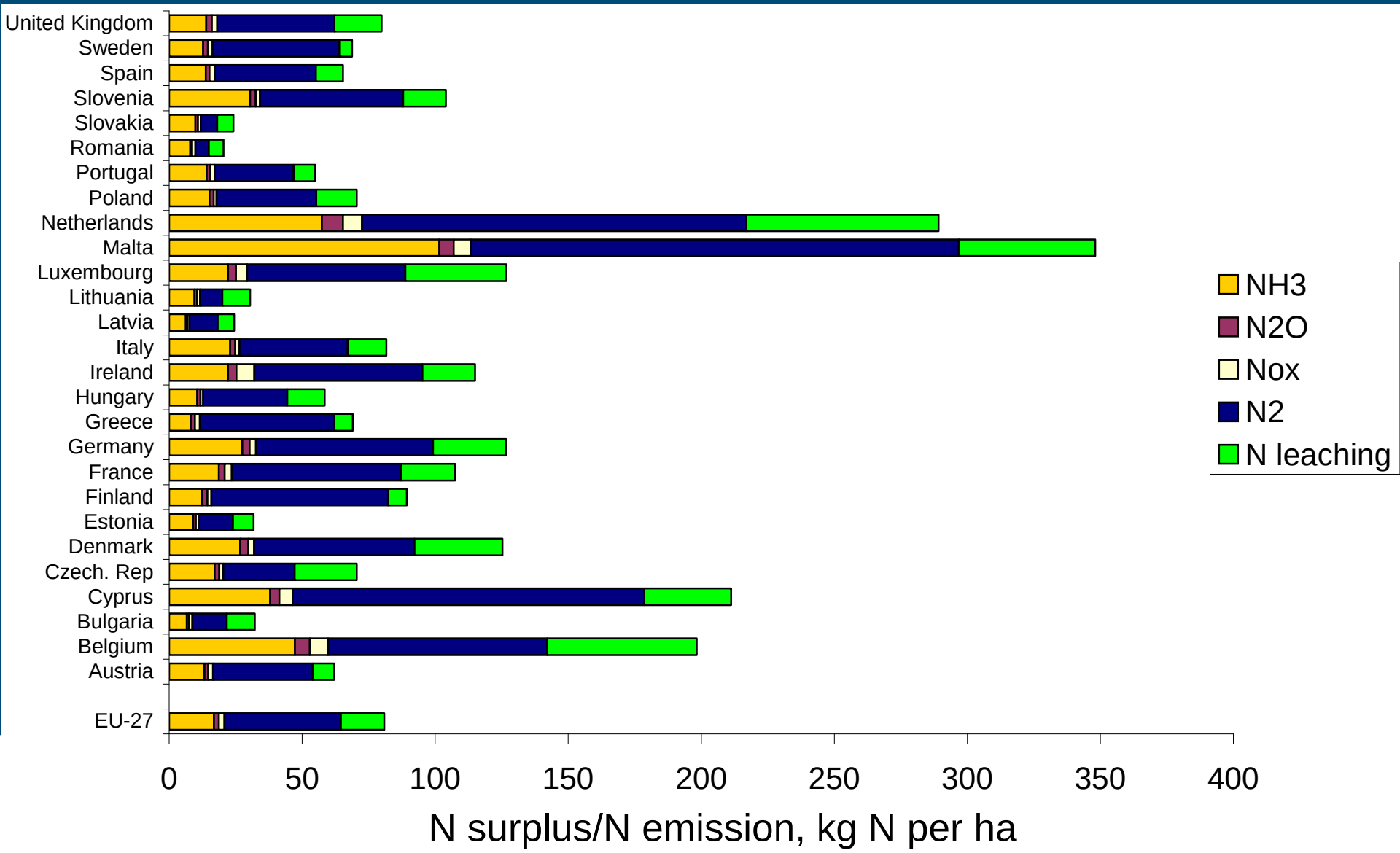




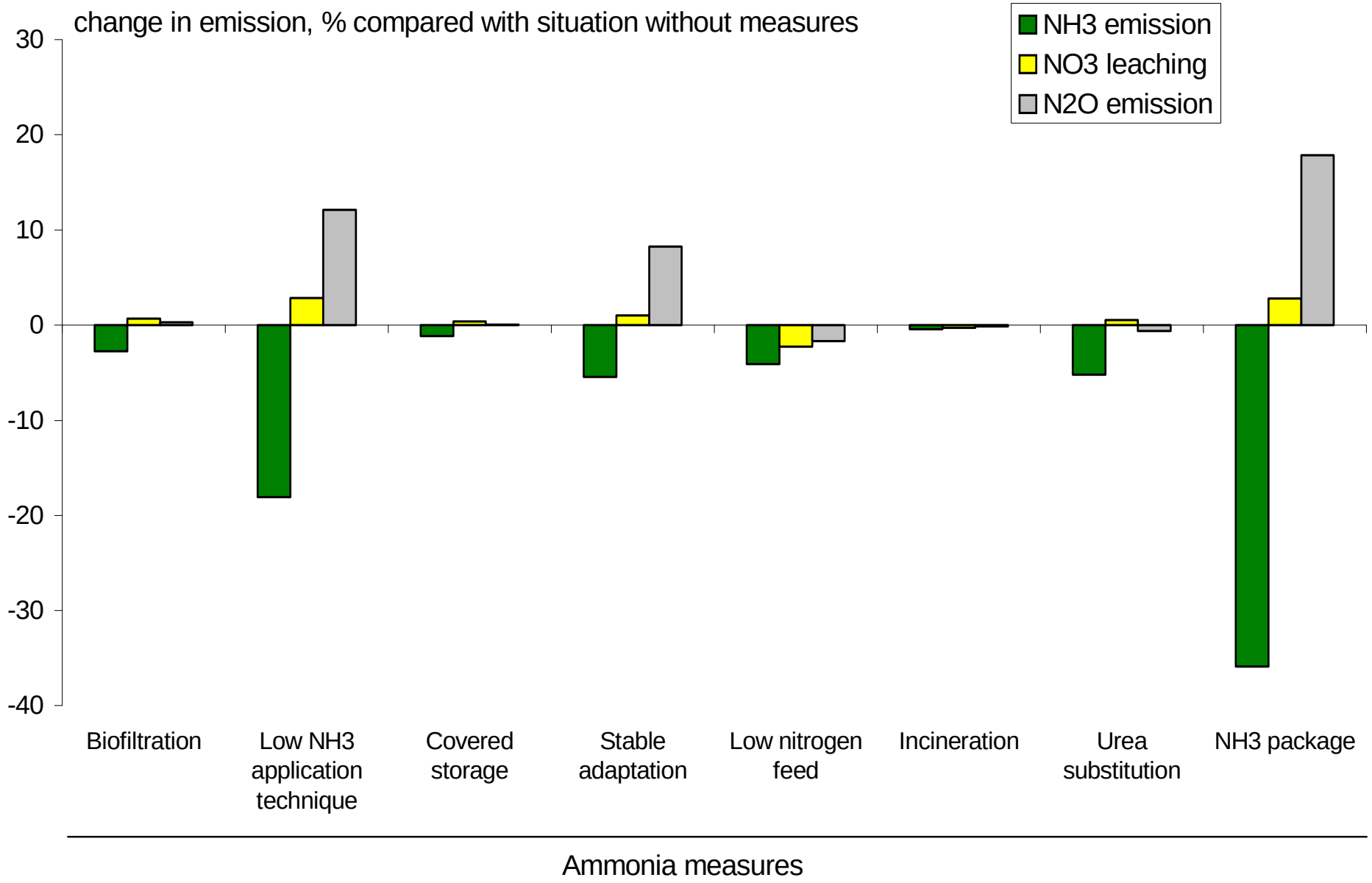
Q K$_6$ hp lvvlrq Q $_5$R hp lvvlrq Q dmdfklqj

lq nj Q kd djulfxowxudo odqg

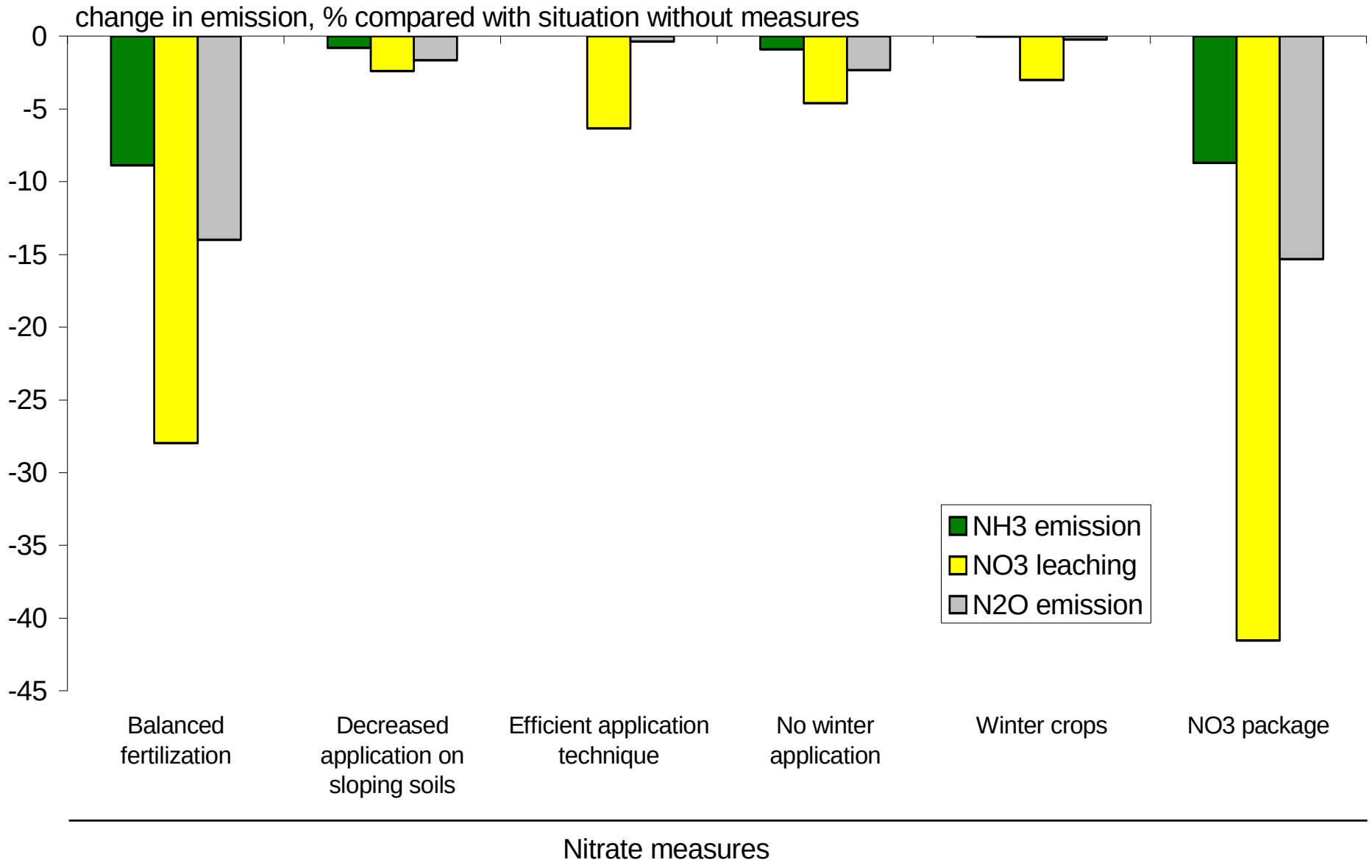
N surplus and emissions in kg N/ha agricultural land



Potential effects of NH_3 mitigation measures in EU 27

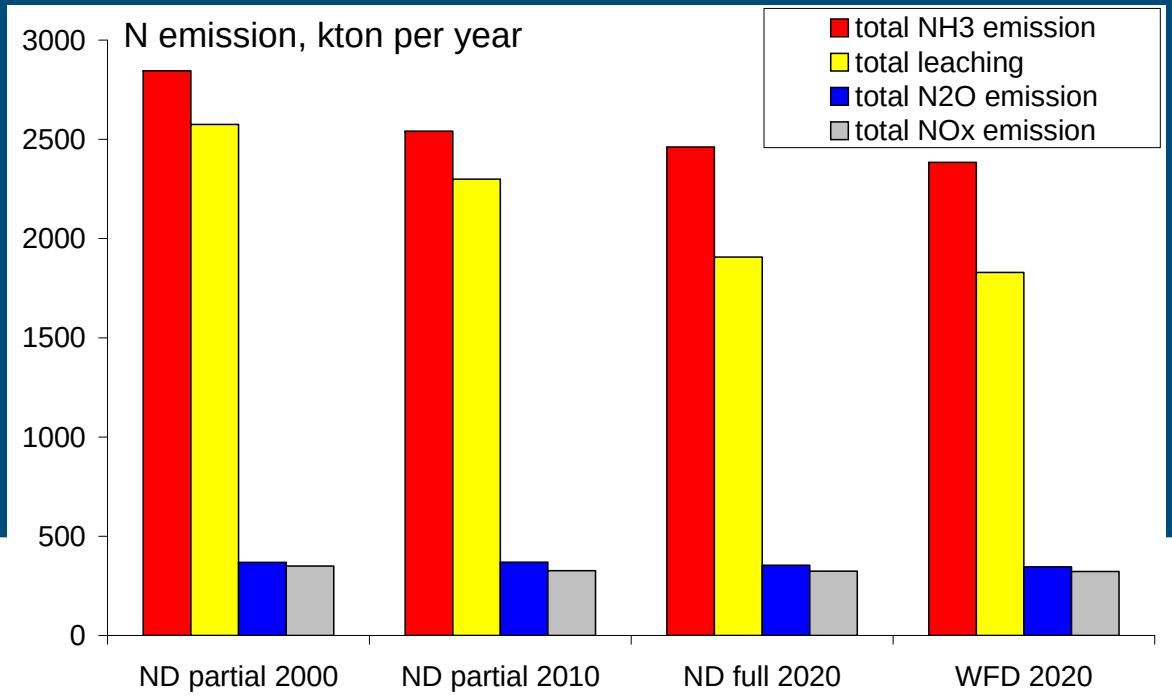


Potential effects of NO_3 mitgation measures in EU 27



Policy scenarios

- 4 scenarios RAINS
- 4 scenarios Nitrates Directive/Water Framework Directive
- 7 scenarios most promising measures
- 7 scenarios Integrated Prevention and Pollution Control Directive (IPPC)



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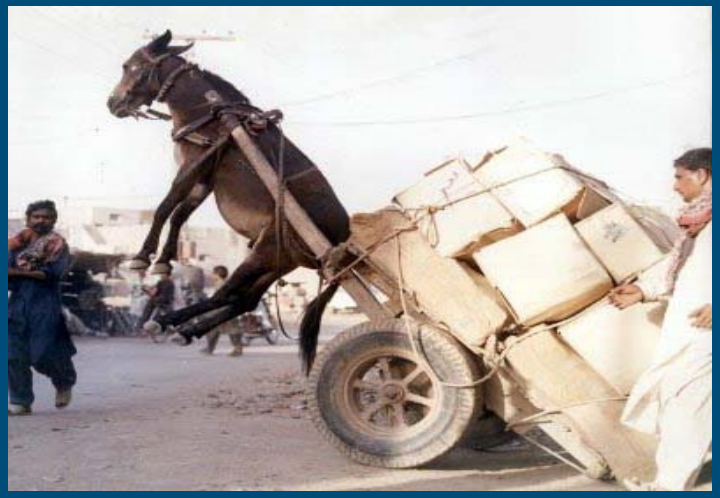
“Validation”

- NH_3 emissions: RAINS
- GHG emissions: UNFCCC
- NO_3 leaching: EEA/European Commission
- N and P balances: OECD



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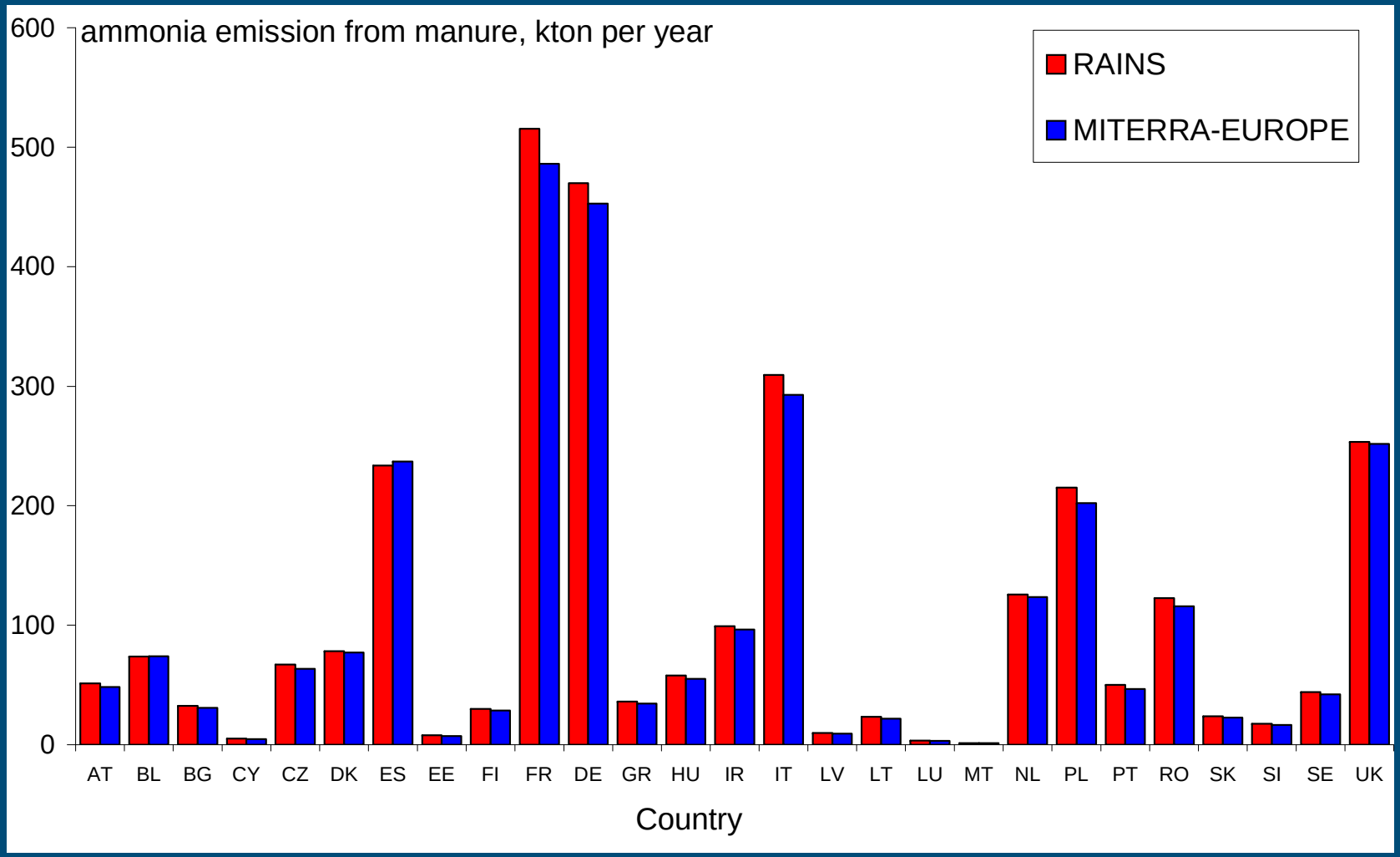

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“Validation”

Table xxx. Distribution of nitrate concentration in wells in groundwater bodies in European countries in 2002* (SOURCE EEA**) and the average calculated nitrate concentration with MITERRA-EUROPE in 2000.

	Percentage of wells				average NO3 concentration MITERRA-EUROPE, mg NO3/l
	<10	10-25	25-50	>50	
	mg NO3/l				
Austria	35	27	22	16	7
Belgium	0	0	100	0	56
Bulgaria	43	25	18	14	24
Czech Republic	65	19	6	10	53
Denmark	49	17	13	21	50
Estonia	81	18	1	1	10
Finland	100	0	0	0	10
France	22	25	48	4	22
Germany	40	40	20	0	38
Greece	52	23	14	11	13
Ireland	73	23	5	0	14
Italy	56	12	13	19	18
Latvia	100	0	0	0	8
Lithuania	99	1	0	0	14
Malta	0	0	33	67	162
Netherlands	69	7	7	17	78
Poland	74	13	5	8	36
Portugal	47	19	16	18	7
Slovakia	66	13	13	8	12
Slovenia	24	31	29	17	11
Spain	4	16	38	42	26
Sweden	100	0	0	0	6
United Kingdom	37	22	28	12	17

* for all countries results are from 2002, except for France (2000), Greece (1998), and Spain (1999).
** http://dataservice.eea.europa.eu/atlas/viewdata/viewpub.asp?id=1364

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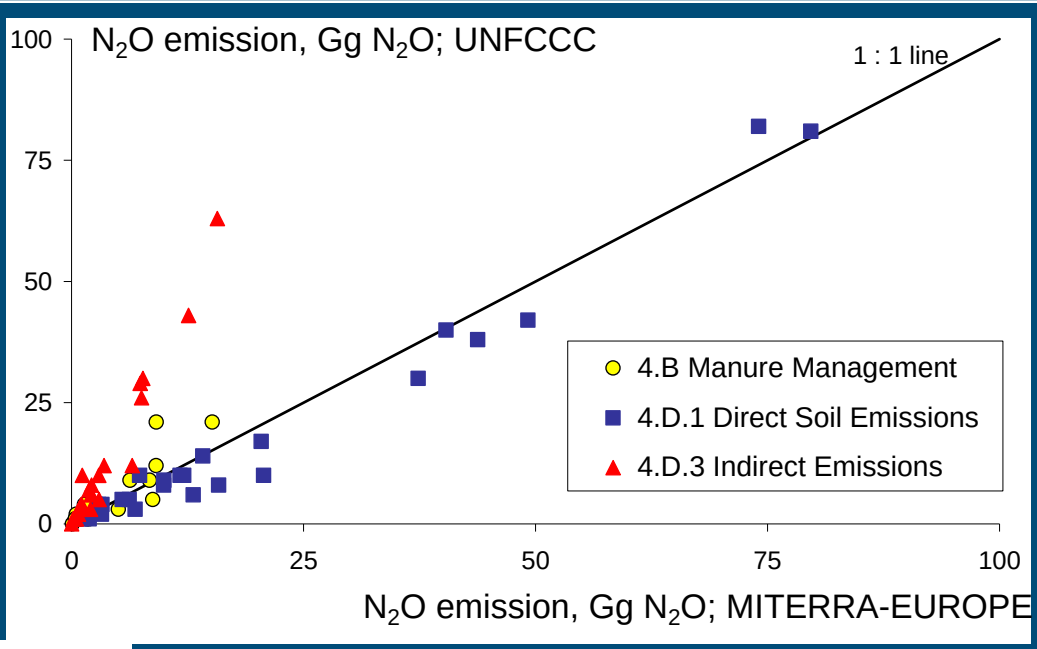

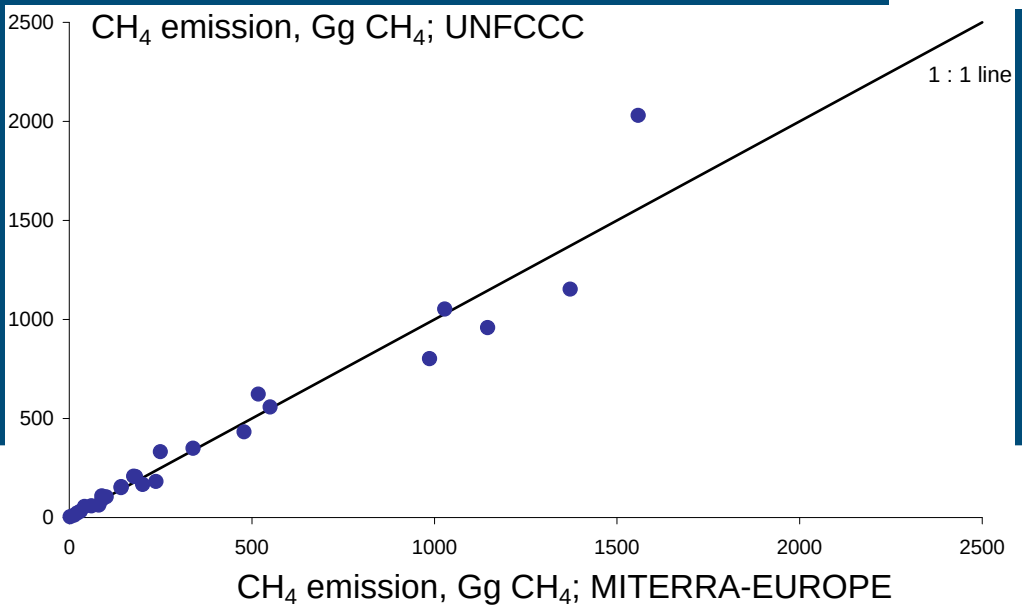

Source: http://unfccc.int

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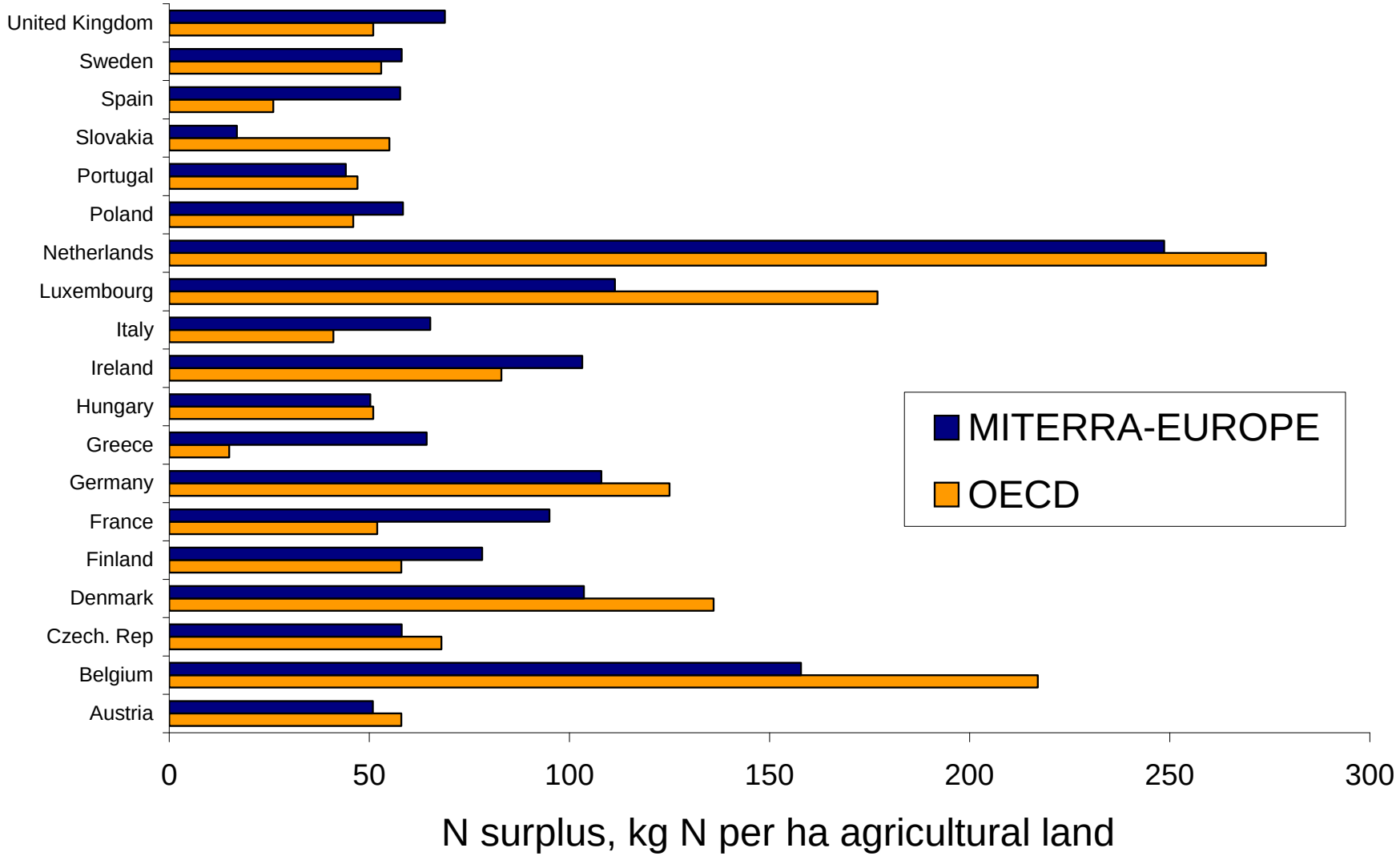

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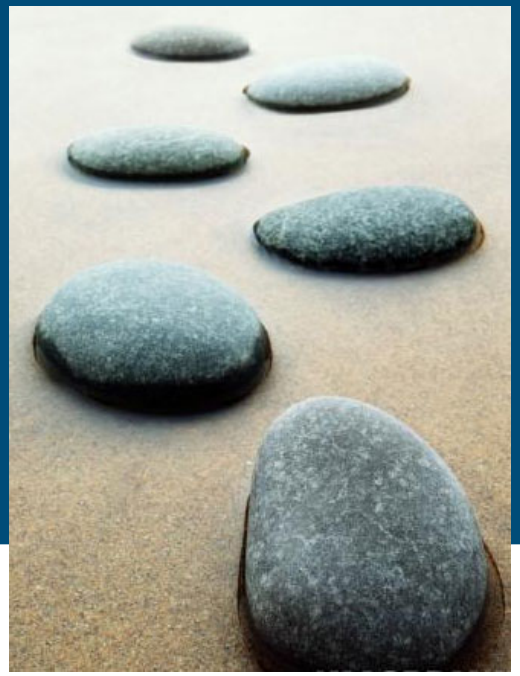
Source: http://www.oecd.org

Developments I

- MITERRA EUROPE extended with:
  - Soil carbon balances (CCAT and PICCMAT projects)
  - Measures to reduce GHG emisssions (CCAT and PICCMAT)
  - Heavy metal balances (CCAT)
  - N C interactions (R&D Wageningen UR)



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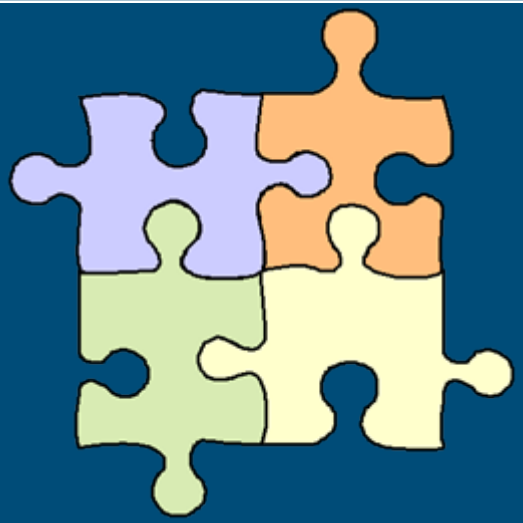
Developments II



- (Parts of) MITERRA incorporated in
  - RAINS
  - CAPRI
  - CCAT tool (Cross Compliance Assessment Tool): http://www.ccat.nl/UK/
  - Eururalis → land use: http://www.eururalis.eu/index.htm
  - INTEGRATOR prototype (Nitroeurope): http://www.nitroeurope.eu/

Developments III

- Water Frame Work Directive
  - Risk indicator for P leaching
  - River basin district approach

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Conclusions: MITERRA EUROPE

- Helpful tool for integral assessment of effect of policies
  - N and GHG emissions, N and P surplus
- Integrated N policy most effective to achieve environmental targets
  - combination of reducing N input and technical measures
- Large spatial differences in emissions in EU
  - country or region specific measures
- Link with other models/tools
  - RAINS, CAPRI, CCAT, Eururalis, INTEGRATOR
- Developments
  - Soil C
  - Measure to mitigate GHG
  - Indicator for risk on P leaching?

Thank you!

Oenema, O, D Oudendag & GLVelthof (2007) Nutrient losses from manure management in the European Union. Livestock Science 112, 261 272

http://www.scammonia.wur.nl/UK

http://ec.europa.eu/environment/air/cafe/activities/ammonia_en

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