



Nitrogen Balances for EU27 at NUTS II level

combing the farm gate
and soil surface approach

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Outlay

- Background
- Comparison of Farm-Gate and Soil-Surface Balances
- Data sources and data gaps in the calculation of regional balances
- Methodology and assumptions
- Main results
- Outlook



Background and Aims

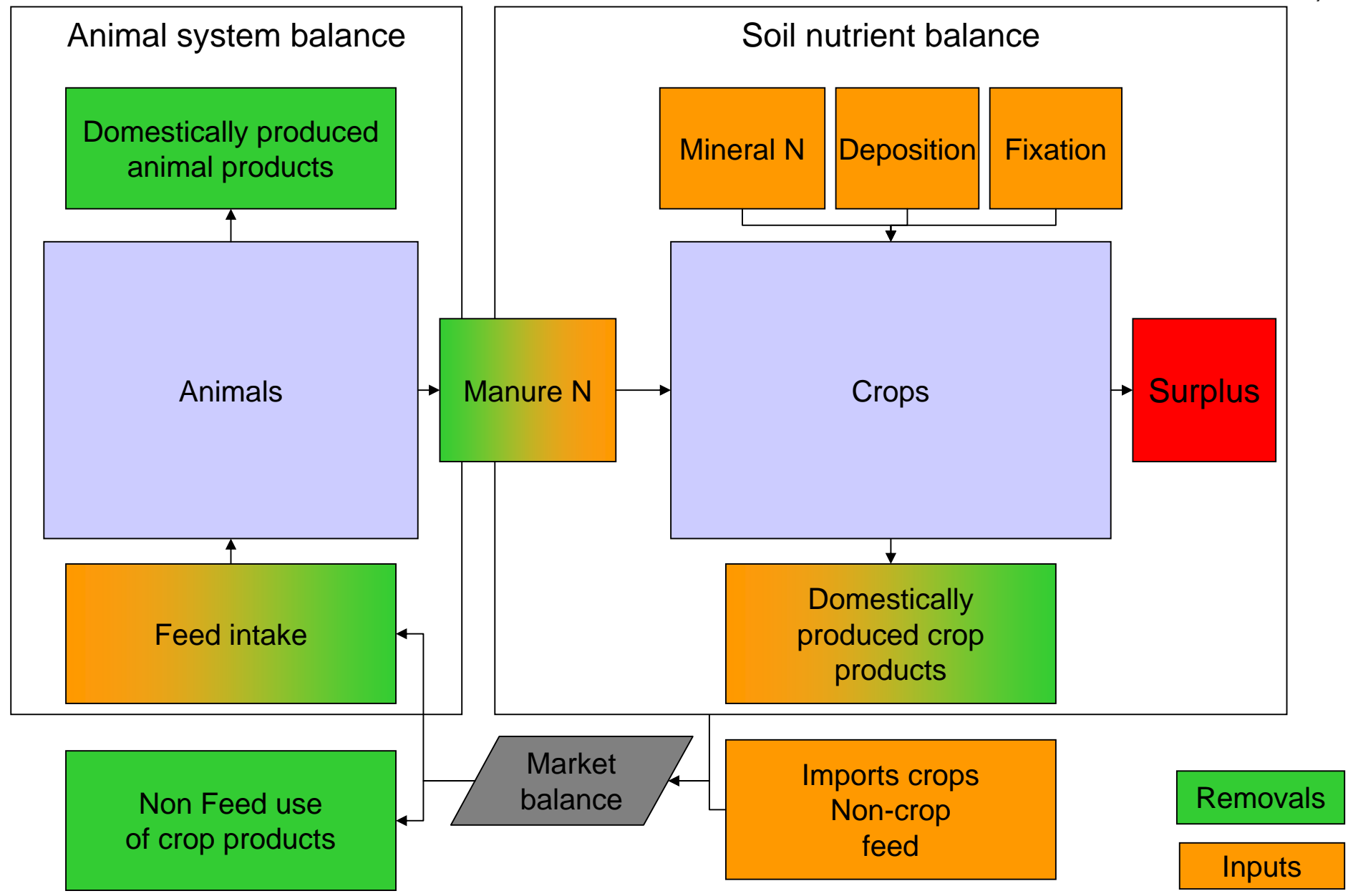
- Integration of environmental indicators (nutrient balances, output of GHG and NH₃, High Nature Value farmland characterisation, energy life cycle assessment of agricultural production activities, water abstraction ...) in large-scale Pan-European economic modelling system (CAPRI) to allow for combined economic/environmental policy impact analysis
- Provision of time series (in most cases since 1985) of those indicators, and possibility to link them to projection and ex-ante scenario results
- Based on harmonized data bases at European level
- Consistent up-and-down scaling from Member State to NUTSII to 1x1 km grid cells
- Combined activity of different teams, financed by different projects, ongoing since 1997



Comparison of data needs and surplus calculation of Farm-Gate and Soil-Surface Balances

	Farm Gate National	Farm Gate Regional
Surplus	<p style="text-align: center;">imports (mineral fertilizer, feed bought, atmospheric deposition, bio. fixation) – exports (crop and animal products sold)</p>	

? Needed to define consistent excretions factors





What are challenges at regional level?

- Major input data not available:
 - Mineral fertilizer use (needed for both approaches)
 - Feed import (needed for farm gate balance)
 - Fodder production (needed for soil-surface approach)
 - Typical approach to close data gaps:
(e.g. OECD Handbook on "Soil Surface Nitrogen Balances")
 - Estimate regional mineral fertilizer use based on crop specific application rates, and statistical data on crop areas
 - Estimate regional use of *tradable* feed from industry data of concentrate use per animal type, and statistical data on herd sizes, correct where applicable crop production accordingly to derive at net trade of crop products
 - Estimate regional fodder production as the difference between use of tradable feed and feed requirement recommendations
- => Allows for consistency to national farm gate balance, if regional estimates are lined up with given national data (mineral fertilizers, use of tradable feed)



Data sources used in current study

- Use of tradable feedstuffs at Member State level from ZPA1 market balances, feed and trade statistics
 - Regional yields, herd sizes and crop areas from REGIO (NUTS II, FSS not used as not available as time series)
 - Expert based yields for grass land at Member State level (replace data from ZPA1, taken from recent study for DG-ENV)
 - Total fertilizer use per Member State and mineral fertilizer application for major crops per Member State, both provided by EFMA
 - Engineering information, e.g. extension data from DEFRA
- => Basically standard data set assumed to be available by OECD handbook on gross nitrogen balances



Providing the missing input data at regional level

- Regional fodder yields are estimated from herd sizes of ruminants in relation to fodder area
 - Regional and national energy needs from ruminants not covered by concentrates per ha of fodder area are used to estimate regional from national fodder yields
- Nutrient excretion factors per animal type are estimated as the difference between protein input from feed and protein removals with final and intermediate animal products
 - based on distribution of all feed stuffs (tradable, where quantities are known at national level, and regional produced as estimated above) to the regional herds
 - which takes animal requirements (energy, protein, dry matter, lysine, fibre..), typical feeding practise and feed costs into account
 - part of CAPRI data base, generated with statistical estimator
- Improvements compared to the OECD handbook on "Soil Surface Nitrogen Balances"



Estimation of regional surplus

– methodology and further assumptions

Application of Bayesian based statistical estimator
(Highest Posterior Density Estimator):

- Find most probable regional inorganic crop application rates and thus regional mineral fertilizer use
- Under the following constraints:
 - Regional N excreted must be distributed to the crops in the same NUTS II region
↔ no inter-regional trade in nutrients
 - Total inorganic N at national level must be exhausted by the regional and crop specific application rates times given regional crop areas
 - Total N deliveries for group of crops (inorganic, organic, fixation, atmospheric deposition) must exceed N removals from those crops, accounting for estimates of gaseous and run-off losses
 - Certain minimum percentages of crop needs are covered by mineral nitrogen
 - Certain crop residues are taken into account as nitrogen removals and deliveries to account for nutrient exchange between arable crops
- Gas loss and run-off estimation from MITERRA/RAINS are taken into account



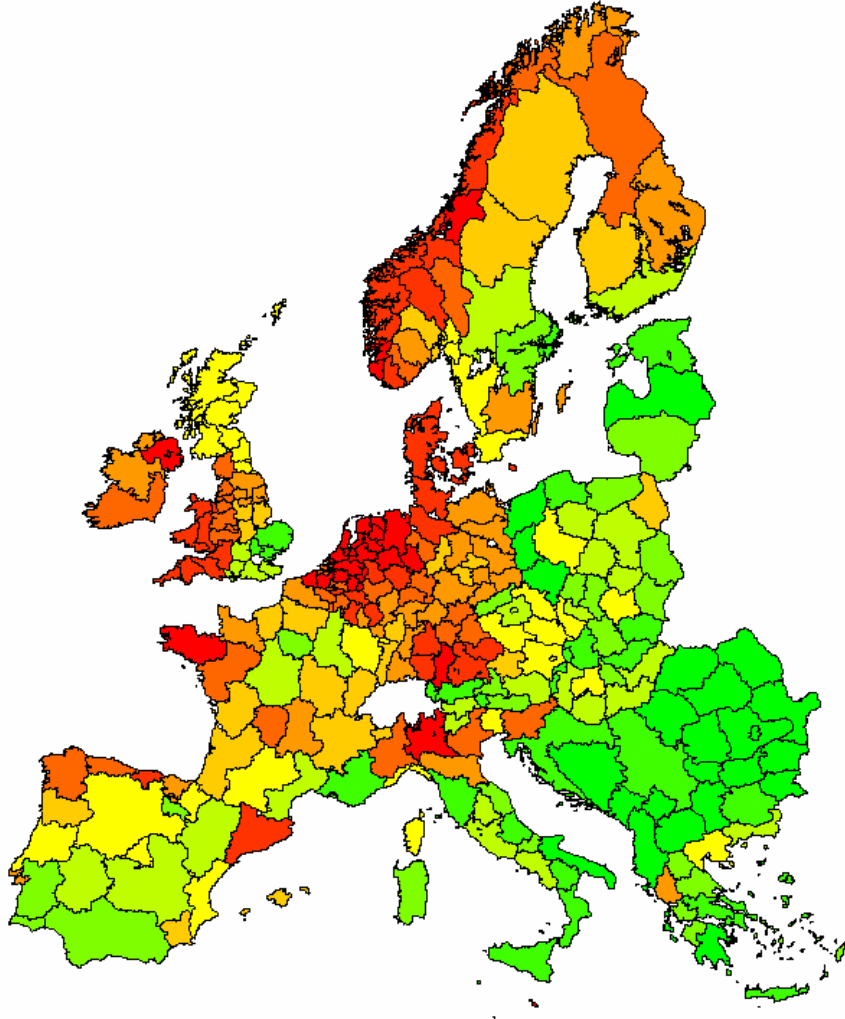
Estimation of regional surplus

– methodology and further assumptions (cntd.)

- Most probable solution (joint posterior density to maximize) takes into account:
 - Deviation of average national inorganic crop specific application rates for N,P,K from EFMA questionnaire data
(but regional application rates are allowed to vary as a function of yields [nutrient removal per ha], manure availability, atmospheric deposition and soil/climatic conditions)
 - Deviation of organic N share for group of crops on total N uptake of the crops from assumed typical shares
 - Deviations from assumed loss rate for nitrogen in manure and crop residues
 - Deviations between regional and national crop specific mineral rates per kg removed nitrogen
 - Maximum bounds of manure application rates



Gross surplus at NUTS II level



Data are based on three-year average 2001-2003, total surplus is set in relation to Utilizable Agricultural Area





Summary

- Time series of regional nitrogen balances are derived for NUTS II regions based on readily available statistical information
 - Combining farm-gate and soil-surplus approach
 - Leading to harmonized methodology applied to EU 27, Norway, and Western Balkans
 - Comprising already estimates of gas losses
 - Application of statistical estimators allows integration of additional information as engineering knowledge or results from farm questionnaires and guarantees closed balances
 - Methodology is also applied ex-ante in CAPRI for DG-AGRI baseline and counterfactual scenarios
- Main data gaps, currently closed by estimates or assumptions:
 - National/regional grass land and fodder yields
 - Regional inorganic application rates
 - Manure application rates
 - International/regional trade in manure and fodder

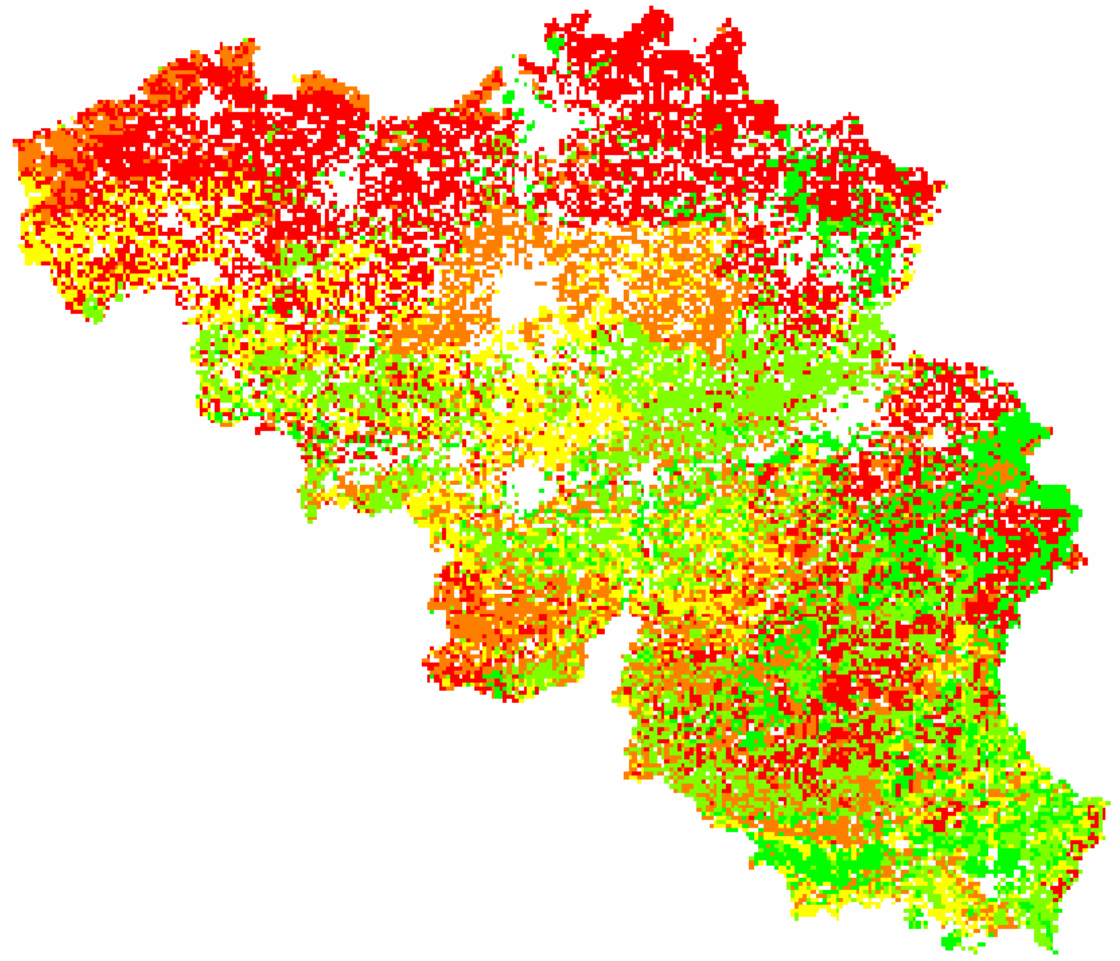


Further work

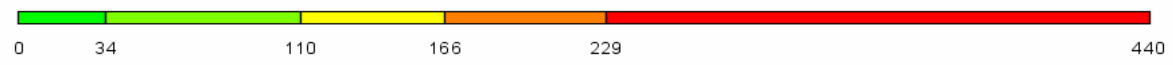
- Continued quality check, by comparing balance elements
- Estimation of a statistical meta-model from bio-physical models (DNDC, EPIC)
 - From surplus to nutrient fate (NH₃ losses, leaching, further gas losses, changes in soil content)
 - Taking into account changes in Nitrogen content in agricultural soils
- Calculation of balances at 1x1 km grid for EU15, based on already generated data at grid level (cropping shares, yields, animal stocking densities; equally included: economic performance indicators including CAP Pillar I subsidies)



Gross nutrient balance for Belgium and Luxembourg at 1x1 km grid



Data are based on three-year average 2001-2003, total surplus is set in relation to Utilizable Agricultural Area





Thanks for your attention

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