TALLINN UNIVERSITY OF TECHNOLOGY

Interreg Estonia-Latvia
European Regional Development Fund

EUROPEAN UNION

Introduction to Model of harmonized assessment of reactive nitrogen (Nr) and its flows, pools and transformation

Arvo Iital

Methodology – guidance documents

- **Eurostat, 2013. Nutrient Budgets – Methodology and Handbook.**
  Methodology for estimating the agricultural gross nitrogen surplus.
- **UN, 2013. Guidance document on national nitrogen budgets.**
  For estimating emissions of NOx and NH_3 from anthropogenic and natural sources.
- **EPNB, 2016. Detailed annexes "Guidance document on national nitrogen budgets"**
- **EMEP/EEA air pollutant emission inventory guidebook 2016.**
  Emissions of NOx and NH_3 from Energy, Industrial processes, Product use, Agriculture, Waste, Natural sources and others
- **IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories** (http://www.ipcc-nggip.iges.or.jp/public/2006gl/)
  Guidance on the quantification of anthropogenic N_2O and nitrogen trifluoride (NF_3) emissions.

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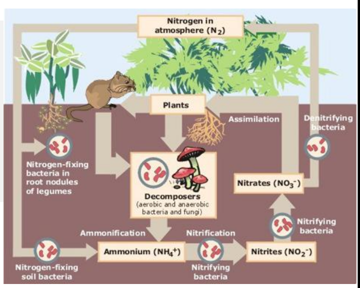
Overall aim: quantifying the N cycle (natural)

Five main processes:

1. biological fixation
2. uptake by plants
3. mineralization
4. nitrification
5. denitrification



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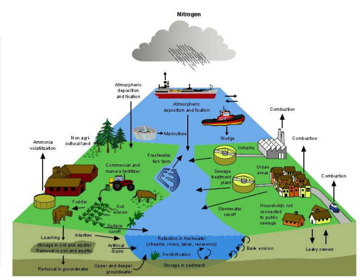
Human interventions in the N cycle

1. Agriculture and N fertilizers
2. Industries
3. Transport
4. Energy production
5. Waste production
6. Waste water
7. Aquaculture, incl. fisheries
8. Human settlements



Different N compounds emitted to atmosphere, hydrosphere, pedosphere

Why needed?

- To know more about the N sources and flows
- To provide suitable measures to decrease N load to surface water bodies and the sea
- To focus on sources that are more important
- Scientific interest – including minor flows that have not been assessed
- To inform public

Data sources?

- National statistics
- Research results – (incl. the outcome of earlier work done by the partners)
- Specific flow coefficients (both national and from other comparable regions – e.g Latvian coefficients applicable in Estonia and *vice versa*)
- N content in products (food and other)
- Expert opinion

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N budget

National and catchment scale

Only reactive nitrogen(Nr) – bio-available (via biochemical processes):

- ammonia (NH_3),
- nitrogen oxide (NOx),
- nitrous oxide (N_2O),
- nitrate (NO_3)
- organically bound N in plants, animals, humans and soil
- etc;

Inactive nitrogen (inert) - molecular nitrogen (N_2) and other fully unreactive forms (e.g., N in mineral oil, or in polymer fibers)

NB! N_2 from denitrification and combustion, N_2 input to transport sector – should be accounted

All N forms transformed into N_{total} – sum of N in all (reactive)forms

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N budget

- Quantification of **all major Nr flows**
- Across sectors and media (pools)
- **Within given boundaries** (Latvia, Estonia, selected catchments)
- And **flows across** these **boundaries** (imports/exports)
- **Changes of nitrogen stocks** within the respective sectors and media (perhaps not part of our work?)
- In a given time frame (**one calendar year**)
- All flows in **tons (or kT) of N/year**
- **A mixture of simple** (international data sources, coefficients) **and more comprehensive approach** (national/catchment data) - depending on the data availability

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N budget

The country total as well as each individual pool must comply with the equation:

$$\Sigma N_{inflow}+\Sigma N_{source}=\Sigma N_{outflow}+\Sigma N_{sink}+\Sigma N_{stockchange}$$

Inflow and ***outflow****:* to and from the system under study (catchment, state)
Source: from a pool

Ideally: left and right sides of the formula are equal

Not possible:
- imperfect and conflicting data
- unaccounted nitrogen flows
- errors
- expert opinion

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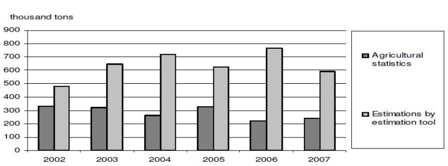
Catchment scale Nr budget

- The range of uncertainty of the data and quantified Nr budgets can be large
- Imperfect and conflicting data, expert opinion, etc.
- Applies also to downscaling of the national scale N flows data



Quantities in grazed biomass estimated by estimation tool (by using coefficients suggested by Eurostat's experts) and statistical data. (Economy wide material flow account, Estonia, 2010)

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Next steps

- **The meta-database have been compiled, incl. possible data sources**
- Need for **harmonization of data**, including calculation coefficients, data quality and handling of missing data

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Paldies!

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