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Towards an integrated approach for nitrogen in Europe

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Outline and main message

- CLRTAP was successful in integrating policies using an effect based approach reaching appreciable emission reductions and will now be expanded to do nitrogen leading to an integrated nitrogen approach

Outline

- A successful example of an integrated approach
- Why CLRTAP for Nitrogen in Europe
- A proposal for integrated nitrogen approach

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A successful example: Convention on Long Range Transport of Air Pollution

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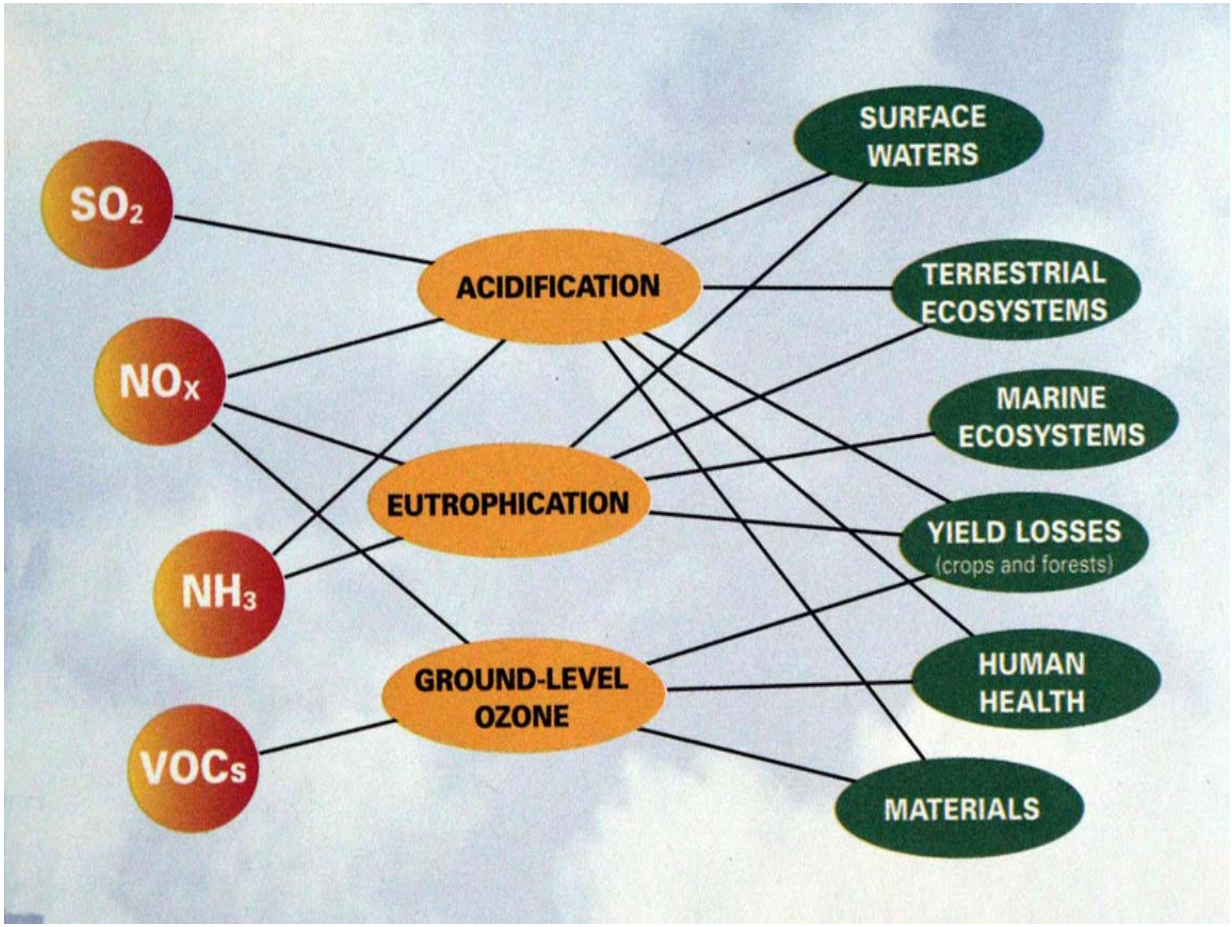
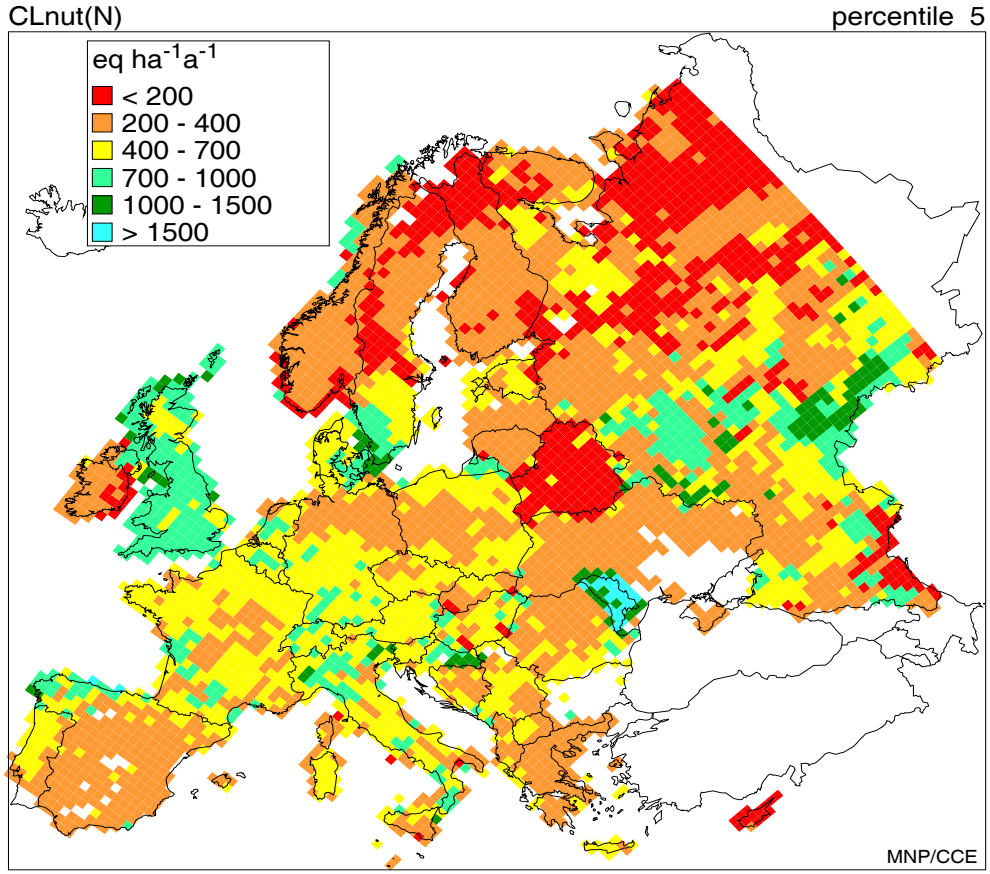
Convention on Long-range Transboundary Air Pollution (CLRTAP)

- Framework Convention (1979) and 8 specific Protocols
- Science and effects-based: >>1000 experts and scientists networked
- Scientific support from 3 core activities
  - atmospheric measurements and modelling
  - effects
  - integrated assessment

Multi-pollutant multi-effect approach



Effect based approach, based on ecosystem critical loads

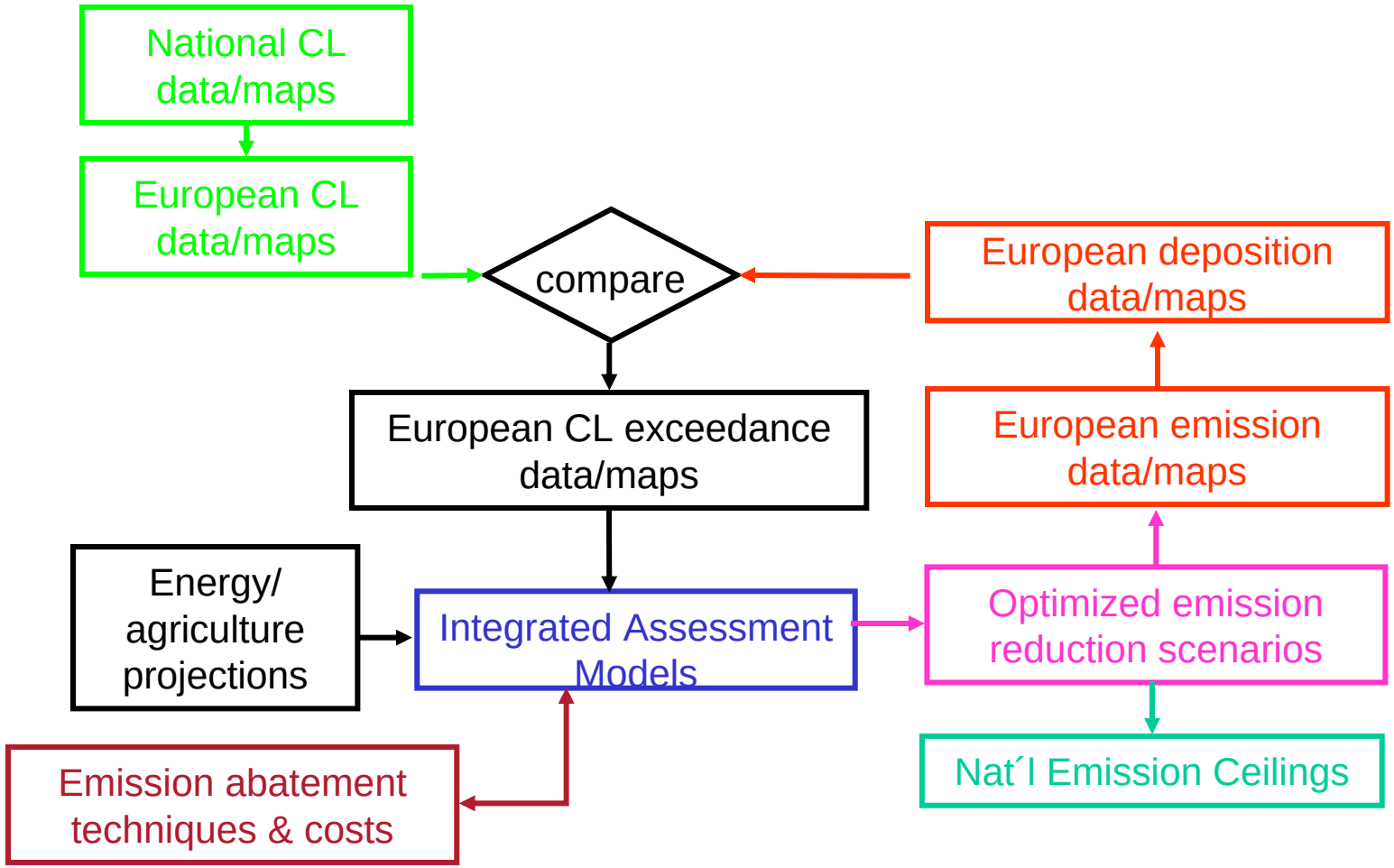


Critical load: “the highest deposition of (…) below which harmful effects in ecosystem structure and function do not occur according to present knowledge”

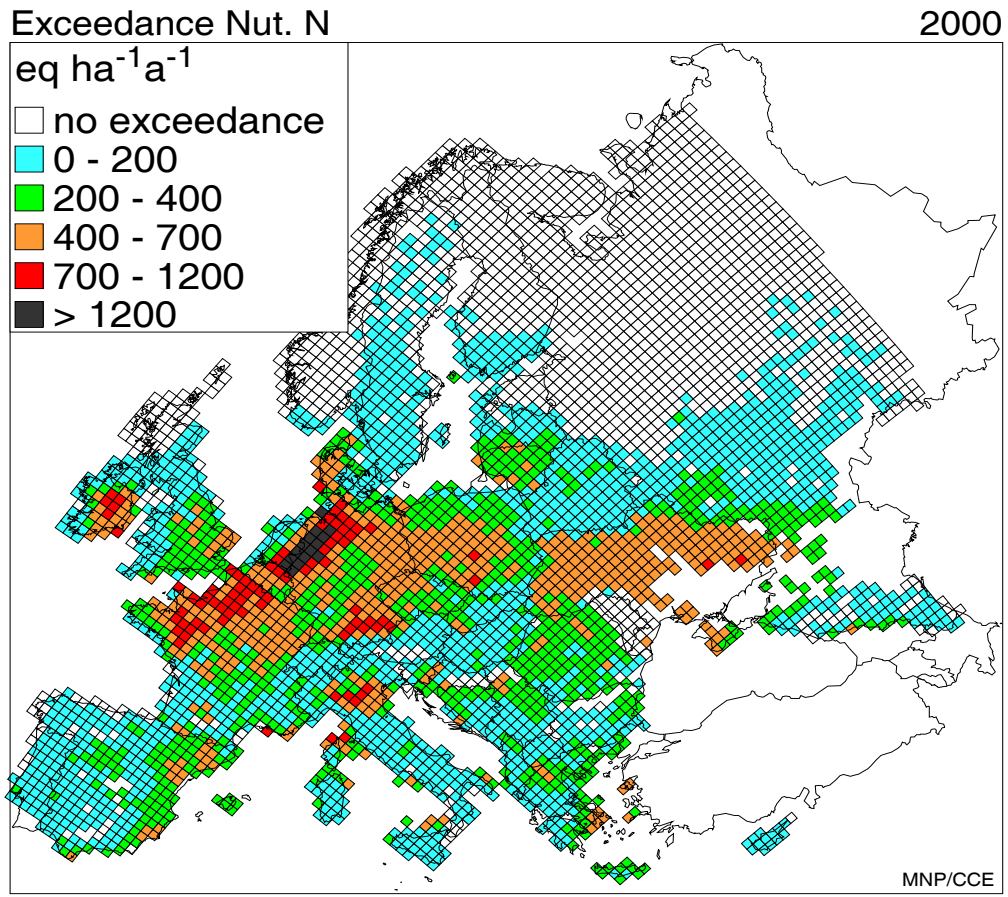
= long-term ecosystem capacity against eutrophication, acidification, heavy metal effects

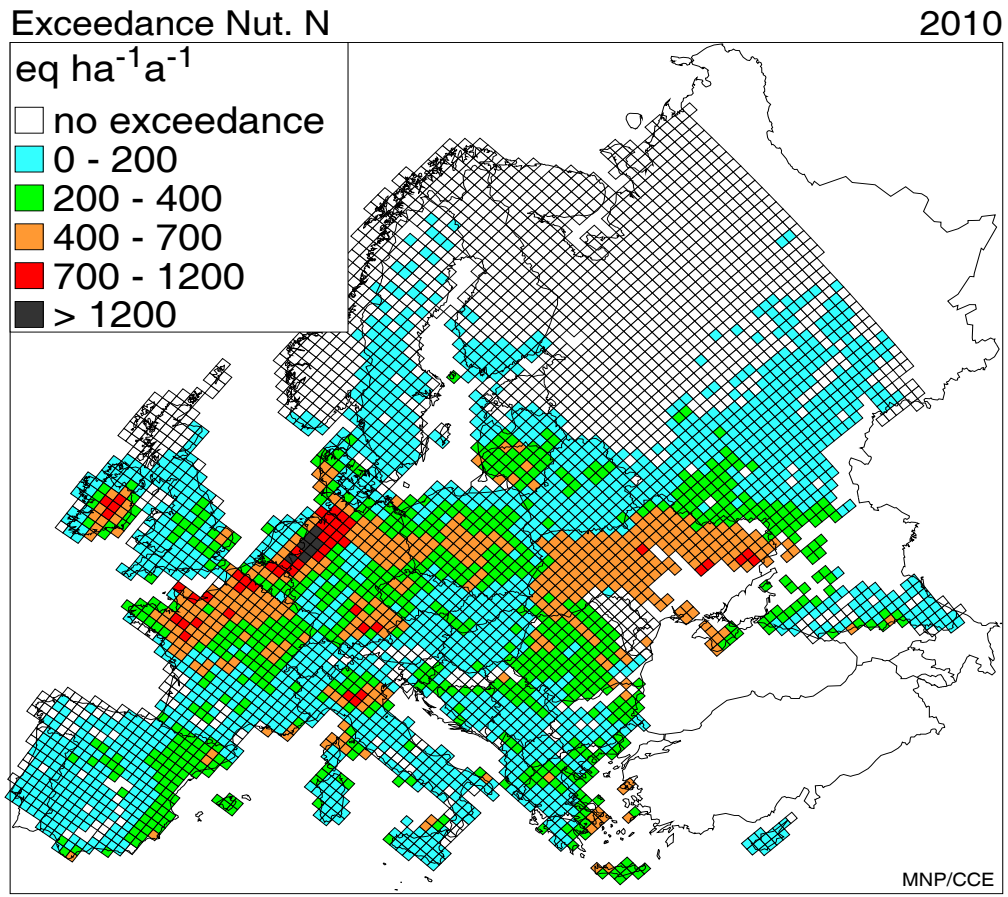
used as sustainability indicators for policy guidance

Use of CLs in Integrated assessment Models

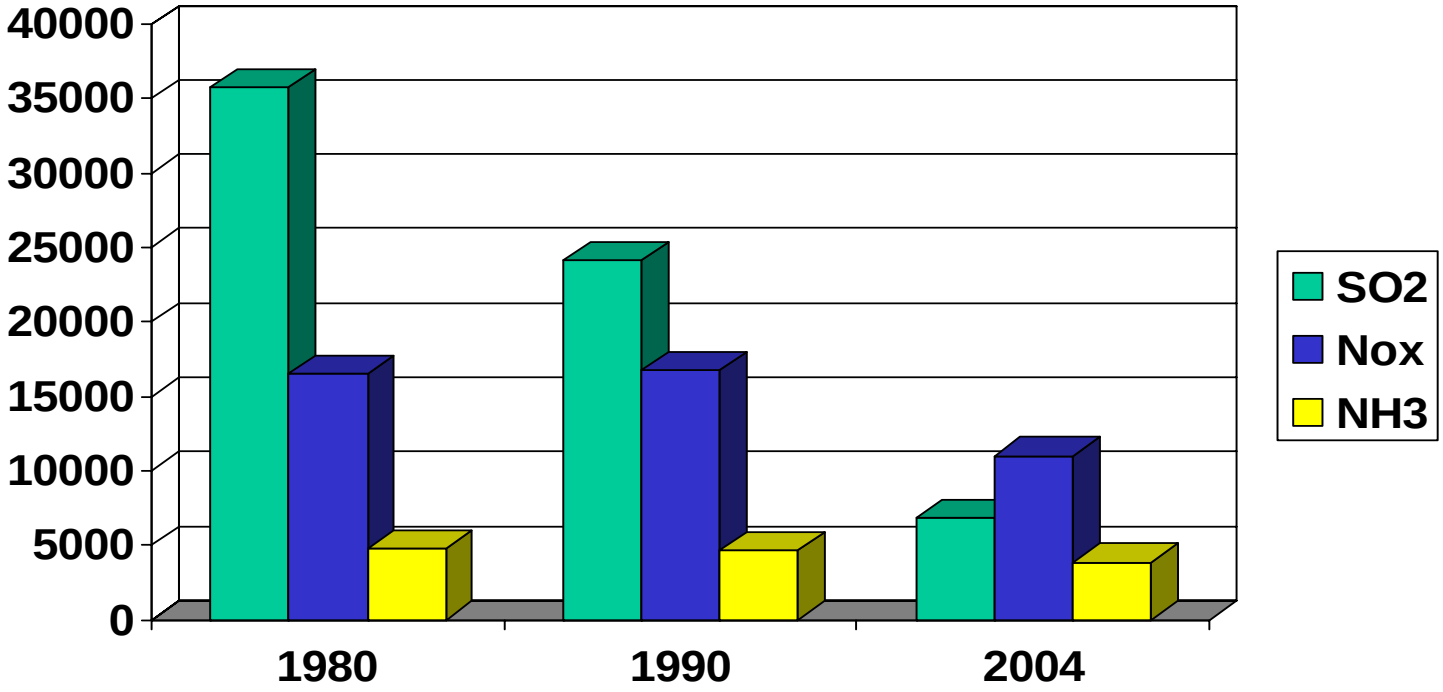


Exceedance eutrophication





The success of CLRTAP: EU25 emission reductions



SO_2 -81%

NO_x -34%

NH_3 -19%

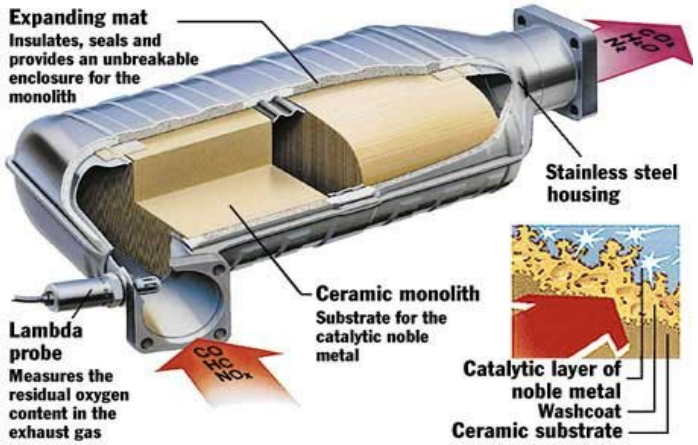
Succesful technologies almost all ER technologies

Low NOx burner

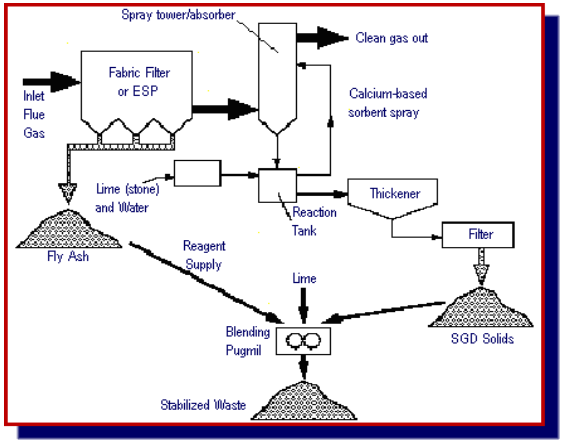
Desulphurization

SMELL-EX®

MINAS



3-way catalyst



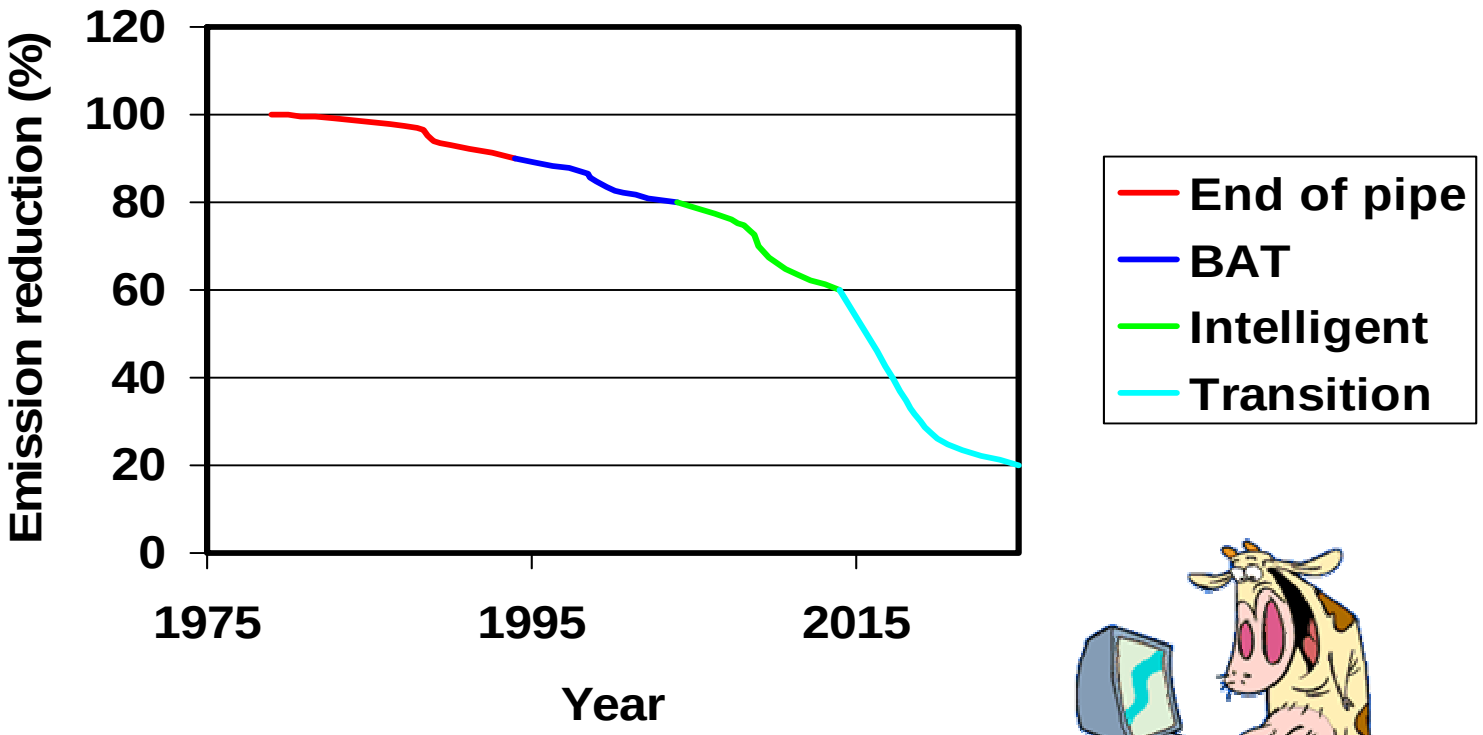
Flue gas desulpherization

Application technique

Success factors

- Bottum-up Science and Policy approach, signaling, establishing research, assessment and monitoring bodies and dissemination.
- It covered the whole DSPIR (Driving policies, Pressures, State of the environment, Impacts and Responses
- Involvement of all stakeholders
- Cost/benefit integrated assessments
- Relatively simple problem, no discussion about evidence
- …….

The evolution of emission reduction



Ammonia:

Covering storage
Manure processing
Slurry injection

Green label housing
Air washers

MINAS
Manure trading
Optimisation of N cycle
Biogas from manure

??????
Gene modification
Pig flats???

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Next step: Nitrogen

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The Nitrogen challenge

Multi-source/actor

- agriculture, fossil fuel (energy, industry, transport), natural

Multi-pollutant

- N_2O, NOx, NH_3, aquatic NO_3^-, organic N, aerosol etc

Multi-problem

- GHG balance, biodiversity, water quality,
- human health
- cascade

Multi-receptor

- Forests & other terrestrial ecosystems, agriculture, rivers,
- Troposphere, stratosphere, urban, coastal & marine, humans

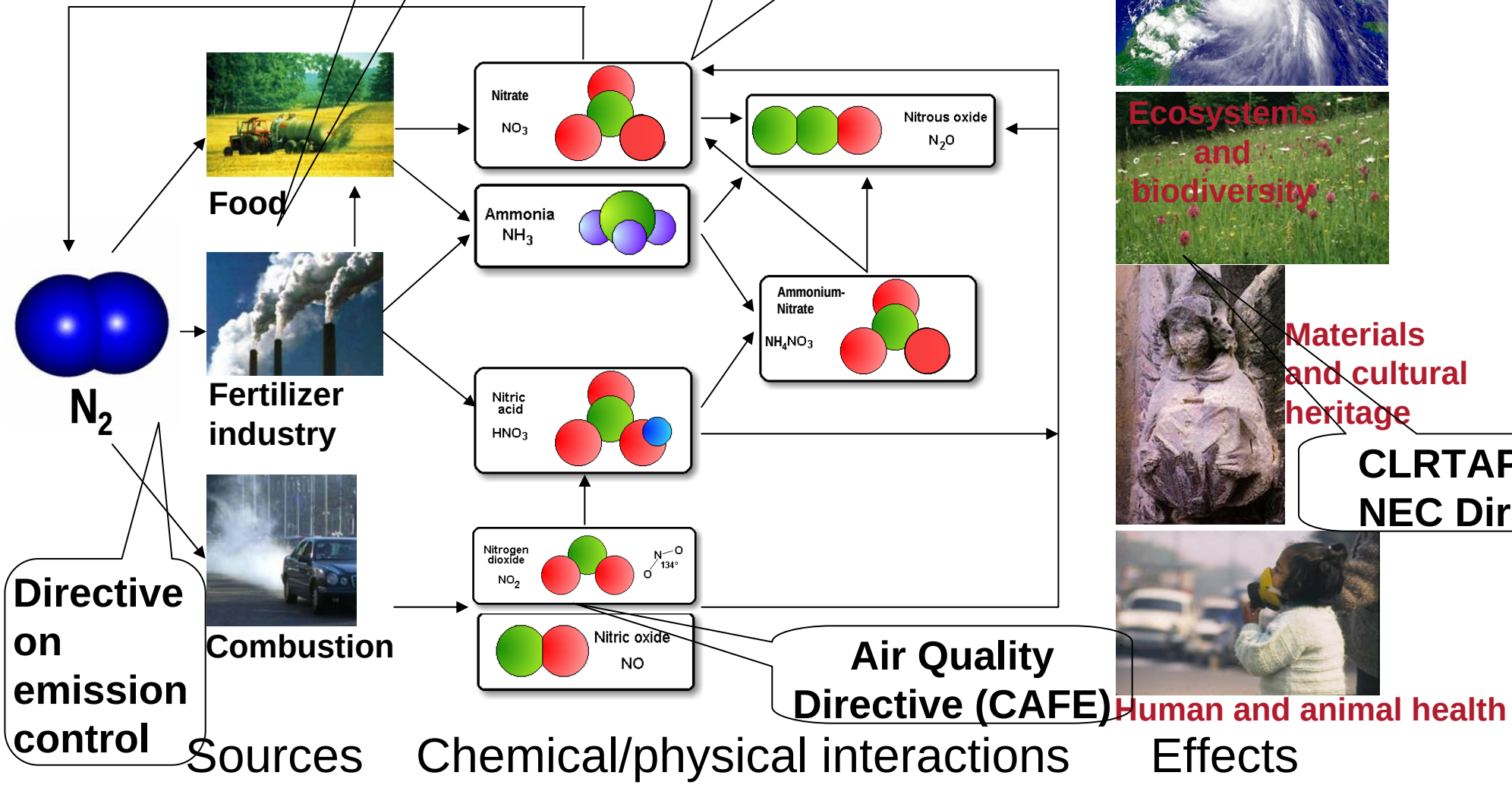
Multi-effect

Current strategies to address (part) of the N-issues

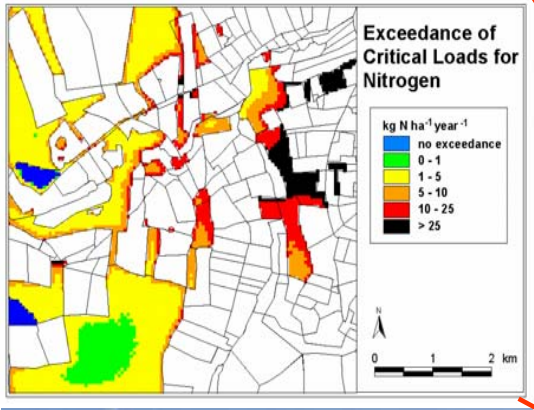
More integrated

- Directive on Integrated Pollution Prevention and Control (IPPC)
- Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol to the Convention on Long-range Transboundary Air Pollution [LRTAP] (1999)
- Directive on National Emission Ceilings (2000)
- The Clean Air for Europe (CAFE) Programme (2004)

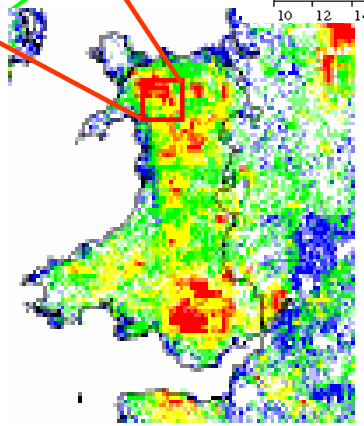
Nitrogen pollution: integral approach



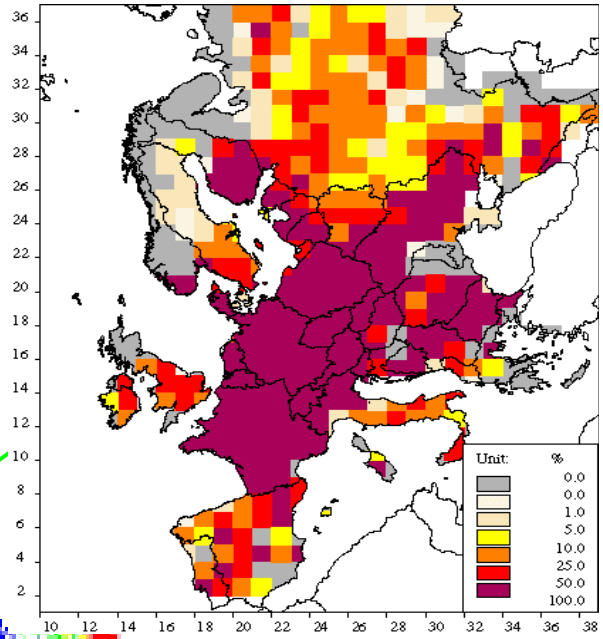
Dealing with spatial scale



Ecosystem protection

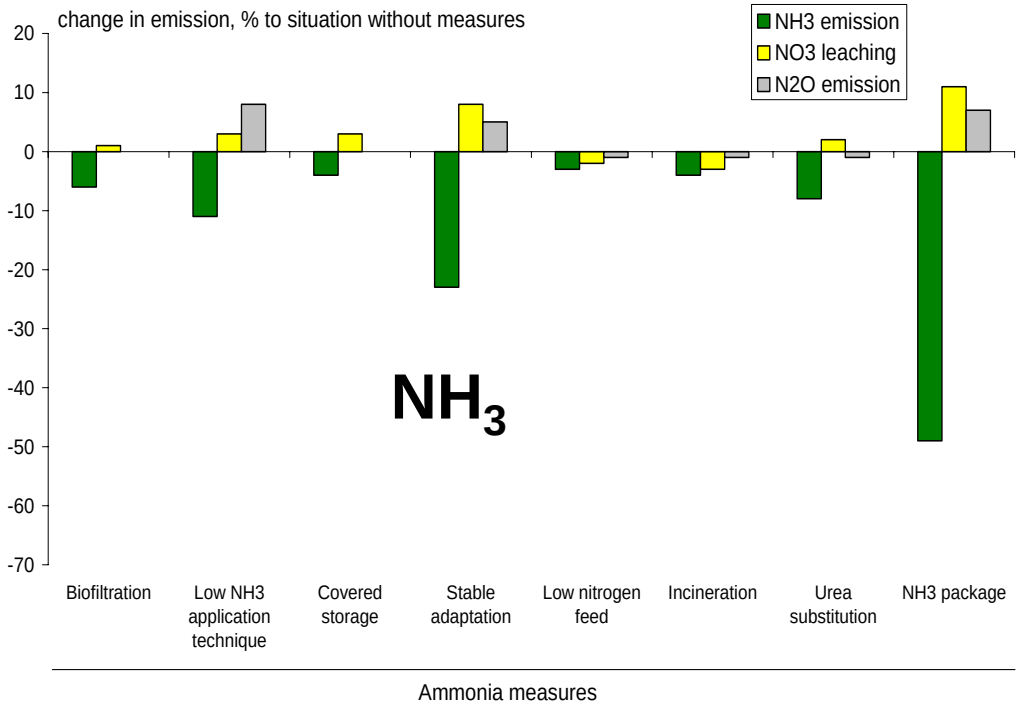


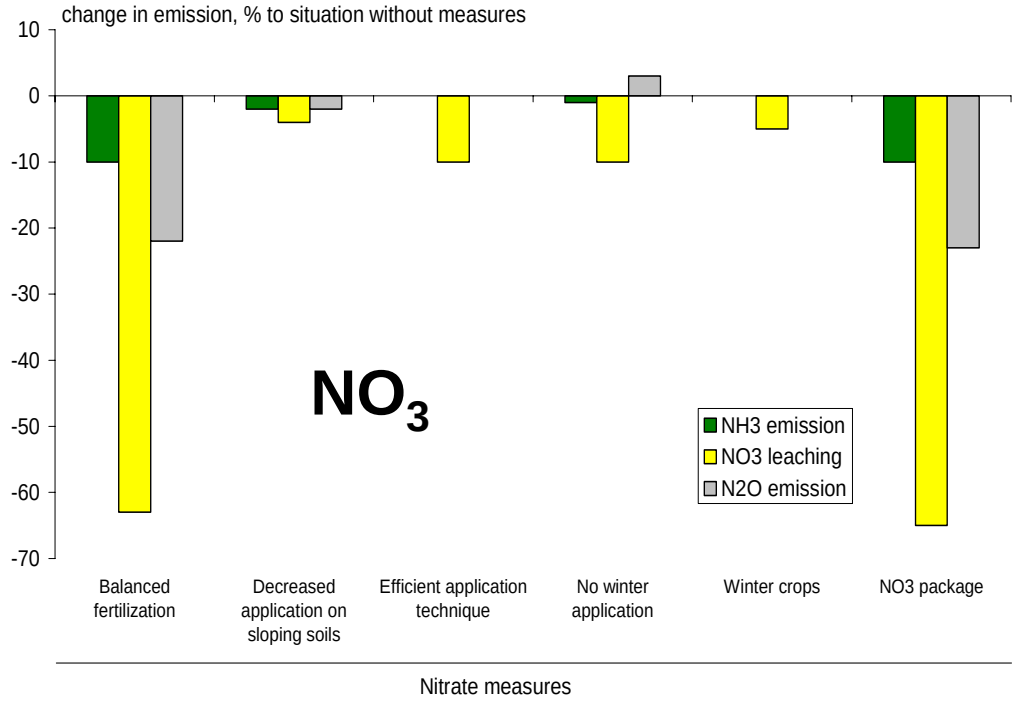
National targets and policy



European emissions, deposition and critical load exceedances

Result of first integrated model Miterra: pollutant swapping?



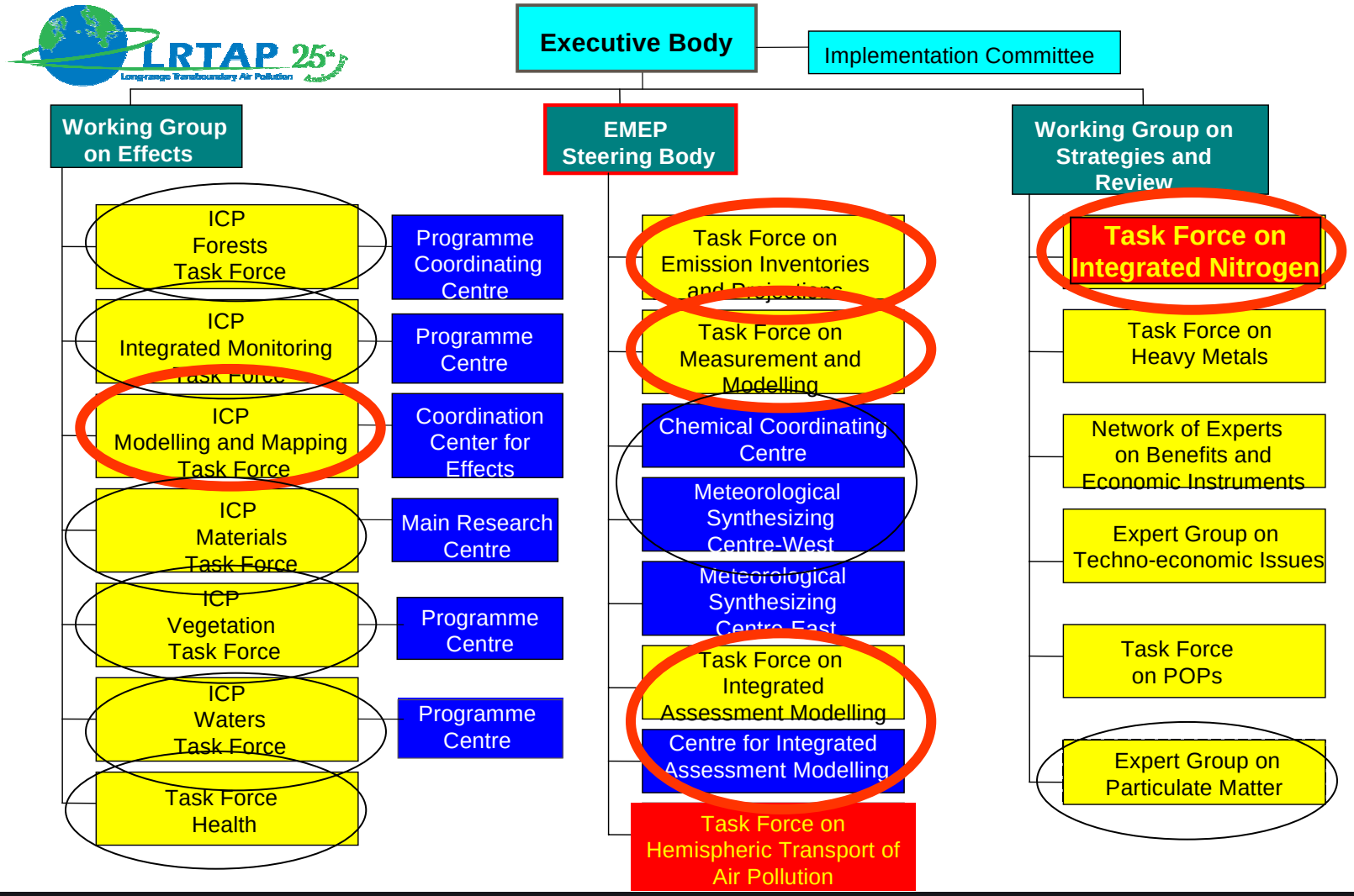


Oennema et al., Contract No 070501/2005/422822/MAR/C1

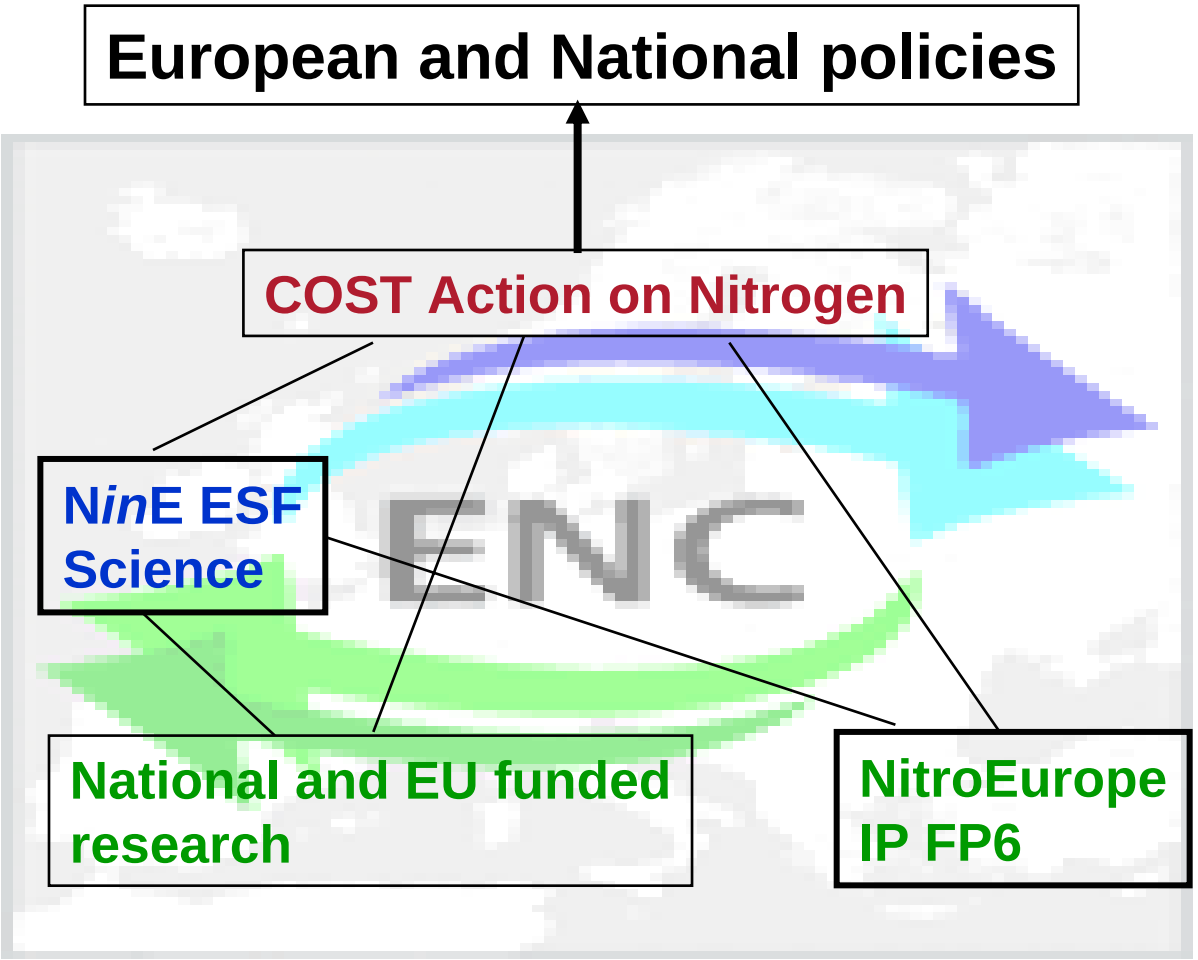
Focus on nitrogen

- Effects are less pronounced/obvious and there is not one single dominating effect (human health, ecosystems, marine, ozone layer, climate change)
- Sources are less well defined and difficult (diffuse sources)
- There is no ‘integration’ at the source side (different sectors).
- Interchange between forms of N (ox vs red)
- Abatement options difficult; emission reduction technologies not obvious (except for NOx)
- No ownership (transport)
- New sector that has been stimulated to increase production for basic needs: food (agriculture)

Nitrogen and the Convention



European Nitrogen research and policy



UNEP, EU, VROM, LNV, TFIN

Integrated Assessment, Policy support

European Nitrogen Assessment Scientific coordination

Science Knowledge basis

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Towards an Integrated Nitrogen approach

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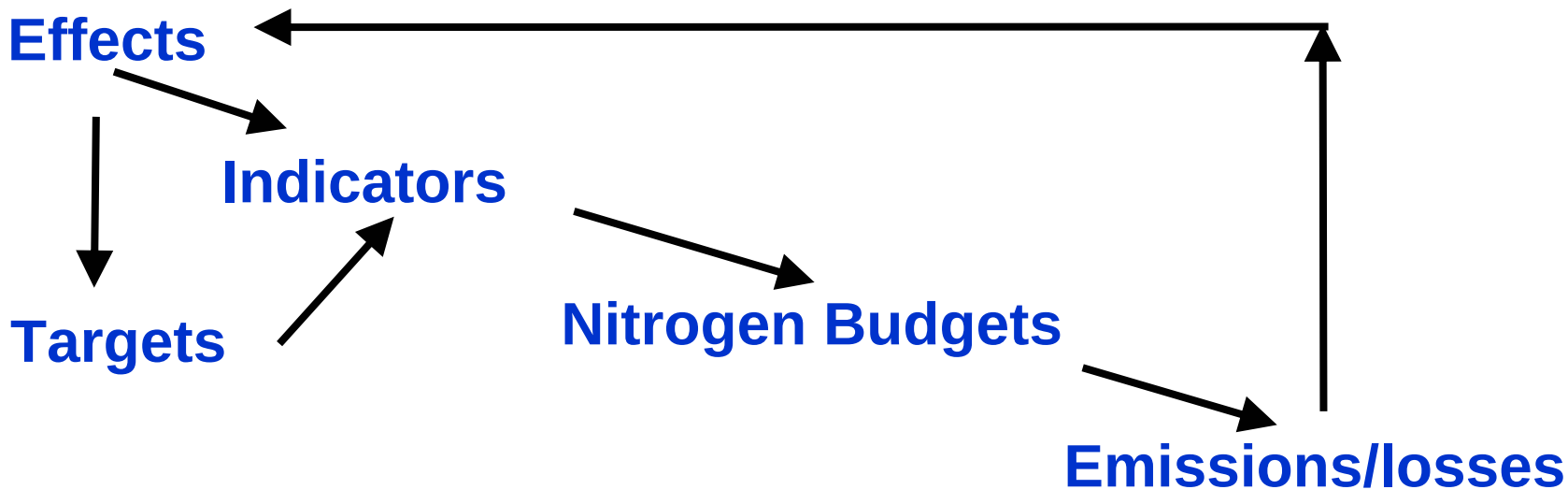
Ingredients for an integrated approach

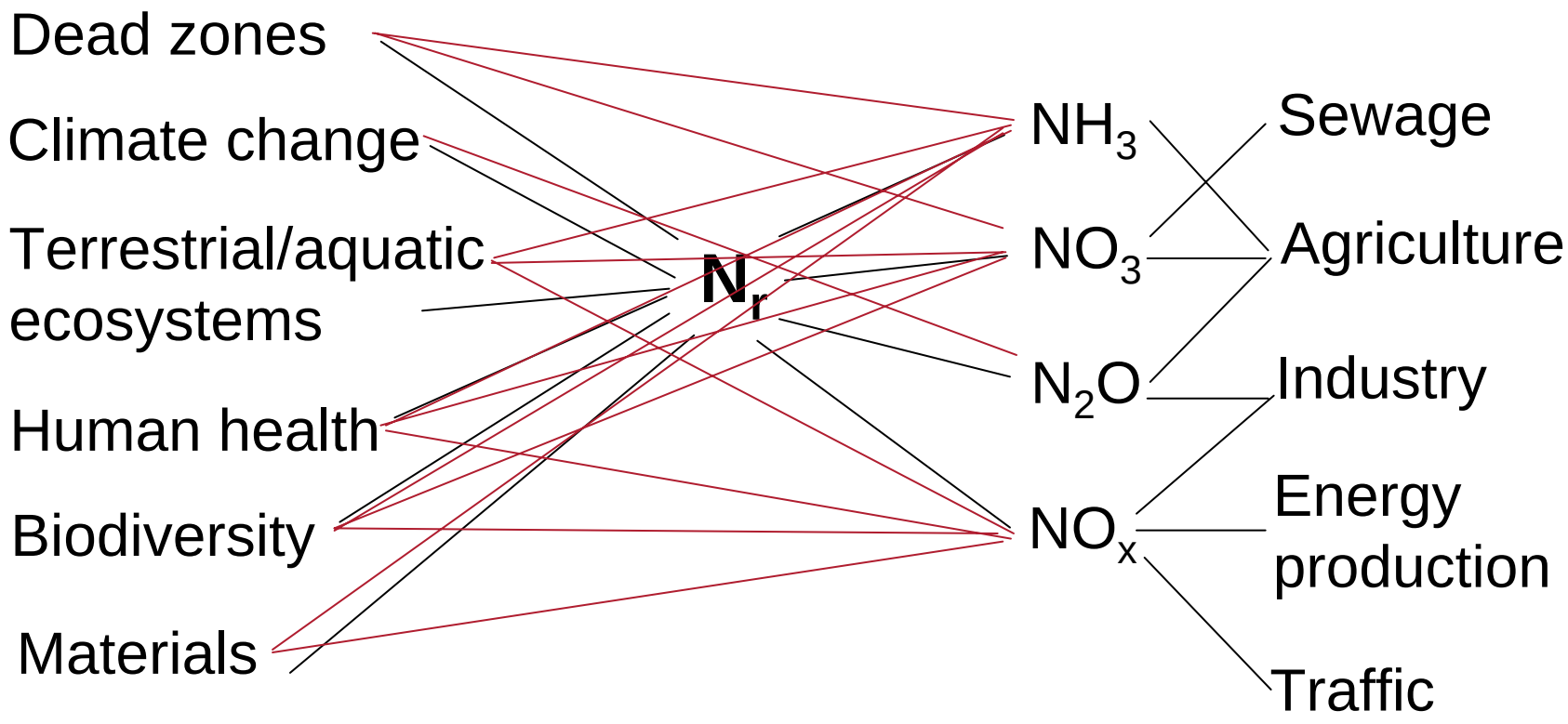
- Science (fundamental, applied research)
- Set of indicators
- Data and monitoring
- Integrated assessment
- Policy developments
- Communication
- Partnership, stakeholder involvement
- Policy implementation (protocol, guidelines, bill, etc.)

Build on the effect based approach for N

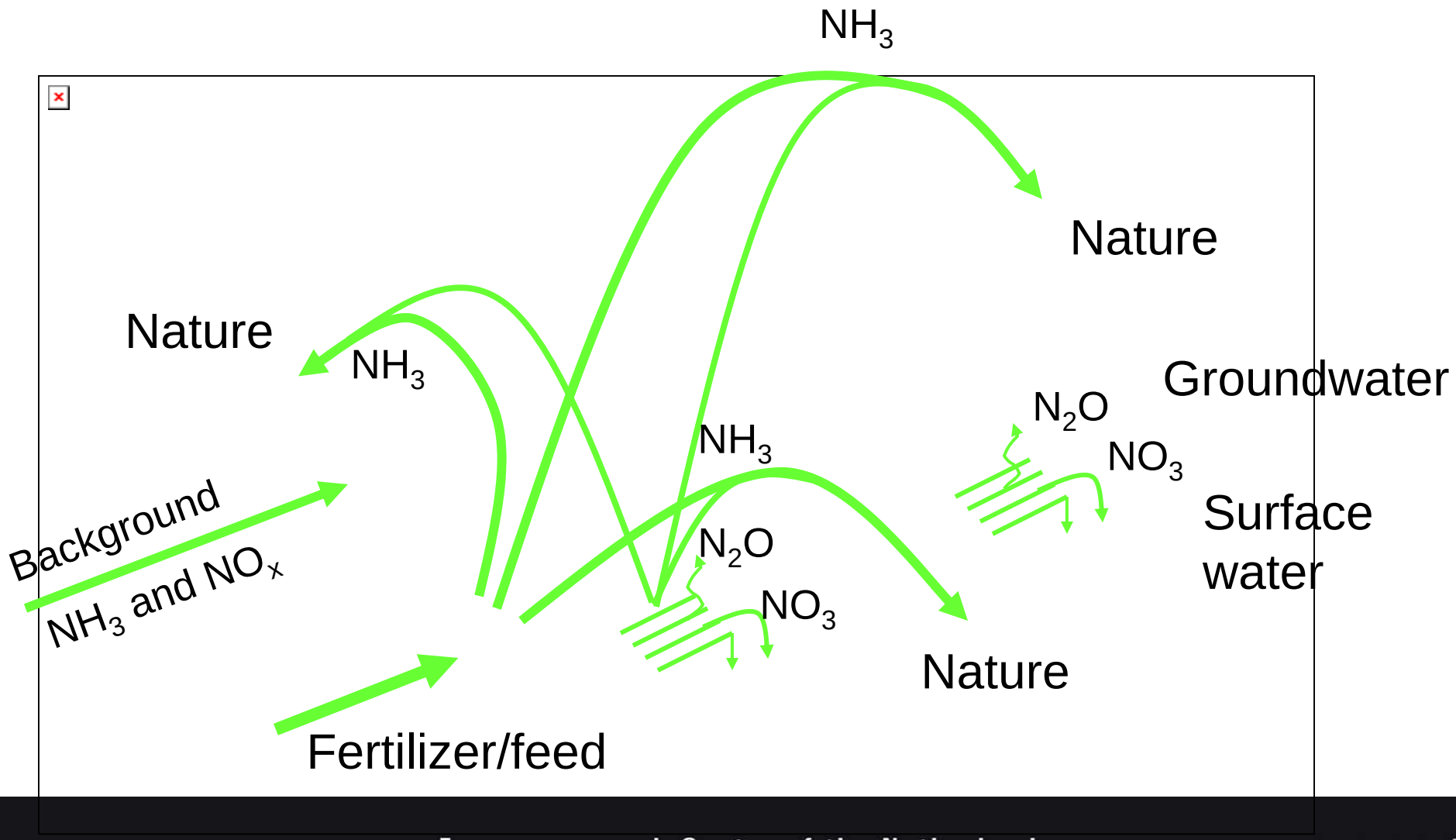
- Reduce emissions by increasing nitrogen efficiency
- Solve the 'local problems' through the IPPC directive
- Established a effect based framework to deal with N in an integrated manner:



Effect based framework for transboundary N_r

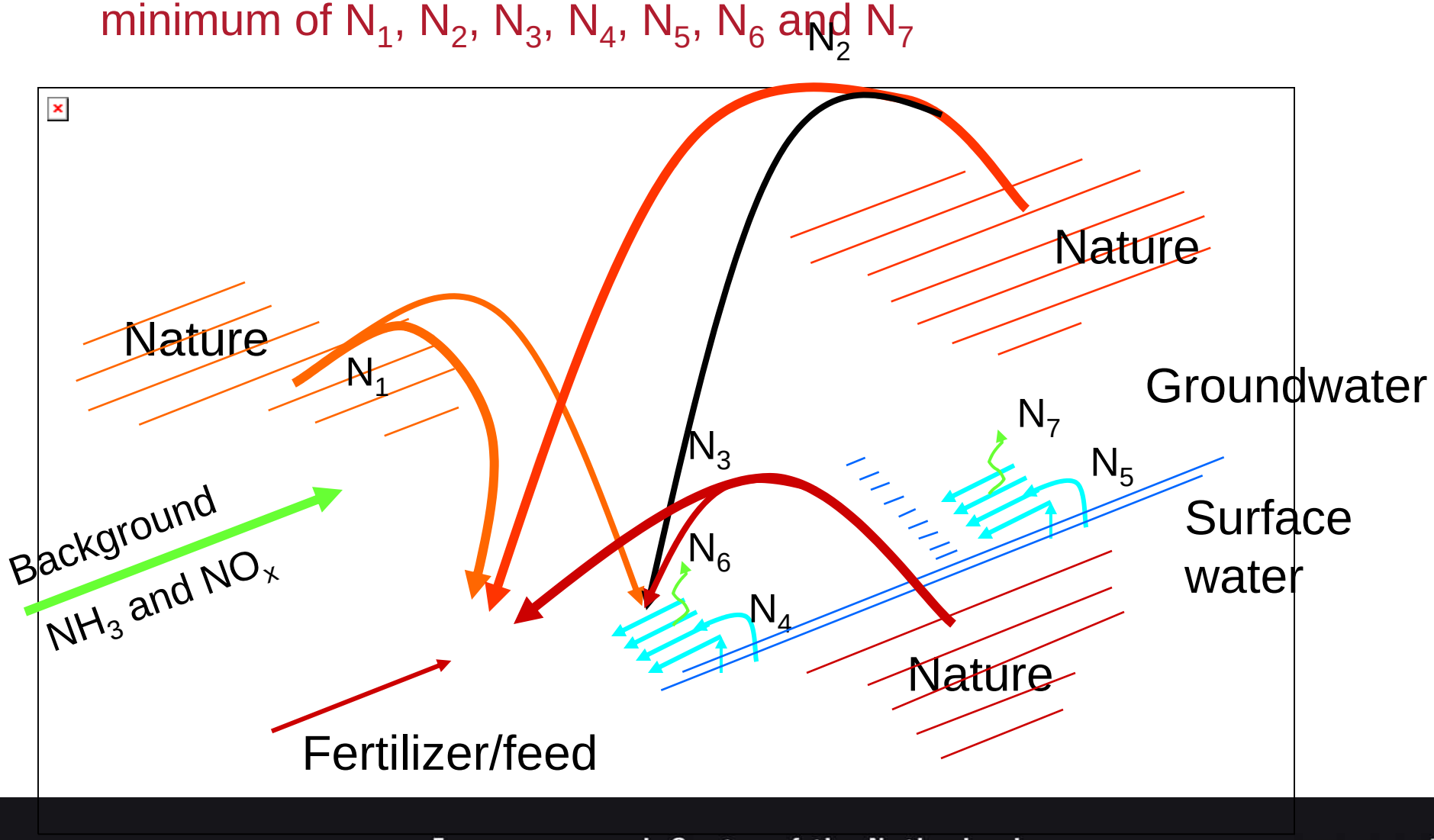


Spatial optimisation of nitrogen emissions

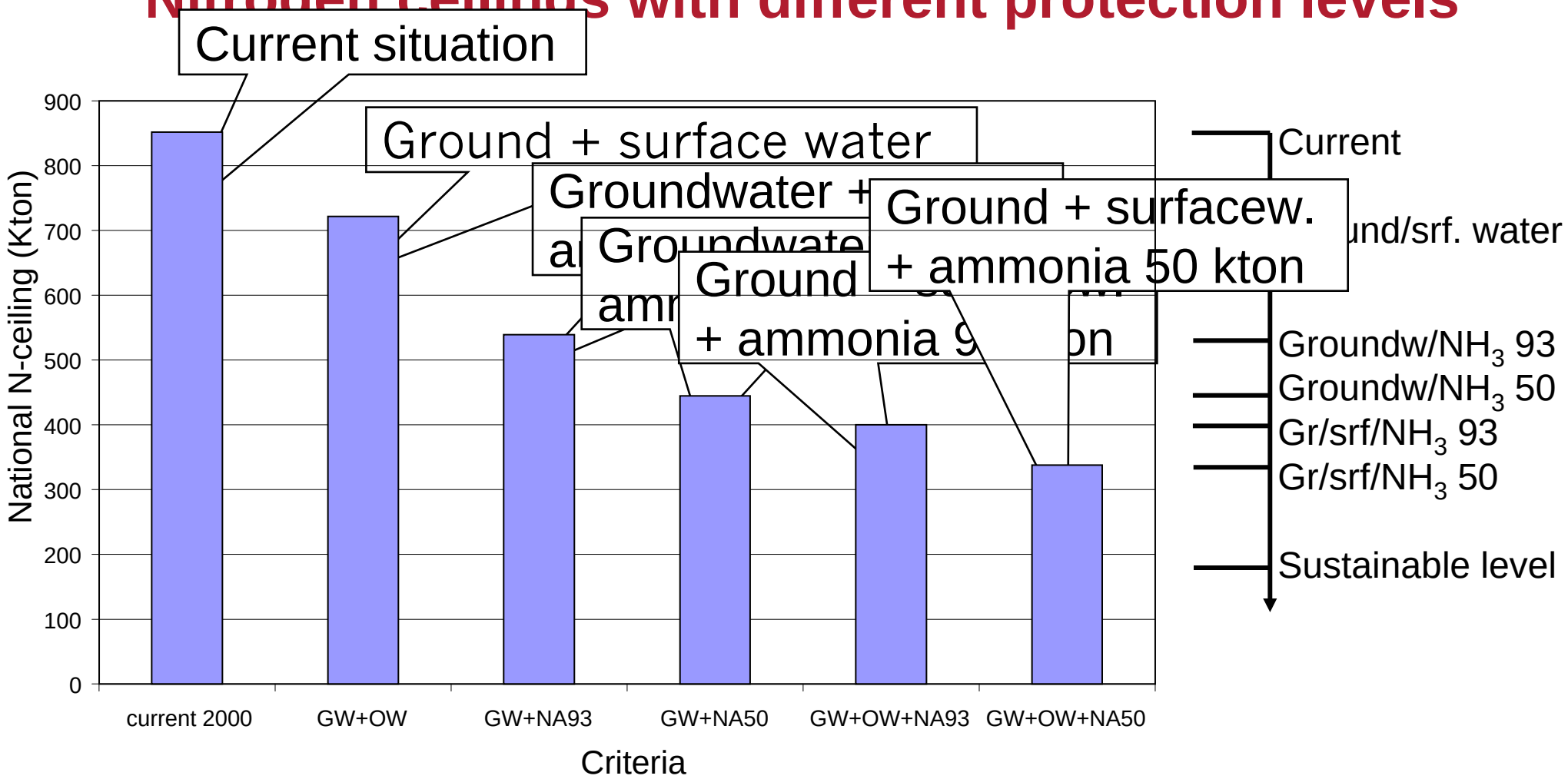


Nitrogen ceiling;

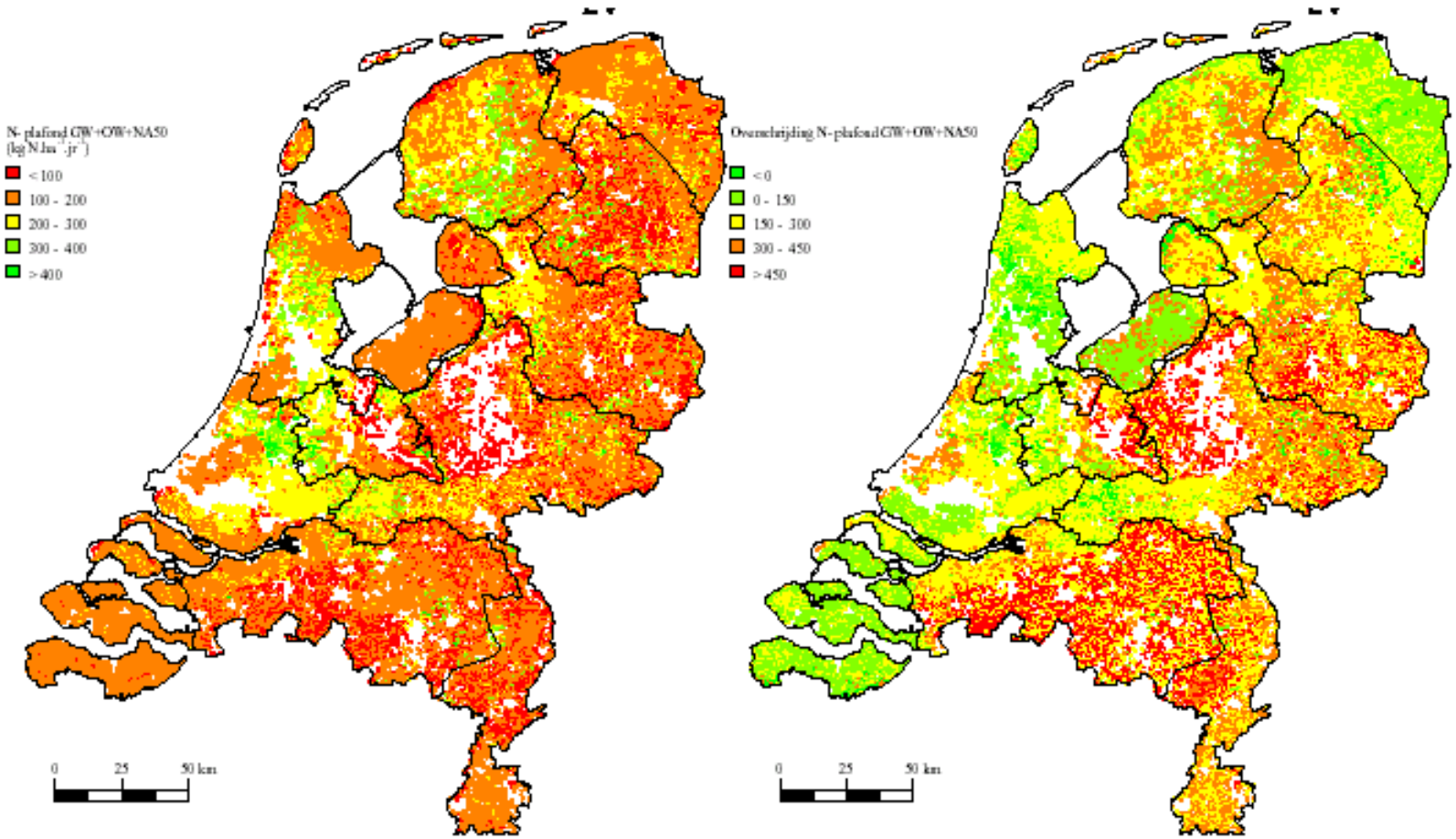
minimum of N_1, N_2, N_3, N_4, N_5, N_6 and N_7



Nitrogen ceilings with different protection levels



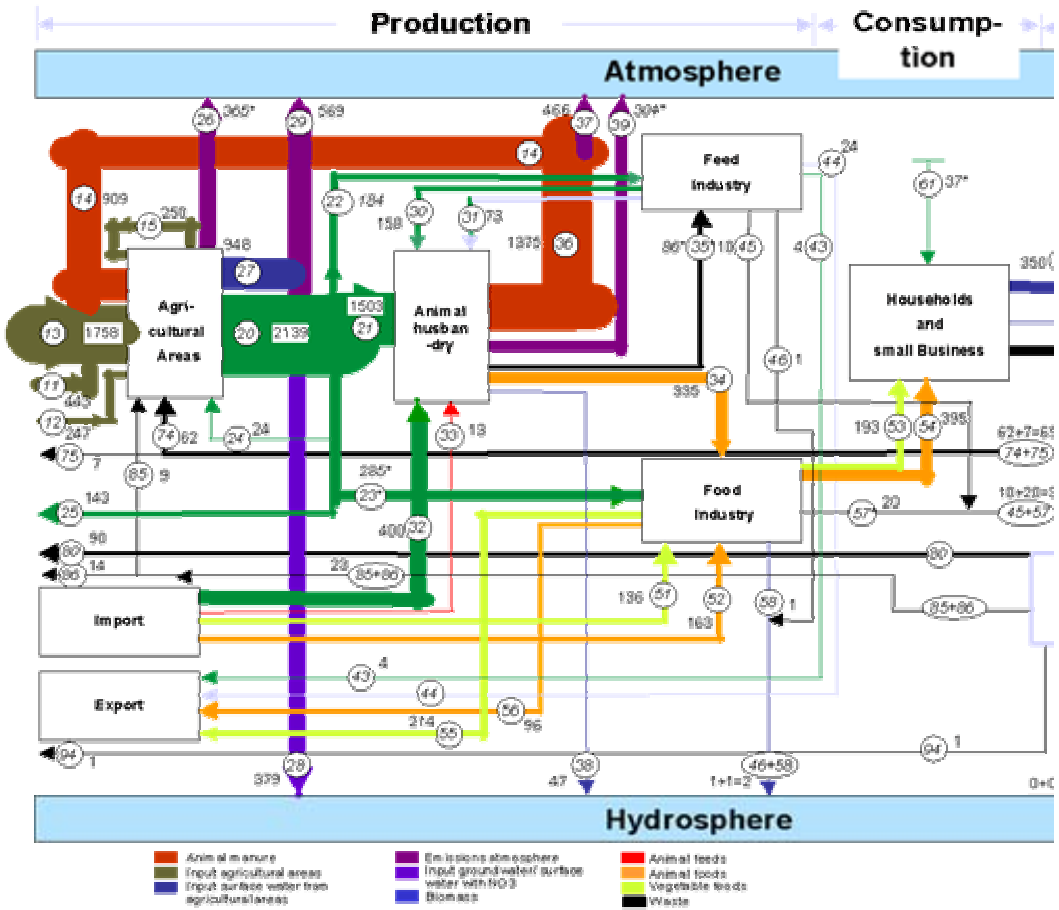
N ceiling and current exceedance



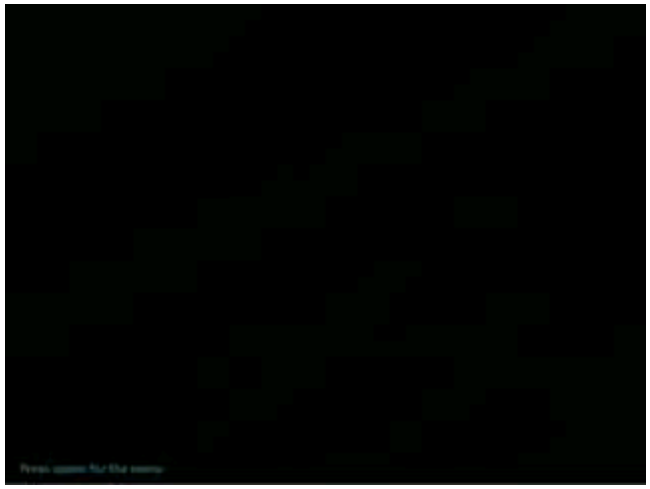
Implementation and use of N ceilings

1. Set Environmental quality standards as a basis for sustainability
2. Derive/chose targets for different effects (protection levels)
3. What is limiting? Example CL Europe: 1970-1990 dominated by sulphur. Now its ammonia, but the CL's are still the same!
4. Calculate Nitrogen ceilings
5. Implement Cap and trade system

Complexity and communication



German N-flows in Kton N/yr; Isermann, 2005

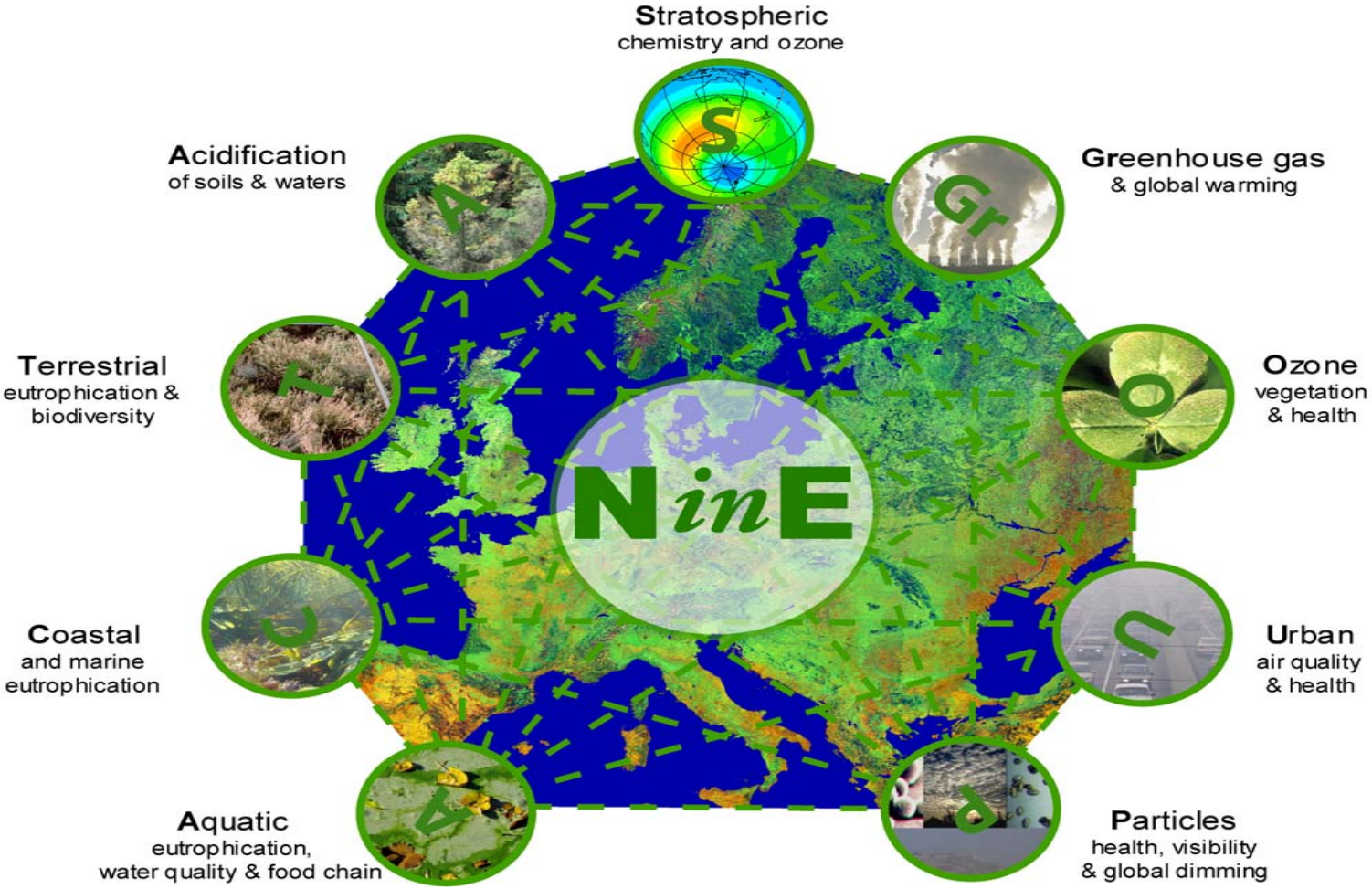


www.initrogen.org

European Nitrogen Assessment

Jan Willem Erisman, Mark Sutton, Stefan Reis
and Albert Bleeker

The Nine most important effects of nitrogen



The ESF Research Network Programme, N*in*E will operate through:

- **Travel grants for short visits**, of up to two weeks for activities that address one or more of the N*in*E objectives.
- **Travel grants for longer visits**, of up to 6 months for activities that address one of more of the N*in*E objectives.
- **Summer Schools**, providing training to young scientists on nitrogen interlinkages, building the capacity for integrated assessment of nitrogen.
- **Targetted Workshops** (10-40 people), relating to specific issues of the N*in*E programme.
- **Science Conferences,** bringing together analyses of all nine nitrogen problems.

Workplan and outline

- Summary for Policy Makers
- Technical Summary
- Chapter 1. Introduction, Scope and Objectives
- **Section A. Nitrogen in Europe: the present position.**
- Chapter 2. The European nitrogen problem in a global perspective
- 3. Nitrogen in current European policies
- 4. The need to integrate nitrogen science and policies.
- **Section B. Nitrogen processing in the biosphere**
- 5. Nitrogen turnover processes and effects in terrestrial ecosystems
- 6. Nitrogen turnover processes and effects in aquatic ecosystems
- 7. Nitrogen turnover processes and effects in coastal and marine ecosystems
- 8. Nitrogen turnover processes in the atmosphere
- **Section C. Dispersion, budgets and impacts of nitrogen on different scales**
- 9. Dispersion and fate of nitrogen in rural landscapes
- 10. Dispersion and management of nitrogen in urban landscapes
- 11. Nitrogen and Regional Watersheds in Europe (including Coastal and Marine issues)
- 12. Atmospheric transport and deposition of reactive nitrogen in Europe.
- 13. Integrating nitrogen fluxes at the European scale

Continued

- **Section D. Managing nitrogen in relation to key societal threats**
- **14.a Quantification and comparison of threats**
- **14. The impact of nitrogen on the European greenhouse balance**
- **15. The impact of nitrogen on European terrestrial biodiversity**
- **16. The impact of nitrogen on European water quality**
- **17. The multiple impacts of nitrogen aerosol in Europe**
- **18. The impact of nitrogen on the European ozone threat**
- **Section E. European nitrogen policies and future challenges**
- **19. Future scenarios of nitrogen in Europe**
- **19b. Costing nitrogen in the environment**
- **20. Developing integrated approaches to better nitrogen management**
- **21. Coordinating European nitrogen management between international conventions**
- **22. Societal choice and the European nitrogen challenge**
- **23. Communication and dissemination.**
- **Section F. Appendices**

Planned workshops in the process (2008-2009)

- ***ENA Workshop 1: Multiple Nitrogen Problems and the Current Policy Measures.***
- ***ENA Workshop 2: Nitrogen processing in the biosphere***
- ***ENA Workshop 3: Dispersion, budgets and impacts of nitrogen on different scales.***

- ***Other ENA Workshops***
- ***Managing nitrogen in relation to key societal threats***
- ***European nitrogen policies and future challenges***

Who is who in nitrogen: building a network

www.nine-esf.org
www.nitroeurope.eu

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Thank you for your attention

More information? erisman@ecn.nl

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Policies, actions and strategies to address N_r excess

Research, monitoring and evaluation

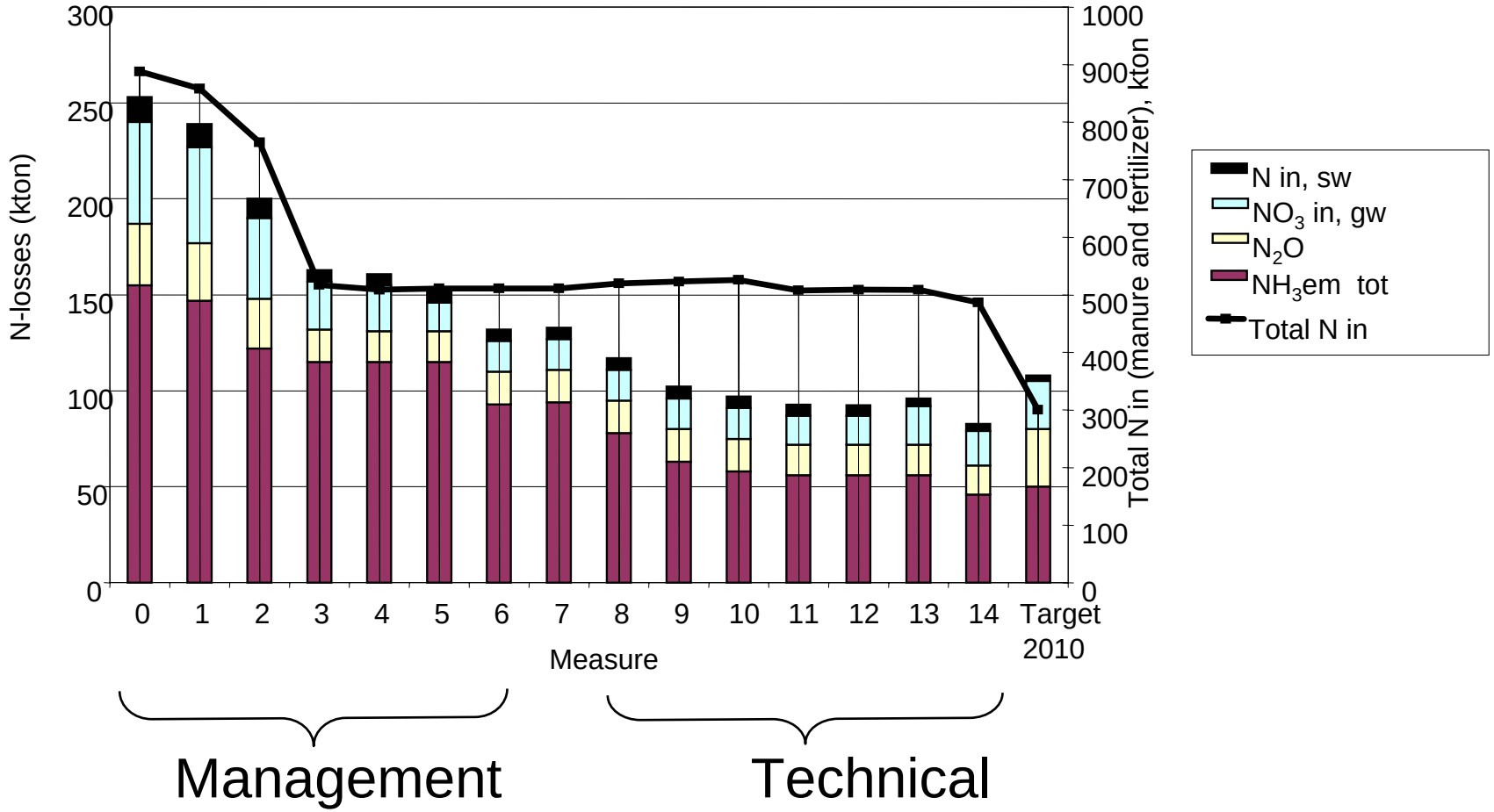
- Provide evidence, tools, N-budgets, indicators and monitoring
- Simplification of the issues: integrated assessment, visualisation

Education and outreach

- Environmental education
- Public awareness
- Outreach and technical assistance

Policy frameworks

- Environmental quality standards and targets
- Economic and fiscal incentives
- Technology and manufacturing standards
- Effluent/emission limits and watershed caps; N ceilings?
- Ecosystem preservation and restoration

Institutions, capacity and partnerships

Effect of measures