ECN

Energy research Centre of the Netherlands

NitroEurope IP

NinE

European Science Foundation

ini

cost

Towards an integrated approach for nitrogen in Europe

Jan Willem Erisman, ECN, The Netherlands

Outline of presentation

- Why Nitrogen?
- Synthesis of the assessments
- Relevant issues for an integrated nitrogen approach
- International activities

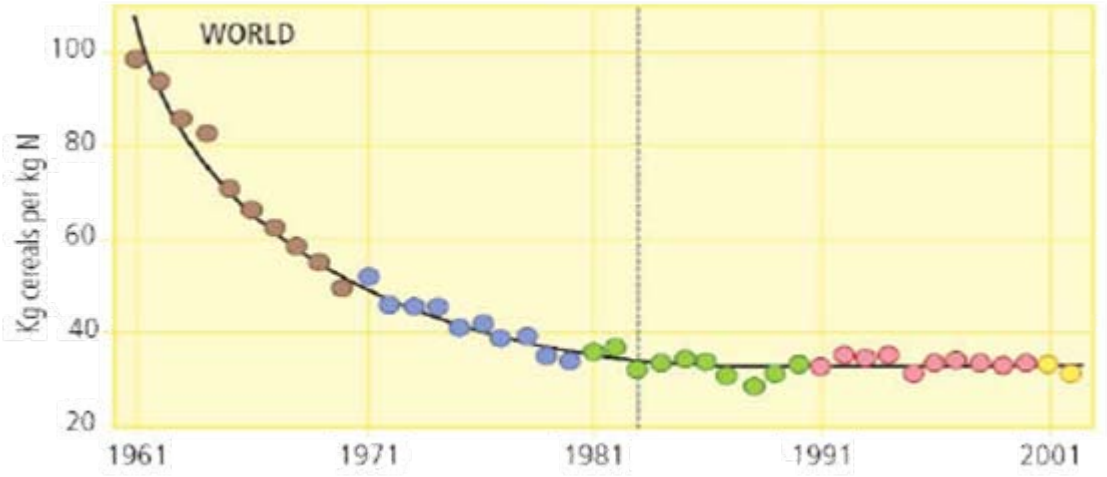
All organisms depend on Nitrogen for food

Insufficient protein in the diet may prevent the body from producing adequate levels of peptide hormones and structural proteins to sustain normal bodily functions

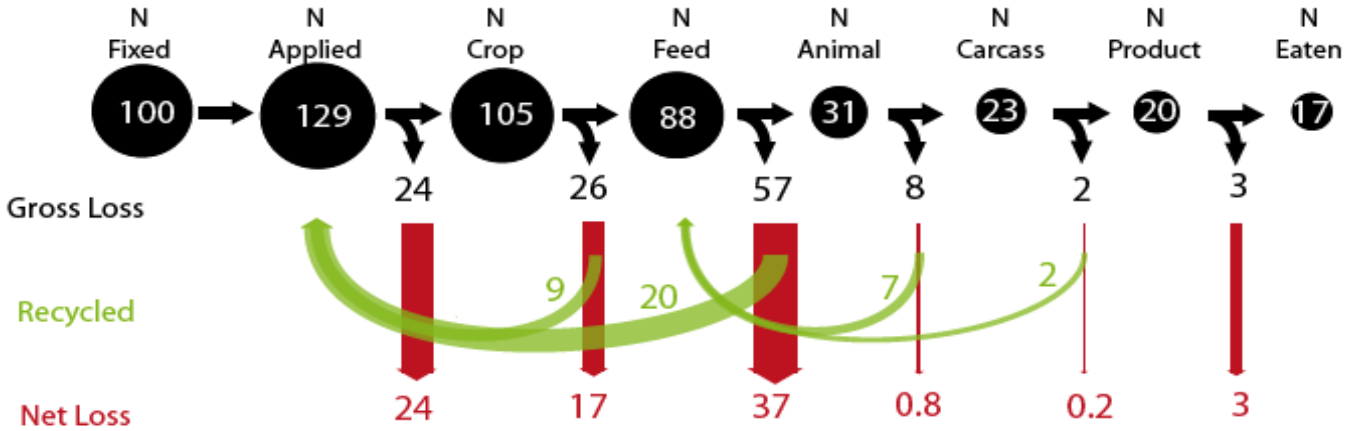
40% of the world population exist because of fertilizers.

…….. too little …….. too much

Fertilizer and its efficiency



Source: IFA, 2007

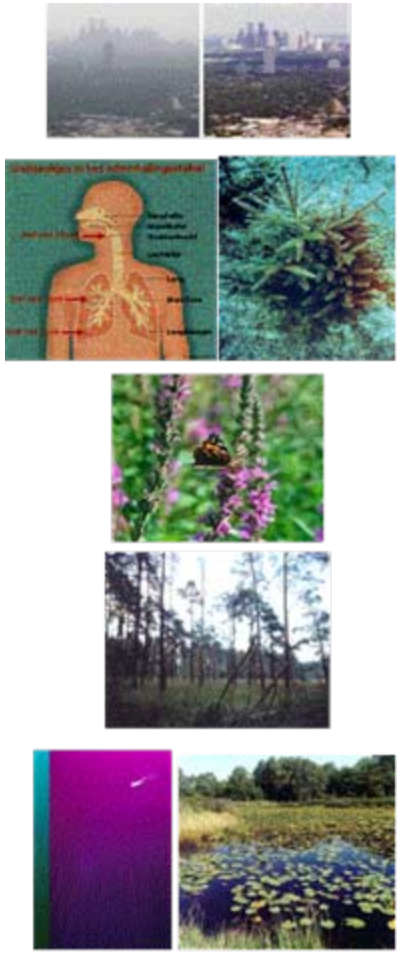


Reactive Nitrogen in the Environment, UNEP, 2007

Fossil fuels/energy and nitrogen

- NO_x emissions from combustion
- Fertilizer production
- Globalisation through transport
- Increased production through increased manpower
- Biofuels/bioenergy will require more fertilizer use

Cascade effect of reactive nitrogen



Hours	days	Weeks	months	years	decades	centuries

Cascade

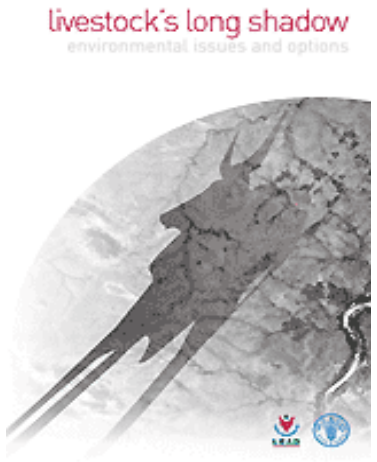
Fish kill Red tide Algal bloom

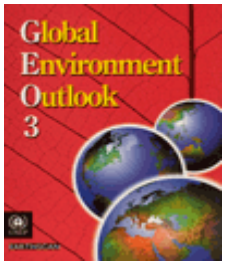
Worry about Nitrogen

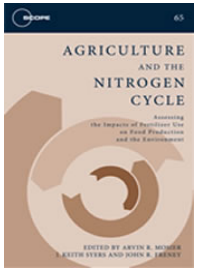
- N is essential for life but:
  - in some regions there is not enough;
  - in other regions there is too much.
- Excess N contributes to most environmental issues.
- We expect an increase in Nr production (food, biofuels, energy)
- The challenge is to optimize its availability while minimizing its negative effects.

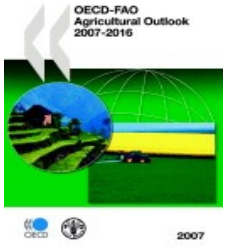
One week of food: .. too little .. too much

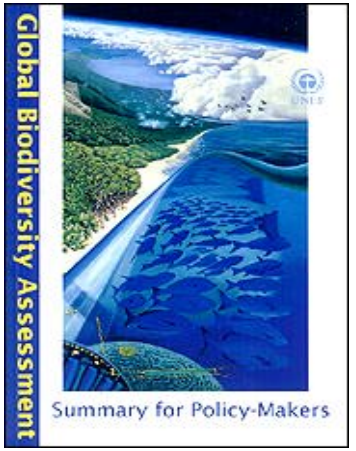
Synthesis of assessments

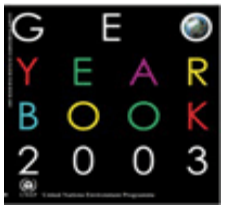


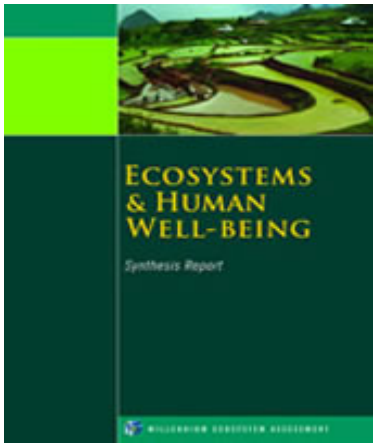


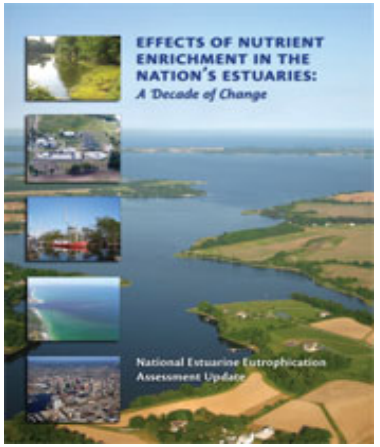


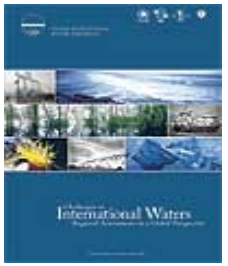


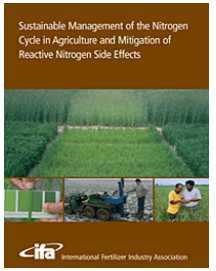


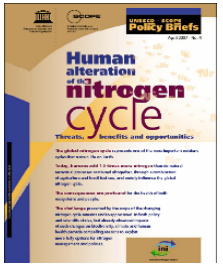












And many more .....

Assessments focus on part of the nitrogen issue

Drivers and Sources

- Energy/industry
- Agriculture

OECD-FAO Agricultural Outlook

State of the environment, impacts and effects

- Ecosystems
- Global warming
- Human health

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Responses

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 (CAFÉ) Programme (2004)

Nitrogen pollution: integral approach

CAP

Nitrate Directive
Water Framework Directive

FCCC

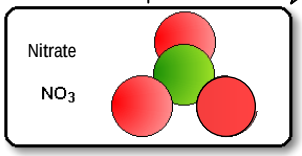
Food

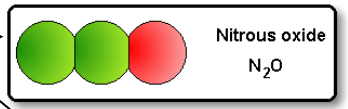
Fertilizer industry

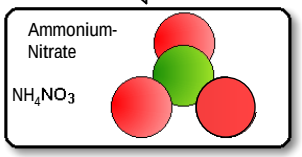
Combustion

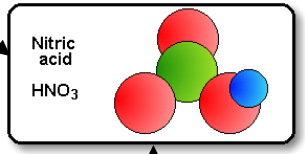
N_2

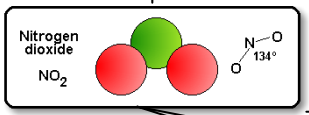
Directive on emission control

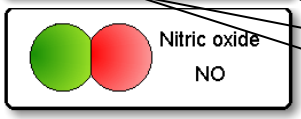




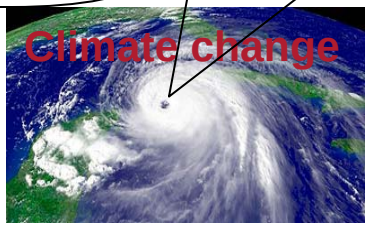








Air Quality Directive (CAFE)



Climate change

Ecosystems and biodiversity

Materials and cultural heritage

CLRTAP
NEC Dir.

Human and animal health

Sources Chemical/physical interactions Effects

Concluding remarks

- The assessments contain only limited quantitative relationships on nitrogen issues
- Nitrogen is not treated in an integrated way, while there is overlap in sources, actors and problems. “Water’ and ‘air’ scientists and policy makers work separately on similar science and policy issues. An effect based approach would lead to more integration.
- There is a strong need to combine data and knowledge through networking, and to communicate and disseminate knowledge in a comprehensive, simple way.

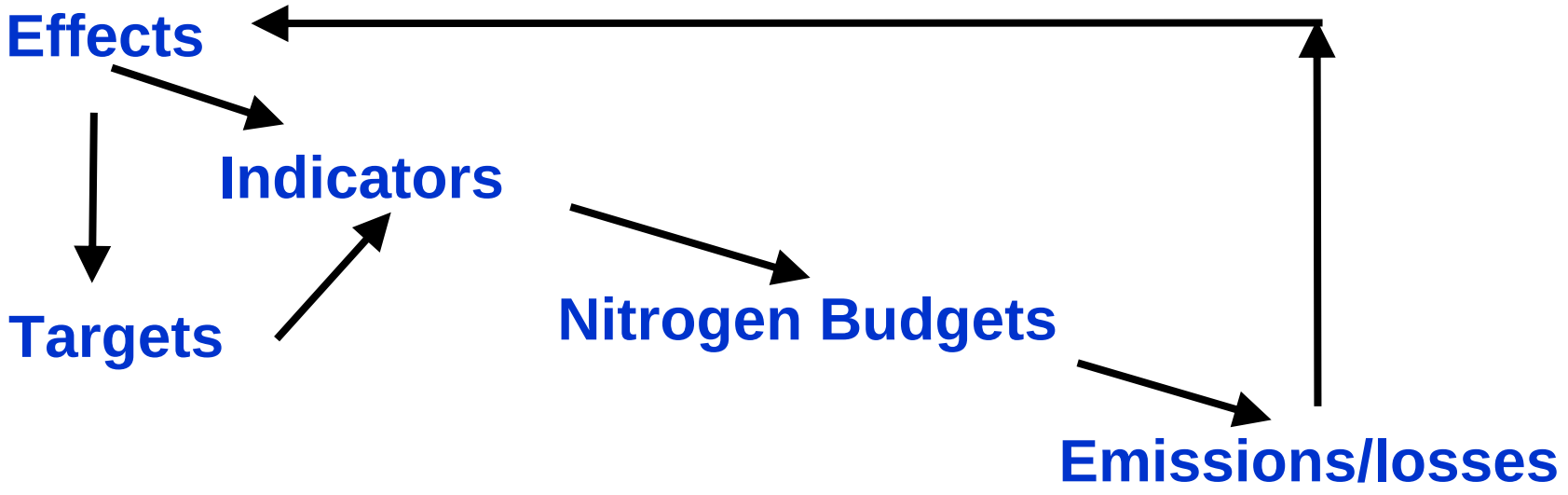
An integrated nitrogen approach

- 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)
- No ownership (transport)
- New sector that has been stimulated to increase production for basic needs: food (agriculture)
- Air and water transport and effects are connected
- Cascade of nitrogen through source and receptors/effects
- Interchange between forms of N (ox vs red)
- Single issue focus less effective and might lead to pollutant swapping

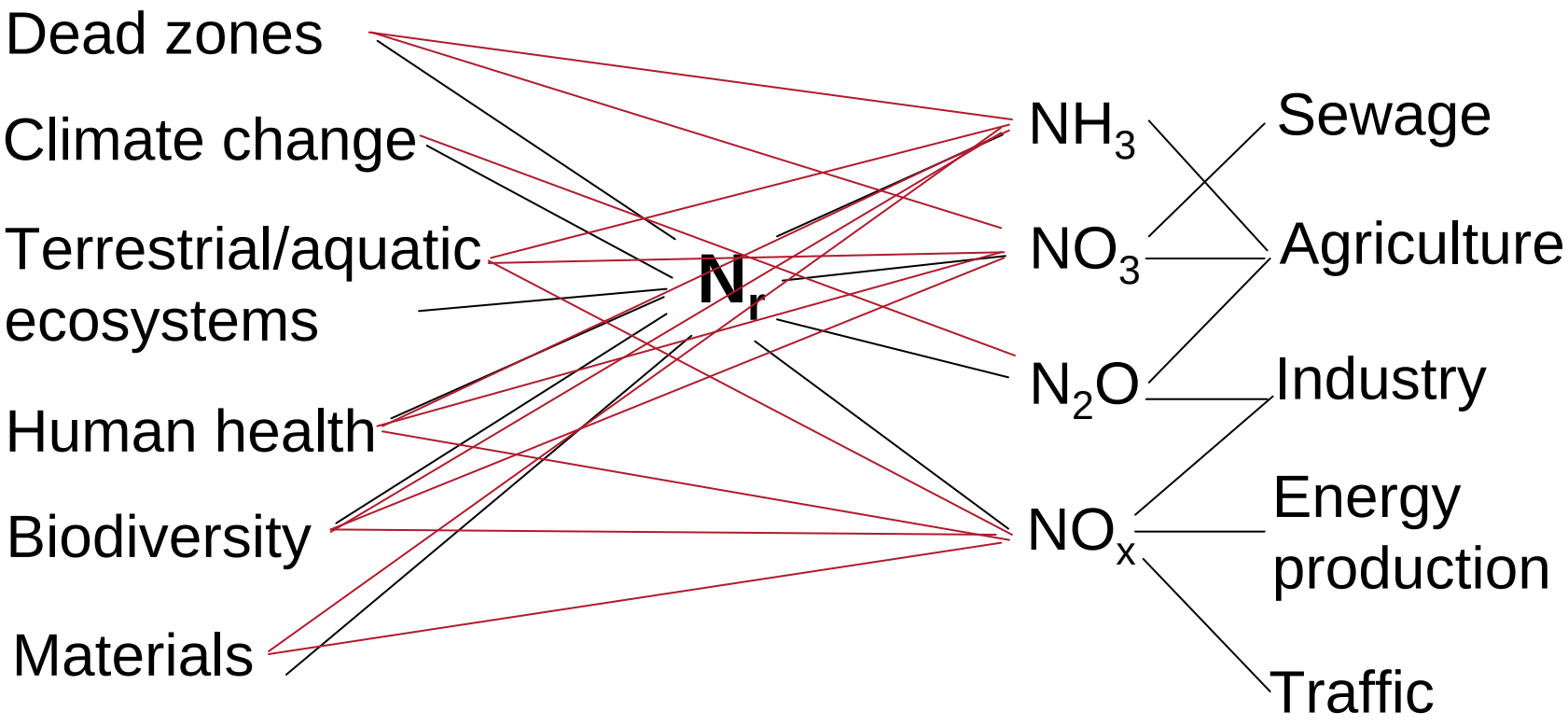
➡ Effect based nitrogen management policy

Build on the effect based approach for N

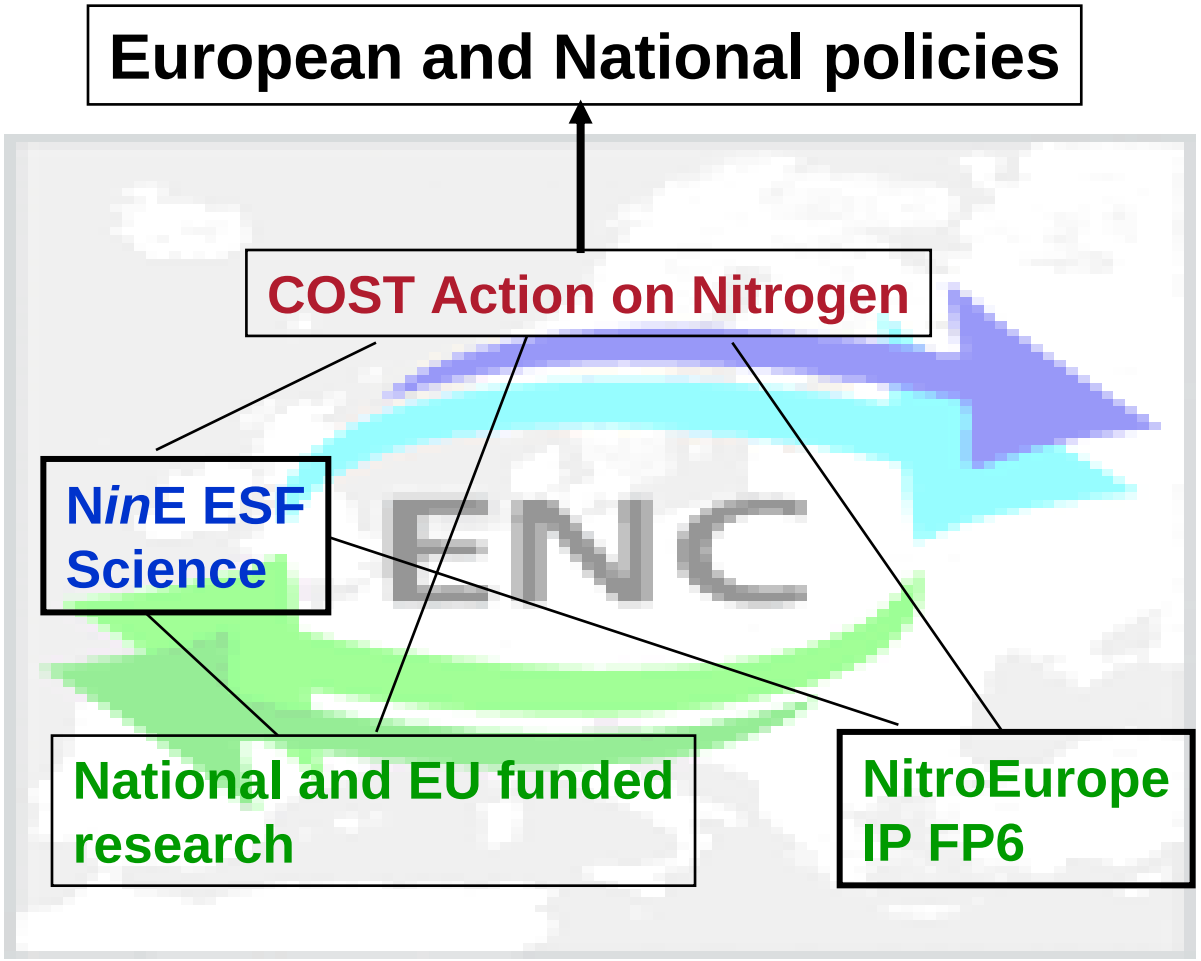
- Reduce emissions by increasing nitrogen efficiency
- Solve the ‘local problems’ e.g. through the IPPC directive
- Established a effect based framework to deal with N in an integrated manner:



Effect based framework for transboundary N_r



European Nitrogen research and policy



UNEP, EU, VROM, LNV, TFIN

Integrated Assessment, Policy support

European Nitrogen Assessment Scientific coordination

Science Knowledge basis

COST Action 729

Assessing and managing nitrogen fluxes in the atmosphere-biosphere system in Europe

Combining knowledge of various research areas to provide a scientific basis for an integrated approach to nitrogen management; requiring knowledge on:

- The formation of reactive nitrogen and the resulting emissions to the atmosphere
- Transport, transformation and deposition
- Integrated assessment modelling
- Policy analysis and support

www.cost729.org

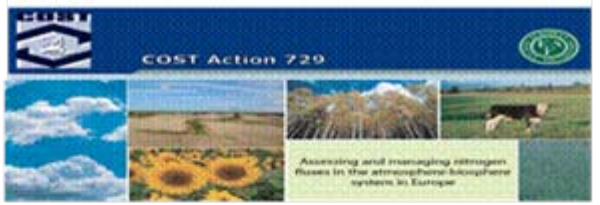
ESF – Research Network Programme Nitrogen in Europe (NinE)

- **Running for 5 years, started March 2006**
- **Aims to integrate European research and researchers**
- **Delivering an assessment report of the state of European nitrogen, sources, transformations and impacts, as well as establishing a basis to recommend future solutions (European Nitrogen Assessment)**

www.nine-esf.org

International Nitrogen Initiative

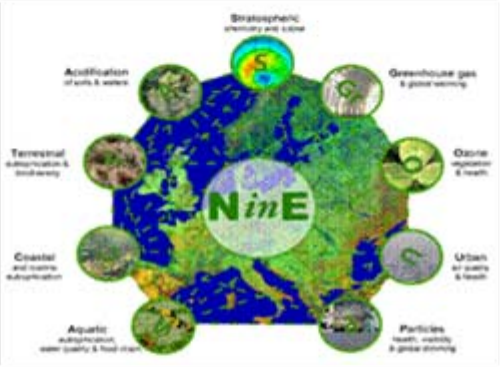
Thank you for your attention



www.cost729.org

More information:

www.initrogen.org



www.nine-esf.org

www.nitrogencentre.org

NitroEurope IP

http://www.nitroeurope.eu/