# Strategies for controlling nitrogen emissions from agriculture:

## Regulatory, voluntary & economic approaches

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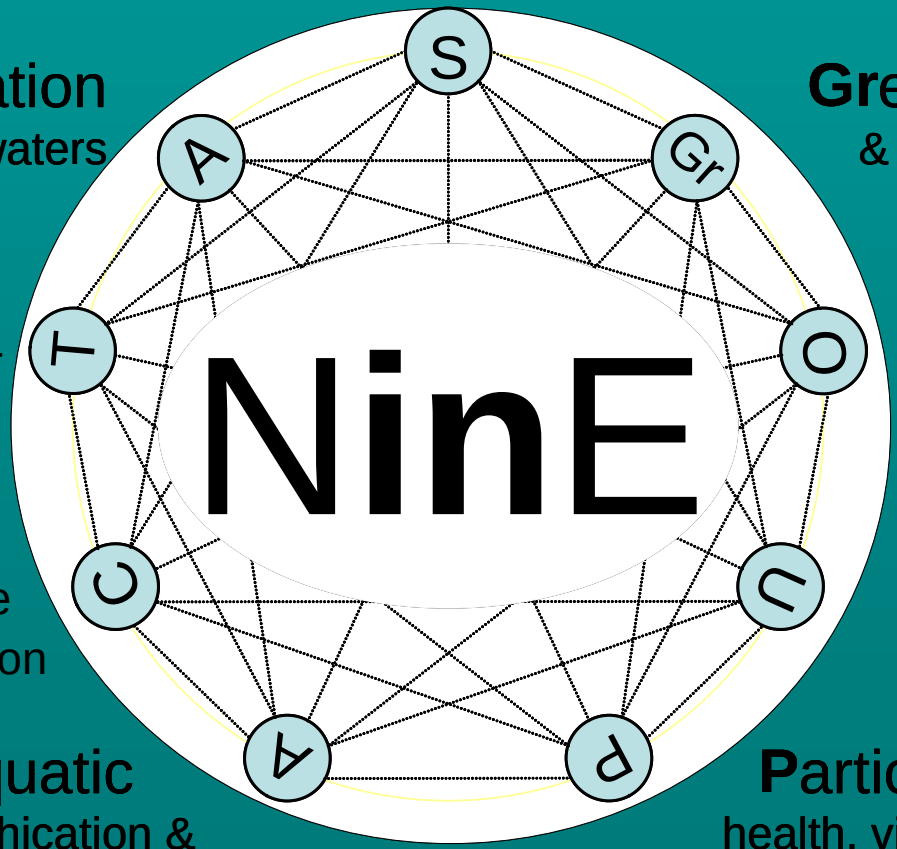
# Activities

- International Nitrogen Initiative (INI)
  - project under SCOPE/IGBP, organizing N2007 Brazil
  - Focus to address linkages and strategies in global nitrogen cycle
  - European Centre
- NitroEurope Integrated Project (NEU)
  - EC Framework 6 project 2006-2010, 62 partners
  - Effect of N on the European GHG balance
- COST 729: Nitrogen in biosphere atmosphere
  - Link transboundary air pollution and GHG problems
- Nitrogen in Europe (NinE)
  - ESF framework programme
  - Assessing links between the 9 challenges of excess N
  - Will prepare European Nitrogen Assessment Report

Access point: www.nitroeurope.eu

NitroEurope IP

# NinE Nitrogen in Europe (ESF)




**S**tratospheric
chemistry and ozone

**A**cidification
of soils & waters

**Gr**eenhouse gas
& global warming

**T**errestrial
eutrophication &
biodiversity

**O**zone
vegetation
& health

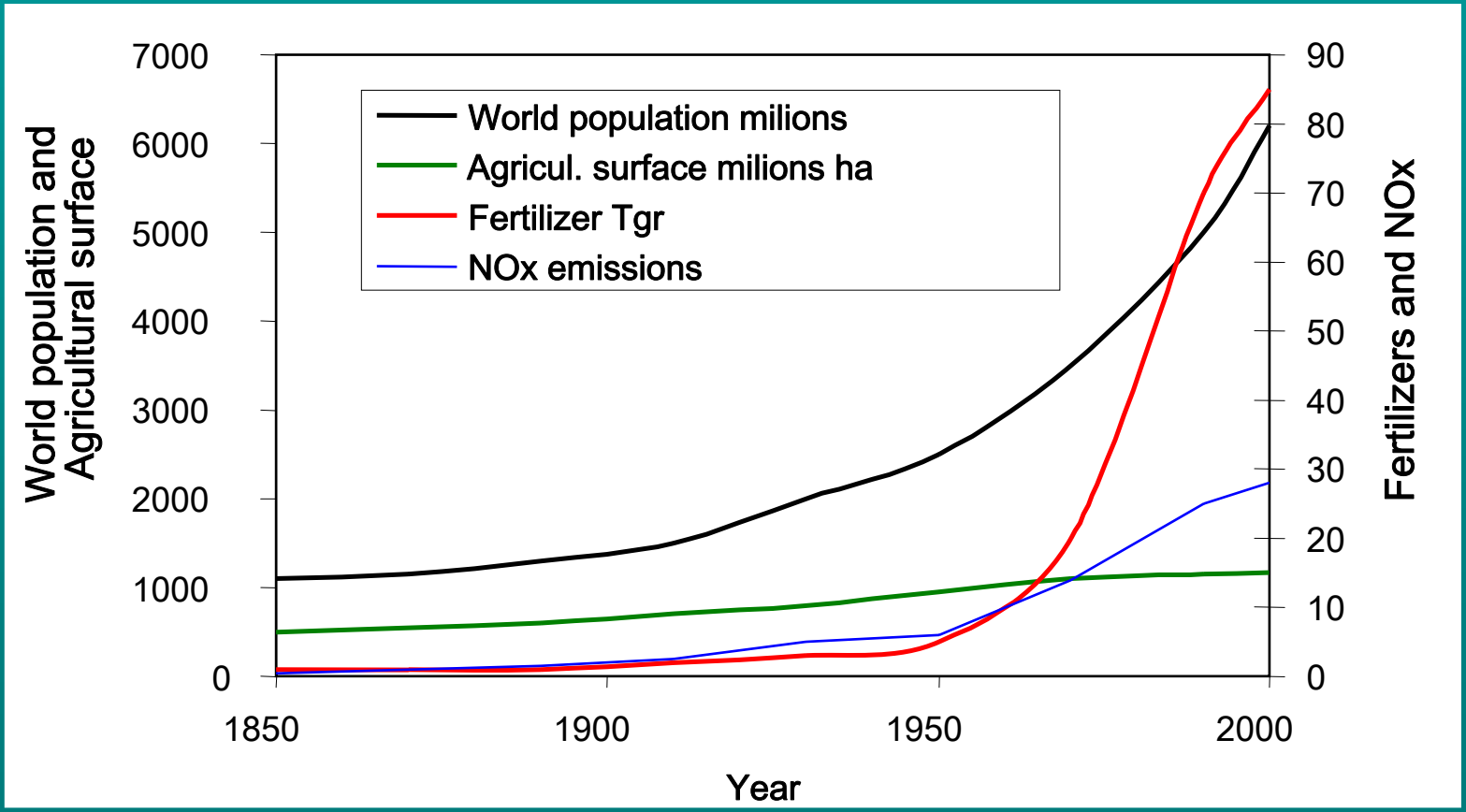
**Coastal**
& marine
eutrophication

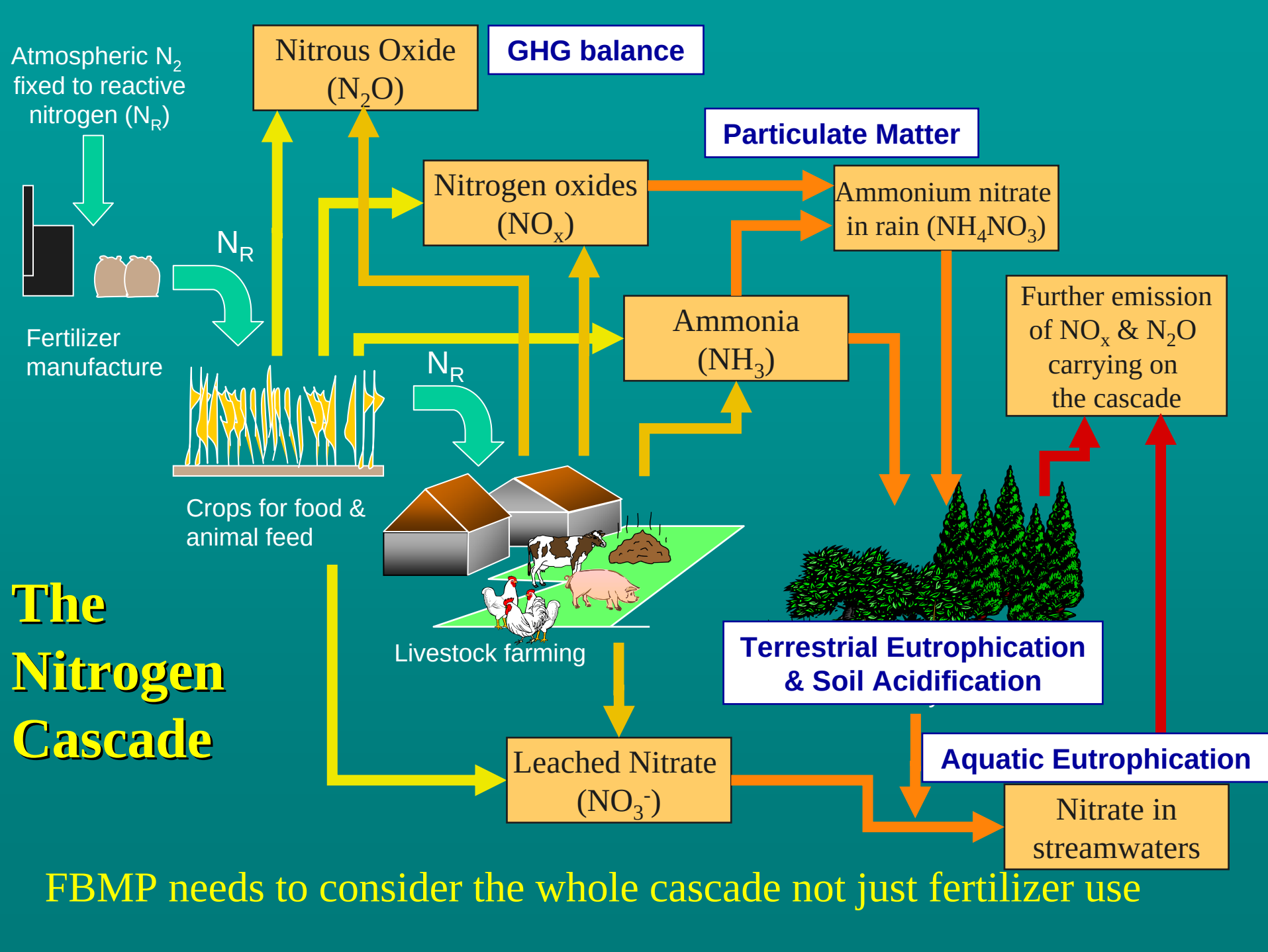
**U**rban
air quality
& health

**A**quatic
eutrophication &
water quality

**P**articles
health, visibility
& global dimming

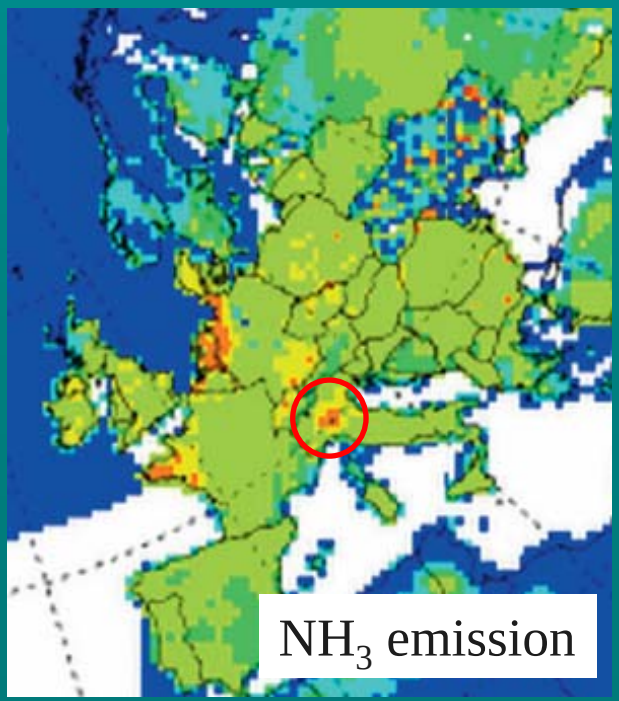
# Global increase in amounts of nitrogen




Atmospheric $N_2$ fixed to reactive nitrogen ($N_R$)
Nitrous Oxide ($N_2O$)
GHG balance
Particulate Matter
Nitrogen oxides ($NO_x$)
Ammonium nitrate in rain ($NH_4NO_3$)
$N_R$
Fertilizer manufacture
Ammonia ($NH_3$)
Further emission of $NO_x$ & $N_2O$ carrying on the cascade
$N_R$
Crops for food & animal feed
Livestock farming
Terrestrial Eutrophication & Soil Acidification
Aquatic Eutrophication
Leached Nitrate ($NO_3^-$)
Nitrate in streamwaters
The Nitrogen Cascade
FBMP needs to consider the whole cascade not just fertilizer use

# Ammonia contributes substantially to particulate matter (PM) concentrations

- Reduced visibility
- Human heath impacts

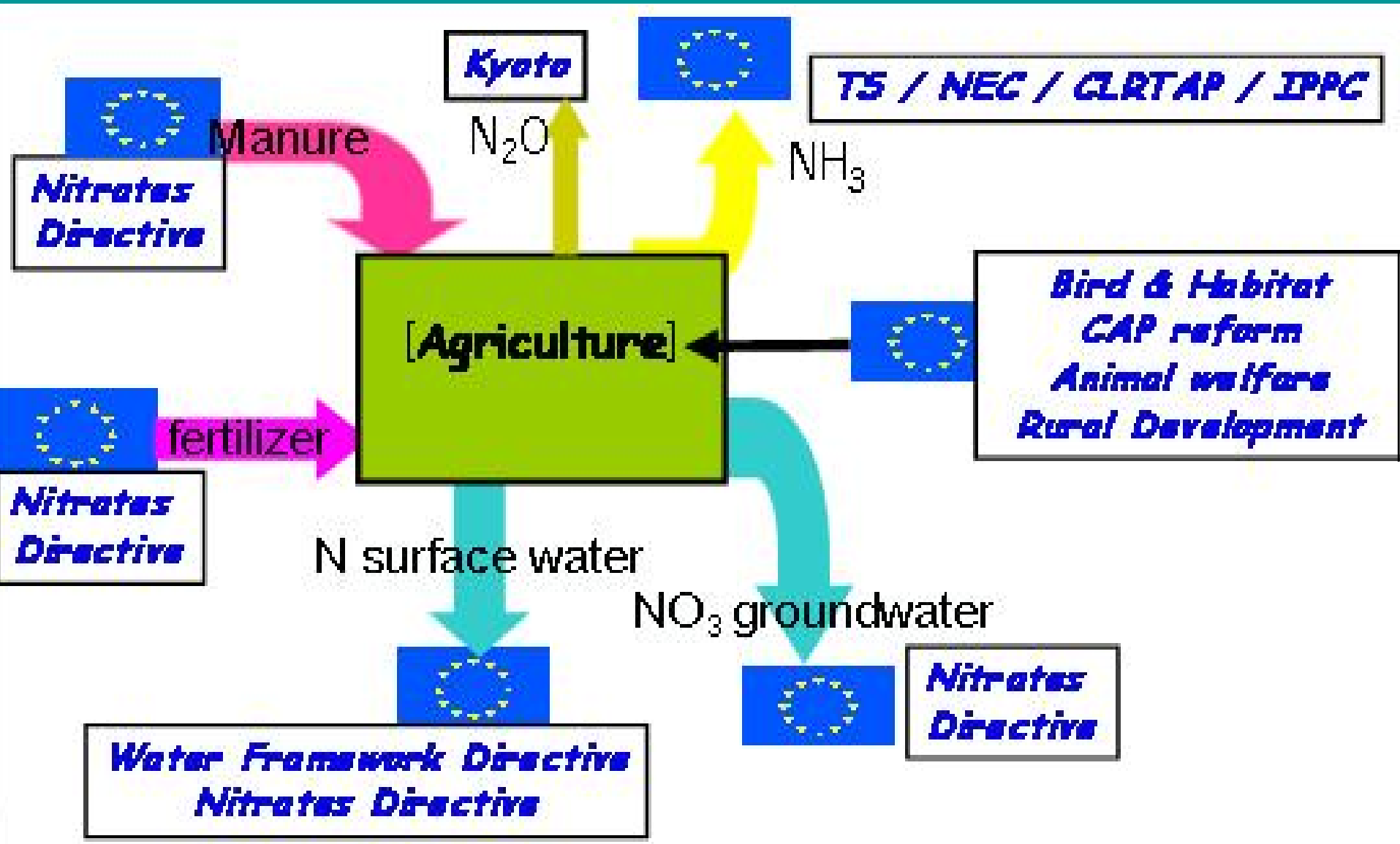



Parma, Emilia Romagna, Italy

# Tool box of policy instruments

- Economic instruments
  - taxes & subsidies
  - price support
  - import/export tarifs
  - tradable rights and quotas
- Communicative instruments
  - agricultural extension service
  - education, demonstration and persuasion
  - co-operative approaches
- Regulatory measures
  - public land use planning (zoning/spatial planning)
  - pollution standards and national emissions
  - prohibition of particular agricultural production methods

# Multiple EU policies affect nitrogen in agriculture

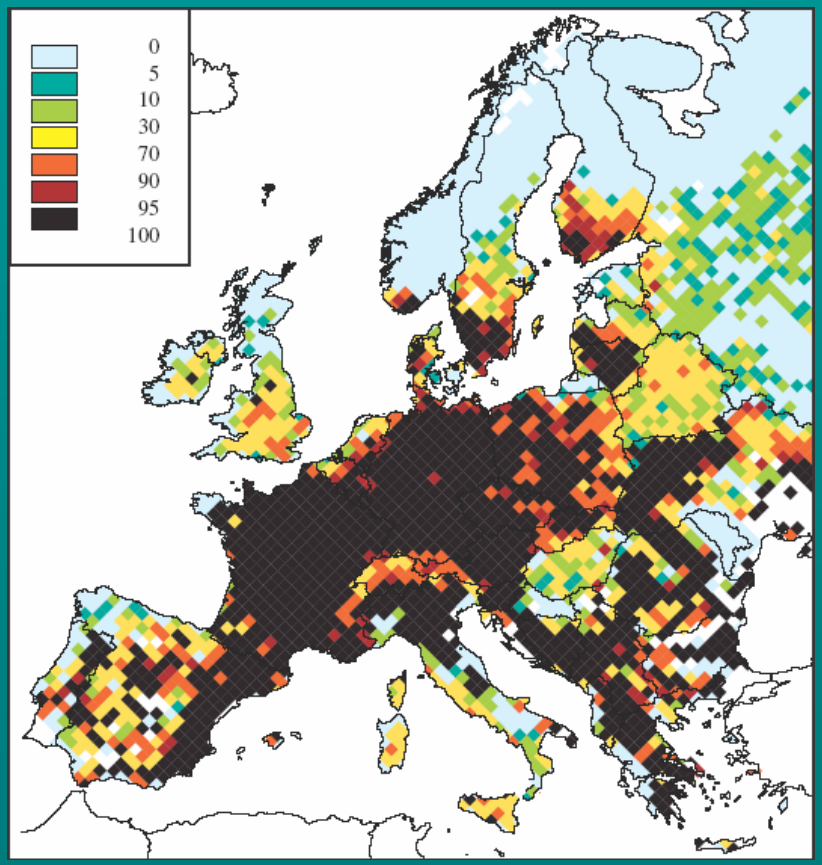


# Transboundary Air Pollution from Agriculture

- UNECE Gothenburg Protocol and EC National Emissions Ceilings Directive
- Ammonia targets as national emissions for 2010, currently under review
- Effects-based, but not so high ambition
- Some countries got exemptions (e.g. Spain)
- Mandatory-voluntary COGAP to reduce $NH_3$ emissions
- Full ban on ammonium carbonate; debated ban on urea use - cheap measure on cost curves

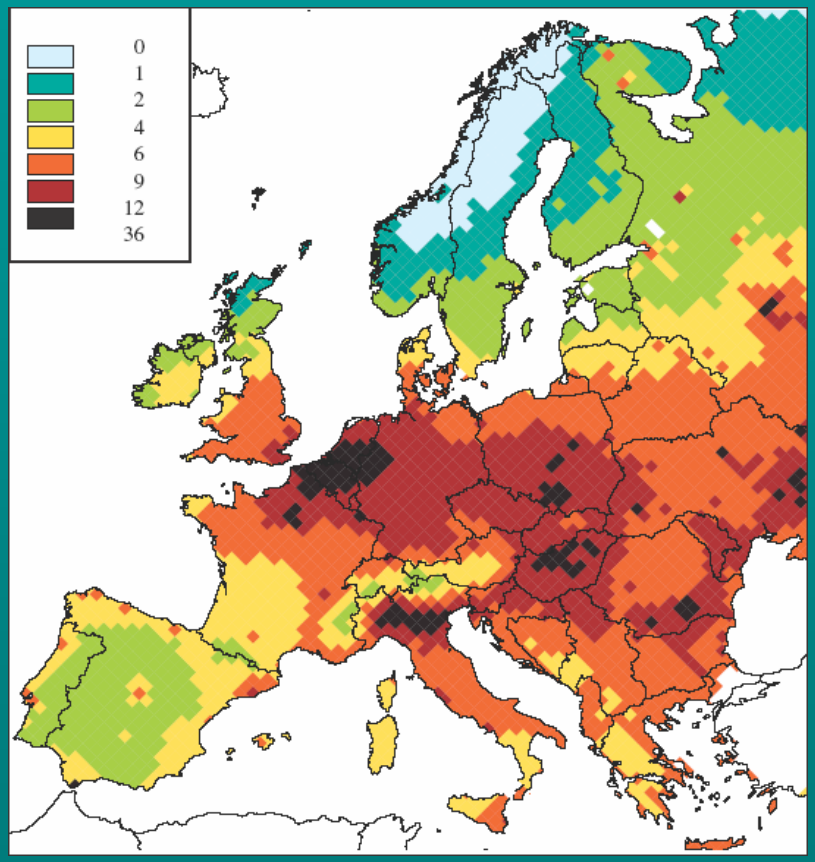
# Predicted effects across Europe

Critical load exceedance
for N effects on ecosystems




% of ecosystems area with grid average N deposition > eutrophication critical loads (for 2000)

Loss in life expectancy
attributable to $PM_{2.5}$




Loss in average life expectancy in months due to identified anthropogenic $PM_{2.5}$ (for 2000)

IIASA

# Lack of integration between regulations

- Ammonia abatement– some measures may increase nitrates emissions and nitrous oxide emissions (need to quantify)
- Nitrates abatement– some measures may increase ammonia emissions (e.g. winter closed period)
- Need for a more integrated approach.  Targeted on balanced N supply, but other measures needed

# Integrated Pollution Prevention and Control (IPPC) Directive

- Industrial approach to pollution control, using installation permits and Best Available Techniques (BAT)
- Pig farms above 2000 fatteners, 750 sows; poultry above 40,000 birds
- In principle integrated, (inc energy, noise etc), but most focus on $NH_3$
- BAT does not relate to specific emission targets
- Debate on inclusion of field spreading of manures!
- Link between IPPC and Habitats Directive and the loophole
- Not all N sources considered – possible unfairness
- Debate on extending IPPC to large cattle farms (e.g. >500 animals)

# Benefits & challenges of regulatory approaches

- Benefit
- Can be clearly focused on specified environmental targets
- Clear basis for international agreements

- Challenge
- Develops a confrontational approach with industry, including governments in “policing role”
- Regulation overload for farmers…

# Need to agree $N_r$ pollutant priorities

- Where there are trade offs between pollutant control, which form of $N_r$ loss should have the priority?

| | General | Global | Transboundary | National | Local |
|---|---|---|---|---|---|
| Acidification from $NH_3$ | 1 | - | 1 | 2 | 1 |
| Eutrophication from $NH_3$ | 1 | - | 2 | 1 | 1 |
| $NH_4^+$ aerosol as a global coolant | - | 1 | - | - | - |
| Effect of $NH_3$ on atmos. transport of $SO_x$ & $NO_y$ | - | 2 | 2 | 3 | - |
| Global warming from $N_2O$ | 1 | 1 | - | - | - |
| $NO_3^-$ leaching | - | - | - | - | 2 |

Results of DELPHI analysis by Angus et al. (J. Env. Man. 2003)

# Voluntary Approaches

- Government-led Codes of Good Agric Practice
  - Sensible approaches, but question of how much is achieved
- Industry-led initiatives
  - FBMP – excellent contribution; to be encouraged
  - Stewardship and product labelling – encouraging public involvement
  - So far most labelling is animal and human health focused: challenge to raise the profile of $N_r$ and environmental issues.

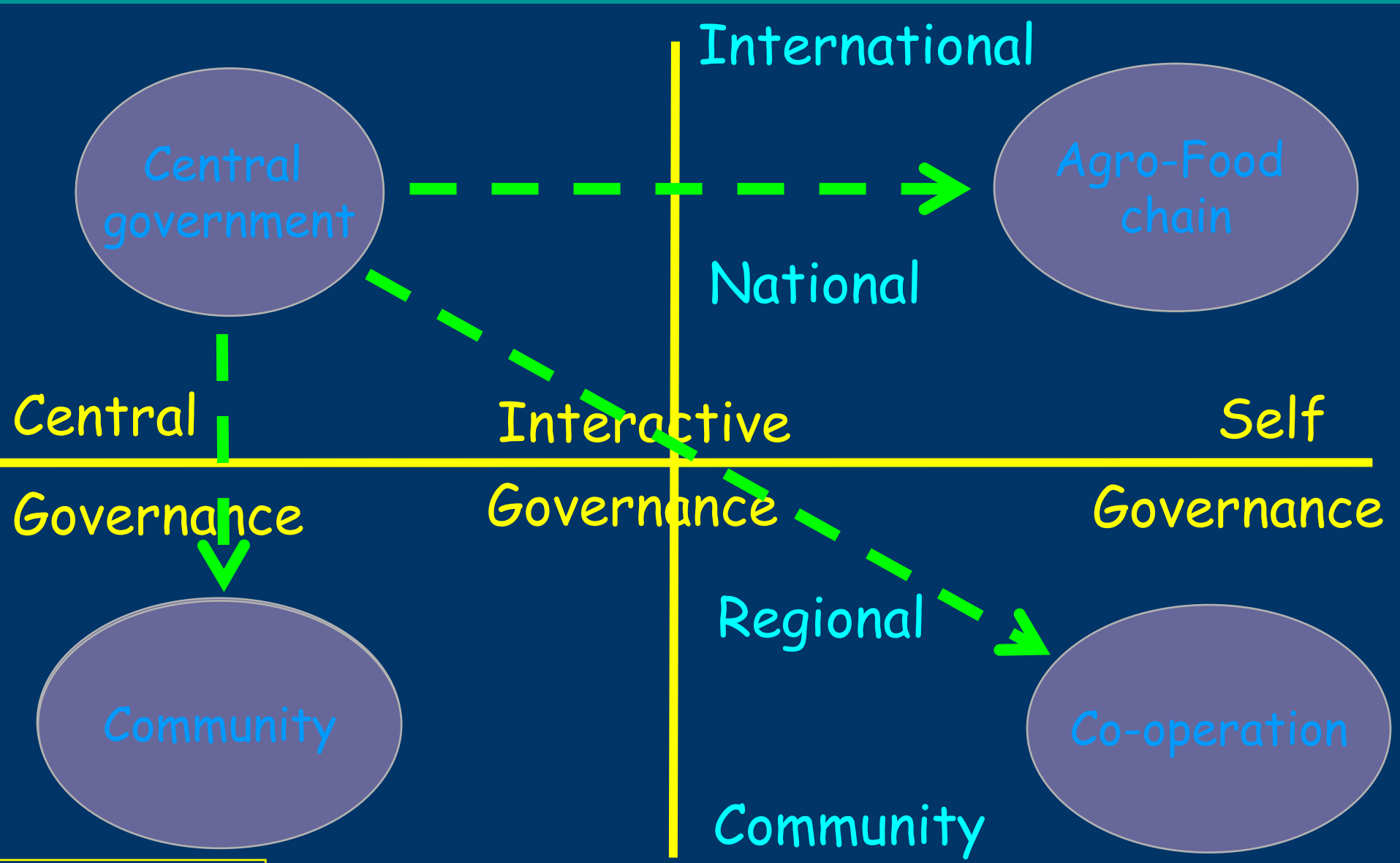
# Need for greater use of economic incentives

- Contradiction in agriculture:
  - CAP support makes strong link to wildlife and countryside management
  - CAP currently weak link to better nutrient management and reducing $N_r$ emissions
  - IPPC even has agriculture paying for pollution control: “polluter pays principle” applies.
- Rural Development Programmes:
  - Potential for incorporating N management issues
  - E.g. Austria, includes RDP funding for measures to reduce $NH_3$ emissions.

# Finding the appropriate mix of instruments

- Overall Europe strongly regulation led. Provides clear focus, but confrontational and potential regulation overdose
- Governments need to encourage industry-led voluntary initiatives in partnership.
  Potential for innovative and optimised solutions.
- These should be supported by better integration of nutrient pollution issues into economic incentives of CAP and RDPs.

# Policy Strategy and Scale



# Question 1 to governments/society

- **What are the specific targets we agree on to reduce nitrogen emissions and impacts?**
- Agri-food chain can make improvements, but are these enough?
- Need to find consensus on quantified environmental targets and priorities between N forms and problems.
- Need to know whether voluntary achievement is a “drop in the ocean”, or the main way to meet targets.

# Question 2 to governments/society

- **How can we adequately monitor the achievement of measures and environmental outcomes?**
- Difficulty to report achievement in the needed form is a central limitation to the adoption of more flexible voluntary approaches.
- Must be able to monitor contribution of measures to international conventions (e.g. GAP, FBMP in Gothenburg Protocol)
- Need to encourage regulators to focus more on international commitments that are measured in terms of environmental outcome.