

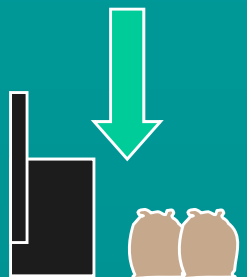


Integrated Nitrogen Activities in Europe

Workshop: TFIAM/COST729/NinE
Workshop on integrated Modelling of Nitrogen

Mark Sutton
CEH Edinburgh, INI European Centre

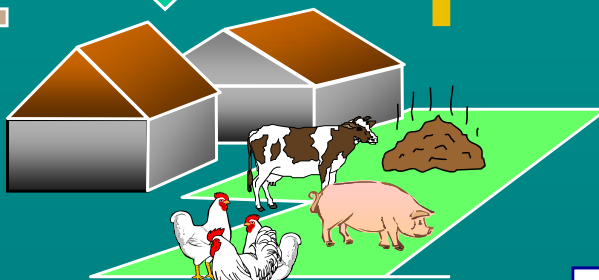
Atmospheric N_2 fixed to reactive nitrogen (N_R)



Fertilizer manufacture



Crops for food & animal feed



Livestock farming

Nitrous Oxide (N_2O)

GHG balance

Nitrogen oxides (NO_x)

Particulate Matter

Ammonium nitrate in rain (NH_4NO_3)

Ammonia (NH_3)

Further emission of NO_x & N_2O carrying on the cascade

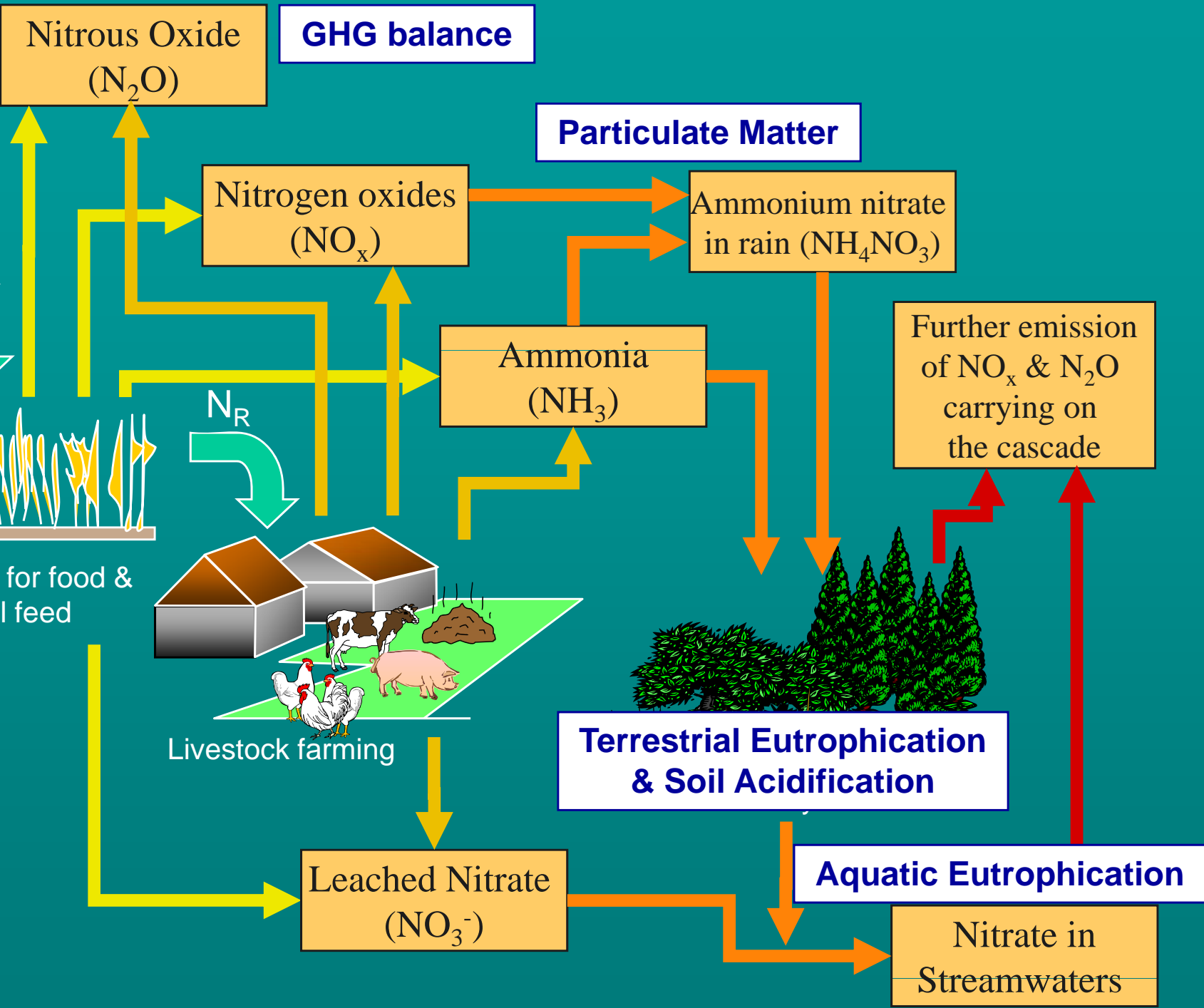
Terrestrial Eutrophication & Soil Acidification

Aquatic Eutrophication

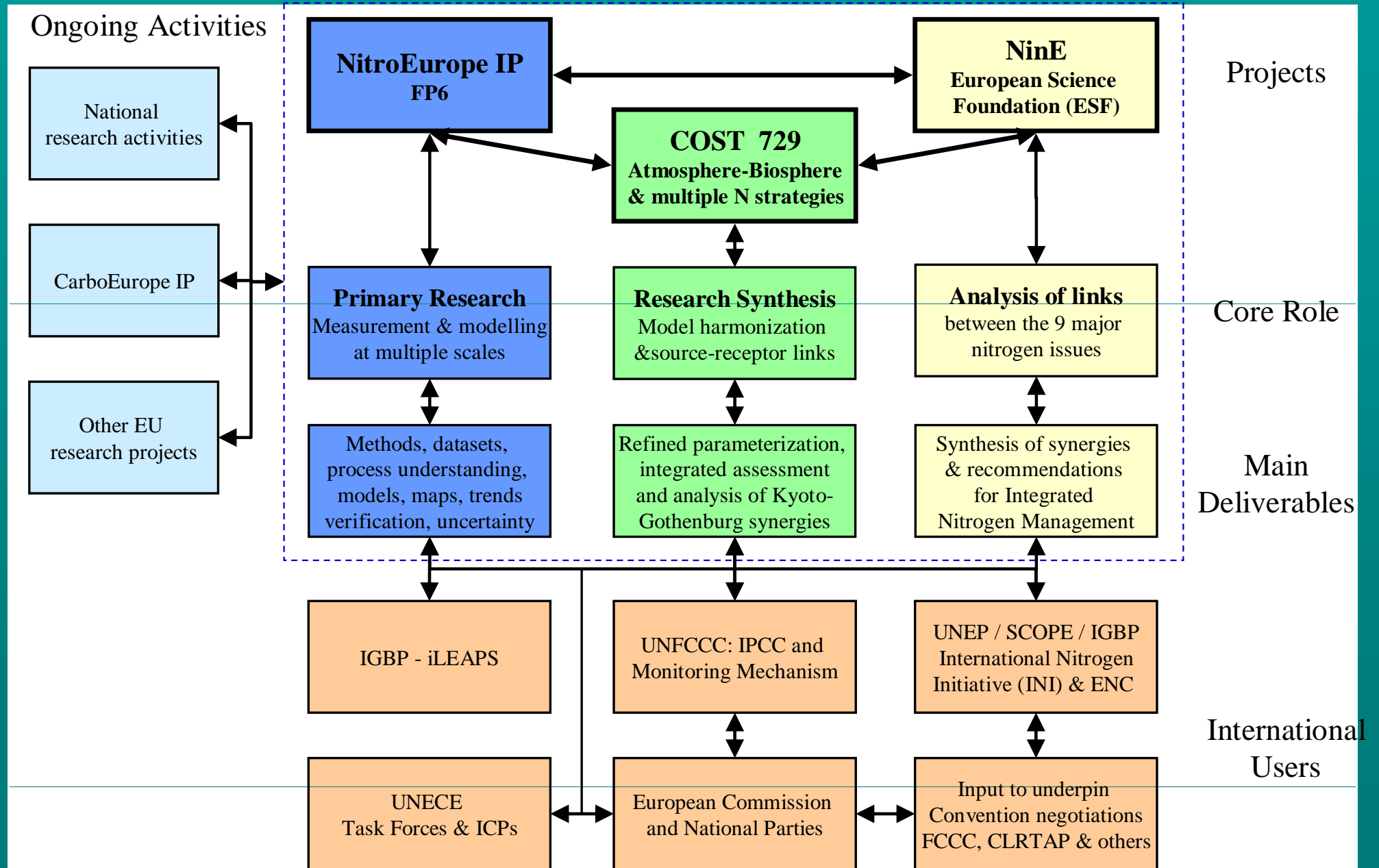
Leached Nitrate (NO_3^-)

Nitrate in Streamwaters

The Nitrogen Cascade



Developing an integrated approach: The Building Blocks



NitroEurope IP



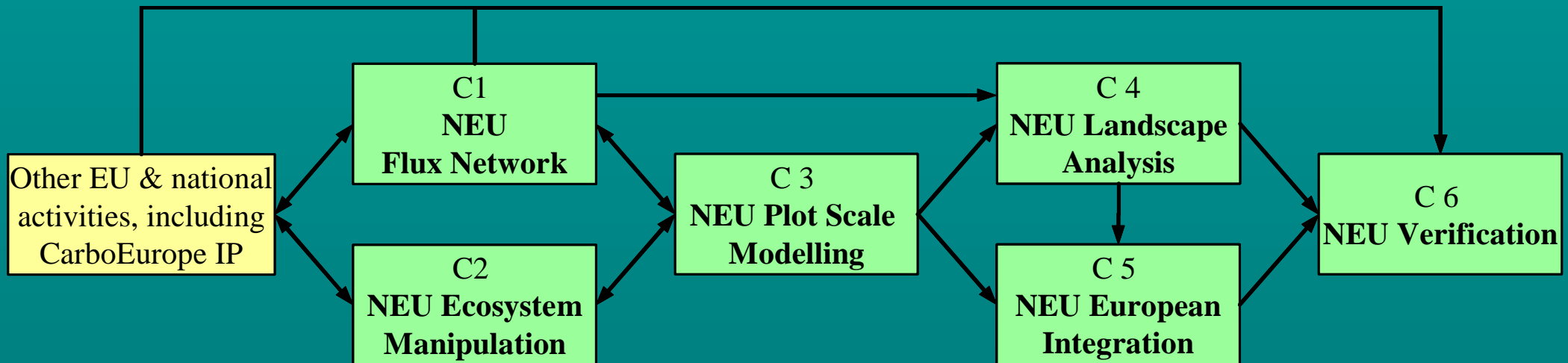
What is the effect of reactive nitrogen supply on the direction and magnitude of net greenhouse gas budgets for Europe?

Effect of N on the GHG balance:

↑ GHG	?	↓ GHG
N₂O (+2' from NH ₃ , NO ₃ ⁻)	Cattle CH₄	C uptake by plants
CH₄ from wetlands	SOM decomposition	Nitrogen aerosol
NO_x → O₃ → less primary production		

NitroEurope

Overall Science Structure



Plus four supporting components:

C7. Standards and Data Management

C8. NEU Management

C9: NEU Training

C10: NEU Dissemination

NitroEurope: Flux network (C1) & Manipulation network (C2)

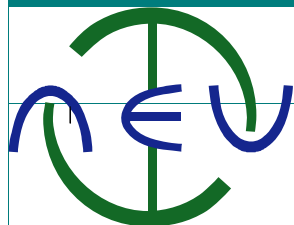
13 Super Sites

9 Regional Sites

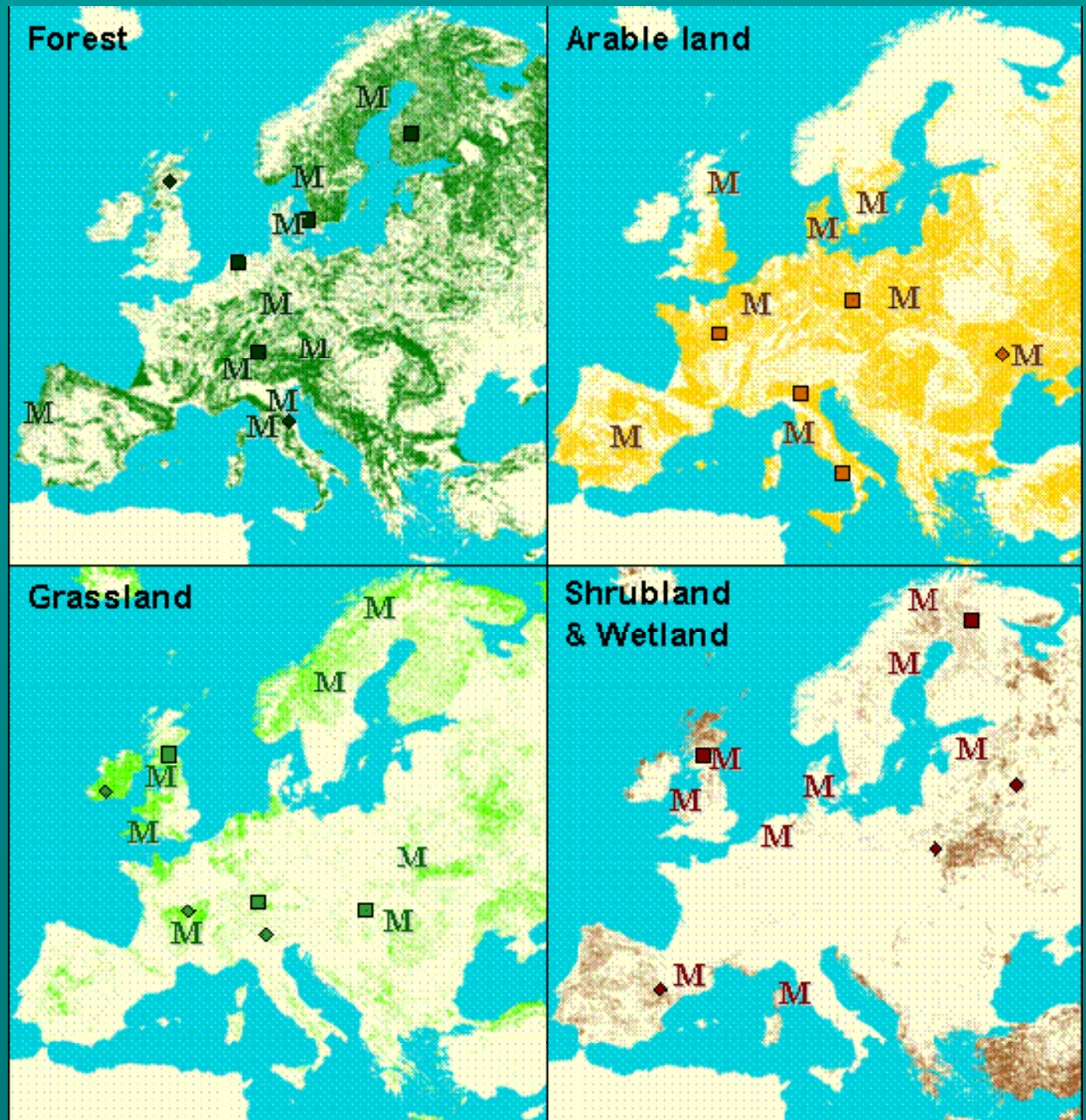
55 Inferential Sites

22 Core Manipulation Sites

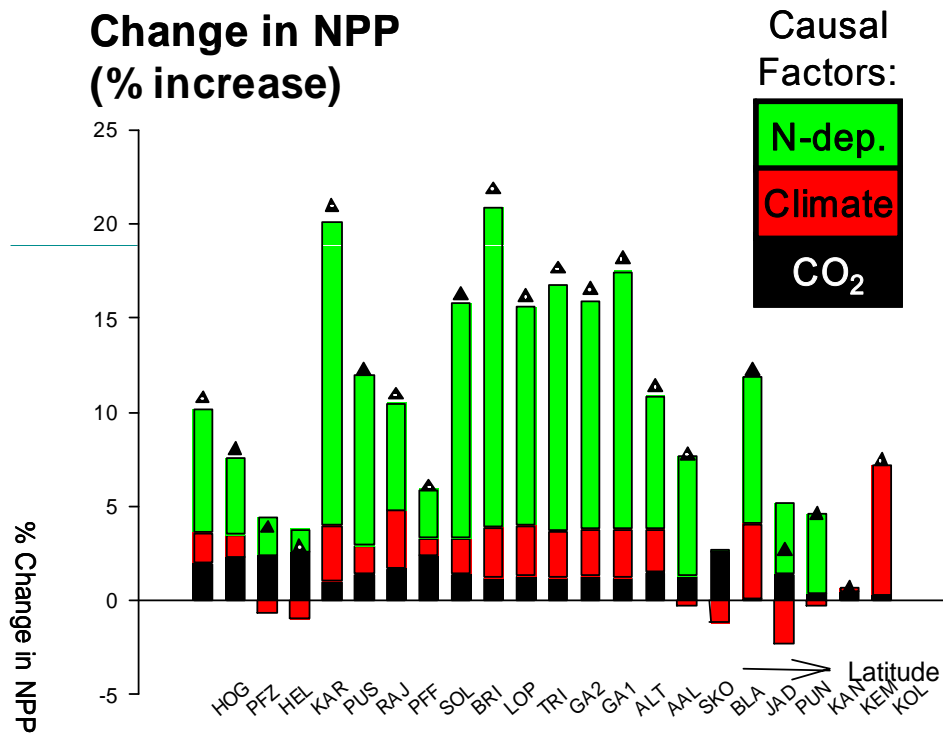
14 Assoc. Manipulation Sites



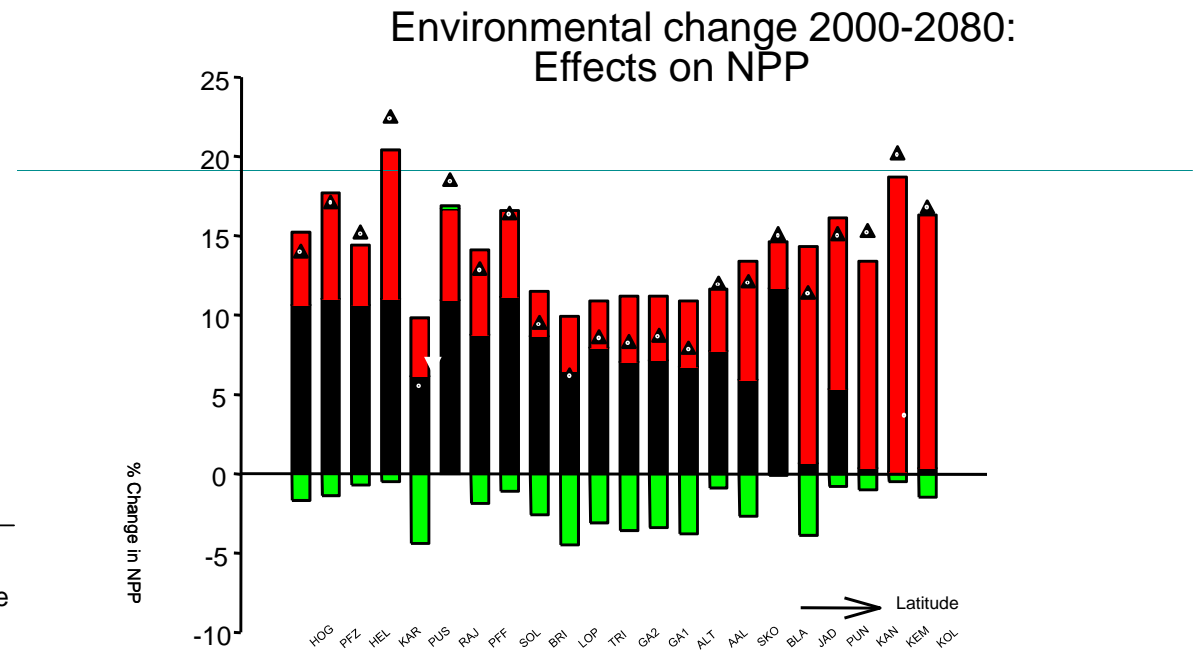
NitroEurope IP



Multi model comparison at European forest sites (RECOGNITION)



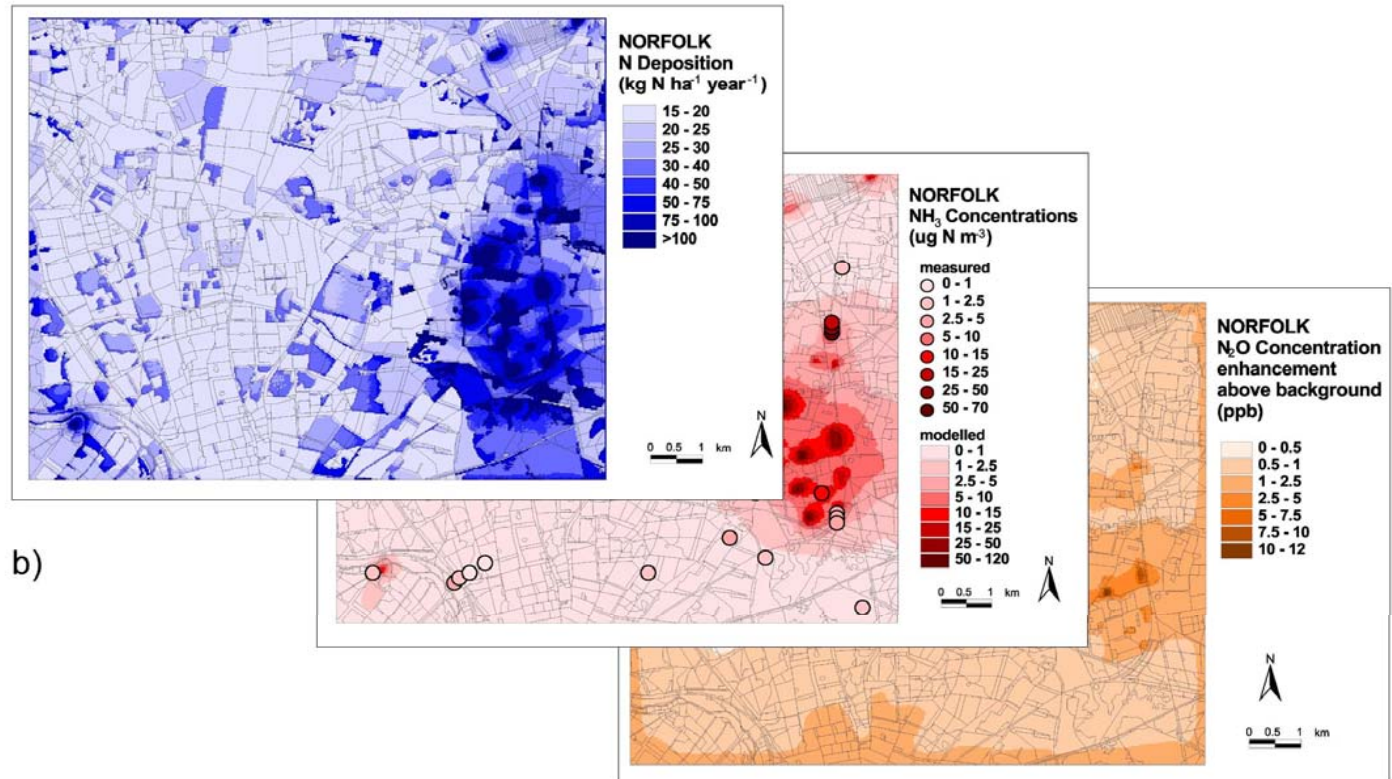
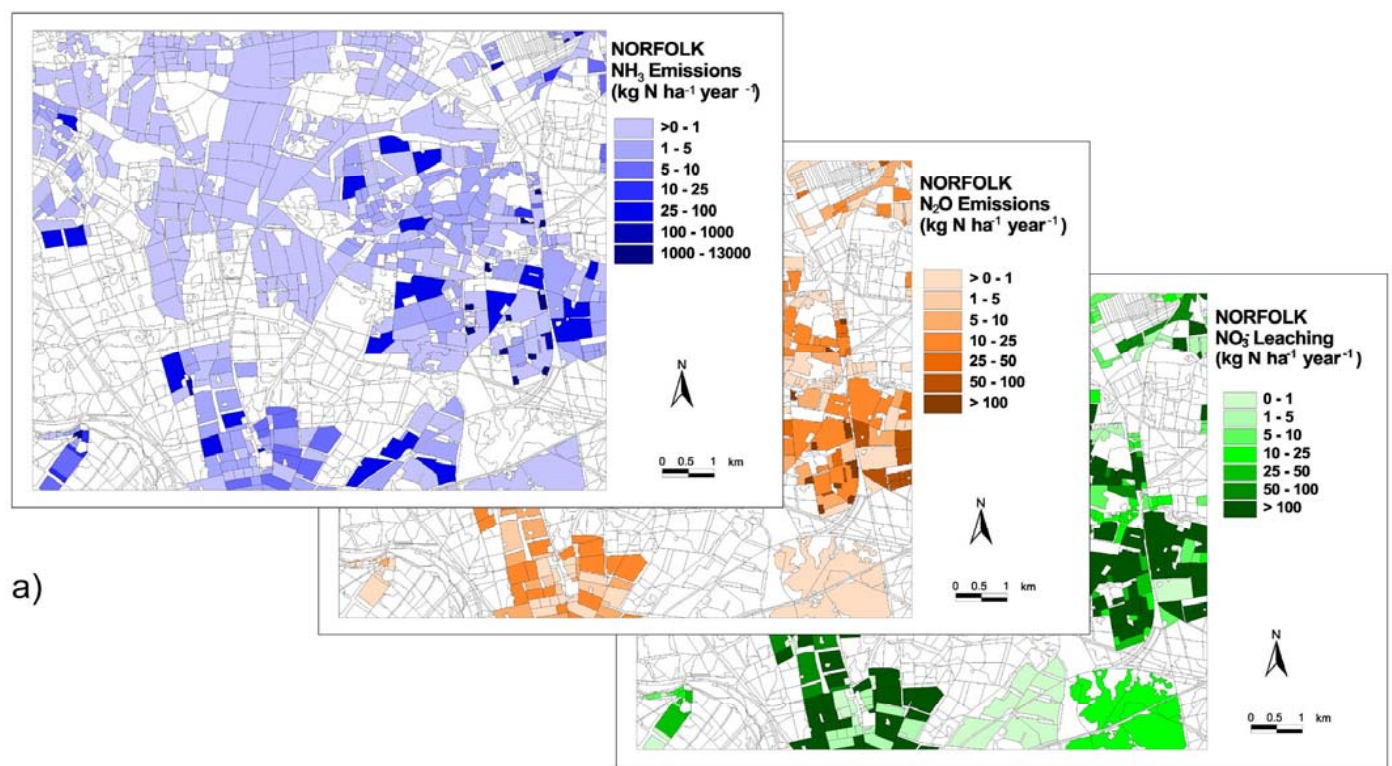
20th Century



21st Century

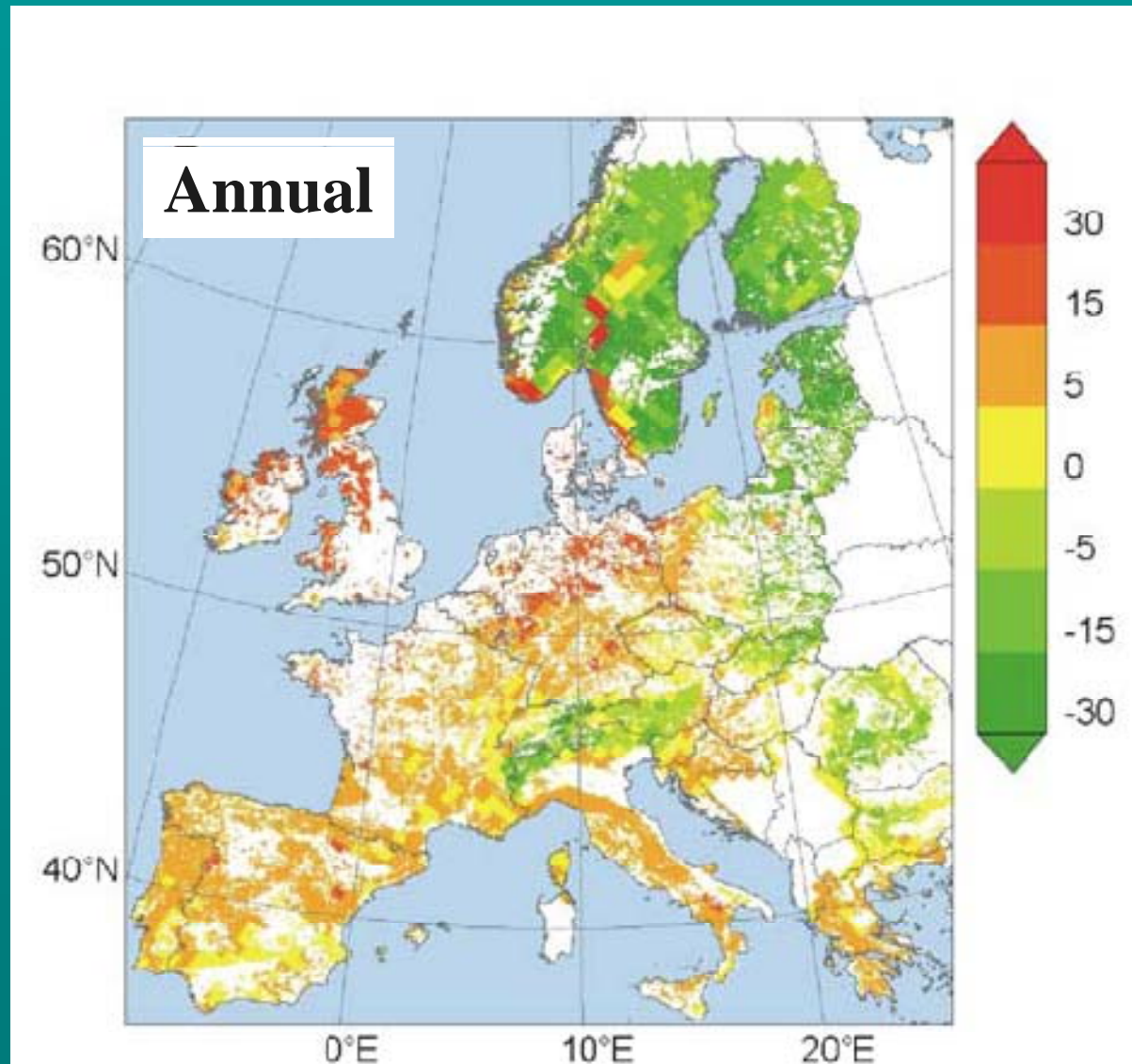
Landscape Analysis

- Spatial interactions
- Complexity
- Management interactions
- Abatement strategies



GaN₂E

Relative change in N₂O emission forest between 1990s and 2030s



The Nitrogen Challenge

- **Multi-source**
agriculture, fossil fuel, natural
- **Multi-pollutant**
 N_2O , NO_x , NH_3 , aquatic NO_3^- , aerosol etc
- **Multi-problem**
GHG balance, biodiversity, water quality, human health
- **Multi-receptor**
Forests & other terrest. ecosystems, agriculture, rivers, stratosphere, urban, coastal & marine, humans

European Nitrogen Assessment

- **Major Sponsor:** ESF Nitrogen in Europe (NinE)
- **Coordination:** International Nitrogen Initiative (INI) European Centre
- **Reported to:** International Conventions on climate, air, water, biodiversity under the lead of the UNECE Task Force on Reactive Nitrogen (TFRN)
- **Timing:** Planning 2007; Workshops and chapters 2008-09. Delivery 2010.
- **Contributions:** Express interest via ENA website

Overall structure of the ENA - 1

1. Introduction, Scope & Objectives

A. Nitrogen in Europe: the present position.

2. European N problem in global perspective
3. N in current European policies
4. Challenge to integrated N science & policies

B. Nitrogen processing in the biosphere

5. N processes & effects in terrestrial ecosystems
6. N processes & effects in aquatic ecosystems
7. N processes & effects in coastal/marine ecosystems
8. N processes & effects in the atmosphere

Overall structure of the ENA - 2

C. Dispersion, budgets & impacts of nitrogen on different scales

9. Rural landscapes

10. Urban landscapes

11. Regional watersheds (inc. coastal & marine)

12. Atmos transport & deposition over Europe

13. Integrating N fluxes at European scale

Overall structure of the ENA - 3

D. Managing nitrogen in relation to key societal threats

Need to develop consensus on the 5 priorities!

- GHG balance
- Air quality (esp. particulate and ozone)
- Terrestrial biodiversity
- European water quality
- Soil fertility/soil quality

Overall structure of the ENA - 4

D. European N policies and future challenges

19. Future scenarios

20. Costing nitrogen in the environment

21. Integrated approaches to better N management

22. Streamlining European nitrogen management between international conventions

23. Societal choice and the European N challenge

24. Communication and dissemination

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