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Task Force on Reactive Nitrogen

Opportunities, costs/benefits & actions for nitrogen mitigation

Lead countries: UK and Netherlands

Mark Sutton and Oene Oenema
(co-chairs TFRN)

WGSR-51, Geneva
2 May 2013

éclaire
Effects of climate change on air pollution impacts and response strategies for European ecosystems

TFRN Key Topics

- Mitigation of **agricultural nitrogen**, with special attention to ammonia.
- Development of regional **nitrogen budgets** to inform full N optimization strategies
- Assessment of the relationships between **nitrogen and food** choices
- Awareness and knowledge building on **nitrogen in EECCA** countries.
- Nitrogen options within the **green economy**.

TFRN outreach

UN says fertiliser crisis is damaging the planet

Scientists urge rich world to halve its meat consumption

The shape of nitrogen to come

An analysis reveals the huge impact of human activity on the nitrogen cycle in China. With global use of Earth's resources rising per head, the findings call for a re-evaluation of the consumption patterns of developed societies.

MARK A. SUTTON & ALBERT BLEEKER

Although Earth's atmosphere consists of nearly 80% dinitrogen (nitrogen

NO_x to the formation of ground-level ozone, which causes crop losses; increased emissions of nitrous oxide (N_2O), a greenhouse gas; and extreme levels of water pollution by nitrates

Nature doi:10.1038/nature11954

18 Feb 2013: *Independent* , *Guardian*, *Herald Tribune*, *Times of India* and 300 articles worldwide

Global Overview on Nutrient Management

Our Nutrient World

The challenge to produce more food and energy with less pollution

Prepared by the Global Partnership on Nutrient Management in collaboration with the International Nitrogen Initiative

Ammonia mitigation in agriculture – Guidance Doc

- Expert Panel on Mitigation on Agricultural Nitrogen (Canada: Bittman; Czech Republic: Dedina)
- Ammonia Guidance Document (>100 pp)
  - ECE/EB.AIR/120 at EB Decision 2012 L.9.
  - Coordinated with GP Annex IX
  - Living document – the field develops
  - Publish and disseminate glossy ‘authored’ version during 2014.
- Annex IX: left unchanged in GP review
  - Efforts needed from 2015, 2016...?

Ammonia mitigation – Updating the Framework Code

- Basis for Countries to establish their own Codes of Good Agric Practice for Ammonia (required under GP Annex IX)
- Framework code last updated 2001. Update rescheduled to take account of GP revision.
- **Framework Code Plans:**
  - Contract for support from Germany. Main document revised during 2013. (c. 20 pages)
  - Plus Glossy Leaflet Executive Summary (2014)
  - Plus longer version with pictures for internet (2014)

5 top priorities for ammonia mitigation

1. Low-emission **land application** of manure & fertilizer:
   a) Application of cattle, pig & poultry slurry & solid manure
   b) Low emission use of urea fertilizer (ban is not proposed)
2. **Animal feeding strategies** to reduce N excretion, from cattle, pig & poultry.
3. Low-emission techniques for all ***new*** **stores** for cattle and pig slurries and poultry manure.
4. Strategies to improve N use efficiencies and reduce N surpluses, with **N balances on *demonstration farms***,
5. Low-emission techniques in new and largely rebuilt pig & poultry **housing**.

Slurry spreading:

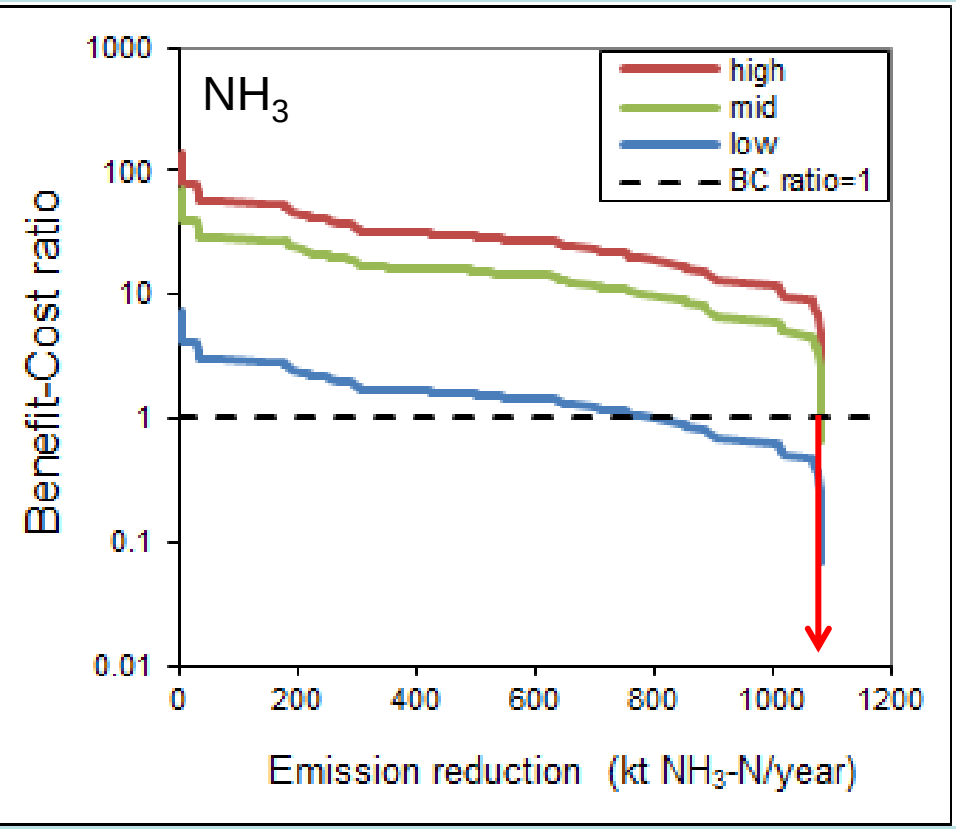
a wide range of low-emission techniques are available

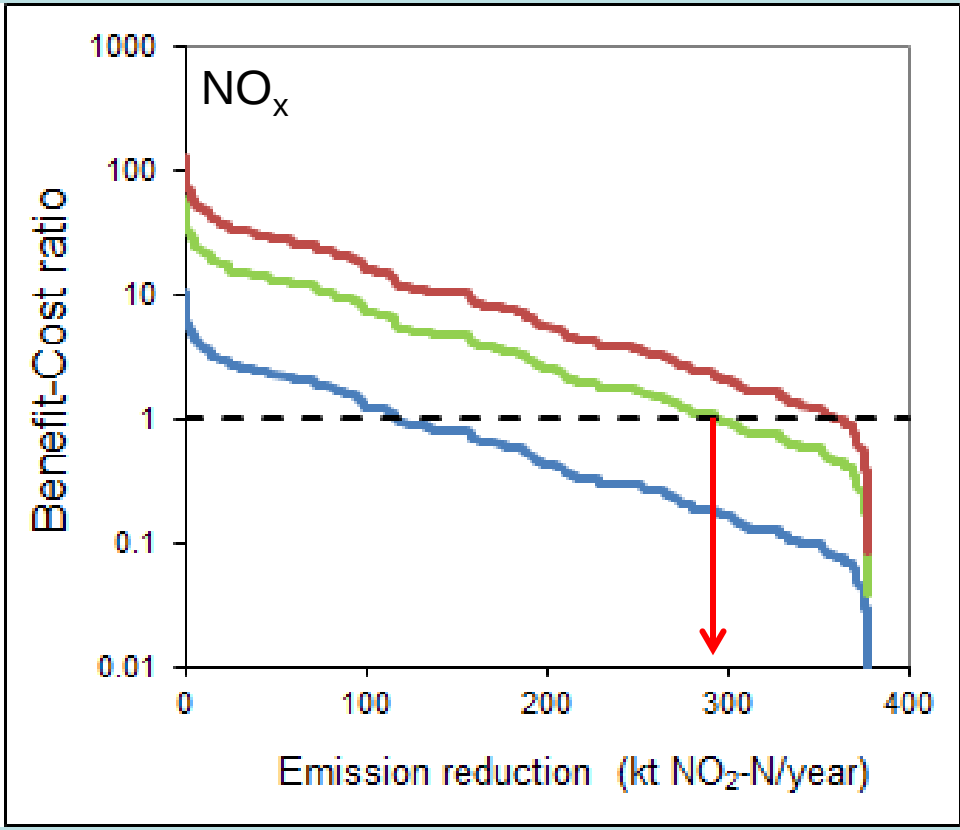
The car and the exhaust pipe…

Overview of costs of ammonia abatement measures

Measures	**Cost, €/kg NH_3-N saved**
Nitrogen management	-1.0 to 1.0
Feeding strategies	-0.5 to 1.0
Animal housing	0.0 to 10.0
Covering slurry storages	0.1 to 4.0
Slurry application	-0.5 to 3.0
Urea application	-0.1 to 4.0

EU benefit-cost ratios for NH_3 and NO_x mitigation

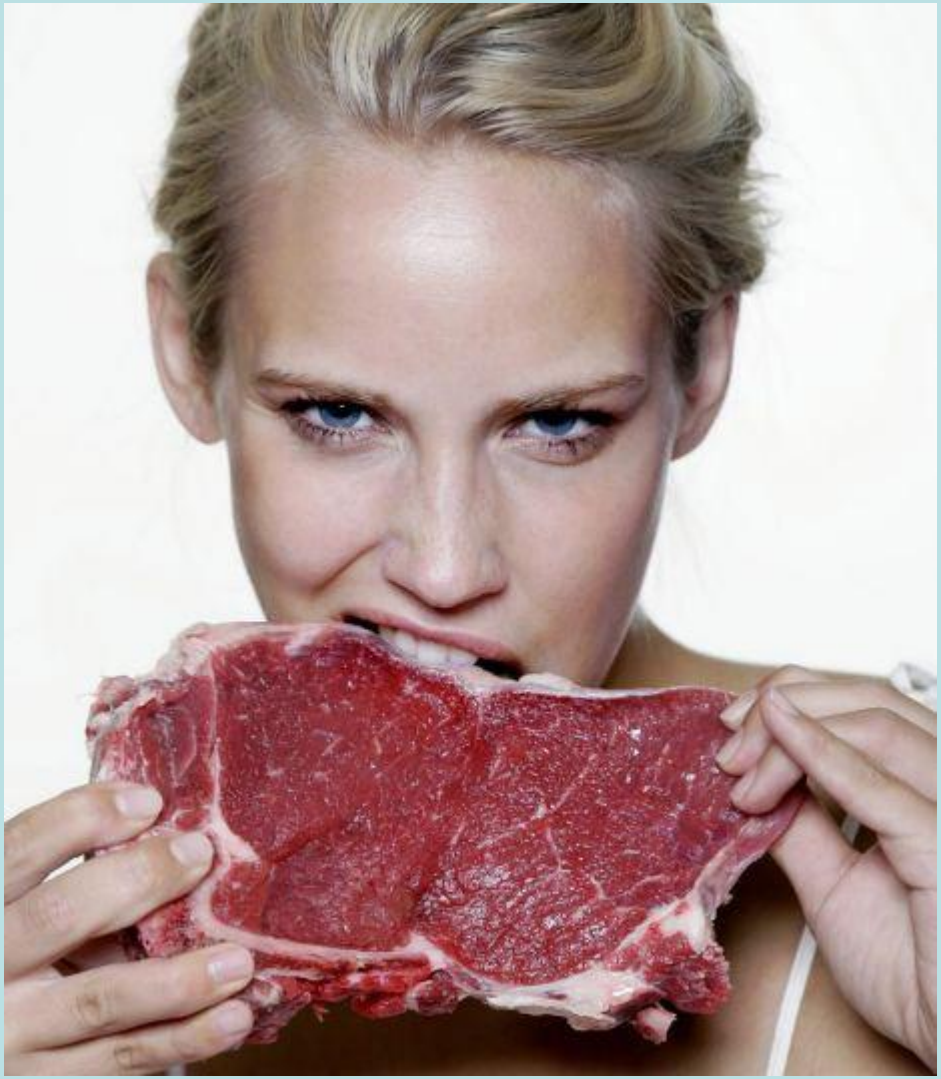




Van Grinsven et al. (*Environmental Science and Technology,* 2013)

Nitrogen Budgets

- Expert Panel on Nitrogen Budgets (Austria: Winiwarter; NL: Bleeker)
- Guidance Document on Nitrogen Budgets
  - ECE/EB.AIR/119 at EB Decision 2012 L.8.
  - Now preparing supporting annexes
  - Publish and disseminate glossy ‘authored’ version during 2015.
- Further development
  - Refining interpretive indicators
  - Mainstreaming demonstration in example countries.



£650-a-year nitrogen pollution 'could be reduced by eating less meat'

Press Comment on the *European Nitrogen Assessment*

***Metro* 10 April 2011:**

Nitrogen and Food

- Expert Panel on Nitrogen & Food (NL: Westhoek; 'Fertilizer Europe': Palliere)
- Preparation of Report on N & food choice
  - Peer review paper under review
  - ENA Special Report on Nitrogen & Food – in progress
- Future development
  - Further build quantitative scenarios on the interactions between technical mitigation options and options related to behavioural change.
  - Further linking the evidence on Nitrogen, food choice, environment and health.

Behavioural change, nitrogen & food choice

Example scenario of 50% consumption reduction

Aspect	Unit	Reference	-50% meat, dairy and eggs
Protein			
Average daily intake	g cap^{-1} day^{-1}	83	75
Proportion of animal origin	%	60%	36%
Red meat			
Average daily intake	g cap^{-1} day^{-1}	88	47
Compared with the RMDI	%	207%	107%

Westhoek and the TFRN-EPNF (under review)

Nitrogen in EECCA Countries

- New Expert Panel on Nitrogen in EECCA Countries (Chairs: Russia: Koslova, Lukin, with support DE & NL)
- Developing the N-EECCA network
  - Translated Ammonia Guidance Doc into Russian
  - Sharing techniques on nitrogen and ammonia mitigation across the EECCA region
  - Building network to contribute to TFRN workplan
- Next Steps
  - Developing the basis to support ratification of the Gothenburg Protocol.

LRTAP
Long-range Transboundary Air Pollution

TFRN Copenhagen, April 2013:
Country Reports and Lessons Learned

- Seven countries reported their progress in nitrogen related research & policy (DK, CH, FR, SP, IT, D, UK);
- Large decreases in N emissions reported by DK and CH;
- Less progress reported by FR, SP, IT, D, UK;
- Research in all countries indicate that N emissions can be decreased further; gap between practice and research;

LRTAP
Long-range Transboundary Air Pollution

Lessons learned: Continued

- Regulatory approaches versus voluntary approaches require further examination; how to improve their effectiveness?
- Following the ‘light touch’ revision of the GP for ammonia: Voluntary approaches become more important;
- Are theory and communication tools of current voluntary approaches for N management up-to-date?
- What can research and policy learn from marketing and advertisement in modern businesses?

Possible response actions

- How to communicate more effectively with farmers?
  - Stronger engagement of research with practice and extension?
  - Demonstration and pilot farms needed?
  - Farmers' study groups needed?
- How to monitor progress and accredit scientists for their efforts?
- Is a mild regime of regulation still necessary as a basis?

TFRN Outreach :

Global Partnership on Nutrient Management

Global Programme of Action for the protection of the marine environment from land-based activities.

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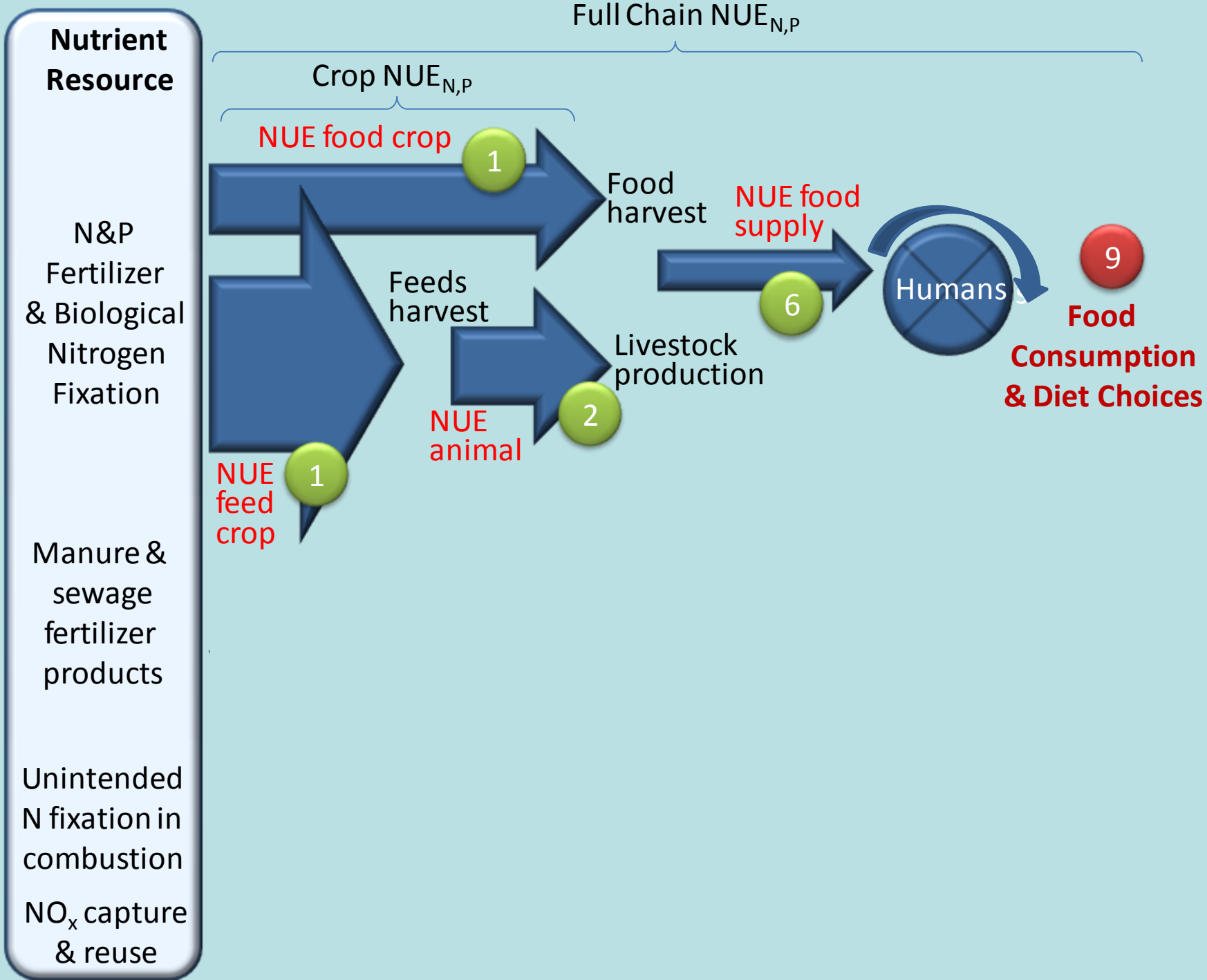
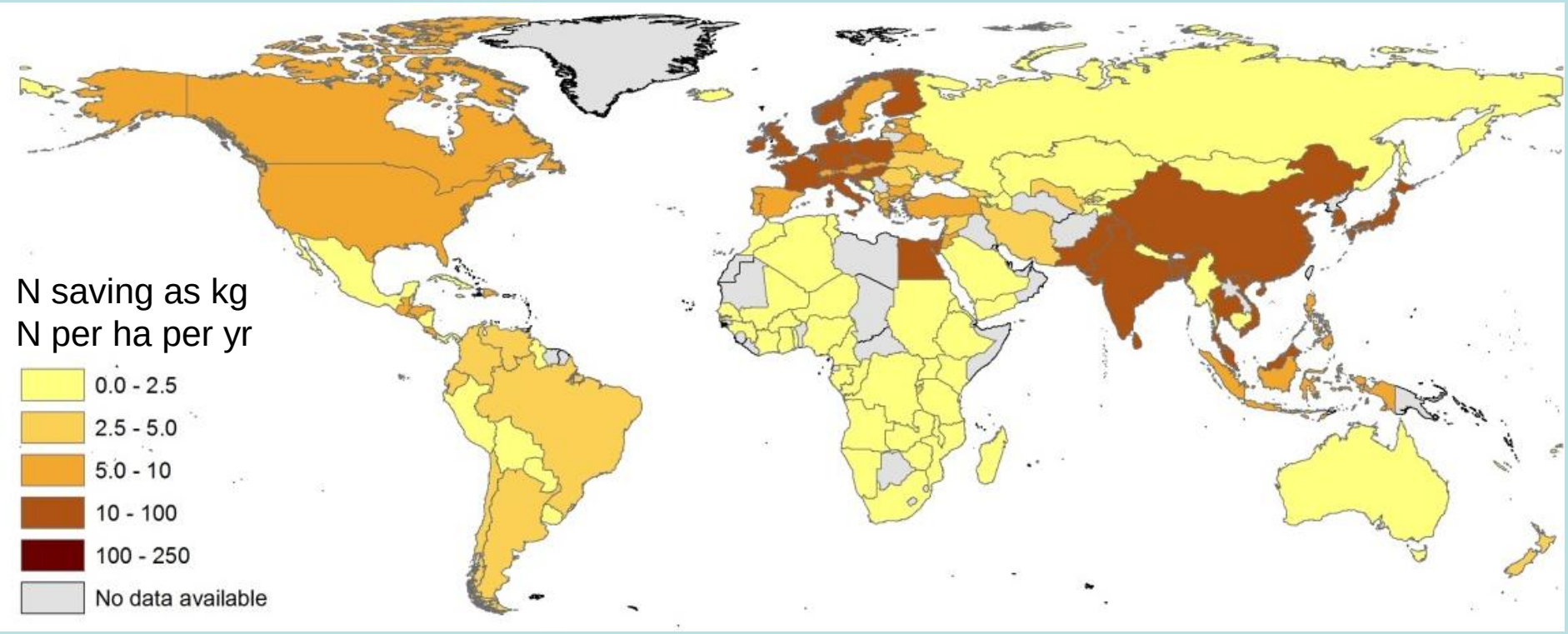

Nutrient Resource
N&P Fertilizer & Biological Nitrogen Fixation
Manure & sewage fertilizer products
Unintended N fixation in combustion
NOx capture & reuse
Full Chain NUEN,P
Crop NUEN,P
NUE food crop
1
Food harvest
NUE food supply
6
Humans
9
Food Consumption & Diet Choices
Feeds harvest
Livestock production
NUE animal
2
NUE feed crop
1

“20:20 for 2020”

20% better NUE: saving 20 Mt N per yr by 2020



Benefits expressed here as N saving / ha per year (Full-chain NUE)

Bottom line for the Green Nutrient Economy ($billion/year)

Net Benefit 170= Fert Saving 23 + Env+Health 160 –Implementation 12

Resource outlook:
Global Environment Facility

- Outline proposal (6 M USD + partner contribs.)
- Global nitrogen cycle, toward *International Nitrogen Management System (INMS)*
- **Opportunities**
  - Sharing CLRTAP experience within GPA
  - Improving indicator development, moving to operational delivery to support countries
  - Sharing and development of mitigation and management practices – understanding barriers
  - Case studies supported, including EECCA (e.g. East Baltic, Black Sea, Central Asia).