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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

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

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



Splash Plate Spreader
- 1950s technology



Trailing Hose



Trailing Shoe



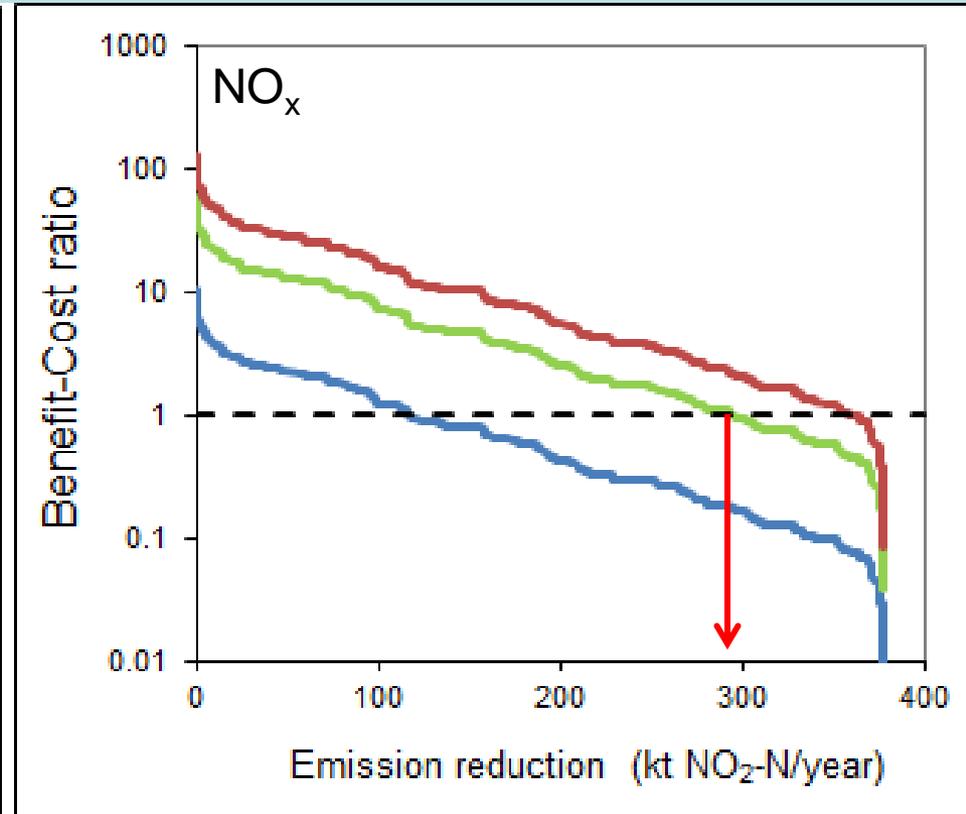
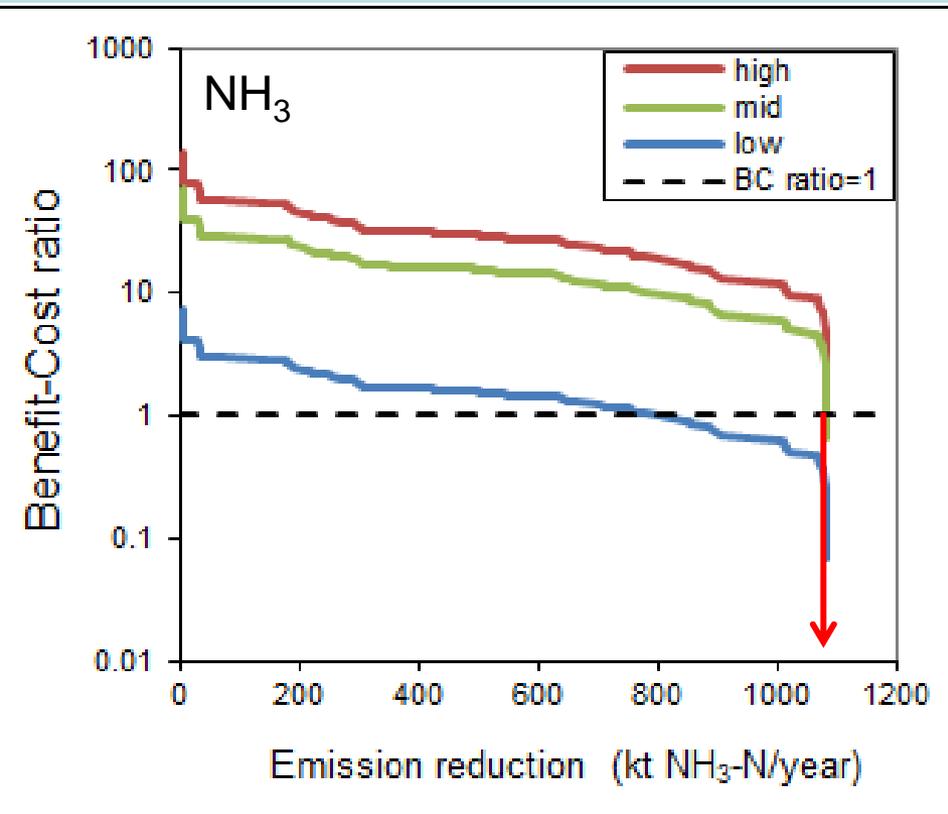
Slot Injector

The car and the exhaust pipe...

Overview of costs of ammonia abatement measures

Measures	Cost, €/kg NH₃-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.

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.



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;

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 fundamental 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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Full Chain $NUE_{N,P}$

Nutrient Resource

Crop $NUE_{N,P}$

$NUE_{\text{food crop}}$

1

Food harvest

$NUE_{\text{food supply}}$

6

Humans

9

Food Consumption & Diet Choices

N&P Fertilizer & Biological Nitrogen Fixation

Feeds harvest

NUE_{animal}

2

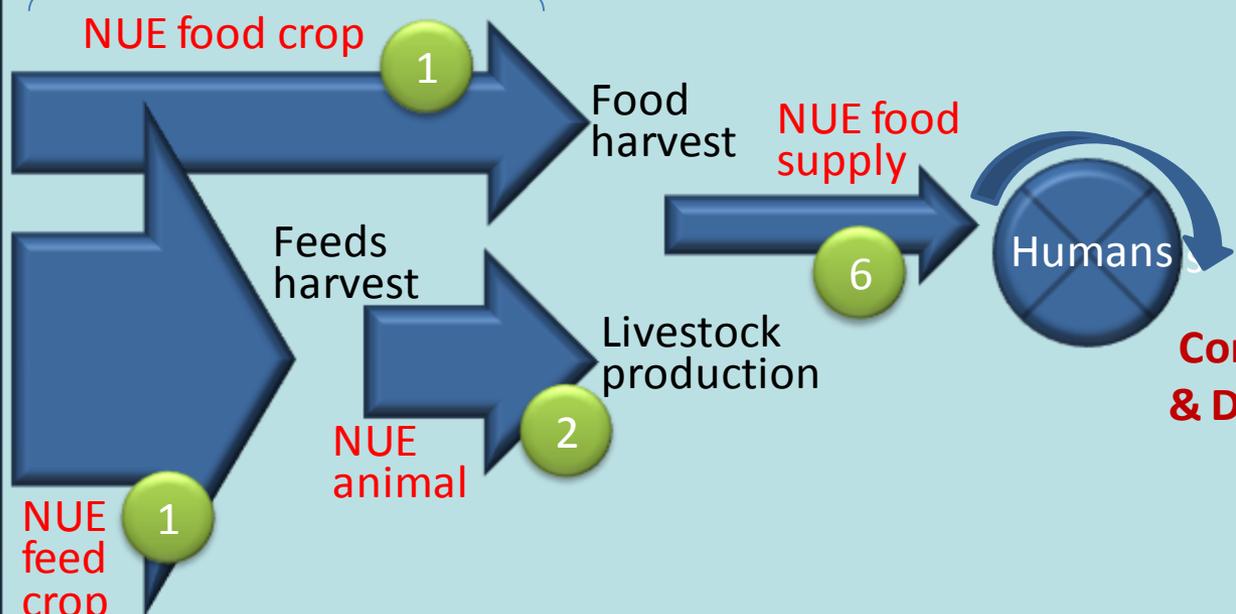
Livestock production

$NUE_{\text{feed crop}}$

1

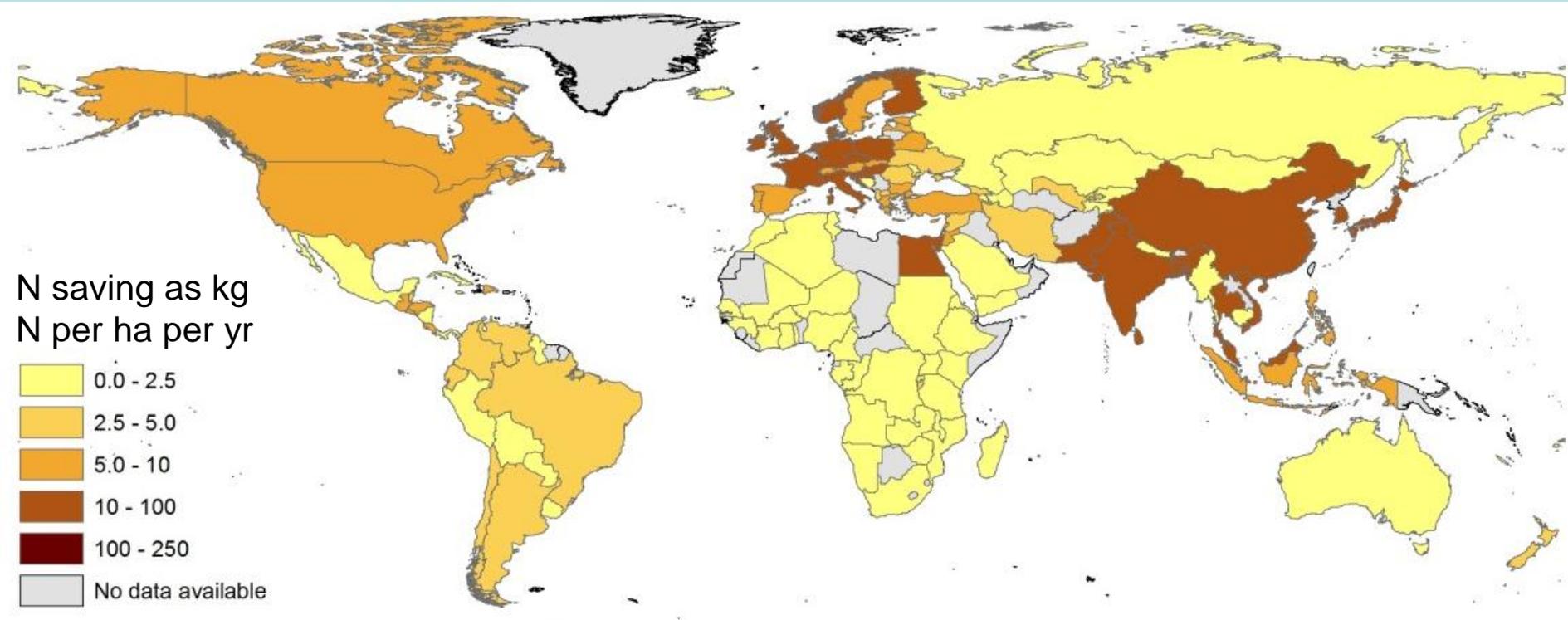
Manure & sewage fertilizer products

Unintended N fixation in combustion
 NO_x capture & reuse



“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).