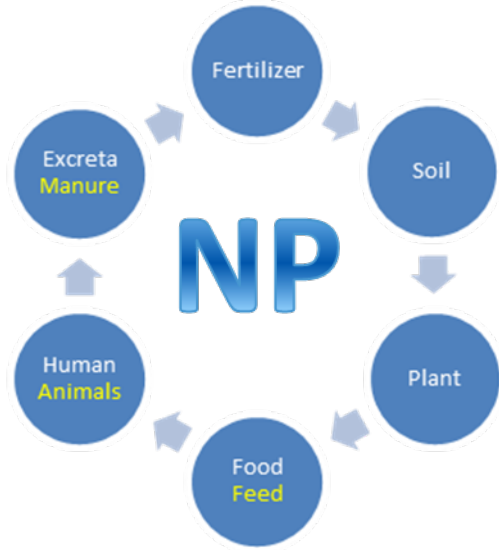


# 'Our Nutrient World'

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# Our Nutrient World

The challenge to produce more food and energy with less pollution



**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 (N<sub>2</sub>)

NO<sub>x</sub> to the formation of ground-level ozone, which causes crop losses; increased emissions of nitrous oxide (N<sub>2</sub>O), a greenhouse gas; and

*Nature* doi:10.1038/nature11954

Nutrient

Global Overview

**More environment-friendly nutrient use could save \$170bn a year**

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

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

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# Outline

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- Background
- Resources use
- Pollution by excess nutrients
- Challenges



# Background

**Plants** need 14 nutrient elements (in addition to C, H, O):  
N, P, K, Mg, Ca, S, Fe, Mn, Zn, Cu, B, Mo, Cl (Ni)

**Animals and humans** need 22 nutrient elements:

N, P, K, Mg, Ca, S, Fe, Mn, Zn, Cu, Mo, Cl, Co, Na, Se, I,  
Cr, Ni, V, Sn, As, F

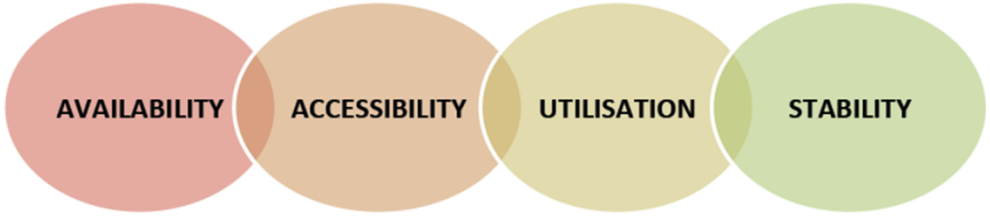
**Uneven distribution** on the globe:

1. Shortages lead to poor growth & development
2. Surpluses lead to pollution & ecosystem degradation
3. Easy accessible reserves are depleted



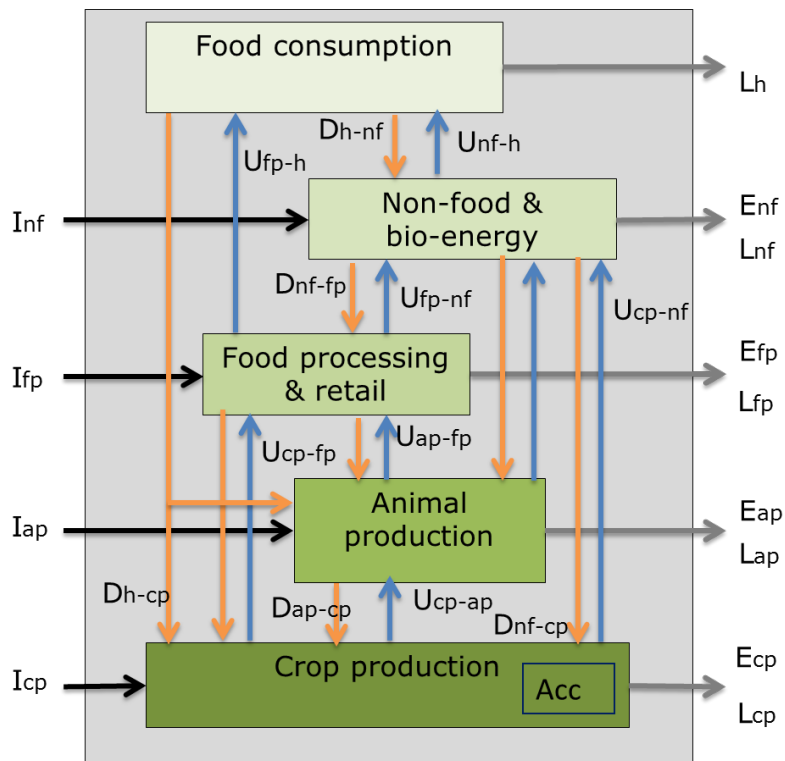
# Uneven distribution:

- More than 2 billion people in the world suffer from (micro) nutrient deficiency, especially in developing countries. Most critical are protein-nitrogen, phosphorus, calcium, zinc, iron, iodine
- An increasing number of people is obese



# 'Food has high nutrient cost'

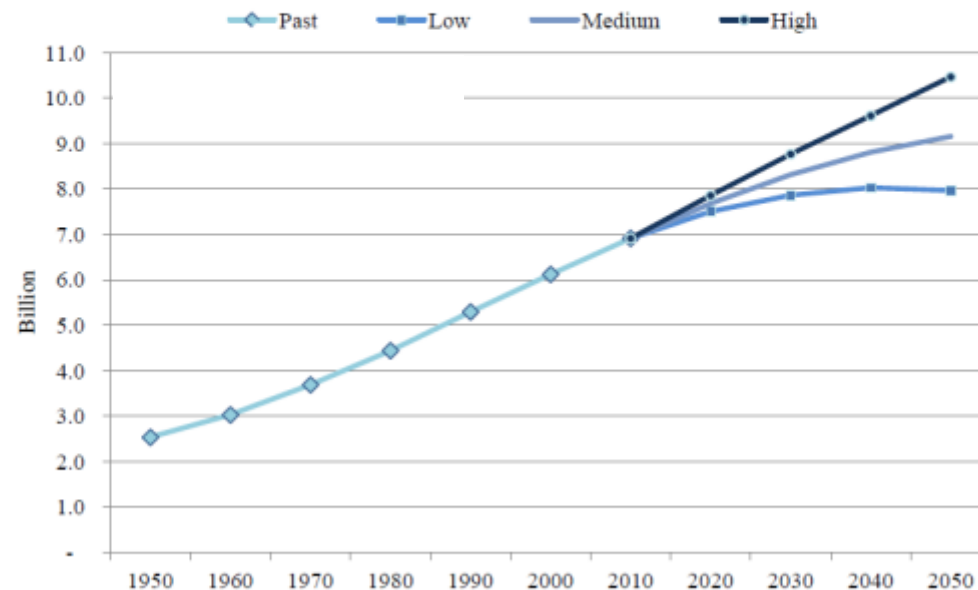
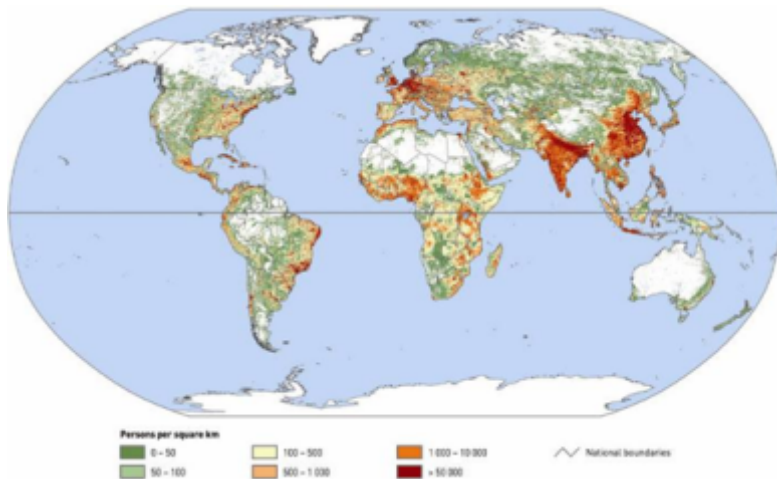
In total, 4 to 12 kg of "new" nitrogen and 4 to 12 kg of "new" phosphorus are needed to get 1 kg of nitrogen and 1 kg of phosphorus in food of consumers.



Ma et al., 2010, 2012  
Van Dijk et al., 2013

# Rapid changes occur in food production

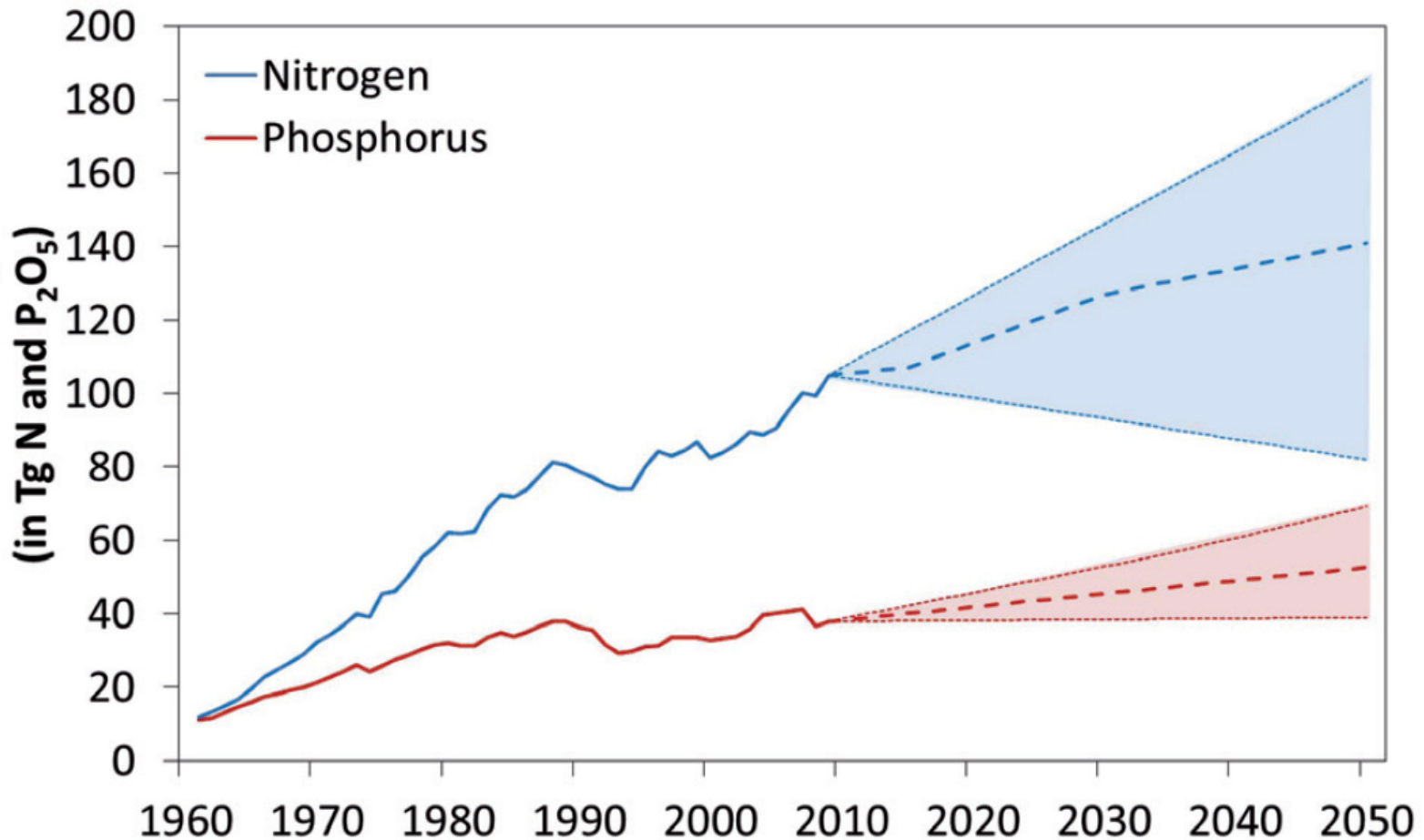
- Increasing population; more food needed
- Urbanisation & wealth: more animal-derived food
- Globalisation: agglomeration & transport
- Technological developments: changing systems
- Governmental policies (agriculture, industry, environ.)



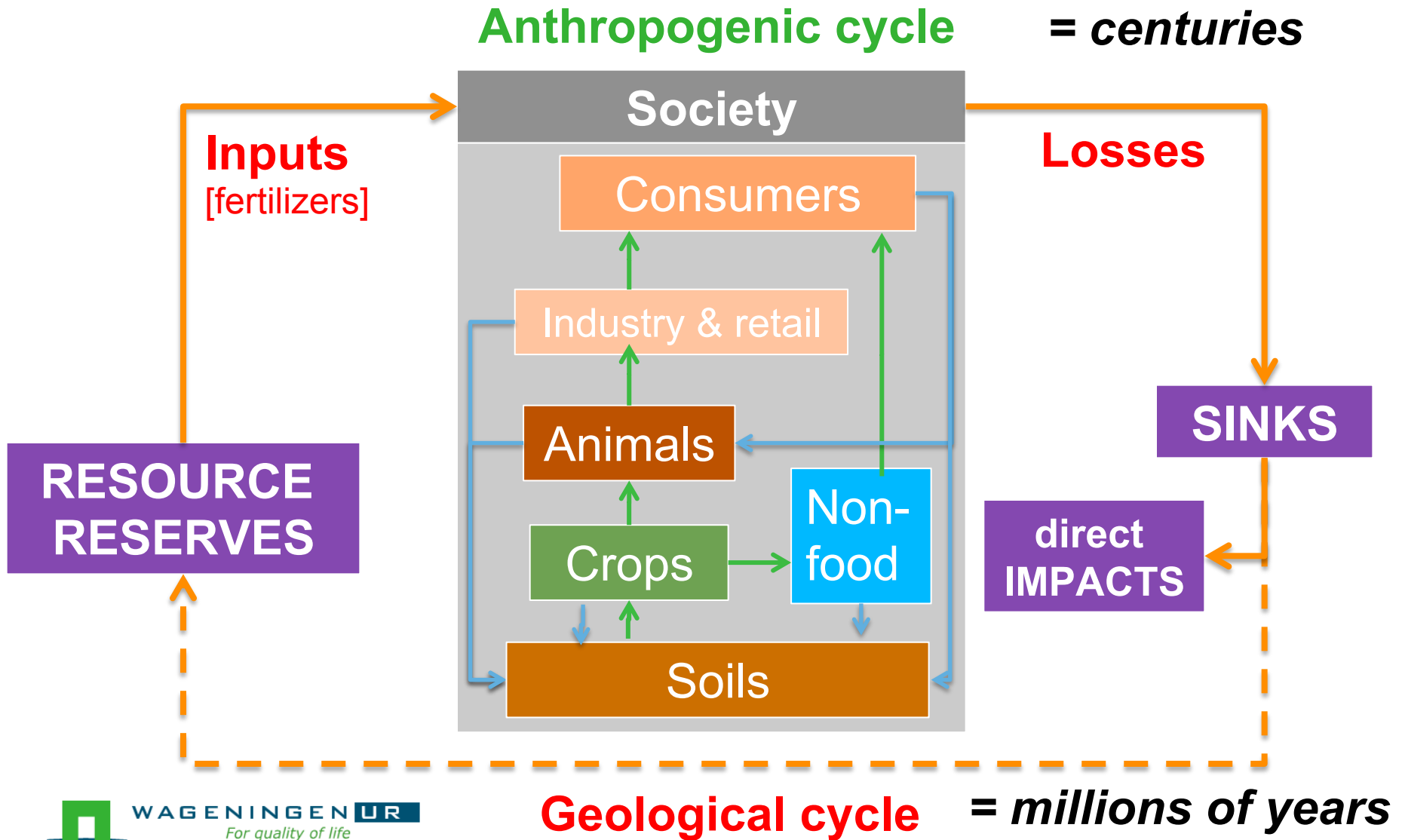
# Resource use



# 'Our world depends on fertiliser nutrients'



# What happens with fertilizer nutrients?





# Assessment of micro nutrient elements

Element	R/P <sup>1)</sup>	Econ. <sup>2)</sup>	Supply Risk <sup>3)</sup>	Use in Agric. (%)	Recycling (%)
B	49	5.0	0.6	12	0
Co	77	7.2	1.1	< 1	24
Cu	43	5.7	0.2	< 1	32
Mo	40	8.9	0.5	< 1	30
Se	47	?	?	10	0
Zn	20	9.4	0.4	< 1	27

1) R/P = Reserves (known) / Production (annual)

2) Economic importance, with 10 most important

3) Supply risk is high if value >1 and low when value is <1

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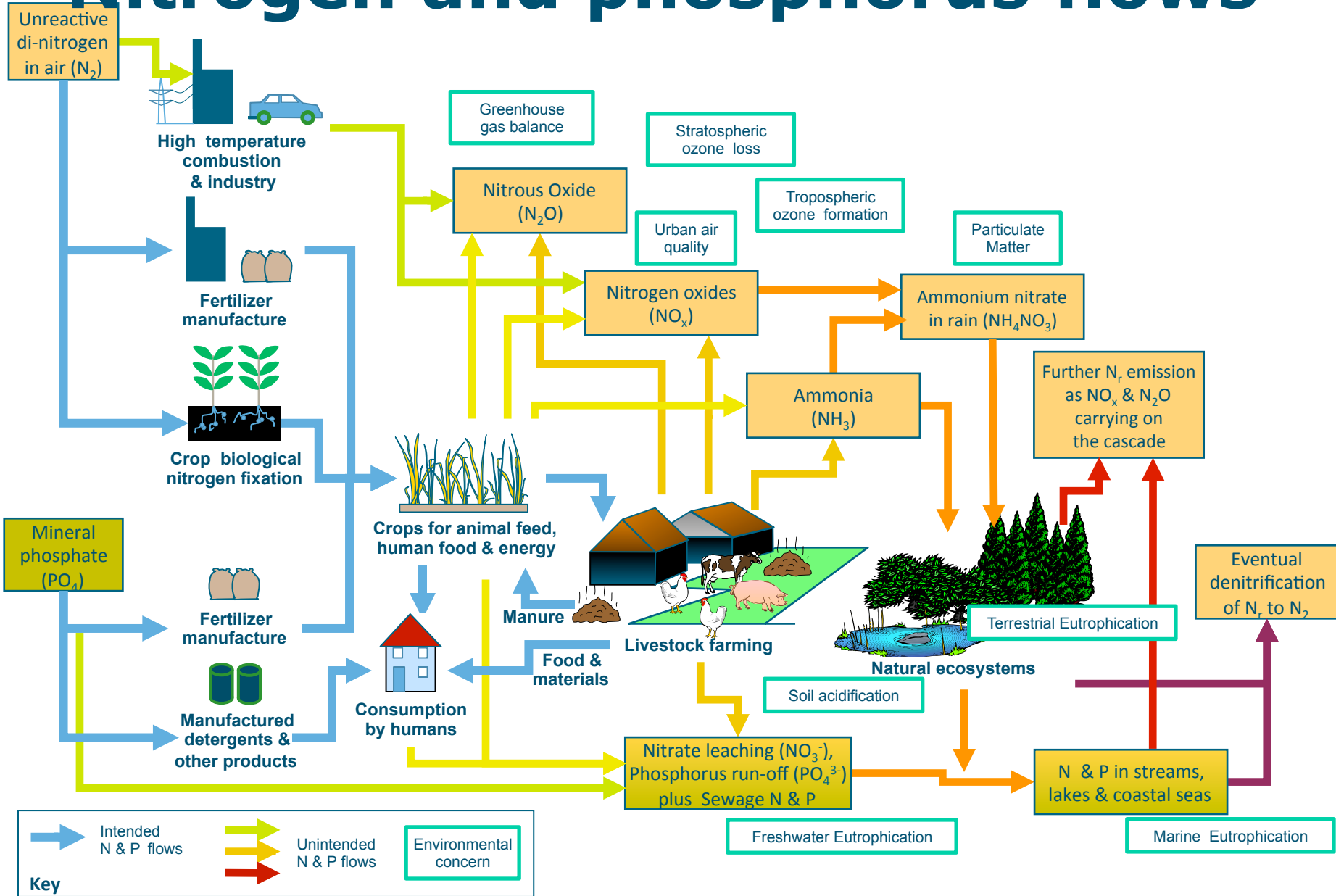
# Implications

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- Fertilizers might get too expensive to be affordably for poor countries
- Micro nutrient scarcity might be solved by increased recycling of wastes and use of `stone-meal (e.g., olivine);
- Labels on fertilizer bags should tell the whole story, including the content of impurities (uranium, thorium, cesium, radium, cadmium)

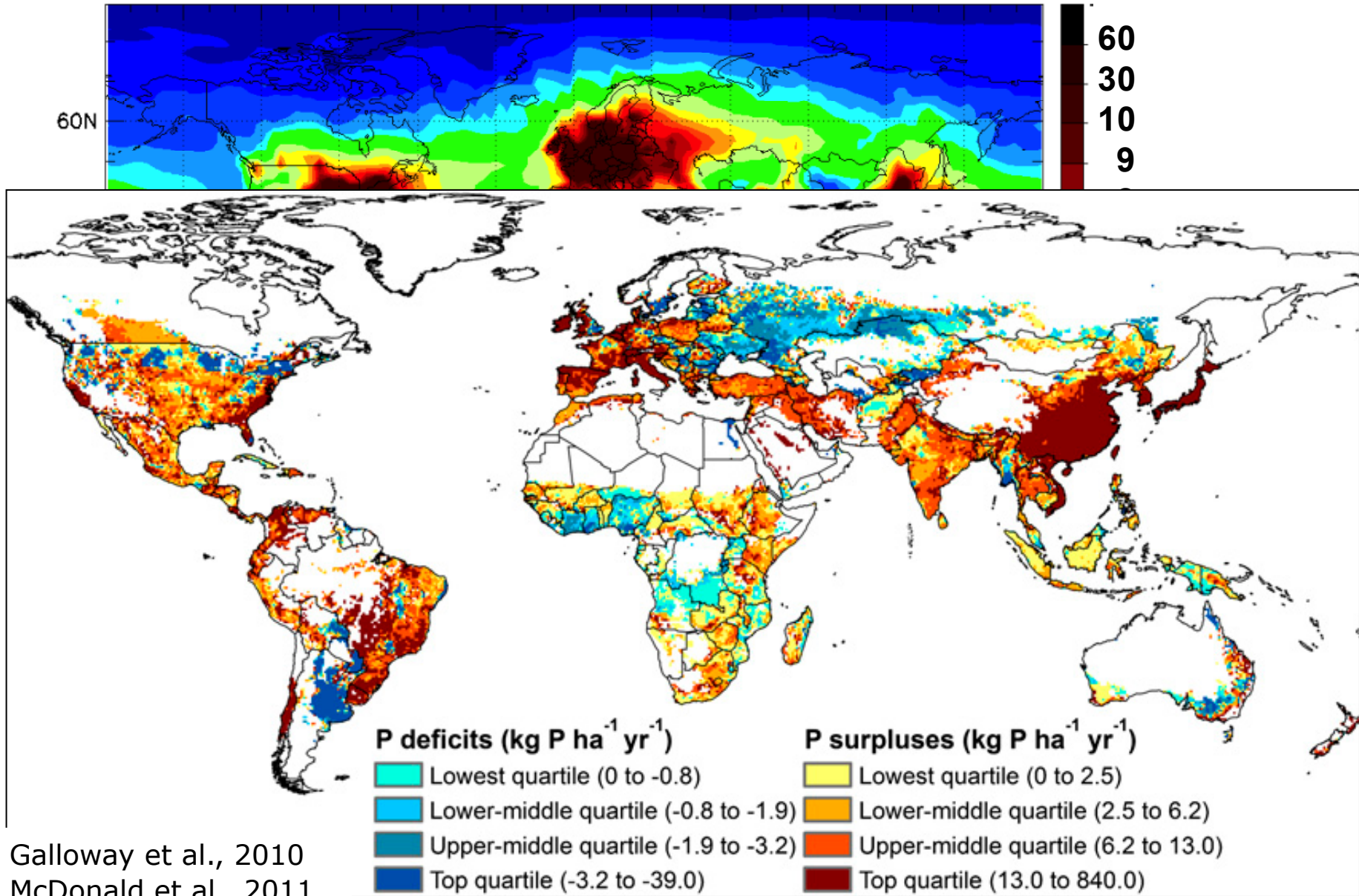
# Pollution by excess nutrients

# Nitrogen and phosphorus flows



For quality of life

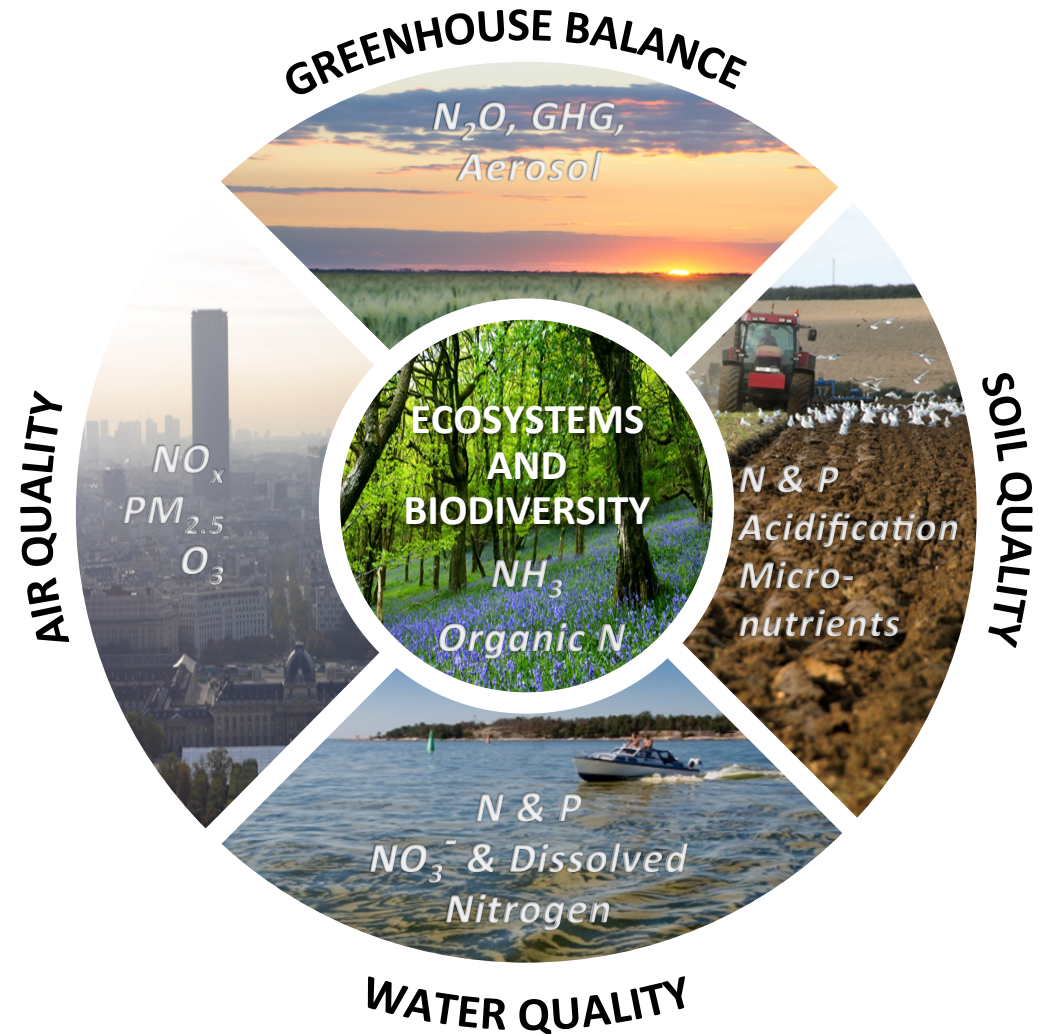
# Nutrient pollution is a global problem





# The five key threats of excess nutrients

**W**ater quality  
**A**ir quality  
**G**reenhouse balance  
**E**cosystems  
**S**oil quality



# Challenges

- Producing more, safe food with less pollution
- Increasing nutrient use efficiency

# Ten key actions nutrient management

## Agriculture

1. Improving nutrient use efficiency in crop production
2. Improving nutrient use efficiency in animal production
3. Increasing the utilization of nutrients in animal manure

## Transport and Industry

4. Low-emission combustion and energy-efficient systems
5. NO<sub>x</sub> capture and utilization technology

## Waste & Recycling

6. Improving food supply efficiency & reducing food waste
7. Recycling nutrients from waste water systems

## Societal consumption patterns

8. Energy and transport saving
9. Lowering the human consumption of animal protein

## Integration

10. Spatial optimization and integration

# Our Nutrient World:

## A new inter-governmental focus

- There is no global treaty that links the many benefits and threats of altered N & P cycles.

### Options

- To extend and strengthen the mandate of
  - The Global Programme of Action for Protection of the Marine Environment from Land-based Activities (GPA)
  - UN Framework Convention on Climate Change
  - UN Convention on Biological Diversity
  - others...



# Tasks for an inter-governmental process on the global nutrient challenge

- Global assessment of nutrient linkages, benefits threats and Green Economy opportunities
- Investigate practice options, **agree indicators** and set targets for improved N (& P) management
- Address barriers to change, fostering education, stakeholder discourse and public awareness
- Quantify the multiple benefits of meeting the targets: inc. how these support other global treaties
- Monitor time-bound achievement of the targets

# Aspirational target “20:20 for 2020”

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

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

Fertilizer Saving 23

+Env+Health benefits 160

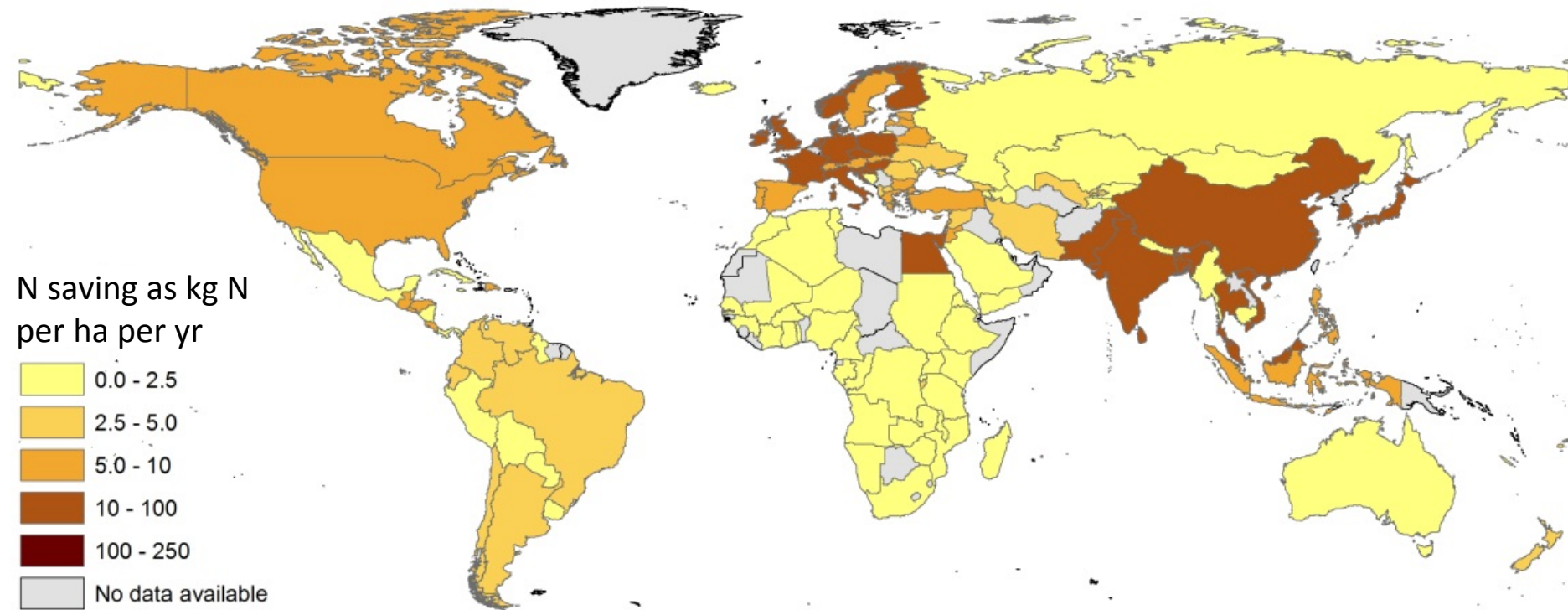
– Implementation 12

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**= Net Benefit 170**

# “20:20 for 2020”

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



Benefits expressed here as equivalent N saving / ha per year from the Full-chain NutUE target

# Summary & conclusions

- Our world depends on fertilizer nutrients
- Uneven distribution of nutrients around the world
- Excess nutrients contribute to ecosystem degradation
- Need for global action in nutrient management





International Nitrogen Conference

**N2013**

Kampala 18-21 November 2013

# Next steps



# Next steps: Global

- **Track 1: The policy process**
  - Governments to evaluate if GPA the best place
- **Track 2: The science support process**
  - International Nitrogen Initiative (INI), UNEP & the Global Partnership on Nutrient Management (GPNM) working with the Global Environment Facility (GEF)
  - Preparing a new effort towards demonstrating an *International Nitrogen Management System (INMS)*