PBL Netherlands Environmental Assessment Agency

Prioritising Nitrogen Threats and Benefits:

Which issues need to be linked when developing integrated modelling capability?

Background document

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INMSpp

The overall goal of INMSpp

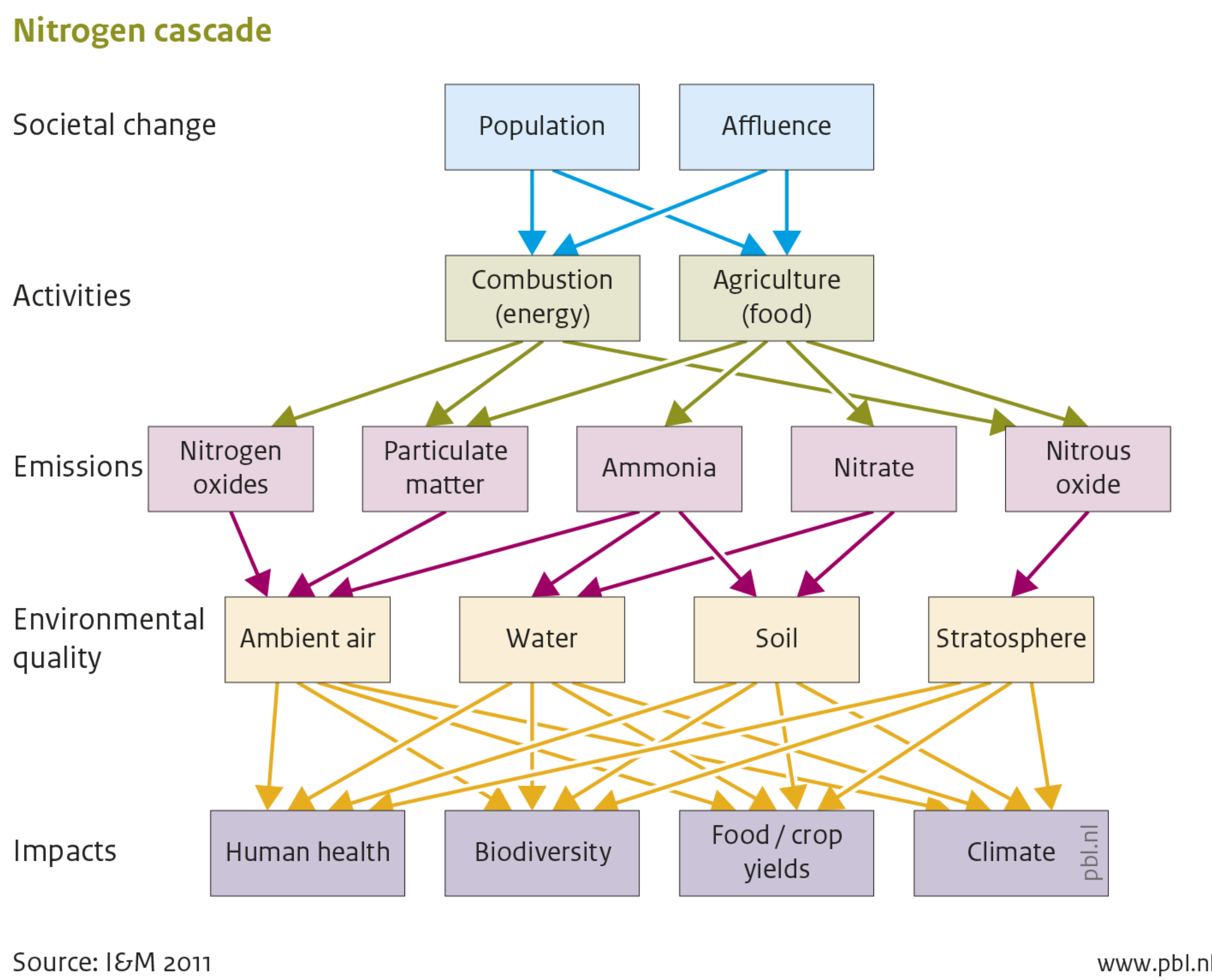
- Establish a framework for the international model chain
- Develop the global capability for nitrogen integrated assessment modelling
- Focus starts from the needs of international conventions and policy makers (*link to needs of general public / voters*)
- Demonstrate how feasible improvements (scenarios) in global and regional nitrogen management would translate into quantified co-benefits in net economic terms
  - improved food and energy security,
  - reduced pollution
  - climate threats

- HIGH AMBITION

Nitrogen Cascade

(DPSIR)

Multiple:
- Sources
- Forms
- Routes
- Impacts



The challenge

- Prioritization is a societal/political process
- What are current N priorities, and how differ across regions?

- What support did / can science deliver?
- Consequences for INMS modelling?

- Global context more complicated than EU/ENA experience
  - Different levels of democratic / policy processes
  - Regions with no energy, food, water security
  - Limited environmental regulations (Australia, N Zealand)
  - Science community – policy interface less well developed

Priority setting requires impact quantification

A. Environmental emissions and quality

B. Real impacts in their proper units: e.g. incidence COPD and cancers, biodiversity, forest vitality, habitat quality, HAB incidence etc.

Link A&B: causality, dose response relationships, critical loads and levels

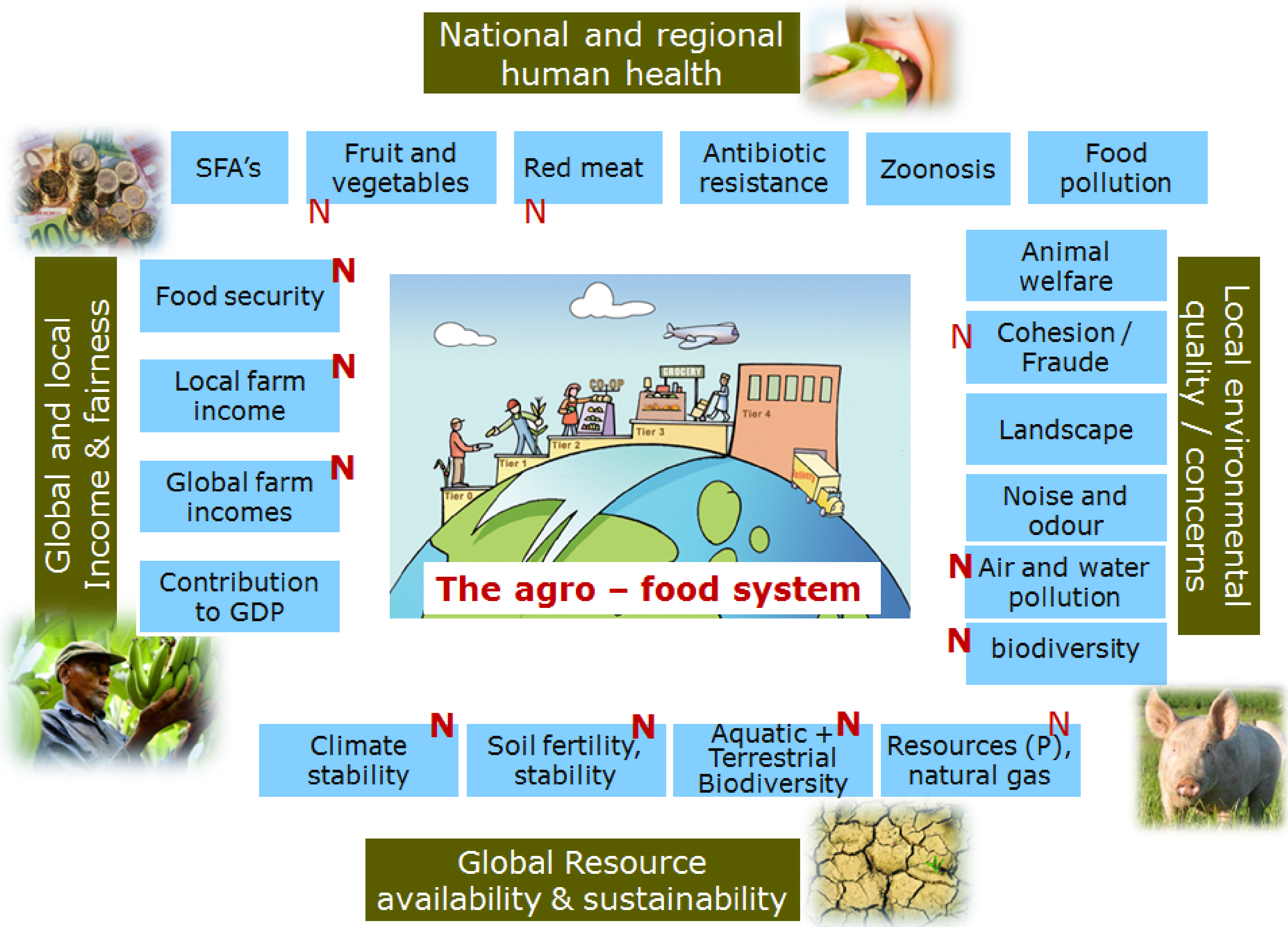
C. Policy objectives, targets: distance to target

D. Impacts in same units and relevant for society: lost (healthy) life years, ecosysystem services, welfare loss in monetary units

INMS, how far we need to go beyond ENA/WAGES?

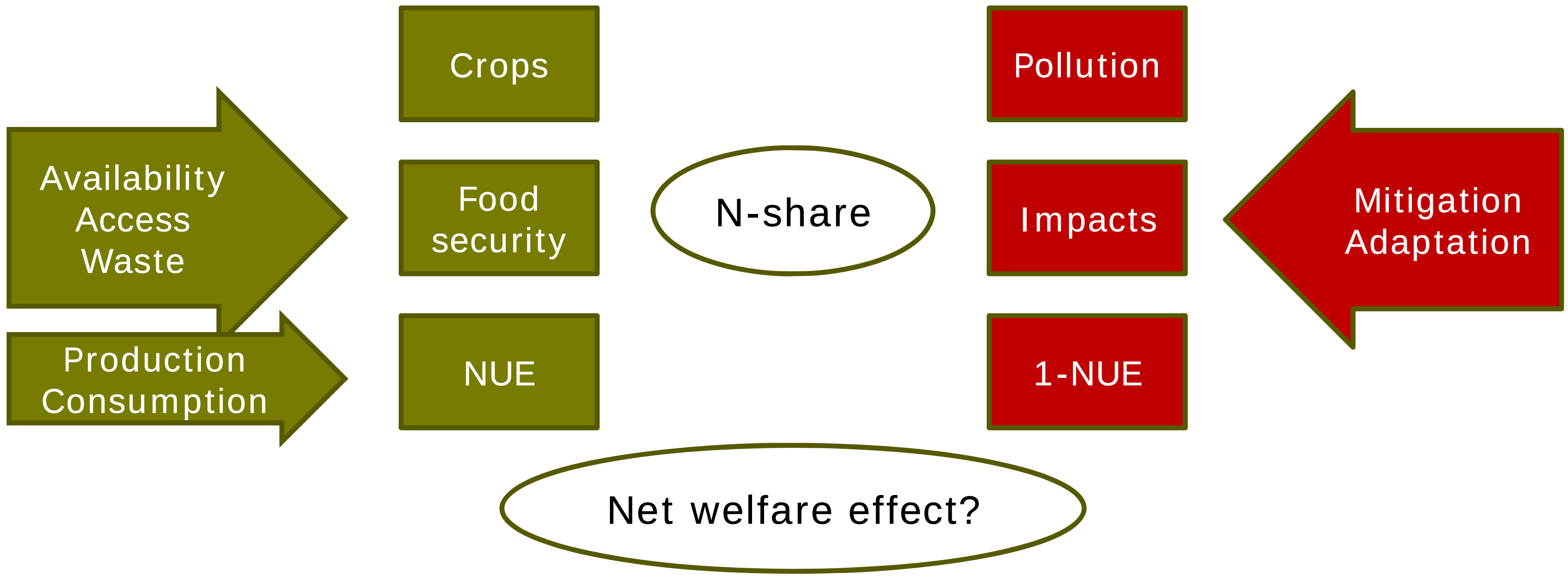
- Differentiate between local, regional and global issues
- Differentiate between issues that create local discomfort and issues that create system disruption
  - morbidity or mortality to humans versus issues that threaten the functions of the wider agro-food, energy, and environmental systems as a whole
- Translate N issues to food and energy security
- Include aspects of fairness: sharing costs and benefits of N
  - Between regions
  - Between players in the supply chain: weak position farmers

Sustainable agro-food systems and linkage to N



Nitrogen, food security, environment and welfare

Food & resources | Nitrogen | Environment



“is nitrogen fertilizers feeding half of the world’s population”? (Smil, 2002)”

Social and economic barriers to change

Smart mitigation has to consider priorities and barriers o change e.g.:

- Economic development stage
- Global and regional issues of trade
- Political system
- Organization structure
- Cultural norms
- Institutional assurance
- Conflicts
- Political will

Where can we use N cost–benefit assessments?

- CBA is a "*trick*" to weigh and add up Nr emissions
- Weights based on WTP – people's preference: in ideal world/survey WTP reflects popular vote - policies
- In policy analysis CBA complementary tool to other weighting approaches like "Distance To Policy Target"
- Examples for EU, China and USA
- Controversy about added value of weighing threats to human health, ecosystem health, climate and benefits for food and energy security in one?

Weight = unit price: N-Cost = Price x Emission

	Health	Ecosystem	Climate	Total
	euro / kg N_r	euro / kg N_r	euro / kg Nr	euro / kg N_r
NO_x -N to air	10-30	2-10	-9 - 2	3-42
NH_3-N to air	2-20	2-10	-3 - 0	1-30
N_r to water	0-4	5-20		5-24
N_2O-N to air	1-3		4-17	5-20

X

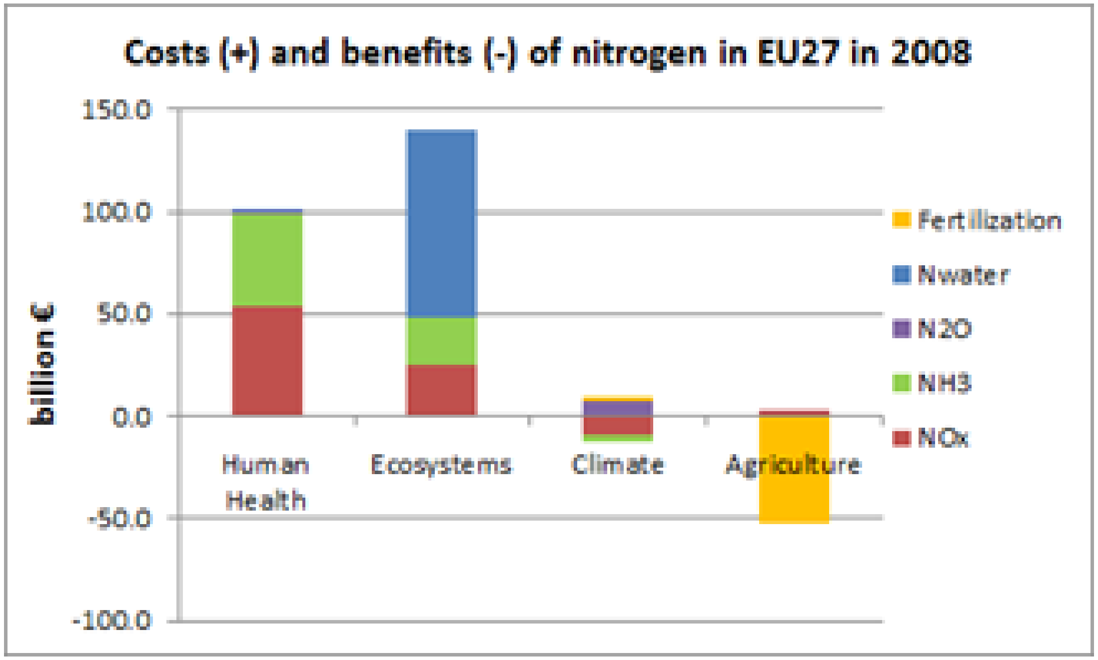
	Emission EU27
Year 2008	Mton (Tg)
NO_x -N to air	3.2
NH_3-N to air	3.1
N_r to water	4.6
N_2O-N to air	0.8

Costs and benefits of N for EU27 - 2008

Total sources

N pollution cost:
75-485 billion euro/yr
150-1150 euro/capita
1-4% GDP loss

Large uncertainties
50 - 70% air pollution
35 - 55% human health
60 - 100% ecosystems
-50 - 20% climate change



Societal cost NO_X, NH_3, N_{water} comparable – similar priority

Importance of N_2O in research and policy overrated

- N_2O contributes: 5% to total reactive N loss; 8% to totaal GHG emissions; 3% of total N-cost in (EU27; 2008).

- No major improvement of N_2O budgets and emission factors
  - In spite of >100,000 articles sinds 2000

- In land – animal based agriculture, emission of N_2O (and CH_4) are “natural” process emissions
  - In contrast to industrial emissions

- Limited potential to reduce agricultural emission of N_2O given
  - current live stock dominated structure of agriculture
  - current western diets rich animal protein

For discussion

- Common criteria for what is a "priority nitrogen issue"
  - Can we make provisional but reproducable rankings per region
  - Can we, in advance, omit issues (plastics?)
- Do we need to deal with / how do we deal with
  - Linkage to food and energy security
  - Fairness criteria (farm income!)
- Monetization of N threats useful - feasible for other regions
  - WTP data carce & outdated - no data outside EU, US?
  - WTP data for ecosystems scarce
- Apply welfare optimization as a goal for N scenarios?
- How do take into account barriers to change in INMS scenarios

So far so good