



Towards the International Nitrogen Management System

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INMS-3
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Why care about nitrogen?

- As N_2 : 78% of every breath we take
- As fertilizer: it feeds the world
- 80% of N_r inputs lost as pollution and N_2
- Multiple environmental impacts
- N losses are a huge waste of resource worth around \$200 billion per year
- Addressing nitrogen can help overcome the barriers to change



- INMS now established to bring scientific evidence together to inform policies and the public on the multiple benefits and threats of reactive nitrogen
- UNEP and INI have launched this global international process with funding from the Global Environment Facility (GEF) for the project “*Towards INMS*”

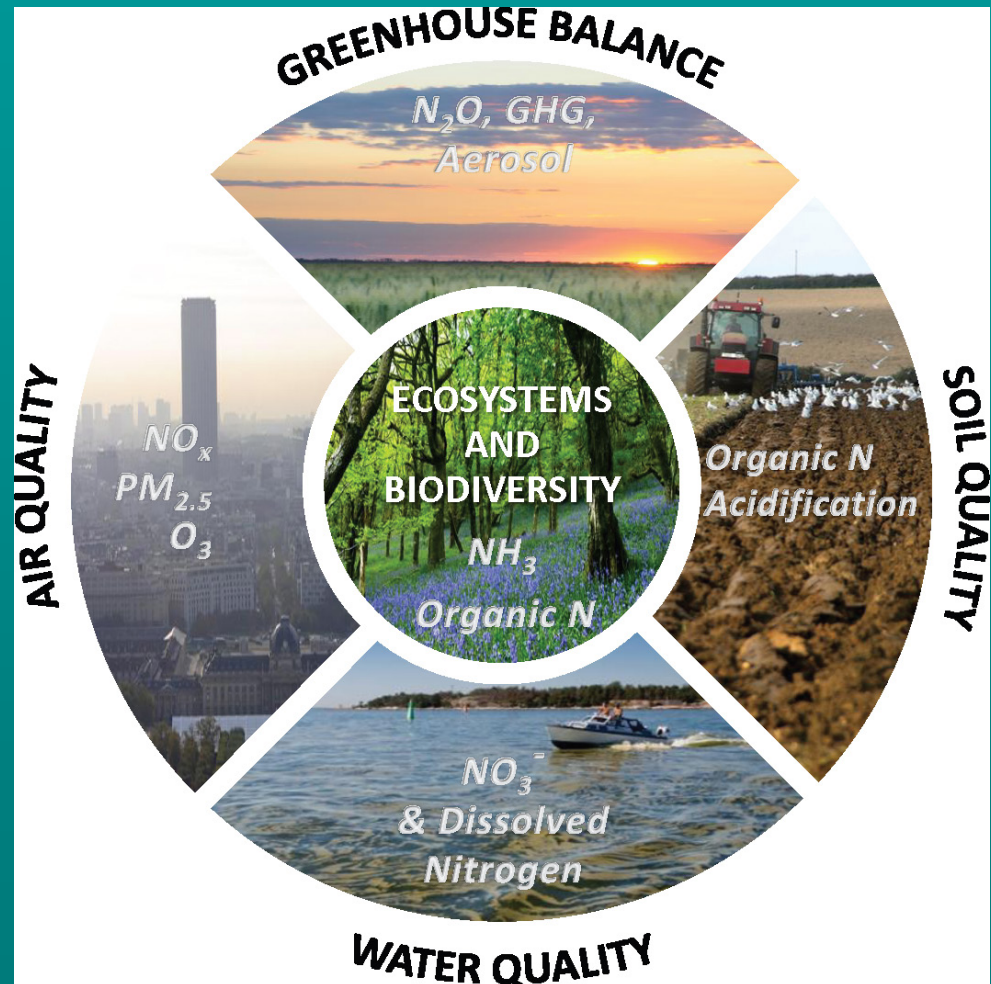


Like an IPCC for nitrogen... with key differences

- IPCC 1988 came before UNFCCC 1992
 - IPCC and UNFCCC now mature processes
- INMS just starting 2016/2017
 - No international nitrogen convention
 - An array of different policy processes
 - Plan closer INMS engagement with policy
 - Science driven, but multi-actor with business, inter-governmental organisations & civil society

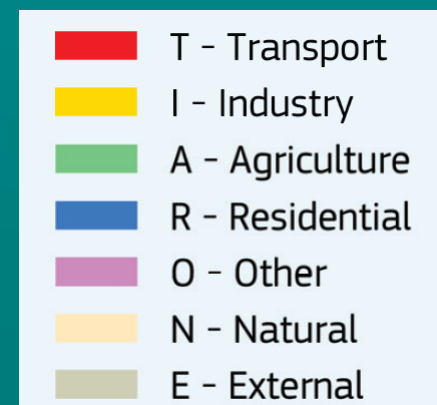
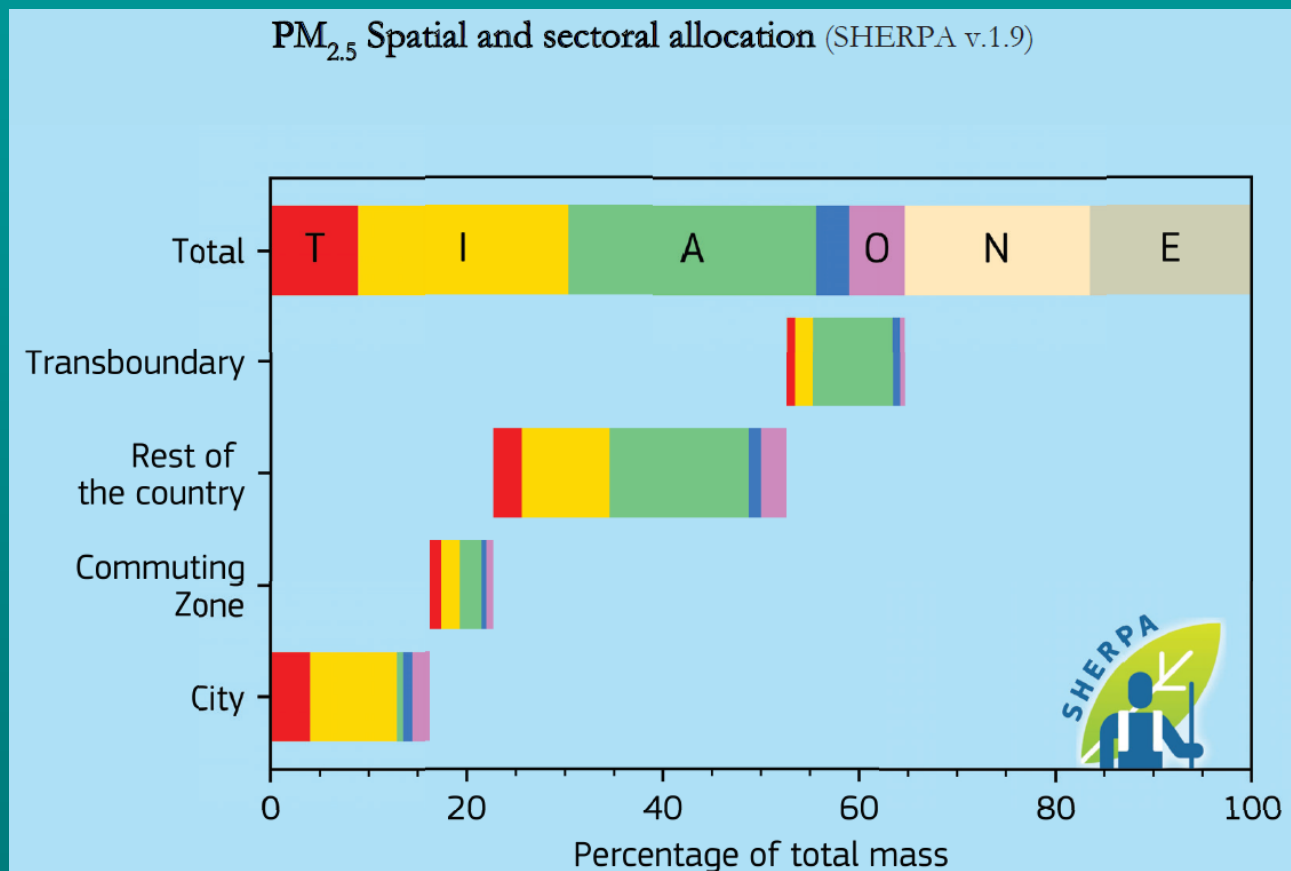
The five key threats of excess Nitrogen

Water quality
Air quality
Greenhouse balance
Ecosystems
Soil quality





What is the main source of Particulate Matter (PM_{2.5})?



Urban PM_{2.5} Atlas: Air Quality in European cities
(Thunis et al. European Commission November 2017), Example Edinburgh



Photos
Sutton et al., *Nature* April 2011



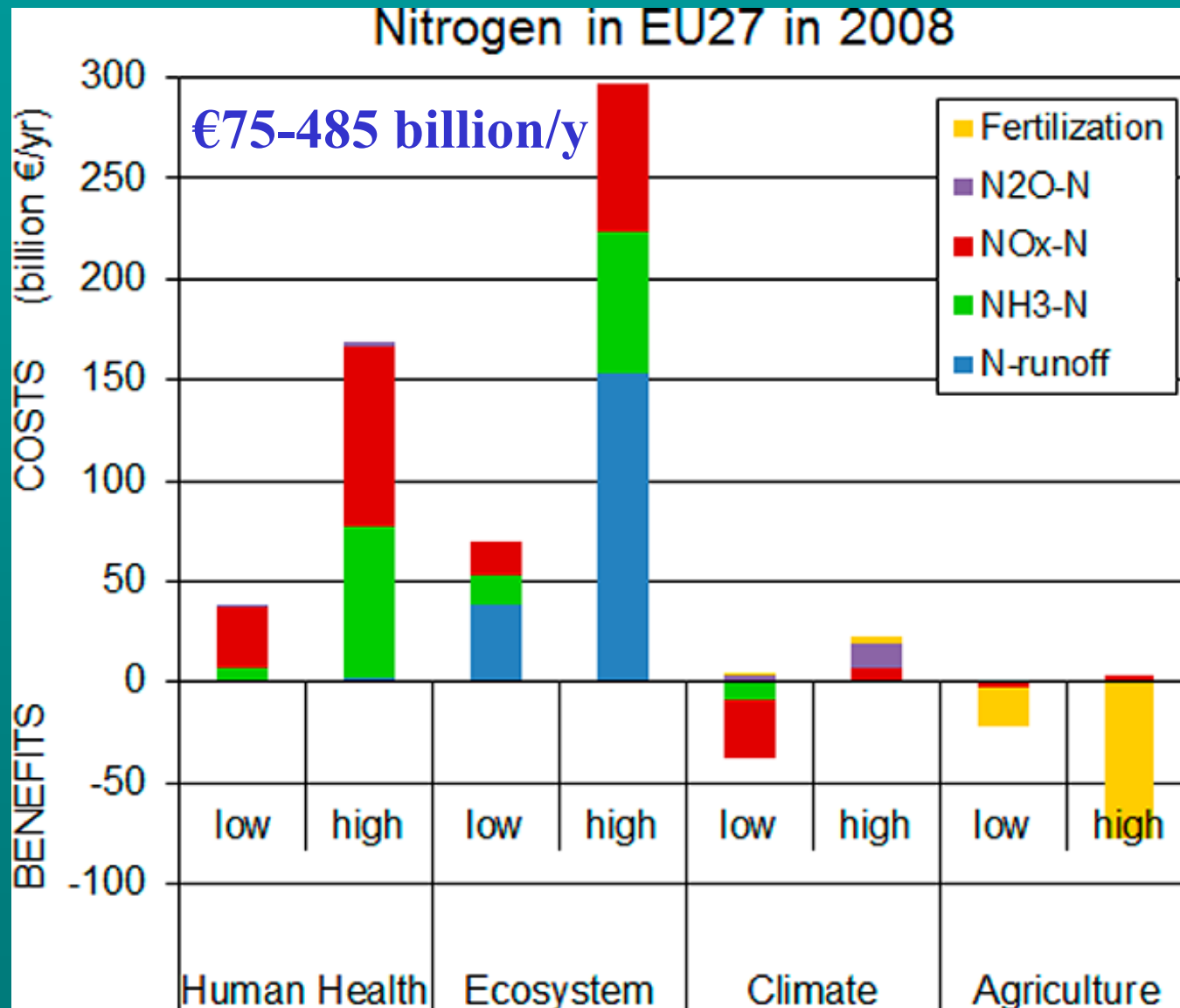
BEFORE



AFTER



Why care about nitrogen? The money



Economics for a more joined up Nitrogen Approach?

Loss as N_r to air: 8 M tonne/yr

Loss as N_r to water: 5 M tonne/yr

Loss as N_2 : 9 M tonne/yr

Total N loss: 22 M tonne/yr

At €0.8/kg N = €18 billion /year

Agric. share €14 billion/ year

Values for EU27 from ENA.

Component N losses to air:

NH_3 : 3.2 NO_x : 3.5 N_2O : 1.2 (M tonne/yr)

25% of CAP

Scope and Approach

Data need
& concepts

Improved management practices,
Mitigation, Adaptation

C1:
Tools and
methods for
understanding
the N cycle

C2:
Global & regional
quantification of N use,
flows, impacts & benefits
of improved practices

Informing
modelling
requirements

C3:
Regional
demonstration
& verification

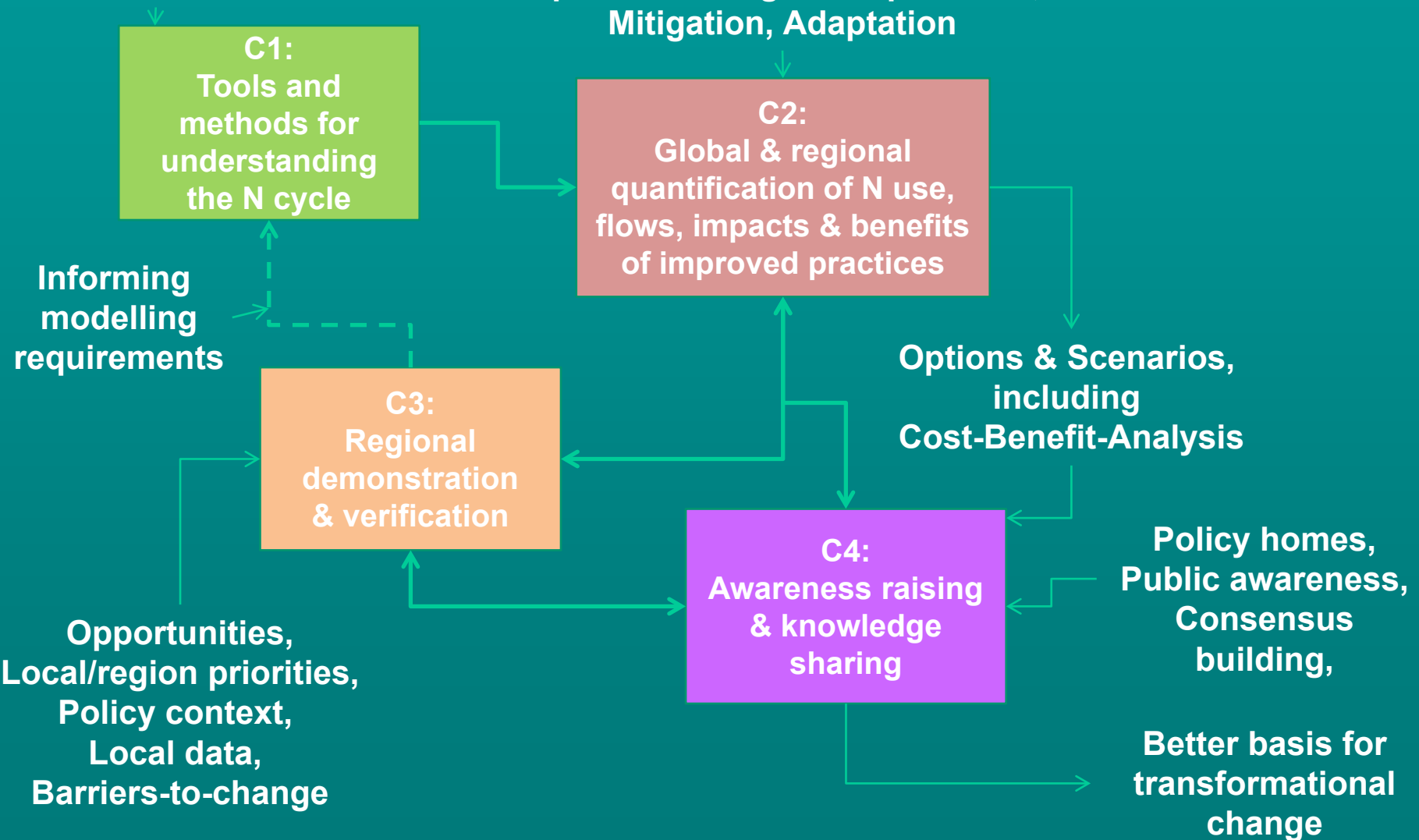
Options & Scenarios,
including
Cost-Benefit-Analysis

C4:
Awareness raising
& knowledge
sharing

Policy homes,
Public awareness,
Consensus
building,

Better basis for
transformational
change

Opportunities,
Local/region priorities,
Policy context,
Local data,
Barriers-to-change



Kinds of products from INMS

- **Guidance Documents** – technical supporting delivery by countries, conventions & actors
- **Special Reports** – specific topic report
- **Global Assessment** – science synthesis, emerging challenges, opportunities, solutions, public outreach
- **Regional Assessments** – linked to INMS demonstrations
- **Databases** – tools for online use (can be linked to guidance documents)
- **Process Support** – for conventions, IGOs, NGOs, etc.

First Element of INMS

C1:
**Tools and methods for
understanding the N
cycle**

**Development of N system
indicators**

**Threat assessment
methodology**

**Methodology for N fluxes
and distribution**

**Approaches for N threat-
benefit valuation**

**Flux-impact path models
for assessment, scenarios
& strategy evaluation**

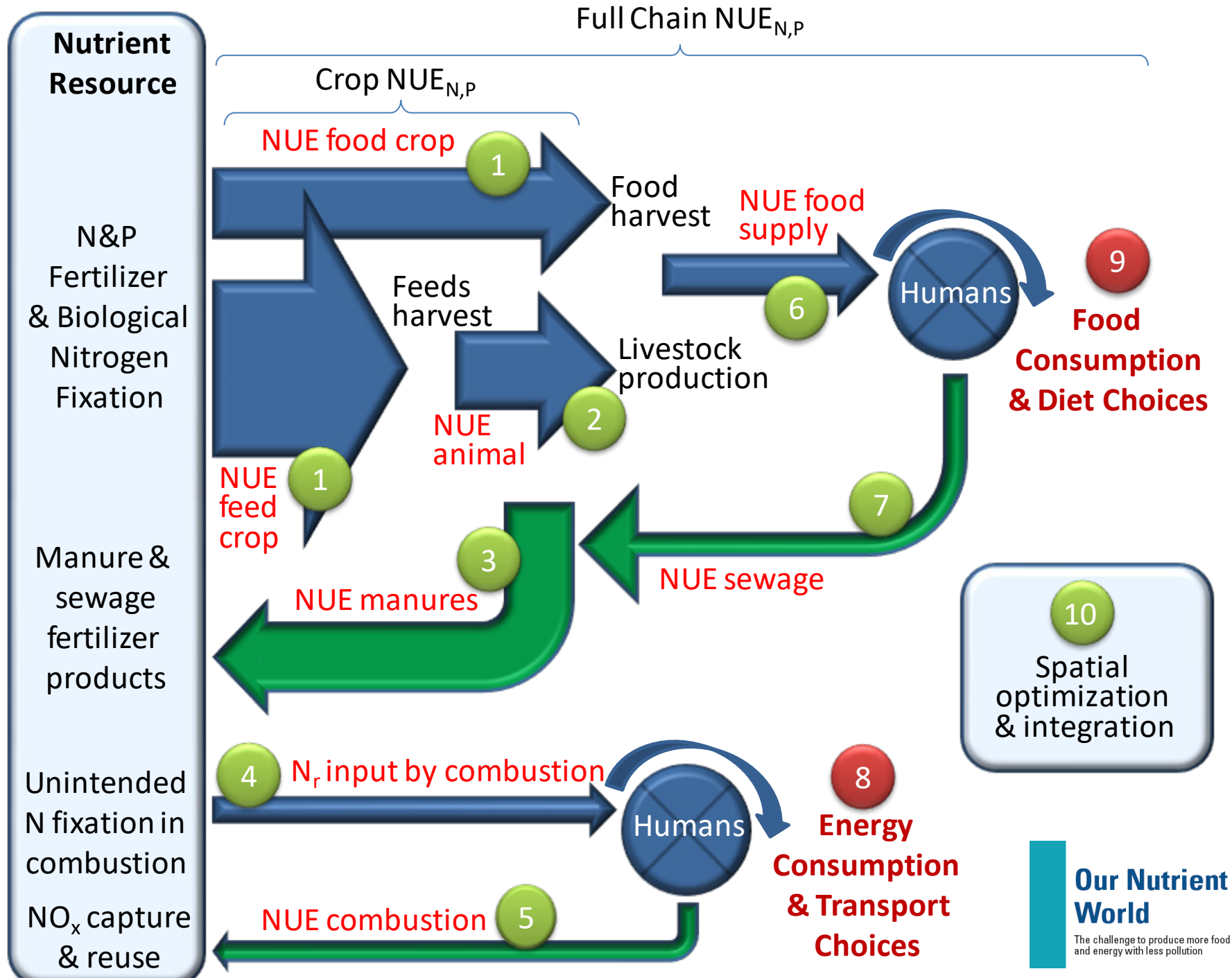
**Barriers to achieving
better N management**

**National N
budgets**

**Farm N
budgets**

**NUE
approaches**

**Relating
different N
indicators**



Second Element of INMS



Quantifying N flows, threats and benefits at global and regional scales

Preparation of Global Nitrogen Assessment flows, impacts, opportunities

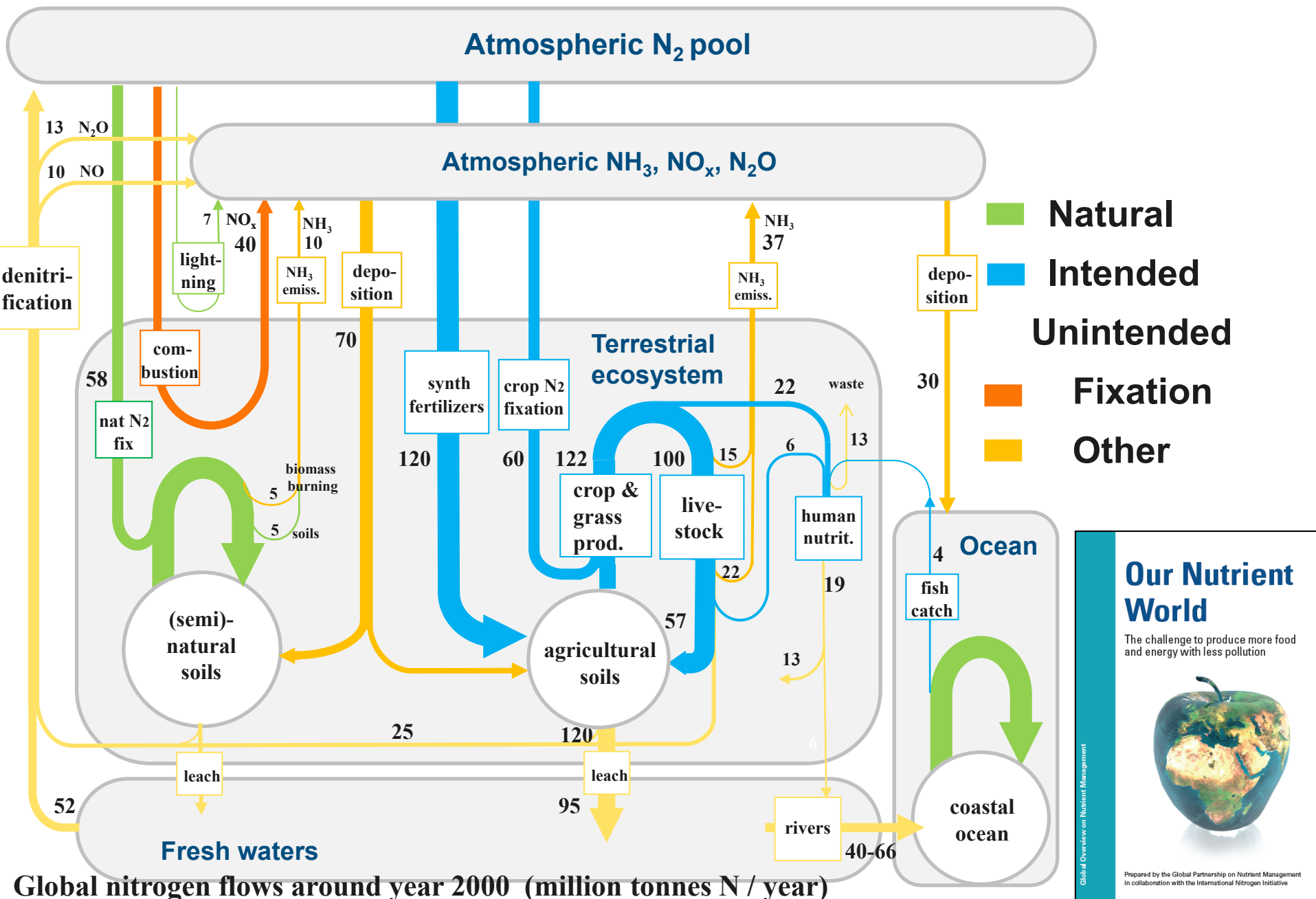
Integrating methods, measures & good practices to address N_r issues

Future N storylines & scenarios with management / mitigation options & CBA

Collation & synthesis of experience & measures adopted by GEF and others

**C2:
Global & regional quantification of N use, flows, impacts & benefits of improved practices**

What will we say about global flows for present conditions and future years?





**Houlton et al., *Science*:
20-30% of global nitrogen
from rock weathering**

Photo: The Independent, 5 April 2018: Gunung Mulu in Borneo

Remapping from Climate to Nitrogen storylines & scenarios

Extent of warming

Representative
Concentration
Pathways

Global economic
character

Shared
Socioeconomic
Pathways

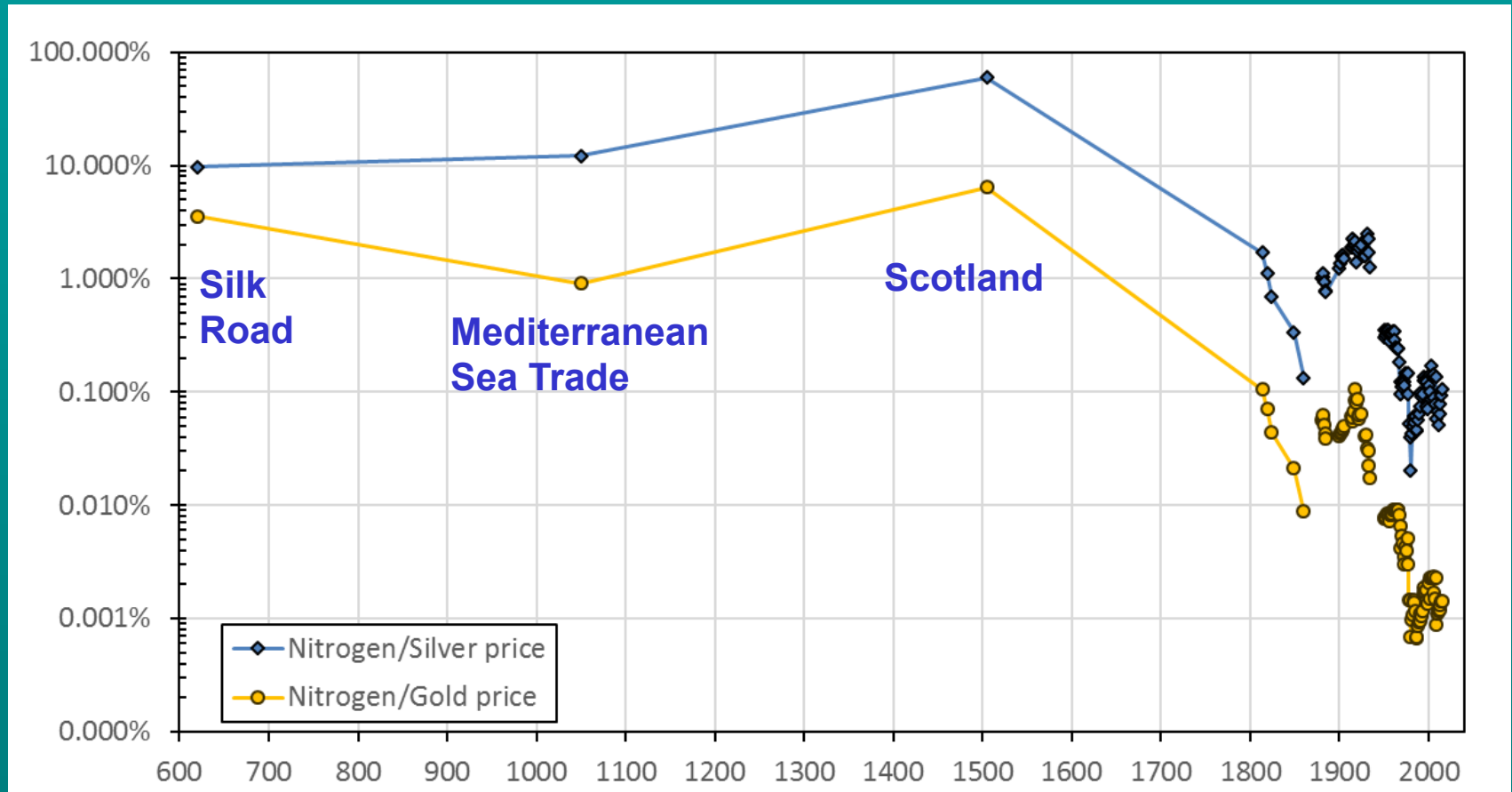


What would it mean to “Halve nitrogen waste by 2050”?

- Challenge to more than double economy-wide NUE using all available options (crop, animal, food waste, food choice, sewage, combustion etc)
- Roughly halve the amount of N fertilizers produced from N_2 fixation
- Massively increase the extent of circular economy nitrogen fertilizer production
- Huge business opportunities for circular economy innovation

Possible pathways: how could we get there?

Nitrogen is cheap today. What about the future?



- Farmers want fertilizer cheap
- Environment & circular economy need fertilizer expensive

How will future drivers affect prices, innovation & environment?

INMS Component 3

Regional Demonstrations



Country clusters:

- Major N sources,
- N flows, opportunities,
- NUE, barriers to change,
- Sharing successes

South Asia India, Sri Lanka, Bangladesh, Nepal, Maldives

East Asia China, Japan (South Korea, Phillipines)

East Africa L.Victoria Basin: Kenya, Uganda, Tanzania, Rwanda, Burundi

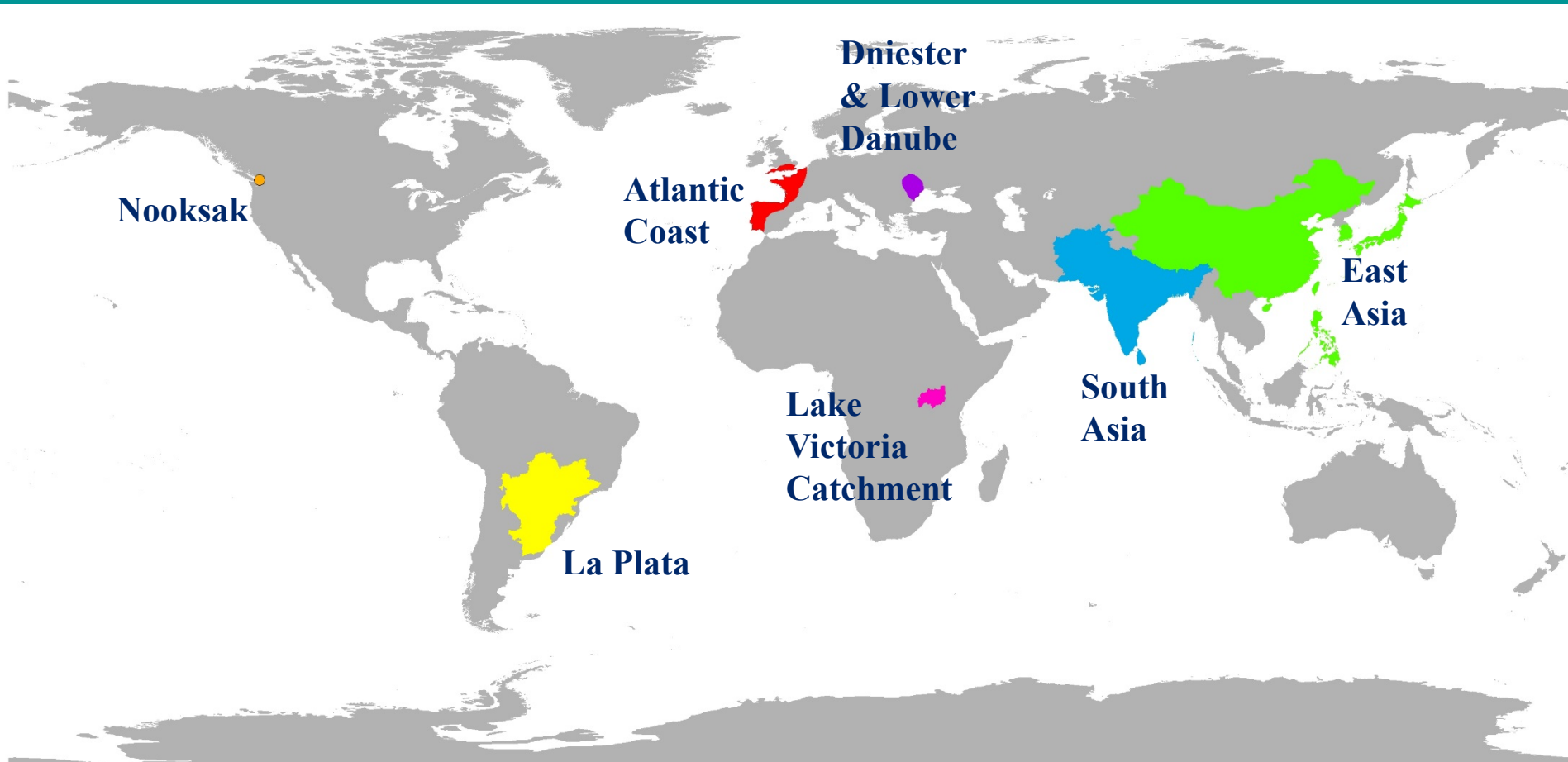
Latin America La Plata: Brazil, Paraguay, Uruguay, Argentina, Bolivia

East Europe Black Sea: Diester, Prut & Lower Danube

North America Nooksak & Lower Fraser Valley: USA, Canada

INMS Component 3

Regional Demonstrations



Fourth Element of INMS



C4: Awareness raising & knowledge sharing

Establishment and operation of
INMS communications hub

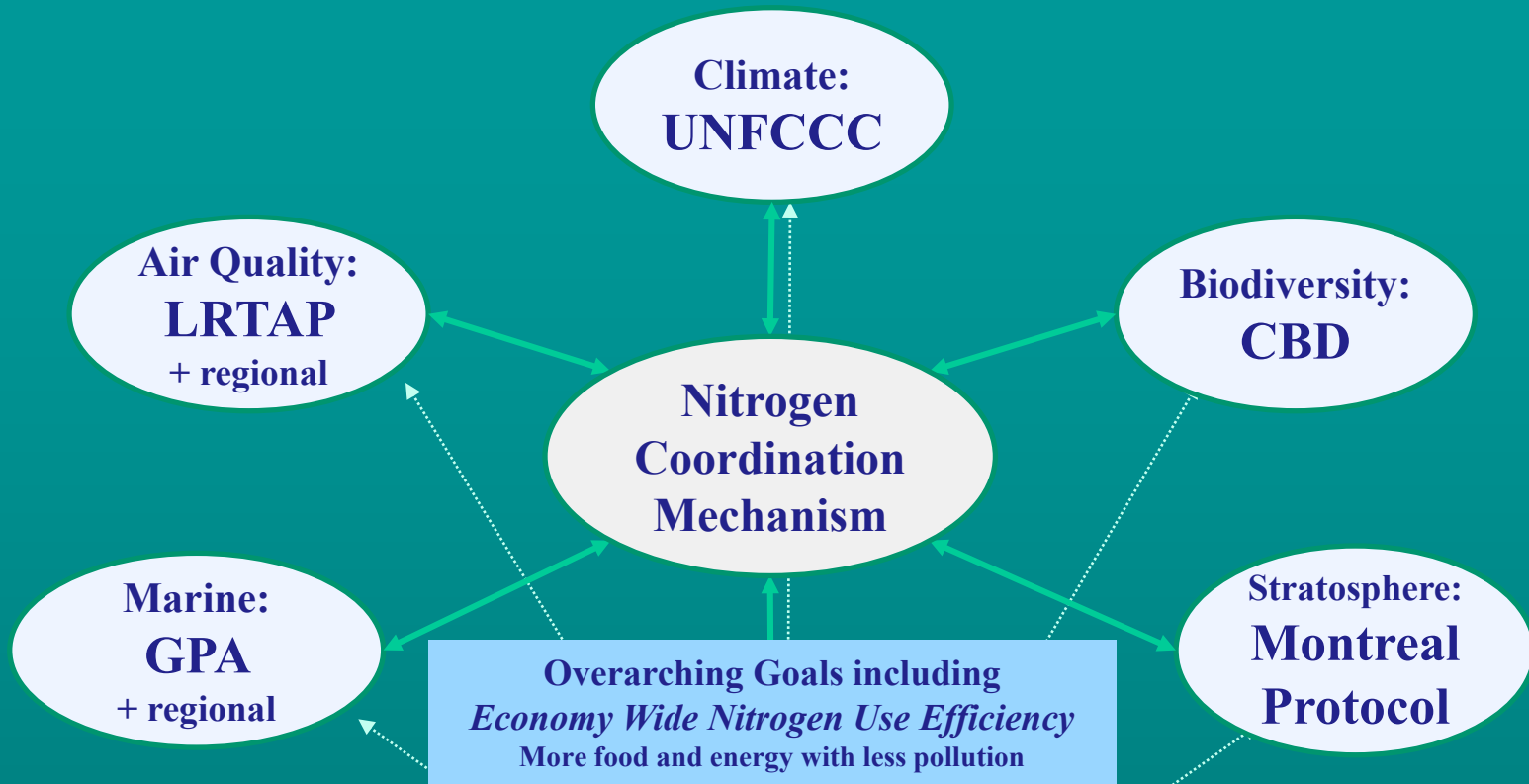
Training, diffusion & **international relations**, inc. N footprinting

Support to policy frameworks
& **long-term strategy**

Harmonization, publication &
dissemination of guidance docs

Support to IW-LEARN &
engagement with GEF & STAP

Developing the Policy Arena for Nitrogen



United Nations Environment Assembly

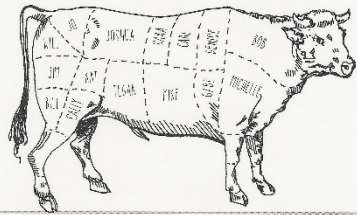
From UNEA-3 to UNEA-4

INMS community contributed UNEA-3 Air Resolution

« 4. *Further encourages* governments to pursue synergies and co-benefits between national clean air policies and policies in key areas such as transport, including vehicle emissions and fuel standards, urbanization, climate change, energy access and agriculture and **to take advantage of synergistic effects of efficient nitrogen management on reducing air, marine and water pollution.** »

UNEA-3 Nitrogen Event: SACEP, INMS, UN Environment
Report resolution from SACEP Malé Workshop (September 2017)

UNEA-4 2019 Nitrogen Resolution?



EATYMOLOGY

(EET-UH-MOL-UH-JEE, *noun*)

the dictionary of
modern gastronomy

JAMES BEARD AWARD-WINNING CREATOR OF @RUTHBOURDAIN

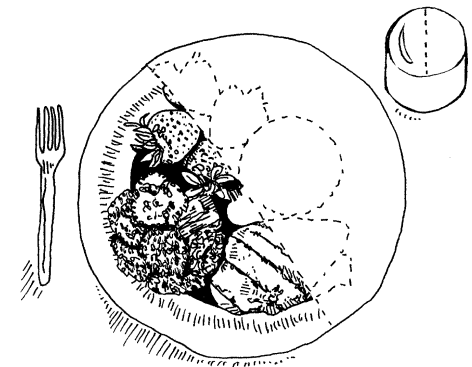
JOSH FRIEDLAND

Raising Awareness

DEM•I•TAR•I•AN

(*adjective*): Of or relating to a diet limiting meat consumption to half the standard portion eaten at regular meals.

D



ENVIRONMENTAL IMPACT

A 2014 report by the UN Economic Commission for Europe, *Nitrogen on the Table*, found that if a demitarian diet was adopted throughout Europe and meat and dairy intake was cut by 50 percent, it would reduce greenhouse gas emissions by 25 to 40 percent and lower soybean imports (mostly used to feed livestock) by 75 percent.

== BARSAC DECLARATION ==

The term appeared in 2009 in the Barsac Declaration, developed in Barsac, France, at the combined workshop of Nitrogen in Europe and Biodiversity in European Grasslands: Impacts of Nitrogen: "We declare our commitment to: a. Encourage the availability of reduced portion sizes of meat and animal products, compared with current standards in developed countries, for the preparation of healthy meals, b. Implement this commitment through promotion of the 'demitarian' option, which we define as a meal containing half the amount of meat or fish compared with the normal local alternative, combined with a correspondingly larger amount of other food products..."

What will INMS deliver?

- **A platform for better cooperation** across science and policy helping to overcome the barriers.
- **Guidance on joining up** mitigation and adaptation options and strategies, linked to circular and green economy thinking.
- **A global assessment** of the threats and benefits of human alteration of the nitrogen cycle and the opportunities for improvement.
- **A forward look** of what may happen if the problem is ignored.

Building the case for change

- Hard times: period of little commitment
- How can countries benefit from a joined up nitrogen approach?
 - **WAGES**: Water, Air, Greenhouse, Ecosystems, Soils
 - **Win-wins**: environment, food & energy security
 - **Nitrogen Use Efficiency**: a positive approach
 - **Nitrogen Circular Economy**: innovation & jobs
 - **Addressing the Barriers**: gravity of common cause

Will we have made progress with the policy arena?

