



'Towards INMS' & INMSpp

Science in support of international nitrogen policy development

Mark Sutton, Clare Howard, Will Brownlie

Centre for Ecology & Hydrology, Edinburgh



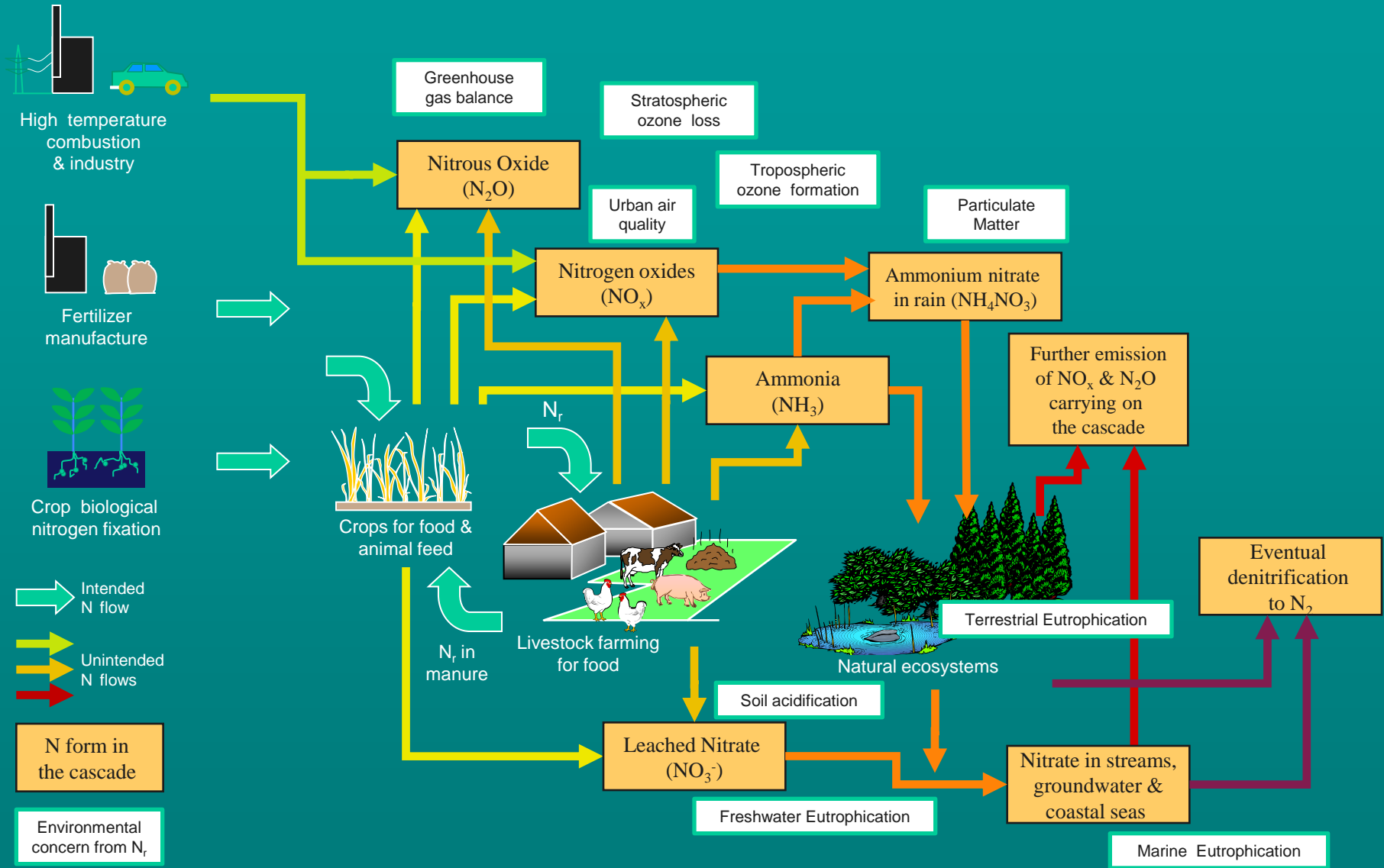
INMS Pump Priming
Edinburgh Workshop
6 May 2015



The Nitrogen Snowball

- Joined up management of the nitrogen cycle to strengthen the common cause between environmental, food & energy security challenges
 - What would a global science policy support process for nitrogen look like?
 - What are the issues to connect?
 - What are the main, research, demonstration and communication challenges?
- Why should the world be talking nitrogen?

Simplified view of the Nitrogen Cascade



The European Nitrogen Assessment

Sources, Effects and Policy Perspectives

Edited by

Mark A. Sutton

Clare M. Howard

Jan Willem Erisman

Gilles Billen

Albert Bleeker

Peringe Grennfelt

Hans van Grinsven

Bruna Grizzetti



CAMBRIDGE

COMMENT

Vervuiling met stikstof kost miljarden

Nitrogen taint alert

Warning over nitrogen footprint

Pollution à l'azote : une lourde facture pour l'Europe

Too much of a good thing
Curbing nitrogen emissions is a central environmental challenge for the twenty-first century, argue Mark Sutton and his colleagues.

Nature 14 April 2011

Union defends use of nitrogen in high-octane climate change debate

www.nine-esf.org/ENA

Five key threats

The WAGES of
too much nitrogen

Water quality

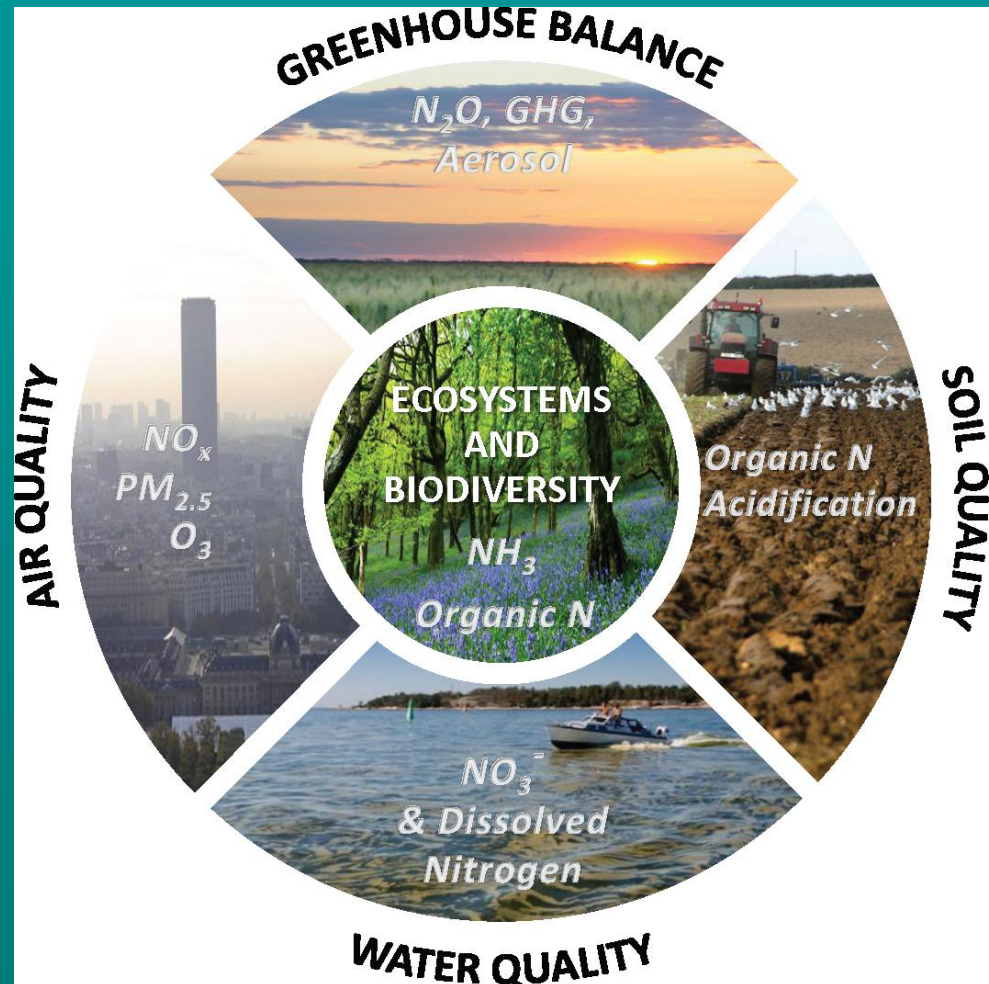
Air quality

Greenhouse balance

Ecosystems

Soil quality

Plus Food & Energy Security



The Big Idea

- A science support process for international policy development on nitrogen.
- *Examples of science support*
- IPCC – but not the best example?
- CBD – INI provides the N indicator for CBD.
- Others, LRTAP, GPA.
- We can all think of examples and should learn from them.

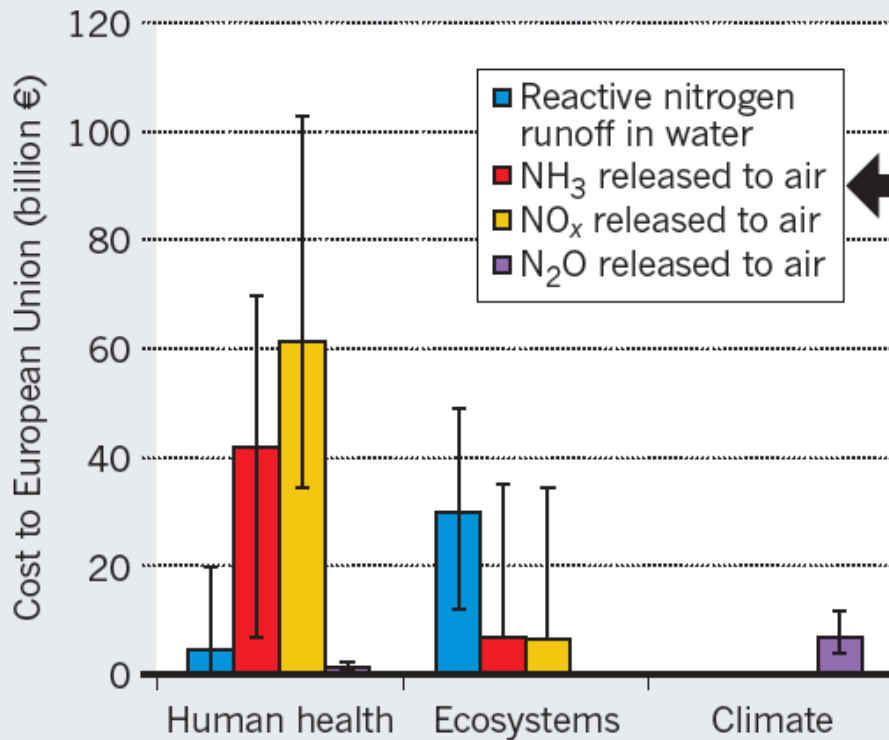
Elements of INMS

- Nature and location of major nitrogen sources and flows
- **Nitrogen benefits and nitrogen threats**
- Capability to deliver this information, with integrated models, cost-benefit analysis, development of performance indicators
- **A combination of global analysis and regional demonstration**
- Successes, barriers to change, and how to overcome those barriers.

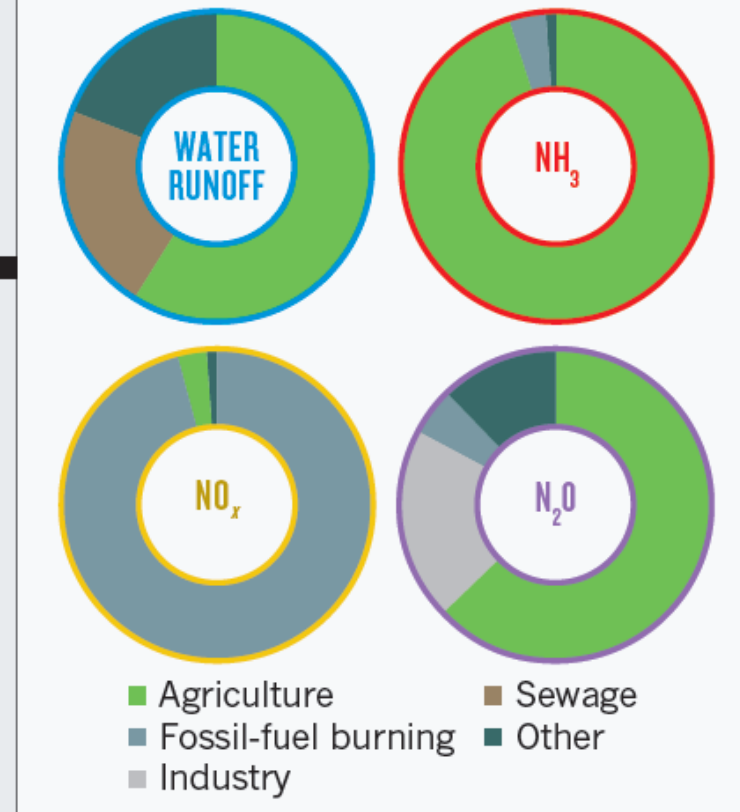
Nitrogen Damage Costs & Sources

DAMAGE COSTS OF NITROGEN POLLUTION

Agriculture and fossil-fuel burning load the environment with reactive nitrogen, affecting water, soils and air.



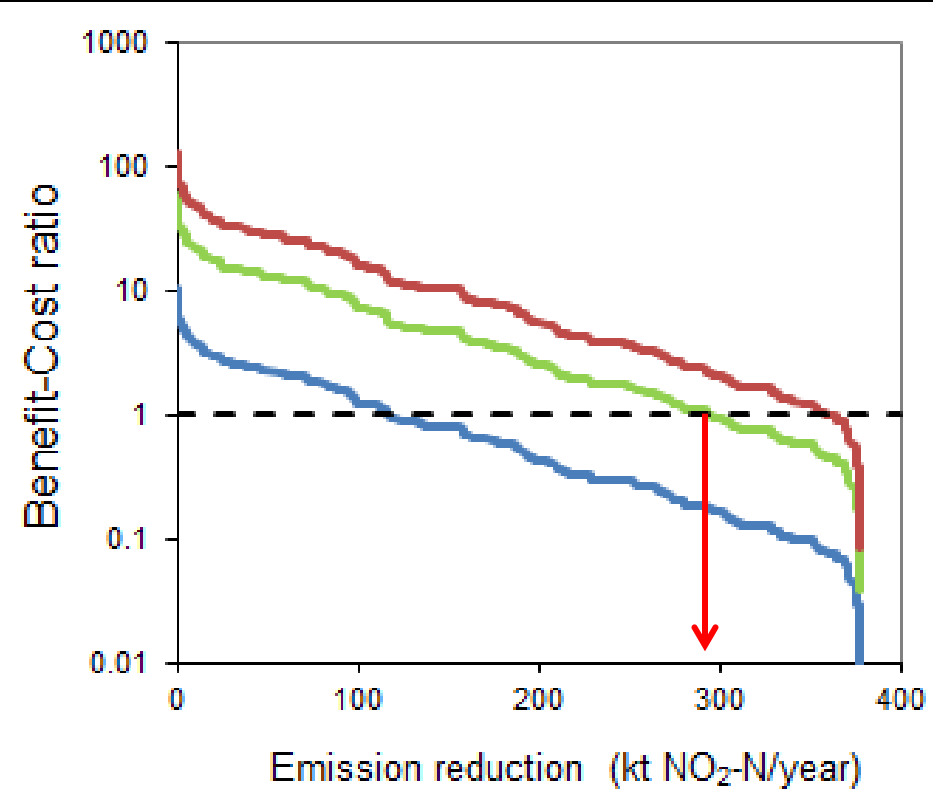
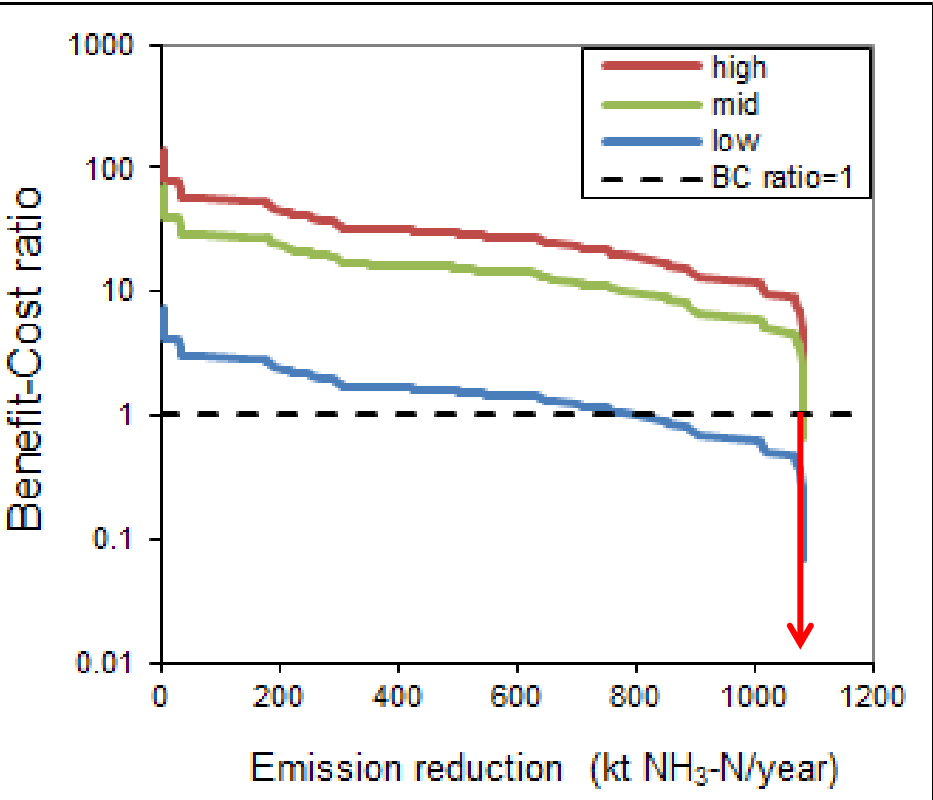
MAIN NITROGEN SOURCES



EU Damage cost: 70 - 320 billion € / year

EU benefit-cost ratios: NH₃ & NO_x mitigation

Product from ENA & GAINS



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

TFRN engagement

Global Partnership on Nutrient Management



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

Global Overview on Nutrient Management

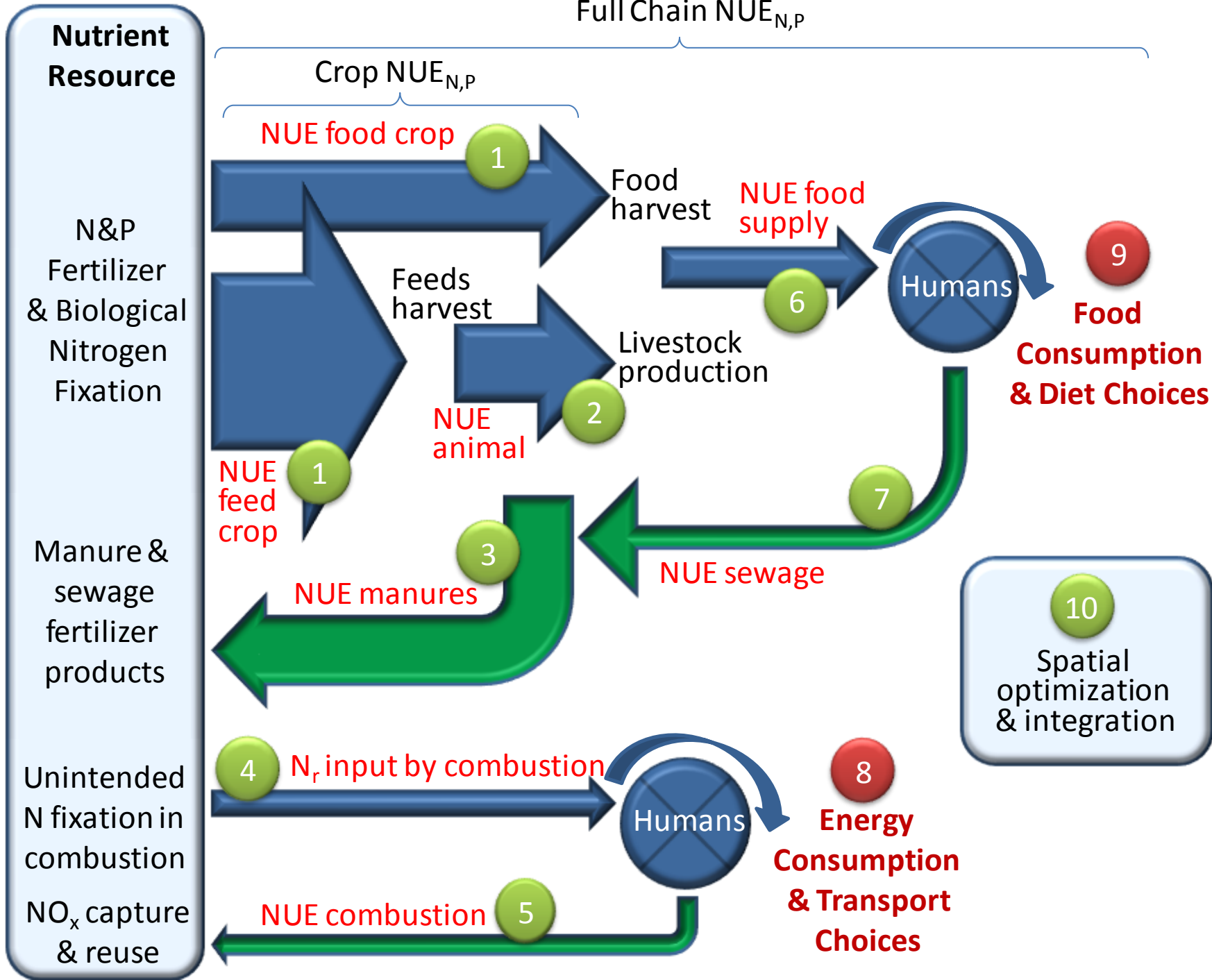
Our Nutrient World

The challenge to produce more food and energy with less pollution



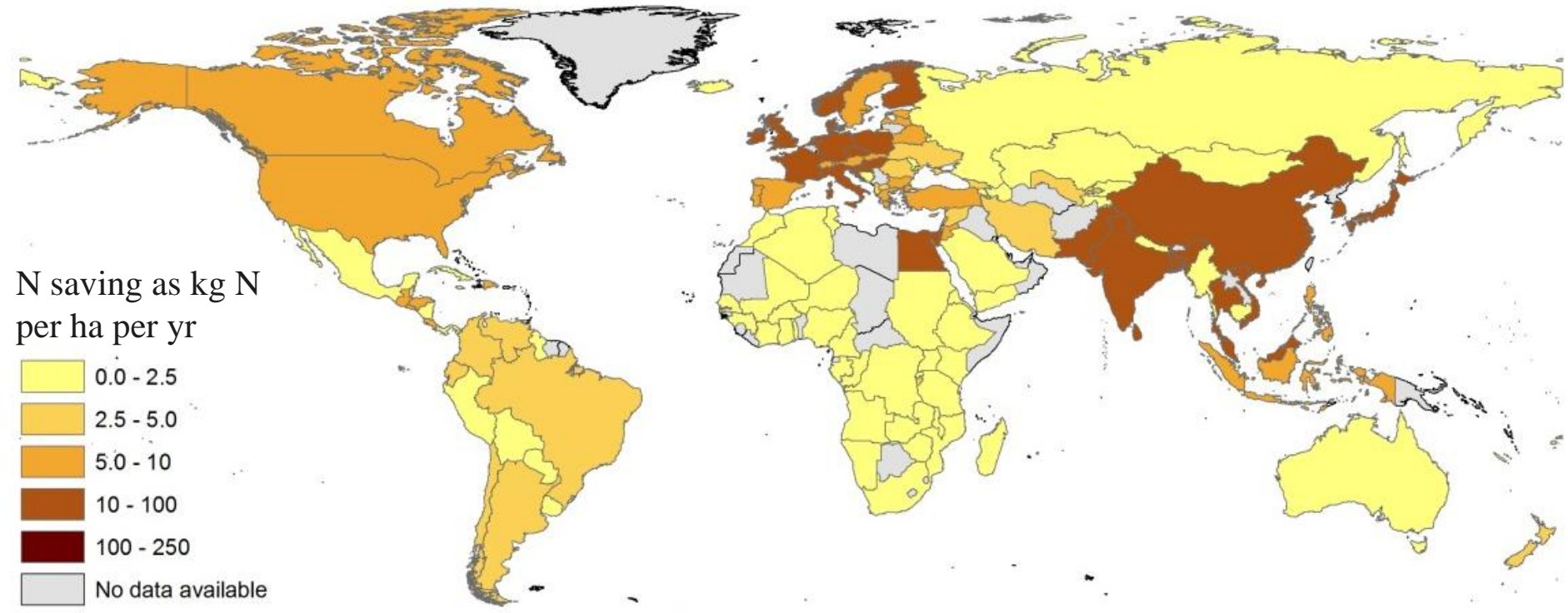
Prepared by the Global Partnership on Nutrient Management in collaboration with the International Nitrogen Initiative

Full Chain $NUE_{N,P}$



“20:20 for 2020”

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

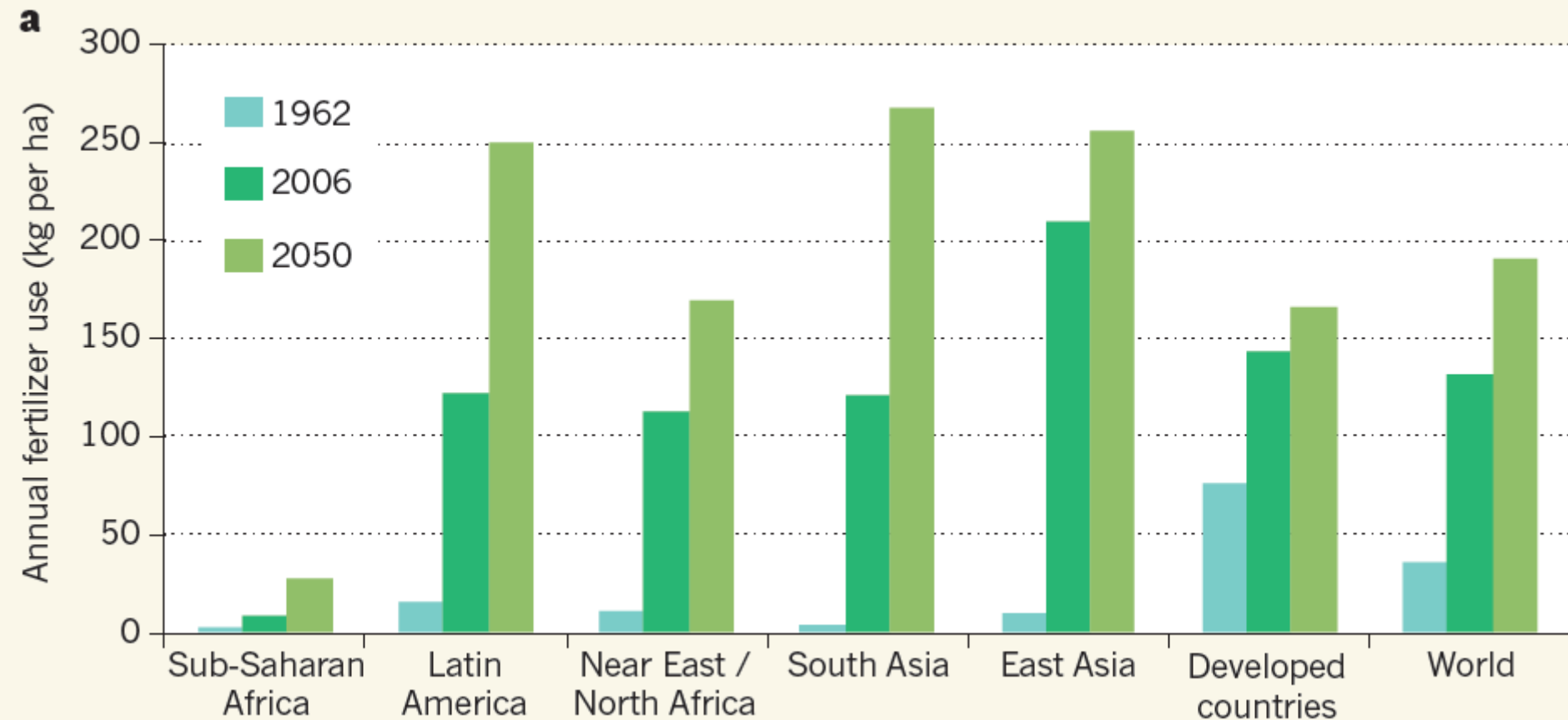


Bottom line for the Green Nutrient Economy (\$billion/year)

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

Past change – future risks

Global fertilizer use



Sutton and Bleeker *Nature* 2013
based on FAO projections



- Halving EU meat & dairy intake would reduce N pollution by 40%
- NUE of the food system increases from 22% to 44%



Raise taxes on meat to turn us into demitarians, says UN

Ben Webster Environment Editor

Extra taxes could be imposed on meat to deter families from buying it, according to a United Nations task force which recommends halving consumption of meat and dairy products to reduce pollution.

Britain's livestock farmers would suffer a "severe" loss of income from such a change in diet but there would be environmental benefits, including less pollution of the air, water and soil, and lower greenhouse gas emissions.

A team of scientists advising the United Nations Economic Commission for Europe (Unece) studied ways of reducing nitrogen pollution from chemical fertiliser and manure.

The task force on reactive nitrogen concluded that if everyone in the EU became "demitarian" — halving the amount of meat and other animal prod-

ucts consumed — it could reduce greenhouse gases from agriculture by 25 per cent to 40 per cent and nitrogen emissions by 40 per cent.

It would also cut the risk of heart disease and cancer by bringing consumption of saturated fats down to within levels recommended by the World Health Organisation.

The task force's report, published today, will inform negotiations between governments over tightening the EU emissions directive and the Unece's convention on cross-border air pollution. The scientists found that beef was the worst meat for environmental impact, causing 25 times more nitrogen pollution per unit of food protein than cereals. For pig and poultry meat, eggs and dairy, the pollution was 3.5 to 8 times that of cereals.

The team questioned whether people would be likely to cut consump-

tion of meat simply by being better informed. They suggested that tougher measures, such as new taxes, might be more successful in changing behaviour.

They conclude: "A more direct policy intervention could be that of making meat and dairy products more expensive, either by direct taxation or by taxing the environmental effects."

The report admits that "the effects on the livestock sector will most likely be severe". Some farmers would be able to switch from rearing animals to planting cereals, but others with land less suitable for crops, particularly in Scotland and Wales, would suffer loss of income.

Reducing meat consumption would free "large areas of agricultural land in the EU" because much less land would be needed for grazing and for growing crops to feed to livestock. The report says the land could be used for growing biofuels to replace fossil fuels. Professor

Mark Sutton, from the UK's Centre for Ecology & Hydrology and co-author of the report, said: "Adopting a demitarian diet across Europe would reduce nitrogen pollution levels by about 40 per cent which is similar to what could be achieved by adopting low-emission farming practices."

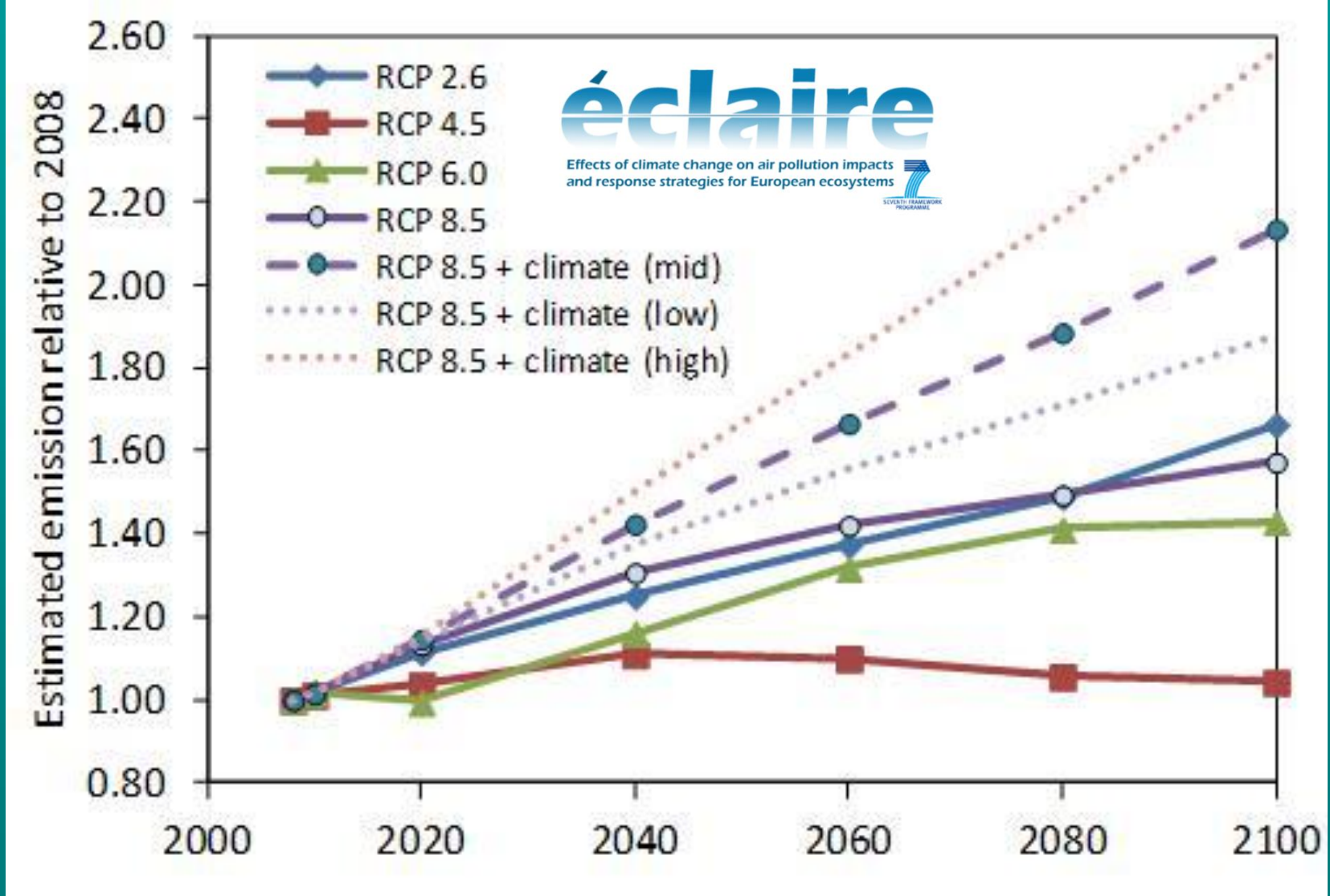
He acknowledged that reducing consumption in Britain would have limited impact on global emissions because countries such as China and India were increasing their consumption.

Dr Diane Mitchell, the National Farmers' Union chief environment adviser, said: "Eating less meat is a simplistic solution to what is a highly complex situation. The livestock and dairy sectors are already doing much to tackle their footprint.

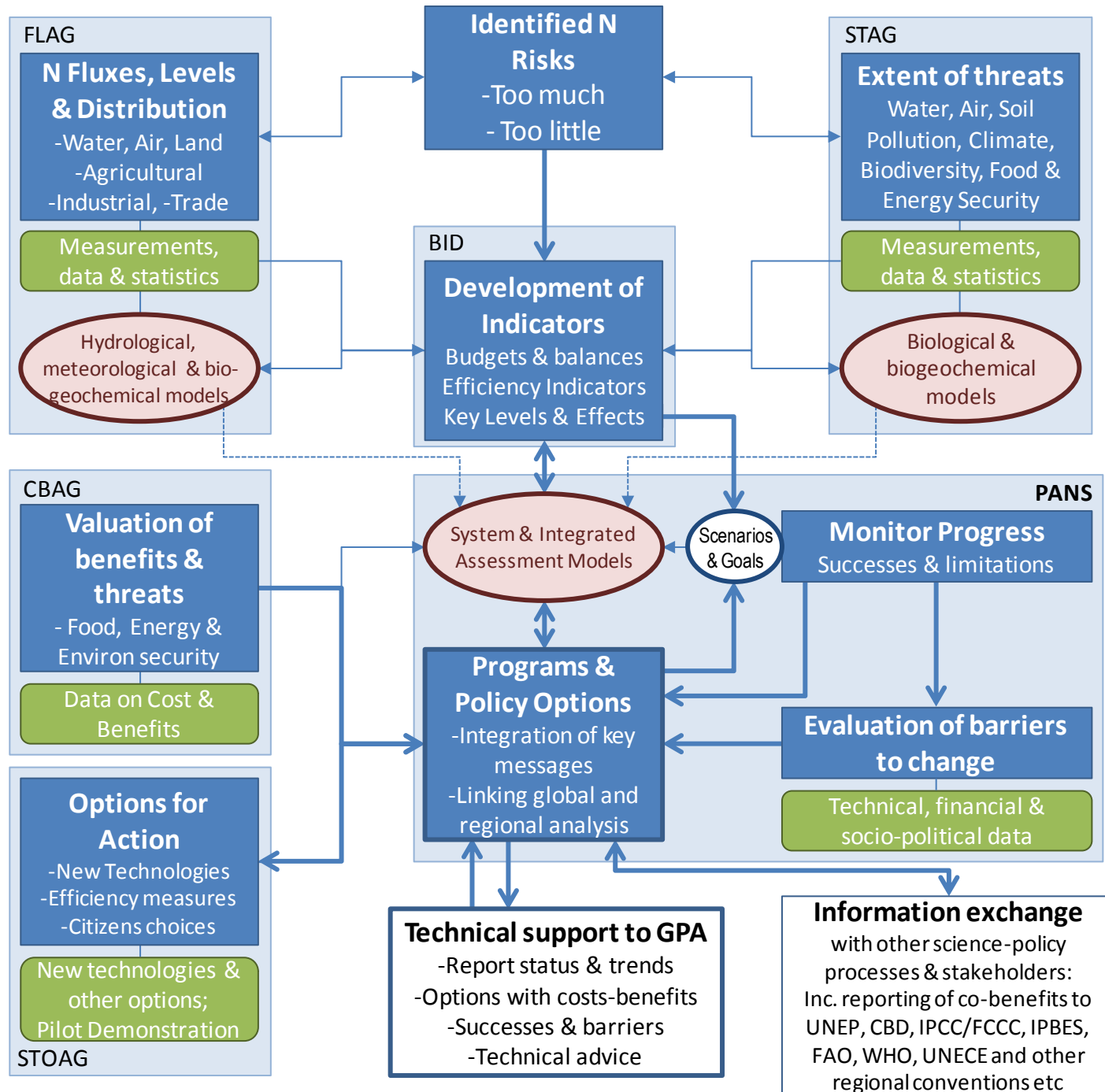
"Some of this land can only be used for pasture and goes some way to protecting our wonderful countryside."

Nitrogen on the Table
Westhoek et al., 2014

Climate and global ammonia emissions

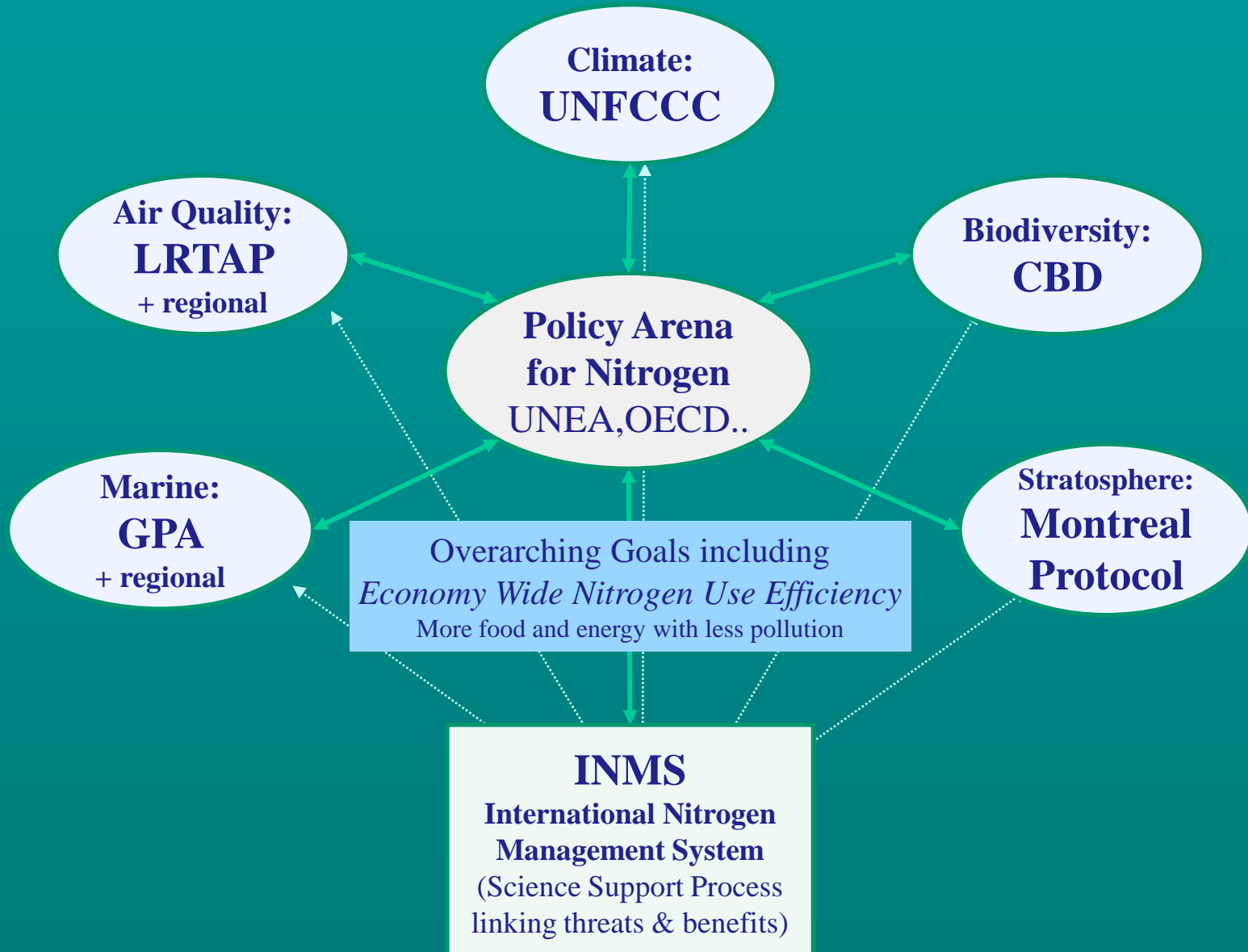


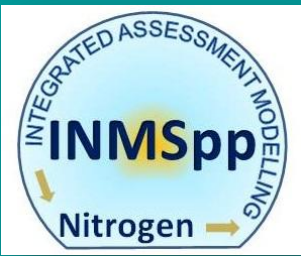
Toward the International Nitrogen Management System (INMS)



GPA:
Global Programme of Action for the Protection of the Marine Environment from Land-based Activities

Linking International Nitrogen Policy Frameworks





Modelling to support the needs of nitrogen-related policy making

Needs of international conventions and policy makers

Demonstrate how feasible improvements in N management translate into quantified co-benefits

Improved food and energy security

Reduced climate & pollution threats

In net economic terms

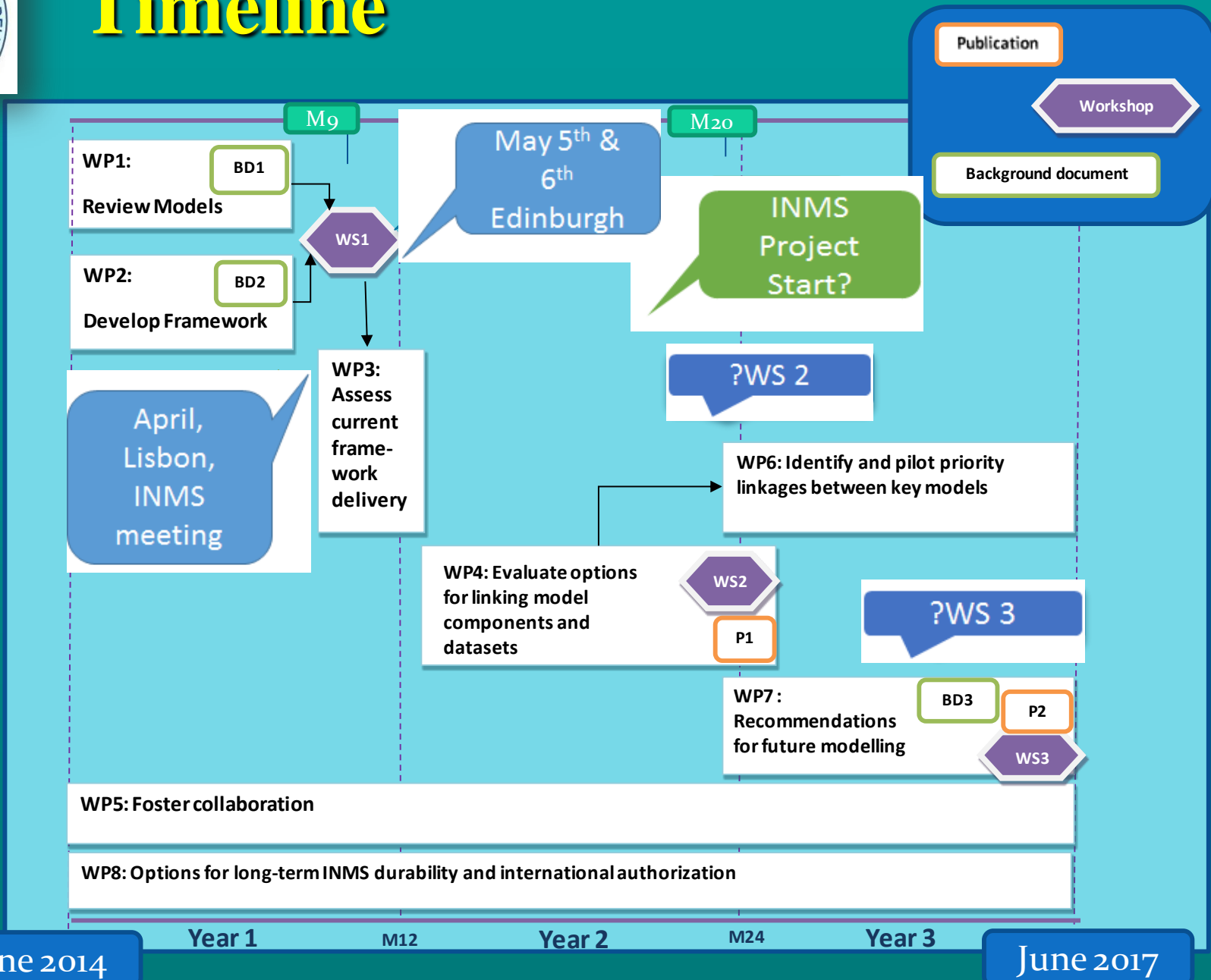


Tasks for INMS pump priming

1. Take stock of the current model situation
2. Consider what we should try to model - framework
3. Assess how models can deliver on this framework
4. Consider how we can link models and data
5. Engage with the community to assess short and long term possibilities
6. Agree priority linkages to work with
7. Use this to make recommendations for global and regional modelling
8. Consider how this can strengthen and support INMS and what authorisation would be needed



Timeline





Workshop Themes

- **WG1: Nitrogen threats and benefits**
Which issues need to be linked in models?
- **WG3: Policy linkages**
What measures for better N management need to be in the models?
- **WG3: Linking compartments & Issues**
How should the nitrogen cycle be linked up when formulating nitrogen IAM models?
- *Cross-cutting topic*
What are the data implications and needs?