ACTIVITY 2.3

"Developing joined up guidance for good nitrogen management"

Activity leads Oene Oenema & Will Brownlie
Wiki page link: https://wiki.ceh.ac.uk/x/14_tGw

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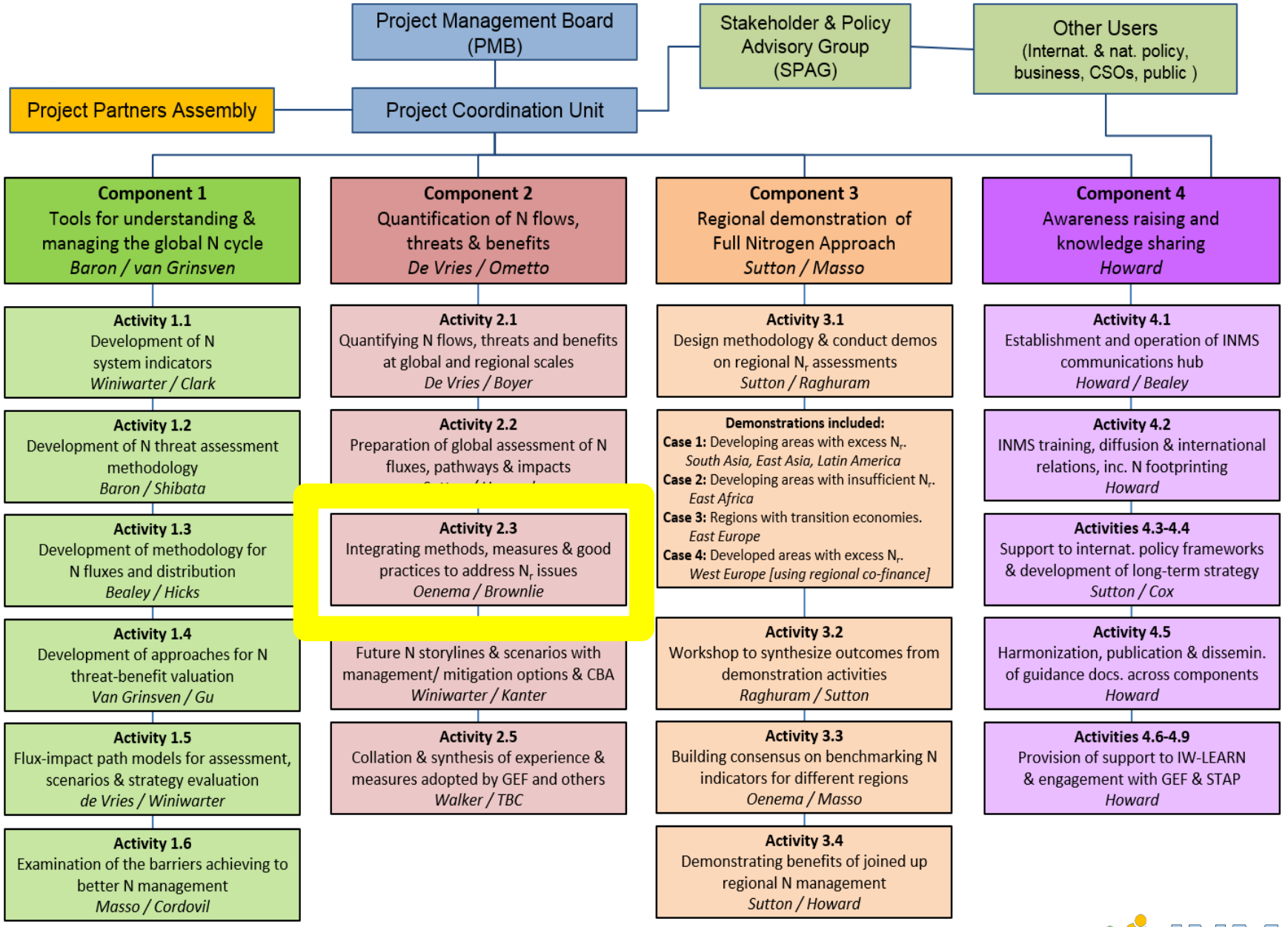
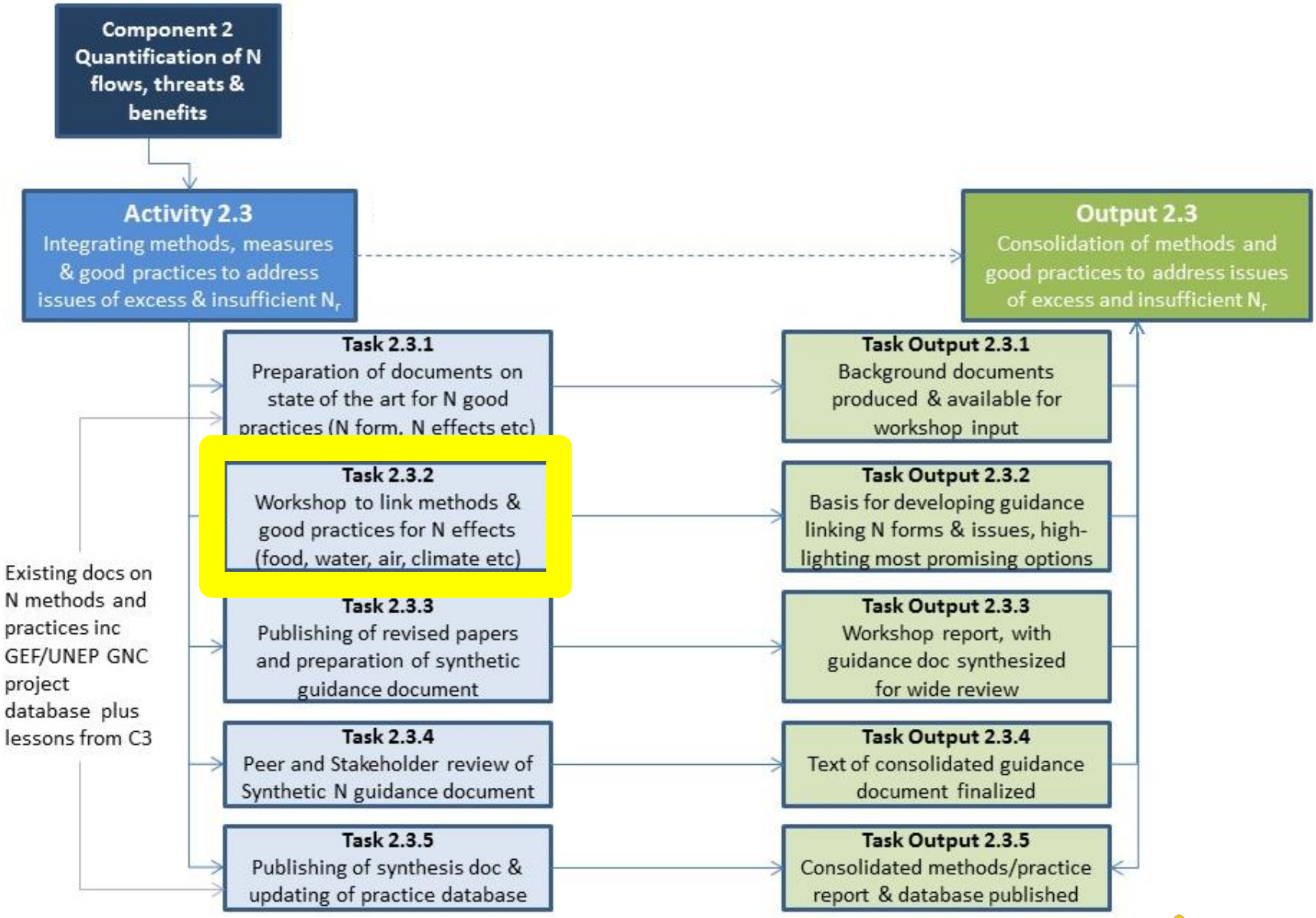
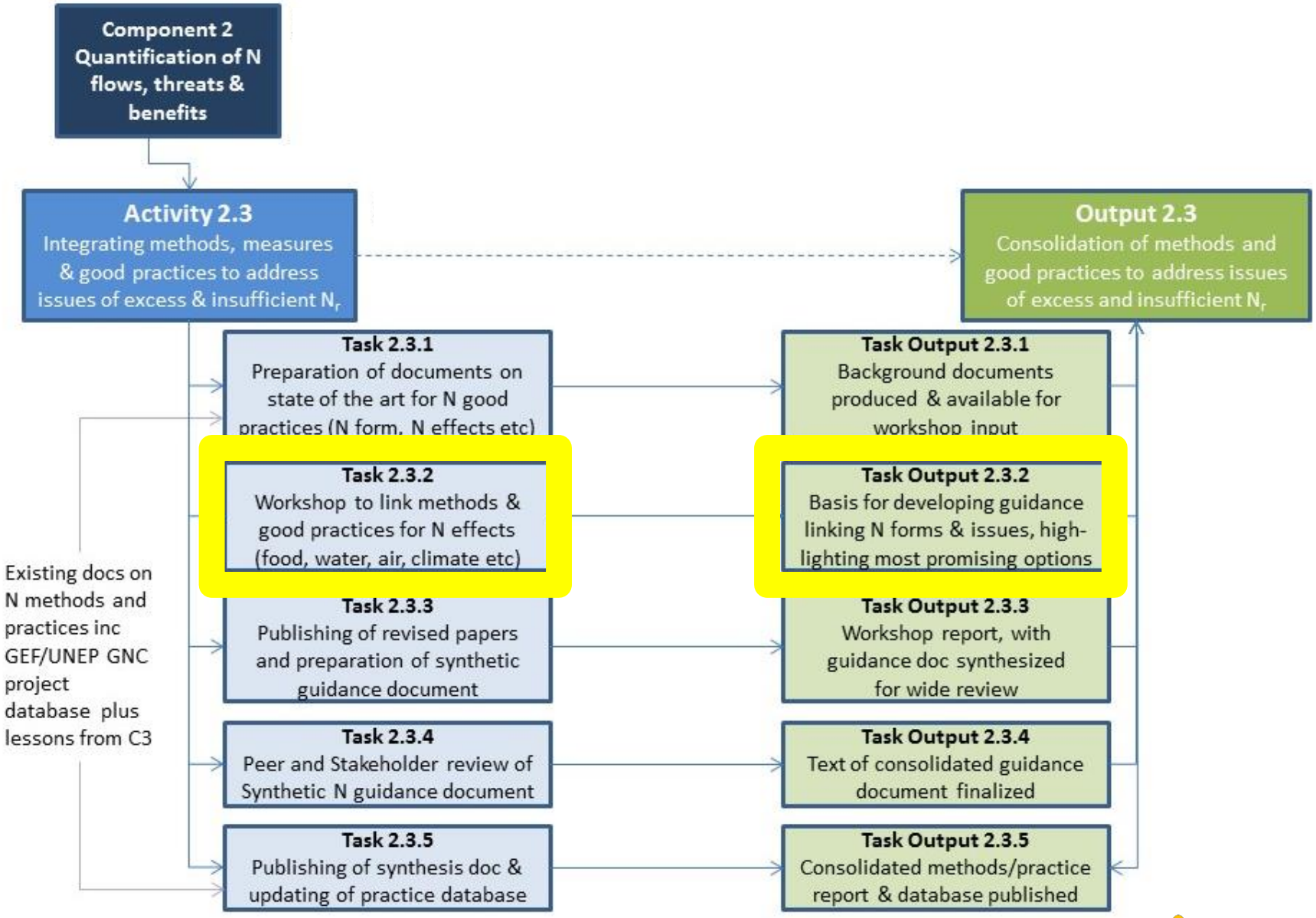
AGENDA

- 13:00 – 13:15 – Group introductions
- 13:15 -13:30 - Overview to activity 2.3
- 13:30 – 15:00 - Breakout group session
- 15:00 – 15:15 – Coffee
- 15:15 – 16:30 – Groups report back and discuss
- 16:30 – 17:00 – Next steps/agreements/timelines


Project Management Board (PMB)
Stakeholder & Policy Advisory Group (SPAG)
Other Users (Internat. & nat. policy, business, CSOs, public)
Project Partners Assembly
Project Coordination Unit
Component 1
Tools for understanding & managing the global N cycle
Baron / van Grinsven
Component 2
Quantification of N flows, threats & benefits
De Vries / Ometto
Component 3
Regional demonstration of Full Nitrogen Approach
Sutton / Masso
Component 4
Awareness raising and knowledge sharing
Howard
Activity 1.1
Development of N system indicators
Winiwarter / Clark
Activity 1.2
Development of N threat assessment methodology
Baron / Shibata
Activity 1.3
Development of methodology for N fluxes and distribution
Bealey / Hicks
Activity 1.4
Development of approaches for N threat-benefit valuation
Van Grinsven / Gu
Activity 1.5
Flux-impact path models for assessment, scenarios & strategy evaluation
de Vries / Winiwarter
Activity 1.6
Examination of the barriers achieving to better N management
Masso / Cordovil
Activity 2.1
Quantifying N flows, threats and benefits at global and regional scales
De Vries / Boyer
Activity 2.2
Preparation of global assessment of N fluxes, pathways & impacts
Activity 2.3
Integrating methods, measures & good practices to address Nr issues
Oenema / Brownlie
Future N storylines & scenarios with management/ mitigation options & CBA
Winiwarter / Kanter
Activity 2.5
Collation & synthesis of experience & measures adopted by GEF and others
Walker / TBC
Activity 3.1
Design methodology & conduct demos on regional Nr assessments
Sutton / Raghuram
Demonstrations included:
Case 1: Developing areas with excess Nr.
South Asia, East Asia, Latin America
Case 2: Developing areas with insufficient Nr.
East Africa
Case 3: Regions with transition economies.
East Europe
Case 4: Developed areas with excess Nr.
West Europe [using regional co-finance]
Activity 3.2
Workshop to synthesize outcomes from demonstration activities
Raghuram / Sutton
Activity 3.3
Building consensus on benchmarking N indicators for different regions
Oenema / Masso
Activity 3.4
Demonstrating benefits of joined up regional N management
Sutton / Howard
Activity 4.1
Establishment and operation of INMS communications hub
Howard / Bealey
Activity 4.2
INMS training, diffusion & international relations, inc. N footprinting
Howard
Activities 4.3-4.4
Support to internat. policy frameworks & development of long-term strategy
Sutton / Cox
Activity 4.5
Harmonization, publication & dissemin. of guidance docs. across components
Howard
Activities 4.6-4.9
Provision of support to IW-LEARN & engagement with GEF & STAP
Howard
INMS


Component 2
Quantification of N flows, threats & benefits
Activity 2.3
Integrating methods, measures & good practices to address issues of excess & insufficient N_r
Output 2.3
Consolidation of methods and good practices to address issues of excess and insufficient N_r
Task 2.3.1
Preparation of documents on state of the art for N good practices (N form, N effects etc)
Task Output 2.3.1
Background documents produced & available for workshop input
Task 2.3.2
Workshop to link methods & good practices for N effects (food, water, air, climate etc)
Task Output 2.3.2
Basis for developing guidance linking N forms & issues, high-lighting most promising options
Task 2.3.3
Publishing of revised papers and preparation of synthetic guidance document
Task Output 2.3.3
Workshop report, with guidance doc synthesized for wide review
Task 2.3.4
Peer and Stakeholder review of Synthetic N guidance document
Task Output 2.3.4
Text of consolidated guidance document finalized
Task 2.3.5
Publishing of synthesis doc & updating of practice database
Task Output 2.3.5
Consolidated methods/practice report & database published
Existing docs on N methods and practices inc GEF/UNEP GNC project database plus lessons from C3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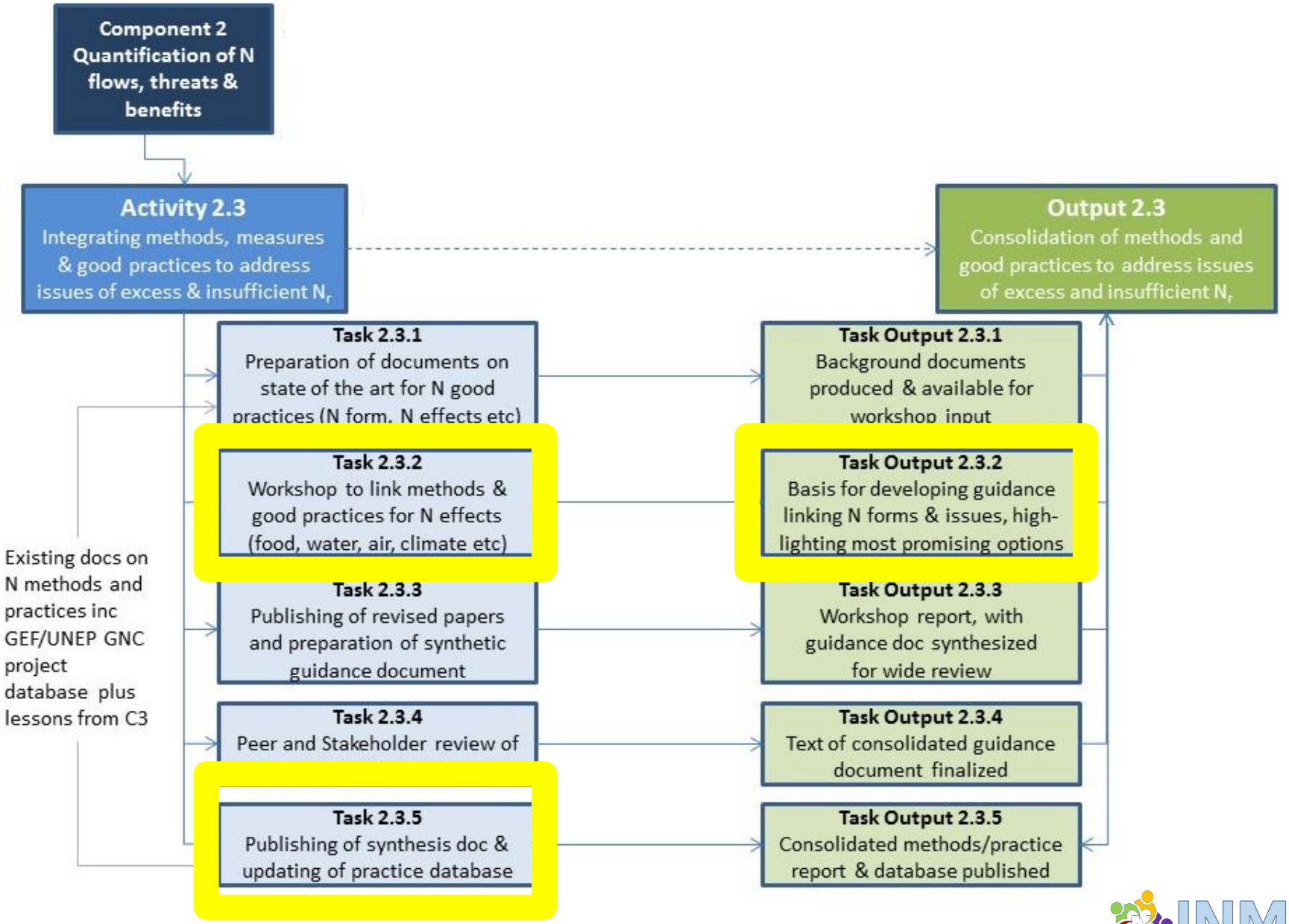
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Guidance on

INTREGRATING

NITROGEN MANAGEMENT MEASURES



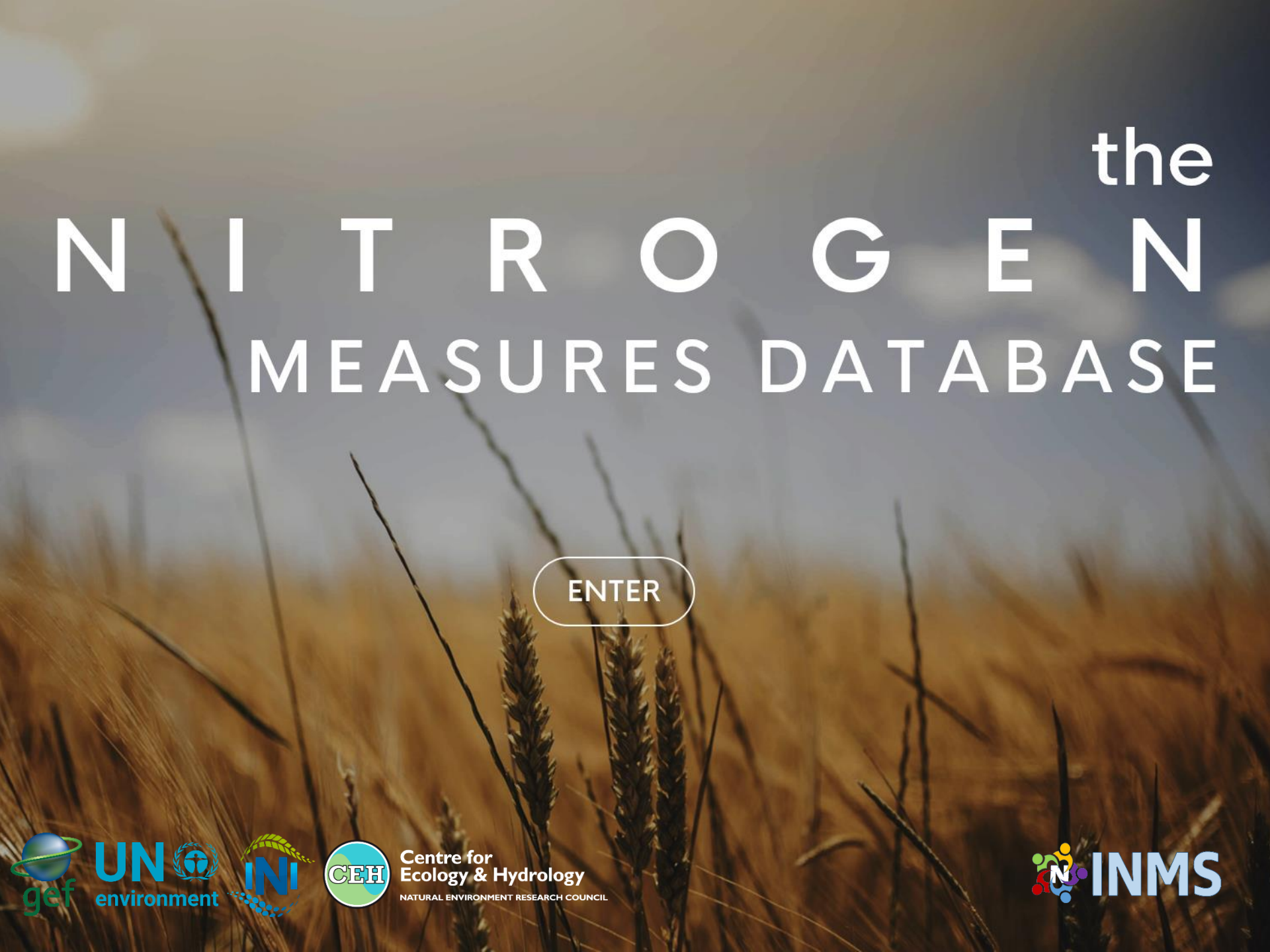

GUIDANCE DOCUMENT

AUDIENCE: Policy makers, environment agencies and extension services

- PURPOSE: Outline why we should, and how we can integrate nitrogen measures.

- WHAT IT WILL LOOK LIKE:
- Concise, highly visual, easily accessible/readable.
- 50-100 pages
- Printed
- Web-based (interactive PDF) versions.

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NITROGEN MEASURE DATABASE

AUDIENCE: Policy makers, environment agencies and extension services

- PURPOSE: Store technical information on all nitrogen measures (>200?). Including: 'appropriateness for region', and 'how to' implement measures.

- WHAT IT WILL LOOK LIKE:
- Highly visual, easily accessible and readable.
- Freely available searchable web based tool (available on the INMS website)
- Living document

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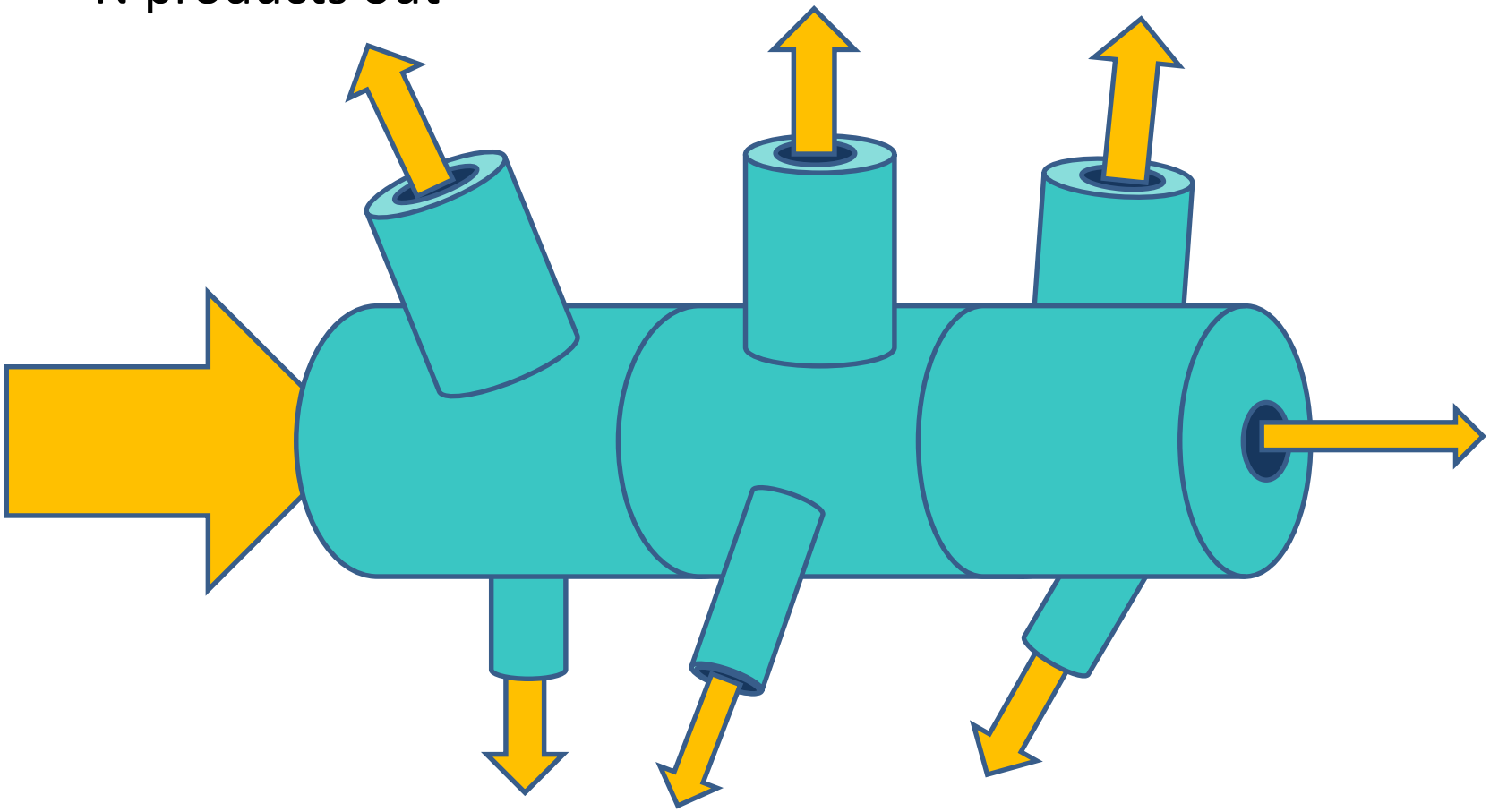
Why do we need

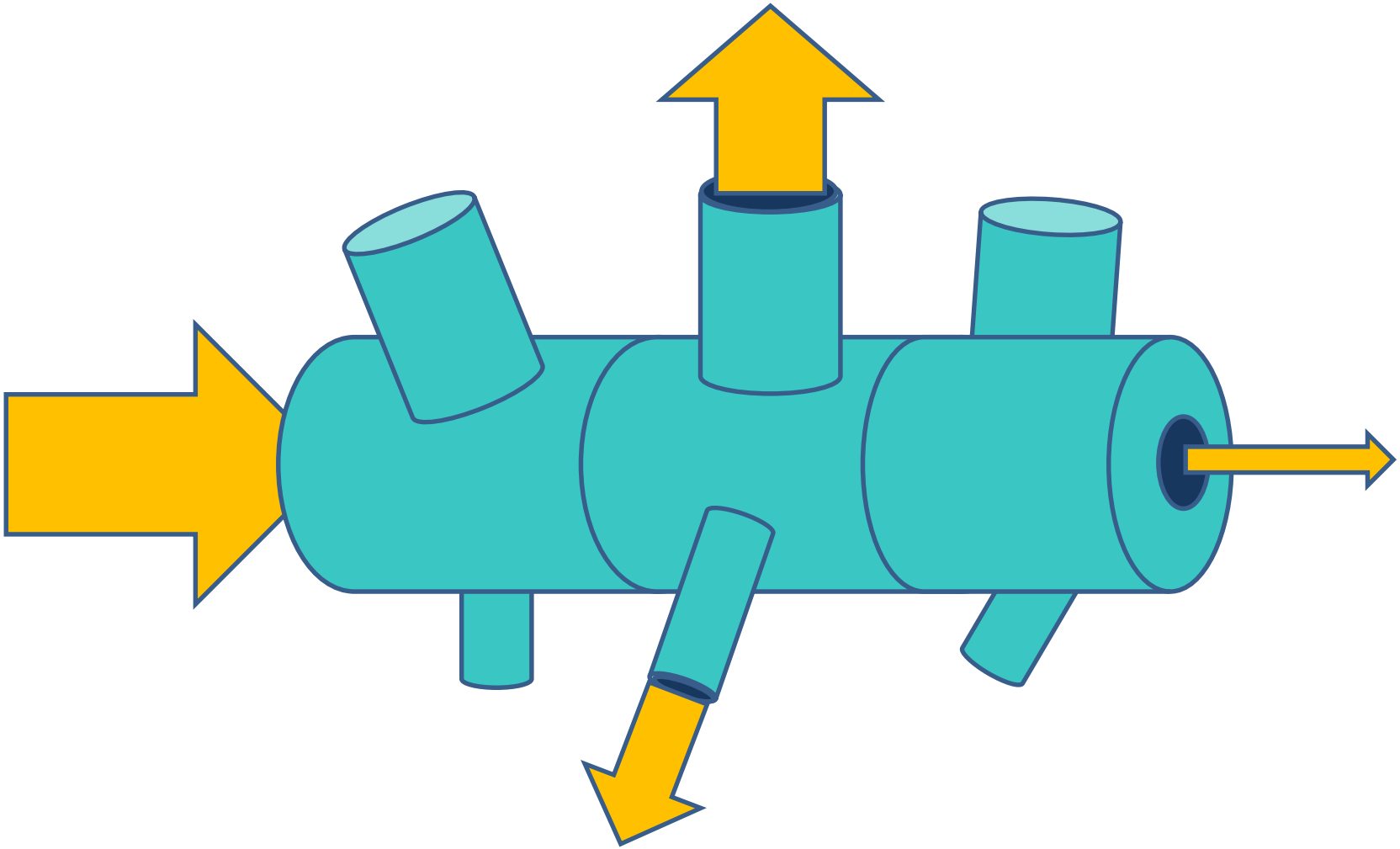
INTREGRATION

OF NITROGEN MANAGEMENT MEASURES?

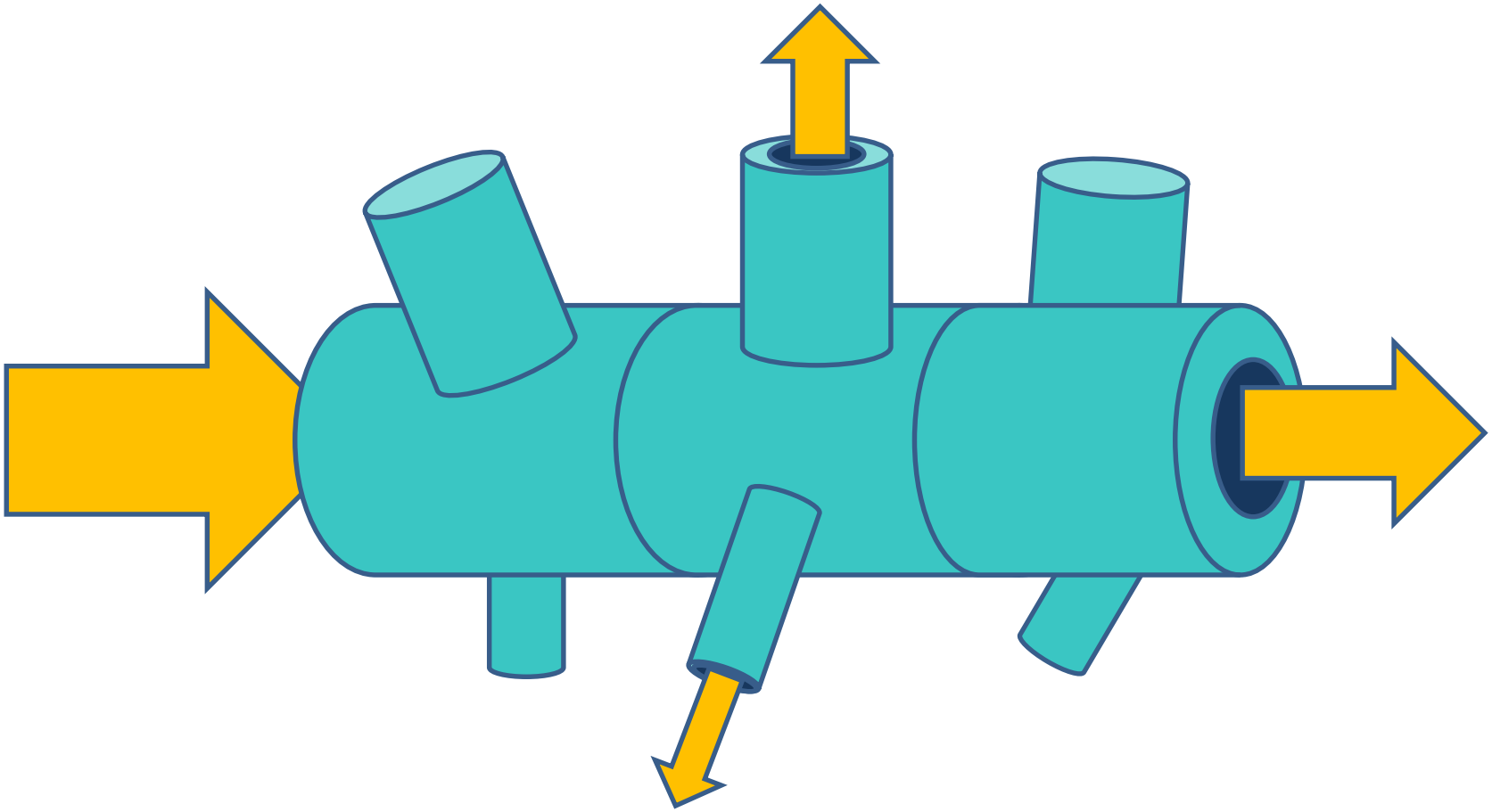
In order to get the benefits of measures to reduce nitrogen loss you either need to put less N in or get more N products out



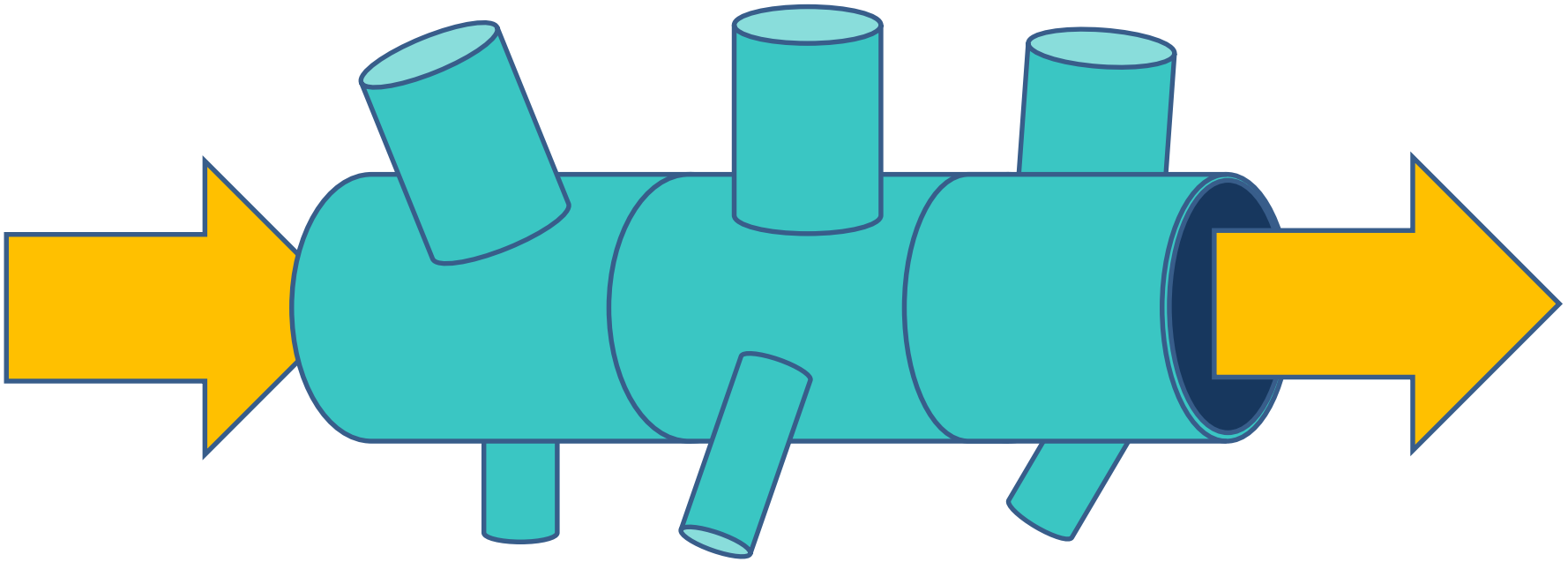
Reducing N leaks, may cause pollution swapping IF output remains the same



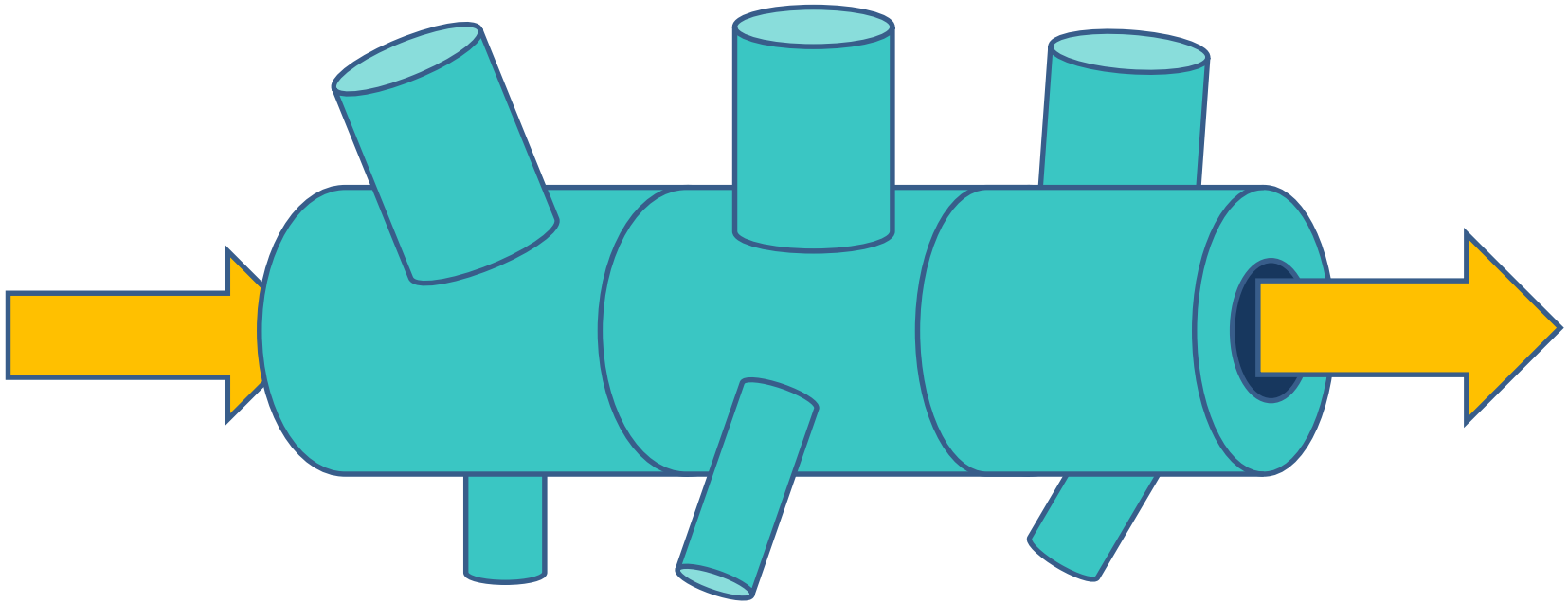
Reducing N leaks, and
INCREASING N output will reduce
scale of N leaks

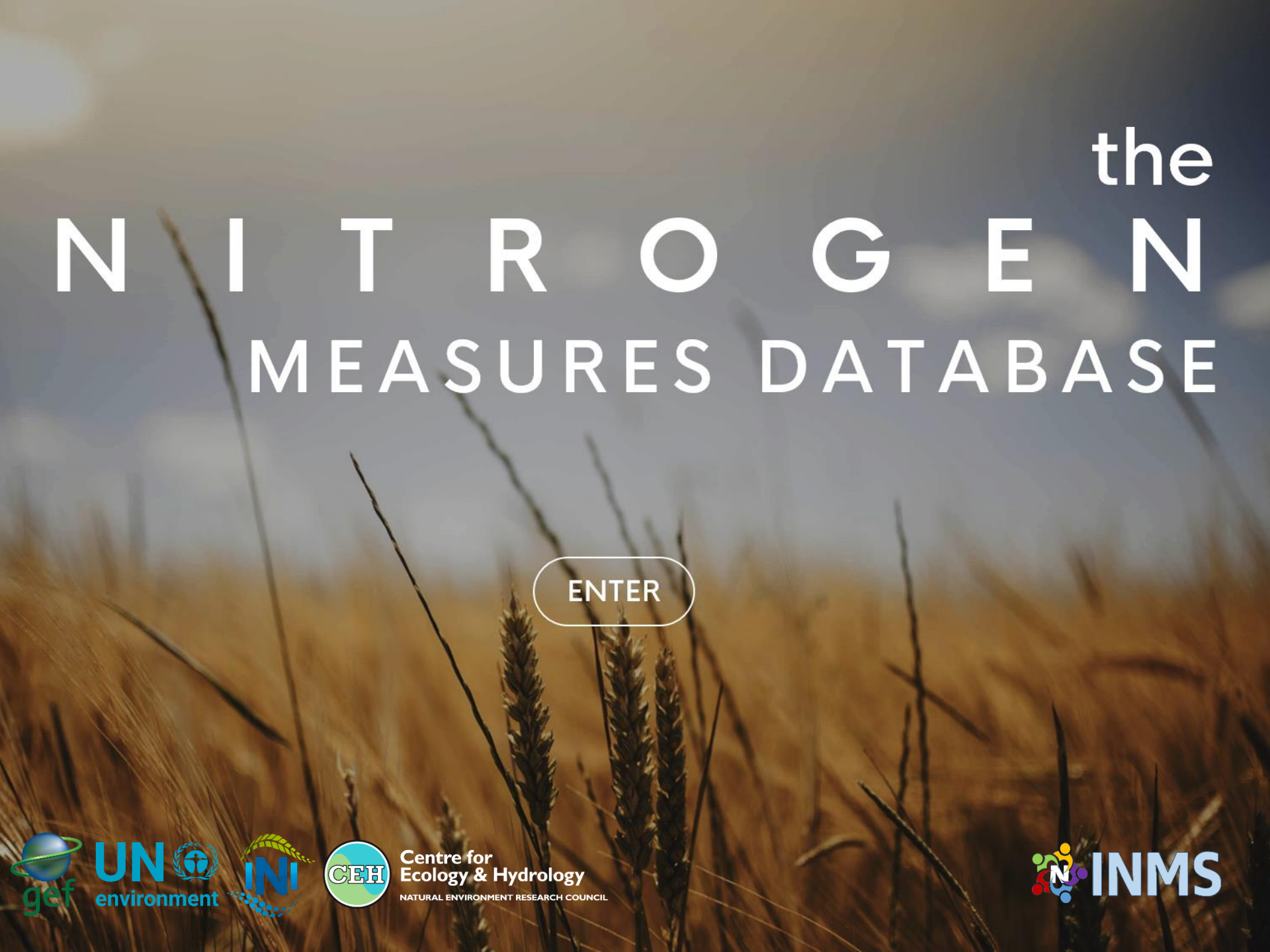


A system with no leaks:
INPUT = OUTPUT



Perhaps what we are aiming for is a system with no leaks:
INPUT = OUTPUT where the size of flows within the whole system is also reduced

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the NITROGEN MEASURES DATABASE

The INMS 'Nitrogen Measures Database' will be a web-based database cataloguing the information needed to compare and contrast 'measures that address issues of excess and insufficient reactive nitrogen'.

MEASURES TO REDUCE NITROGEN LOSSES

All measures that reduce wasteful nitrogen losses to the environment
(full measures catalogue)

MEASURES TO INCREASE NITROGEN USE EFFICIENCY

Measures that will reduce wasteful nitrogen losses to the environment by improving nitrogen use efficiency
(subset of the full measures catalogue)

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Home

Nitrogen

- **All**
- Ammonia (NH3)
- Nitrogen Dioxide (NO2)
- Nitrogen Oxide (NOx)
- Nitrous Oxide (N20)

Region

- **All**
- East Africa
- East Asia
- Eastern Europe
- Latin America
- North America
- South Asia
- Western Europe

Sector

- **All**
- Agriculture (arable)
- Agriculture (livestock)
- Agriculture (mixed)
- Farm (arable)
- Farm (livestock)
- Farm (mixed)
- Food Industry

Lowering crude protein of ruminant diets

"Tight" lid, roof or tent structure

Increase grazing time

Removing slurry from pit

Absorption or adsorption by bedding

Manure belts

No more cars

Decreasing surface area fouled by manure

INMS

Criteria used to search through data records contained within the nitrogen measures database (suggested content)

	Search Criteria	Options provided (in drop-down menus)
1	**Aim of measure**	1) Reducing N nitrogen losses, 2) Increase N use efficiency
2	**Nitrogen Species**	1) NH3 2) NO2 3) NO_x 4) N_2O 5) NH_4NO_3 6) N_r
3	**Geographic Region**	1) Latin America 2) Africa 3) East Asia 4) South Asia 5) West Europe 6) East Europe 7) USA and Canada 8) Oceania
4	**Sector**	1. Industry 2. Agriculture to produce crops 3. Agriculture for livestock production 4. Water resource management 5. Society 6. Urban Infrastructure
5	**Sector Category**	1) Livestock feeding strategies 2) Animal housing techniques 3) Manure storage techniques Etc.

The nitrogen measures database will include a ‘data record’ for each ‘measure’, containing information gathered from sources including existing guidance documents and expert opinion.

Grooved flooring in cattle housing

Principle of the measure

Decreasing the surface area fouled by manure will reduce ammonia emissions.

“The “grooved floor” system is appropriate for dairy and beef cattle housing and can help to reduce the surface area of wastes.

Measure overview

Housing systems for cattle vary. While loose housing is most common, dairy cattle are kept in tied stalls in some countries. In loose housing systems, all or part of the excreta is collected in the form of slurry. In systems where solid manure is produced (such as straw-based systems), it may be removed from the house daily or it remain there for up to the whole season, such as in deep litter stables. The system most commonly researched is the “cubicle house” for dairy cows, where ammonia (NH_3) emissions arise from fouled slatted and/or solid floors and from manure in pits and channels beneath the slats/floor (Swierstra et al. 2001).

Ammonia is formed by the breakdown of excreted urea in the urine of the animals. The ammonium ions produced in the liquid layer (slurry or urine pool) are released at the air–liquid layer boundary (volatilization phase). Emission of ammonia takes place as the inside air of a building, and thus the volatilized ammonia, is exchanged by ventilation and replaced by outside air (emission phase). Systems that reduce the surface area of cattle wastes will therefore reduce volatilization of ammonia.

By covering the slurry pit with the solid grooved concrete elements and by draining the urine via the grooves and perforations, a substantial reduction in ammonia emission can be obtained. In a study by (Swierstra et al. 2001) The ammonia emission from the compartment with the open grooved floor (figure 1) was reduced 46% compared with the emission from the compartment with a slotted floor (i.e. wastes collect in slots and are not free to drain).

The “grooved floor” system for dairy and beef cattle housing, employing “toothed” scrapers running over a grooved floor, is a reliable technique to abate NH_3 emissions. Grooves should be equipped with perforations to allow drainage of urine. This results in a clean, low-emission floor surface with good traction for cattle to prevent slipping. Ammonia emission reduction ranges from 25% to 46%, relative to the reference system outlined in (Bittman et al. 2014).

How to implement the measure

Floors are generally made of concrete and are a place where slurry accumulates so frequent (two to three times per day) and thorough scraping is required.

All floors must be properly drained and treated in such a way to prevent slipping with a gentle gradient to provide good footing. The slope of the floor should be between 1.5–3%. The floor should provide sufficient slip resistance when covered in slurry, at all times of the year.

All surfaces on which cows walk should be easily cleaned and provide adequate traction to prevent slipping and falling. The provision of slip-resistant flooring in collecting yards and parlours will also be beneficial.

Parallel grooves should be placed 40mm between centres and the groove should be around 10mm wide to prevent slurry accumulation. The grooves should be 6 to 10mm.

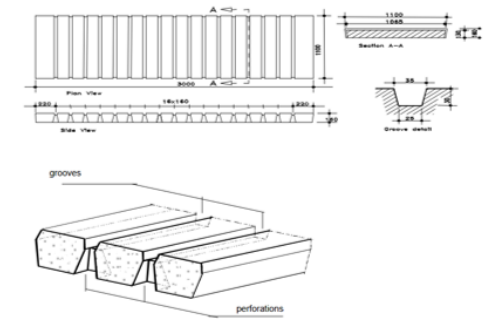

Figure 1. Typical dimension of a grooved floor system in concrete flooring. Such a system in cattle housing can help to reduce ammonia emssions from wastes. Diagram source:

It is important to ensure wastes do not collect with in the goorves of such flooring systems. Waste can be cleaned from a grooved flooring system using a handheld tool (Figure 2b). Automatic scrapers can also be installed (Figure 2b). These scrapers run frequently to remove waste material from the passages within the building. The scrapers either deposit the slurry outside the building on a hard standing for collection by a tractor scraper or scrape directly into a slurry lagoon or slurry channel.

Unless scraped runs are kept less than 25m in length, there is likely to be a build-up of slurry in front of the scraper blade. Slurry accumulation does not appear to concern the cow, however soiling of the foot and lower limb can have a negative impact on foot health and cow cleanliness when manure is trampled into the cubicle.

Installing of a slatted cross-passage every 25m will significantly reduce the pooling of slurry in front of the scraper blade.

Figure 2. a) Manually cleaning wastes from a grooved system. B) Automatic scraper cleaning wastes from a grooved floor system.

Opportunities, synergies and co-benefits

Short statement of opportunities, synergies and co-benefits that are available if this measure is implemented (<200 words).

This may include:

- Opportunities for reuse, recycling and recovery of nutrients and subsequent opportunities for the circular economy.
- Reduction of other pollutant flows to the environment (i.e. phosphorus, greenhouse gases),
- Increase in sustainable use of other resources (i.e. water, energy, labour).
- Benefits to the environment (i.e. protecting biodiversity, provision of ecosystem service).
- Benefits to animal health and wellbeing.

Constraints, concerns and challenges

Short statement on any constraints, concerns or challenges that maybe encountered implementing this measure, with solutions offered where available. (<500 words).

This may include:

- Pollution swapping
- Policy constraints.
- Increase in sustainable use of other resources (i.e. water, energy, labour).
- Risks to the environment, biodiversity, and provision of ecosystem service.
- Risks to animal health and wellbeing.

Technical Statistics at a glance

Aim of measure	Reducing N nitrogen losses
Nitrogen species	NH3
Geographic region	Latin America Africa East Asia South Asia West Europe East Europe USA and Canada Oceania
Sector	Agriculture (livestock)
Sector Category	Livestock feeding strategies
Reduction in N losses by implementing the measure	27%
Cost savings and production benefits	$ 10 per N kg
Capital costs of implementing this measure	$ 10 per N kg
Operational costs of implementing this measure	$ 10 per N kg

Links to further information

Bittman, S., Dedina, M., Howard, C. M., Oenema, O., & Sutton, M. A. (2014). *Options for ammonia mitigation: Guidance from the UNECE Task Force on Reactive Nitrogen. TFRN-CLRTAP, Centre of Ecology and Hydrology, UK.*

Swierstra, D., Braam, C. R., & Smits, M. C. (2001). Grooved floor system for cattle housing: Ammonia emission reduction and good slip resistance. *Applied Engineering in Agriculture*, *17*(1), 85–90.

	Category title	Description
1	**Measure**	Name of the measure (<10 words)
2	**Principle of the measure**	Short statement on the theory behind the measure. (<50 words)
3	**Measure overview**	Detailed statement on what the measure is, how it achieves its aim and delivers the principle of the measure. (<500 words)
4	**How to implement the measure**	Details on how to implement the measure, heavily supplemented with photos and figures. (<500 words)
5	**Opportunities, synergies and co-benefits**	Short statement of opportunities, synergies and co-benefits that are available if this measure is implemented. (<500 words)
6	**Constraints, concerns and challenges**	Short statement on any constraints, concerns or challenges that maybe encountered implementing this measure, with solutions offered where available. (<500 words)
7a	Reduction in N losses by implementing the measure (%)	Based on a reference emission.
7b	Cost savings and production benefits ($)	Estimation of the cost savings and production benefits (i.e. in terms of fertiliser costs not lost to environment due to measure or reduced costs for abatement).
7c	Capital costs of implementing this measure ($)	Estimation of capital cost for fixed equipment + labour cost for installation.
7d	Operational costs of implementing this measure ($)	Capital cost divided over life of the investment + repairs per year + labour costs + fuel energy costs + cost of any change in livestock performance - cost savings and production benefits (not to include costs of outreach, education etc.).
8	**Links to further information**	List of 5-10 key publications & websites where users can find more information, to include references used within the text.

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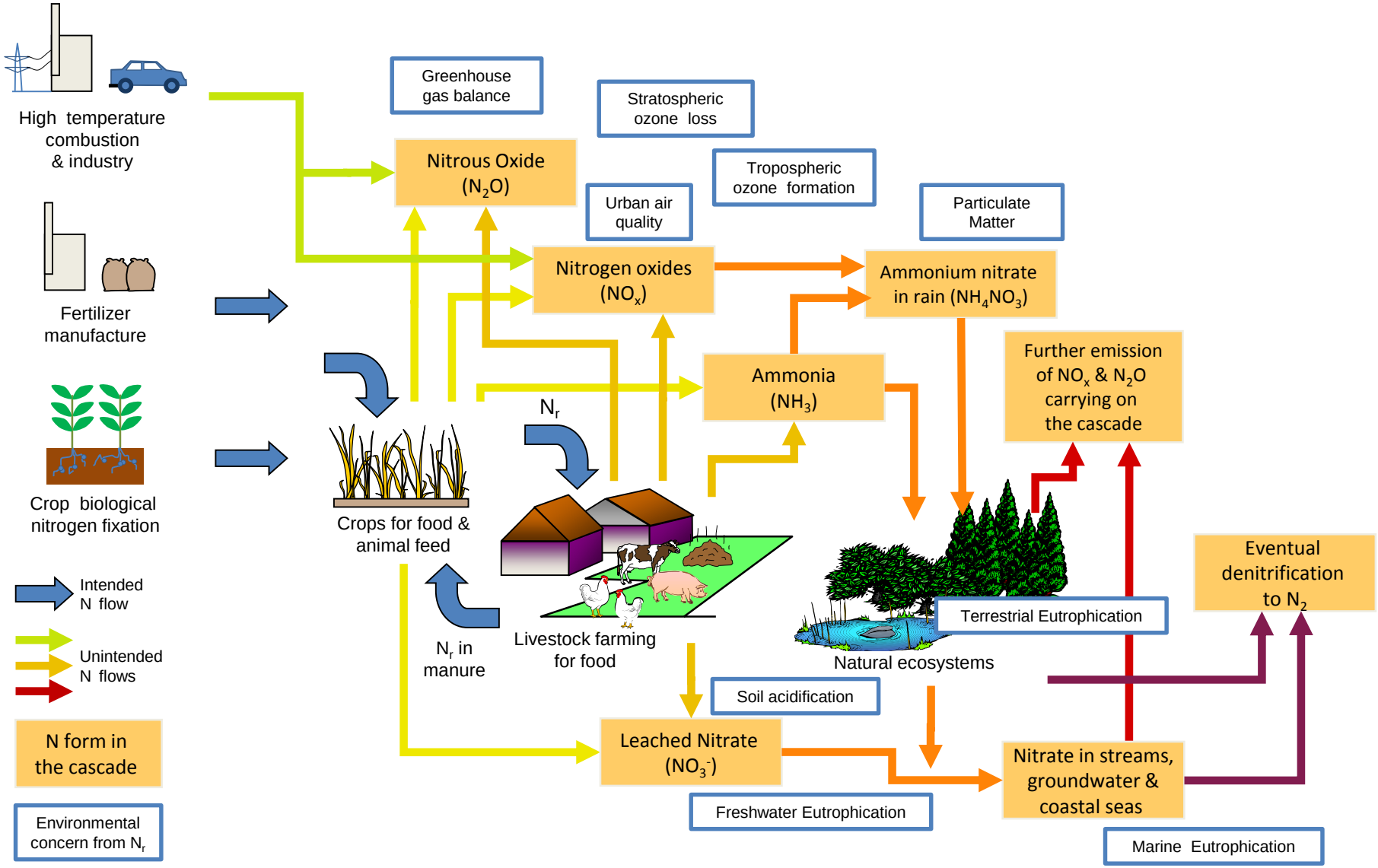
Simplified view of the Nitrogen Cascade



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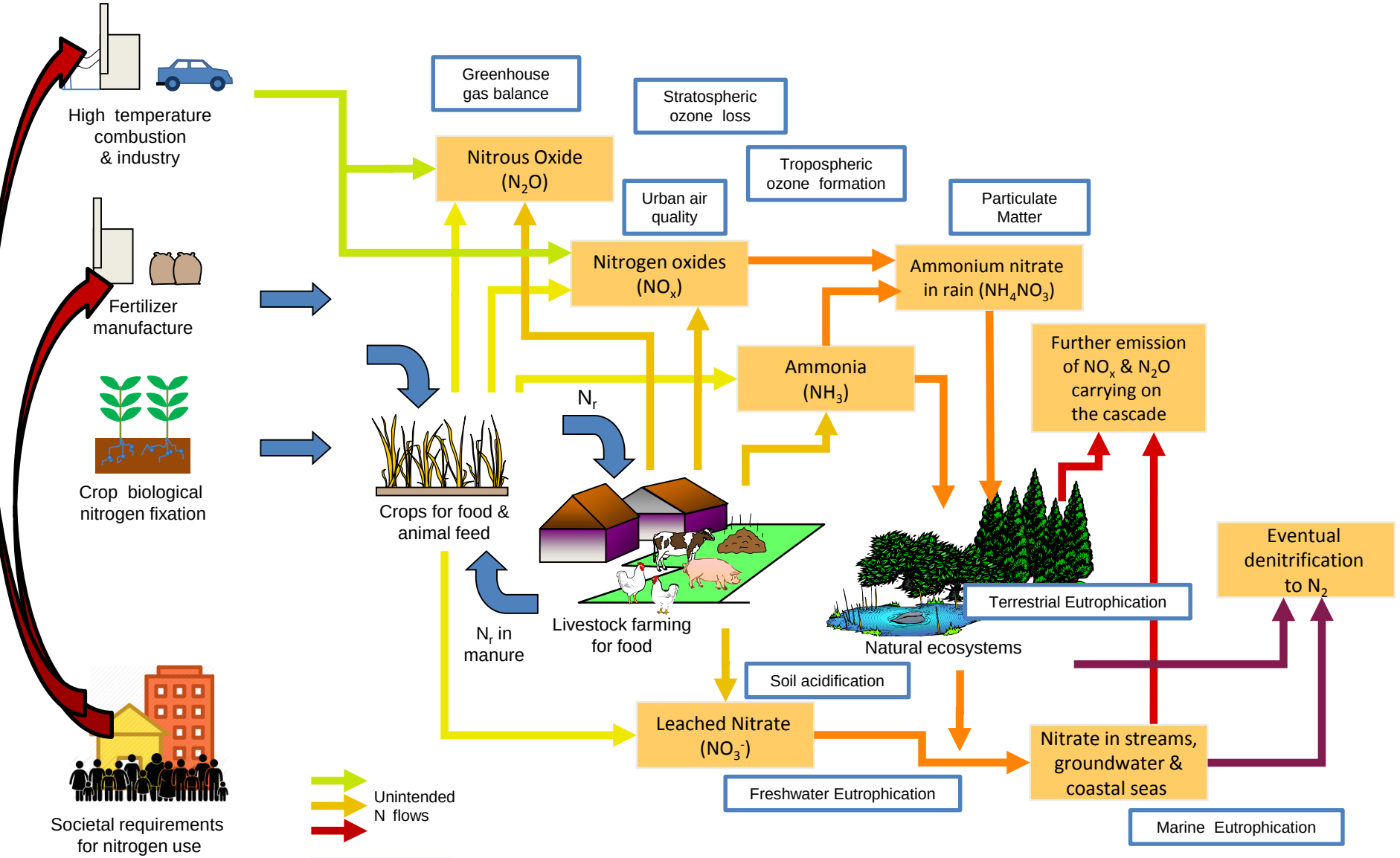
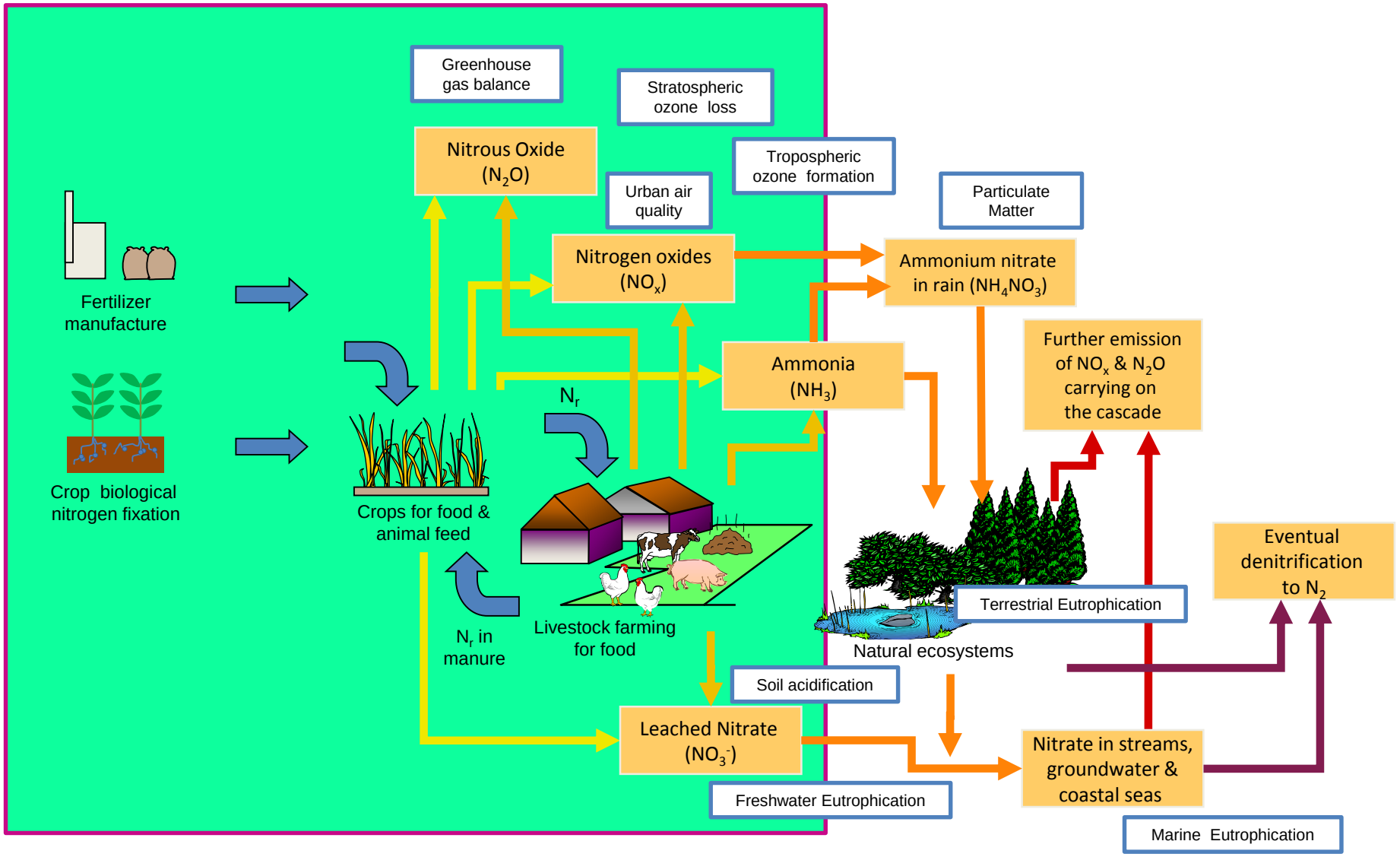
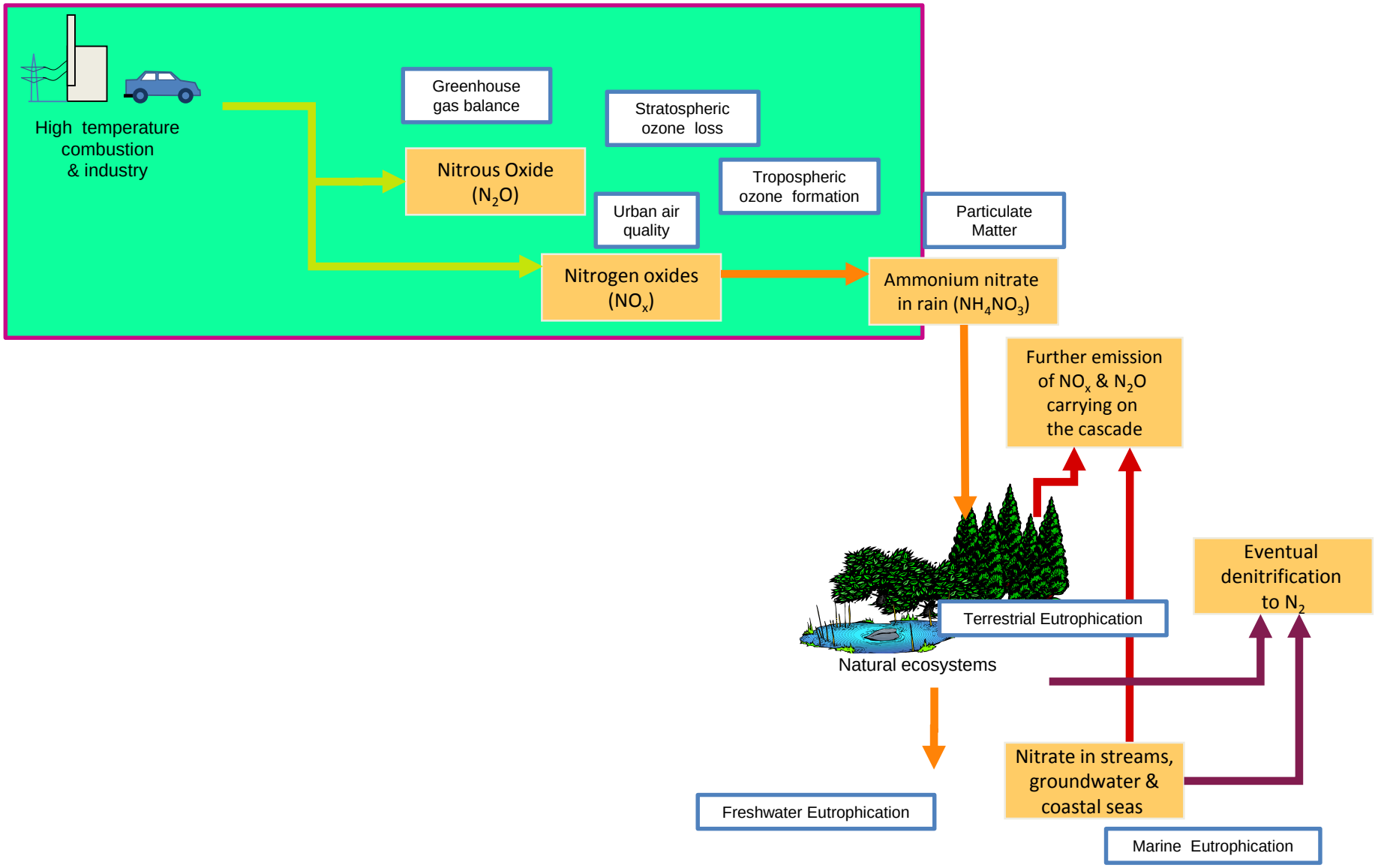


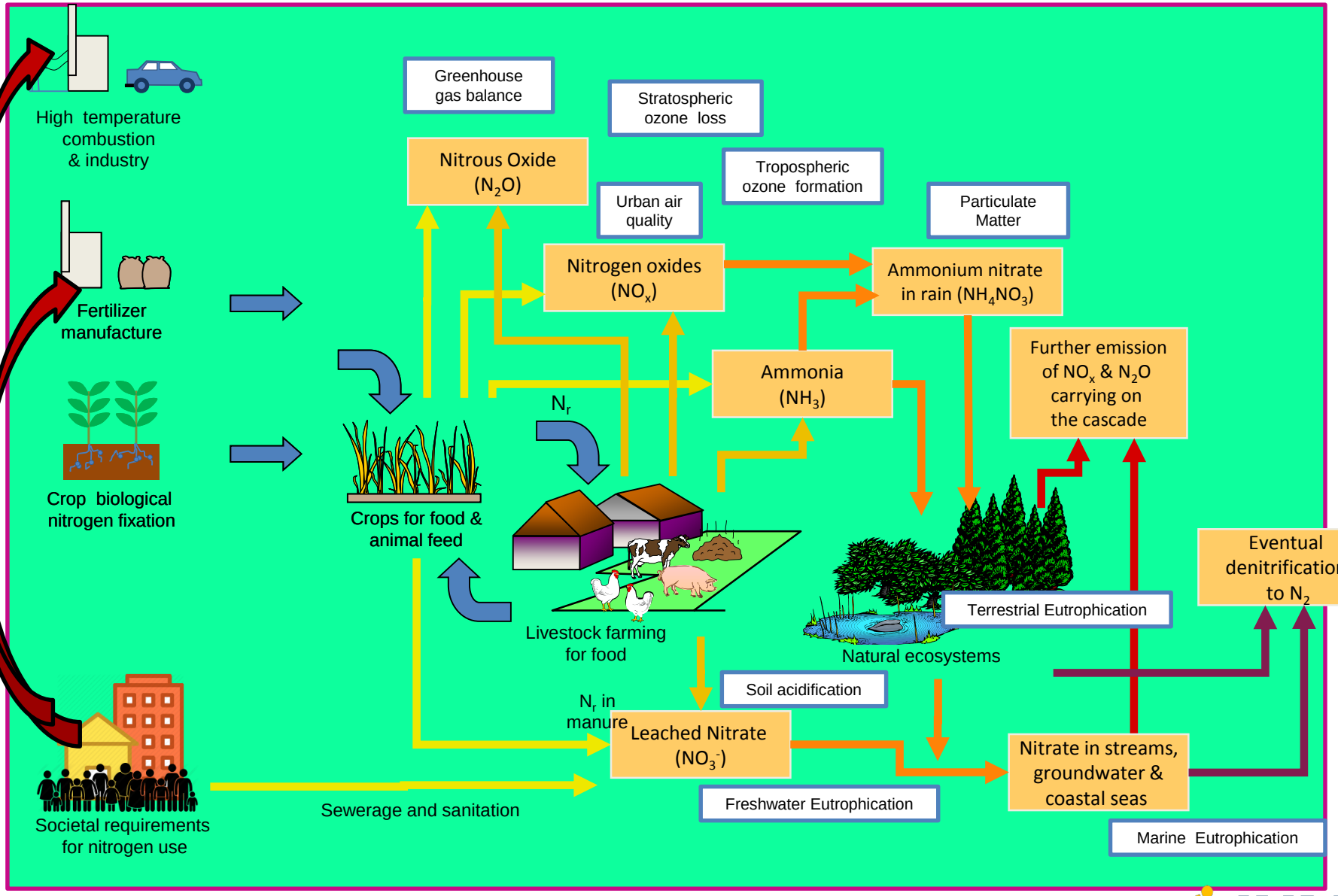
1. Agriculture



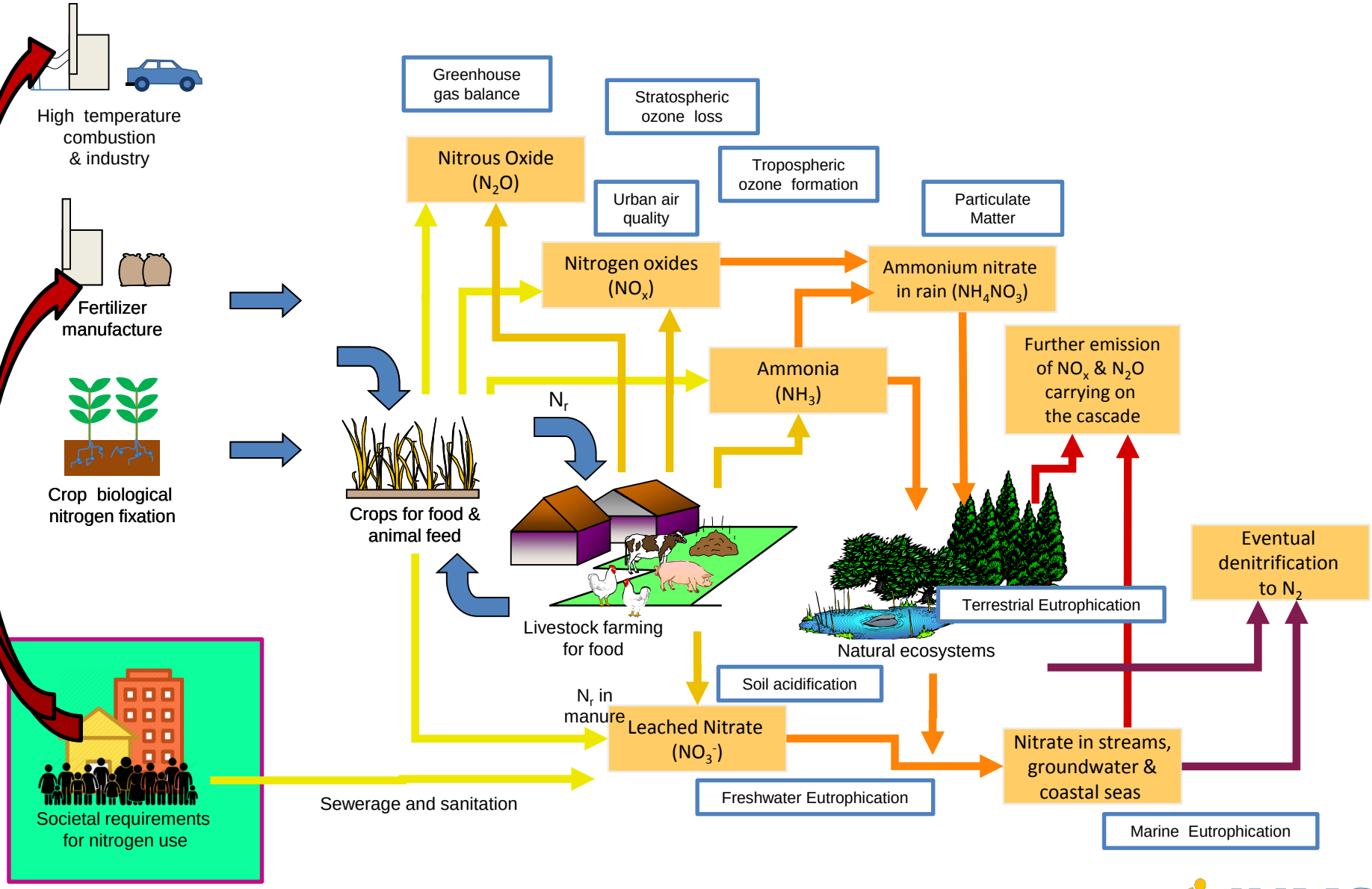
2. Transport and Industry



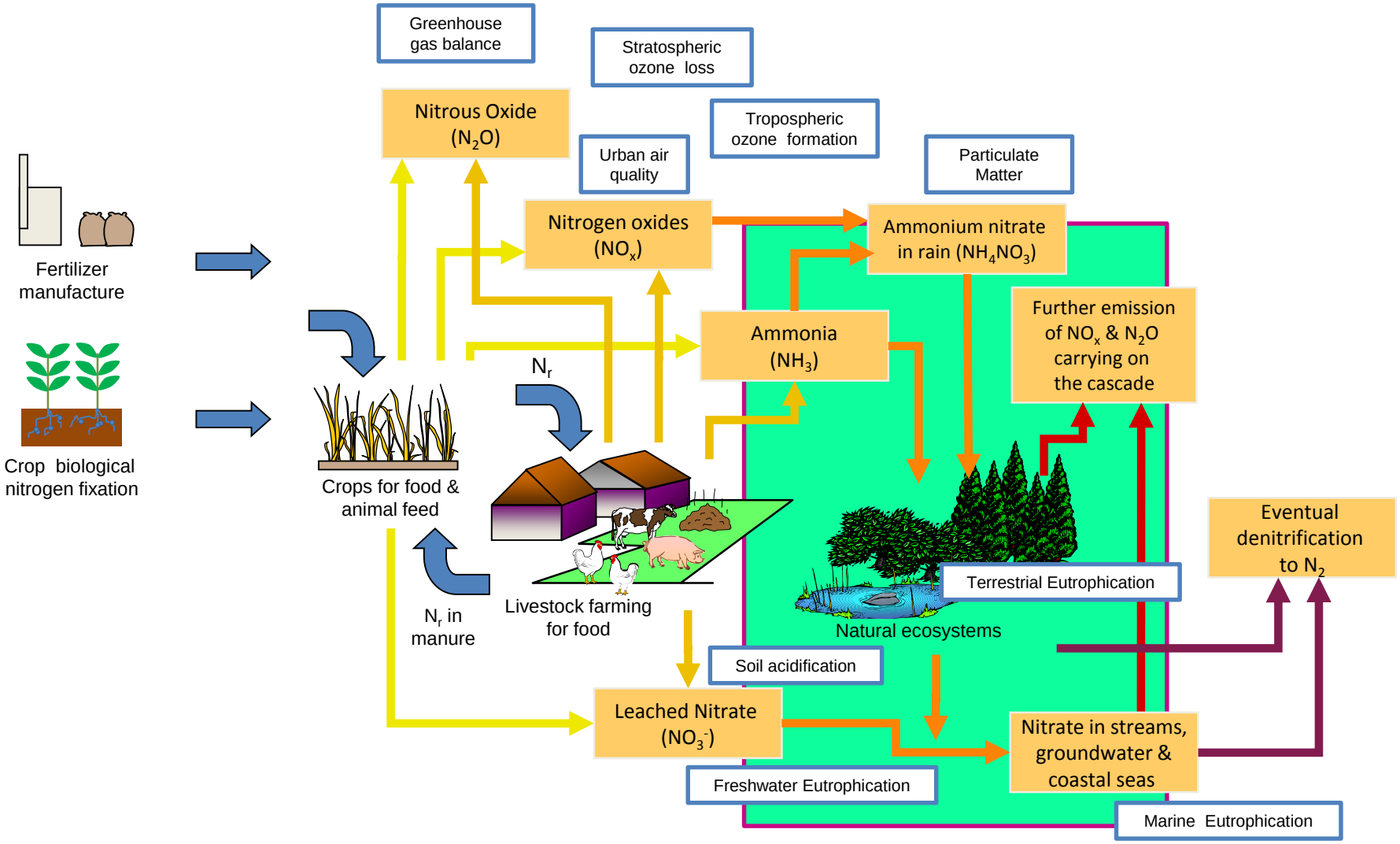
3. Waste and Recycling



3. Societal consumption patterns



3. Integration and Optimisation




Options for Ammonia Mitigation
Guidance from the UNECE Task Force on Reactive Nitrogen
Department of the Environment
fertilizers europe
Code of Best Agricultural Practice
UREA
Code of Practice For Agriculture Use Of Sewage Sludge
Department of Agriculture and Rural Development
Good Agricultural Practice for the Protection of Water, Air and Soil
Global Assessment of Manure Management Policies and Practices

Drawing Down N_2O

To Protect Climate and the Ozone Layer

A UNEP Synthesis Report

UNEP

European Commission

Resource Efficiency in Practice – Closing Mineral Cycles

IMPEL

European Union Network for the Implementation and Enforcement of Environmental Law

Good practice for tackling diffuse nitrate pollution from farms & farmsteads

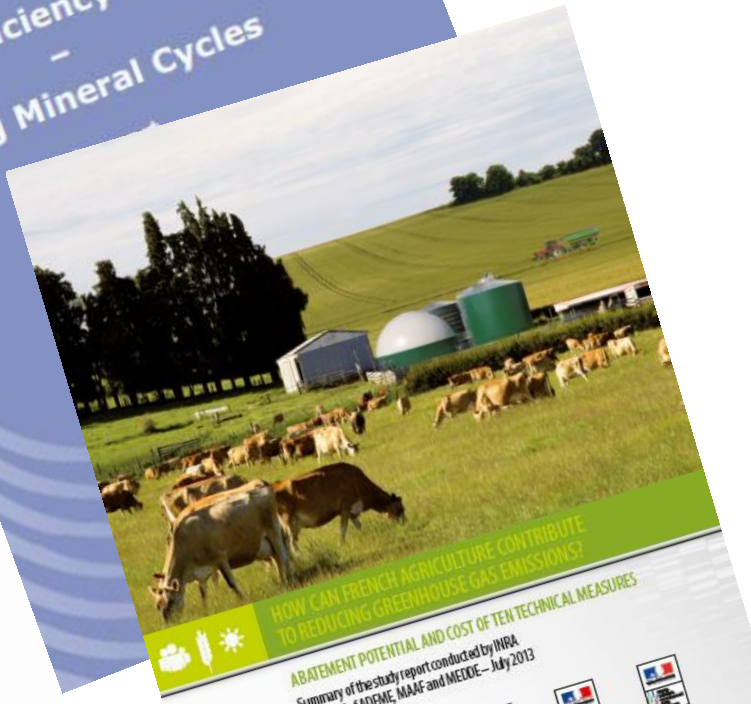
A guidance document with examples of good practice

Analysis of the potential of 10 practices for reducing ammonia emissions from French livestock farms by 2020 and 2030

Study carried out for ADEME

by the Centre Interprofessionnel Technique d'Etudes de la Pollution Atmosphérique (CITEPA)

Etienne MATHIAS and Edith MARTIN



HOW CAN FRENCH AGRICULTURE CONTRIBUTE TO REDUCING GREENHOUSE GAS EMISSIONS?

ABATEMENT POTENTIAL AND COST OF TEN TECHNICAL MEASURES

Summary of the study report conducted by INRA on behalf of ADEME, MAAF and MEDDE – July 2013

INRA SCIENCE & IMPACT

1. Agriculture

2. Transport and Industry

3. Waste and Recycling

4. Societal consumption patterns

5. Integration and optimisation

From each group

1. Read out group section in Our Nutrient World
2. Fill in ‘measures forms’/data records, identifying gaps within the Our Nutrient World ‘practical options’
3. Suggest the top ten measures

Measure	Name of the measure
Principle of the measure	Short statement on what the measure is and how it works.
Opportunities, synergies and co-benefits	Short statement of opportunities, synergies and co-benefits that are available if this measure is implemented.
Constraints, concerns and challenges	Short statement on any constraints, concerns or challenges that maybe encountered implementing this measure.
Consideration of regional context of this measure	Short statement outlining which geographic region(s) this measure is/isn’t appropriate for, and how this impacts its importance as a globally important measure.

Group discussion on integration of measures

Group discussion on how to represent regional differences

Nominate leaders for each sector to help compile measures and write chapters

Who will contribute to each chapter