Report of the INMS First Plenary Meeting

Lisbon, 27-28 April 2015

Introduction

1. This report summarizes the presentations and discussions during the INMS Plenary Meeting, held from 27 to 28 April 2015 in Lisbon. The meeting was hosted by the Ministry of Environment (MAOTE) of Portugal.

2. The meeting was attended by 85 experts from 29 countries, including representatives of international conventions, programmes and organizations, researchers, industry representatives and other stakeholders (full list of participants in Annex A). The meeting was immediately followed by the 10th meeting of the UNECE Task Force on Reactive Nitrogen, which allowed for additional synergies to be developed, with 110 delegates joining the combined meetings. The INMS meeting also provided the opportunity for engagement of the 'Nitrogen in Future Earth' project, including developing feedback with Future Earth projects through side meetings hosted by the International Nitrogen Initiative (INI).

3. The present meeting report was prepared by the *Towards INMS-PPG* Coordination Team (Clare Howard, Albert Bleeker, Peter Whalley and Mark Sutton) with the support of UNEP (Chris Cox) and the UNECE (Alisher Mamadzhanov) secretariats.

Session 1 – Welcome and views from multi-lateral agreements

Session Chair: **Claudia Cordovil** (University of Lisbon, Portugal)

4. The meeting was opened by the Chair, thanking the host (Ministry of Environment) for the facilities and the presence of representatives from more than 39 countries, many international organisations, private sector companies, etc.

5. **Alexandra Carvalho** (Secretary General of the Ministry of Environment, Spatial Planning and Energy) welcomed the participants on behalf of the ministry and noted that the topic was one of the most important environmental issues of current concern. Reactive nitrogen links needs and concerns in water-air-soil and has impacts on both health and environment in addition to the positive aspects of food production. The importance of mobilizing commitment to address nitrogen challenges was emphasised and it was noted as important that the meeting discuss the key science issues to assist with policy formulation. Portugal is active through its co-chairmanship of the Task Force on Reactive Nitrogen (TFRN) under the United Nations Economic Commission for Europe (UNECE), Convention

on Long Range Transboundary Air Pollution (CLRTAP) and with activities on nitrogen through the Organisation for Economic Co-operation and Development (OECD).

6. **Till Spranger** (German Ministry for the Environment) on behalf of **Anna Engleryd** (Chair of the Executive Body of the LRTAP Convention) reported on the work of the UNECE LRTAP Convention addressing issues in North America, Europe and the EECCA countries (Eastern Europe, Caucasus and Central Asia) specifically addressing air pollution and the effects of N on other media. It was mentioned that the Convention has been successful in institutionalizing the science-policy link, which will provide valuable lessons for the design of an INMS as a home for policy based on science guidance. The INMS in its turn can help the Convention achieve global outreach.

7. **David Coates** (Convention on Biological Diversity (CBD)), introduced the in-depth review of progress towards implementation of the 2011-2020 strategic plan and Aichi targets. Reactive Nitrogen is an important subject for the CBD. A good example can be seen in the CBD CoP 10 and in the Aichi Biodiversity Target 8 (regarding pollution). This target is still far from being achieved. Scenarios for halting biodiversity loss were shared and achieving better N control was seen as key to meeting these scenarios. Key responses required include: improving fertilizer use efficiency, use of diverse crops, reducing wastes, eliminating harmful subsidies and others.

8. **Christopher Cox** (United Nations Environment Programme (UNEP), Global Programme of Action for the Protection of the Marine Environment from Land-based activities (GPA)) provided an overview of the GPA and its achievements over the last 20 years. This included the three Inter-governmental Reviews (IGRs) to-date and the 72 countries that have prepared National Programmes of Action (NPAs). GPA stimulates countries to develop their NPAs and mainstreams them into the development plans. The presentation highlighted capacity-building, normative and regulatory work undertaken under GPA.

9. **Christopher Cox** (UNEP, GPA) on behalf of **Greg Crosby** (Global Partnership on Nutrient Management (GPNM)) presented on the work and role of the GPNM within the GPA, which was summarised as a global knowledge platform with over 40 active partners. The GPNM was launched in 2009 as a global partnership of governments, scientists, international organizations, and NGOs. Components of the action plan were outlined, including work through regional platforms in Africa, Asia and the Caribbean.

10. **Gerard Bonnis** (OECD): Summarised the work of the Environmental Directorate within OECD. The science – policy interface is considered crucial to managing reactive N. The current policy in OECD regarding N follows on from the work of the European Nitrogen Assessment (ENA) and the US Nitrogen Assessment. OECD is interested in air and water policies and the effectiveness and feasibility of instruments to control/manage N to minimise impact on ecosystems and health. The OECD project on Policy Instruments for the Prevention of Nitrogen Impacts was summarized, which is based on a risk approach. OECD is ready to work with the INMS science team to help combine science understanding with their policy team's work.

11. **Isabelle Van der Beck** (UNEP), is the Global environment Facility (GEF) International Waters portfolio manager with UNEP based in Washington DC. The process of applying for GEF support was summarised and how a successful INMS project would be undertaken through UNEP as the

Implementing Agency, and the Centre for Ecology and Hydrology on behalf of the International Nitrogen Initiative (INI) as the Executing Agency. The importance of partners and their co-finance to supplement the 'catalytic' resources provided by the GEF was emphasised. Any ongoing projects that could contribute to the INMS can be counted as in-kind co-financing. Any staff time assigned specifically for the project is considered as in-cash contribution. The formal completion of the Project Documentation to the UNEP approval committee has to be at the end of July to meet the ultimate deadline for a GEF submission in September 2015.

12. **Steffen Hansen** (GEF Secretariat): The work of the GEF and the financial mechanisms for supporting countries was summarised. The GEF recognised the importance of N as a pollutant and through International Waters Focal Area has been supporting countries address excess nutrient for over 20 years, giving the extensive work undertaken in the Danube/Black Sea region as an example. GEF recognises that excess reactive nitrogen is an issue for water and air with negative impacts on ecosystem, health, climate etc and the need for nitrogen is important for food security and improving livelihoods. The 'seed' nature of GEF resources was emphasised and that this builds on a baseline of national and private sector work in addition to the resources offered by partners/ stakeholders to the INMS project. GEF expects that the Towards INMS project will also assist with integration across other Focal Areas within the GEF (e.g. Biodiversity, Climate Change, Land Degradation, etc.).

13. **Peter Anura Jayatilake** (Director General, South Asian Cooperative Environment Programme) was due to speak in this session by video link. As a result of technical issues, this was rescheduled to Session 2 (para. 16).

Session 2 – Sharing the INMS vision and baseline activities

Session Chair: **Wilfried Winiwarter** (Director of the European Centre of INI, Austria)

14. **Mark Sutton** (Chair INI, lead of *Towards INMS* UNEP/GEF project), provided an overview of the concept and vision of the proposed *Towards INMS* project with the objective of seeking comments and suggestions from the meeting participants. The link between environmental, food and energy security challenges was highlighted. The ENA helped communicate nitrogen challenges to public and other stakeholders, through five key threats – WAGES (Water, Air, Greenhouse Gas Balance, Ecosystems, Soil). CLRTAP through TFRN provides a link from science to policy for the air issues. The presentation was supported by a number of key meeting background reports provided via the project website. The overview summarised the 'science to policy support' aspect that the project will address which will benefit multiple international agreements' secretariats and organisations. It was made clear that the *Towards INMS* is not a policy process but is intended to support policy development through improved scientific understanding of the reactive nitrogen cycle, sources, impacts etc. on ecosystems and health across water and air addressing issues of too little and too much N_r.

15. Questions, Reflections and Answers (Q/R/A)

Q (**Tommy Dalgaard** – Aarhus University): Stated that this was an impressive planned undertaking, asking how the *Towards INMS* will build on other initiatives, e.g. climate, water, etc.

A (**Mark Sutton)**: 'Joining up' or integrating the management of N across the different media and interest areas will help provide better control of the negative impacts of too much N

Q (**Jakob Hansen** – Director General, Fertilizers Europe): Wished to emphasise the positive aspects of N_r not just the negative aspects of too much. Concluding that to really make a change there was a need to engage more with the producers and the farmers.

A (**Mark Sutton)**: Acknowledged that the opening presentation on the *Towards INMS* project did not sufficiently emphasise the benefits that nitrogen fertilisers had conveyed in feeding a growing global population and this must be clearly addressed. In developing the project, work would be continued to engage and include the private sector.

Q (**Brian Kronvang** – Aarhus University): Noted it would be beneficial to develop common monitoring across air/water through the *Towards INMS* Fluxes, Levels and Assessment Group.

A (**Mark Sutton)**: Noted (yes)

Q (**David Coates -** CBD): With regards to policy frameworks (e.g. climate change at the national and regional level) science has made significant impacts on the policy process and hopes that this project will lead to similar benefits for N. Has a 'simple question' been established for the N cycle (cf. with climate change the question was 'have man-made activities had an impact')?

A (**Mark Sutton)**: We are much earlier in the process than (e.g.) climate change discussions for N. The discussion will lead to the testing of a number of N related hypotheses, for example – does managing N in an integrated manner have multiple co-benefits?

Q (**Gerard Bonnis** – OECD): Stated that from a policy level, each impact should be addressed separately realizing the co-benefits involved. He was concerned about the use of 'risks' as a term.

A (**Mark Sutton)**: Stressing co-benefits is definitely needed.

Q (**Aimable Uwizeye** – Food and Agriculture Organisation (FAO)): How will the INMS project be undertaken with the multiple interests? How will organizations that have different mandates be cooperating, including issues of overlap and comparability.

A (**Mark Sutton)**: A step-wise approach to finding who is doing what and investigating multiple models. GEF will be expecting this understanding as an integral part of the baseline for this project.

Q (**Pascal Boeckx** - University Ghent): There is a need to have greater balance on regions / uses where there is insufficient nitrogen, e.g. Sub-Sahara Africa.

A (**Mark Sutton)**: The project will look at regions where insufficient N is an issue (the 'too little' N aspects of this project). This represents Case 2 of the regional demonstrations.

Q (**Prince William** - CSIR-National Environmental Engineering Research Institute (NEERI)): Solid waste (e.g. composted material) is relevant and assisting farmers in S and SE Asia.

A (**Mark Sutton)**: Noted and fully supportive.

Q (**Nick Hutchings** – Aarhus University): Would find it beneficial to map the policy options for different problems /regions for N.

A (**Mark Sutton)**: Visualisation will be of significant importance within this project.

16. **Peter Anura Jayatilake** (Director General, South Asian Cooperative Environmental Programme (SACEP)) [video link], provided the overview of the programme (via weblink), established in 1982 to promote cooperation on the environment. The South-Asia Seas Programme is relevant to INMS. Specifically, SACEP provides a regional international policy context for addressing the outcomes for the South Asian Regional Demonstration.

17. **Chris Cox** (UNEP, GPA, Project Manager of the GEF Global Nutrient Cycles (GNC) project), described the overall objective and expected outcomes of the GEF funded GNC project, which is a key baseline project for the *Towards INMS* project. In particular the project is supporting the identification of measures to address issues of excess nutrients for both farmers and policy developers. The Project toolkit includes more than 100 examples of agricultural and urban best practices. The possible links to INMS under each of the project components was outlined.

18. **Clare Howard** (CEH, *Towards INMS* Team, presented the UK funded 'INMSpp' (pump priming) project that is a cash co-financing contribution to the overall INMS project and is providing support on the science- policy aspects related to N integrated assessment modelling, including the links between N models addressing differing matrices (air, water). She introduced the objectives of the Edinburgh workshop in May 2015 on N integrated assessment modelling.

19. **Albert Bleeker** (Energy Research Centre of the Netherlands (ECN) and INI Director of Operations) described the development of regional and global indicators. The starting point for this work has been the European Nitrogen Assessment and is building N budgets to assist with indicator development of interest to a number of international organisations (e.g. CBD, OECD, GPNM, EU Expert Panel on N, etc.) and is closely aligned with UNECE CLRTAP. A brief introduction was also given on the work of the 'Nitrogen in Future Earth' project, which is working to develop the N linkages across the Future Earth academic community, including interactions between terrestrial and marine sciences and between natural and social sciences.

20. **Questions, Reflections and Answers (Q/R/A)**

Q (**Hans van Grinsven** – Netherlands Environmental Assessment Agency (PBL)) to Chris Cox: The GNC project had identified 100+ 'best practices – is there any information on how these are being used?

A (**Chris Cox)**: The best practices are in draft form at the moment and are due to be launched soon – it will be important to build-in some assessment of uptake.

Q (**Teresa Diaz** - University of Lisbon) to Clare Howard: Wanted to understand more on which communities would be engaged with, during the INMSpp project.

A (**Clare Howard)**: Involvement will be with the wider N modelling community.

Q (**Patrick Heffer** – International Fertilizers Industry Association (IFA) to Albert Bleeker: All the indicators described are on 'outcomes'. Also need indicators on 'inputs' – e.g. how are the farmers informed, etc.

A (**Albert Bleeker)**: These are also included.

Session 3: Reflections and Engagement – Statements for Country Stakeholders

Session Chair: **N. Raghuram** (Director of the South Asian Centre of INI)

21. **Heidi Foth** (German Advisory Council on the Environment), introduced the German Advisory Council on the Environment as an interdisciplinary, scientific and independent body. The Council has come up with 14 recommendations on managing nitrogen, with relevance to the NEC directive, water directive, fertilizer regulation, transport sector and others.

22. **Till Spranger** (German Ministry of Environment), discussed the National N Strategy as current N environment targets are not being met. Since the target date is set at 2016 for the strategy, measurements have to begin. A recent study by UBA Berlin has shown a breakdown of sectors and sources of N where NH_3 is the largest contributor of N to the environment indicating that twice as much reactive nitrogen is released to air compared with release to water.

23. **Shabtai Bittman** (Agri-Food Canada), stated that there is no national N policy as this a province related issue. There is most interest in the NUE of crops. Great NUE successes include N planting reduced tillage, genetics for yield and pest resistance and extending crop rotations. Currently, there is increasing interest in acid rain issues. Would like to 'twin' with the INMS project and to share experiences from Canada and to benefit from the improved global understanding of the N cycle and science to policy.

24. **Jean Ometto** (Director, Latin American Centre of INI): A key issue in Latin America is a lack of information on N. To-date there has been little consideration of transboundary pollution (either water or air). N fertiliser use has increased from 5 -50 kg/ha over the last 50 years. 20% of wastewater is treated and about 17% of the population has no access to sanitation. The relevant national legislation was introduced. It was suggested that La Plata basin be considered as a potential demonstration site to in the Towards INMS project.

25. **Cameron Gourley** (Victorian Department of Economic Development, Australia). Australia is a 'small' producer globally with 1% of the world's N use (fertiliser) with about 30 kg/ha application. Currently there is no federal legislation as this would be a state issue and they are focussing on point (not diffuse) pollution. Agriculture is spatially disconnected from major urban areas. A national research project on N management was introduced. There are many projects looking at N (including the impacts on the Great Barrier Reef where there was a new initiative recently to further reduce N). He would like to be involved further in the INMS process in particular in the dialogue on science – extension policy. The next INI Conference in Melbourne 2016 on 'Solutions for improving NUE' was also advertised.

26. **Jatish Biswas** (Bangladesh Rice Research) [Video link], stated that 75% more N is required in the dry season and 50% more N in the wet season compared with the 1980s. There is considerable interest and work on NUE. Improved crop practices led to higher harvests and improved NUE. Another focus of the project was the on the effects of N on coastal areas pollution.

27. **Zhao Xu**, **Shan Jun** (Institute of Soil Science, China). Excess N is a considerable issue in China and there is significant interest in N budgets and NUE. China is the largest user of N fertiliser and this is still increasing. About 20% of N is lost to water bodies. More attention is needed on the challenges of food production whilst protecting ecosystems and minimising climate changes. China has a target of having no increase of N use by 2020.

28. **Cargele Masso** (Director, African Centre of INI). The key issue for Africa is insufficient N although there is evidence (e.g. Lake Victoria) where excess N results in significant eutrophic conditions. In the region atmospheric deposition of N is higher than fertiliser application to land. Soil erosion is also a big problem due to utilization of marginal lands. There is a need to improve access to fertiliser, access to N research, to enforce policy decisions and to create a N platform that will help the region.

29. **Questions, Reflections and Answers (Q/R/A)**

R (Claudia Cordovil): The morning's presentations highlighted the need for an 'INMS' and the importance of the proposed project to help design it.

R (Markus Geupel) The presentation on Germany showed how the government was starting to recognise the importance of reactive nitrogen in the environment and is acting upon this information.

R (Shabtai Bittman): Great Lakes pollution problem. Sometimes policies that appear right can produce negative impacts. For example, "no tillage" of arable farming could cause problems. INMS needs to be able to investigate synergies and trade-offs.

Section 4 – Reflections and Engagements – IGOs, Business and NGOs

Session Chair: **Jean Ometto** (Director, Latin American Center of INI)

30. **Alexander Baklanov** (World Meteorological Organization – WMO): It was noted that the WMO's Global Atmospheric Watch (GAW) Programme involves some 100 countries and follows an end to end approach and supports the various international conventions. The programme concentrates on climate studies and the interaction with human health and ecosystems. The key GAW focal areas were also outlined, which include stratospheric ozone, greenhouse gases and reactive gases. The programme is built around a global network (30 global and 400 regional stations) of central facilities and their observations including educational outreach. Within the GAW the nitrogen cycle is captured in terms of NO and NO_2 and investigated via precipitation chemistry and aerosol chemical properties. The GAW can contribute to INMS through coordination and access to high quality observations and analysis. The presentation was concluded by showing some of the

types of applications that are available and directed participants to the website for more information.

31. **Jacob Hansen** (Director General, Fertilizers Europe): Fertilizers Europe is the primary lobbying group for the industry. The organization also contributes to discussions on carbon sequestration, chemical regulations and matters of the environment. Fertilizers Europe is very interested in how fertilizer products are used, having worked on development of good agriculture practices for a long time for the purposes of promoting the proper and most effective/efficient use of products. The organization has been working on precision farming, improved fertilization practices and practices to reduce ammonia emissions, along with work on monitoring tools and carbon emission mitigation from fertilizers. Contributions are also being made in the area of NUE indicators in collaboration with the EU. It was stressed that the organization wants to sell better knowledge to farmers and assists fertilizer companies in providing this value. On a practical level this support allows farmers to see how to minimize losses and enhance economic and soil sustainability.

Fertilizers Europe can contribute to INMS through work on indicators and in the conduct of evaluations in use of products. The organization has good access to agronomic sciences through an extensive stakeholder network. Contributions can also be made to the political arena.

32. **Patrick Heffer** (International Fertilizer Manufacturers Association – IFA): The IFA works across the entire fertilizer production, management and use chain. The organization has more than 500 members in 80 countries and places high value in the interventions proposed under INMS. The IFA believes and advocates science-based policy and the need to quantify flows and values. There is concern that in many cases information presented as opinion is not correct and to better lend value to discussion, policy and action there is need to develop improved metrics.

The INMS initiative is noted as a comprehensive approach that takes on all flows, where emphasis should be on identification of priorities for action, a view that the industry shares. The IFA network can contribute resources in-kind through provision of analytical products on the industry. They are willing to share this with the project, but note that it can be used for analysis but not for direct publication. It was stated that there is need to improve the quality of the data in some regions of the world. The IFA has a good forecasting programme. In terms of the N challenge the IFA promotes best fertilizer practices and applying the 4Rs of fertilizer use is an important part of their work. It was also noted that many small farmers do not have access to the best practices. There is interest in improving management practices in Sub-Saharan Africa.

33. **Cliff Snyder** (International Plant Nutrition Institute - IPNI): The IPNI works with government and science/research agencies in best practices for fertilizer management and believe that the local challenges need to be considered in getting to best practices. IPNI's clientele are fertilizer dealers and extension service providers. IPNI works through demonstration and watches out for opportunities for innovation. The organization works at the global and regional tactical levels. Its scientists go in at the regional levels to lend expertise to stakeholders. It was noted that in many parts of the globe nitrogen deficits are developing at local and regional scales and that while nothing is wrong with global plans, these must be tailored to the local scale. There is a wish to see INMS to get practitioners to endorse the 4R approach.

34. **Barbara Nave** (BASF): BASF is a chemistry company engaged in many areas of chemicals management and product development. There is a crop research unit that focuses on crop production and the N cycle. Priorities for the company are water and nitrogen management. BASF has built a unit around this called BASF Functional Crop Care. There are 3 specific products that are aimed at improved nutrient management; urease inhibitor, nitrification inhibitor and biological N fixation. BASF can contribute knowledge from many of its global field trials and can make data available. The company can also provide soil solution products and can reach out to all kinds of stakeholders and facilitate improved interactions/best practices along the value chain. The BASF 'Fireside Chat: Nitrogen' is a useful mechanism for collaboration and information exchange. BASF has learned that there is no one size that fits all. Tools applied can have various effects based on the approach needed.

35. **Henning Steinfeld** (FAO) [presentation via Video link]: FAO is a knowledge organization rather that a financing agency. The agency possesses a very large database and statistics that are of relevance to nutrient management and have gone through a systematic process in assessments over the past 4 years. The 'GLEAM', the Global Livestock Assessment Model offers a full-chain N efficiency analysis and can do scenario analysis. The FAO estimates that some 46 Mt of reactive N compounds associated with livestock production are generated annually. In the livestock sector methane and nitrogen are the main climate change concerns rather than carbon dioxide. There is concern in the Asia region over emissions from pig and chicken production. The FAO engages in multi-stakeholder discussions in promoting best practices and roots these discussions in the SDGs. The strategies include development of action pathways, take home messages, assessing livestock rearing improvements on the environment and benchmarking methods. There is a need to improve manure management, reduction of food waste, development of international appropriate policies and interdisciplinary approaches for improved nutrient management. Overall a global nitrogen management system /policy is needed, targeted at addressing the interdisciplinary issues and ensuring good science –policy linkages.

36. **Joao Breda** (World Health Organization – WHO) [presentation via Video link]: Non-communicable diseases are very important and are very preventable, key factors include body weight and associated risk factors. It causes 80% of deaths particularly in developing countries. In Portugal childhood obesity is a problem. There are many ambitious targets on health in the EC region, including governments discussing targets in Rome in 2014. Many of the issues related to diet, food consumption and nutrient management link very closely with the planned INMS project. New strategy on food and nutrition in the EC region is very pragmatic and was derived from a 2013 ministerial congress. The strategy is built around priorities that include the adoption of a life course approach, consideration of healthy food and the environment and leadership and governance approaches for healthy diets. Moderation of consumption of dairy and meats (saturated fats) is a key link.

37. **Gabriela Soto** (International Federation of Organic Agricultural Movements (IFOAM) and National University of Costa Rica): The Federation has 800 members from NGOs to farmer organizations to certification agencies. The organization works within regional platforms and along thematic lines; includes work on the science cycles with keen interest on fluxes and underestimating the impacts. There are many studies that look at comparative systems that have provided useful

data with an emphasis on protection of soil resources. There is a need to look for best practices that are already happening; the network of farmers within the organization can provide this. It is well-recognized that many constituents have limited resources to effect change hence the organization can collaborate in the area of advancing alterative systems.

38. **Questions, Reflections and Answers (Q/R/A)**

R (**Cliff Snyder),** would like to see more endorsement of the 4 'Rs' by INMS.

39. Wrap-up by Chair: Data access from partners will be very important in terms of knowledge transfer and how information will be channelled, noting how the various stakeholders can contribute. The efficient use of nitrogen and other nutrients permeates all levels of society in different ways, something that the INMS initiative will contribute to.

Section 5: Science Examples and Nitrogen Dating

Session Chair: **Mark Sutton** (Chair of INI, INMS lead)

40. Benjamin Bodirsky (Potsdam Institute for Climate Impact Research, Germany): The Institute looks at biosystems assessment links to social assessments and has been providing policy advice based on modelling for both biophysical and social systems. The Potsdam Integrated Assessment Modeling Framework (PIAM) integrates climate, land use, vegetation, macroeconomic and energy issues to create future scenarios on 10-year cycles. The models can be used for a variety of purposes and address other processes, including water and phosphorus management, food security and general questions on economic development. There is a link to a dynamic flow N model; the MAgPIE model can do forecasts in agricultural systems and also incorporates dietary changes and technology changes to create scenarios for N pollution under business-as-usual versus improved practices. The model can also evaluate emissions scenarios including scaled up to global-level modelling.

41. Pedro Pinho/Teresa Dias (University of Lisbon, Portugal): The faculty has several research interests around agro-forestry including ecosystems flows, calculating critical levels of emissions of reactive N and other key pollutants. Future work will entail downscaled N cycle analysis and mapping. Focus has been on impacts of N on ecosystems and soil quality in Portugal and other regions with Mediterranean climates (there are 5 such regions across the globe). These areas, while having a 2% of global coverage, contain 20% of vascular plant biodiversity. These ecosystems are very sensitive to N variability, which is a peculiarity and there is interest in understanding how N fluxes impacts these systems. Research focus is on ammonia toxicity, N levels, soil micro-biodiversity and identification of appropriate indicator species.

42. Michelle McCrackin (Stockholm University Baltic Sea Centre, Sweden): The Baltic Sea has significant N and P loading problems; the nutrients that get in the sea tend to remain there - the dead zone is large and there are persistent harmful algal blooms (HABs). Over the past 10 years the Baltic 'Nest' decision support system (DSS) has been applied to facilitate adaptive management of nutrients. It allows for assessment and evaluation of various mitigation options. The platform is implemented through the Baltic Marine Environment Protection Commission (HELCOM). Baltic Nest

has been instrumental in management planning in meeting reduction targets, and HELCOM countries have agreed to targets based on this work. The Baltic Sea Action Plan contains strategies based on these targets, although not legally binding. There are some targets that are not on track for achievement; there needs to be policy enhancements to facilitate attainment of the targets. The Baltic Ecosystems Policy Briefs are intended to make such contributions. The Centre is happy to exchange experiences within the INMS Project.

43. **Brian Kronvang** (Aarhus University, Denmark): The Department has long experience in modelling N; this was based on a policy directive issued some 30 years ago. In the country the target of 50% reduction has been reached. Policy makers want a further 15% reduction, however farmers are advocating for more nutrient use. They are observing the practices of nutrient use in Germany where they are using more fertilizer, considering the local Danish policy unfair to farmers. The institute is collecting data to show how the improved practices are taking effect using modelling approaches. Vulnerability mapping for N loss has been generated; the SWAT model has been applied. The country is going to the next step of reducing runoff water from agricultural fields. Engineered buffer strips to treat agricultural runoff are being used. These are large investments but are known to be effective. The institute can share lessons in improved practices.

44. **Xiaotang Ju** (China Agricultural University): The University is doing work on NUE on cropland and livestock systems at different scales, from field to national levels. There is great opportunity to improve practices in China, particularly in eastern parts of the country that have significant issues. A great challenge that needs to be addressed is in respect to aquifer pollution. With optimal practices farmers can substantially reduce reactive N flows. There is high urea use to balance high pH in soils. Science contributions by the university work on NUE present opportunities for collaboration.

45. **Clare Stirling** (International Maize and Wheat Improvement Center - CIMMYT): The Centre can provide research support on improving datasets in respect to N emissions from tropical soils. There is a gap in data for tropical regions and work is ongoing to expand knowledge in this area; data contributions in tropical regions are only 20%. Work is also underway to determine whether reactive N emissions are being correctly estimated; this is supported through work in Mexico and India looking at high-intensity and low-intensity wheat and maize cultivation. The work in these countries are considered to be representative of >70% of the tropics. A review of relevant data and development of improved empirical modelling is underway, including assessment as to whether there is a regional relationship between reactive N emissions and N fertilizer application. There is a suggestion that the IPCC may be overestimating emissions from African landscapes.

46. **Pierre Cellier** (National Institute of Agronomic Research - INRA): INRA collaborates with many institutes in France, with some 42 labs and 8000 staff across the country. The organization works in many fields from forests to grasslands. INRA has undertaken field monitoring over 20 years at different scales from farm scale up to the watershed and up to zonal scales. It also conducts modelling at different scales; at landscape and watershed scales. It develops decision support systems and maintains databases on soils, agricultural practices. It conducts collective scientific assessments and builds strong links with stakeholders. The Institute is engaged in many INMS-related activities and foresees collaboration in the following areas; development of Western

European demonstration area, sharing data from its observing system, dissemination of models, and organizing training workshops/seminars on N cycle modelling.

47. **Wilfried Winiwarter** (International Institute of Applied Systems Analysis – IIASA): Work focuses on assessment of emissions using input data from energy production and agricultural production with the application of an emission factor based on technologies used. This is used to suggest alterative management scenarios that are linked to costs. The cost-optimized solutions are designed meet environmental targets/impacts. The GAINS model runs scenarios on the global scale on 5-year increments projecting to 2050, and uses annual averages for atmospheric data. Where there is little data (e.g. within Africa), amalgamated approaches are applied. It is anticipated that the INMS collaboration will improve application of the model.

48. **Baojing Gu** (Zhejiang University, China): The focus is on combining natural sciences with social science. This includes assessing the damage costs of atmospheric reactive nitrogen and developing cost-benefit analysis and other applications of natural science and social science in China. In China analyses are based on dividing the region into 14 subsystems where modelling is being done down to the county level.

49. **David Kanter** (Columbia University, USA): Links the INMS approach to that adopted by the Montreal Protocol and how this could be a 'possible home' for INMS. Considered that many existing MEAs/targets are working in narrow silos and INMS could provide a framework for managing N responses more effectively between these agreements/conventions.

50. **Questions, Reflections and Answers (Q/R/A)**

Q (Patrick Heffer): In Denmark they have effectively reduced N applications but the consequence of this has been a reduction in the protein content. With reductions in nutrient inputs at the field level how can you keep the balance with food protein content?

A (Brian Kronvang): This is being counterbalanced by application of agronomic practices that seek to maintain nutrients in the field. For example, treating farm runoff water using new technologies to retain the nutrients being applied.

51. Structured Discussion - The Nitrogen Dating Game (introduced by **Clare Howard**): This breakout session brought people together, discussing the different sections of potential working groups in the INMS structure (e.g. Fluxes, Levels and Assessments Group (FLAG) as further described by the figure in Annex B). By means of 'post-it-notes' people were able to bring in topics that they think are important to take into account, organised by 'working groups'. Short plenary feedback on the different sections followed the interactive breakout session. The comments provided by participants are also listed in Annex B.

Day 2

Session 6: Regional Demonstration and other aspects of the project

Session Chair: **Cargele Masso** (Director, African Centre of INI)

52. **Mark Sutton** provided an overview of the proposed approach to the demonstration activities within the *Towards INMS* project to assist participants in developing a common view of the purpose of these activities. Primarily the purpose is to test 'joined up' or integrated management of reactive nitrogen across air/water/soil to identify the co-benefits and win-wins from developing such a joined-up approach. The approach will be tested on 4 cases identified in the INMS Project Initiation Form, PIF (1. Developing regions too much N; 2. Developing regions too little N; 3. Transition Economies; 4 Developed regions too much N). The first 3 would be funded by GEF, with the last brought into INMS through national resources. A suggested total of 6 demonstration regions was described that will help test the principles of INMS, identify benefits and barriers to change (and means to overcome these). The proposed regions outlined were: Case 1: East Asia, South Asia, Latin America; Case 2: East Africa; Case 3: East Europe; Case 4: West Europe (Atlantic Coastal region).

53. **Questions, Reflections and Answers (Q/R/A)**

Q (**Wilfried Winiwater)**: How will the models from different regions be brought together?

A (**Mark Sutton)**: Through a stepwise/iterative approach sharing and comparing approaches. There will need to be a balance between long-term development of models vs the more short-term deliverables that are needed by this project.

Q (**China**?): Understands demonstration as a 'gathering' of information?

A (**Mark Sutton):** This will depend on the region. The point is to demonstrate how a joined-up approach to nitrogen science evidence can help mobilize transformative change.

Q (**Pierre Cellier)**: Interested in a NW European demonstration that will need to collect finance. What to focus on? What are the deadlines?

A (**Mark Sutton)**: We are required by UNEP to be a position to submit documents in summer for approval autumn 2015. The possible demos will be reviewed the next part of the meeting. It will also be possible for certain regions/demos to join later after the project has started as additional co-financing, and for non-GEF eligible regions to seek additional funds or build on current activities with some small support (e.g. travel for meetings) possibly provided through the *Towards INMS* project.

Q (**Maria Amelia Louçao**): It would be good to include the Mediterranean region as the areas uses different models and also has different social conditions.

A (**Mark Sutton)**: Good comment and will be explored. For example, building on existing activities and when new proposals are prepared (for other donors) then reference can be made to the GEF INMS project and they can be linked.

54. The meeting then split into groups to discuss the regional demonstrations, with feedback provided by sub-group rapporteurs. (Notes on this provided in Annex C).

Session 7 – Summing up INMS approach and relationship with global and regional intergovernmental processes

Session Chair: **Christopher Cox** (UNEP/GPA)

55. Mark Sutton: Many baseline activities are underway (including large initiatives such as PEMSEA, Black Sea, LRTAP, SACEP etc.) There is a need to gather further information to make the case explicit for a demonstration activity in each region. Also it will be important to link to relevant international agreements and processes. A process of mapping information, agreements and conventions related to N will be undertaken. A relationship figure was shown (see Annex D, Figure D1) summarizing the key links of INMS to several different intergovernmental conventions, processes etc, which formed a basis for further discussion.

56. Questions, Reflections and Answers (Q/R/A)

R (Isabelle Vanderbeck): The private sector needs to be represented in the relationship figure

R (David Coates): The figure is currently very 'environment' focused. Food security, SDGs etc. need to be represented ensuring that issues such as food links with poverty reduction are shown. Also important to show FAO in figure.

A (Mark Sutton): The diagram is deliberately 'convention' oriented at the moment – likely will need several figures to represent the relationships

R (Alisher Mamadzhanov): The Gothenburg Protocol needs to be included together with the targets. It will be necessary to consider the inclusion in figures of river commissions (and marine etc) to give regional interest.

R (Patrick Heffer): When looking at food security need to consider regional agreements / bodies

R (David Kanter): INMS could help break the silos of the existing conventions and link through N, either by providing better co-ordination or a policy body to manage an INMS.

R (Claudia Cordovil): Need to consider both food security and food safety.

R (Kevin Hicks): Need to work with voluntary organisations/private initiatives.

R (Till Spranger): Running into problems when trying to put everything into one graph (several graphs needed). Currently there is no global policy framework for air.

A (Chris Cox): Mapping these relationships / themes will be an important first step

R (David Coates): Consider UNCCD (although not clear where N sits) and Ramsar (clear programme on nutrients and impacts/benefits of wetlands).

R (Aimable): Need for government involvement in the formulation of an INMS.

R (Raghuram): Need to ensure freshwater links (surface and ground) are also included in figure – not just marine.

A (Mark Sutton): More discussion on 'Policy arena for nitrogen' – INMS project should help stimulate countries and others to address N in more joined-up manner.

R (Aimable): Need to include more economists to help with the 'home' for INMS.

R (Patrick Heffer): For energy – need International Energy Agency (IEA), pollution UNEP, food – FAO. Also Committee on World Food Security (linked in to the UN).

R (Jean Ometto): Look at regional IGOs – example APN (Asian Pacific Network).

Q (Kevin Hicks): How to link in to countries in the face of policy fatigue?

R (Chris Cox): Keep track of the objective/outcomes expected from this project.

R (Aimable): FAO Committee on Agriculture with 100 countries involved – assists with what policies to put in place. Next meeting 2016 (Rome, September). Maybe opportunity to hold side event. Ministers will be attending.

R (Gabriella Soto): At a regional level need to get farmers associations/groups involved

R (Alexander Baklanov): WMO has a good mechanism for dissemination with ministers present at meetings.

R (David Kanter): Need to expand scheme to include reference to the Planetary Boundaries.

57. **Chris Cox** (as session chair) summarized the discussion**:**

- Food security not highlighted enough
- Regional vs global needs should be stressed more
- Packaging to different clients should be considered
- Freshwater issues/agreements need to be reflected in the diagram
- How to mainstream the issues of INMS in countries?
- Identifying additional links to process involving ministers
- Take stock of upcoming activities
- How to get farmers board
- Partners involvement in this
- Should Planetary Boundaries be included or linked to such a diagram
- Mapping of all these needs to be considered by the *Towards INMS* Team

[Mark Sutton adds: this discussion has been used to make a revised version of Figure D1, which is shown attached as Figure D2. It has been possible to include many more of the linkages identified. The diagram is necessarily more complex. It remains a topic for further discussion to agree the optimal level of detail to convey key messages for different stakeholder groups.]

Session 8 – Developing INMS Procedures

Session Chair: **Mark Sutton** (INI chair and INMS lead)

58. **Mark Sutton:** Reflection on and Introduction of the INMS procedures. A summary explanation was given of the role of the different partners and contributions within the project, together with an overview of the co-financing possibilities, as well as the contributions-in-kind.

59. **Peter Whalley:** a draft version of the Towards INMS governance and management structure was presented, as well as the roles of General Assembly, Stakeholder and Policy Advisory Group (SPAG), Project Management Board (PMB) and Project Coordination Unit (PCU).

60. **Clare Howard:** An overview was given of some of the important dates in the near future. Official letters for the co-funding commitments are due in the period May-July 2015. Project documentation should be ready by July 2015. Some future meetings were mentioned:

- Geneva workshop on nitrogen and ammonia air quality challenges, WGSR, December 2015 [note: this nitrogen workshop has now been rescheduled for 2016]
- UNECE Ministerial Conference – Environment for Europe (EfE), Batumi, June 2016
- 4th Inter-governmental review of the GPA, Autumn 2016
- 7th International Nitrogen Initiative Conference (INI 2016), Melbourne (Australia) 4-8 December 2016

61. **Agnieszka Becher:** Outlined some aspects of potential financial reporting, partner contracts and reporting under contracts and of project co-financing.

62. **Mark Sutton**: Summarized status on development of the INMS project. In particular he requested agreement from the meeting on 3 points: a) A draft mission statement for Towards INMS, b) the overall project communication and governance structure and c) selection of the demonstration regions to be included in the project.

a) ***Towards INMS*** **Mission statement.** Following substantial editing on-screen, the following was agreed: *"To improve the understanding of the global and regional N cycle and investigate practices and policies to maximise sustainable production of food, goods and energy while reducing negative impacts of reactive nitrogen on the environment and human health."*

b) **Project Communication and Governance Structure.** Based on the presentation from Peter Whalley, the meeting agreed to the proposed structure, consisting of GEF, Implementing Agency (IA, UNEP), Executing Agency (EA, CEH for INI), General Assembly (GA, consisting of all funding partners), Project Management Board (PMB), Project Coordination Unit (PCU), Science and Policy Advisory Group (SPAG), with the project structured through four components. Figure D3 in Annex D summarizes the relationships. Further information is shown in Figure D4.

c) **Selection of the INMS Regional Demonstrations.** Based on the background document INMS/PPG/2015.2.6 and the discussions in Session 6, it was agreed to adopt the following regional demonstrations for core funding in Component 3 of *Towards INMS*: **Case 1:** Developing regions with too much N: South Asia, East Asia, Latin America (La Plata); **Case 2:** Developing regions with too little N: East Africa (Lake Victoria Catchment); **Case 3:** Transition Economies with too much N: East Europe (Dniester and adjacent part of Prut/lower Danube). In addition, it was agreed to further develop **Case 4:** Developed regions with too much N: Atlantic Coast of Europe, based on national financing contributions.

63. **Any final Questions, Reflections and Answers (Q/R/A)**

There were no questions arising at this point.

64. The meeting closed.

Annex A: List of participants

Surname	Forename	Organisation	Country
Adhya	Tapan	KIIT University, Odisha / ING, New Delhi	India
Alonso del Amo	Rocío	CIEMAT	Spain
Amon	Barbara	Leibniz Institute for Agricultural Engineering (co-chair TFRN Expert Panel on Mitigation of Agricultural Nitrogen)	Germany
Baklanov	Alexander	WMO	Switzerland
Becher	Agnieszka	Centre for Ecology & Hydrology (INMS coordination team)	UK
BESIRLI	GULAY	Ataturk Central Horticultural Research Institute	Turkey
Bittman	Shabtai	Agriculture and Agri-Food Canada (co-chair TFRN Expert Panel on Mitigation of Agricultural Nitrogen)	Canada
Bittner	Antje	SKW Stickstoffwerke Piesteritz GmbH	Germany
Bleeker	Albert	ECN (INI Director of Operations; INMS coordination team)	Netherlands
Bodirsky	Benjamin Leon	Potsdam Institute for Climate Impact Research	Germany
Boeckx	Pascal	Ghent University	Belgium
BONNIS	Gerard	OECD	France
Brownlie	Will	Centre for Ecology & Hydrology (INMS coordination team)	UK
Buchkina	Natalia	Agrophysical Research Institute	Russian Federation
Catianis	Irina	National Institute of Research and Development - GeoEcoMar	Romania
Cellier	Pierre	INRA	France
Cermak	Pavel	Crop Research Institute	Czech Republic
Coates	David	Secretariat of the Convention on Biological Diversity	Canada

Annex A: List of participants

Surname	Forename	Organisation	Country
Corinne	GALY-LACAUX	Laboratoire d'Aerologie UPS/CNRS	France
Cox	Christopher	United Nations Environment Programme (GPA and GPNM Secretariat)	Kenya
Dalgaard	Tommy	Aarhus University (co-chair, UNECE Task Force on Reactive Nitrogen)	Denmark
Dammers	Enrico	VU Amsterdam	the Netherlands
De Marco	Alessandra	ENEA	Italia
Dedina	Martin	Research Institute of Agricultural Engineering	Czech Republic
Delon	Claire	CNRS/Laboratoire d'Aerologie	France
Dias	Teresa	Faculdade de Ciências, Universidade de Lisboa, Ce3C	Portugal
Doehler	Helmut Georg	DoehlerAgrar	Germany
Foth	Heidi	German Advisory Council on the Environment (SRU)	Germany
Geupel	Markus	Federal Environment Agency	Germany
Gourley	Cameron	Department of Economic Development, Jobs, Transport & Resources	Australia
Gu	Baojing	Zhejiang University	China
Hansen	Steffen	Global Environment Facility Secretariat.	U.S.
Heffer	Patrick	International Fertiliser Manufacturers Association (IFA)	France
Howard	Clare	Centre for Ecology & Hydrology (INMS coordination team)	UK
Hutchings	Nick	Aarhus University	Denmark
Isaura	RABAGO	CIEMAT	Spain
Ju	Xiaotang	China Agricultural University	China
Kakareka	Sergey	Institute for Nature Management, National Academy of Sciences	Belarus

Annex A: List of participants

Surname	Forename	Organisation	Country
Kanter	David	The Earth Institute, Columbia University	US
Karyotis	Theodore	National Agricultural Research	Greece
Kozlova	Natalia	Institute for Engineering and Environmental Problems in Agricultural Production IEEP (co-chair Expert Panel on Nitrogen in EECCA countries)	Russian Federation
Kronvang	Brian	Department of Bioscience, Aarhus University	Denmark
Leip	Adrian	European Commission, Joint Research Centre	Italy
Lukin	Sergei	All-Russian Scientific Research Institute of Organic Fertilizers and Peat (co-chair Expert Panel on Nitrogen in EECCA countries)	Russia
M S Cordovil	Claudia	Instituto Superior de Agronomia (co-chair TFRN)	Portugal
Mamadzhanov	Alisher	UNECE Secretariat	Switzerland
Martins-Loução	Maria Amélia	CE3C. University of Lisbon	Portugal
Masso	Cargele	CGIAR; International Institute of Tropical Agriculture (Director, INI Africa Centre)	Kenya
McCrackin	Michelle	Stockholm University Baltic Sea Centre	Sweden
Medinets	Sergiy	Odessa National I. I. Mechnikov University	Ukraine
Misselbrook	Tom	Rothamsted Research	UK
Moklyachuk	Lidiya	Institute of Agroecology and Environmental Management of NAAS	Ukraine
Morozova	Irina	SRI Atmosphere	Russia
Munzi	Silvana	cE3c, Universidade de Lisboa	Portugal

Annex A: List of participants

Surname	Forename	Organisation	Country
Nandula	Raghuram	Guru Gobind Singh Indraprastha University (Director, INI South Asian Centre)	India
Nave	Barbara	BASF SE	Germany
Ometto	Jean Pierre	National Institute for Space Research (Director, INI Latin America Center)	Brazil
Palliere	Christian	Fertilizers Europe (Secretariat EU Nitrogen Expert Panel)	Belgium
Pinho	Pedro	Faculdade de Ciências da Universidade de Lisboa	Portugal
Povilaitis	Arvydas	Institute of Water Resources Engineering, Aleksandras Stulginskis University	Lithuania
Schuster	Carola	SKW Stickstoffwerke Piesteritz GmbH	Germany
Shan	Jun	Institute of Soil Science, Chinese Academy of Sciences	China
Shibata	Hideaki	Hokkaido University	Japan
Snyder	Clifford	International Plant Nutrition Institute (IPNI)	US
Soto	Gabriela	National University (also representing the International Federation of Organic Agriculture Movements)	Costa Rica
Spott	Oliver	SKW Stickstoffwerke Piesteritz GmbH	Germany
Spranger	Till	Federal Environment Ministry	Germany
Stirling	Clare	CIMMYT	UK
Suntharalingam	Parvadha	University of East Anglia	UK
Sutton	Mark	Centre for Ecology & Hydrology (INI chair, INMS coordination team)	UK
Uwizeye	Aimable	UN FAO	Italy

Annex A: List of participants

Surname	Forename	Organisation	Country
van Grinsven	Hans	PBL Netherlands Environmental Assessment Agency	Netherlands
van Pul	Addo	RIVM	Netherlands
Vanderbeck	Isabelle	UNEP (INMS Implementing Agency)	-
Walker	Sara	World Resources Institute	US
Wechsung	Gabriele	UBA, Germany	Germany
Whalley	Peter	Consultant	UK
William	SPM. Prince	CSIR-National Environmental Engineering Research Institute (NEERI)	India
Wiltshire	Jeremy	Ricardo-AEA	UK
Winiwarter	Wilfried	IIASA (Director, INI European Centre)	Austria
Ye	Qian	Integrated Risk Governance/Future Earth	China
Zamora	Lauren	NASA GSFC/ ORAU	US
Zhang	Ying	Beijing Forestry University	China
Zhao	Xu	Institute of Soil Science, Chinese Academy of Sciences	China
Zondervan	Ruben	Earth System Governance Project	Sweden

Annex B: Further information on the 'Nitrogen Dating Game' session

The interest of participants in possible components of INMS (as summarized in the diagram below) were discussed through a dating game. All comments provided in the 'Nitrogen Dating' session are included below, organised by group.

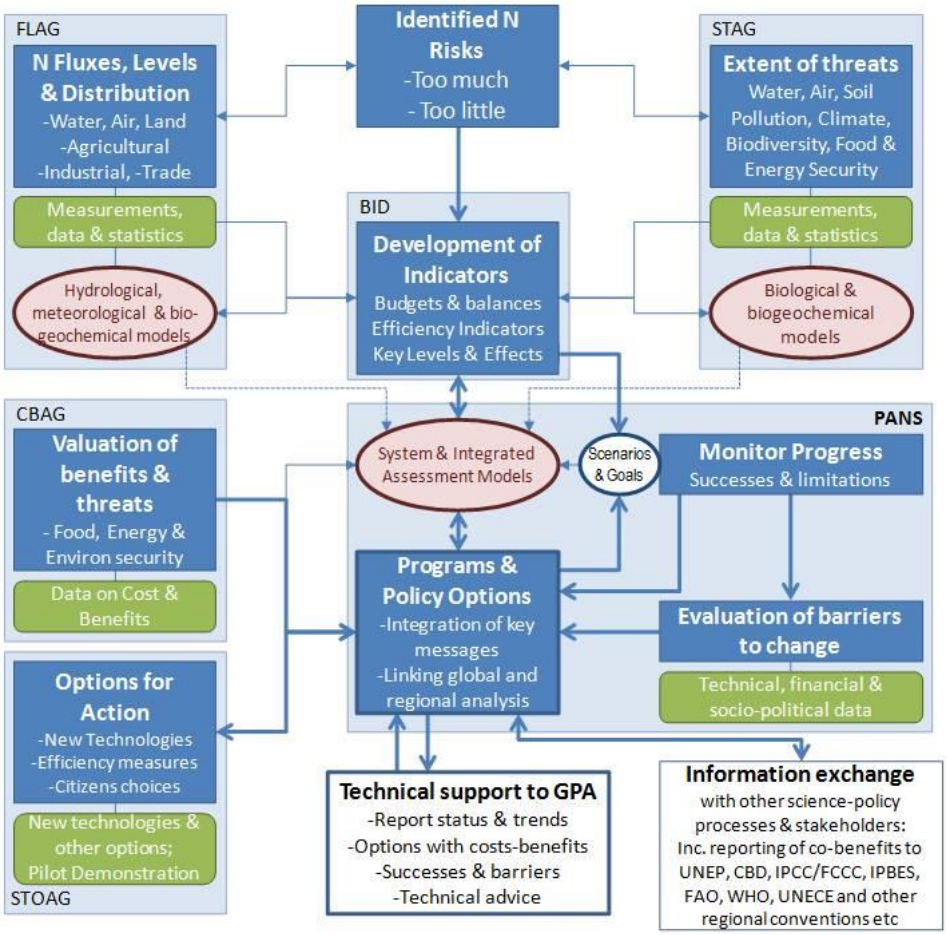

Figure B1: Summary structure of potential working groups in an eventual INMS process and its possible information exchange with GPA and other science policy forums. Key: **Light blue boxes** indicate groups; **dark blue boxes** indicate tasks; **green boxes** indicate data; **brown ellipses** indicate models.

Budgets and Indicator Development Group (BID)

Number	Remark	Name
1	Developing the whole N budget and agronomic/environmental indicators to increase NUE and reduce losses in different scales	Xiaotang Ju
2	Farming system related indicators are useful - distinguishing livestock and crop production systems	Tommy Dalgaard
3	Indicators must be relevant to the relevant audience. i.e. farmers need profit/production indicators	Cameron Gourley
4	Disseminate N budget methodologies (at different organization levels) in farmer and farming 'practices'	Pierre Cellier
5	Will need a suite of indicators / not any one	Cameron Gourley
6	N budgets should not be limited to the agricultural system alone if they are to inform policy on a national/global scale	Till Spranger
7	Budgets are an excellent tool to communicate the N issue and to set management/policy priorities	Till Spranger
8	Bench-mark information for easy interpretation	-
9	Indicators need to provide information which you can act upon	-
10	Development of common methods and indicators for nitrogen use efficiency, nutrient losses and hotspot analysis	Aimable Uwizeye
11	Indicators for N-use in identified ecologies in terms of ecosystem services	T.K. Adhya
12	Nitrogen empirical critical loads for no loss of biodiversity	Alexandre
13	Country / Region specific budgets	Prince William
14	Availability of information & Institutional relationships for gathering input information	Irina Morozova
15	Multi-dimensional indicator development	Adrian Leip
16	Combining indicator for product, demand, impact, economic aspects	Adrian Leip
17	Addressing soil stock change	Adrian Leip
18	To develop a simple method to calculate uncertainties (to be used by ordinary researchers)	Lidiya Moklyachuk
19	Innovative outreach/communication tool/games/.. E.g. based on N-budgets, N-footprint	Adrian Leip
20	Need to integrate monitoring programs for different species (NO_x, N_2O), NH_3, …) to get full picture	Parv. Suntharalingam
21	Region - country specific budgets	
22	To use the same budget program for calculations in different regions	Sergei Lukin
23	Pay due attention to "leading" indicators in addition to "lagging" indicators. For instance, indicator of outreach to farmers	Patrick Heffer

Number	Remark	Name
24	Don't reinvent the wheel on the crop NUE indicator. Build on the indicator agreed upon by GPNM following multi-stakeholder consultation	Patrick Heffer
25	Long-term analysis using site-based research findings are important to develop useful indicator for N_r loss to the Environment	Hideaki Shibata
26	Budgets (static, dynamic, target). For the last option you need at least effects indicators + targets	Till Spranger
27	Need agri indicators scalable from field - farm - county - watershed - state/province - national + could rely on fertilizer + manure nutrient performance indicators (by GPNM & IPNI) that frame efficiency ranges	-
28	Need to develop monitoring capability on national + regional scales to ensure compliance with policy regulation	Parv. Suntharalingam
29	Range of "simple" indicators for different sectors. Cost/benefit environment/efficiency (region specific)	Jean Ometto
30	Need data (or else keep repeating same outputs esp. Farm data)	Shabtai Bittman
31	System specific benchmarking (dairy, pig, etc)	Nick Hutchings
32	Invest more in order to: 1) strengthen regional assessments to develop more robust budgets and indicators that are actionable at the national or provincial level, and understandable to the stakeholders, 2) have multiple indicators to suit different sectors/scales in the local or global level, 3) develop ecosystem-specific effluent/emission standards	N. Raghuram
33	Nitrogen budget for all countries	-
34	I would like to contribute: N-budgets of global long-term models for agriculture, energy, transport and natural ecosystems	-
35	Keep a balance in the money invested on finding the most precise and exact indicators vs. The money invested on implementing changes. Sometimes we want to get to the 3 digits indicators, when changes are more urgent	-
36	NUE is efficient indicator (K = sum costs / N loss)	Natalia Kozlova

Costs and Benefits Assessment Group (CBAG)

Number	Remark	Name
1	Need full value chain economic benefits of N in agric. (uphill to downhill) estimates…. Not just farm gate increased crop & animal yield …. to add to N policy considerations	-
2	Why should the farmers be interested in best management options? What does he/she have to gain?	Claudia Cordovil
3	Reducing of nutrient losses from the soils to the water sources -> better N utilization in agriculture	-
4	The ENA seems to have a good methodology/approach. How can this be 1) improved, 2) applied to different regions, 3) scaled up/down?	Michelle McCrackin
5	Robust quantification of benefits (lessened impacts) related to N-emission reduction	Wilfried Winiwarter
6	Integrate impacts of N management on environment, farmers and industry	Davd Kanter
7	Separate NEED to have versus NICE to have	
8	Important to understand barriers to adoption/change/engagement - not just economic; regionally specific; engage all relevant stakeholders	Tom Misselbrook
9	Needs to be assessed for each stakeholder individually. We may be able to help on some of these aspects (especially societal cost etc.) with our AgBalance tool	Barbara Nave
10	To separate cost and benefits for the society vs. Cost and benefits for the people that should apply the techniques. PICHAP can help in methodology for cost calculation and provide information about profitability crossing these data. Project can advise about actions to promote different strategies	-
11	WRI can conduct analyses of practices and policies for cost effectiveness and summarise the themes for maximizing investments in nitrogen mitigation measures	Sara Walker
12	To make sure that the end user really understands the benefits and costs of implementing good measures. Good quantification of benefits (euros)	Claudia Cordovil
13	Dont' forget to take food quality (grain protein content) into the equation, especially if one has to reduce protein intake from livestock origin	Patrick Heffer
14	Consider best examples of fiscal policy that drives best practice -> need to be perhaps region-specific	Chris Cox
15	Cost-benefit analysis modelling	Lidiya
16	Improve the estimate of costs linked to damage to ecosystem and disseminate this to the public	Pierre Cellier
17	Avoid undue focus on the data of too few countries to calculate costs/benefits of too many countries	N. Raghuram
18	Check for regional/local variations in the costs/benefits	N. Raghuram
19	N leakage and eutrophication in aquatic ecosystems through modelling	T.K. Adhya
20	It is a challenge to discuss/compare benefits for human and ecosystem health	-

Number	Remark	Name
21	Within INMS, I would like to create a "model of nitrogen and social welfare", and economic model balancing N-Impacts with mitigation costs and co-benefits	-
22	Cost-benefits evaluated separated for each partner	-

Policies and Analysis of Nitrogen Synergies (PANS)

Number	Remark	Name
1	Policy at Govt. Level for managing N use in cropt	T.K. Adhya
2	Managing leakage of reactive N at different system level - policy decision	T.K. Adhya
3	I would like to provide indicators for co-benefits of nitrogen mitigation (e.g. phosphorus, climate, water, food security, ….)	-
4	Regulation reduces N-pollution more/faster than awareness building	-
5	Stakeholder involvements is needed to get acceptance and effect of measures	Tommy Dalgaard
6	While reflecting generic processes, must retain ability to respond to regional specifics and innovations	Tom Misselbrook
7	INMS must not forget the farmers! We offer/provide contact with farmers via network.	-
8	The existing databases should be used for better flux assessments. My institute can provide of over 10 years monitoring of N_2O fluxes and related soil and climate properties for North-Western Russia and some data for Central Russia	Natalia Buchkina
9	Why Western Africa is not included in the demonstration areas?	Claire Delon
10	WRI can use the policy toolbox we developed to serve as a foundation for analyzing policy and practices success stories to pull out lessons learned for scaling up and adopting policies in other areas	Sara Walker
11	Linking LRTAP work to global actions	Alisher Mamadzhanov
12	Monitoring contribution of project to Gothenburg Protocol targets	Alisher Mamadzhanov
13	Capacity building in Eastern Europe, Caucasus & Central Asia	Alisher Mamadzhanov
14	Links to UNECE Water Convention - nexus assessment	Alisher Mamadzhanov
15	Get into policy makers. Involve Federal Governments in preparation of project phase	-
16	Do we need a spatial approach to policy? Or a circular economy approach? Or both?	-
17	Nitrogen policy can be developed by taking into account the regional variability in nitrogen availability and use. It can be also associated with other initiative to reduce environmental burden in agriculture	Aimable Uwizeye

Number	Remark	Name
18	Focus on areas and actions that can harvest the main benefits, e.g. those with the highest health costs and greatest mitigation opportunities at least cost	Patrick Heffer
19	INMS as a catalyzer of a Global Assessment, with country engagement, and representation from the beginning. Include all regions	Jean Ometto
20	INMS advising various + distinct policy processes/institutions. Will this work. This by itself is unknown terrain!	Till Spranger
21	(integrated) modelling of feedback effect between agri supply, technologies, policy and prices on regional & global efficiencies	Adrian Leip
22	WRI can build on and expand the policy toolbox to include and highlight policies and practices that address the complete "nitrogen nexus" to better understand the co-benefits of N management	Sara Walker
23	There is a need for a proper policy to increase fertilizer use in the developing world	Aimable Uwizeye
24	Important to consider: how to reconcile global action on N pollution with heterogeneities of local implementation	David Kanter
25	Get a unique worldwide policy evaluation related to N pollution	-
26	Offer: begin a comprehensive global policy assessment of options to manage N pollution	David Kanter
27	Geographically targeted measures are needed	-
28	WRI has experience assessing barriers to implementing environmental policies and options for overcoming them. We can conduct this work in the INMS context to assure the identified policy options are appropriate or how to make them more appropriate	Sara Walker
29	Geographically specific policies are mandatory. Why? Diff regions/diff policies/Diff people/Diff behaviour	Claudia Cordovil
30	WRI can expand the BMP + Policy toolbox already develop under GNC/GEF project with GPNM to be more searchable for queries and extraction of useful information	Sara Walker
31	We (natural scientists) need to engage more with social scientists in this area to better understand legal frameworks, policy cohesion better vertically + horizontally.	Michelle McCrackin
32	Implementation of policies is needed locally/regionally. How to distinguish sustainability arguments to characterize implementation and economic consideration?	Wilfried Winiwarter
33	Keep the messages simple and the strategies easy to perform	Claudia Cordovil
34	Incentives for change (taxes reduction, market, PES) more than control.	-
35	For sustainable solutions the policy and using of N or take under control of using N, analysis of nitrogen strategy is very important. My institution can give knowledge to the policymaker in my country.	Gulay Besirli

Fluxes and Levels Assessment Group (FLAG)

Number	Remark	Name
1	Farm level tools/models (development to quantify (extended) formats NUE and demonstrate their usefulness and importance for precision	-
2	Develop NH_3 concentration networks and link with remote sensing measurements (to be developed too)	Pierre Cellier
3	More information is needed on dry deposition estimations	Rocio Alonso
4	Develop an N deposition network for the central Congo basin (no data!!)	Pascal Boeckx
5	Ammonia concentrations and trends, satellites observations, IASI-NH_3	Enrico Dammers & Jan Willem Erisman
6	Relevant observation data of the UEMO? LEMO? Global Atmosphere Watch observation programme	Alexander Baklanov
7	How can we investigate NUE in low Nutrient regions (Africa). Different pattern than in high input regions?	Claire Delon
8	Reach out to remote sensing community to better assess remote developing regions	Lauren Zamora
9	Upscaling and downscaling strategies for fluxes (commonality) and assessment interconnections	Jean Pierre Ometto
10	Producing more yield and energy with less N pollution in Chinese agriculture	Jun Shan
11	Need to integrate monitoring programs for different species (NO_x, N_2O), NH_3, …) to get full picture	Parv. Suntharalingam
12	Integrated N flux in different levels propose a proper N management in practices	Xiaotang Ju
13	More attention to interaction of the different layer (?) ecosystems (i.e. interaction atmosphere-water)	Alessandra De Marco
14	Pay more attention for quantification and composition of ORGANIC N in atmosphere fluxes (e.g. deposition emission) as well as water fluxes	Sergiy Medinets
15	Don't forget grassland based ruminant systems	Tom Misselbrook
16	Don't forget open ocean fluxes (N_2O, ammonia) some of this is bidirectional (e.g. ocean uptake)	Parvadha Suntharalingam
17	Integrated management at catchment level, N pollution from agriculture systems to natural systems (China)	Ying Zhang

Number	Remark	Name
18	Don't forget to include oceans in assessments	Lauren Zamora
19	Include CSIRO group of Mario Heneio "ruminant model' (process based livestock model global scale)	Benjamin Leon Bodirsky
20	Don’t forget the models that are already in place for regularly purposes. Even if they may not be 'state of the art'	Addo van Pul
21	Take into account seasonal processes	Rocío Alonso del Amo
22	There are many N models and the modelling community doesn't always talk to each other. There is great opportunity to improve models via multi model interconnections (like IPCC)	Michelle McCrackin
23	Include waste management sector in fluxes and levels assessment	SPM.Prince William
24	N pollution from anthropogenic sources - impact on water quality / N input - N output in aquatic systems (river, delta, sea)	-
25	N Inputs - Outputs In Soils Systems Nitrates Leaching	Theodore Karyotis

Sustainability and Threats Assessment Group (STAG)

Number	Remark	Name
1	Low Nitrogen (species) are the driver for high diversity so: critical loads for sustainability of ecosystems need to be addressed	Heidi Foth
2	BNF for Africa / Measuring atmosphere and deposition in the central Congo basin	Pascal Boeckx
3	Threats to livelihoods (to farmers/fishermen etc.) should be an integrated part of the sustainability analysis	Raghuram Nandula
4	Global Land Project (GLP) core project of future earth. Land use change and ecosystem behaviour is key drivers for sustainability under changing N environment	Hideaki Shibata
5	Make citizens more aware of biodiversity issues and link with our own choices	Pierre Cellier
6	Take into account the convention to combat desertification and land degradation (due to interactions with nitro pollution)	Pedro Pinho
7	Ataturk Horticultural Research, Turkey, Yaloua. For keeping biodiversity using N level get low, my institute does research on suitable nitrogen levels	Gulay Besirli
8	Importance of scales, modelling should focus on connecting scale, from soil biogeochemical processes to global climate systems	David Kanter

Number	Remark	Name
9	Threats are contextual, space and time etc.	Shabtai Bittman
10	Pay attention to interactions, among compounds, among air pollutants, with climate etc.	Rocío Alonso del Amo
11	Impacts on land use change	Maria Luisa Ballesteros-Jareño
12	Translate scientific findings into food energy and environmental security	Claudia M S Cordovil
13	What do you mean by "threat"? exposure, vulnerability, likelihood, take these together and they call it 'risk'. I am asking for risk maps of nitrogen	Gerard BONNIS
14	Scaling across scales and disciplines is important to include in modelling	Tommy Dalgaard
15	Are threats communicated effectively so people/public feels affected by high N?	-

Societal & Technical Options Responses Group (STORG)

Number	Remark	Name
1	Don't forget, Not the farmer but the consumer is the ultimate polluter	-
2	Science communication	Maria Amélia Martins-Loução
3	Appealing strategies to drive citizens choices increase education and awareness	Claudia M S Cordovil
4	Advertisement campaigns to reduce meat consumption, promote health by eating less meat and perhaps attach a negative rather than positive stigma to meat consumption	Lauren Zamora
5	Great to have consumers involved, because they will pull changes from the market place. But risky to have a very demanding uneducated consumers	Gabriela Soto
6	Education and dissemination of threats and cares	Maria Amélia Martins-Loução
7	Dissemination of results to media	-
8	We are always talking to each other we need to talk outside of our groups - alliances with communications specialists are a must	Gabriela Soto
9	Develop clear, readable guidance documents (web pages) on potential mitigation/best mgmt. practices that are regionally/system specific (e.g. development from TFRN guidance document)	Tom Misselbrook

Number	Remark	Name
10	Need to fully integrate human and agri systems	Shabtai Bittman
11	Induce of nitrogen level in the soil water. Not only farmers and scientists work but only the consumer do also effort. My institute can do seminars, demonstrations for consumers	Gulay Besirli
12	Focus iconic brand	Maria Amélia Martins-Loução
13	How to drive the change in citizen habits (i.e. food choice)	Alexandre?
14	Need to consider scales	Shabtai Bittman
15	Common protocols for technical assessments - Don't go for site specific situations/situation specific protocols	SPM. Prince William
16	Support widely and agreed nutrient management concepts such as the 4R's and integrated soil fertility management (ISFM)	Steffen Hansen
17	Challenge - Scale thus, regional and cultural aspects should be part of the design of an assessment	Jean Pierre Ometto
18	Strong regional/local inputs are essential for such options to be workable. They may even require capacity building in some regions	Raghuram Nandula
19	Don't forget agricultural industry suppliers - not just fertilisers but livestock housing, feeding and manure management	Tom Misselbrook
20	Drought and heat stress will limit NUE of fertilisers. Need to adapt to climate change	Pascal Boeckx
21	Development of RRI	Maria Amélia Martins-Loução
22	Technical solutions are needed to manage high production areas (intense farming). For example how to get ammonia from agriculture into chemical production	Heidi Foth
23	Technical measures for recycling is important	Tommy Dalgaard
24	Should we promote to close the cycle from farm to consumer to farm to be practical and not forget organic farming	Gabriela Soto

Annex C: Minutes from the parallel working groups on demonstration activities

1. East Africa INMS demonstration region

WG Chair: Chris Cox (UNEP); Rapporteur: Pascal Boeckx (university of Ghent);

Additional facilitation: Cargele Masso (Director, INI Africa)

Key Points Arising from the Discussion.

- The proposed area is the Lake Victoria basin: Kenya, Uganda, Tanzania, Rwanda, Burundi
- Although this demonstration region has been listed as Case 2 (developing country with too little N), it also includes elements of Case 1 (developing countries with too much N).
- It is a key world region with high population pressure.
- It includes intergovernmental partnership: link to action plan identified by Lake Victoria Basin Commission
- Threat: large catchment (195.000 km2, second largest freshwater lake in the world, 68.000 km2) with lack of data (N-loads, -budget,…)
- Some (isolated) activities are ongoing, but baseline study is required (summarize existing data); need clear site identification.

Key concerns

- **Eutrophication** (fisheries, recreational use, navigation challenge (erosion induced siltation)
  - Foundational knowledge contribution: identify contribution of N source to lake Victoria (where eutrophication is an issue)
  - Develop monitoring protocol for assessing N-input drivers
- **Low soil fertility and food insecurity**
  - Build on existing (long term) field demonstrations
  - Integrated Soil Fertility Management (being addressed by IITA)
    - Considering local context of small holder farmers
    - BNF (food quality and profitability)
    - wise use of mineral fertilizer
- **Open question on the relative role of agriculture vs waste water vs atmospheric inputs to N driven eutrophication of Lake Victoria.**

2. East Europe and Black Sea convention related INMS demonstration region

WG Chair: Tommy Dalgaard; Rapporteur: Pierre Cellier;

Additional facilitation: Wilfried Winiwarter (director, INI Europe)

The presentations from this session will be added to the INMS website.

Presentations by: Lidiya Moklyachuk and Serge Medinets (Ukraine), and Sergey Lukin (Russia), Chair of the Expert Panel on Nitrogen in EECCA countries.

Agricultural and chemical factories along the river – green from organic pollution on satellite image! Polluted wetlands and changes to ecosystems.

In the Russian part there are many forests and different types of soils. The southern part is more agriculture dominated. The most intensive Livestock is in the Belgrade/Belgorod Region; incl. a lot of poultry and pigs, with significant increase over the last 10 years (6-7 times increase). 210 thousand tons as mineral fertilizer + 12 t farm yard manure (96 kg N/ha average input in the Belgrade region, while only 20 kg N/ha in the region north thereof). Gradient between Belarus, Ukraine and Russia with the most intensive N input in Belarus. Long term field research results from Russia can be utilized (> 300 long term experiments in Russia).

East Europe – Dnieper/Dniester/Danube: This demonstration offers a clustering between several EECCA countries, with the advantage of significant flexibility depending on the exact boundary to be agreed to the demonstration area. At present it is proposed to include the Dnieper and Dniester in full, and the immediately adjacent part of the Danube Basin (Siret/Prut). This would promote better nitrogen management between Ukraine, Moldova, Belarus, Russia and Romania, contributing substantially to the objectives of the LRTAP convention in relation to transboundary air pollution, as well as to the objectives of the Black Sea Commission and the Danube River Commission in regard of freshwater and marine objectives. Discussions are now being developed between the partners on how this demonstration can support essential regional cooperation while recognizing the current GEF funding rules. Development of the partnership is being developed under the lead of the UNECE Task Force on Reactive Nitrogen, in cooperation with the European Centre of the INI. A key issue in

this area has been the substantial reduction in fertilizer use and livestock numbers since 1989, which has led to an improvement in water and air quality. As these transition economies seek to develop, it remains an ongoing challenge to ensure that good nitrogen practices are adopted, that can help develop the green nitrogen economy while avoiding to jeopardize these environmental gains.

Case 3: Regions with transition economies. Revised proposal: East Europe – Dnieper/Dniester/Siret (part of Danube) (Ukraine, Moldova, Belarus, Russia and Romania).

In addition, while there is not yet sufficient foundation to conduct a Central Asia demonstration, it is proposed to include preparatory activities, as a basis for preparing a Central Asian demonstration in a future project. (In particular, the Ferganah Valley is highlighted as a key area of excess nitrogen with major air and water pollution pressures.)

Details from relevant background documents to the meeting were presented, to aid the discussion:

The outcomes of the regional demonstrations should include:
a) quantification of the main nitrogen flows differentiated according to source sectors and key loss pathways,

b) better access to and understanding of data availability and limitations,

c) identification and quantification of the major source sectors and uncertainties,

d) highlighting and quantifying the different nitrogen benefits and threats in the region,

e) further examination of the biggest nitrogen threats and benefits in this region, (including where feasible cost-benefit analysis), including identification of priorities through engagement with policy and other stakeholders,

f) description in relation to nitrogen performance indicators (in cooperation with the global scale work),

g) review of available options for mitigation and better management of the nitrogen cycle, including identification of co-benefits and trade-offs. Development of a priority list of key options according to regional priorities,

h) profiling of current efforts, success stories, barriers to change and demonstration of how a joined up approach to nitrogen management may help overcome the barriers.

i) development of scenarios for future options in cooperation with the global analysis, but informed by the regional evidence.

The research activities of the Towards INMS team will require close liaison with policy audiences. For example, science can provide information on evidence of the main flows and opportunities for change, but it is a matter of policy to identify priorities. Similarly, while the science community can design scenarios, to be most effective, these will need to be developed considering a two-way interaction with the international policy community. In addition in order to incorporate information from the full range of experiences and to develop consensus on the opportunities for better nitrogen management and constraints, the process must engage with a wide range of other stakeholders including business and civil society.

Criteria for selection

Based on the PIF and subsequent discussions during 2014 and 2015, we list the following criteria for selection of the Towards INMS regional demonstrations:

1) The demonstration region should cover more than one country. This is necessary to address transboundary pollution issues, allow comparison of success stories and challenges between policy contexts, and address the barriers-to-change which are often international in nature.

2) The demonstration region should be feasible, bearing in mind the needs for cooperation, financing and datasets, while building synergies with other existing and planned activities. In particular it should build on other ongoing activities to be sure to maximize synergies.

3) Each of the four cases described in the PIF should be addressed:

- **Case 1:** Challenges and opportunities for developing areas with excess N_r.
- **Case 2:** Challenges and opportunities for developing areas with insufficient N_r.
- **Case 3:** Nitrogen challenges and opportunities for regions with transition economies.
- **Case 4:** Challenges and opportunities for developed areas with excess N_r.

4) The group of case studies should be representative of the key nitrogen challenges faced by different regions across the globe (according to the four cases), and together contribute to the global critical mass to support two-way interaction with the global analysis.

5) The demonstration region should have a convincing science partnership in place, demonstrating readiness and capability to establish the demonstration, including appropriate co-financing.

6) The demonstration region should have a convincing partnership with at least one regional intergovernmental environment program – ensuring a clear regional policy audience.

7) The demonstration partnership should be able to identify the key outcomes anticipated in terms of capacity building in nitrogen science and management and improved cooperation.

Main questions during the discussions:

How to relate to social science knowledge. E.g. cost-benefit analyses and the links to policies, stakeholder involvement etc.

In the group there are both ecologists and economists available.

Peter Whalley:

The GEF have a lot of previous information and studies on the Black Sea and the Danube, including real-time monitoring data over the last 10-15 years. The problem is the compatibility between the data from the Danube, The Dniester and the Dneiper.

We need to be clear in the pro-doc in how this demonstration area will add to the existing GEF studies in the area, with a focus on the integration across the nitrogen cycle. We must emphasize the management system for the demonstration area. Ivan Savetsky secretary of the Danube secretary supports and is behind this. This can contribute to the big picture and integrated assessment, and a special focus on (lost) nitrogen – we need to create more benefit from the previous GEF investments. Full N budget is complicated. Contribution to integrated management important.

Criteria	East Asia [a]	South Asia [b]	East Africa (Lake Victoria catchment)[c]	Latin America (La Plata catchment)[d]	East Europe (East Baltic)[e]	E. Europe (Dnieper/ Dniester/ Siret)[f]	Central Asia (Syr Darya) [g]	W. Europe (Atlantic seaboard)[h]
1. More than one country.	Yes (3-4 countries)	Yes (4, potentially 6 if extra funding)	Yes (4 countries)	Yes (5 countries)	Yes (3-4)	Yes (5 countries)	Yes (4 countries)	Yes (5 countries)
2. Feasibility and building on existing Nr activities (cooperation, data, finance, synergies)	Yes	Yes	Yes	Yes	Builds on existing, but not currently feasible due to GEF finance rules.	Yes	No (not yet sufficient network)	Yes (subject to EU project resources)
3. Covers each of the Cases 1 to 4	Case 1	Case 1	Case 2	Mix of Case 1 & Case 2	Case 3	Case 3	Case 3	Case 4
4. Representative of key world regions & contributes to global critical mass	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5. Convincing partnership with readiness for demonstration	Yes	Yes	Yes	Yes	Yes (but not finance)	Yes	Not yet (needs prior capacity building)	Yes
6. Partnership with intergovernmental framework	Yes, PEMSEA	Yes, LVBC	Yes, SACEP	Yes, CIC	Yes, LRTAP & HELCOM	Yes, LRTAP, Danube Commission (ICPDR)& Black Sea Commission	Yes, LRTAP and UNECE Water Convention	Yes, LRTAP, OSPAR, UNECE Water Convention
7. Identification of key outcomes anticipated by the regional demo partnership	Not yet tested	Not yet tested	Not yet tested	Not yet tested	Not yet tested	Not yet tested	Not yet tested	Not yet tested

Notes: a, China, Japan, South Korea, with involvement of the Philippines; b, India, Bangladesh, Sri Lanka, Nepal, and potentially (dependent on additional funds) Pakistan and Myanmar; c, Kenya, Uganda, Tanzania, Burundi, Rwanda; d, Brazil, Paraguay, Uruguay, Argentina, Bolivia; e, Russia, Estonia, Latvia, and potentially Finland; f, Ukraine, Moldova, Belarus, Russia and Romania (flexible, as more Danube could be included if additional funds); g, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan; h, Spain, Portugal, France, UK, Belgium.

Table: Summary of INMS proposed demonstration region evaluation from the document: "Selection of Regional Demonstrations in 'Towards INMS' " [INMS/PPG/2015.2.6] http://www.inms.international/inms-meeting-lisbon/selection-of-regional-demonstration-in-towards-inms

Alisher Mamadzhanov: Re the transboundary air and water conventions. There is also an UNECE project on climate change adaptation. There is a vast area of cooperation. N is also part of climate change interaction.

Adrian Leip, JRC: The socio-economic aspects to be included in the scenarios and assessment model is very important. For example, how will increased efficiencies effect the whole food chain. Adrian could provide the agro-environmental model e.g. via CAPRI (both global and especially for Europe), which could be expanded to the Black Sea watershed.

Answer from Lydia: There is already a risk model, based on the US cartox model, and a PhD study defended next month with a cost-benefit model. For e.g including organic farming, soil related measures, pesticides etc. This is complementary to what Adrian has to offer.

Güday, Turkey: How to integrate the farmers in the work?

Lydia says, recommendations for good farming practices is an important message (in the form of small books for farmers etc., re soil protection etc.). The problem is it is often not used. Why is this the case and how should we better use the resources. Maybe use connection via daughter organizations like the research station for organic farming.

Pierre Cellier: Ask for relations to local actors; farmers, industry, policy makers etc. Are they already involved? Lydia responds it is included partly via the agricultural department. E.g. via field plots etc.

From Russia side: A big gap between collaboration between research (only taken to the academy of sciences) and farmers (don't pay attention to that), and policy makers. The local stakeholders have to struggle – they only change it if it provides them "extra income" – facilitating cooperation between research – and farmers and policy makers is a key issue.

Integrate with:

- UNECE, transboundary (air and water) conventions (including the UNECE Expert Panel on Nitrogen in EECCA countries),
- Danube (Prut) and the Dnieper, Black Sea commissions

Wilfried Winiwarter: Remember all the effects assessed, including the very steep increase in livestock production presented by Sergey Lukin.

Integration of Romania: **Irina Catianis** et al. in the studies; both incl. black sea delta, Danube etc.

3. East Asia INMS Demonstration Region

WG Chair: Albert Bleeker (INI Director of Operations); Rapporteur: Baojing Gu (Zhejiang University)

East Asia, located at the eastern margin of the Eurasian Continent and the western coast of the Pacific Ocean, lives on 22% of the world's population, cultivating 9.2% of the world's arable land and consuming 37% of the world's N fertilizer with the unprecedented increase in food and energy demand in the last three decade. Owing to large variation in socioeconomic development, the environment, meteorological factors, culture, etc. in East Asia, grand challenges exist to conduct the demonstration in this region. However, it also suggests that studies in this region may contribute to the advance of nitrogen science if we can solve the complex relationships between socioeconomic development and reactive nitrogen uses.

We plan to include China, Japan, South Korea, and the Philippines, two developing and two developed countries. In China and Japan, many related studies can be helpful for the demonstration, such as the national scale assessments on the N footprint, air and water N pollution, N deposition, industrial N use, climatic changes derived from N use, etc. Although there is still no integrated database that contains enough information for the demonstration, scientists in China and Japan have started to work together to make the integrated work possible.

Two new organizations, "Nitrogen Working Group under the Soil Science Society of China" and "Japanese Nitrogen Expert Group", have been established to facilitate the N studies. One Chinese study has conducted a national N budget with 14-subsystems (cropland, grassland, forest, livestock, aquaculture, industry, human, pet, urban green-land, wastewater treatment, garbage treatment, atmosphere, surface water, and groundwater) has been finished. This would largely promote the demonstration in China, which has global significance since its N flux is almost one third of the global total. However, more data is still needed to quantify more detailed N fluxes in these demonstration regions. Although we can get some of these data from global database such as FAO, more local database can refine these estimations. More difficultly, large ocean area in East Asia, the N cycling in these ocean area is not easy. At the beginning, we may can calculate how much N transferred to the ocean first through riverine export and atmospheric deposition. There are no region agreements and conventions specifically for reactive nitrogen in East Asia yet. However, East China Sea is an area of common environmental interest in this region. There is also concern of transboundary air pollutants. There may be regional agreement or convention in the future.

Other countries including South Korea and Philippines still need more coordination to include more scientists. We believe there should be some very good scientists to conduct related N studies. If it is difficult, other efforts such as by using an international database to conduct an international scale N assessment should also be meaningful. Owing to the large socioeconomic variations in East Asia, social scientists should be included in the demonstration, to analyze the socioeconomic barriers that compromise the pollution mitigation. From quantifying the N fluxes to finally maximum the benefit and minimize the cost of Nr uses, different stakeholders should be involved from scientists, and policy makers to public. These analysis on multiple scales are very important and essential to solve the Nr problems in East Asia.

We also have Dr. Cameron Gourley from Australia joining our group and discussed the possibility of doing the comparison of N assessment in East Asia and Australia. These two regions are in the two sides of the world and own many similar and very different natural and socioeconomic development.

4. Latin America INMS Demonstration Region

Feedback presentation made in plenary

WG Chair: Claudia Cordovil (University of Lisbon); Rapporteur: Gabriela Soto (National University Costa Rica and IFOAM);

Additional facilitation: Jean Ometto (Director, INI Latin America)

What do we need in the regions

- Local resources as added contribution to the project
- Data availability: not just N information, but Nationa Regulations, etc.
- Find on going activities / actors / institutions
- Set goals that we can actully do considering availability of data
- Who are the major players: who is generating data.

La Plata watershed

- 4 regions in one Water Shed
- Intensive agricultura production
- Spide being very productive region the amount of N is very inequal
- Lack of transboundary regulation
- 85% of the population lives in the cities (70 million people): Sewage contamination
- Local resources: Ballmon Forum, Projects of Food Security.
- Uruguay is already having drinking water problems: two activities mentioned: water quality, animal husbandry,
- Nitrogen Budget for Latin America: Bolivian Institute for Forestry, EMBRAPA, etc.
- Water Shed project (Isabel) 11 billion
- Monitoring air quality in Buenos Aires and San Paolo
- Interesting links from the Mississippi research in soybean BNF

Caribbean region

- Mesoamerican Caribbean contamination project lead by the Mesoamerican Corridor
- Agriculture intensive production not in all countries
- Gulf of Mexico Eurtrification 10 million in the first fase and second
- 22 million Land and water management, where maybe some founds can go
- Sugar cane production in Guatemala
- Lack of information
- Little agricultural research
- Inventory needed

Initial steps required

- Inventory of data, actors, institutions, alliances in the regions
- Maps of information sources
- Bring together environmentalist and agricultural production researchers together
- Inventory in Caribbean region can be done through IPBS, and INI

Possible gaps

- Deposition
- Not a broader scale
- Biodiversity link with N management

Challenges

- Scaling up and scaling down
- Building the budgets and considering soil N
- Policies gaps: the research do is responding to local demands. To take advantages of what exist, but also that it responds : San Paolo is air, Uruguay is water.
- Gaps in governence
- Maping information: what is critical?
  - N reactive concentration
  - How soil types: organic matter distribution
  - Cattle production
  - Land us mapping
  - Flow data and water quality from the rivers

Demonstrate impact and mitigation

- La Plata has available data in the Agricultural areas
- The information is no integrated yet, is not regionalize.
- The regional budget is not there
- Deposition: point studies, but not maps, or regional air maps.

Other regions should be included?

- Caribbean

Maps of actors / regions

- Validate models
- N influence on biodiversity
- Resources

Latin America Budget

- Join efforts with already existing modeling

Notes from the Working Group

In general the situation in Latin America is:

- There is a lack of homogeneity in fertilization practices
- There are different agricultural management practices
- There are no policies to control pollution
- Urbanization is intense
- There are big farms which have their own particular management

However, there are currently some ongoing projects which aim at verifying pollution situation in some parts of LA

- The La Plata region project
- The Belmonte forum
- N budget in LA
- Brian Kronvang pointed out a collaboration with Uruguay which has produced interesting data
- Jean Ometto referred a collaboration of Embrapa with the University of Buenos Aires and the Bolivian Institute
- Existing models for the incidence of forest fires in the Amazon region
- Gabriela Soto mentioned a project in the Gulf of Mexico which monitors land and water management (focus on eutrophication)
- Gabriela also mentioned a project in Costa Rica for biodiversity
- ECN satellite monitoring of the big cities (S Paulo and Buenos Aires)

Needs identified:

- Mitigation of GHG from cattle production, said Nick Hutchings
- N from SOM is important, due to the land use changes
- Need to scale up and scale down knowledge (a good way of being able to produce as policy interface with science can be to produce messages from modeling. This is scaling up, which then will allow to scale down.
- Mapping of:
    - Air quality
    - Soil quality
    - Water quality
- The knowledge needs to be in such a form which can feed into policy needs

Key points

Proposed decision for the demo region – La Plata

Include also a case study – Costa Rica

Proposed Priorities: Water to start with

Gaps identified: need to further study Air pollution and biodiversity

Ongoing air quality monitoring in São Paulo and Buenos Aires is a good tool to fill in gaps.

5. South Asia INMS Regional Demonstration

Summary of the Working Group

WG Chair: Tapan Adhya (KIIT University, Odisha / ING, New Delhi); Rapporteur: N. Raghuram (INI Director South Asia).

Others who attended the session included Prince William from NEERI, India, Patrick Heffer from IFA, Gabriole Weschung from UBA, Germany, Pravadha Suntharalingam from UK, Enrico Dammers, Vrije Univ., Amsterdam, Lauren Zamora, NASA, USA, Steffan Hansen, GEF, Benjamin Bodirsky, Postsdam, Oliver Spott, SKWP, Clare Stirling, CIMMYT.

Prof. Adhya started the meeting with a background of the Indian Nitrogen Group and its role in hosting N2010 and building the South Asian regional centre for the INI. He then requested Prof. Raghuram to give an outline of the South Asian Demo plan for INMS.

Prof. Raghuram gave a brief outline of the emerging plan for South Asian Demonstration. He said that the Indian Nitrogen Group has started consultations with various partners in India for a national N assessment covering all sectors, sources and sinks of N. Some contacts were also made in Sri Lanka, Bangladesh and Pakistan during a desk study commissioned by the South Asia Cooperative Environment Programme on nutrient management in South Asia. Based on these leads, the INI South Asian Regional Centre proposes to demonstrate a comprehensive assessment of the overall status of reactive nitrogen loading and its management in South Asia based on the scientific capacities and data from the above countries. India, Bangladesh, Sri Lanka and Pakistan constitute the largest area/population/emissions of the region, though data can be included (if available) from other countries of the region such as Myanmar, Nepal, Maldives, and Afghanistan. Within each of the countries, it is proposed to bring together all available data from all the relevant sectors such as crops, livestock, fisheries, sewage/waste, energy, transport, etc. The scale of coverage will be from national to state/provincial levels and if possible include district/county levels and beyond, at least in those countries where such level of resolution is possible. The trends to be captured may include sources, sinks, flows, impacts, loads, mitigation options etc. Case studies and best practices will be included, such as Lake Chilika in India.

There were queries regarding whether the demonstration can adequately capture the South Asian diversity, provide an integrative picture, cover not only crops but also livestock, burning of biomass/residue/wastes, N-deposition, etc. They were assured that all these issues will be addressed, though their depth and resolution may vary from country to country or regions within each country. There were some offers from the participants for technical support/expertise sharing on nitrification inhibitors, N-deposition, Climate smart agriculture, modelling, livestock issues etc. The need to make additional budgetary provision in the main part of the INMS to support any budgetary support for such external partners (from outside the South Asia) was discussed, as the regional budgets are already looking very tight. Overall, the participants expressed their support to the high level of ambition in the South Asian demonstration and underscored the need for a more quantitative understanding of the N budgets for South Asia.

Annex D: Key INMS project diagrams

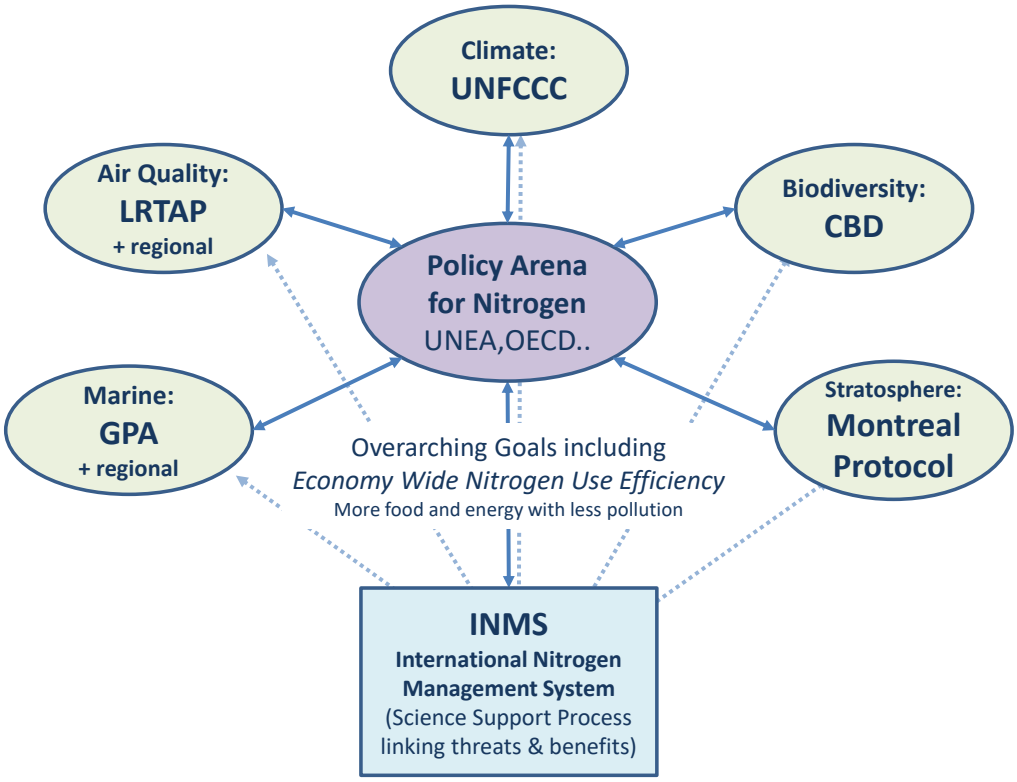

Figure D1: Summary of how INMS may link with international nitrogen policy frameworks (From the presentation of Mark Sutton). This diagram was used to stimulate discussion in Session 7. Its main purpose is to show simply key linkages for INMS in relation to international policy processes. This model conceives of INMS supporting multiple processes, with these brought together through the concept of a "Policy Arena for Nitrogen". The model focuses on working with existing processes rather than establishing a new nitrogen convention, or only working with one convention. The idea for such a Policy Arena for Nitrogen arose during discussions at a forum hosted by the Organisation for Economic Cooperation and Development (OECD), and could also point to a role for the United Nations Environment Assembly (UNEA).

This initial diagram is kept simple to illustrate these key points. As the subsequent discussion in Session 7 showed, many other organizations could be added to the diagram. The challenge in making the diagram more comprehensive, would be to still keep visual simplicity to convey a clear overarching message. The processes listed in this initial version of this diagram are as follows:

- Global Program of Action for the Protection of the Marine Environment from Land-based Activities (GPA) (secretariat with UNEP), with relevant contributions from the Global Partnership on Nutrient Management, GPNM, and the Global Partnership on Waste Water, GPWW).
- Geneva Convention on Long-range Transboundary Air Pollution (LRTAP). (UN Economic Commission for Europe – inc. US, Canada, Western Europe, Eastern Europe, Caucasus and Central Asia). Other regional air quality policy processes are relevant. There is no global convention at present for air quality.
- United Nations Framework Convention on Climate Change (UNFCCC)
- United Nations Convention on Biological Diversity (CBD)
- United Nations Montreal Protocol, which has its secretariat with UNEP and is established under the Vienna Convention for the protection of the ozone layer.

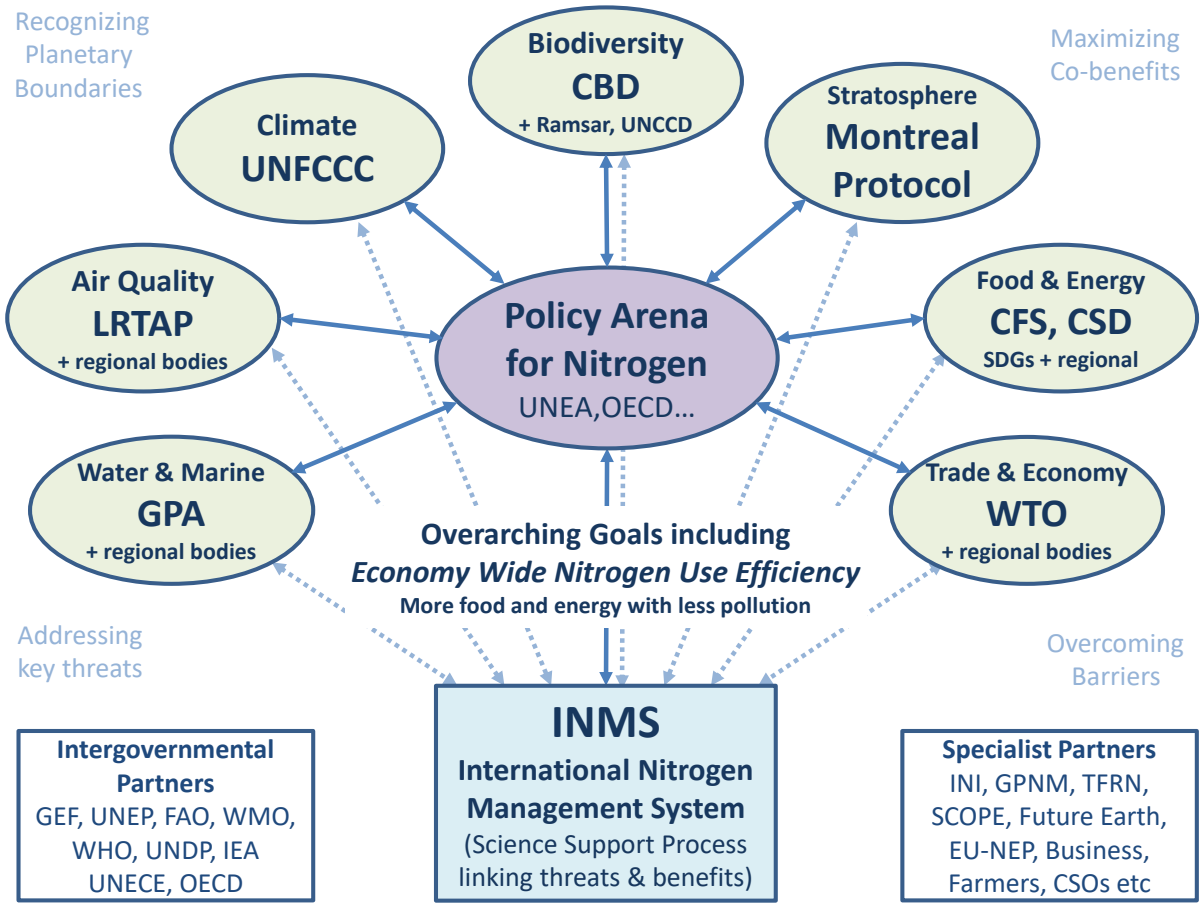

Figure D2: Revised summary of how INMS may link with international nitrogen policy frameworks (Revised by Mark Sutton following the requests made in Session 7). UNCCD is the United Nations Convention to Combat Desertification; CFS is the Committee on World Food Security; CSD is the Commission on Sustainable Development, under which Sustainable Development Goals (SDGs) are being developed; WTO is the world trade organization. IEA is the International Energy Agency, EU-NEP is the EU Nitrogen Expert Panel; CSOs is civil society organizations.

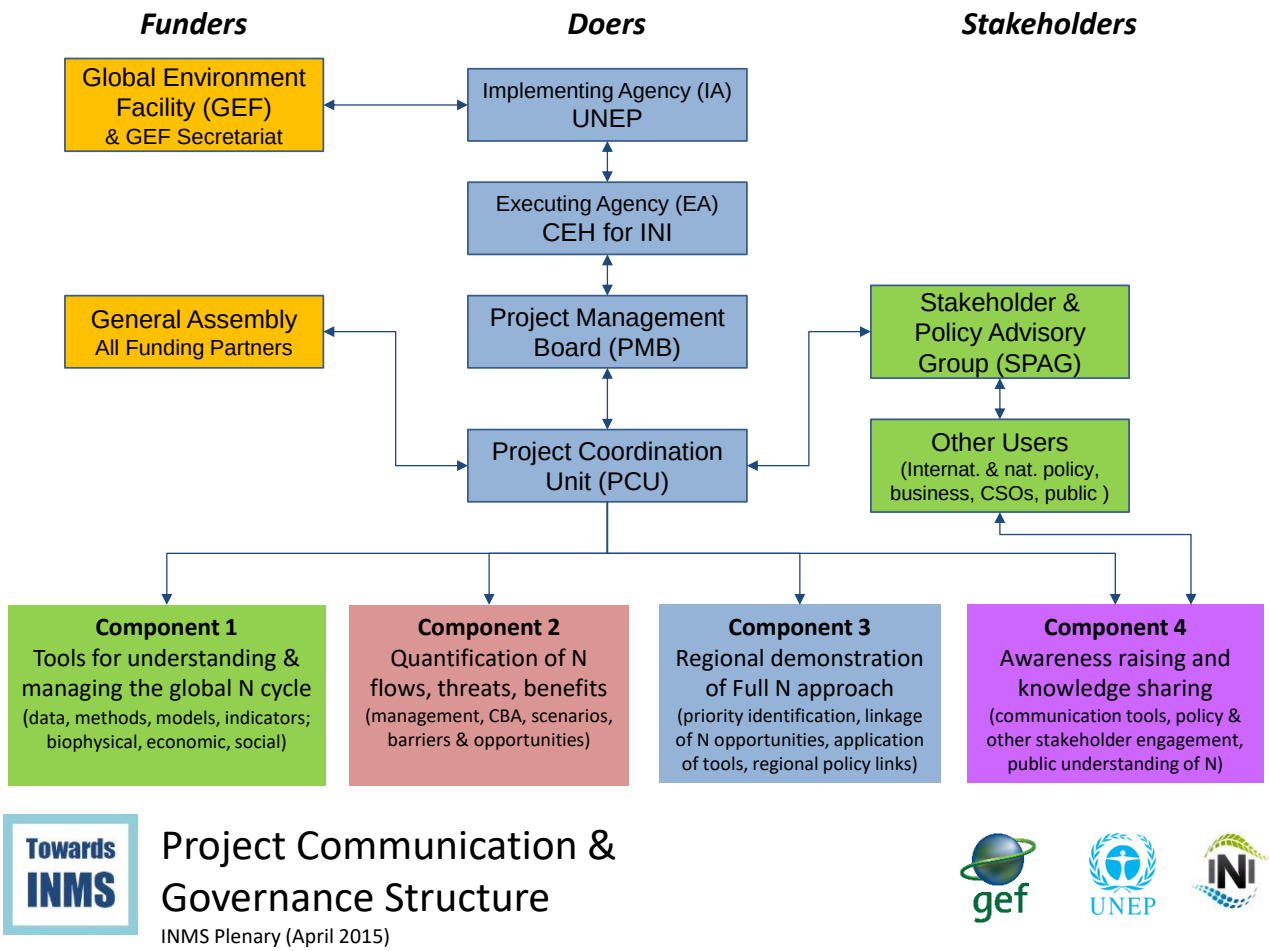

Figure D3: Summary of the Towards INMS project communication and governance structure. Catalytic funding is provided by the Global Environment Facility, while all funding partners are represented in the General Assembly. UNEP is the Implementing Agency (IA), while CEH on behalf of the International Nitrogen Initiative (INI) is the Executing Agency (EA). The Project Coordination Unit (PCU) is the team that actually manages the project coordination (based at the EA), who work closely with the Project Management Board (Component Leaders, IA and EA). The project direction is supported by the Stakeholder and Policy Advisory Group (SPAG), which consists of key users, which may also be project partners. Membership of the SPAG will be proposed during project Inception Phase by the EA and IA, for agreement by the General Assembly. Further details of the project components in which the project Partners make their contributions are provided in Figure D4. The lines indicate key communication routes.

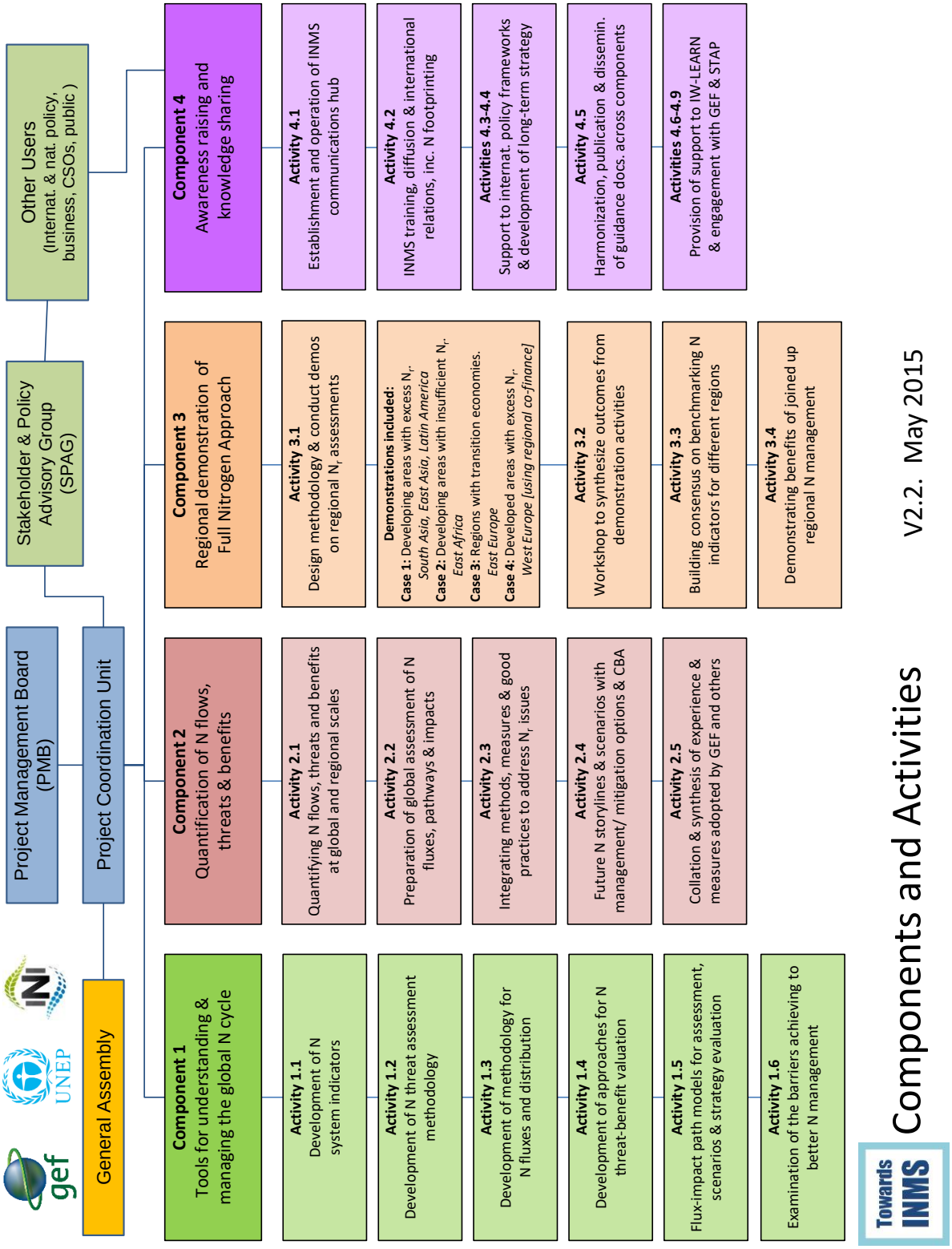

Figure D4: Summary of components and activities of *Towards INMS*. This diagram was developed following the Lisbon INMS Plenary Meeting, and is therefore supplementary to the minutes. It is included here to show the links to Figure D2. Boxes for the IA, EA and GEF are not shown in this figure to optimize space.