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Policy needs to the outcome of Nitro Europe

– results of polling policy makers

Deliverable D 6.4.4

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NitroEurope IP

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NitroEurope IP

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Executive Summary

The Nitro-Europe project intends to tune its outputs to be useful in the policy process. In order to better understand which topics of the project may be most useful in this respect, interviews with people directly involved in the policy process were held. A concept was developed to obtain interview results in a structured form. The exercise comprised a total of twelve interviews.

Depending on the background, the personal preference, and the position and the responsibilities taken, interview partners provided an interesting set of often consistent, sometimes conflicting views on certain topics. While there was a general understanding of the importance of integrated treatment of nitrogen in the environment, the perception how this integration is facilitated within the respective own structures differed. In some but not all institutions covered large structural obstacles still seem to exist which prevent overarching treatment. Sometimes such obstacles are being defended as an option to maintain control within an overall policy process, while they are being challenged from areas that are less important (with climate change being recognized as the issue currently dominating European environmental policies rather than air pollution or water pollution).

Policy makers also observe the interest and perceptions of groups they keep contact with. It may seem somewhat surprising that, in addition to the scientists, often end users expressed the strongest interest in integration of all issues regarding to nitrogen (like farmers' interest groups). An explanation was given that the constituents of these interest groups are most strongly affected by potentially conflicting legislation, and thus need to make sure that integration really happens.

Very different views were also expressed regarding the level of interference of policy. On one end of the scale was a very formal view, expressed from representatives of international bodies, which basically allowed no interference (policy making) but merely coordination of interests of the actors, in this case countries. The opposing view, also characterized by the different position of its representative, highlighted the competition of different policy processes leading to implementation of certain action or legislation. According to this view, there clearly is a "policy making", i.e. a purposeful intervention set, once it is possible to represent the own position strongly enough. These different views definitely derive from the different responsibilities of the interview partners in the respective processes of elaborating environmental guidelines.

A very general request of policy makers to science regarded, in general, to further advance basic scientific understanding on the multiple effects of nitrogen compounds on different compartments of the environment. Transparent algorithms which drive detailed models are desired to describe the release of nitrogen compounds. Regarding N_2O, a "tier 2" approach could fulfil such a demand – positioned between the current IPCC method based on N-input only, and complex models that will not allow to set clear relationships between abatement options and effects. Such an approach should allow the accounting of emission reductions beyond a mere input reduction. While currently it could be used in national inventories only when it can be shown to be more reliable than the current IPCC method, development of a "tier 2" approach may feed into a process of future IPCC guidelines in the relatively near future.

Objectives
This report describes activities aimed to improve communication between policy makers and scientists. While, on the one hand, the intention is to advertise important work of NitroEurope to people involved in the policy process, it allows on the other hand to bring to the attention of the NitroEurope community the specific interest as well as the thinking in different aspects of policy making. Ideally, the report could help bring out available research results that are of interest in the policy process, but might have gone unnoticed if specific interest had not been detected.

Activities
This work is part of Activity 6.4 “Verification of official inventories and improvement of IPCC methodology”. Its task is to establish a link between policy needs and available scientific results. In addition to the preparation of the interview sheets, the major activity consisted of the interview series and the documentation of the interviews.

Results
The report contains
1. An overview on the results of the elicitation of science expectations from policy experts.
2. A methodology description of the expert elicitation.
3. The respective background documents and interview transcripts (as appendices).

Milestones achieved
The attached report

Deviations and reasons
This deliverable has been delayed by two month from the original plan, due to a transfer in responsibility to the overall activity 6.4. As a consequence of previous experience and especially the availability of experts in the wake of the Copenhagen UNFCCC conference in December 2009, it was decided to change the concept of this work from a workshop (as planned originally) to a series of interviews, mostly by phone. It is expected that this will have a similar or even better effect on linking policy interest and scientific results in NitroEurope, while the needs for expert time and costs of travel arrangements considerably decrease, making it easier for policy experts to actually contribute to these interviews.

Publications
The attached report

Meetings
1 preparation meeting WU – IIASA, Wageningen, NL (July 1, 2009)
2 NEU General Assembly, Solothurn, February 2010
3 face-to-face interviews during TFRN meeting, Prague, May 2010

Policy needs to the outcome of Nitro Europe – results of polling policy makers

Wilfried Winiwarter (IIASA)

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1. Introduction

Nitro Europe explores the nitrogen cycle in European soils in order to arrive at a better understanding of the anthropogenic impacts on the environmental pools. Specifically, the emissions of N_2O to the atmosphere are addressed. This understanding does not only serve strictly scientific purposes. The project also aims at disseminating results to the policy arena. The current work was performed in order to make the needs of policy making better understood to the NitroEurope scientists.

In order to reach out to the requirements of policy, but also to inform policy makers of the achievements of NitroEurope so far, a series of telephone interviews was performed. The setup of these interviews as well as the results are described in detail in this report. Following concepts of Morgan and Henrion (1990), structures were established for a consistent compilation of information. In this way, ambiguities of the very subjective approach of questioning people can be held smaller than they would otherwise be.

Assimilation of scientific results into policy usually does not occur immediately (Neftel and Winiwarter, 2003). The results of bottom-up, self defined research as is typical for framework programme projects will be taken by policy as an indication of potentials for action, at most. Often there is the need for a second stage, where direct contracts allow a much closer interaction between science and policy. With a contract in place for such a second stage, also the policy interest becomes more focussed and can then be more readily used for policy application. Any approach to refine policy needs more clearly already before a second stage will simplify and accelerate that process. Exactly such a support is the intention of this paper, in order to facilitate a smoother transfer of NitroEurope results to where these results are urgently needed.

This report is organized as follows. Section 2 describes the approach taken and the background of action. In section 3, the detailed timeline of events is presented and the results are introduced. Section 4 provides an interpretation of the responses. While all efforts were made to reflect the positions of the persons interviewed as closely as possible, the conclusions contain the author’s subjective valuation and therefore the author also is the person solely responsible for the contents.

2. Methodology

The intention of this effort was to draw rather subjective views, opinions, and perceptions regarding their work environment from a selected group of people, while keeping an objective approach in order to allow for comparable responses. Methods to assess such information are well established in the social sciences. Structured interviews allow, despite of many differences in terms of personality, situation, position or other personal background, at least to some extent to guide the discussions along a given line. Therefore an interviewing situation was created as similar as possible each time, starting from the invitation to participate to the aftercare. Also the interviewer was the same person each time. But as people will respond differently, also interviews take a different course along the responses, and also the expertise and the knowledge of the participants steer the further questions and answers. In order to capture this knowledge, it was not the intention to strictly follow the guidance documents prepared, rather a careful balance between an “objective” strict approach and a more lenient approach was taken.

In contrast to a typical social science investigation on interactions in the techno-political arena, the interviews were performed by someone personally known to most of the participants, who also personally uses the results to perform all evaluations as an author of the present report. The interviewer is a scientist who, like the participants in general, comes from a scientific/technical background. This enables him to talk the same language and, expecting to continue collaboration with the participants, establishes a generally constructive setting.

The author had taken a similar perspective already in previous work (Winiwarter and Rypdal, 2001; Leitao et al., 2007), even if at that time the focus of the questions was much stronger directed on technical aspects. Still expectations are that also for the not strictly technical questions, a more collegial approach helps to maintain a good level in communication. Moreover, the proximity of

educational backgrounds allows for an everyday communication setting (asking for advice) while the interview structure helps keeping the focus.

As an added side benefit, we intentionally aimed to create awareness of the NitroEurope project among interview partners.

3. Work performed

Based on the initial task to feed back information from “policy makers” to NitroEurope, regarding their potential needs and in order to discover potentially available results, the first idea was to organize a conference, inviting key participants from the science and the policy arenas, and prepare a report from the proceedings of that conference. This plan was given up as first contacts established that, especially in the second half of the year 2009, many potential participants would be absolutely unavailable, and the likelihood that the conference would be a success was diminished.

In that phase, a pilot interview was held with one public official. This pilot interview demonstrated that it was indeed possible to address experts via telephone alone, and to receive responses of significant relevance to the further development of the NitroEurope project. Therefore, the work plan was revised to systematically address selected persons from public offices and/or closely related to environmental policy (“policy makers”) via a telephone contact.

Already for the pilot interview, the timing was prearranged via e-mail, to allow both participants to reserve a proper amount of time for the conversation. This principle of prearranged conversations was then also used throughout the effective phase of the interviews. A letter of invitation was prepared (see Appendix 1), which was used in this or a similar formulation for a first contact of candidates. From the beginning, a set of 12 interviews was seen as an appropriate sample.

The pilot interview, and further internal discussions in the NitroEurope project, helped determine the questions to be asked. We settled for three main sets of questions. In the first set, we asked about the perception of integrative treatment of nitrogen in policies. The second set referred to the perception of reporting and responsibility (direct – indirect – purposeful release of nitrogen), and the third set questioned about use and potential problems of uncertainty. While focusing on nitrous oxide and greenhouse gases in general (in line with the primary targets of NitroEurope), the concept of this “Guidance document to structured interviews” was to allow more general responses to the questions (especially for those participants who were themselves not directly involved in greenhouse gas emissions). This “Guidance document” (available as Appendix 2) was sent out to all candidates for an interview, together with the letter of invitation. This allowed participants to familiarize themselves with the specific aspects covered, and to focus on the interview beforehand.

A list of potential interviewees was drawn from people engaged in the policy arena according to

- Previous collaboration of the interviewer
- Reasonable geographical mix within Europe; EU or international bodies vs. country representatives; gender and age mix;

Typically all of these candidates, even if active in environmental policy for many years, had a technical or physical science background. Therefore they all were in general terms familiar with the concepts of physical models.

In addition to personal contacts of the interviewer, two persons suggested from within the NitroEurope community were invited (both participated). Also, all participants were asked at the end of the interview to recommend further participants. Out of five recommendations that were invited, only two agreed to join (one of which was on an original list of personal contacts anyway), the others never replied.

The overall interview series lasted for more than two months. Up to three candidates were contacted, and appointments for telephone interviews were arranged. Candidates that would not respond received reminders after approx. one week. A maximum of two reminders was sent. Only one

interview was scheduled per day. Further invitations were sent out after interviews had been conducted, or as soon as it became clear that there would be no response from the contacts.

Four candidates only reacted to the E-mail contact after a reminder was sent. Out of all candidates, in addition to those three (out of five) recommended only by other participants who did not reply, four were not able to participate. In one case, no response at all was received; another had changed topics since and did not feel competent. Two more candidates eventually agreed to an appointment, but for lack of finding appropriate timing the interviews had to be cancelled.

During the interview, which lasted about one hour each, notes were taken (handwritten) and then used to prepare the transcripts as soon as possible, either on the same or on the next day. The respective transcript was then sent via E-mail to the participant for comments. If such comments were received (which happened in about two thirds of the interviews) usually they were fully taken into account. Transcripts in their final version are included in Appendix 3. Usually, interviews were held in English language, but for participants who used German as their official language in their day-to-day work, it was also used in the interviews. Generally, that made interviews (and taking notes) easier for the native German speaking interviewer, but more work was needed to prepare English transcripts.

While most of the interviews were scheduled by telephone, an occasion of actually meeting interview candidates at a workshop was used to perform face-to-face interviews. Two such face-to-face interviews were arranged and agreed upon even before the workshop started. The procedure of invitation to the interview, as well as to produce transcripts and request comments here was absolutely the same as for the other interviews. While communication seemed somewhat easier, in principle no differences to telephone interviews became evident.

4. Discussion

Interesting insights are available from each of the interviews. Often the answers agreed among the participants and a coherent understanding could be derived. But even more insightful evaluations were possible where contradictions became evident, which were influenced by a different societal, regional or political background.
We may differentiate several types of responses

- Factual information, when experts could present information or ideas that are not generally available, but based on provable facts.
- Interpretation of processes; this is, when experts due to their multiple interactions in the policy arena and their experience have a better grasp of the contexts in which processes occur.
- Personal values and judgements; even as such values may seem subjective, they provide an interesting perspective of the way certain issues are being addressed

Considering these different perspectives, the following analysis will attempt to provide the highlights following the structure (major headings) of the questionnaire. This is, highlights will first of all be discussed along the perceived priorities given to nitrogen regarding problem areas, and their interaction, and the way the respective constituents respond to that issue. Next, the questions of reporting obligations and extent of responsibility, and the necessities as well as dangers of harmonization will be covered. The responses to questions on the usability and uncertainty will be treated at the end.

While we believe that the responses presented below may be generalized, as they are repetitive and similar responses have been provided in completely independent interview situations, we do not think they are specific enough for a quantitative analysis. After all, the number of interview partners remained much too small to allow for such a detailed analysis. For this reason we refer to “the majority of respondents” and “individual responses” in the evaluation, but will not quote the respective percentages.

Background on nitrogen policies
One may have expected similar institutional handling of the overarching topic of nitrogen policies in general. But even here interesting feedback was obtained. While all experts agreed that the

consideration of different flows of nitrogen is important, in order to prevent pollution swapping, there seem to be different levels of integration under different circumstances. Several of the responses indicated problems due to split responsibilities. Division of tasks within administration – and legal obligations of policy makers to cover one but not another topic – made it, in some occasions, difficult to transgress boundaries. So despite of better knowledge, the interview partners felt they sometimes had to accept and adhere to the existence of such spheres of interest, and implement regulations according to the respective obligations imposed.

Often attempts were in place to overcome this separation of tasks. In part this may depend on the respective background, with people working on politically “strong” agendas less inclined to compromise to the needs of other topics; also, user communities affected by specific legislation tended to request a harmonized approach in order to avoid different requirements put onto them.

Nitrogen and greenhouse gas emissions
The current methodology to estimate and report emissions of N_2O from soils seemed, very generally, unsatisfactorily to all respondents involved in greenhouse gas emissions. While the advantage of a common procedure to obtain comparable results for different countries was recognized, several of the participants also pointed to the specific value of country approaches in regard to methodological improvements.

Almost all experts supported the development of a Tier 2 methodology for soil N_2O emissions. This methodology would be less simplistic than the current approach and allow for a more detailed assessment of emissions as a function of environmental parameters as well as agricultural practice. Some respondents even considered a more complex model an appropriate tool to assess emissions, but in that respect the majority indicated they rather favoured a transparent methodology over a model that would have certain “black-box” aspects with model output difficult to interpret.

It is interesting to note the response of a representative of an international organization, who insisted that their organization would clearly not have a position on such matters. It is the decision and the responsibility of the member states/participants, whether or not certain methods were to be considered acceptable or not. The organization would just help to implement any approach laid out according to an agreement. This position was maintained also with respect to a consideration of indirect effects, possibly even extending into total footprints: the international organization would just accept and administer whatever has been decided.

Other respondents were able to provide and work with their own opinion in that matter, but no clear consensus emerged. Generally the polluter-pays principle was recognized, which would call for a total footprint analysis. However, some voices raised the problem of consistent accounting: in order to assess the total effect of nitrogen release, more and more precise information about nitrogen flows and their environmental effects would need to become available. This is where research is being challenged: only when good guidance is provided, can the current approach of responsibility (direct emissions & indirect emissions in some cases) be extended.

Licensing was suggested as a way to resolve accounting problems of nitrogen release. For each transfer process of nitrogen between economic entities, the “nitrogen license” could be transferred (in the case of products) or kept (for waste), thus making clear which share of pollution remained at the discretion of which stage of processing.

A further extension of responsibility, e.g. also considering and accounting for positive effects of pollution (N-fertilization may increase carbon sequestration) or even geoengineering, in general was dismissed. Interestingly, respondents in part used scientific arguments to discredit such an approach, which may be seen as emphasizing how impossible they considered such an idea. But there were also more policy oriented answers. One referred to the duty of policy officers to enforce legal obligations. Such enforcement never allows for giving up one obligation in favour of another one. That kind of decision, i.e. prioritizing one problem over another, can only be made at a political level but not by individual policies. There was one opinion putting that statement into a more pragmatic context. This voice insisted that, among all problems discussed, one would at a certain point in time get priority

and become implemented. In case this implementation shows negative side effects, a next step (in force of additional remediation) would attempt to clear up after that step.

Robustness of results and uncertainty
Uncertainty for most respondents was an interesting scientific concept, valuable in the scientific realm but not of much use in the policy world. The concept seemed just too difficult to be useful in the real world. A lot could be gained if focussing on establishing language that could make the concept understandable. Scientists may wish to spend more effort on proper language.

Therefore, for the time being, adding uncertainty as a criterion of analysis to national inventories seemed not useful. Using scientific methods to minimize uncertainty, and using uncertainty analysis as a tool to assess the areas contributing to uncertainty was definitely considered a worthwhile task.

It was also pointed out that, already now, methodological uncertainties are being considered when certain sectors are being included into regulations or not. The emission trading scheme, for example has so far been limited to areas where uncertainty in general is considered manageable. While not being a parameter for direct use in assessments, uncertainty in this way can be used for further deciding about the way data (or source sectors) are being used.

Specific requests to research (responses have been selected and compiled):

- Investigate the interaction between the nitrogen cycle and biodiversity: is a full recovery possible? Does climate change have consequences?
- Further work on interactions between environmental compartments is urgently needed, e.g. by developing a scheme of consistent N flows (based on or calibrated towards data that are indeed available from statistics).
- Assess costs of measures (specific also by farm type), define conditions for behavioural change.
- Provide (in general) factual support to policy making; specifically, N_2O as a greenhouse gas is still not sufficiently recognized in the public – science can contribute to change that image.
- Cover co-benefits, integrate tradeoffs of measures and management options into global models. Also consider the unintended side-effects.

5. Conclusions for NitroEurope

The respondents very generally supported the idea of science-based policy. This statement was clearly made in several interviews, and should encourage NitroEurope scientists to pursue their activities and adequately publish their results.

Specific interest was raised to any ideas to improve the currently unsatisfactory approach to estimate national N_2O emissions from soil. Both the reduction of the overall uncertainty and development of approaches to properly address abatement measures (in addition to simply minimize N input) would be extremely valuable and helpful. A tier-2 approach, possibly to be developed into new IPCC guidelines in a not too distant future, could satisfy such demand and provide harmonized information while still accounting for climatic differences, soil properties and specific agricultural practice.

As some countries have started their own national research programs, there has been a request to open also the measurement databases of NitroEurope for a detailed inspection, once the publication of these results is completed (e.g., a year after finishing NitroEurope).

6. Acknowledgements

The author wishes to thank Andre van Amstel for his support in developing the questionnaire, and in the discussions leading to a list of policy experts to be interviewed. Most of all, this report relies on the responses of those experts that have been willing to spend their time on a telephone interview, and reviewing the respective interview transcripts. In alphabetical order (not attributable to any of the individual transcripts presented in Appendix 3), these experts are:

- Christer Ågren, AirClim, Gothenburg (Sweden)
- Richard Ballaman, Federal Office for Environmental Protection, Berne (Switzerland)
- Katherine Bass, DEFRA, London (UK)
- Antje Branding, Agriculture and Rural Development Division, Scottish Government, Edinburgh (UK)
- Romain Joya, CITEPA, Paris (France)
- Astrid Olsson, UNFCCC, Bonn (Germany)
- Tiziano Pigniatelli, ENEA, Rome (Italy)
- Klaus Radunsky, Umweltbundesamt, Wien (Austria)
- Luisa Samarelli, DG Environment, European Commission, Brussels (Belgium)
- Till Spranger, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Berlin (Germany)
- Janka Szemesova, Slovak Hydrometeorological Institute, Bratislava (Slovakia)
- André Zuber, DG Environment, European Commission, Brussels (Belgium)

7. References

Leitao, Joana, Wilfried Winiwarter, Jochen Theloke, Giuseppe Etiope, Domenico Gaudioso, Ernst Gebetsroither, Susannah Grice, Magda Kesik, Marek Korcz, Renate Köble, Sanna Saarnio and Gerhard Smiatek. Uncertainties and sensitivities of emission natural and biogenic sources in Europe. Deliverable 07 – NatAir. Report to the European Commission FP6-2003-SSP-3 – Policy Oriented Research, Proposal No.: 513699. University of Stuttgart (2007).

Morgan, M.G., Henrion, M., 1990. Uncertainty – a guide to dealing with uncertainty in quantitative risk and policy analysis. Cambridge University Press, New York.

Neftel, A., W. Winiwarter. Integration – Scaling up. In: A. Neftel and C. Spirig (eds.) EUROTRAC - LOOP (Limitation Of Oxidant Production) Final Report, pp. 105-108. GSF, Munich, Germany, 2003.

Winiwarter, W., K. Rypdal. Assessing the Uncertainty Associated with National Greenhouse Gas Emission Inventories: A Case Study for Austria. Atmospheric Environment 35, 5425-5440 (2001).

APPENDIX 1: Invitation to interviews

Dear [….],
As you may know, NitroEurope is a large European science project aimed to study the exchange of gases between soil and the atmosphere. The project has just entered its fifth and final year, and produced a multitude of scientifically highly valuable results. We wish to make these results also relevant for environmental policy.

In order to do so, I may ask for your help. You are a person that is familiar to both the scientific/technical aspects of exchange of greenhouse gases and air pollutants, and with the policy process. We have selected a small numbers of experts like you who can provide guidance to us how we should proceed to process our results in a way most useful also for policy. We have prepared a questionnaire (attached), and I would like to have a telephone interview with you along this questionnaire. The details are laid out in the attachment.

Please let me know if you are willing to provide such an interview, scheduled for 30 minutes (may take longer if we involve ourselves more deeply into discussions). In your reply, I would be happy if you could suggest an appropriate time for such a conversation (my next possibilities are [….] and possibly also later) and the telephone number that I could call you at.

Many thanks for your support

Best wishes

Wilfried Winiwarter

APPENDIX 2: Guidance document to structured interviews

Guidance for structured interviews

“NitroEurope policy interactions”

Purpose:

*) inform policy-orientated scientists and science-driven policy makers on the potential outcomes of NitroEurope
*) help define structure and scope of final NitroEurope products

Status of NitroEurope

NitroEurope is an integrated project in the EU R&D 6th framework program. Its task is to cover, according to the full project title, “The nitrogen cycle and its influence on the European greenhouse gas balance”. The key question has been formulated as: *What is the effect of reactive nitrogen supply on the direction and magnitude of net greenhouse gas budgets for Europe?* The project is scheduled for 5 years. With a start in early 2006, now there is just one more year to go. This means that most of the results have been achieved already, and the contributing scientists are busy to bring together and interpret the results.
This is an opportunity to focus the attention of researchers to topics that are really needed for practical use of their results. Please help us to define such topics by scheduling a telephone interview.
Information on NitroEurope is not restricted to collaborators. A wealth of detailed information is available from the web site (www.nitroeurope.eu). Even further details, down to individual research reports, can be made open upon registration. Registration is also not limited to active collaborators, but it may be that a specific interest on nitrogen issues needs to be explained before an account is set active. One way of expressing such interest is responding to this questionnaire.
NitroEurope, on the one hand, consists of a set of coordinated field experiments set up to assess the release of nitrogen compounds under a variety of input conditions. These experiments first of all focus on an observation of existing farming practice. Some of these input variations refer to a change of practice, or even change of external conditions (manipulation experiments). On the other hand, NitroEurope also involves an extended share of modeling at different scales, from a plot scale to landscape scale to European scale. Bringing together model approaches and the result of measurements is meant to provide an understanding of the processes underlying the release of nitrogen compounds.
In principle, NitroEurope attempts to maintain a complete N cycle. This involves measurement of the fluxes of NH_3, NO_x, N_2O, if possible also N_2 and occasionally also nitrate leaching. Understanding soil activity is also a topic. This means that also emissions of methane are being considered, which also links to the carbon cycle (and links to CarboEurope and GHGEurope projects have been established).

Setup of interviews:

We intend to contact about a dozen experts well-established along the science-policy interface, and to correspond via phone along the outline presented below. Such an interview should last 30-60 minutes. A protocol of the respective interview will be written down and returned to the expert, to safeguard against misrepresentation. All protocols, together with a summary of recommendations to be used within NitroEurope, will be combined into an internal report used as a project deliverable.

1) Background on nitrogen policies:

- Regarding a “nitrogen policy”, which “interest groups” are you confronted with (e.g., which economic sectors; which ministries; …)? You may wish to specify by individual N component (NO_x, ammonia, nitrate, greenhouse gases, …).
- How do you perceive the interest of these groups?
- Do you see an interest of stakeholders to address nitrogen in a general way, or is interest focused on particular aspects (water, air, greenhouse gases, …) only?

2) Nitrogen and greenhouse gas emissions:

[Note: while this set of questions is formulated explicitly to greenhouse gases, in the essence the topics covered concern environmental aspects in general; depending on the interview, questions may be translated into a different area of concern]

- The current IPCC method to assess N_2O from soils is very transparent, but not able to capture the release processes properly. Would you be prepared, in your field of action, to introduce a "black box" type of model (similar to the US' approach to apply DAYCENT) – even if it is not clear what the model does – once it gets scientifically accepted?

- Methodology to assess N_2O emissions from soil currently is either simple ("Tier1") or very complex ("Tier3"). Would a science-based intermediary approach ("Tier2") be of interest, presenting emission factors for individual activities and also allowing for recommendations of changes in such activities, which may have different emission factors and consequently also different emissions?

- The IPCC methodology (and in consequence the UNFCCC data) requests indirect emissions from agriculture to be considered. How far should the consideration of such indirect effects extend?

  - As far as agricultural area is concerned
  - As far as it is within a country's boundary
  - Total footprint

- In the 2006 IPCC guidelines, consideration is taken also regarding indirect effects of other than agricultural N-emission (NO_x from combustion and industrial processes, basically). Reference to that is given in the "General Guidance" volume, however, and not in the description of the respective processes. Will that be sufficient to be considered? Should it actually be considered, from a policy point of view, if the actual formation of the greenhouse gas (N_2O) occurs very remote from the source (see above)?

- Nitrogen indirectly affects the release of greenhouse gases in more than one way. Also CH_4 and CO_2 emissions as well as uptake may be changed due to availability of reactive nitrogen. Is it useful to consider these further indirect effects, covering compounds and elements beyond the ones direct emitted?

- Is it acceptable/feasible to recommend measures which release nitrogen into the environment in order to foster carbon sequestration, even if they have some negative side-effects associated with this release?

(questions regarding extent of responsibility towards indirect effects; coverage of tradeoffs; acceptance of geoengineering)

3) Robustness of results and uncertainty

- Can we define minimum (quality) requirements for useful N_2O inventories (or GHG inventories, in general)?

- How can information on uncertainty / reliability of an inventory be used in a policy process?

  - Would it e.g. be feasible to request readjustment of measures if – due to known uncertainty – certain measures later turn out not adequate (introducing a risk factor to emission certificates)?
  - Would “flagging” of robust vs. non-robust data help? I.e., declaring which kind of information is more reliable, and which is less reliable? (example for N_2O: while emission fluxes are considered enormously uncertain, emission trends are seen quite reliable; even emission levels, as inverse models seem to indicate). Would there be a discrimination point between a qualitative indicator set useful/not useful ? (see also the question above)

- How can we deal with different “national” methodologies, when country results merely are distinct by the method used (not necessarily justified by scientific evidence)? Should countries be requested to agree on a common and comparable methodology?
- Which kind of further scientific data would you consider most urgent?

Many thanks for your support!

Wilfried Winiwarter and Andre van Amstel

APPENDIX 3: Interview transcripts

Pilot interview – July 20, 2009

In terms of N_2O from soils, there are two elements of interest to inventory compiler and policy makers:

1) Reduce uncertainty, maybe by developing a methodology requiring (and taking advantage of) additional data that would allow a more precise estimate of soil N_2O emissions than those currently available in the IPCC approach (in the sense of a “Tier 2” methodology).
2) Discriminate between agricultural practices with respect to their N_2O emissions. If it can be proven that differences between practices can be determined with high confidence, then it may even be that uncertainty in emissions does not matter. Being able to recommend a change in agricultural practice with confidence (better than now with just assuming that less nitrogen equals less N_2O emissions) would be very valuable.

According to current guidelines, any country is free to use a “national” methodology if it can be proven that it is better than the existing default guidelines. With respect to the current question this means that NitroEurope should establish a methodology and get it published as a peer-reviewed paper – best would be if scientists outside (i.e., U.S., Australia) are able to support and reproduce results. From that point in time, national inventory agencies could seriously consider using this new “Tier 2” methodology if they find it valuable. A positive attitude may e.g. come from being able to “harvest” N_2O reductions due to other agricultural measures than just reducing fertilizer inputs.

Even if desirable, a harmonization within Europe or only between EU member countries seems, at this point in time, infeasible. Countries do have the possibility to select – if sufficiently supported by scientific material – the methodology best fit for their respective country.

The IPCC 2006 guidelines will be used for the years to come (after 2012), a revision probably will depend on the outcome of the Copenhagen conference end of the year. Depending on the timelines agreed upon, revised guidelines may be prepared for the year 2015. This may mean that activities will start soon after the closure of NitroEurope.

Interview 2 – March 15, 2010

The interview partner is well aware of the concept and aims of NitroEurope, even if personally more involved in air pollution policy. The following general remarks are made on the scope and method of interviews:

- It may be worth considering extending the "guidance" document and the interviews into other policies linked by the nitrogen cascade (notably air pollution), even if NitroEurope is focusing towards the effect of nitrogen on greenhouse gases
- The overall concept may be adapted towards allowing interview partner to maintain their anonymity. They may be confronted with a conflict between their private and official positions, which can be more easily sorted out if statements are not necessarily attributed. Listing names of interview partners in a report should be o.k.

1) Background on nitrogen policies

In political practice, there is very little, if any, connection between different policy areas addressing nitrogen. Ministries, but also stakeholders are usually focusing on one item only (air pollution OR climate change OR water pollution OR biodiversity). In policy, focus is along national regulation and/or international agreements which are organized this way. Stakeholders tend to address items as they occur on the agenda, and respond accordingly to the administrative subdivisions. Also NGOs predominantly focus on items where they expect publicity. The focus of the political agenda on the topic "climate" has not helped to improve necessary links between e.g. air pollution and climate change aspects of the nitrogen problem. There are some exemptions such as activities to relate air and water pollution (e.g. Nitrate Directive) abatement measures and strategies. The European Nitrogen Assessment provides a good framework for this policy development; and the CLRTAP Task Force on Reactive Nitrogen, actively pursues cross-media policy development from the air pollution side.
Potentially, a big "event" – e.g., the April 2011 Conference on Nitrogen and Global Change – can trigger a press echo big enough to have NGO's notice and look at the overall nitrogen problem.

2) International reporting

Transparency and credibility are the most important ingredients in international emission reporting. Only if it is possible to understand and justify the emission of the own country as well as of other countries, an interest in providing most accurate results will be maintained. This will be true for emission models, i.e. the simpler and more transparent a model, the better and more useful it is. A "tier 2" approach to IPCC, using a couple of simple emission factors, seems very useful in such a respect.
Transparency will be very important also regarding indirect emissions. It needs to be very clear how and to which extent indirect emissions should be and are being considered.
A full life cycle balance would most appropriately reflect the desired output, which also should be reported. A polluter pays principle would require to not only consider the direct emissions, but go further to indirect emissions within and even outside a country's border, if the connections can be established. Such a life cycle approach however may be limited by the transparency outlined above: if complex models have to be used, which operate in a "black box" manner, simplification to a level that is less comprehensive will become an advantage – even if not all consequences of nitrogen release are fully covered, as e.g. carbon sequestration due to nitrogen fertilization. [editor's comment: one could draw a recommendation to scientists, to carefully provide transparent methods in direction of a full life cycle]
Likewise, it needs to be seen problematic if second-order positive environmental effects are seen, but a first order damage is ignored. The valuation of the damage can be a matter of perspective, and in consequence, any attempt to provide a solution for one problem at the cost of another problem may be seen as making things worse. One example is the possible recommendation to increase carbon sequestration via deliberate release of reactive nitrogen to the environment. The interview partner

strongly disfavors this idea because the carbon sequestration is a transient effect, and because negative nitrogen effects on biodiversity, air and water pollution etc. are disregarded.

3) Uncertainties

Political agreements need certainty. It is not advisable or even acceptable to alter targets (e.g., emission reductions) during the course of action. A political agreement should refer to a defined set of methods and data. However, increasing knowledge (methods and data) may change the target in a next step of development. Thus it will be useful for such agreements to allow for revisions (or new agreements to be forged) according to the respective knowledge increase.
Treating highly uncertain emission sources, categories or emitted substances differently bears the danger that methodological development may be hampered: Uncertainty may otherwise protect emitters from firm regulation, thus providing a strong incentive not to provide better methodology or data. As a consequence, there is good reason to treat all sources, categories or emitted substances (highly uncertain as well as quite certain) the same. Ideally, all incentives should be directed to improvement of knowledge and its rational use in implementing in regulation at some point in time.
Even if precision of an individual country may suffer, harmonization of methods will provide transparency (see above) such that some compromise on precision seems acceptable. Ideally, a combination of national information and a harmonized method (consultation approaches) should be aimed for. In addition, national, more precise information is advisable for implementing optimal measures (e.g. emission reduction) on national levels.
Progress (on science, communication and policy) is needed most urgently on the relationship between the nitrogen cycle and biodiversity under climate change.

Interview 3 – March 17, 2010

The interview partner knows about the activities of the "nitrogen" scientists, but finds it difficult to understand which of the activities are related to a specific project. In this sense also the definition, scope and extent of the NitroEurope project are not clear, even if the community's activities are in general well known.

1) Background on nitrogen policies

Working on the air pollution side for an environmental NGO, contacts of the interview partner extend to other NGO's, and to governments/environmental agencies/the EU institutions. Delineation on "air pollution" is to draw a line somewhere, as one can not deal with everything. Interest extends into air pollution related issues as eutrophication or biodiversity. The focus is likewise primarily on sulfur and nitrogen (with somewhat less priority on ammonia).
Within the own organization, climate related research and legislation are also dealt with. Irrespective of the delineation and the division of labour within the own institution, the total picture (i.e., coverage of all interrelated issues of air pollution, water pollution, climate, biodiversity, …) is maintained to the extent possible. This is also recognized by the stakeholders. One-dimensional thinking is a concept of the past and may have been possible 20 years ago.

2) International reporting

An NGO is not so much interested in the questions of "fine-tuning" of emissions inventory quality – this is being dealt with by other institutions (national agencies, Task Force on Emission Inventory and Projections and their Air Pollutant Emission Inventory Guidebook, AEIGB, issued by EMEP/EEA). Emissions of SO_2 and NO_x are generally assumed to be understood quite well, it is rather the question of projections where uncertainty becomes a real issue.
As a consequence of the relatively higher uncertainty for some "new" pollutants, such as $PM_{2.5}$, some countries prefer – at least initially – to use relative ceilings (xx % reduction) instead of absolute ceilings as currently implemented in the NEC directive and Gothenborg protocol. This is as governments want to know what they sign up to, and want to avoid to again experience surprises like new emission sources appearing.
With respect to comparing between countries, it is most relevant to rely on "fairness" between countries. Such fairness can be established by using comparable methodologies like the AEIGB.
Side effects of emissions and emission reductions, or tradeoffs should always be considered. It is done routinely in connection with ozone as a result of NO_x emissions. Surprisingly seldom discussed are the emissions of N_2O as a consequence of NO_x emissions, subsequent deposition and conversion in ecosystems. Additional N_2O emissions which may occur as a consequence of NO_x abatement may have been accepted on the assumption that NO_x avoided also means to avoid indirect N_2O (as a consequence of N deposition), and that overall N_2O at least does not increase – question to scientists: has such a relationship between NO_x abatement and N_2O emissions been firmly established?
While clear links between SO_2 and NO_x emissions and secondary PM pollution are generally accepted, the role of ammonia is hardly ever discussed. The understanding seems to be that NH_3 is not limiting, thus does not affect the amount of secondary PM formed – but is this true generally, even for nutrient-deficient regions of Europe?
In general, relying on positive (like carbon sequestration) second and third order effects can be quite dangerous. In forestry, carbon sequestration may be an issue of a rather short time period – forest cycle times of 50 years may mean that most of the sequestration is reverted after that period, while climate science thinks in century terms (see e.g. GWP's have been derived for a 100 year period). Moreover, after harvesting the soil is left with ~~the~~ residual acidification as an additional effect to consider. Additional issues are that forestry practices as such impacts on biodiversity, and questions about what may happen to the large stores of nitrogen in forest soils if/when climate changes (warmer temperatures, more precipitation).
Here the precautionary principle should prevail. Second and third order effects are difficult to foresee, and may take the opposite direction to what has been expected. Especially fiddling with ecosystems can be dangerous: as a minimum, a long-term carbon sequestration due to nitrogen emissions first has to be proven.

3) Uncertainties

It seems as if working with high uncertainty is more easily accepted for VOC than for $PM_{2.5}$ or NH_3. Possibly, this is related to the “perceived danger”: VOC are generally unpleasant, possibly dangerous substances and one would like to get rid of them. Possibly this also has to do with the fact that something really can be done about VOC (e.g., catalyst) – and if action can be shown one is more ready to also accept uncertainty.
A way to deal with it is again a “fair” system comparing individual sources, countries, e.g. as applying guidelines (guidebooks) that are generally accepted. Obviously there is a danger that uncertainty may be misused to distract from action.
Good communication of uncertainty is needed. A statement on quantifying emission uncertainties is not really helpful. Rather it is useful to report the probability of a result, like IPCC is doing it: “under a certain emission reduction scenario, there is a 50% probability that global mean temperatures will not increase by more than 2°C by the year 2100”. With respect to a precautionary principle, a 50% probability to achieve an environmental target seems extremely low anyway. Consequently, issues of uncertainty needs also to be linked to some sort of risk assessment – at higher risks (percieved danger of inaction), decision-makers may have to accept to act in spite a higher level of uncertainty.
Methodological differences, e.g. in reporting, may be sorted out by introducing conversion factors. Another option is applying a consistent overall methodology parallel to the “official” reports and provide and interpret the results of both evaluations. If this is done in a transparent manner, it will be considered as “fair” by all parties involved.
Research needs (in addition to the two questions already outlined above): it would be of great interest to better understand interactions between nitrogen input to soils and biodiversity. Does cutting back nitrogen input really reduce biodiversity problems? Will the situation be restored to normal after some time period (full recovery), or is the nitrogen damage irreversible? Long-term experiments will be needed for that purpose.

Interview 4 – March 18, 2010

The interview partner contributed for some time to NitroEurope as a scientist, but now works for a government agency. So the concept of the project is known from the inside (at least specific aspects) rather than from the outside.

1) Background on nitrogen policies

Within the government agency, the interview partner focuses on climate change. Air pollution is covered by other experts of the agency, but information is closely exchanged (e.g., when communicating with industry on emission issues touching both areas). Professional interaction occurs with the ministry and with industry. Also, environmental data may be exchanged with the "general public" (NGO's are not specifically considered, they are general public). Within the ministry there is a strict separation in responsibilities between air pollution and climate change. Still further separation exists regarding water quality even within the government agency: while people responsible are personally known, there is no formal interaction regarding nitrogen release.

2) International reporting

The agency uses the standard IPCC methods to assess national emissions. Nevertheless, there is strong interest to improve the data quality by introducing country-specific parameters (or even region-specific parameters). There is cooperation with scientists regarding the application of a biophysical model to derive such country-specific information. Currently this activity is just at its start.
In principle, such country specific parameters can also be used to gather information on abatement strategies. Independent emission factors, as the "tier 2" approach outlined as a possible NitroEurope output, will be of great value to validate model results.
Indirect emissions definitely need to be considered if occurring within a country's boundary. The full footprint of an activity may be very difficult to assess. More information will be needed before an extension to such a footprint assessment can be recommended. Research on and better understanding of these interactions definitely is needed. Also indirect emissions from combustion NO_x, currently not considered under national reporting, is of interest. Possibly it is useful to include it under national reporting, but not within the national obligations as long as no political agreement on the accounting has been performed (similar to bunker fuels).
Further consideration of effects, also positive feedbacks, should also be encouraged. While current approaches in the direction of geoengineering may be problematic (like new technologies often are), further refinement and improvement will allow an optimistic perspective on geoengineering.

3) Uncertainties, robustness

The question of uncertainties has not been an issue in the national reporting system. Policy makers are interested in the results and in the reporting requirements. This may be connected to the fact that, for the time being, international targets are being met and there is no need to modify targets – and even in case of modification, this would not change the outcome in terms of policy needs.
Uncertainties caused by different methodology between countries should be regulated, as the EU does in general, by harmonization of procedures. Developing guidelines and recommendations (as worked out and agreed by national experts from the respective EU countries), in addition to the more general guidance available from IPCC, will improve the comparability as well as the transparency of results over time.
Research needs: specific needs are only expected once results from the national model exercise are available. Model development will call for validation data; here results like those achievable from NitroEurope may help.
Further comment: considering the obvious problems caused by nitrogen in different environmental pools, further interaction between policies definitely is worthwhile considering. This is not from an expert's perspective but from that of a citizen, who is e.g. affected by poor water quality of lakes due to eutrophication.

Interview 5 – March 26, 2010

The interview partner works for a national agency reporting to the government. Main responsibility is air pollution. Familiarity with NitroEurope is limited, but the concerns on nitrogen and the knowledge about scientific activities on the nitrogen topic are shared.

1) Background on nitrogen policies

The national agency primarily is in contact with the ministry for the environment, but also with administration of the next (regional) level who are in charge of implementing measures. Due to the competence of the ministry, the agency also limits their dealings to exchange of trace gases to the atmosphere (air pollution, greenhouse gases). There is no authority for N in general: water and soil are mainly in the competence of the ministry for agriculture, and only partially in the competence of the ministry for the environment, thus the issue is handled by different experts. As a consequence, there exists no complete approach to handle environmental nitrogen.
There are no contacts of the agency with industry or with NGO's. This is all done via the ministry or the regional level administration.
Main concern regarding nitrogen release is towards NO_x emissions from transport – given the magnitude of the source, and the importance in ozone formation. While PM pollution is also relevant, the link between secondary PM formation as e.g. from nitrogen pollution to elevated PM concentration is not drawn on the policy level. It is a communication task for the experts of the agency to provide the information that primary PM emissions contribute only a minor part to overall PM concentrations and therefore local measures (see above: measures are local / regional responsibility!) will be of limited use. A message that will require several organizations to cooperate, e.g. in introducing harmonized measures, is quite difficult to transmit.

2) International reporting

Transparency is one of the most important aspects in modeling in order to ensure acceptability of the results. It would be extremely difficult to convince the policy makers (the final end-users of the modeling exercise) about the robustness of the modeling analysis and result if a black box is introduced.
In this sense the proposed "Tier2" based upon emission factors by activity seems very interesting and more acceptable than a "Tier1", too much simplified, or a too complex and finally incomprehensible "Tier3" approach.
It is very important to adjust the communication language to a level to communicate with the respective stakeholders. Policy makers, who are experts in their own arena of discussions, require no extreme details but still need to be briefed the appropriate facts, only if possible in a simpler way.
This also reflects on the extent of indirect/overarching effects that can be attributed, e.g., to N_2O formation from soils. For a consultant, of course the total footprint will be of primary interest, even as bureaucratic obstacles (e.g., regarding responsibilities to water) may remain. But considering that indirect effects, and even more so total footprint approaches, need to be explained to the stakeholders in detail it remains questionable whether one should at all expose oneself beyond assessing the direct emissions (on a plot scale) – even if there is the danger of "wrong" responses. Only if appropriate tools, models are available, and reliable results can be presented to a stakeholder, such an extension beyond the direct emissions as such seem feasible.
It is further of interest to investigate indirect and second order effects, in order to understand which are at all relevant. Irrelevant (=small) effects should be, if possible, ignored in order not to waste time and resources. Counter-effects, when abatement of one adverse situation leads to an enhancement of another adverse situation, should be carefully avoided, as balancing / prioritizing would be extremely difficult or even impossible.

3) Uncertainties, robustness

While scientifically very important, the question of uncertainty is very difficult to communicate to stakeholders, as possibly confused with mistakes. Also, the consequences of reporting uncertainty with respect to some threshold first of all would have to be made clear: would an uncertainty margin

allow for emission limits not to be seen as strict (after all, considering uncertainty, targets may have been actually met) or should the precautionary principle prevail such that under all circumstances, even in the least favorable situation, meeting targets can be guaranteed?
Readjustment of measures according to previously uncertain information, based on further research, seems politically acceptable. It would however be easier if failure would go in both directions, as previous experience (e.g., EURO II, EURO III) indicates that emissions are estimated too optimistic, i.e. adjusting usually means tightening of further regulation. Ranking / flagging of unreliable data could be useful, only a different treatment (e.g., regarding preferred reduction strategies) could be very difficult and controversial.
In order to facilitate discussions at an international level, countries should always maintain a common and comparable methodology. Comparability and transparency are key parameters for being able to communicate to stakeholders even between countries.
Overall, improving the understanding of nitrogen abatement technologies is very welcome indeed, especially if it also comes with cost information. It would be most welcome, however, if it were possible, beyond technical measures, to find ways in implementing behavioral changes.

Interview 6 – April 23, 2010

The interview partner, working for a national agency that also takes functions of a ministry, does not know details of NitroEurope, but is aware of the project as such and also of a number of other international scientific activities on nitrogen. These activities all are considered of great interest, as there is high need in an appropriate representation of the importance of nitrogen as contributor to air pollution as well as to the greenhouse gases. Understanding the relationships is needed to inform public and stakeholders of the interactions in different environmental pools, which is critical just in the case of nitrogen.

1) Background on nitrogen policies

The national agency has a focus on air pollutants and thus primarily deals with NO_x and NH_3. While N_2O is less relevant, still the interaction is high priority. Both nationally and in the international involvement (CRLTAP), issues like the effects of atmospheric N on soils, water bodies and plants (eutrophication, critical loads, drinking water quality) are being considered. The nitrogen cascade, and the consideration of N in general, including biodiversity issues, are key in environmental policy. There are considerable expectations towards research, specifically regarding interactions of the C and the N cycle.
Interactions of the agency comprise contacts with other ministries, with the national parliament as well as with regional authorities. Also other stakeholders (e.g. farmers' unions or consumer protection organizations) are partners. Most commonly, these parties do have a more sectoral approach towards nitrogen, focusing on their specific issue (biodiversity only; or drinking water quality only).
For this reason it is even more important that N cascade and measures on N abatement are being laid out by science in a well-explained matter, to make clear in which areas co-benefits are possible.

2) International reporting

High complexity of methods is an issue that is to be limited to research. For the daily tasks in inventories, derived and simplified approaches to assess emissions are required rather than extremely complex models. On the other hand, very simple approaches (like the Tier 1 IPCC approach for N_2O) may not suffice under specific circumstances. The approaches taken need to be sufficiently robust to balance also a change in the result if something has been changed on the input side.
In case of such changes in the practice of e.g. agriculture, it is important to maintain the plausibility, such that the altered input does affect the outputs. Plausibility can build confidence even in not-so-simple models. In any case, emission models should be "fit-for-purpose", meaning they need to allow performing scenario analyses.
In an inventory clearly all sources need to be identified and quantified. Accounting on the source side is relatively simple. Accounting for indirect emissions creates additional problems, as it transfers responsibility. There is some danger of a discussion on responsibility, when the parties involved do not recognize their responsibility. Science can only provide a very clear definition and explanation. Possibly it is useful to provide two different representations – one assigning emissions to the respective direct sources, and one that establishes the indirect (and possibly disputed) contributions.
Science should do the best to avoid excess expectations on benefits which may not exist. In the case of N fertilization of forests for C sequestration, both short term and long term issues need to be considered. It would be of great value if NitroEurope could provide their expertise such that existing public expectations in such issues can be minimized.
For cases where scientists find benefits in one environmental area but problems in another area, they clearly should lay open their results and provide a transparent explanation. It is up to politics to decide about priorities. Such priorities are also not the responsibility of science, but science needs to carefully explain the different options and document in detail the scientific context.

3) Uncertainties, robustness

Most importantly, a perception of "uncertainty" in some data or results must not lead to a "do-nothing-approach". It will not be possible to define objective criteria on the acceptable quantitative uncertainty. Instead, a pragmatic approach would look for "no-regret" solutions: uncertainty should be used to

assess the robustness of a conclusion, such that any decision taken as a consequence of an uncertain set of data/information/model result may be maintained also under alternative outcomes or interpretations.
Presenting quantitative results of an uncertainty assessment may even discredit the results altogether in public perception – that exactly needs to be avoided. In practice, in the area of air pollution, costs of abatement will be considered and discussed about, but quantifying uncertainty is usually not helpful. Uncertainty is no reason to refrain from action.
Separating emission results into “reliable” vs. “not reliable” also should not be seen as an ideal solution. Scientists need to provide honest results on different levels:

- Scientific reports and papers will give detailed assessments on the uncertainty
- Summary reports may still refer to it
- Recommendations for policy makers (“SPM”) should provide rather a black/white abstract

Comparing results of inventories between countries definitely requires harmonization. Only if results are being made available in a comparable fashion, robust conclusions on the differences can be made. A large integrated project like NitroEurope may be very helpful in developing and disseminating such approaches across the home countries of the scientific institutions involved. Still there are cases where an individual country approach is also valuable, especially regarding countries that lead methodological development. Harmonization should not block the progress in further developing inventory techniques.
Recommendations and further expectations towards science: Science should provide and exhibit the interactions between nitrogen in the respective environmental pools, and the interactions that occur together with vegetation (e.g., regarding CO_2 sequestration – or the lack thereof). Also, any further statements on N_2O as a GHG (and not always on CO_2) will help the public discussion in order to get a broader view.
Science can and should clearly work out facts that otherwise get lost in public discussion. If, e.g., under current strategies, cattle farming is left out from ammonia abatement strategies, half of the total emissions simply are ignored. This will not allow for a proper abatement policy. Thus science can provide the respective background information, and bring up the material needed to appropriately quantify and provide abatement. The final decisions may be taken elsewhere, but at least the facts need to be provided properly.

Interview 7 – April 27, 2010

The interview partner is a scientific advisor in a national ministry with responsibilities towards agriculture as well as the environment. Part of the reason for agreeing to the interview was curiosity on the activities of NitroEurope – the project name as such was familiar, but not so much were the contents and the aims of the project.

1) Background on nitrogen policies

The ministry cooperates with and contracts external researchers in order to create evidence-based policies, specifically (in the current context) in the areas agriculture and climate change, mitigation of climate change, and bioenergy. Within the ministry, a policy team forms the core, and further interactions occur with statisticians, social scientists, and economists within the ministry. Contacts with stakeholders (mostly coordinated by the policy team) are considered very important, these include environmental organizations as well as agricultural and industrial representatives.
Within the ministry, other teams cover air quality or water quality. Considering the impacts across the systems is regarded very important, in order to avoid unintended consequences, and to identify synergies and trade-offs. Increasingly, interactions are also recognized by stakeholders. Industry representatives may have a slightly different view, rather attending to impacts on their profitability.

2) International reporting

There are explicit country targets on emission reductions for 2018. For meeting these targets, the current IPCC Tier 1 methodology for agricultural N_2O emissions is not helpful, as there is too little recommendations on how changed practice can influence emission. The ministry is currently starting up a research program in order to improve the situation and to improve the national inventory using a Tier 2 (national emission factor) or a Tier 3 (national model) methodology. It is conceivable that, for some time, reporting continues in a Tier 1 approach and only the internal, national inventory works on a higher tier, but this has not been decided.
The fact of a research program in the starting phase also explains a considerable interest of the ministry in NitroEurope results. While under normal circumstances, project results would only be considered at an aggregated level (high-level policy reports), currently there is also interest to even obtain the raw data of NitroEurope, if they can be made available to the nationally funded scientists at the end of the project (strictly on the basis of scientific exchange, of course).
While there may also be advantages of the currently very transparent approach to estimate N_2O, there is currently no prejudgement how a future inventory system could look like. Possibly a model operating like a black box may feel uncomfortable to the ministry, but if thoroughly verified it may be worth considering, and the advantages may outweigh the problems.
Indirect emissions are, in principle, easily covered in the national inventory system. It is a policy target not to export emissions, thus the logics of indirect emissions is well understood and also acceptable to the stakeholders. Assessing total footprints of activities may currently seem too difficult, but life cycle assessments do constitute a future challenge: especially, it may be of interest to incorporate also life cycle assessments into reporting. While this does not fit to current reporting methodology, it may be an interesting concept also regarding assigning mitigation tasks to specific source sectors.
The national inventory looks for ways to mitigate rather than offset emissions. Therefore consideration of possibly positive effects of nitrogen on carbon uptakes (irrespective of potential environmental harm) is irrelevant. But it would be very helpful to have a fundamental understanding, scientifically, of the interactions in ecosystems. Going beyond that, and actually recommending measures that eventually may be climate positive (in the sense of geo-engineering) would be a high level government decision, and is not currently being considered.

3) Uncertainties, robustness

Instead of defining a minimum quality, the ministry asked scientists (in the context of the current inventory improvement program) what level of uncertainty would result from an investment into improvement (scientists were not able to provide an estimate).

The assessment of uncertainty as such is still very valuable, even if there is no direct use. Also, flagging certain classes of data, and allowing different handling of data that are available at a specific quality level, in principle can be a very helpful guidance (also with regard to necessity for improvement).
Ideally, in a comparison with other countries it would be helpful if similar processes are used and described. But there may be good reasons why different solutions are pursued in different countries. One needs to rely on further international efforts, e.g. regarding IPCC activities. At least a consistent Tier 2 methodology would be very helpful. But more than the international comparability, it is the country policies driving inventory development. Thus the national priorities also will determine the inventory methodology used, even if international support is available.

Recommendations and further expectations towards science: Science should address the current uncertainty in the range and scale of options to mitigate GHG emissions across all farm types and in relation to local conditions.

Interview 8 – April 28, 2010

The interview partner is a policy officer on the European level, charged primarily with air pollution (national emission ceilings directive) but sees a close link to the nitrogen cycle in general in order to understand the sources of emissions. NitroEurope and its tasks are known in general terms, but not the exact delineation across similar activities and projects.

1) Background on nitrogen policies

On the European scale, the task is to prepare policy proposal, often with the aid of consultants working under service contracts with the Commission that provide information from individual country stakeholders and from researchers. Strong links also exist to other EU departments regarding other environmental topics for which nitrogen is relevant, specifically as the nitrate directive and, of course, the greenhouse gas emissions are concerned.
Additional contacts regard international obligations. The EU is also party to the Convention on Long Range Transboundary Air Pollution, and in this respect contributes to work of the Task Force on Reactive Nitrogen, which has been requested to come up with detailed data on effectiveness and cost related to ammonia emission abatement in the agriculture sector. There is no position yet taken by the EU on the proposals developed by the TFRN, as the full picture of the detailed data coming from the task force still has to be provided.
Reporting of greenhouse gases is largely (but not fully) harmonized with that of conventional air pollutants. But in general, the importance of the nitrogen cycle as a whole, and the inter-linkages between problems, are being considered. Even as there seems to be a general lack in knowledge, their importance is recognized (e.g. also in terms of hemispheric transport, where there is a known contribution of NO_x). This has not always been like that, but this inter-linkage is now also used as an additional argument to support certain policy suggestions (co-benefits).

2) International reporting

EU does have reporting obligations to the convention (as a party). But the reporting is compiled from EU Member States information. It is each Member States responsibility to choose their appropriate method in assessing emissions in accordance with the subsidiarity principle. So far the Member State may choose either the default methodology or a national methodology for their assessment.
Currently, there seems not to have been any need for improvement in terms of N_2O emissions assessment in Member States (for methane, this was an issue). But the new EU "effort-sharing decision" (part of the EU climate change policy) to reduce emissions on non-CO_2 GHG's by a certain percentage (individually set per Member State) by 2020 may require additional guidance or harmonised rules on the methodology and emission factors used for emission inventories. The first or maybe only the second round of reporting will show whether there is a need to harmonize, or whether these reports are sufficiently transparent. So far only few countries have looked in detail into N_2O emissions, thus there are no detailed discussions at the EU level.
Beyond N_2O, secondary emissions of NO_x may be quite small and possibly not so important. While indirect emissions play a role for N_2O and greenhouse gases, they might be not relevant for air pollutants. In general, policies like to address sources directly, and regulate at source level. Only if secondary effects are proven to be large, there is a necessity to readdress that issue.
Likewise, prioritizing one effect against another (positive vs. negative) might not happen so often in practice. The often used example of an interaction between nitrogen pollution and carbon uptake in vegetation may miss out on part of the issue which may be equally important (e.g., vegetation damage due to N-induced ozone may offset the gains). As policies address solutions to problems, trying to "fix" them through geoengineering is not an attractive option. Normally, a certain policy pushes, side effects happen and will then be fixed at a later stage. Deliberate trade-offs usually do not happen.

3) Uncertainties, robustness

Uncertainty is normally not an issue when adding up national inventories for an EU total. Member states provide the emission estimates, uncertainty will not be used comparing the resulting numbers with legal obligations.

Instead, in policy setting uncertainty is an issue. As an example, being aware of the uncertainty involved in assessing PM emissions, current discussions to determine national ceilings consider addressing relative changes rather than absolute ceilings. This acknowledges that for relative changes some of the uncertainty may cancel out and overall uncertainty may become smaller. So it may be useful to differentiate more or less uncertain sectors / pollutants.
Once the rules are set, uncertainty does normally not play a role. In a recent case – NO_x emissions and national emission ceilings – additional flexibility in applying the rules may be needed: in setting the ceilings, the uncertainty of the projections of emission factors for future technology had not been properly allocated, therefore an ex post correction as a consequence of the uncertainty may be negotiated.

Recommendations and further expectations towards science:
Science should

- Provide a European assessment of secondary (soil) emissions of NO.
- Assess the tradeoffs between nitrogen (NH_3) and CH_4 regarding food and feed production, and develop integrated management options
- Integrate such tradeoffs and management options into global models

Interview 9 – April 29, 2010

Working in the ministry of agriculture and environment, the interview partner is responsible for agriculture and climate change, and for measures on mitigation and adaptation in agriculture. The activities of NitroEurope and its tasks are, in general terms, familiar.

1) Background on nitrogen policies

The ministry is in close contact with many different stakeholders. There are direct contracts with scientists (some "main research providers" are bound to the ministry in longer term contracts) as well as industry, e.g. national farmers union.
Within the ministry, all environmentally relevant aspects of the N cycle are covered (greenhouse gases, air pollution, water quality). Integration is an important aspect, but still more integration would be valuable. The policy landscape is diverse, and it is organized to provide legislation along the EU directive. Just pursuing one specific legislation may favour pollution swapping. Interestingly, it happens that supporting scientists wish to neglect interactions between environmental compartment, while the farmers' union realizes that an integrated approach is needed. This may be unexpected, but finds an explanation. Policies (e.g., following EU directives) are developed according to a certain problem and may neglect other issues. Also scientists may wish to restrict themselves to their respective area of expertise. Farmers are then confronted with different, possibly conflicting messages, and therefore have an understandable interest to have these conflicts resolved.

2) International reporting

The Tier 1 methodology to assess N_2O from soils has serious deficiencies. What is required is a transparent but also very detailed approach to assess and report emissions. The blanket assumption of reducing N input as a means to also reduce emissions merely covers a small section of possible options. Good timing or optimizing processes of nitrogen fertilizer are also important but will not be reflected in a simple methodology. In order to convince farmers to comply, an immediate feedback on success is needed, which also needs to reflect in the inventory. The best practice approach needs to also show as an improvement.
Complex models would be very helpful to provide a better feedback. For the ministry, running a complex model is not needed – it is good enough if operated e.g. by "main research providers". An IPCC backed approach, not necessarily identical to the complex model, may be added to allow international comparison. This could also make use of an intermediate approach, which also in general is considered interesting.
Both coverage of direct and indirect emissions (including the overall footprint) are of interest and may even be assessed parallel, depending on the respective question. This would allow to look at the situation in different ways that may each be of interest. Shifting responsibilities between the respective levels of a footprinting approach can be avoided when a licensing approach is introduced. Material transfer between agents is then automatically connected with licenses on the respective contribution to an environmental damage or threat.
Prioritizing different effects (nitrogen pollution vs. carbon sequestration) carries considerable danger that additional side-effects go unnoticed. In terms of nitrogen, this could be aspects of biodiversity deterioration (conflicting with Natura 2000 obligations). Also, the long-term component of CO_2 uptake in forestry may be overestimated. Such prioritization is in principle unacceptable, as the country will get an infraction procedure if not complying obligations. Violating one commitment in order to observe another is not permitted.
If there is absolutely no way out, it needs a high-level political decision (e.g., geoengineering) – but this is a very theoretical question: regarding nitrogen, there is sufficient potential to improve efficiency in fertilizer use, i.e. there are still sufficient co-benefits to make use of.

3) Uncertainties, robustness

There is no point in now defining a quantitative criterion on acceptability of a certain level of uncertainty, as especially for N_2O knowledge on the extent of uncertainty as such is quite limited. A qualitative indication / different treatment depending on level of uncertainty may be worthwhile. For the topic in question, however, nitrogen and farming, a higher efficiency is considered beneficial anyway.

So measures and the costs spent on measures are no-regret solutions, therefore assessing the uncertainty before deciding to embark on a specific strategy is not such a high priority. Research to reduce uncertainty none the less is considered important.
Differences in reporting between different countries should normally not be an issue. Reporting is to be done according to specifications that force harmonization – if there are differences, the commission would pick it up. Also, NGO's are good in pointing out differences. Checking is going on all the time, and will lead to continuous improvement.
Differences between inventories as such also do not pose a problem. Problems may occur only once commodity prices are burdened with costs regarding the respective emissions to produce them (commodities like e.g. imported meat, in the context of nitrogen). In such cases it is important that the respective assessment of emissions is done correctly – it may be expected that regulation on the EU level will do.

Recommendations and further expectations towards science:
Science should provide results on the effectiveness of abatement measures and costs, and on the cross-cutting benefits of measures (impacts of more efficient nitrogen use on combating different nitrogen threats, on food security, on health benefits).
The need for integration also needs support by scientific data

Interview 10 – May 12, 2010

Within an agency charged with establishing national emission inventories, the interview partner is responsible for the sector agriculture. The agency is organized as a private non-profit organization and established on a collaborative basis between the country and major industry, but public funding by far dominates (e.g., government funding is available for inventory work). Some information on NitroEurope has been received via exchange with participating scientists from within the country.

1) Background on nitrogen policies

As the inventory agency works for the ministry on one hand, and receives input from scientific institutes and institutes of applied science on the other hand, interactions first of all occur with those partners. Scientists are interested to get their methods used also in the official national methodologies, thus they are interested to cooperate and support the inventory agency e.g. by performing assessments of the inventory results.
Within the agency, all fluxes to the atmosphere are covered. While in principle they support an integrative approach, covering water pollution also would need external expertise. Such integration, to some extent, can be performed via the ministry (linked with their needs regarding the nitrates directive). In any case, on the ministry level, integrative approaches find support. Scientists also think more and more in a holistic manner. Just the experts of the institutes of applied science typically are charged with consideration of relatively narrow areas only (e.g., specific crops, or specific animal categories). Thus there is a very pragmatic, but fragmented approach towards all kinds of issues from these experts.

2) International reporting

IPCC emission (and other) factors, as currently used, definitely lack the potential to cover other – also important – issues like climatic variations, different farming practices or specific mitigation options (other than reducing N). All of these would be valuable. In order to obtain better options, a national research program (including N_2O measurements) has been initiated.
A complex model which is able to handle the processes in detail might not find acceptance by the ministry, as long as it can not be operated within the country. It is important that the agency responsible for national inventories can implement and use such a complex model, in order to perform scenario runs as may be required for certain policy purposes. Thus such a model would require full documentation, and possibly also training courses would need to be offered to national experts, so that they can use the model appropriately.
There is considerable potential for an improved, but not “black-box” model. E.g., a model for inventory regionalization (NUTS2 – NUTS3 level) has been established that would allow using regionalized emission factors (and mitigation practices) once they become available.
Indirect emissions: consistent with the idea of integrative approaches, indirect emissions are important to be considered, and the responsibility for any adverse effects to the environment needs to be established. An inventory however still remains with a source approach, not a footprint approach. Especially as uncertainties are so large that a correct attribution to a source would fail, this perspective should be maintained. But if a better method were available, of course establishment of footprints could be valuable, preferably in scientific studies (not as a part of the inventories), in order to define policies and for the reflection of the policy makers in the ministry. Such footprints would be calculated separately from source inventories, they could be very valuable also to avoid double counting. But probably no action will be taken for inventories before there is a need to quantify (e.g. reporting requirements to UNFCCCC).
There may be positive and negative aspects of geoengineering, these arguments have to be weighed. The processes are too unknown for a final judgment, and uncertainties are too large to currently think about it.

3) Uncertainties, robustness

Uncertainties related to soil N_2O are not well constrained in the IPCC guidelines. Better information on the uncertainty as such would already be helpful. Also a decrease in this uncertainty (by improving the

data quality and their description) would be highly appreciated. Any data use would need to undergo two steps of validation (by the national government/ministry, and by UNFCCC).
Generally, the market should focus on more robust data for emission trading. Uncertain data like N_2O emissions need to become better constrained, they may not become acceptable for trading before uncertainties are less than, say, 50%.
Inter-country comparisons can become difficult when methodologies differ. However, comparing methodologies is highly valuable due to a learning effect. The advantage of national methodology is that potentially it is of higher precision, being more adapted to local agro-climatic context and farming practices. Harmonization is ideal to compare emissions between countries but it does not allow taking advantage of national research.

Recommendations and further expectations towards science:
Science should provide detailed emission factors for each agro-climatic context, taking into account farming practices, as part of a framework to assess N_2O emissions. Improvement of methodologies shall integrate mitigation practices into a calculation model. This also needs a good bibliography to know where parameters exactly come from (measurements, expert estimates, …).
Also such a integrative framework would allow to establish consistency between the respective N flows (NO_x, NH_3, N_2O, …).
Important in establishing new approaches is the consideration of the respective data that might be needed: models need to rely on existing statistical information, instead of data that can hardly be assessed. There is a need for “pragmatic” models!

Interview 11 – May 13, 2010

The interview partner works on the European level, and is charged with water policy and agriculture. In this respect, the task is to prevent and minimize water pollution. This first of all requires consideration of nitrate pollution in water, but links to air pollution and greenhouse gas emissions are very close. There has been no direct exposure to NitroEurope so far, but the project as such is known from being frequently referred to in conferences and workshops.

1) Background on nitrogen policies

There is close interaction, within the DG, regarding the numerous aspects of nitrogen. Cooperation within the commission extends to DG agriculture, and to DG climate. Further regular contacts are with the ministries of member countries and their environment agencies. Occasionally also NGO contacts or sometimes farmers' unions or industry is involved.
Interaction between the different fields of N is usually no problem, just the limited and clear objective of work (nitrate directive) limits the possibility of cooperation with Member States in fields other than water protection, because the legal basis is missing. Lack of time and resources may, however, lead to a focus on the own subject rather than accepting integration of issues (e.g. cooperation among experts on water and biodiversity should be deepened.).
Cooperation across environmental media seems more difficult on the member state level, only few member states consider the atmosphere under their nitrate directive action programme. Also interaction with climate change policies seems very limited.
At the commission, also this problem seems to be better constrained. Even with an organizational change, personal contacts to the experts on climate change remain for the time being. With the internal dominance of that topic now relieved, currently other N related issues gain in importance. This strong focus is also seen in the interest of NGO's and industry who share a huge interest in climate change, reflecting the policy approach. Clearly, the commission is able to shape this interest in general.

2) International reporting

In water pollution from agricultural sources, requirements are to monitor and to report nitrate concentrations in groundwater and surface waters and the eutrophic state (P, chlorophyll A, …). Determination of the latter is not harmonized yet, which causes considerable difficulties when trying to bring together international data. Attempts to harmonize are under way, but currently it is difficult to bring together comparable information on eutrophic state. Guidance is provided regarding the density of the measurement network, inside and outside of the "nitrate vulnerable zones".
The effectiveness of measures is also determined via self-checks of member states. The member states are also tasked with source identification in order to correctly apply measures related to agriculture rather than e.g. to sewage water treatment, it is not done by the commission. There is occasionally a discussion about the proper attribution of pollution release, this occurs between sectors normally and not between countries (fluvial pollution import is not so much an issue, at least not for the nitrates directive).
Regarding prioritization of different environmental problem areas, first of all a detailed assessment of all issues would be needed before any one measure could be suggested favouring one but potentially damaging another environmental pool. But in respect to water pollution, the principle is prevention anyway (minimizing inputs), thus typically co benefits can be harvested and negative side effects need not to be considered. In any case, a preference of one environmental issue (climate change) over other issues needs to be avoided.

3) Uncertainties, robustness

In water pollution, measurements are quite robust and their uncertainties are not a big issue. An exception is the uncertainty introduced by specific spatio-temporal conditions like drought or rainfall which affect the waterflow of a river. Furthermore, data transmission can be incomplete (e.g., when no information on groundwater depth is delivered with concentration measurements) – but here at least there is a legal handle that missing data can be requested from the providers (Member States).

Different national methodologies, as discussed previously, may also add to uncertainty. Some of the difference may be justified due to regional differences, and that result in different thresholds regarding eutrophic state being used in different countries, which prevents a proper comparison. Harmonization based on scientific work is quite complex, as is the definition of a most appropriate methodology – still the steps in that direction need to be taken.

Recommendations and further expectations towards science:
Unintended side-effects of measures to abate certain environmental problems always should be considered. E.g. regarding biofuels, any analysis of the climate benefits of biofuels need also to consider the effects of fertilizing biofuels crops, which may lead to eutrophication. It is not acceptable to focus on one issue, and to solve that issue only, just to find out later on that a new problem is being created. It is the task of science to understand these interactions beforehand (assuming that science is objective). Too often, the position of an administration is only influenced by interest groups – it should rather be affected by and supported with scientific results.

Interview 12 – May 20, 2010

The interview was performed with a person working for the secretariat of an international climate convention (referred to as "the secretariat" in the text below). Nitrogen first of all is considered with respect to the emissions of nitrous oxide. There has been no closer interaction with the NitroEurope project previously.

1) Background on nitrogen policies

Since much of the work deals with the national submissions of greenhouse gas emissions and the associated reporting, prime external contacts are experts on the ministry or inventory agency level from the parties to the convention (individual countries). In coordinating interactions with parties, often contacts with national experts and scientists beyond the ministries are made. Normally the secretariat does not deal with NGO's (environmental NGO's or interest groups), instead leaves such contacts to the respective internal national communication. NGO's also appear in the negotiation process (e.g. as observers in conferences of the parties to the convention).
While the focus of work is on greenhouse gases and GHG emissions, interaction regarding air pollution is also maintained. Information transfer to the respective partners in air pollution (also on a convention level) is operative, and for many European countries the experts contributing to emission inventories are the same or closely interacting. Regarding nitrogen fluxes to soil or water, these are considered only as much as relevant for climate change (e.g., when soil nitrogen models are used or carbon sequestration is considered, or when water bodies release greenhouse gases).

2) International reporting

Reporting of emissions, especially N_2O emissions from soils, for almost all countries is performed according to IPCC's default methodology. While in principle the use of national methods is considered appropriate and positive, such methods need detailed explanation. A centralized (desk) review of a national inventory might not be able to capture the concepts of such a national method, especially when this entails a complex model this might not be transparent enough. In an in-depth country review, the country experts may be able to convince the review team that their respective approach is plausible and actually an improvement over an existing method (like IPCC) and better reflects a country's situation. In such a review, the secretariat or its representative takes an impartial role, it is the experts of the review team that need to take the decisions on appropriateness of an approach.
If new science adds to the IPCC methodology, this in principle is welcomed by the secretariat. In order to apply such results to a national inventory, good and transparent documentation (e.g., peer-reviewed journal articles help) is required to convince the experts in a review team that this methodology is more appropriate to describe the situation of the respective country than the default method. The secretariat remains neutral in that matter.
There also exists another path to add new science to the inventory process. For this usually guidance of IPCC is sought. The parties, represented by an advisory committee for scientific/technical matters, may recommend certain IPCC documents to be endorsed as default methodology. This is what e.g. is now being discussed for the IPCC 2006 national greenhouse gas inventory guidelines. So far, methods described in these guidelines may be used by countries in the same way as national methodology only, i.e. when a country is able to demonstrate that this method is more appropriate for the respective country. After endorsing, i.e. with the agreement of the parties to the convention (the individual countries that agreed to it), these guidelines will become the default method – as will be the case from 2015, when post-Kyoto emissions (later than for the year 2012) will be reported according to the UNFCCC Annex I reporting guidelines. The secretariat simply facilitates such meetings and allows the negotiation teams to come up with a decision.
Moreover, the same advisory committee may also invite IPCC to provide guidance on a specific issue. Such guidance can later be used, if parties find an agreement, for certain issues in inventories and/or reporting.
A current topic that is on the agenda of such discussions is indirect CO_2 emissions (referring to CO_2 formed in the atmosphere from CH_4 and NMVOC). Pending a future agreement of the parties, reporting of such indirect emissions will or will not become mandatory.

Indirect emissions of N_2O from soils are part of the 1996 IPCC guidelines and therefore also are part of the inventory system. Treatment of further indirect effects (as e.g. oceanic N_2O or carbon sequestration as a consequence of nitrogen pollution) will depend on decisions based on agreement of parties, which of course may be science based. Obtaining the whole picture in a transparent manner may however be extremely difficult. Intransparent data that moreover are difficult to report (and potentially only reported by very few parties) definitely is not what the secretariat is after.

3) Uncertainties, robustness

It does not seem possible to define a minimum quality of reporting. After all, as the decision of parties is to cover the complete inventory, intrinsic uncertainty associated with specific processes has to be accepted.
Even if policy makers are used to decide under lack of information, they are usually not interested in data uncertainty, also as the concept of uncertainty is quite difficult to convey. They like to work with one number, and may rather request an improvement of reliability than considering it for certain decisions.
Improvement is also a primary motivation to estimate the uncertainty of inventories. Such uncertainty assessments are driving an inventory improvement program, and for this purpose it can definitely be recommended.
An inventory review team (and, supporting that team, also the secretariat) will merely ensure that the countries follow specific principles, its task is not to provide or value such principles. The inventory methods, expressing these principles, are being decided upon by agreement of the parties, thus it is the parties that will (on a political level) decide about the principles that determine the further development of inventory methods and use of uncertainty.

Recommendations and further expectations towards science:
The secretariat is interested in scientific progress in general, which will improve future greenhouse gas inventories. As details are to be decided by the respective parties, no specific recommendation can be given.