Concerns over the effectiveness of ammonia emissions abatement in Europe.

Summary of a policy discussion from the EC GRAMINAE project in relation to the EU Acidification Strategy.


TERI-GRAMINAE Context.
As part of the EU Terrestrial Ecosystem Research Initiative (TERI), the GRAMINAE project (GRassland AMmonia INteractions Across Europe, 1998-2001) provides an integrated programme to address European exchange fluxes of ammonia. Taking the comparison between semi-natural and managed grasslands as a focus, GRAMINAE is combining micrometeorology, eco-physiology and atmospheric chemistry to develop process based models suitable for scaling up in European models of transboundary air pollution. Such atmospheric transport models provide the basis for negotiations in the EU Acidification Strategy and the UNECE Nitrogen Protocol. Ammonia represents a major uncertainty in these models, making development of improved quantification central to the success of future abatement strategies. The GRAMINAE focus on grasslands allows the European transect approach of TERI to be applied, but is also relevant as grasslands may be both sources of ammonia to the atmosphere (intensive systems) and sensitive to ammonia deposition (semi-natural grasslands).

As part of the contribution of GRAMINAE, a number of meetings on ammonia and trace gases were held at ITE Edinburgh during the week 11-15 January 1999. The GRAMINAE 2nd Workshop took place on 11-12 January, and this was followed on 13-14 January by the TERI Concerted Action (TERICA) Working Group 6: “Trace fluxes and ecosystem functioning”. Following these, a focused GRAMINAE policy meeting was held on 15 January to address concerns regarding the effectiveness of European ammonia emissions abatement.

The policy meeting was attended by Dr. Diana Wilkins (Ministry of Agriculture, Fisheries and Food, UK), Prof. David Fowler (ITE, UK), Dr. Jan Willem Erisman (ECN, NL) and Dr. Mark Sutton (ITE, UK).

European ammonia emission abatement
As the EU develops policies to reduce ammonia emissions in the Acidification Strategy, Integrated Pollution Prevention and Control (IPPC) and under the UNECE Convention on Long-Range Transboundary Air Pollution (future ‘multi-pollutant, multi-effect’ Nitrogen Protocol), a key concern is to identify whether the abatement measures will be successful. To address the effectiveness of the measures, requires comprehensive monitoring networks in combination with a sound process understanding built into quantitative models. It is important to note that this is the first time that ammonia abatement policies have been developed across Europe. There are few locations where ammonia emissions have decreased substantially and monitoring is available to assess the predicted changes. These few sites are therefore of prime importance in considering the future agreements.

The Netherlands provides the clearest example of an area where emission abatement measures for ammonia have already been established and monitoring data are available. It is also of great interest as the ammonia emission reductions claimed (around 40%) do not appear to have translated into similar reductions in air concentrations and deposition (Erisman et al.
1998). This Dutch case study has provided most of the material for discussing the current uncertainties and implications for policy. A second example was provide for Hungary, where the structural changes in agriculture after 1989 resulted in an estimated emission reduction of 50%. In this case, monitoring as part of the European Monitoring and Evaluation Network (EMEP), has also shown no clear reduction in concentrations of ammonia or its reaction products since 1989 (Horváth and Sutton 1998).

Explaining the “Ammonia Gap”

The meeting discussed the implementation of emission abatement measures in the Netherlands, considered the reliability of the monitoring data and evaluated the degree to which the atmospheric cycle of ammonia is understood. Several possibilities may explain why the expected reductions in monitored ammonia were not observed (see also Erisman and Monteny, 1998), including: a) the abatement measures were less effective than anticipated, b) atmospheric reaction rates have changed due to reduced SO$_2$ emissions inducing increased long-range transport, c) there are other uncertainties in the atmospheric transport models or monitoring data. The present conclusion is that the abatement measures were not as successful as had been expected. This may be due, for example, to:

1. reduced efficiency when measures are applied on real farms,
2. increased emissions as the result of extending the area where manure is applied
3. interactions with other environmental policies (e.g. limitation of manure spreading in winter to satisfy the EC Nitrates Directive, leading to increased summer emissions),
4. increasing grassland emissions related to a larger ammonia ‘compensation point’ (the equilibrium ammonia concentration of the canopy) following better conservation of the nitrogen,
5. non-compliance of the abatement measures (expected to be a small effect),

It should be emphasised that the issue is still not fully understood. For example, in the Hungarian monitoring record, it is not clear why ammonia levels did not decrease even where the expected change was due to reduced animal numbers, rather than technical measures. Again this may relate to the existence of the ammonia compensation point for semi-natural land, although it is concluded that much wider analysis of parallel Eastern European datasets is needed.

What next?

Currently work is ongoing in the Netherlands to address these questions, with the European work in GRAMINAE contributing to the improved understanding of ammonia grassland exchange and the effect of compensation points on atmospheric transport. In the Netherlands it is expected that the ammonia abatement strategy will be formally reviewed. There are also clear implications for European policies under the developing Acidification Strategy and Nitrogen Protocol. While it is clearly necessary that the abatement agreements move forward, it is equally vital that these are underpinned by sufficient monitoring and research. It is of crucial importance to establish the ammonia budgets over regions and countries with monitoring and modelling studies in order to evaluate (future) ammonia abatement.

As part of the policy response wider issues also need to be considered. Ammonia emissions from agriculture are closely linked to an excess of nitrogen in the environment. Hence technical measures injecting manures might reduce ammonia emissions, but conversely increase nitrate leaching and emissions of the greenhouse gas nitrous oxide. There is therefore a strong case for a broader strategy to be developed that would reduce all nitrogen inputs. This could include a ‘nitrogen tax’ and should certainly be co-ordinated with the ongoing reform of EU agricultural subsidies.
References

Mark Sutton and Jan Willem Erisman
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