# Nitrogen Deposition and Natura 2000
# Science and Practice in Determining Environmental Impacts

## COST 729 Mid-Term Workshop, Bedford Hotel and Conference Centre, Brussels, 18 - 20th May, 2009

## Introduction to the workshop

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## Background

The Habitats Directive (92/43/EEC) is a cornerstone of Europe's nature conservation policy. It promotes the maintenance of biodiversity and requires Member States to take measures to maintain or restore natural habitats at a favourable conservation status. The Directive establishes the Natura 2000 network with the aim to assure the long- term survival of Europe's most valuable and threatened species and habitats. The provisions of the Directive require strict site protection measures, avoidance of deterioration and introduce a precautionary approach to permitting "plans or projects" which may have a likely significant effect on a site.

Control of emissions to air of reactive nitrogen are regulated under several directives including the National Emissions Ceilings Directive (NECD, 2001/81/EC), the Large Combustion Plants Directive (LCPD, 2001/80/EC), the Air Quality Directive (AQD, 2008/50/EC) and the directive on Integrated Pollution Prevention and Control (IPPC, 96/61/EC). A range of other policies and legislation also influence emissions, such as the Nitrates Directive (91/676/EEC). However, the impacts of nitrogen deposition on the Natura 2000 network, together with the associated impacts due to elevated concentrations of ammonia ($NH_3$) and nitrogen oxides ($NO_X$), are often not addressed adequately or systematically; this is despite the strong protection measures in place through the Habitats Directive.

At present there is no common European approach for determining the impacts of N deposition on individual sites or on conservation status. At the same time, the scale of pollution exposure suggests that there are widespread threats to the Natura 2000 network due to the concentrations and deposition

of reactive nitrogen species. These issues provide a major challenge for this workshop to develop best practices in conducting assessments and to identify the needs for future policy development.

## Aims and overall goal

The aims of the workshop are as follows:

- to compare case studies of N impacts on Natura sites from across Europe,
- to compare national criteria for risk assessment between countries,
- to develop clear messages that could improve assessment approaches,
- to communicate the scale of the nitrogen threat to the Natura network,
- to review the role of cross-compliance on managing Natura sites,
- to link the science with decision making at local to European scales.

Together these aims contribute to the overall workshop goal: *to harmonize approaches for determining the impacts of atmospheric nitrogen deposition on Natura 2000 sites and review the future policy options.*

## Overview of the Workshop

To address these concerns, the workshop is structured into five main themes. For each theme, a background document explains the issues in detail and challenges currently faced. These background documents raise key questions as a starter for discussions at the workshop. The Working Groups will operate in parallel, with the opportunity for exchange and discussion between the groups as needs arise. Overall, the workshop will encourage the links to be developed between the scientific basis of nitrogen deposition effects, regulatory practice and policy application. A graphical summary of the different Working Groups and their relationships is shown in Figure 1. While other links may be envisaged, this illustrates the main interactions.

Two key points should be noted. Firstly, the workshop title refers to nitrogen deposition, the process by which reactive nitrogen compounds are removed from the atmosphere, including both removal by precipitation ('wet deposition') and direct uptake by surfaces of gases and particulate matter ('dry deposition'). As many effects are related to the total deposited amounts of reactive nitrogen, the ecological effects are typically compared with this metric. In addition, nitrogen compounds may have effects which are related to their concentration in the environment, either as gases or as the aqueous substances (e.g. in rain or cloud water). This distinction between deposition and air concentrations is made when setting thresholds for reactive nitrogen effects: a) amounts of nitrogen deposition are compared with 'critical loads', while b) air concentrations are compared with 'critical levels' (Achermann and Bobbink, 2003; ICP Mapping & Modelling, 2004). Both the critical loads and critical levels thresholds are exceeded widely across Europe, making it important that each of the air concentration- and deposition-related effects is considered.

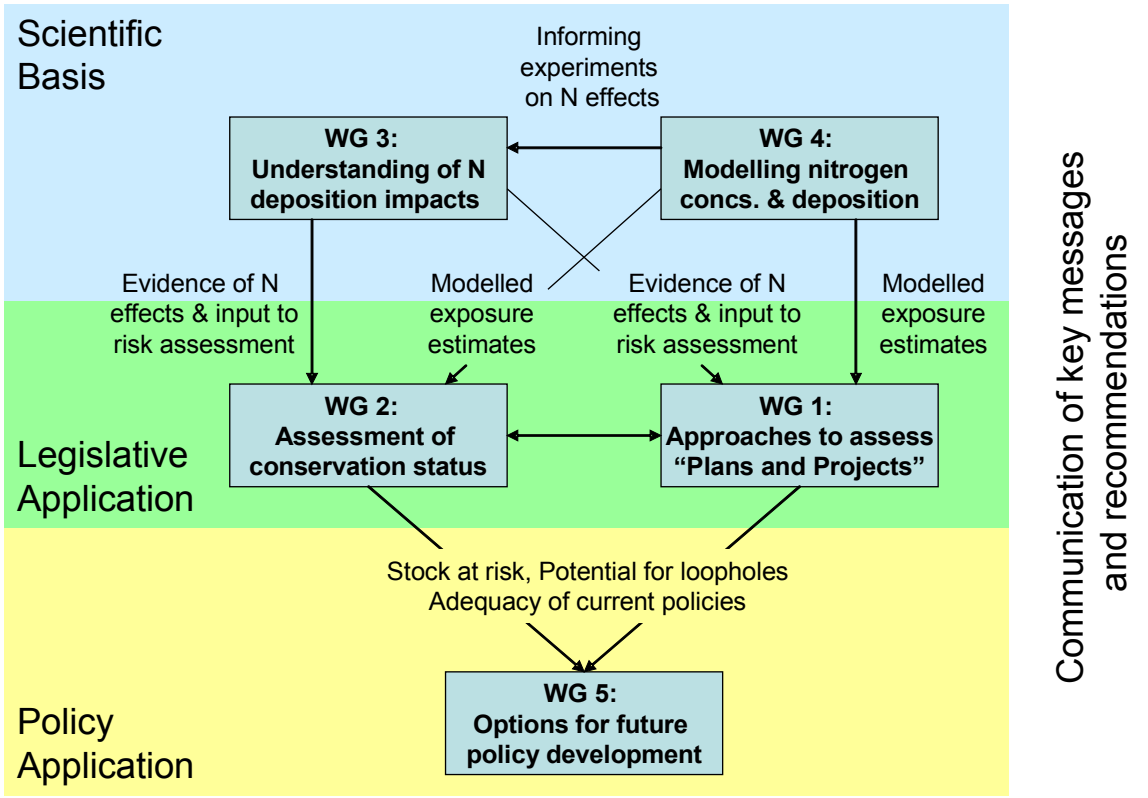


**Figure 1:** Summary of the workshop structure into five main Working-Groups, highlighting the interlinkages.

Secondly, it may be seen from the workshop structure illustrated in Figure 1 that two groups are established to consider the scientific basis. For the first of these (WG3: Understanding of N deposition impacts), both measurement and modelling approaches are considered as part of the review. By contrast, for WG4 (Modelling nitrogen concentrations and deposition), the focus is explicitly on the modelling aspects. Although measurement of concentrations and deposition will be discussed where necessary, these aspects are not a major focus of the present review. In the case of $NO_x$ measurements methods, these are well established through parallel activities related to urban air quality management. For ammonia, the measurement basis has recently been reviewed by the Edinburgh Expert Workshop, jointly supported by COST 729, and held under the auspices of the UNECE Convention on Long Range Transboundary Air Pollution (UNECE, 2007; Sutton et al., 2009). That workshop also reviewed, from a scientific perspective, the critical level for ammonia, as well as local and transboundary atmospheric modelling approaches. The present workshop may be distinguished from this in that it focuses on the application of the scientific work toward the regulatory context of managing Natura 2000 sites.

## Key issues to be addressed

The following Working Groups will be established:

## Working Group 1: Approaches to assess "Plans and Projects"

Chair: Anne Christine Le Gall; Rapporteur: Zoe Masters; BGD lead author: Bill Bealey

**Task**: *To compare impact assessment and decision making approaches to determine the N deposition impacts of plans and projects in the context of Habitats Directive Article 6.3 obligations.*

The Habitats Directive requires that all 'plans and projects' be assessed in relation to possible impacts on Natura 2000 sites, and that subject to certain exemptions, the projects can only be approved where they are shown to have no adverse effect on any Natura 2000 site, i.e. Special Area of Conservation (SAC) or Special Protection Area (SPA). However, at present, there is no common approach for evaluating the effects of nitrogen deposition and concentrations on these sites. By reviewing the practices in use across Member States, the intention is to discuss what could be considered as best practice, as well as identify problem issues. One such challenge is how to handle the situation where local background levels of deposition (or concentrations), resulting from existing activities already lead to exposure in excess of critical thresholds. In this case, it becomes challenging to define what constitutes an acceptable additional pollution burden, when in principle, any further exposure from a proposed plan or project will give rise to a worsening adverse impact. Specifically, a rational basis is needed of how to define *de minimis* in such assessments.

Related to this is the challenge of how to consider effects of multiple plans and projects 'in-combination'. Alone a single project might be considered an insignificant source, but consensus needs to be developed on how wide to consider the analysis of 'in combination' effects. Should for example, the in-combination approach only consider other regulated sources, or should all sources be considered, and over what geographical range?

## Working Group 2: Assessment of conservation status

Chair: Ian Strachan; Rapporteur: Maarten Hens; BGD lead author: Clare Whitfield

**Task**: *To compare approaches for assessing and reporting N deposition impacts on conservation status (Habitats Directive Article 17) and discussion of harmonising approaches for future reporting rounds.*

The Habitats Directive requires Member States to provide an assessment of conservation status of habitat and species listed in the Annexes of the Directive every six years. At the highest level, favourable conservation status is defined and there is a standardized approach as regards the parameters to assess and descriptive statements of condition (e.g. favourable, unfavourable, unknown). Nitrogen deposition is recognised as a major issue for biodiversity across Europe (EEA, 2007). However, there is currently no standardisation as to how to consider nitrogen deposition impacts on conservation status. There is a high likelihood that the scale of nitrogen deposition effects on conservation status of habitats and species is not being accurately reported.

A comparison of experience between countries will be used as a basis to investigate what might be considered best practice in the assessment of conservation status. The working group will be asked to consider various approaches to assessing whether nitrogen deposition is a pressure on the 'structure and function' of habitats or a 'threat' to the future prospects. These include critical loads exceedance, field survey and bioindicators. As such, this is closely related to Working Group 3. Limitations to implementation will be considered including financial and expertise resource requirements.

## Working Group 3: Understanding of nitrogen deposition impacts

Chair: Joachim Strengbom; Rapporteur: Helle Vibeke Andersen; BGD lead author: Annika Nordin

**Task**: *To review the latest science on the effects of nitrogen deposition and concentrations on Natura 2000 sites, including the use of bio-indicators, effects of N-form (e.g., $NH_x$ vs $NO_y$), and the relationships between critical thresholds and biodiversity loss.*

Action to manage the Natura 2000 network, and to assess conservation status, must be based on a sound scientific understanding of how reactive nitrogen deposition causes impacts on sensitive habitats. The Working Group will review the latest evidence, looking to provide a clear picture of the scale of threat from nitrogen deposition to the Natura 2000 network and to conservation status. In particular, clear attention will be given to reviewing the relative effects of different nitrogen forms, including ammonia vs nitrogen oxides (especially as this relates to different polluting source sectors) and to dry vs wet deposition (as this relates to near source impacts versus long range transport).

To date, much use has been made of the critical loads and levels approach, and the Working Group will consider both the strengths and limitations. The Group will ask to what extent other approaches could play a role in future management and assessment, including the further development of bioindicator approaches, from measured indicators at the site level to indicators applicable at the European scale. In particular, the group will consider the potential to improve relationships between concentrations/dose, thresholds and biodiversity loss. For this purpose both the loss of the species groups most sensitive to nitrogen (target groups at risk) and overall impacts on biodiversity will be considered. The use of management practices to counteract N deposition impacts will also be discussed.

## Working Group 4: Modelling nitrogen concentrations and deposition

Chair: Pierre Cellier; Rapporteur: Mark Theobald; BGD lead author: Ole Hertel

**Task**: *To review approaches to modelling local N deposition and concentrations in the regulatory context of Natura 2000.*

Assessment of the threat of nitrogen to the Natura 2000 network is fundamentally dependent on our ability to model the pathway from emissions, though air chemistry to deposition. There are currently many atmospheric models available, and recent reviews (for ammonia) have considered these at both local and regional scales (Loubet et al., 2009; van Pul et al., 2009). The challenge in the present workshop is to address effectiveness of such models for assessment in relation to the protection of Natura 2000 sites. For this purpose, the different pollutant forms resulting from both nitrogen oxides and ammonia emissions need to be considered, with a view to identifying the relative contributions from short range, mesoscale and transboundary (international) atmospheric transport. Key questions include, how well we can simulate measured air concentrations for relation to critical level estimates, and to what extent is the ecosystem dependence of dry deposition treated in models. Specifically, examples will be considered of where models have been applied in existing case studies to investigate the relative contribution of emissions from different sources (regulated and non regulated, local vs distant) to nitrogen deposition (and concentrations) experienced at Natura 2000 sites The question will be asked to what extent the models are adequate for these purposes, with a short-list made of the major uncertainties in the assessment. This will include review of the extent to which such assessments are limited by the availability of emissions data, and the role of screening models in such assessments.

## Working Group 5: Options for future policy development

Chair: Till Spranger; Rapporteur: Kevin Hicks; BGD lead author: Mark Sutton

**Task**: *To review options for future policy development to manage and mitigate the impacts of N deposition on the Natura 2000 network.*

One of the main motivators for the present workshop is the perception that current practices to protect Natura 2000 from nitrogen deposition are far from optimal. Although, in principle, the Habitats Directive affords the highest level of protection, much of the Natura network remains under threat. This can be illustrated by the wide degree of critical load and level exceedance for nitrogen across Europe, as well as measured datasets on changes in community species composition. This Working Group will consider the evidence emerging from other groups to review the options for future policy development to better protect that Natura 2000 network. While the aim is to focus on Natura 2000, this objective will be seen in the context of the wider aims of the Habitats Directive (inc. habitats/species outside of Natura 2000 sites) and other European biodiversity policy.

The group will analyze the current mechanisms by which the Habitats Directive affords protection to Natura 2000 sites, including the application of cross-compliance with other community legislation. It will discuss the existence of potential loopholes, where certain polluting activities continue without formal review and assessment, including the relative roles of industrial, transport and agricultural emissions. The group will review a wide range of potential future options that could support Natura 2000 protection from nitrogen deposition, including: the strengthening of existing legislation, the application of spatial and landuse-based policies, the role of positive and negative changes to ecosystem services, consideration of air quality objectives and local air quality management for the protection of Natura 2000 sites occurring in nitrogen source regions. The discussion will aim to short list a number of the most promising options.

## Communication and dissemination

Following presentation and discussion of the background papers, most of the workshop time will be spent within the Working Groups, including bi-lateral discussions where needed. The Working Groups will then summarize their main findings to report back for plenary discussion of the emerging messages. This discussion will serve to reach agreement on the key conclusions of the workshop.

Following the workshop, these key messages will be summarized in the form of briefings to inform the development of best practices across Europe and to provide input to the policy development process. Depending on the conclusions of the workshop, a notice may also be released for the press. The Background Documents, other papers presented, and the Working Group Reports will be published as a book by COST 729. All authors of posters and papers are invited to contribute to this volume, and further details will be provided.

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