

# Defra project AQ0834 - Identification of Potential “Remedies” for Air Pollution (nitrogen) Impacts on Designated Sites (R.A.P.I.D.S.)

## Appendix 1 - Definition of Scenarios

Ulli Dragosits, Mark Sutton (CEH Edinburgh)

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### Summary

- A wide range of nitrogen sources affecting designated habitats were summarised into a set of five key *scenarios*, for the development and illustration of a generic framework to target mitigation measures.
- The five scenarios were defined as follows:
  1. Lowland agriculture (many diffuse sources)
  2. Agricultural point source(s)
  3. Non-agricultural (point) source(s)
  4. Roads
  5. Remote (upland) sites affected by long-range N input
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### 1. Introduction

Five scenarios of contrasting source attribution were developed in consultation with the Steering Group (StG), to illustrate the key nitrogen (N) threats to Designated Sites across the UK. These scenarios can be envisaged as simulated typical case studies that allow the development of a generic/practical framework for identifying the main N threats for each Designated Site. The ultimate aim was to develop a toolkit and policy framework for UK-wide use, providing guidance using e.g. flow charts/decision trees, which leads users such as Site managers through the process of identifying suitable measures for Designated Sites as simply and intuitively as possible.

For the purposes of RAPIDS, measures were defined as primarily off-Site interventions, such as agricultural mitigation methods or planting of trees buffer zones rather than on-Site habitat management-type measures (e.g. burning, cutting, shrub removal, grazing management of sensitive habitats). The latter were agreed to be beyond the project boundaries, whereas measures directly aimed at reducing N emissions, atmospheric concentrations or deposition already investigated for application outside Designated Site boundaries *may* also be relevant on-Site, depending on the individual site and measure. For example, tree planting measures may be equally applicable inside and outside Site boundaries, hence the distinction for inclusion of measures under RAPIDS is made using types of measures rather than strictly geographical boundaries.

The scenarios need to be

- Representative for different situations of atmospheric N deposition and NH<sub>3</sub>/NO<sub>x</sub> concentrations across the UK (e.g. contribution of wet or dry N deposition, and near source/long range sources responsible for effects at Designated Sites)
- Representative for different sources of N pollution (e.g. livestock agriculture, arable farming, industry, transport)
- Representative for different types of Designated Sites (e.g. size, habitat types, neighbouring conditions/ surrounding area)
- Sensitive to the UK perspective with regard to the views of the Devolved Administrations (as appropriate)
- Sensitive to emerging points raised by the StG

It was suggested that different farm types (arable, cattle, pigs, poultry, etc) or other sources (e.g. roads, industry, waste processing) would be dealt with at a secondary level in a flow chart/decision tree approach, to further distinguish what local measures would be most suitable and most likely to make a difference. The potential measures could then be grouped for each scenario/case depending on local/regional farm types and other emission sources present.

## **2. Scenario categories**

The five core scenarios described below (individually and in combination(s)) were agreed with the Steering Group. They are intended to cover all possible N-related threats to Designated Sites, but do not include a separate category for sites not currently under threat from elevated atmospheric concentrations or deposition of N. The flow chart/ decision tree approach developed for assessing whether a site is under threat from N input or not combine detailed local on-the-ground information with national-scale UK-wide datasets (e.g., 5 km grid N deposition and Critical Loads/Level exceedance maps). This approach for identifying N sources for individual Designated Sites (source attribution) is described in more detail in the main RAPIDS report and in **Appendix 2** (Source Attribution data) and **Appendix 5** (Scenario Allocation Pilot).

### **2.1. Lowland agriculture (many diffuse sources)**

The Designated Site is embedded in a lowland agricultural landscape with a multitude of farming activities taking place in the immediate vicinity of the site and the wider area. Typical agricultural activities include livestock grazing spreading of manure and fertilizers, combined in a mix with animal houses (e.g. cattle sheds) with associated farmyard manure heaps and slurry tanks.

Ammonia emissions from these activities and the resulting medium to high atmospheric concentrations and near-source dry deposition of nitrogen cannot easily be linked to a single source or activity across the area or throughout the year, and could be characterised as of a diffuse nature, with a multitude of sources. (Example: Shropshire/Cheshire area).

Suitable measures would depend on farm and land use types present (e.g. arable, dairy), which are suggested to be used in the subsequent steps of a flow chart/decision tree approach.

## **2.2. Agricultural point source(s)**

The Designated Site is located near a single or small number of agricultural point sources. Such nitrogen 'hot spots' are mainly large intensive livestock farms, such as pig or poultry businesses. They have the potential for large ammonia emissions and associated high atmospheric concentrations and near-source dry deposition of nitrogen which can be linked to a single source or activity across the area or throughout the year. These point sources may be situated among other agricultural activities, in lowland or upland areas, with general background NH<sub>3</sub> concentrations and N deposition from other sources not constituting a major threat. The relative spatial location of the Designated Site and the point source(s) may be an important factor in determining potential impacts on the site, depending on prevailing wind directions. (Example: near major livestock installations in Norfolk)

Suitable measures would depend on farm and land use types present (e.g. pig, poultry), which are suggested to be used in the subsequent steps of a flow chart/decision tree approach.

## **2.3. Non-agricultural (point) source(s)**

The Designated Site is located in the vicinity of a single or a number of non-agricultural point sources, such as industrial plants, combustion/power generation or waste processing sites. Depending on the activities taking place, emissions of NH<sub>3</sub> or NO<sub>x</sub> may result in locally or regionally increased atmospheric concentrations or dry deposition of nitrogen. The relative spatial location of the Designated Site and the point source(s) may be an important factor in determining potential impacts on the site, depending on prevailing wind directions.

This category also includes 'diffuse' local non-agricultural sources (e.g. shipping channel nearby), however 'diffuse' depends on the scale/perspective taken. The main reason for including e.g. shipping with Scenario 3 (other non-agricultural (point) sources) rather than Scenario 4 (roads) is that local measures such as vegetation screens can be readily identified for the latter, whereas other point sources and shipping are a) more diverse source types and therefore b) often less suitable for establishing local air quality management schemes. Suitable measures depend on the type of source(s) present, which are suggested to be used in subsequent steps of a flow chart/decision tree approach.

## **2.4. Roads**

The Designated Site is located near a major road or even dissected by it, or otherwise in an area with large amounts of motorised traffic. The main N threat in this scenario, with local background

NH<sub>3</sub>/NO<sub>x</sub> concentrations and N deposition from other sources not constituting a major threat, would come from NO<sub>x</sub> emissions originating from large numbers motor vehicles, although NH<sub>3</sub> may also represent a significant threat as a result of emissions from catalytic converters on cars. Elevated NO<sub>x</sub> and NH<sub>3</sub> concentrations and dry deposition in the immediate vicinity of busy roads may impact adversely on the Designated Site. [Example New Forest]

Depending on the nature of the motorised traffic, different types of measures can be suggested at next level, distinguishing between arterial roads (e.g. motorways) vs. diffuse transport sources (e.g. suburban/urban areas) vs. local destination traffic (e.g. to Designated Site as tourist attractions). For example, measures such as tree planting may be appropriate to provide a screen between a Designated Site and a motorway to capture and disperse N emissions, other measures such as removing car parking and providing shuttle bus access may be more suitable for tourist destination Sites.

## **2.5. Remote (upland) sites affected by long-range N input**

The Designated Site is in a remote location, often in the uplands, away from nearby diffuse or point sources of nitrogen. For such sites, source attribution to any particular activity may be difficult to determine, and wet deposition is often the main source of N input, originating from medium to long range transport [Example Pennines or Lake District]. In this context, low-density, extensive grazing from hill sheep farming is unlikely to constitute a threat to the Designated Site in terms of atmospheric N emissions and deposition.

It may be possible to determine the main source sector(s) or geographical region(s) of the nitrogen, such as whether it likely to be of UK origin or from further afield (trans-boundary such as mainland Europe, main shipping lines). In contrast to the other scenarios, where local measures may address the consequences of specific sources, remote sites will typically require national scale or international scale interventions to achieve significant reductions in N impacts.

## **2.6. Mixed categories**

Sites with more than one type of N threat present need to be catered for in the development of the scenarios and the draft framework. For example, there are many sites with both diffuse and point agricultural sources in the immediate vicinity, or a mix of agricultural sources together with major roads. It is important that this is built into the decision tree/flow for identifying both the key threats and potential measures.