Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

Source Attribution and Critical Load Assessment of the Impacts on Designated Conservation Sites in the UK

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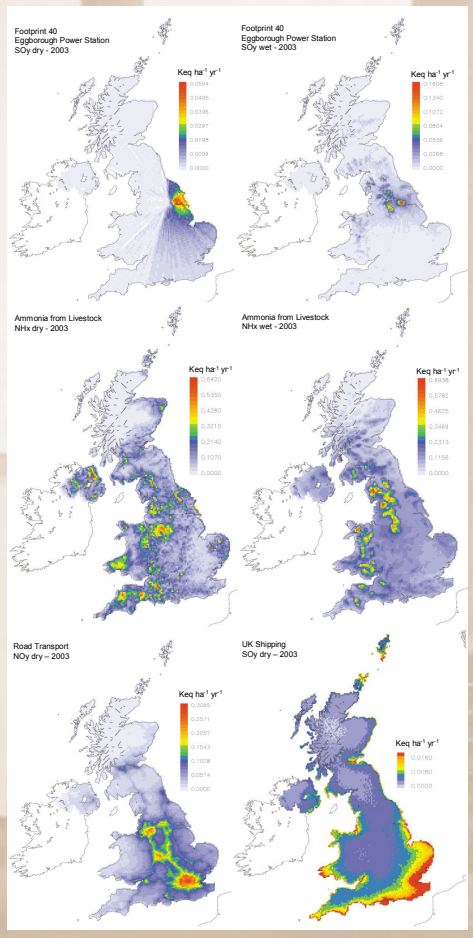
Overview

Industrial emissions of sulphur and nitrogen compounds are regulated in the United Kingdom to protect the environment. Regulation of industrial releases are based upon the issuing of permits which typically set limits to control the level of pollutants that can be released to air, land or water from a particular source. Under the Habitats Directive there is a duty for regulators to review existing permits and to take account of the impact of industrial processes on European sites of conservation, namely Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). Sites are designated on one or more priority features (e.g. a habitat type or bird species) considered to be most in need of conservation at the European level.

Assessment

Assessment of the potential impacts on SACs and SPAs involved the allocation of critical loads (an environmental limit) of acidity and nutrient nitrogen to designated features. Feature critical loads were then compared with the modelled deposition values for each SAC and SPA.

The long-range dispersion model FRAME (Fine Resolution Multi-pollutant Exchange) was used to estimate, the pollution footprint for each source, providing a mechanism for defining the percentage contributions of individual sources to each 5 km grid square in the UK. 120 individual point sources and 14 other source sectors for the years 2003 and 2010 were modelled for wet and dry components of Nitrogen Oxides (**NOy),** Sulphur Dioxide **(SOy)** and Ammonia **(NHx)**.



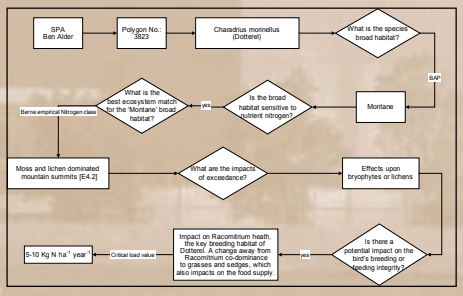
Footprint maps for industrial sectors

Assigning critical load values to features

Dotterel, *Charadrius morinellus*, summer migrant to Scotland.

There are few, if any, instances of direct effects on bird species from nitrogen and acid deposition. Assigning critical loads directly to bird features is an unsuitable method for assessing impacts. However, an examination of the relationship between a bird and that of its habitat provides a better causal link between potential bird decline and atmospheric pollutant deposition. An indication of potential impacts can be determined by considering whether the established impacts of critical load exceedance on a habitat are likely to affect the suitability for bird breeding, feeding or roosting.

The definition of site-relevant critical loads or, more strictly, feature-relevant critical loads, represents the allocation of the most relevant critical load for every designated feature at a particular European site. Under this project, critical loads for both acidity and nutrient nitrogen were assigned for each designated feature sensitive to acidification or eutrophication. Assigning critical loads to the Habitat Directive's Annex I habitat features is straightforward as a good match can be made between Annex I habitats and the critical load habitat classification.

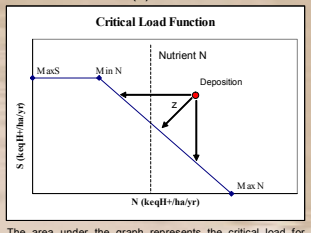


Decision support system for allocating critical load values to bird features.

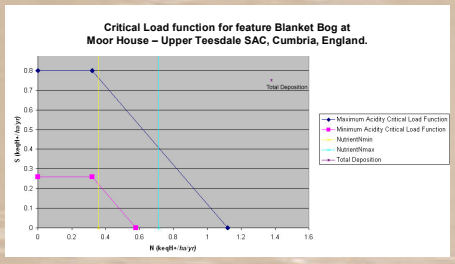
Critical Load Function

A representation of the critical load function graph (below left) shows an exceedance of the critical load for acidity and nutrient nitrogen, providing a very useful tool for assessing any potential remedial action required to meet or better the critical load (i.e. whether S or N deposition or both need to be reduced to avoid exceedance of the critical load). The area under the graph is below the critical load. The dashed line indicates the critical load for nutrient nitrogen with exceedances to the right of this line. In general, but not always, the most practicable method is to reduce both pollutants by the smallest amount, represented by the shortest distance (z).

Blanket bog in Cumbria.



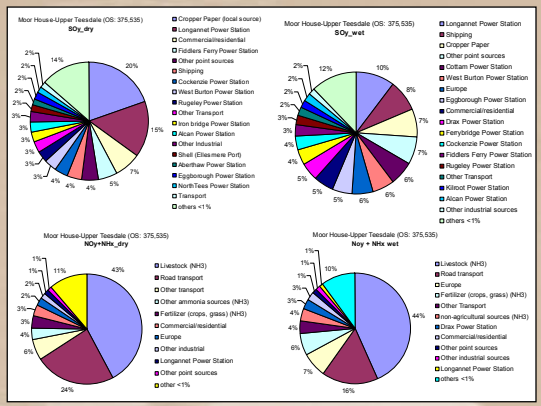
The area under the graph represents the critical load for acidity. The dashed line represents the critical load for nutrient nitrogen. By plotting the deposition for sulphur and nitrogen, an exceedance of both the critical load for acidity and nutrient nitrogen occurs. To 'move' to a status of no exceedance would involve a reduction in both sulphur and nitrogen.



Critical Load function for the designated feature Blanket Bog at SAC Moor House – Upper Teesdale in Cumbria, England. The total deposition exceeds both critical loads of acidity and nutrient nitrogen.

Source Attribution

By 'stacking' all the modelled footprints on top of each other, the contribution from each source can be defined. This can be used to inform regulators and conservations officers about the most significant sources affecting SACs and SPAs across the UK.



Source apportionment for sulphur and nitrogen (wet and dry deposition) at Moor House-Upper Teesdale SAC, Cumbria, England. Agricultural livestock make up the majority of the nitrogen inputs, while sulphur breaks down in to many smaller contributions from some of the UK's largest power stations.