

UK Biodiversity Indicators 2019

This document supports
B5a. Air pollution

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B5. Pressure from pollution

B5a. Air pollution

i. Area affected by acidity

ii. Area affected by nitrogen

Type: Pressure Indicator

Revised to correct a small error in the 2015 pollutant monitoring data.

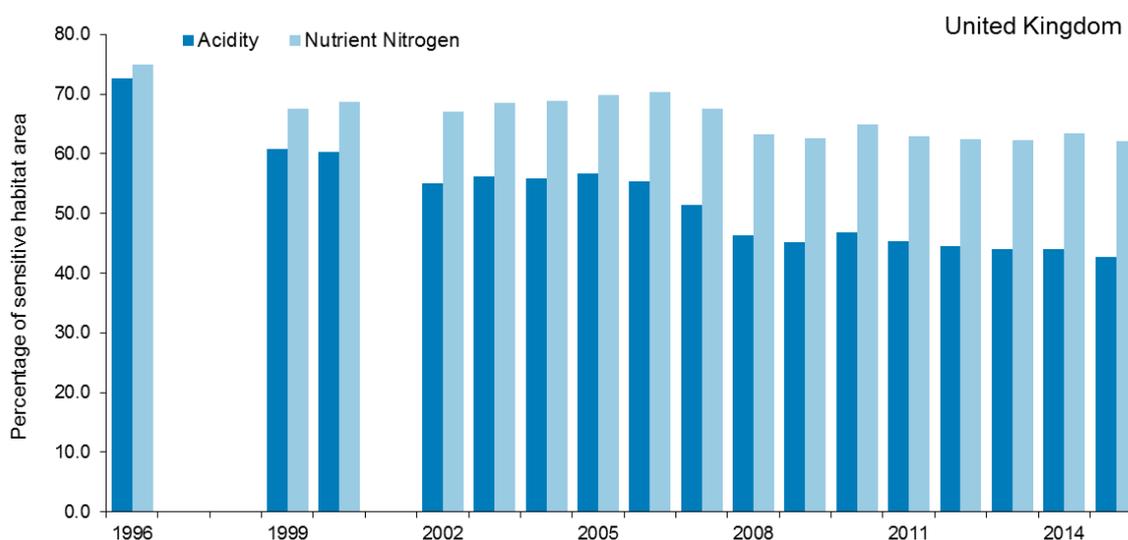
Summary

The area of sensitive UK habitats that exceeds the critical load for acidification has continued to decline since 1996¹, but there has been less change in the area that exceeds the critical load for eutrophication. Acid deposition exceeded critical load in 43% of sensitive habitats in 2015, and nitrogen deposition exceeded critical load in 62% of sensitive habitats in 2015.

Indicator Description

The air pollutants sulphur dioxide, nitrogen oxides and ammonia can contribute to acidification, and nitrogen oxides and ammonia can contribute to terrestrial eutrophication. These pollutants arise mainly from burning fossil fuels and from livestock waste. Around a third of UK land area is sensitive to acidification, and a third to eutrophication (with some areas sensitive to both). Critical loads are thresholds for pollutant load above which significant harmful effects may occur on sensitive habitats, so statistics on critical load exceedance indicate the risk of damage.

Figure B5ai. Area of sensitive UK habitats exceeding critical loads for acidification and eutrophication, 1996 to 2015¹



Notes:

1. Each column represents critical load exceedances based on a 3-year average of deposition data to reduce year-to-year variability.
2. Since 2002, nitric acid has been included in the estimates of nitrogen deposition, and since 2003 aerosol deposition loads of sulphate, nitrate and ammonium have also been

¹ For ease of reference, time periods are usually referred to using the middle year of the 3 years used to calculate the mean. This example "1996" refers to the time period 1995 to 1997. In figure B5ai "1996 to 2015" refers to the time period 1995-1997 to 2014-16.

included. This additional deposition led to some increases in critical load exceedance compared with earlier periods.

- There are a few inconsistencies between years due to changes in methods used to derive deposition estimates, and some minor alterations to the acidity critical loads. This information should be taken into account when interpreting the trends results.

Source: Centre for Ecology & Hydrology.

Assessment of change in area of sensitive habitat exceeding critical loads			
	Long term	Short term	Latest year
Area affected by acidity	 1996–2015	 2010-2015	Decreased (2015)
Area affected by nitrogen	 1996–2015	 2010-2015	Decreased (2015)

Note: Long and short-term assessments are based on a 3% rule of thumb. Where possible, the base years for these assessments use a 3-year average. See [Assessing Indicators](#).

Critical loads are thresholds for the deposition of pollutants causing acidification and/or eutrophication above which significant harmful effects on sensitive UK habitats may occur. Approximately 78,000km² of UK terrestrial habitats is sensitive to acid deposition. About 73,000km² is sensitive to eutrophication; much of this is sensitive to both.

In 1996, acid deposition exceeded critical loads in 73% of the area of sensitive habitats. This declined to 43% in 2015. There has been a slight decrease in the area affected over the short term, since 2010, when the figure was 47%.

In 2015, nitrogen deposition exceeded critical loads in 62% of sensitive habitats. This was a decrease from a level of 75% in 1996. However there was little change in the short term.

Based on these figures the habitat areas at risk from acid and nitrogen deposition has declined over the long term (1996 to 2015), however, reducing deposition below the critical loads does not necessarily mean that ecosystems have recovered, as there can be a time-lag before the chemical environment and the flora and fauna recover.

Relevance

The air pollutants sulphur dioxide, nitrogen oxides and ammonia can contribute to acidification, and nitrogen oxides and ammonia can contribute to terrestrial eutrophication, which both adversely affect semi-natural ecosystems. Exceeding the critical load for acid deposition is likely to cause low pH and high aluminium availability, making the habitat unsuitable for many species. Excess nitrogen as a nutrient can also affect species composition, for example by triggering accelerated growth of some species at the expense of others.

Background

A 3-year average of deposition is used to calculate the exceedance of critical loads to give the figures for each year represented. The assessment is based on a direct comparison between the earliest and latest data points, using a 3% [rule of thumb](#) to determine if a change is significant or not.

Critical loads are thresholds above which significant harmful effects on sensitive UK habitats may occur, according to current levels of scientific understanding. Critical loads have been

established separately for nutrient nitrogen (eutrophication effects) and for acidification. The pollutants causing acidification and eutrophication mainly arise as a result of emissions from burning fossil fuels in industry and road transport, and from livestock waste.

There are 3 main steps in the assessment of the area of sensitive habitat that exceeds critical loads:

- calculation of critical loads for each of the sensitive habitats;
- mapping of the habitats; and
- identification of the area of habitat where deposition exceeds the critical load.

Critical loads for acidity and nutrient nitrogen are calculated for 14 broad habitats (Table B5ai) considered sensitive to acidification and/or eutrophication. Different methods have been used to calculate critical loads, based either on empirical (observational or experimental) evidence or on mass-balance (input/output) data. To identify the area exceeding critical loads, deposition maps based on a 5km x 5km grid covering the UK are produced based on the sum of wet deposition, dry deposition and cloud deposition. These deposition data are overlain on maps of critical loads for each habitat to calculate critical load exceedances and the areas of habitat exceeded. Critical loads data for freshwaters are available for 1,752 sites selected across the UK where water samples have been collected and analysed – these data do not provide complete UK coverage. The critical loads data for all the other habitats listed are based on national-scale habitat distribution maps.

Table B5ai. The 14 habitats considered sensitive to acidification and/or eutrophication for which critical loads are calculated

Habitat
Acid grassland
Calcareous grassland
Dwarf shrub heath
Bog
Montane
Coniferous woodland (managed)
Broadleaved woodland (managed)
Beech woodland (unmanaged)
Oak woodland on acid soil (unmanaged)
Scots pine (unmanaged)
Other unmanaged woodland
Dune grassland (eutrophication only)
Saltmarsh (eutrophication only)
Freshwaters (acidification only)

In general the area of sensitive habitat where critical loads are exceeded for both acidity and eutrophication is lower in Scotland than elsewhere in the UK (Table B5aii); this is because levels of deposition are generally lower in Scotland. Further information on how critical loads are calculated and detailed critical load exceedance maps are available on the [Critical Loads and Dynamic Modelling](#) website.

The trends in critical loads exceedances use deposition maps based on the CBED (Concentration Based Estimated Deposition) methodology. Since 2002 (2001-3), the inclusion of nitric acid deposition in the assessment has increased the area of estimated critical load exceedance compared to earlier periods. The deposition values from 2003 (2002-4) additionally include aerosol deposition of ammonium (NH₄₊), nitrates (NO₃₋), and sulphates (SO₄). In all years, the 3-year average deposition is used to smooth substantial year-to-year variability. The deposition data sets for 2004 to 2013 were updated in 2015 following research by NERC CEH and Defra and the report can be viewed on the [NERC website](#). The research assessed the current DELTA sampler configuration's specificity for HNO₃ measurement and showed additional sampling of other atmospheric oxidised nitrogen species (HONO, N₂O₅, ClNO₂). From the research a correction factor has been obtained and applied to the HNO₃ concentrations used in the CBED mapping. The trends in critical loads exceedances for the period 2004-06 to 2011-2013 have therefore also been updated.

Table B5aii. Percentage area of sensitive UK habitats exceeding critical loads for acidification and eutrophication for 2015 (2014 to 2016)

	Acidification (%)	Eutrophication (%)
UK	42.7	62.1
England	60.0	95.7
Wales	72.4	88.5
Scotland	29.6	40.8
Northern Ireland	64.3	85.1

As new research data become available critical loads are reviewed and updated periodically. New and revised critical loads for nutrient nitrogen were established in 2010/11. The results for all years for exceedance of nutrient nitrogen critical loads were updated in 2011 using the new/revised critical loads. Details of the revision can be found in the 2011 UK Status Report and the 2015 Methods Report, available on the [Critical Loads and Dynamic Modelling](#) website. The results for exceedance of acidity critical loads remain unchanged from those published earlier.

Critical loads for acidification and nutrient nitrogen have been applied to interest features of protected sites (Special Areas of Conservation, Special Protection Areas and Areas/Sites of Special Scientific Interest). Further information on critical load exceedance on protected sites is available on the [Air Pollution Information System \(APIS\)](#) website.

Goals and targets

Aichi Targets for which this is a primary indicator

Strategic Goal B. Reduce the direct pressures on biodiversity and promote sustainable use.



Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Aichi Targets for which this is a relevant indicator

Strategic Goal B. Reduce the direct pressures on biodiversity and promote sustainable use.



Target 10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Web links for further information

Reference	Title	Website
Centre for Ecology & Hydrology	Critical Loads and Dynamic Modelling	http://www.cldm.ceh.ac.uk/
UK conservation bodies/environment agencies/CEH	Air Pollution Information System	http://www.apis.ac.uk/
United Nations	Convention on Long Range Transboundary Air Pollution	http://www.unece.org/env/lrtap/welcome.html
Netherlands Environment Assessment Agency	Critical Loads Coordination Centre for Effects (CCE)	http://wge-cce.org/
Natural Environment Research Council (NERC)	2015 Development of a new model DELTA sampler and assessment of potential sampling artefacts in the UKEAP AGANet DELTA system: summary and technical report	https://nora.nerc.ac.uk/id/eprint/512599/
European Environment Agency	Annual air quality report	https://www.eea.europa.eu/publications/air-quality-in-europe-2018

Full details of this indicator, including a datasheet and technical documentation are available at: jncc.gov.uk/ukbi-B5a

Last updated: revised September 2019

Latest data available: 2015 (2014 – 2016)