19. Trends in pressures on biodiversity: pollution

Type: Pressure indicator

19a. Air pollution

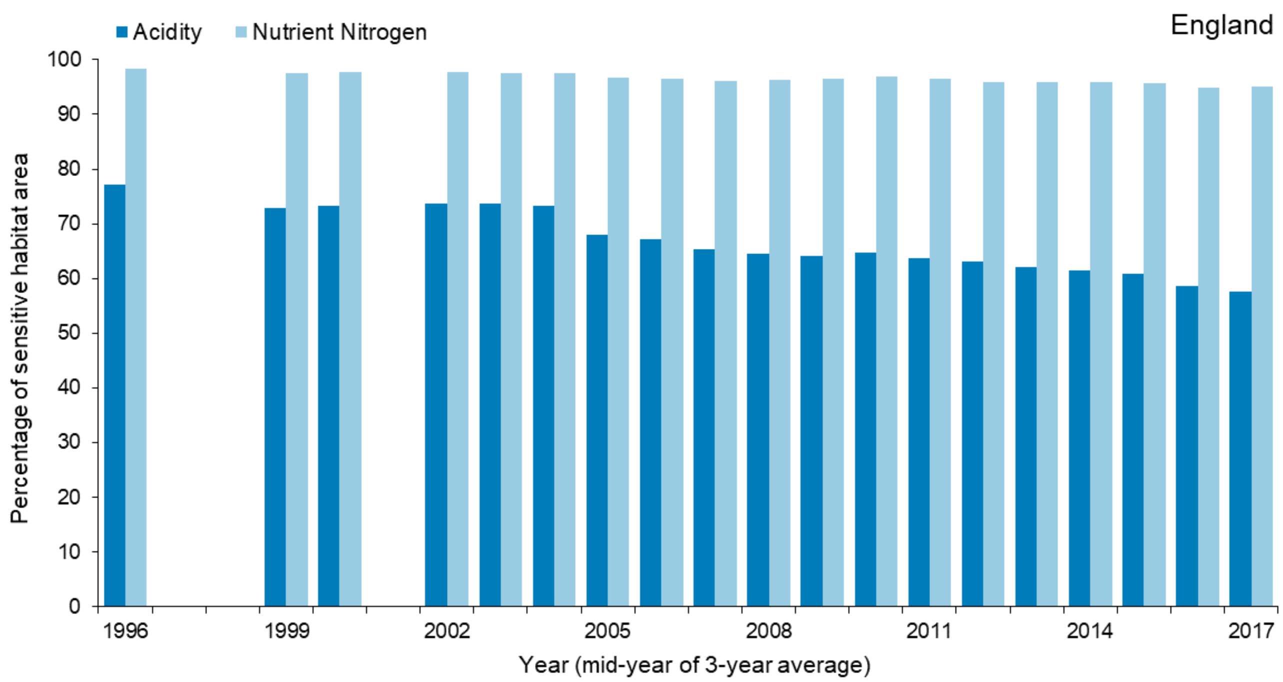
Indicator Description

The first part of this indicator shows changes in pressures on biodiversity from air pollution in England. Critical loads are air pollution thresholds above which significant harmful effects may occur on sensitive habitats. The pollutants arise mainly from burning fossil fuels in industry and road transport, and from emissions from livestock waste. Approximately 18,000km^2 of terrestrial habitat areas are sensitive to acidification and about 20,000km^2 are sensitive to nutrient nitrogen deposition (eutrophication); many areas are sensitive to both.

This indicator has been updated with 2017 data. The percentage of sensitive habitat areas in England exceeding critical load for acidification fell from 77% in 1996 to 58% in 2017 (Figure 19.1)[1] (**Footnote:** For ease of reference, time periods are usually referred to using the middle year of the 3 years used to calculate the mean. For example, "1996" refers to the period 1995 to 1997. In figure 19.1, "1996 to 2017" refers to the period 1995–97 to 2016–18).

Over the same period, the percentage area of sensitive terrestrial habitats in England where nutrient nitrogen deposition (eutrophication) exceeded critical load also fell (98% in 1996 and 95% in 2017).

Figure 19.1: Percentage area of sensitive terrestrial habitats in England where critical loads for acidity and nutrient nitrogen were exceeded, 1996 to 2017[1]



[1] For ease of reference, time periods are usually referred to using the middle year of the 3 years used to calculate the mean. For example, "1996" refers to the period 1995 to 1997. In figure 19.1, "1996 to 2017" refers to the period 1995–97 to 2016–18.

Notes:

1. Each bar represents 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 included. This additional deposition led to some increases in critical load exceedance compared with earlier periods.
3. 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.
4. The method for calculating acid-sensitive habitat area has changed since the last edition of this publication. The area of acid-sensitive habitats now excludes catchments above acid-sensitive freshwater locations, which had led to overlaps. Numbers for all preceding years have been recalculated, so results and trends presented here are internally consistent but may differ from those in previous reports.

Source: UK Centre for Ecology & Hydrology.

In 1996, acid deposition exceeded critical loads in 77% of the area of sensitive terrestrial habitats in England. This declined to 58% in 2017. The short-term trend between 2012 and 2017 (using a 3-year average for years 2011 to 2013 and comparing with 2017), showed a 9% decrease in the area affected by acidity. In 2017, nitrogen deposition exceeded critical loads in 95% of sensitive habitats. This was a decrease from a level of 98% in 1996. In the short term, nitrogen deposition decreased by 1% (using a 3-year average for years 2011 to 2013 and comparing with 2017).

Indicator assessment

Assessment of change in area exceeding air pollution critical loads

Area affected by acidity: Long term (1996 to 2017): Improving; Short term (2012 to 2017): Improving; Latest year (2017): Decreased

Area affected by nutrient nitrogen: Long term (1996 to 2017): No change; Short term (2012 to 2017): No change; Latest year (2017): No change

Note: Long and short-term assessments are based on a 3% rule of thumb. The base years for these assessments use a 3-year average. See Assessing Indicators.

19b. Marine pollution

Indicator Description

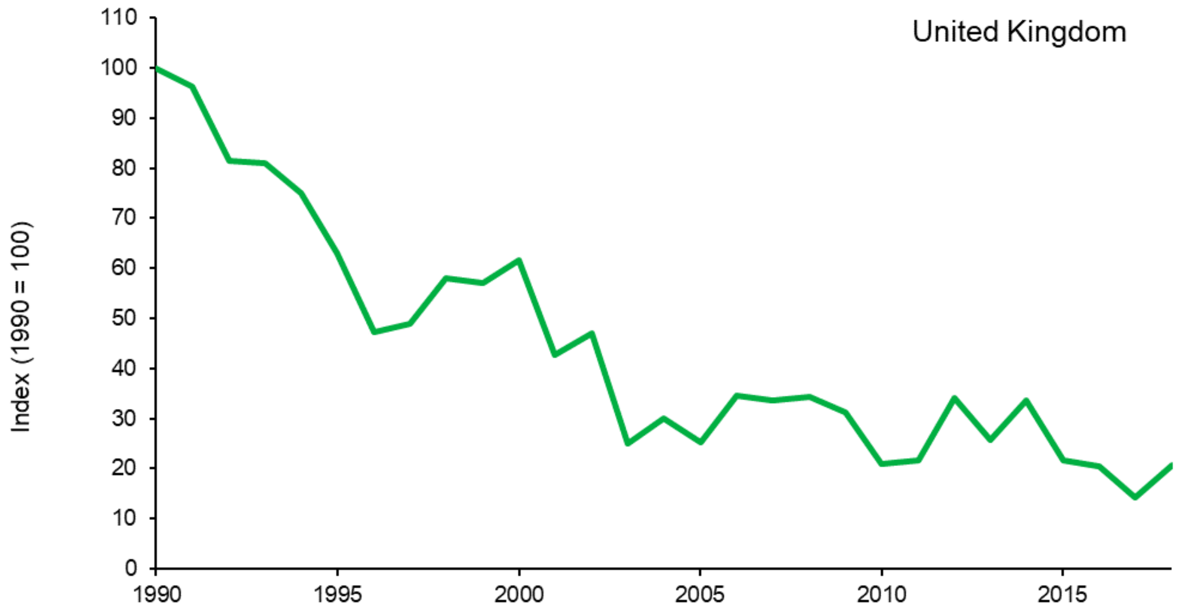
The second part of this indicator shows changes in pressures on marine biodiversity from waterborne pollution in the UK (separate England figures are not currently available). It provides the combined input of 6 of the most hazardous substances to the UK marine environment: 5 heavy metals (cadmium, mercury, copper, lead and zinc); and one organic compound (lindane). Pollution in the marine environment from these 6 substances should decrease to levels that are non-detrimental by 2020.

The combined inputs of all 6 of the hazardous materials included within this indicator have shown a long-term decrease of 79% since 1990 (Figure 19.2). In the short term (since 2013), inputs of 5 out of 6 of these substances show decreases; one heavy metal (zinc) has increased.

Levels of all 6 substances declined over the period 1990 to 2018. The heavy metals, mercury, cadmium, lead, copper and zinc decreased by 92%, 89%, 67%, 60% and 53%, respectively. The organic compound lindane decreased by 84% (Figure 19.3).

In the short term, the combined inputs of all 6 hazardous substances decreased by 33% from 2013 to 2018 (using a 3-year average for 2012). Inputs for 5 out of the 6 of the hazardous substances declined in the short term: lead had the highest percentage decrease (-49%), cadmium and mercury both decreased by 43%, lindane by 42%, and copper by 19%. By contrast, Zinc increased by 7%.

Figure 19.2: Combined input of hazardous substances to the UK marine environment, as an index of estimated weight of substances per year, 1990 to 2018



Source: Defra Marine Strategy and Evidence Division, using data provided by: Environment Agency, Northern Ireland Environment Agency, Scottish Environment Protection Agency.

Indicator assessment

Assessment of change in the combined input of hazardous substances to the UK marine environment

Long term (1990 to 2018): Improving; Short term (1913 to 2018): Improving; Latest year (2018): Increased

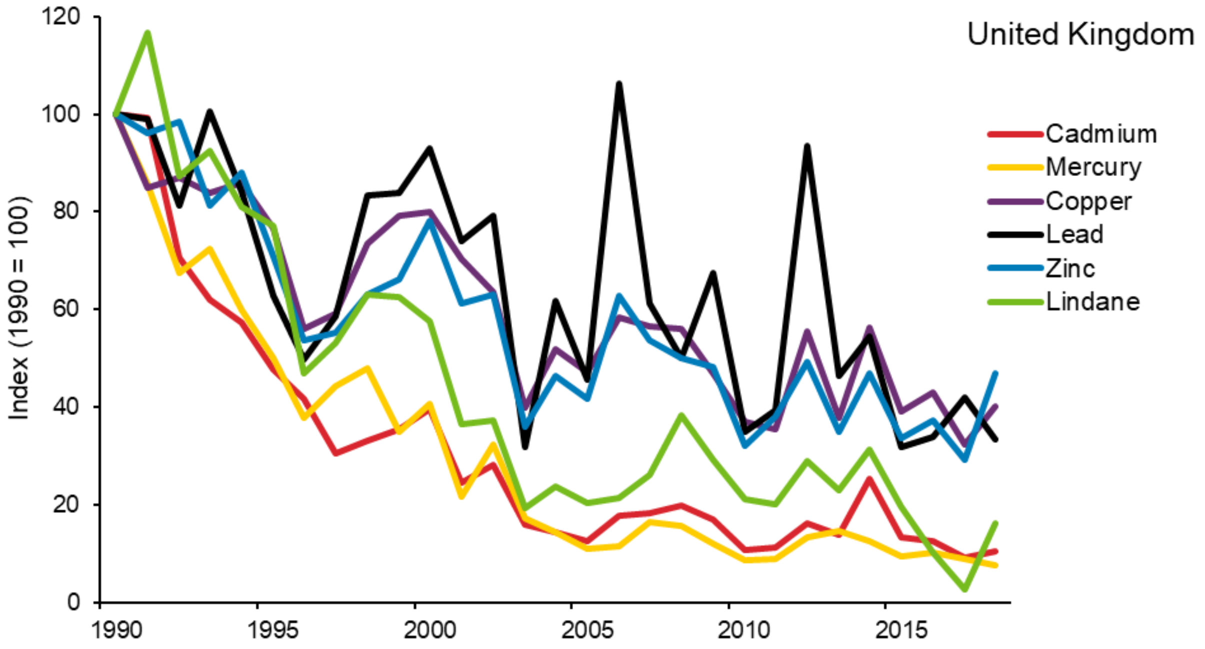
Note: Long and short-term assessments are based on a 3% rule of thumb. The base years for these assessments use a 3-year average. See Assessing Indicators.

Indicator description

Inputs into the marine environment are estimated from concentrations and flow rates in rivers entering the sea and those from estuarine and coastal point sources. Riverine inputs reflect both point and diffuse sources upstream of the sampling point and tend to be strongly influenced by flow rates. Flow rates are heavily affected by rainfall patterns so year to year fluctuations in pollutant loads are likely.

A detailed illustration of changing levels of each input is seen in Figure 19.3. The low point in 2003 is thought to be a consequence of reduced river flows during an exceptionally dry year. Conversely, levels increased in 2012 and again in 2014 corresponding with years of heavy rainfall. In 2012, England had the wettest year since records began in 1910; the summer was the wettest since 1912. Increased rainfall in November and December contributed to extensive flooding. In 2014, the winter period (January to February) was the wettest since records began.

Figure 19.3: Inputs of hazardous substances to the UK marine environment, as an index of weight of substance per year, 1990 to 2018



Source: Defra Marine Strategy and Evidence Division, using data provided by: Environment Agency, Scottish Environment Protection Agency, and Northern Ireland Environment Agency.

Relevance

The indicator shows progress with commitments to reduce pressure from a range of sources as set out in Biodiversity 2020: A strategy for England's wildlife and ecosystem services *Biodiversity 2020: A strategy for England's wildlife and ecosystem services* (see Annex A). The indicator is also relevant to international goals and targets (see Annex B of the aforementioned publication).

Background

Air pollution impacts on sensitive habitats

Critical loads have been established separately for nutrient nitrogen (eutrophication effects) and for acidification. The pollutants causing eutrophication and acidification mainly arise as a result of emissions from burning fossil fuels, and from livestock waste. Land which is currently used for intensive agriculture or for urban purposes such as housing is not assessed for sensitivity. Of the land area of England, around 13% contains habitats which are assessed as sensitive to acid deposition, and 15% contains habitats assessed as sensitive to eutrophication; much of this area is sensitive to both impacts. The 3 main steps in the assessment of the area of sensitive habitat exceeding critical loads are: the calculation of critical loads for each of the sensitive habitats; the mapping of the habitats; and the 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 19.1) considered sensitive to acidification and/or eutrophication. A range of methods are used to calculate critical loads, based on either empirical (observational or experimental data) or mass balance (input/output) data. Critical loads of nutrient nitrogen were updated in 2011; further information on how critical loads are calculated can be found on the Critical Loads and Dynamic Modelling website.

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, dry 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 load exceedance maps are available on the Critical Loads and Dynamic Modelling website.

Since 2002 (2001–2003), the inclusion of nitric acid deposition in the assessment has increased the area of estimated critical load exceedance compared with earlier periods. The deposition values from 2003 (2002–2004) additionally include aerosol deposition of ammonium (NH_4), nitrates (NO_3) and sulphates (SO_4). In all years, the 3-year average deposition is used to smooth substantial year-to-year variability.

Table 19.1: The 14 habitats considered sensitive to acidification and /or eutrophication for which critical loads are calculated

Acid grassland; Calcareous grassland; Dwarf shrub heath; Bog; Montane;
Coniferous woodland (managed; Broadleaved woodland (managed);
Beech (Fagus) woodland (unmanaged); Acidophilous oak woodland (unmanaged);
Scots Pine woodland (unmanaged); Other unmanaged woodland;
Dune grassland (eutrophication only); Saltmarsh (eutrophication only);
Freshwaters (425 sites only) (acidification only)

Hazardous substances in the marine environment

The data presented relate to the UK as a whole; separate data are not readily available for England. Although data for total UK (direct plus riverine) inputs to the marine environment are available as lower and upper estimates, for ease of interpretation only upper (i.e. maximum) values have been used in this assessment, rather than presentation of the data range for each substance.

Web links for further information

Defra: Trends Report 2020: Trends in critical load and critical level exceedances in the UK Report (PDF, 4.08 MB)
Defra: Clean Seas: hazardous substances
Defra: EU Marine Strategy Framework Directive
Defra: Technical Background Document
OSPAR: Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR)

UK Centre for Ecology & Hydrology: Data on critical loads modelling and mapping

United Nations Economic Commission for Europe: Convention on Long-range Transboundary Air Pollution

Last updated: October 2020

Latest data available:

19a. Critical load exceedance – 2017 (average of 2016 to 2018);

19b. Marine pollution – 2018