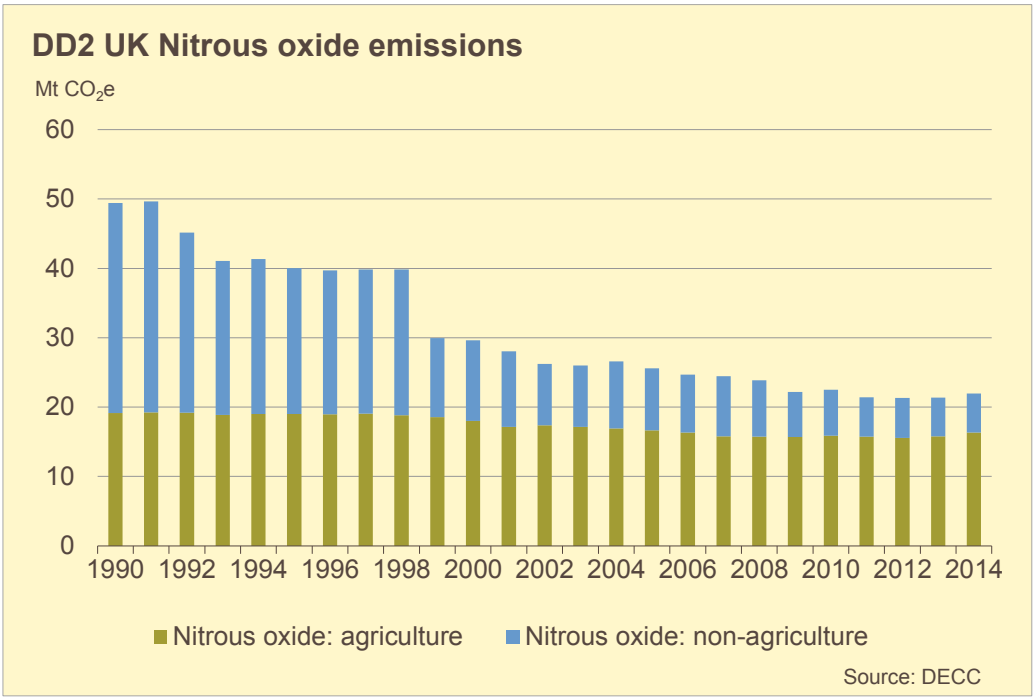
Observatory monitoring framework – indicator data sheet

Environmental impact: Climate change

Indicator DD2: Nitrous oxide emissions

This indicator shows agriculture's contribution to total UK nitrous oxide (N_2O) emissions.

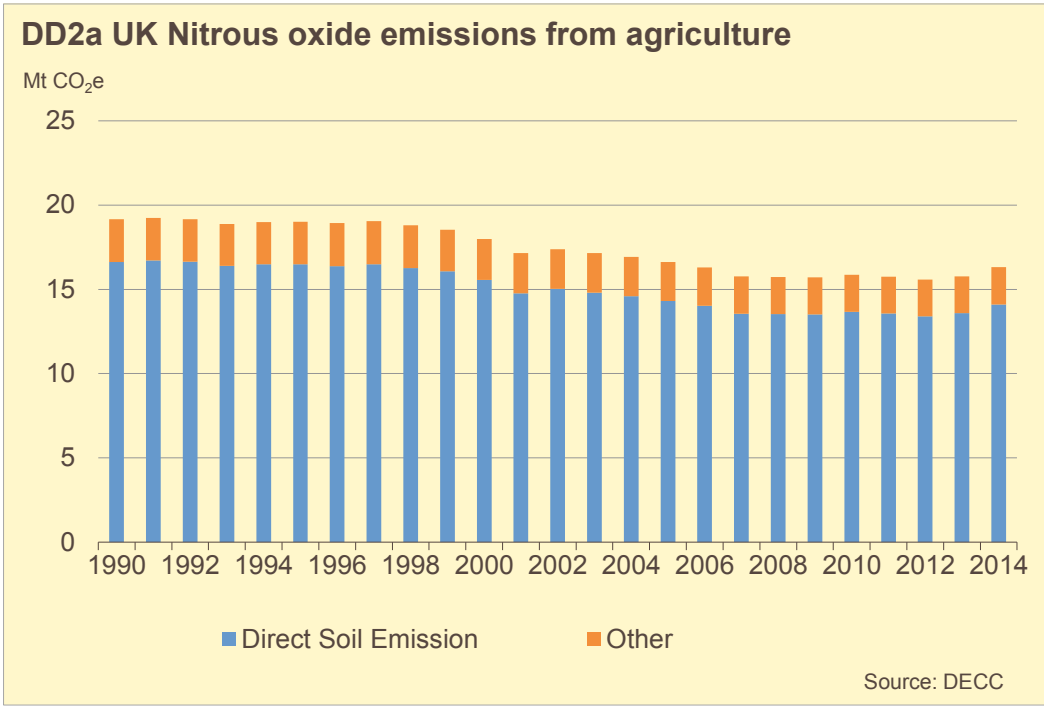


In 2014:

- N_2O emissions have fallen by 56% since 1990;
- agriculture is the main source of N_2O emissions, accounting for 74% of emissions;
- industrial process emissions of N_2O have continued to decline primarily due to decreases in emissions from the production of nitric acid as a result of the fitting of catalytic N_2O abatement systems to nitric acid plants.

In 2014:

- N_2O emissions from agriculture were 18% below 1990 levels;
- N_2O emissions were 3% above 2013 levels;
- Around 86% of agricultural N_2O emissions come from soils, particularly as a result of nitrogen fertiliser application, manure (both applied and excreted on pasture) and leaching / run off



This indicator was updated in March 2016. It will next be updated in February 2017.

Further information and contact

Background information can be found in the accompanying fact sheet.

For further queries or information on this indicator contact Defra's Observatory team on +44 (0) 1904 455058 or email Observatory@defra.gsi.gov.uk

Observatory monitoring framework – indicator fact sheet

Environmental impact: Climate change

Indicator DD2: Nitrous oxide emissions

Indicator	Nitrous oxide emissions from agriculture.
Data	Emissions of nitrous oxide from agriculture.
Geographic coverage	UK
Years	1990 - 2014
Source	Department of Energy and Climate Change (DECC)
Origin of data	UK greenhouse gas inventory, Ricardo Energy & Environment
Updates	This data will be updated annually. The next update is due in February 2017.
Background	Nitrous oxide (N_2O) is a greenhouse gas which contributes to global warming and climate change. N_2O emissions accounted for about 4% of the UK's greenhouse gas emissions in 2014. Agriculture is the largest source of N_2O emissions in the UK; around 79% of N_2O emissions are produced by agriculture. Approximately 86% of this is from soils, particularly as a result of nitrogen fertiliser application, manure (both applied and excreted on pasture) and leaching / run off. Nitrous oxide is one of the basket of six greenhouse gases for which emission reduction targets were agreed internationally under the Kyoto Protocol. For the first commitment period (2008-2012) the UK target was to reduce total greenhouse gas emissions by 12.5 percent below base year (1990). This target was met. Under the second commitment period (2013-20) the EU has a collective target to reduce its emissions by 20 percent relative to base year levels over the period. The exact details of the UK's target for the period are still being finalised. The Climate Change Act 2008 sets a legally binding commitment of at least an 80% cut in Greenhouse Gas (GHG) emissions by 2050 measured against a 1990 baseline. To support progress towards achieving this ambition, a carbon budgeting system which caps GHG emissions over five year periods, has been established with the first three carbon budgets running from 2008 – 2012, 2013 – 2017 and 2018 – 2022. Carbon budgets cap GHG emissions from the overall 'carbon' economy but do not set targets for sectors as action to reduce GHG emissions is focused on areas where cost effective savings may be achieved. The level of savings between sectors of the carbon economy will therefore vary to reflect the unique challenges and circumstances each face. In England, the approach for reducing GHG emissions from agriculture includes a range of actions led by industry and government. The Greenhouse Gas Action Plan (GHGAP) is an industry led voluntary initiative being taken forward by an Industry Partnership consisting of 14 organisations. It outlines how GHG emission reductions could be delivered between now and the third carbon budget (2018 – 2022) through wider uptake of more resource efficient practices. Its ambition is to: • Reduce annual GHG emissions from English agricultural production by 3 MtCO2e by the third carbon budget period (2018 – 2022), compared to a 2007

baseline.

Statistical & methodological information

The UK Greenhouse Gas Inventory is compiled for the UK governments by Ricardo Energy & Environment. The inventory is reviewed every year, and the whole historical data series is revised where necessary to incorporate methodological improvements and new data.

Changes as a result of updated reporting guidelines from the Intergovernmental Panel on Climate Change (IPCC)
The UK's greenhouse gas inventory is required to comply with reporting guidelines published by the IPCC. These guidelines were been revised for 2015.

Agriculture – methodological changes
Results from a Defra project identified new country-specific emissions factors for direct nitrous oxide emissions from urine and dung deposited by grazing animals. This decreased emissions by around 4 MtCO2e in 1990 and by around 3 MtCO2e in 2013.

There have been several changes to estimates of emissions from grassland. The emission factor used for grassland drainage on drained organic soils was corrected. This decreases emissions across the whole time series; previously the Intergovernmental Panel on Climate Change (IPCC) 2006 emission factor for cultivated organic soils was used. A new variable for grassland has been reported for the first time in the 2016 Inventory. This increases emissions estimates in 1990 and 2013 due to the change between shrubby and non-shrubby grasslands. The methodology and emissions factors for calculating emissions from controlled burning following deforestation were also updated to follow the IPCC 2006 guidelines. The 2014 British Geological Society (BGS) Directory of Mines and Quarries included peat sites in Northern Ireland for the first time which has allowed peat extraction areas in Northern Ireland to be assessed using Google Earth as for other administrations rather than relying on literature estimates. More minor updates include the correction of the land use change soils model and changes to carbon stock change estimates. Overall these changes to emissions from grassland have decreased emissions by around 3 MtCO2e in both 1990 and 2013.

New country-specific emissions factors for indirect emissions from atmospheric deposition have been derived directly from the UK agriculture ammonia emissions inventory. This change harmonises the modelling in the UK nitrous oxide and ammonia emission inventories which was identified as an improvement in a previous independent review. These changes have decreased emissions by around 1 MtCO2e in both 1990 and 2013.

Following a Defra project, new country-specific emissions factors for indirect emissions from leaching and run-off have replaced default values. The changes to these emissions factors have decreased emissions by around 1 MtCO2e in both 1990 and 2013.

Other earlier research from Defra has produced updated estimates of the average weights of dairy cattle and beef cattle. In addition new information on the manure management practices of UK farms has been included and the total area of organic soils in the UK has been updated. These changes are estimated to increase emissions by around 3 $MtCO_2e$ in both 1990 and 2012 (though overall emissions from the agriculture sector have decreased).

Estimates of N_2O emissions are calculated for livestock wastes and agricultural soils. For agricultural soils, contributions are estimated separately from:

(i) The use of inorganic fertilizer

(ii) Biological fixation of nitrogen by crops
(iii) Ploughing in crop residues
(iv) Cultivation of histosols (organic soils)
(v) Spreading animal wastes on land
(vi) Manures dropped by animals grazing in the field

In addition to these, the following indirect emission sources are estimated:

(vii) Emission of N_2O from atmospheric deposition of agricultural NO_x and NH_3.
(viii) Emission of N_2O from leaching of agricultural nitrate and runoff.

The analysis of the uncertainties in N_2O emissions is particularly difficult because emissions sources are diverse, and few data are available to form an assessment of the uncertainties in each source. However, an analysis of uncertainty in emission estimates for the 2003 NAEI suggested that the level of uncertainty for N_2O emissions was between -76% and +267% of the total emissions. Although for any given year considerable uncertainties can surround the emission estimates for a given pollutant, trends over time are likely to be more reliable. UK national emission estimates are updated annually and any developments in methodology are applied retrospectively to earlier years. Adjustments in the methodology are made to accommodate new technical information and to improve international comparability.

Further information

Data and information on greenhouse gas emissions can be found at:
https://www.gov.uk/government/collections/uk-greenhouse-gas-emissions

Further information about the Kyoto protocol can be found at:
http://unfccc.int/files/national_reports/initial_reports_under_the_kyoto_protocol/application/pdf/report_final.pdf

Further information on the 2008 Climate Change Act can be at:
https://www.gov.uk/government/policies/reducing-the-uk-s-greenhouse-gas-emissions-by-80-by-2050

The 2012 review of progress in reducing greenhouse gas emissions from agriculture can be found at:
https://www.gov.uk/government/publications/2012-review-of-progress-in-reducing-greenhouse-gas-emissions-from-english-agriculture

The National Atmospheric Emissions Inventory web site can be found at:
http://www.naei.org.uk/

The Agricultural statistics and climate change publication can be found at:
https://www.gov.uk/government/publications/agricultural-statistics-and-climate-change