Agriculture - greenhouse gas emission statistics

Statistics Explained

Data from July 2015. Most recent data: Further Eurostat information, Main tables and Database . Planned article update: March 2018 .

This article is part of a set of statistical articles based on the Eurostat online publication "Agriculture, forestry and fishery statistics" . It focuses on greenhouse gas emissions from agriculture and aims to give an overview of selected statistics and indicators in the European Union (EU) .

	Total greenhouse gas emissions (1)	Emissions from agriculture (2)		
		Methane (CH_4) emissions	Nitrous oxide (N_2O) emissions	CH_4 and N_2O emissions
EU-28	4 548.4	198.8	271.9	470.6
Belgium	116.5	5.0	4.3	9.3
Bulgaria	61.3	1.9	4.6	6.5
Czech Republic	131.5	2.5	5.6	8.1
Denmark	51.6	4.2	5.4	9.6
Germany	939.1	25.8	43.7	69.5
Estonia	19.2	0.5	0.9	1.3
Ireland	58.5	11.0	6.9	18.0
Greece	111.0	3.7	5.4	9.1
Spain	340.8	17.9	19.8	37.7
France	490.3	38.4	50.8	89.3
Croatia	26.4	1.0	2.4	3.4
Italy	461.2	15.3	20.1	35.4
Cyprus	9.3	0.3	0.5	0.8
Latvia	11.0	0.8	1.6	2.4
Lithuania	21.6	1.7	3.4	5.1
Luxembourg	11.8	0.3	0.3	0.7
Hungary	62.0	2.8	5.9	8.7
Malta	3.1	0.1	0.0	0.1
Netherlands	191.7	9.2	6.7	15.9
Austria	80.1	3.5	4.0	7.5
Poland	399.3	11.5	25.2	36.7
Portugal	68.9	4.0	3.3	7.2
Romania	118.8	8.7	9.5	18.2
Slovenia	18.9	1.0	0.8	1.9
Slovakia	43.1	1.0	2.2	3.3
Finland	61.0	1.8	3.9	5.7
Sweden	57.6	2.9	4.8	7.6
United Kingdom	582.9	22.1	29.7	51.8
Iceland	4.5	0.3	0.4	0.7
Liechtenstein	0.2	0.0	0.0	0.0
Norway	52.8	2.2	2.3	4.5
Switzerland	51.5	3.1	2.4	5.5
Turkey	439.9	21.4	10.9	32.3

(1) Excluding land use, land use change and Forestry (LULUCF) net removals.
(2) Emissions from agricultural transport and energy use are excluded, as these sectors are not defined as part of the agriculture sector by the current IPCC reporting guidelines.

Table 1: Greenhouse gas emissions, 2012(million tonnes of CO2 equivalent)Source: European Environment Agency and Eurostat (aeiprghg)

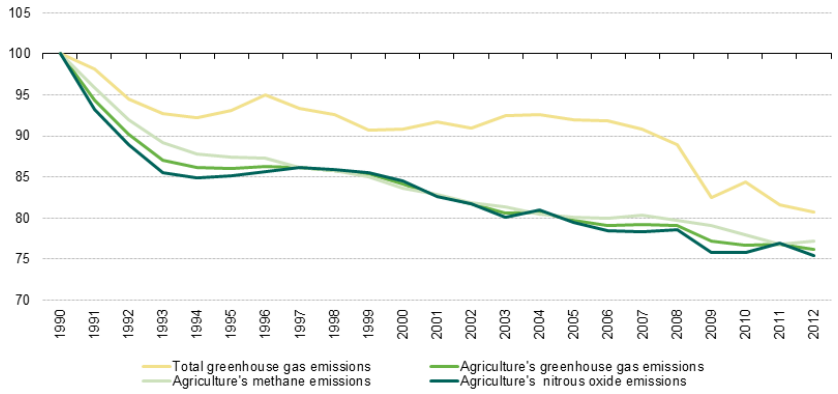


Figure 1: Greenhouse gas emissions, EU-28, 1990–2012(1990 = 100)Source: European Environment Agency and Eurostat (aeiprghg)

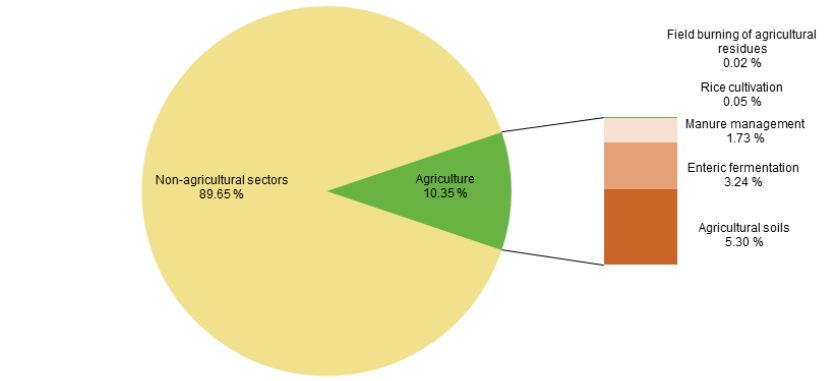


Figure 2: Greenhouse gas emissions, EU-28, 2012 (1)(% of total greenhouse gas emissions)Source: European Environment Agency and Eurostat (aeiprghg)

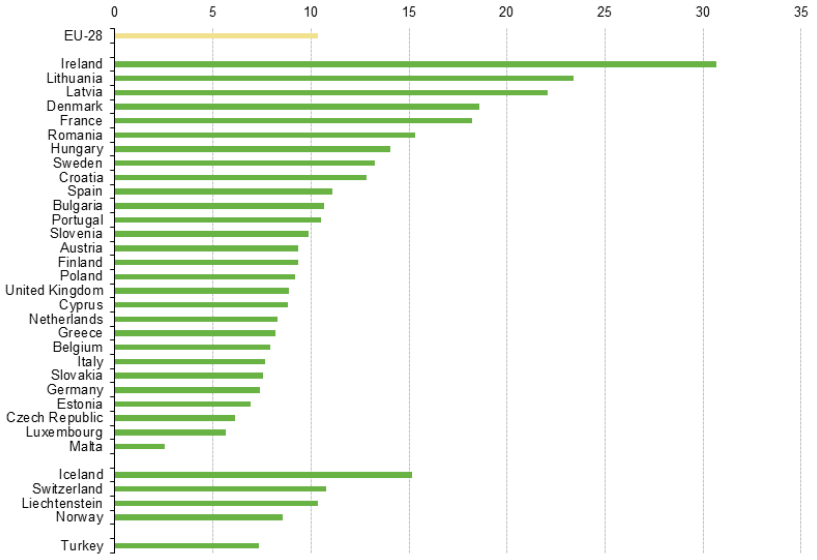
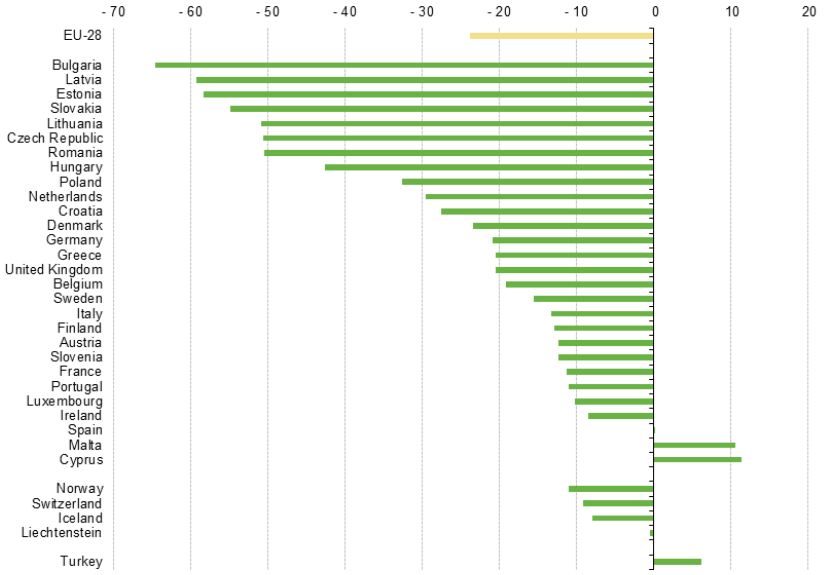


Figure 3: Greenhouse gas emissions from agriculture, 2012(% of total greenhouse gas emissions)Source: European Environment Agency and Eurostat (aeiprghg)



(*) Field burning of agricultural residues also contributes to nitrous oxide emissions — however, this is a relatively minor source of emissions compared with the two sources illustrated.

Figure 4: Change in aggregated emissions of methane and nitrous oxide from agriculture, 1990–2012 (1)(%)Source: European Environment Agency and Eurostat (aeiprghg)

Main statistical findings

The concentration of greenhouse gases in the atmosphere has grown mainly as a result of human activity. Greenhouse gases trap heat that would otherwise escape into space and they radiate it back towards the earth's surface: a phenomenon known as the 'greenhouse effect'. The growth of greenhouse gas emissions may be linked to rising temperatures, otherwise referred to as 'global warming'.

Some greenhouse gases, such as carbon dioxide (CO2), occur naturally and are emitted to the atmosphere through natural processes. However, carbon dioxide emissions also result from human activities, primarily the burning of fossil fuels (oil, natural gas and coal). Some other greenhouse gases (for example, fluorinated gases) are generated and emitted solely as a result of human activities (for example, industrial processes).

Like most economic sectors, agriculture produces greenhouse gases. Agricultural emissions are generally linked to the management of agricultural soils, livestock, rice production and biomass burning. The main agricultural sources of greenhouse gas emissions are:

- enteric fermentation (flatulence) by ruminant animals such as cattle , sheep and goats , which produce methane (CH4) emissions; enteric fermentation is a natural part of the digestive process for many ruminants as anaerobic microbes decompose and ferment food in the rumen, then they are absorbed by the ruminant; this digestion process is not 100 % efficient, so some of the food energy is lost in the form of methane; measures to mitigate enteric fermentation would not only reduce emissions, they may also raise animal productivity by increasing digestive efficiency;
- soil nitrification and denitrification, which produces nitrous oxide (N2O) emissions; nitrification is the aerobic microbial oxidation of ammonium (NH4) to nitrates (NO3), whereas denitrification is the anaerobic microbial reduction of nitrates to nitrogen gas (N2);
- manure decomposition, which produces methane and nitrous oxide emissions.

In recent years, greenhouse gas emissions from agriculture have been influenced by a number of factors: general underlying economic trends; regulatory instruments; farm management practices; and trends in the number of ruminant animals.

Agriculture's contribution

Agricultural activities in the EU-28 generated 470.6 million tonnes of CO2equivalent in 2012, corresponding to about 10 % of total greenhouse gas emissions (see Table 1); note that information on land use, land use change

and forestry is excluded (as this heading is omitted from the measurement of greenhouse gases under the Kyoto Protocol).

EU-28 greenhouse gas emissions from agriculture declined by 147.3 million tonnes of CO2equivalents over the period between 1990 and 2012, a decline of almost one quarter (23.8 %). This was a slightly faster pace than the reduction recorded for all greenhouse gas emissions in the EU-28 (down 19.2 %), although the difference narrowed rapidly from 2008 onwards (see Figure 1) — reflecting the impact of the financial and economic crisis on industrial emissions and emissions linked to levels of consumption.

The vast majority of the EU-28's greenhouse gas emissions from agriculture came from one of three sources: agricultural soils (accounting for about one half of agricultural emissions), enteric fermentation (about one third) and manure management (about one sixth). The other sources of agricultural greenhouse gas emissions — field burning of agricultural residues and rice cultivation — were only minor contributors at the EU-28 level (see Figure 2).

The reduction in agricultural emissions of greenhouse gases may, at least in part, be attributed to an overall reduction in livestock numbers, more efficient farming practices, the reduced application of nitrogen-based fertilisers , as well as better forms of manure management. The volume of soil-related greenhouse gas emissions in the EU-28 declined by 74.3 million tonnes of CO2equivalents between 1990 and 2012. The volume of livestock-related greenhouse gas emissions fell by 48.2 million tonnes of CO2equivalents for enteric fermentation and by 24.4 million tonnes of CO2equivalents for manure management during the same period.

As may be expected, those EU Member States with the largest agricultural sectors tend to account for the highest greenhouse gas emissions from agriculture, reflecting their larger areas of farmland, higher levels of production, and extended livestock populations. France and Germany together contributed just over one third (33.7 %) of the EU-28's greenhouse gas emissions from agriculture in 2012. The combined emissions of the United Kingdom (11.0 %), Italy (7.5 %), Spain (8.0 %) and Poland (7.8 %) accounted for more than one third (34.3 %) of the total.

Figure 3 shows that agriculture accounted for a 30.7 % share of total greenhouse gas emissions in Ireland in 2012. This was the highest contribution from agriculture among any of the EU Member States and could be contrasted with a low of 2.5 % recorded in Malta. These figures reflect the relative importance of the livestock industry to Ireland's (agricultural) economy, as well as the relatively low level of greenhouse gas emissions in Ireland from other sectors (such as energy production or transport).

Developments in agricultural greenhouse gas emissions by Member State

Over the period from 1990 to 2012, the largest overall declines in agricultural greenhouse gas emissions were recorded in Romania (a reduction of 18.5 million tonnes of CO2equivalents), Germany (18.3 million tonnes of CO2equivalents) and Poland (17.7 million tonnes of CO2equivalents). The reduction in agricultural greenhouse gas emissions was sharpest in Bulgaria (– 64.6 %), followed by Latvia (– 59.2 %) and Estonia (– 58.3 %), while Slovakia, Lithuania, the Czech Republic and Romania also cut their agricultural greenhouse gas emissions by more than half (see Figure 4).

By contrast, the volume of agricultural greenhouse gas emissions produced in Spain was similar in 2012 to the level recorded in 1990 (+ 0.1 %), while the level rose in Cyprus by 11.3 % and by 10.6 % in Malta; in these Member States there were marked changes in the livestock mix. In Spain, the number of cattle rose by 14.0 % during the period 1990 to 2012 (adding 700 000 head to the national herd), while the number of pigs increased by 58 % (an additional 9.3 million head), although there were 32 % fewer sheep (the national flock declining by about 7.7 million head). In the case of Cyprus, livestock numbers were consistently higher (across all types of animal) in 2012 than in 1990, with a 4 % increase in the number of cattle, a 12 % increase in the number of sheep, and a 42.0 % increase in the number of pigs. In the case of Malta the increase in livestock was in the goat and sheep categories, with an 85 % and 45 % rise, respectively over the last decade[1].

[1] Figures taken from livestock tables in Agricultural production database (apromtls) .

Data sources and availability

The emissions data used in this publication are official national totals and sectoral greenhouse gas emissions figures submitted to the United Nations Framework Convention on Climate Change (UNFCCC) , the EU's greenhouse gas monitoring mechanism and the European Environment Agency's (EAA) European environment information and observation network (EIONET) .

Data for the EU are compiled and published by the European Environment Agency in their ' European Union greenhouse gas inventory ' as well as their online database. Recommended methodologies for emissions data collection are compiled by the Intergovernmental Panel on Climate Change (IPCC) and released as ' Guidelines for national greenhouse gas inventories ', supplemented by ' Good practice guidance and uncertainty management in national greenhouse gas inventories '.

Greenhouse gases vary in their ability to absorb and hold heat in the atmosphere. Emissions are expressed in terms of carbon dioxide equivalents (CO2equivalents). All greenhouse gases have what is called a global warming potential (GWP) . These potentials relate to the heat-absorbing ability of each gas relative to that of carbon dioxide, as well as the decay rate of each gas (the amount removed from the atmosphere during a given number of years). By assigning a GWP to each gas, policymakers can compare the potential impact of emissions for different gases. For example, the potential effect of methane and nitrous oxide is considerably higher than that of carbon dioxide. Indeed, methane is a significant contributor to the greenhouse effect and has a GWP of 21. This means that methane is approximately 21 times more heat-absorptive than carbon dioxide per unit of weight. Nitrous oxide is 310 times more heat-absorptive than carbon dioxide per unit of weight.

Each country estimates greenhouse gas emissions by measuring the volume of specific activities (for example, livestock numbers or agricultural practices) and multiplying these by associated emission factors. International guidelines foresee these estimates being made using country-specific methods in order to improve the quality of emission estimates.

Agricultural emissions of greenhouse gases do not include those from fossil fuel combustion arising from agricultural-related processes such as transport, greenhouse heating or grain drying; these sources are inventoried under the energy section of the IPCC.

Context

Through its resource use, agriculture changes rural landscapes and contributes to resource depletion and degradation. Via substance emissions into the wider environment, agriculture may contribute to a complex series of ecological impacts, including human health effects, biodiversity loss and climate change . Policy responses to environmental concerns have included the introduction of: resource use constraints and limits; emission and concentration limits; best available techniques, methods and practices. Nature conservation policies have also been implemented that set various agricultural constraints.

Agri-environmental indicators can be used to analyse, over time, the effects of agriculture on the environment and the interaction between the two, as well as the effectiveness and efficiency of agricultural and environmental policy measures. A Communication from the European Commission to the Council and European Parliament titled, ' The development of agri-environmental indicators for monitoring the integration of environmental concerns into the Common Agricultural Policy ' (COM(2006) 508) identified 28 agri-environmental indicators (AEIs) to help with this assessment; Eurostat coordinates the work within the EEA on the development of these indicators.

The reformed Common Agricultural Policy (CAP) and the Nitrates Directive have influenced emissions of greenhouse gases from the EU 's agricultural sector. The decoupling of farm support from production-based mechanisms to direct area payments under the reformed CAP has acted as a break on incentives for the further intensification of agriculture, while the Nitrates Directive has led to a general reduction in the use of nitrogenous fertilisers.

There are a number of farm management practices that can potentially reduce agricultural greenhouse gas emissions. These vary in cost-effectiveness and practicality, but include: the optimisation of fertiliser application rates; the continuation of non-fertilised set-aside areas; improved feed conversion efficiency by optimising livestock diets; improved animal productivity and rumen (stomach) efficiency through the use of feed additives

and breeding; better control of manure management systems to reduce the extent of anaerobic decomposition as well as the covering of manure and slurry lagoons . Measures to reduce carbon dioxide emissions from soils or to enhance carbon sequestration include the maintenance of permanent pasture , conservation tillage , appropriate crop rotation and cover crops .

See also

- Agri-environmental indicators (online publication)
- Climate change - driving forces
- Greenhouse gas emission statistics
- Europe 2020 headline indicators
- Europe 2020 indicators - climate change and energy
- Greenhouse gas emission statistics - air emissions accounts

Further Eurostat information

Publications

- Agriculture, forestry and fishery statistics — 2013 edition (Pocketbook)
- Analysis of methodologies for calculating greenhouse gas and ammonia emissions and nutrient balances (Statistical working papers)
- Driving forces behind EU-27 greenhouse gas emissions over the decade 1999-2008] - Statistics in focus 10/2011
- Energy, transport and environment indicators — 2012 edition (Pocketbook)
- Environmental statistics and accounts in Europe - 2010 edition
- Figures for the future - 2012 edition
- Sustainable development in the European Union - 2011 monitoring report on the EU sustainable development strategy - Sustainable development in the European Union

Main tables

- Environment (tenv) see:

Greenhouse Gases/Air Pollution (tenvair)

Database

- Air emissions inventories (source:EEA) (envairai)

Air pollution (source: EEA) (envairemis)

Greenhouse Gas Emissions (source: EEA) (envairgge)

- Agri-environmental indicators (aei), see:

Pressures and risks (aeipr)

Greenhouse gas emissions from agriculture (data source: EEA) (aeiprghg)

Gross Nutrient Balance (aeiprgnb)

Dedicated sections

- Environment
- Agri-Environmental Indicators

Methodology / Metadata

- Greenhouse gas emissions from agriculture (data source: EEEA) (ESMS metadata file — aeiprghgesms)

Source data for tables, figures and maps (MS Excel)

- Greenhouse gas emissions from agriculture: tables and figures

Other information

- Commission Communication - Development of agri-environmental indicators for monitoring the integration of environmental concerns into the common agricultural policy {SEC(2006) 1136}

- Agri-Environmental Indicators , see:

Legislation: Commission Staff working document] accompanying COM(2006)508 final

- Agri-Environmental Indicators , see:

- 19 - GHG emissions.pdf IRENA (19) Indicator Fact Sheet Emissions of methane (CH4) and nitrous oxide (N2O) from agriculture
- 34.1 - Share of agriculture in greenhouse gas emissions.pdf IRENA Indicator Fact Sheet (Share of agriculture in greenhouse gas emissions)

External links

- **Database:**
- EEA greenhouse gas - data viewer
- National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism
- **Methodology**
- Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories
- IPCC Guidelines for National Greenhouse Gas Inventories
- **Other external links:**

European Enviroment Agency — annual European Union greenhouse gas inventory 1990–2009 and inventory report 2011

European Environment Agency — climate change

United Nations Framework Convention on Climate Change (UNFCCC)

Notes