



Soil Nutrient Balances UK Provisional Estimates for 2019

Soil nutrient balances provide a method for estimating the annual nutrient loadings of nitrogen and phosphorus to agricultural soils. They give an indication of the potential risk associated with losses of nutrients to the environment; losses which can impact on air and water quality and on climate change. The nutrient balances are used as a high level indicator of farming's pressure on the environment and of how that pressure is changing over time. The balances do not estimate the actual losses of nutrients to the environment, but significant nutrient surpluses are directly linked with losses to the environment.

Nutrient balances are of direct relevance to a number of European directives including the Air Quality Directive, Water Framework Directive and Habitats Directive. The nitrogen balance for England is also used by Defra to monitor farming's environmental performance.

Key Messages

Nitrogen

Provisional estimates for 2019 show the nitrogen balance:

- to be a surplus of 84 kg/ha of managed agricultural land
- decreased 9.0 kg/ha (-10%) compared to 2018
- decreased 27 kg/ha (-24%) compared to 2000

Phosphorus

Provisional estimates for 2019 show the phosphorus balance:

- to be a surplus of 5.4 kg/ha of managed agricultural land
- decreased 1.6 kg/ha (-23%) compared to 2018
- decreased 4.6 kg/ha (-46%) compared to 2000

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What you need to know about this release

This section ensures any important information is clearly explained so users do not misunderstand the data.

Contact details

Responsible statistician: James Maguire

Email: agri.environmentstatistics@defra.gov.uk

Enquiries: 020 802 65783

Media enquiries: 0345 051 8486

National and Official Statistics

Publications with National Statistics status meet the highest standards of trustworthiness, quality and public value, and it is our responsibility to maintain compliance with these standards.

These estimates are based on a methodology developed by the OECD and adopted by Eurostat (see the Methodology section at the end for more detail). Whilst this methodology is sound and allows meaningful comparisons between countries and over time, the specific data sources used within different countries will vary depending on the data available. The majority of the data sources used to calculate these nutrient balance estimates are designated as National Statistics. However, some of the data are from sources that do not have this designation and may have greater levels of uncertainty. As a result these estimates have been designated as Official Statistics.

For general enquiries about National and Official Statistics, contact the National Statistics Public Enquiry Service:

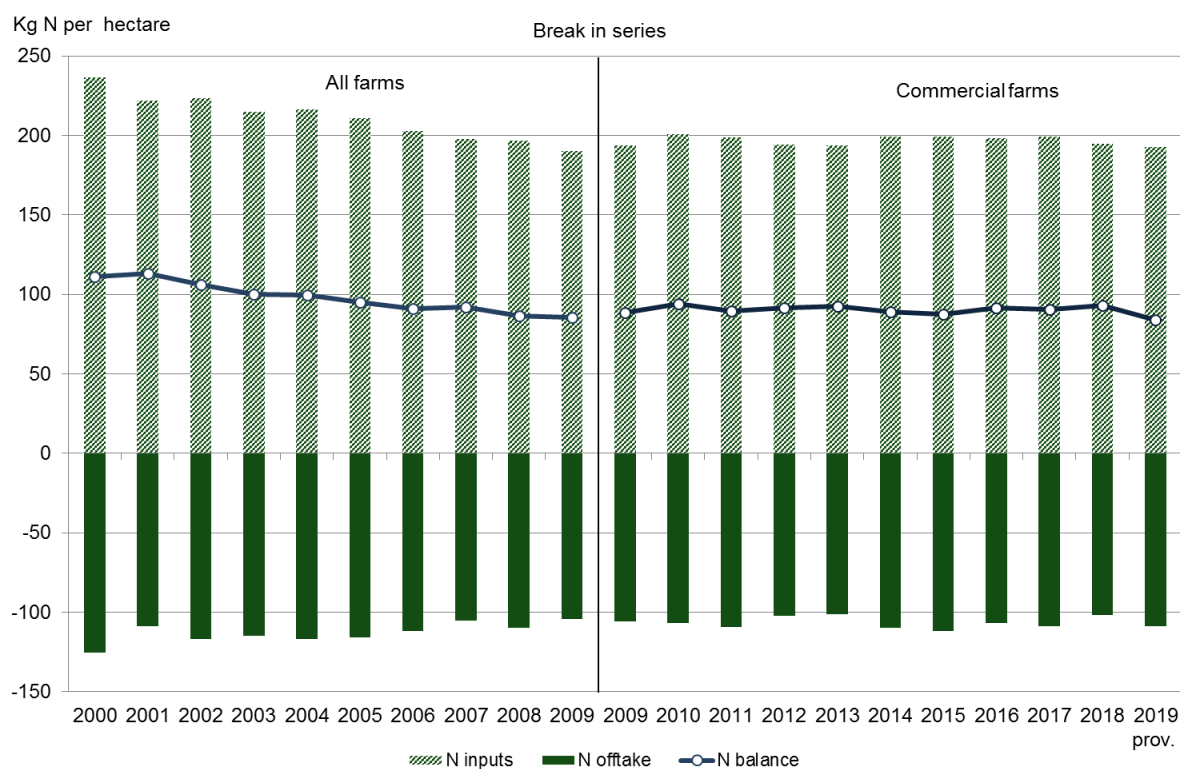
Tel: 0845 601 3034

Email: info@statistics.gov.uk.

You can find National Statistics on the internet [on the Gov.uk website](#).

Section 1 – UK Nitrogen Balance

Figure 1 – Summary of nitrogen balance for UK, 2000 to 2019



For the period 2018 to 2019 the key points are:

- The 9.0 kg/ha (10%) decrease in the total surplus per hectare has been driven by an increase in offtake of 7.1 kg/ha (7.0%) (mainly via harvested crops) while inputs (mainly from inorganic manufactured fertilisers and livestock manures) decreased by 1.9 kg/ha (1.0%) over the same period.
- The increase in uptake by harvested crops was driven by significantly higher yields and production for cereals in 2019 with the largest cereal harvest for decades.

For the period 2000 to 2019 the key points are:

- A 27.1 kg/ha (24%) fall in the total surplus per hectare from 111 kg/ha to 84 kg/ha.
- The main driver has been a 44 kg/ha decrease in inputs (from 237 kg/ha to 193 kg/ha) due to decreases in the application of inorganic (manufactured) fertilisers and manure production (the result of lower livestock numbers). This has been partially offset by a smaller reduction of 17 kg/ha in offtake (particularly forage) from 125 kg/ha to 109 kg/ha.

The series break in 2009 is due to changes in farm survey data collection in England. [See further information here.](#)

Table 1.1 - Nitrogen balance for UK, 2000, 2018 and 2019 (kg N per hectare)

	2000	2018	prov. 2019	Change 2018-19	Change 2000-19
Total Inputs	236.6	194.8	192.9	-1.9	-43.7
Total Offtake	125.4	101.8	108.9	7.1	-16.6
BALANCE (Inputs minus Offtake)	111.1	93.0	84.0	-9.0	-27.1

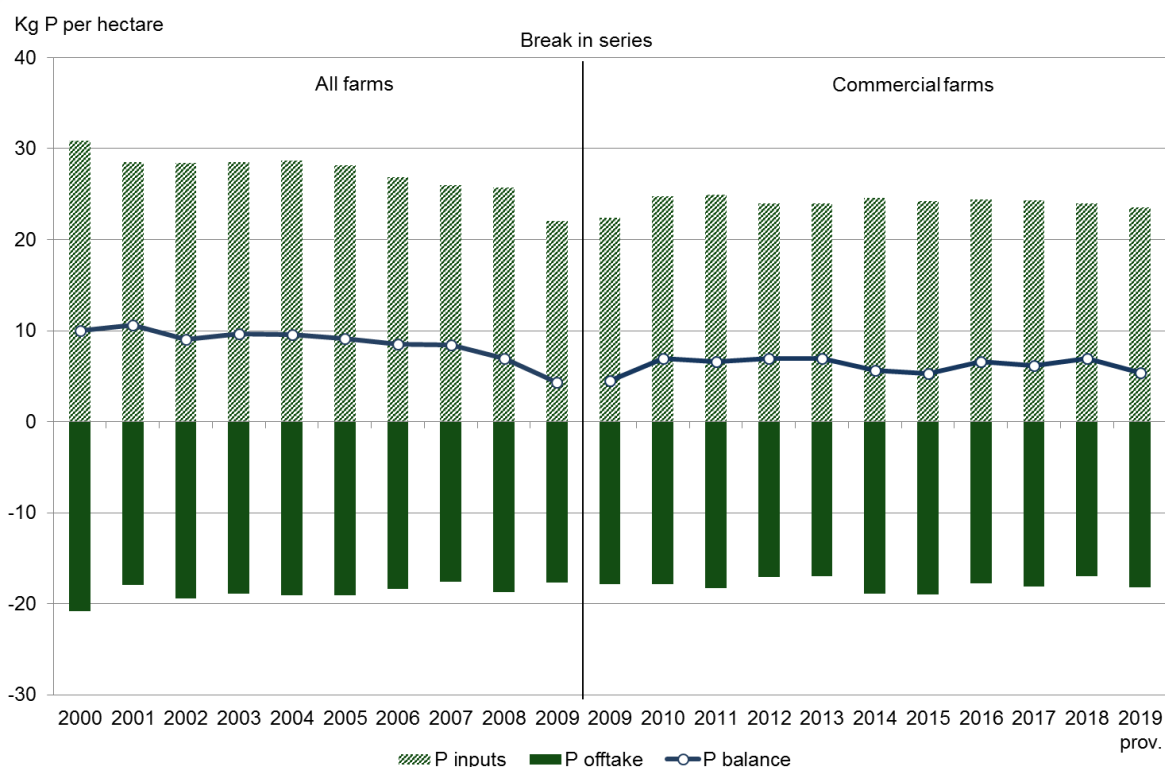
Table 1.2 – Detailed nitrogen balance sheet results, 2000, 2018 and 2019 (thousand tonnes N)

	2000	2018	prov. 2019	Change 2018-19	Change 2000-19
TOTAL INPUTS	2,805	2,391	2,382	-9	-423
Fertilisers	1,301	1,092	1,098	6	-203
Inorganic fertilisers	1,268	1,033	1,039	6	-229
Total organic fertilisers	33	59	59	0	26
Manures	1,180	1,016	1,004	-12	-176
Livestock Manure Production	1,196	1,033	1,021	-12	-175
Cattle	773	665	656	-9	-117
Pigs	73	55	56	1	-17
Sheep and goats	227	184	181	-2	-46
Poultry	116	123	122	-1	6
Other livestock	7	6	6	0	-1
Withdrawals	-17	-17	-17	0	0
Other inputs	325	283	280	-3	-45
Atmospheric Deposition	172	128	128	0	-44
Biological fixation	142	144	141	-3	-1
Seeds and Planting Material	10	10	11	0	0
TOTAL OFFTAKE	1,487	1,249	1,344	95	-143
Total Harvested Crops	561	516	601	85	41
Cereals	453	398	481	83	28
Oil crops	36	62	54	-8	18
Pulses and Beans	29	21	34	13	5
Industrial Crops	15	13	10	-3	-6
Other Crops	27	22	22	0	-4
Total Forage	915	721	730	10	-184
Harvested Fodder Crops	23	42	45	3	22
Pasture	892	679	685	7	-207
Crop residues	12	12	13	0	1
BALANCE (Inputs minus Offtake)	1,318	1,142	1,038	-104	-280
Managed area (thousand ha) (a)	11,858	12,272	12,349	77	491

(a) Excludes rough grazing

Section 2 – UK Phosphorus Balance

Figure 2 – Summary of Phosphorus balance for UK, 2000 to 2019



For the period 2018 to 2019 the key points are:

- There has been a decrease of 1.6kg/ha (23%) in the surplus per hectare compared to 2018. This has been driven by a 1.2 kg/ha (7%) increase in offtake while inputs decreased by 0.4 kg/ha (2%). As with nitrogen, the offtake increase reflects increased production in harvested crops.

For the period 2000 to 2019 the key points are:

- A 4.6 kg/ha fall in the total surplus per hectare from 10 kg/ha in 2000 to 5.4 kg/ha in 2019 (-46%).
- The main driver has been a reduction in inputs (from 31 to 24 kg/ha) reflecting reduced fertiliser application rates and manure production (due to declining livestock populations). Total offtake has fallen from 21 to 18 kg/ha, largely due to reduced forage production.
- After remaining level from 2002 to 2007 there was a sharp fall in the surplus between 2007 and 2009. This was a result of increased offtake from harvested crops in 2008 and a sharp reduction in fertiliser applications in 2009. The surplus has since returned to levels more consistent with the longer term trend.

The series break in 2009 is due to changes in farm survey data collection in England. [See further information here.](#)

Table 2.1 - Phosphorus balance for UK, 2000, 2018 and 2019 (kg P per hectare)

	2000	2018	Prov. 2019	Change 2018-19	Change 2000-19
Total Inputs	30.9	24.0	23.6	-0.4	-7.3
Total Offtake	20.8	17.0	18.2	+1.2	-2.6
BALANCE (Inputs minus Offtake)	10.0	7.0	5.4	-1.6	-4.6

Table 2.2 - Detailed phosphorus balance sheet results for 2000, 2018 and 2019 (thousand tonnes P)

	2000	2018	Prov. 2019	Change 2018-19	Change 2000-19
TOTAL INPUTS	366	294	291	-3	-75
Fertilisers	158	113	111	-1	-47
Inorganic fertilisers	138	82	81	-1	-58
Total organic fertilisers	20	31	31	0	11
Manures	201	175	173	-2	-28
Livestock Manure Production	201	175	173	-2	-28
Cattle	121	104	102	-1	-18
Pigs	15	11	11	0	-4
Sheep and goats	35	28	28	0	-7
Poultry	28	29	29	0	1
Other livestock	3	2	2	0	0
Withdrawals	0	0	0	-	-
Other inputs	7	7	7	0	0
Atmospheric Deposition	5	5	5	0	0
Seeds and Planting Material	2	2	2	0	0
TOTAL OFFTAKE	247	209	225	16	-22
Total Harvested Crops	100	93	107	14	8
Cereals	82	72	87	15	5
Oil crops	7	13	11	-2	4
Pulses and Beans	3	2	4	1	1
Industrial Crops	3	3	2	-1	-1
Other Crops	4	4	4	0	-1
Total Forage	145	114	115	1	-30
Harvested Fodder Crops	4	8	8	-1	4
Pasture	141	105	107	2	-34
Crop residues	2	2	2	0	0
BALANCE (Inputs minus Offtake)	119	85	66	-19	-52
Managed area (thousand ha) (a)	11,858	12,272	12,349	-4	+414

Section 3 – About these statistics

Background

Soil nutrient balances provide a method for estimating the nutrient loadings of nitrogen and phosphorus to managed agricultural soils. Whilst a shortage of nutrients can limit the productivity of agricultural soils, a surplus of these nutrients poses a serious environmental risk. Losses of nutrients to the environment can impact on air quality (ammonia emissions), water quality (nitrate and phosphate levels in rivers) and climate change (nitrous oxide emissions). A soil nutrient balance estimate, expressed as a loading of nitrogen or phosphorus per hectare of managed agricultural land can be used as an indicator of the environmental risks. It provides a high level measure which can be used to monitor long term trends and to make meaningful comparisons between countries.

Methodology

A methodology for calculating soil nutrient balances has been developed by OECD (Organisation for Economic Cooperation and Development) and adopted by Eurostat (Statistical body of the European Commission). Although based on an internationally recognised methodology, the nutrient balance estimates are subject to a level of uncertainty or error margins.

The approach estimates the full range of nutrient inputs and removals to soils from all sources. The input sources are: manures, mineral fertilisers, atmospheric deposition and biological fixation. The removals sources are: crop production and fodder production for livestock, including grazing. The nutrient input or removal from each source is either estimated directly (atmospheric deposition) or calculated by applying a coefficient (e.g. for the amount of nitrogen that a dairy cow produces each year) to the corresponding physical data characteristic (e.g. number of dairy cows). The relevant coefficients are derived from research and the physical data is taken from a wide range of data sources many of which are already published as official statistics.

UK approach

The estimates within this release are based on a programme of work to develop and improve the methodology and data sources. This work includes two funded projects and follow-up work carried out within Defra. [Details of the two projects can be found here.](#)

Follow-up work is presented in a separate paper that gives an overview of the methods utilised to compile the data series within this release. The paper also gives details of where they differ to the proposals within the ADAS project and provides a commentary on the resultant balances and components. [The project report can be found here.](#)

The estimates presented in this Statistics Notice use the June Survey data for England for commercial holdings for 2009 onwards and for all farms for preceding years. A consistent time series can be found in the accompanying excel worksheets.

Managed agricultural land has been defined as the utilised agricultural area (UAA) excluding common land and sole right rough grazing. The balance per hectare is based on the area of managed agricultural land. This is based on the approximation that this is the only land to which significant levels of fertilisers and manures are applied.

Future publications

The next publication is due in July 2021

Section 4 - Glossary

Term	Definition
Nutrients	The key macro-nutrients required for crop growth which are nitrogen and phosphorus
Inputs	The total amount of inputs of each nutrient to the soil. This can be through application of mineral fertilisers or organic manures, atmospheric deposition or biological fixation
Offtake	The total amount of nutrients removed from the soil by the growth of crops, which are either harvested or grazed by livestock.
Nutrient balance	The difference between the inputs and the offtake for each nutrient
Loading	Another term for the balance, conveying that this is the total net amount being loaded onto the soil over a year
Surplus	If the annual inputs exceed the offtake the net balance represents a surplus of the nutrient. This surplus represents an environmental risk as it can be lost from the soil to the air or water courses.
Deficit	If the annual inputs are less than the offtake the net balance represents a deficit of the nutrient and hence the crop growth requirements will not have been met.
Atmospheric deposition	The process by which nitrogen in the atmosphere is transferred into soils.
Biological fixation	The process by which nitrogen in the atmosphere is incorporated into the tissues of plants and crops