Department
for Environment
Food & Rural Affairs

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Soil Nutrient Balances
England Provisional Estimates for 2018

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.

Summary of key results

Nitrogen

Provisional estimates for 2018 show the nitrogen balance:

- to be a surplus of 85 kg/ha of managed agricultural land
- increased 3.2 kg/ha (+4%) compared to 2017
- decreased 23 kg/ha (-22%) compared to 2000

Phosphorus

Provisional estimates for 2018 show the phosphorus balance:

- to be a surplus of 4.7 kg/ha of managed agricultural land
- increased 0.8 kg/ha (+20%) compared to 2017
- decreased 4.4 kg/ha (-49%) compared to 2000

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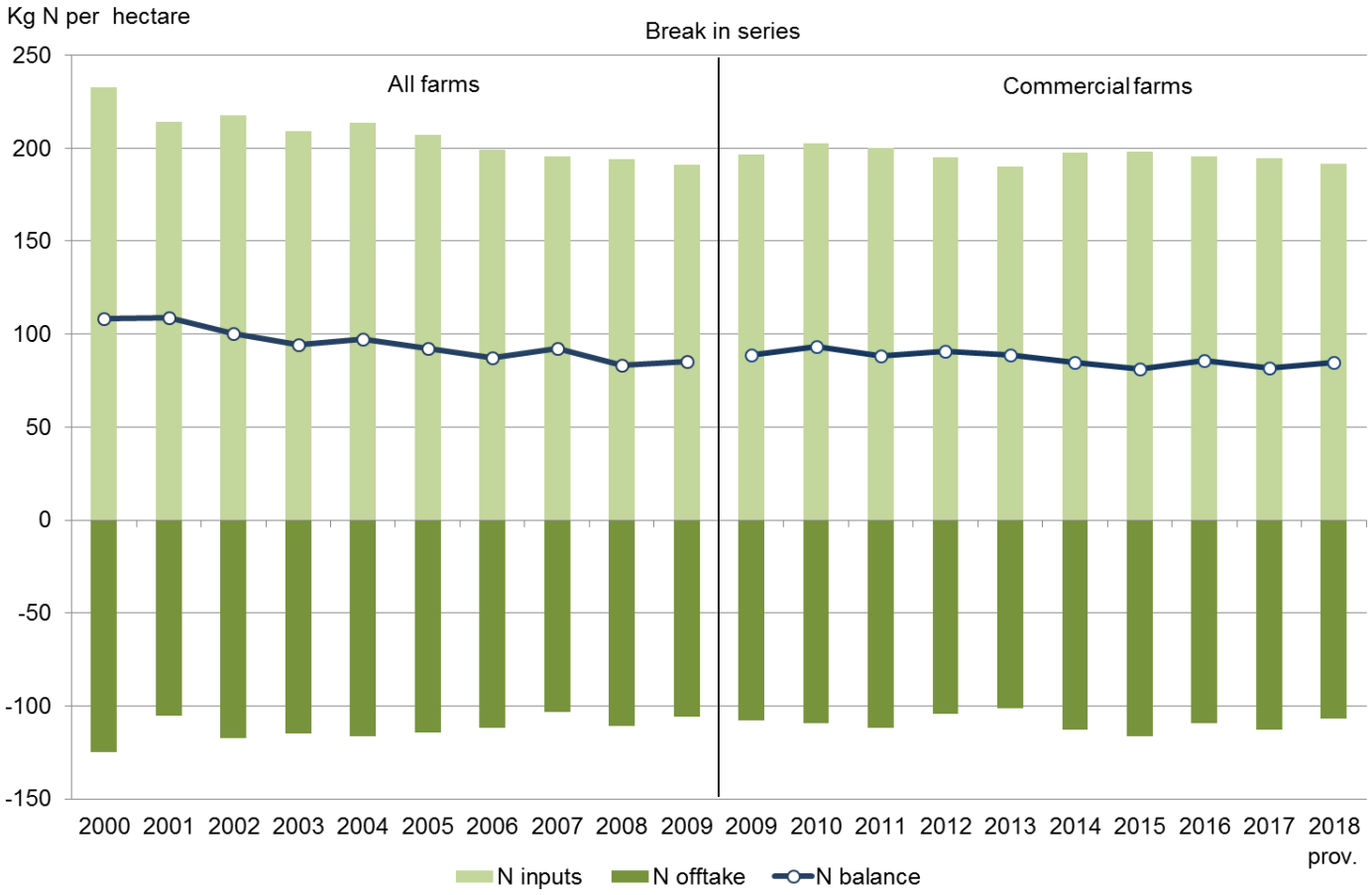
Detail

England Nitrogen Balance

Chart 1: Summary of Nitrogen balance for England, 2000 to 2018 (kg N per hectare)



For the period 2017 to 2018 the key points are:

- Inputs (mainly from inorganic fertilisers and livestock manures) decreased by 2% over this time period, however this was more than offset by a 6% decrease in offtake (mainly via harvested crops) resulting in a 3.2 kg/ha (4%) increase in the balance overall
- Whilst crop areas stayed largely similar, the lower yields and production for both cereals and oil crops was the main driving force behind the decrease in uptake by harvested crops

For the period 2000 to 2018 the key points are:

- A 22% fall in the total surplus per hectare of managed agricultural land in England from 108 kg/ha in 2000 to 85 kg/ha in 2018.
- The main driver for the lower surplus has been a 42 kg/ha reduction in inputs (from 233 kg/ha to 191 kg/ha) largely due to reductions in inorganic fertiliser applications and manure production (reflecting lower numbers of livestock). This has been partially offset by an 18 kg/ha reduction (from 125 kg/ha to 107 kg/ha) in the nitrogen offtake (particularly forage).
- The series break is due to changes[1] in farm survey data collection.

[1] See https://www.gov.uk/structure-of-the-agricultural-industry-survey-notes-and-guidance for further information.

Table 1: Nitrogen balance for England, 2000, 2017 and 2018 (kg N per hectare)

	2000	2017	**prov. 2018**	Change 2017-18	Change 2000-18
Total Inputs	233.0	194.4	**191.4**	-1.5%	-17.8%
Total Outputs	124.9	112.8	**106.6**	-5.5%	-14.6%
BALANCE (Inputs minus outputs)	108.1	81.7	**84.8**	+3.9%	-21.6%

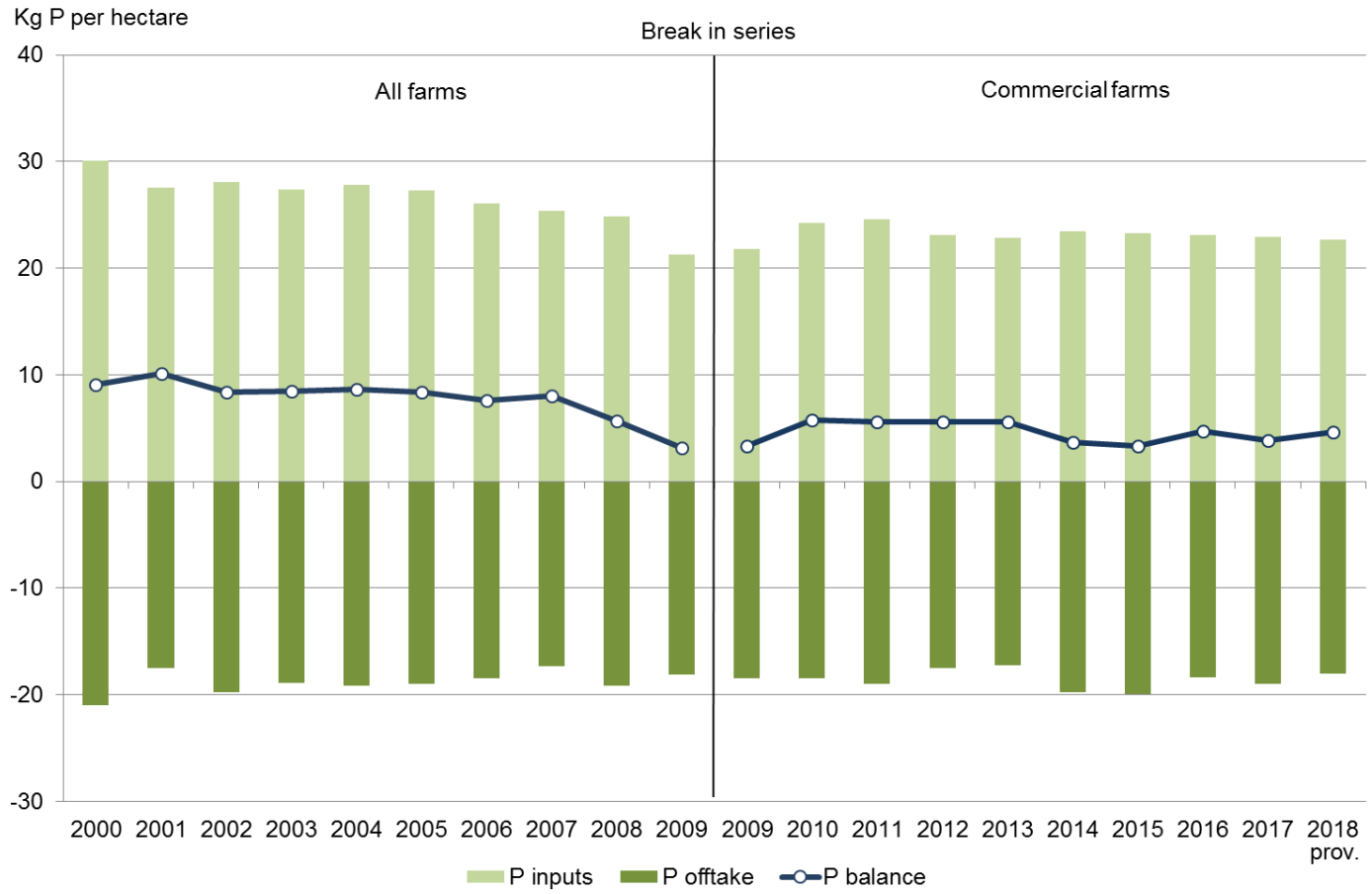
Table 2: Detailed nitrogen balance sheet results, 2000, 2017 and 2018 (thousand tonnes of N)

	2000	2017	**prov. 2018**	Change 2017-18	Change 2000-18
TOTAL INPUTS	1,862	1,591	**1,566**	-25	-297
Fertilisers	938	789	**787**	-2	-151
Inorganic fertilisers	910	742	**740**	-2	-170
Total organic fertilisers	28	47	**47**	0	+18
Manures	680	576	**574**	-2	-106
Livestock Manure Production	697	590	**588**	-2	-109
Cattle	439	368	**364**	-4	-75
Pigs	62	44	**44**	0	-18
Sheep and goats	101	84	**84**	0	-17
Poultry	91	90	**92**	+2	+1
Other livestock	6	4	**4**	0	-1
Withdrawals	-17	-14	**-14**	0	+3
Other inputs	244	226	**204**	-22	-39
Atmospheric Deposition	126	107	**88**	-19	-38
Biological fixation	109	119	**108**	-11	-1
Seeds and Planting Material	9	8	**8**	0	-1
TOTAL OFFTAKE	998	923	**872**	-51	-126
Total Harvested Crops	496	513	**470**	-42	-26
Cereals	398	379	**360**	-19	-38
Oil crops	32	62	**60**	-2	27
Pulses and Beans	29	37	**21**	-16	-8
Industrial Crops	15	15	**13**	-2	-2
Other Crops	22	20	**17**	-2	-4
Total Forage	491	399	**391**	-8	-100
Harvested Fodder Crops	17	31	**35**	+3	+17
Pasture	474	367	**356**	-11	-118
Crop residues	11	11	**11**	0	0
BALANCE (Inputs minus Offtake)	864	668	**694**	+25	-171
Managed area (thousand ha) (a)	7,993	8,183	**8,179**	-4	+186

(a) excludes rough grazing

England Phosphorus Balance

Chart 2: Summary of Phosphorus balance for England, 2000 to 2018 (kg P per hectare)



For the period 2017 to 2018 the key points are:

- Following a similar trend as nitrogen, the 1% decrease in inputs was more than offset by a 5% decrease in offtake resulting in a 0.8kg/ha (20%) increase in the balance overall

For the period 2000 to 2018 the key points are:

- A fall in the total surplus per hectare from 9.1 kg/ha in 2000 to 4.7 kg/ha in 2018, a 49% reduction.
- The main driver has been a reduction in inputs (from 30 to 23 kg/ha), due mainly to reduced fertiliser applications and manure production (as a result of declining livestock populations). Total offtake has also reduced although to a lesser extent (from 21 to 18 kg/ha).
- 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 is due to changes[2] in farm survey data collection.

[2] See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/182206/defra-stats-foodfarm-landuselivestock-june-junemethodology-20120126.pdf for further information.

Table 3: Phosphorus balance for England, 2000, 2017 and 2018 (kg P per hectare)

			prov.	Change	
	2000	2017	**2018**	2017-18	2000-18
Total Inputs	30.0	22.9	**22.7**	-0.2	-7.3
Total Offtake	20.9	19.0	**18.0**	-1.0	-2.9
BALANCE (Inputs minus Offtake)	9.1	3.9	**4.7**	+0.8	-4.4

Table 4: Detailed phosphorus balance sheet results, 2000, 2017 and 2018 (thousand tonnes P)

			prov.	Change	
	2000	2017	**2018**	2017-18	2000-18
TOTAL INPUTS	240	187	**186**	-2	-55
Fertilisers	115	80	**79**	-2	-36
Inorganic fertilisers	97	55	**53**	-2	-44
Total organic fertilisers	18	26	**26**	0	+8
Manures	121	102	**102**	0	-19
Livestock Manure Production	121	102	**102**	0	-19
Cattle	69	58	**57**	-1	-12
Pigs	12	9	**9**	0	-4
Sheep and goats	16	13	**13**	0	-3
Poultry	22	21	**22**	+1	0
Other livestock	2	2	**1**	0	-1
Withdrawals	0	0	**0**	0	0
Other inputs	5	5	**5**	0	0
Atmospheric Deposition	3	3	**3**	0	0
Seeds and Planting Material	2	2	**2**	0	0
TOTAL OFFTAKE	167	156	**147**	-8	-20
Total Harvested Crops	87	90	**83**	-7	-3
Cereals	70	67	**63**	-4	-7
Oil crops	7	13	**12**	0	+6
Pulses and Beans	3	4	**2**	-2	-1
Industrial Crops	3	3	**3**	0	-1
Other Crops	3	3	**3**	0	-1
Total Forage	79	64	**62**	-1	-17
Harvested Fodder Crops	3	6	**6**	+1	+3
Pasture	76	58	**56**	-2	-20
Crop residues	2	2	**2**	0	0
BALANCE (Inputs minus Offtake)	73	32	**38**	+6	-34
Managed area (thousand ha) (a)	7,993	8,183	**8,179**	-4	+186

(a) excludes rough grazing

Background and methodology

A methodology for calculating soil nutrient balances has been developed by OECD[3] and adopted by Eurostat[4]. 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.

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.

Although based on an internationally recognised methodology, the nutrient balance estimates are subject to a level of uncertainty or error margins.

The estimates presented here utilise the June Survey data for England for commercial holdings[5] for 2009 onwards. 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.

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[6,7] and follow-up work carried out within Defra. Details of the two projects are available at: https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs/series/agri-environment-analysis.

The follow-up work is presented in a separate paper[8] 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.

[3] Organisation for Economic Cooperation and Development
[4] Eurostat is the Statistical body of the European Commission
[5] See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/182206/defra-stats-foodfarm-landuselivestock-june-junemethodology-20120126.pdf for further information.
[6] TAPAS Funded Project – UK Soil Nutrient Balances, May 2009
[7] UK Nutrient Balances Methodology Review, ADAS, April 2011
[8] Observatory Report: Soil Nutrient Balances 2010 Update, April 2011
http://webarchive.nationalarchives.gov.uk/20130222210445/http://www.defra.gov.uk/statistics/files/defra-stats-foodfarm-environ-obs-research-soilnutrientbalance-1108-update.pdf