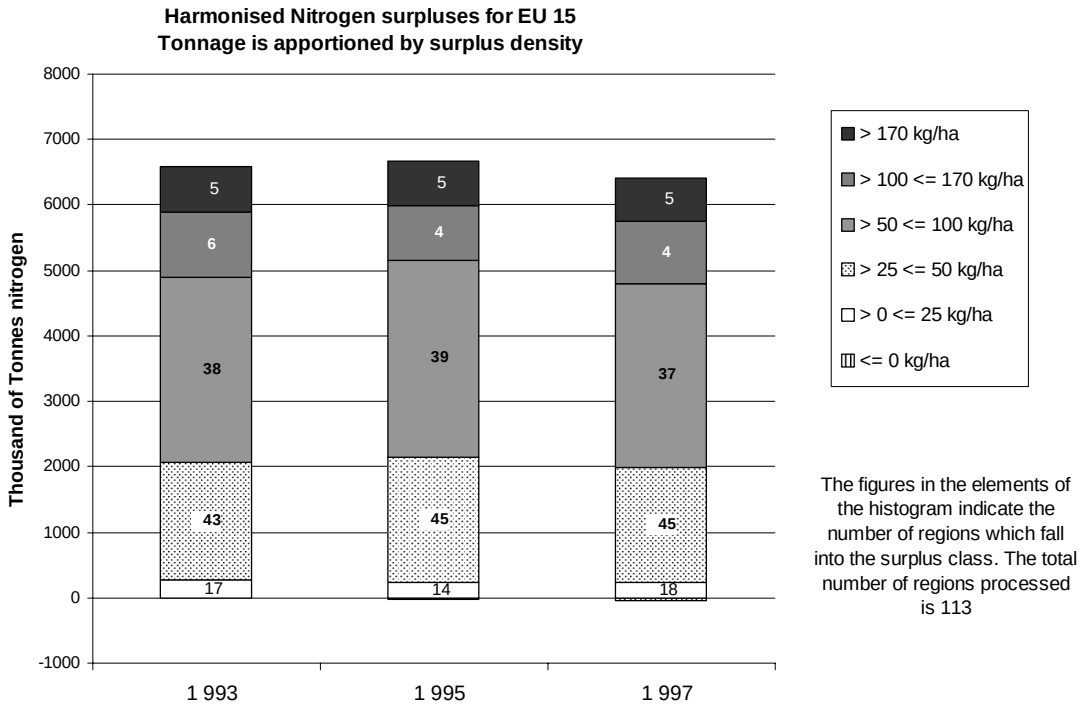
Indicator Fact Sheet Signals 2001 – Chapter Agriculture

(YIR99E2) Nitrogen surplus from agricultural land



[Y-axis legend: 1000 tonnes nitrogen]

Title: Standardised nitrogen surpluses from agricultural land, EU15

Notes: The nitrogen surplus is broken down according to surplus density classes, calculated at the regional (NUTS2) level. Number of regions contributing to a class tonnage is mentioned on the bars. Only regions for which data are available over the period are included in calculations, they contribute to 95% of the total surplus.

Source: EEA calculations with Eurostat data

☹ Nitrogen surpluses from agriculture are rather constant, as well as the distribution of surpluses over density classes is stable. Since surplus greater that 25 kg/ha/year are very likely to contribute to nitrate contamination of water, and surplus over 50 kg/ha/year do contribute to this contamination, respectively 95% and 70% of the tonnage may be involved on the presence of nitrate in waters. A quarter of total amount of nitrogen surplus originates from less than 10% of (NUTS2) regions.

Results and assessment

Relevance of the indicator for describing developments in the environment

Nutrients need to be applied in arable soils and meadows to maintain high crop yield. The main nutrients are nitrogen (N), phosphorus (P) and potassium (K). The surplus is the average balance between inputs (fertilisation, manure spreading, etc.) and outputs by harvesting.

Nitrogen compounds are easily oxidised to nitrate in the soils and contribute to leakage of nitrate into water bodies, and the larger the surplus left on the land, the larger the percentage of surplus actually emitted to waters. Nitrate is understood as the main factor of eutrophication of marine waters, whilst phosphorus is the responsible of inland water eutrophication. Due to data availability at his stage, only nitrogen is considered.

Policy relevance and policy references

Nitrogen surplus is a proxy indicator of non-point nitrate source from agriculture. A variety of policy measures aim to limiting nitrogen losses to inland and marine water bodies. Relevant regulations include the *91/676/EEC Nitrate Directive*, *80/778/EEC Drinking water Directive*, the *EC Regulation 2078/92 "Agri-environment"* and the *OSPAR strategy to combat eutrophication*

Assessment (now 250 words for signals 2001 report)

The leakage and run-off of the plant nutrients nitrogen and phosphorus from agricultural soils is one of the persisting problems of modern agriculture. Overloading of water bodies with these nutrients causes a series of adverse effects. Increased inflow of nutrients can lead to excessive growth of algae, which, when they massively die, use up al the oxygen in the water for their decomposition. This leads in turn to the death or migration of bottom living animals and fish. Phosphorus is the key nutrient for eutrophication in fresh waters and nitrate is the key substance for saline waters and cause of non-compliance for drinking water.

The indicator focuses on the surplus of nitrogen from agricultural land, which is the main source. A surplus of nitrogen occurs when the total inputs on the land (fertilisers, animal manure, etc.) than is taken away by harvesting. Good agricultural practices cause only a small surplus in most areas. However, in the EU more than 95% of the surplus tonnage falls in excessive surplus categories, likely to contribute to leaking of nitrate into waters.

Despite the EU Nitrate Directive and the increased use of agri-environmental measures (see X:X) the total amount of surpluses and the distribution by severity class appear to be very stable. In the EU15 countries about 50 regions (over 113 calculated), produce 2/3 of the tonnage certainly involved in nitrogen pollution of waters. A quarter of total tonnage comes from a ten of regions, mainly located in NW Europe.

Data (for each graph created)

A) base data by country and year

Thousand of tons of N per country

Country	1993		1995		1997	
	>0	<=0	>0	<=0	>0	<=0
be	188.4	0.0	183.7	0.0	199.9	0.0
dk	370.7	0.0	323.2	0.0	299.0	0.0
de	1553.4	0.0	1615.2	0.0	1574.3	0.0
gr	207.1	0.0	176.1	0.0	167.8	0.0
es	835.1	0.0	947.1	-4.7	913.1	-20.0
fr	1060.3	0.0	1132.6	0.0	1161.6	0.0
ie	275.9	0.0	293.1	0.0	273.4	0.0
it	733.3	-4.0	643.8	-10.6	598.2	-14.0
lu	12.8	0.0	12.6	0.0	12.5	0.0
nl	546.8	0.0	548.2	0.0	514.6	0.0
pt	117.8	-5.1	107.9	-5.8	97.1	-4.7
uk	678.7	0.0	687.9	0.0	602.2	0.0
at	NC	NC	107.8	0.0	123.4	0.0
fi	NC	NC	134.1	0.0	120.7	0.0
se	NC	NC	111.4	0.0	108.9	0.0

Source : EUROSAT, New Cronos, sum of surplus per NUTS2

Table above contains the sum of surpluses per country, broken down in positive and negative values. Base data are for the 128 NUTS2 regions and can be obtained separately.

Class #	Total	1 993		1 995		1 997	
		1000*Tons	#NUTS2	1000*Tons	#NUTS2	1000*Tons	#NUTS2
1	<= 0 kg/ha	- 9	4	- 21	6	- 39	4
2	> 0 <= 25 kg/ha	283	17	241	14	243	18
3	> 25 <= 50 kg/ha	1 787	43	2 109	54	2 025	56
4	> 50 <= 100 kg/ha	2 825	38	3 160	45	2 874	41
5	> 100 <= 170 kg/ha	1 003	6	832	4	962	4
6	> 170 kg/ha	682	5	683	5	662	5
T	**TOTAL (>0)**	**6 580**	**113**	**7 025**	**128**	**6 766**	**128**
(3+4+5+6)/T		95.7%	81.4%	96.6%	84.4%	96.4%	82.8%
(4+5+6)/T		68.5%	43.4%	66.6%	42.2%	66.5%	39.1%
(5+6)/T		25.6%	9.7%	21.6%	7.0%	24.0%	7.0%

B) manipulated data for the indicator

Sub table "total" shows the total surpluses for all NUTS2 regions.

Next sub table ("Standardised") shows only those surpluses from NUTS2 regions available for the three years. Ratios in the last lines indicate the percentage of tonnages and NUTS2 involved in each class.

Class #	Standardised	1 993		1 995		1 997	
		1000*Tons	#NUTS2	1000*Tons	#NUTS2	1000*Tons	#NUTS2
1	<= 0 kg/ha	- 9	4	- 21	6	- 39	4
2	> 0 <= 25 kg/ha	283	17	241	14	243	18
3	> 25 <= 50 kg/ha	1 787	43	1 903	45	1 751	45
4	> 50 <= 100 kg/ha	2 825	38	3 013	39	2 796	37
5	> 100 <= 170 kg/ha	1 003	6	832	4	962	4
6	> 170 kg/ha	682	5	683	5	662	5
T	**TOTAL (>0)**	**6 580**	**113**	**6 671**	**113**	**6 413**	**113**
(3+4+5+6)/T		95.7%	81.4%	96.4%	82.3%	96.2%	80.5%
(4+5+6)/T		68.5%	43.4%	67.9%	42.5%	68.9%	40.7%
(5+6)/T		25.6%	9.7%	22.7%	8.0%	25.3%	8.0%

Meta data

Technical information

1. Data source:

Calculations at the NUTS2 level are carried out by EUROSTAT, using the a modified French SCEES soil-balance model.

Producer is F-3 /Environmental statistics unit of EUROSTAT.

Partial data (1995) published as indicator example RD-4 in TEPI 2000 report.

2. Description of data

Data file *new Cronos* . only results for 1993 (some NUTS2 missing), 1995 and 1997 are available.

Original data are in tonnes of N/year/ha per NUTS2 and total of surplus, same geographical unit.

Basic data used for calculations are NUTS 2 aggregates of different crop areas, livestock number, fertilisation (from fertiliser sales), atmospheric N deposits (source RIVM), crop yield.

3. Geographical coverage/

EU-12, per NUTS2 (1993) and EU15, per NUTS2 (1995 and 1997).

4. Temporal coverage

1993-1997.

Basic data is collected every two or three years.

5. Methodology and frequency of data collection

Calculations carried out by Eurostat.

Methodology of data manipulation

The graphic presents the total tonnage per year, sorted by surplus density in 6 classes. Class 1 groups negative surplus data, that are counted separately from positive surplus. Negative surplus are counted separately, since aggregation with positive values would yield inaccurate results.

To make data comparable, only those regions that have complete data series are presented in histograms ("harmonisation"). Hence, total for 1995 and 1997 are underestimated. Raw figures are respectively 7025 and 6766 thousands tons instead of 6671 and 6580 thousands of tons for standardised data.1

6. Quality information

Calculation of surplus data at the State level yields low grade and poorly comparable results, since they are averaged over very different areas, thus ceiling the results at different limits. This limit is roughly depending of state dimension and Utilised Agricultural Area within state. A part of this source of uncertainty is tackled by calculation at the NUTS2 level, thus allowing reporting results as surplus density histograms. Better assessments are expected from the use of regionalised approaches, especially applying model modification involving CORINE *Land Cover* and NUTS3 data from farm structure surveys.

7. Strength and weakness (at data level)

Elementary data sets, at the state level are normally collected regularly by EUROSTAT; no detail is available.

Pilot studies demonstrated the high sensitivity of model to agronomical standards. Checks are foreseen in the next years.

8. Reliability, accuracy, robustness, uncertainty (at data level)

Reliability is not known, since data come from agricultural data collected by states. These data are in practice a mixture of administrative and stratified survey data whenever annual and aggregated data are concerned. Comprehensive surveys deal with periodical census.

Some uncertainty is observed, possibly resulting of different objectives targeted by model users. A comparison on results published respectively by EUROSTAT and by SCEES for France, year 1995, shows a significant difference in results, despite use of the same model. Some countries (a.o. Denmark and The Netherlands) publish regular nutrient surpluses using more detailed input data nad a more detailed calculation model, of which the outcomes differ from the standardised Eurostat calculation.

9. Further work required (for data level and indicator level)

Surplus assessment is an extremely promising indicator, provided uncertainties that jeopardize the possibility to find out trends be levied. If yields both political and environmental impact indicator and allows comparison with water issues, thus allowing its integration in overall indices.

In next future it should be calculated, at the NUTS3 level (or more detailed) using aggregated statistics and the adaptation of the SCEES/EUROSTAT model involving CORINE *Land Cover*, as presented in recent publication.