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EVALUATION

Evaluation of the Nitrates Directive (Council Directive 91/676/EEC)

{SWD(2026) 235 final}

ANNEX XII. MEMBER STATES' APPROACH TO THE IMPLEMENTATION OF MEASURES IN ANNEX II AND III OF THE NITRATES DIRECTIVE

This annex offers an overview of how the measures of Annex II and III of the Nitrates Directive are implemented in the Member States in Nitrate Vulnerable Zones and whether the flexibility linked to the national implementations has an effect on the effectiveness of the directive. It first examines what measures have been implemented in which Member State and then provides examples of how the implementation varies between Member States. To the extent possible, it also describes if the variation is linked with the flexibility to adapt to local circumstances and whether this flexibility increases the risk of losses to the environment and thus has a potential impact on the effectiveness of the measures. Three measures are analysed in more detail: closed periods, balanced fertilisation, including manure application, and the manure application limit. Finally, the annex examines how measures on phosphorus are covered in the national nitrates action programmes, and whether this has had an impact on the effectiveness of the directive.

This annex is based on several studies and scientific articles[1],[2],[3] as well as scientific support from the JRC[4] and from other sources[5].

CONTENTS

[1] Tzivilakis et al, Identification of approaches and measures in action programmes under Directive 91/676/EEC, 2020, Ref. ENV.D.1/SER/2018/0017

[2] J. Tzilivakis et al, A broad-scale spatial analysis of the environmental benefits of fertiliser closed periods implemented under the Nitrates Directive in Europe, 2021. https://doi.org/10.1016/j.jenvman.2021.113674

[3] Recommendations for establishing Action Programmes under Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources, 2011, Contract number N° 07 0307/2010/580551/ETU/B1

[4] Grizetti et al, Assessing the effectiveness of the Nitrates Directive: implications for agriculture and for water, soil and air quality (2025)

[5] Scientific Support for the Implementation of the Nitrates Directive (Directive 91/676/EEC) and for an integrated nutrient management, Service Contract number: 09.0201/2022/881726/ENV.D.1

1. Requirements under the Nitrates Directive

The measures of Annex II and III are implemented in the Member States in accordance to Articles 4 and 5:

Article 4 of the Nitrates Directive requires that Member States establish a code or codes of good agricultural practice. These are to be implemented by farmers on a voluntary basis and should contain provisions covering at least the items mentioned in Annex II A. Article 4 also requires MS to set up where necessary a programme, including the provision of training and information for farmers, promoting the application of the code(s) of good agricultural practice.

Article 5 of the Nitrates Directive requires that Member States establish action programmes in respect of designated vulnerable zones, which shall consist of the following mandatory measures: (a) the measures in Annex III; (b) those measures which Member States have prescribed in the code(s) of good agricultural practice, except those which have been superseded by the measures in Annex III.

The Nitrates Directive leaves a lot of flexibility to the Member States in the implementation of articles 4 and 5. The Nitrates Directive is not a blanket set of prescriptions and nitrate action programmes (NAP) can vary from one Member State or region to another. Consequently, there is scope for differences in NAPs across the EU.

The NAPs (and the codes of good agriculture practices) may relate to all vulnerable zones in the country, or may differ for different vulnerable zones or parts of zones. They also have to take into account the environmental conditions in the relevant regions of the Member State. In practice, while some Member States have one NAP for the whole territory with a limited number of regional variations, other have one national NAP which is complemented or superseded by a number of regional action programmes, managed by the regional authorities. In their study Tzilivakis et al., (2020) created an inventory of NAP measures and identified differences in approaches between Member States and regions (Tzilivakis et al., 2020). The project identified 76 different NAPs across the 27 Member States, with regional NAPs for example in Belgium (2), Finland (2), France (12), Greece (7)[6], Italy (18) and Spain (14). Germany has one national NAP, and then the Lander can implement a certain number of options variations, while Belgium has two disconnected action programmes, one for Flanders and one for Wallonia, but no programme at federal level.

Annex II and III specify the type of measure that is required, but it is up to the Member State to prescribe how each of the measures will be applied throughout its territory. Annexes II and III of the Nitrates Directive outline the minimum measures to be included in NAPs, but Member States have scope to tailor and build upon these to account for national and regional circumstances. This flexibility to adapt to local circumstances is indispensable for Member States to ensure that the measures are the most appropriate and effective to reduce and prevent pollution. The local circumstances include (1) geo-physical characteristics such as hydrology, geography, soil and climate and their associated risk of pollution (2) sensitivity of the waters to nutrients, current levels of

[6] Note that Greece has a national action programme since 2020. This illustrates changes implemented as a result of enforcement actions.

water pollution and water quality objectives; (3) type of farming activity and level of intensity of farming. The flexibility further allows to take into account other environmental objectives such as nature protection, air quality objectives or GHG reduction.

2. Overview of variations and extent of implementation of NAP measures in all Member States

The Tzilivakis et al. (2020) study aforementioned prepared an overview of the NAP measures as implemented in the Member States[7]. It identified more than 70 different measures as declinations of the requirements set out in Annex II and Annex III, detailing or complementing the requirements, as illustrated in the following table:

Table 1 National measures implementing Annex II and Annex III requirements

Category	Sub-category	Measure
Planning	Risk assessment	1. Risk map
		2. Field risk assessment
	Cropping and grazing	3. Prohibited or required cropping*
		74. Prohibited and permitted grazing
		19. Grazing closed periods
	Nutrient balancing	4. Farm nutrient balance*
		5. Field nutrient balance*
	Fertiliser planning	61. Fertilisation plan for nitrogen*
		62. Fertilisation plan for phosphorus*
		6. Soil sampling
		65. Foliar analysis
		71. Analysis of the nutrient content of organic manures
		57. Irrigation water analysis
		47. Education and training
	Record keeping	17. Farm records*
		18. Field records*
Fertiliser storage	Manure storage - permanent	72. Processing of livestock manures
		20. Manure, slurry and effluent storage period and capacity*
		66. Maximum duration of manure storage in permanent stores*
		73. Export of manure from the farm
		51. Distance between permanent manure stores and surface water*
		54. Distance between permanent manure stores and groundwater sources*
		76. Distance between permanent manure stores and other features
		45. Design and construction of storage for manure, slurry and dirty

[7] The authors warn that the overview is not fully exhaustive as they did not have access to the detailed implementations in all Member States, nor could the overviews be verified with all MS. Therefore, the absence of a measure in the table does not mean that it is not implemented in the MS. It is important to acknowledge that some of the measures in the inventory are implemented by other regulations in some MSs/regions, notably in Denmark and France, and these measures are not reflected in the implementation statistics for the NAPs or the characterisation. The tables also include updates from 2022.

Category	Sub-category	Measure
		water*
		46. Design and construction of farmyard buildings and infrastructure
	Manure storage - temporary field	22. Conditions for field manure heaps*
		59. Minimum storage time before storage in temporary heap
		50. Temporary manure heap closed periods
		40. Duration of temporary manure heaps*
		7. Minimum time before a site can be used again for a temporary manure heap
		41. Covering temporary manure heaps*
		43. Distance between temporary manure heaps and surface water*
		42. Distance between temporary manure heaps and groundwater sources*
		44. Distance between temporary manure heaps and exposed cavernous or karstified limestone features*
		69. Distance between temporary manure heaps and other features
	Inorganic fertiliser storage	52. Distance between inorganic fertiliser stores and surface water
		53. Distance between an inorganic fertiliser stores and groundwater sources
		49. Design and construction of stores for inorganic fertilisers
		70. Requirements for fertiliser containers
Application	Conditions	23. Climate and soil conditions that prohibit the use of fertilisers*
		82. Prohibition of fertilisers on sloping land*

Based on this categorisation of measures, the Tzivilakis et al 2020 study prepared a table showing whether the measure is implemented in a way or another in a Member State. This is illustrated in the table below. Noteworthy are the entries in bright yellow which directly correspond to the requirements in Annex II and Annex III, while the other measures are variations and detailed measures around the same requirements. Lighter green colours are used for BE, IT, FR and ES to indicate that there are regional action programmes, with further variations. The study includes detailed tables for the regional NAPs in these countries.

Table 2 Overview of measures in NAP per Member State (period 2016-2019)

	M	AT	BE	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GR	HU	IE	IT	LV	LT	LU	MT	NL	PO	PT	RO	SK	SI	ES	SE
	1												SR															
	2																											
	3																											
	74																											
	19																										SR	
	4																											
	5																										SR	
Annex II B 9 Fertilsation plans	61															SR											SR	
	62															SR												
	6																										SR	
	65																											
	71																										SR	
	57															SR												
	47																										SR	
Annex II B 9 Record keeping	17																											
Annex II B 9 Record keeping	18																											
	72															SR												
Annex II A 5 & Annex III 1.2 Manure storage & capacity	20																											
	66																											
	73															SR												
	51															SR												
	54																											
	76															SR												
	45																											
	46																											
	22																										SR	
	59																											
	50																											
	40																										SR	
	7																											
	41																										SR	
	43																										SR	
	42																										SR	
	44																											
	69															SR											SR	
	52																											
	53																											
	49																											
	70															SR												
Annex II A 3 No fertiliser vs soil conditions	23																										SR	
Annex II A 2 No fertiliser on	82																										SR	

	M	AT	BE	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GR	HU	IE	IT	LV	LT	LU	MT	NL	PO	PT	RO	SK	SI	ES	SE
slopes																												
	83																											
	84															SR											SR	
Annex III 2 Limit on manure application	24																											
	75																											
	81																											
	77																											
	78																											
	25																											
Annex III 1.3 Balanced fertilisation – N field limit	26																											
	27																											
	28																											
	29																											
Annex III 1.1 & Annex II A 1 Closing periods	30																										SR	
	67																											
	31																											
Annex II A 4 Buffer strips (chemical)	32																											
	33																											
	55																											
Annex II A 4 Buffer strips (organic)	34																											
	35																										SR	
	36																											
	80															SR											SR	
	63																											
	64																										SR	
Annex II A 6 Application techniques	37																										SR	
	38															SR												
	56																										SR	
Annex II B 8 Cover crops	39															SR											SR	
	85																										SR	
	60																											
	86																											
	79		*																									

The table shows that mandatory requirements from Annex II and III are implemented in all Member States (occasional blanks are rather missing information than absence of measures) and that voluntary requirements from Annex II B such as fertilisation plans and record keeping are implemented in nearly all Member States, whereas cover crops and land management measures are implemented in a majority of Member States. The

table also shows that there are many additional measures beyond the main requirements of Annex II and Annex III with variable presence in the national or regional implementations. Some are implemented in many Member States, such as soil sampling, design guidance for manure storage, conditions for field manure heaps, while others can be found only in a few Member States, such as maximum duration for manure storage or foliar analysis.

The study also looked at the variation and extent of implementation for individual measures. Among the key measures there is a lot of variation as explained in the table below:

measure	**variation**
61. Fertilisation plan	Variable details for what is required to be included within the N fertilisation plan
17 & 18. Record keeping	Items that need to be recorded vary
M23. Climate and soil conditions that prohibit the use of fertilisers	The conditions that prohibit application vary
M82. Prohibition of fertilisers on sloping land	Typically prohibited on slopes >10-15%, but ranges from 6 to 30%
M26. Field limit for total nitrogen	Limits vary with crops and multiple other variables
M30. Closed periods when the application of fertilisers is prohibited:	Very often MSs/regions have multiple closed periods for different combinations of variables (e.g. precipitation, crop, soil type, etc.). Consequently, the coverage of risk periods for leaching and run-off is highly variable
M32. Distance between the application of inorganic fertilisers and surface water	Buffer distances are typically around 5m, ranging from 0.5 to 200m
M34. Distance between the application of organic fertilisers and surface water	Buffer distances are typically around 10m, ranging from 0 to 500m
M39. Ground cover and land management	Ground cover requirements are variable both in terms of the conditions required and the dates, with the latter being variable in relation to coverage of risk periods for leaching and run-off

The study reveals that there is significant variability between NAPs with respect to the measures that have been implemented and the details of how the measures have been implemented. This variation is expected to tailor measures to regional circumstances, but there are NAPs that implement measures more extensively than others. The study further assessed the extent of implementation based on potential for enhancement as shown in the tables below for MS (in summary, the darker the shading the higher the extent of the implementation)[8]. The regional action programmes are not shown in this table but give a very similar picture.

	Implementation extent		**Implementation extent**		

[8] The study used the risk characterisation for each NAP to determine the scope for enhancement (i.e. to further increase the risk mitigation potential for nitrate). This was done by comparing the current NAP measure to moderate and full implementation scenarios for that measure in each Member State. These findings have not been validated with Member States, and cannot be considered as exhaustive or fully accurate on the extent of implementation.

	None (N)		Moderate (M)	M	Requirement from Annex II and III
	Low (L)		Moderate to High (MH)		Regional AP (see study for details)
	Moderate to Low (ML)		High (H)		

Table 3 Assessment of extent of implementation based on potential for enhancement: MS

M	AT	BE	BG	HR	CY	CZ	DK	EE	FI	FR	DE	GR	HU	IE	IT	LV	LT	LU	MT	NL	PO	PT	RO	SK	SI	ES	SE	UK
1																												
2																												
3																												
74																												
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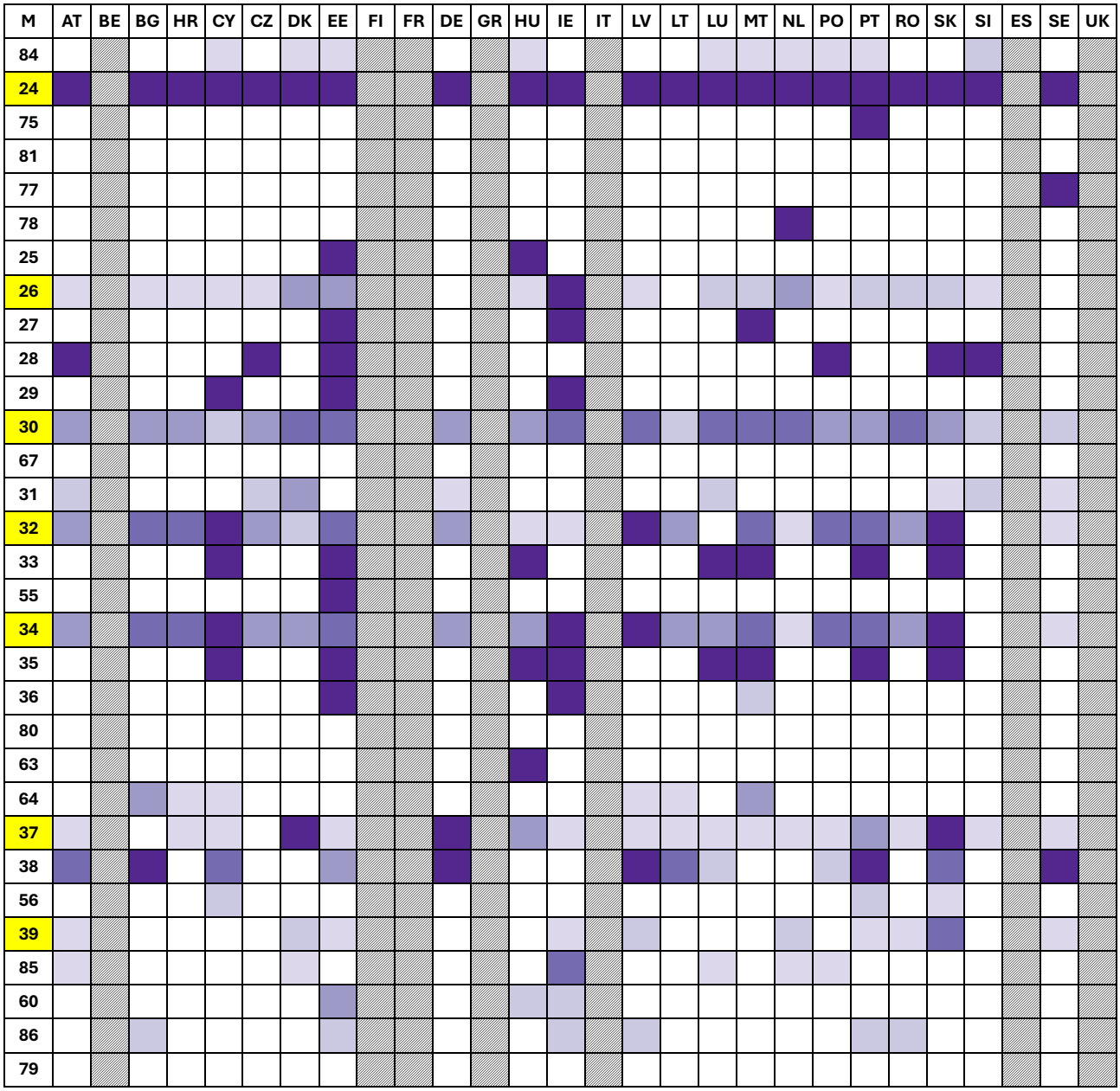


The analysis shows different scenarios for the implementation of the Annex II and III measures in the Member States nitrates action programmes:

I. Mandatory measure, implemented in all Member States, low variation, strong implementation:

e.g. M24 – manure application limit; M20 – manure storage

II. Mandatory measure, implemented in all Member States, high variation, moderate to strong implementation:

e.g. M30 – closed or prohibition periods when the application of fertilisers is prohibited; M32 - Distance between the application of inorganic fertilisers and surface water; M34 - Distance between the application of organic fertilisers and surface water

III. Mandatory measure, implemented in all Member States, high variation, weak to moderate implementation:

e.g. M26 – balanced fertilisation – Nitrogen field limit; M23. Climate and soil conditions that prohibit the use of fertilisers

IV. Voluntary measure, not implemented in all Member States, high variation, weak to moderate implementation:

e.g.M 61 – Fertilisation plan; M17 &18 – Record Keeping

The study therefore concludes that high variation does not necessary correlate with variation in the risk of nitrate loss, as some of the variation will be due to tailoring to regional circumstances. The study recognises that there is scope for MS/regions to learn from each other on the implementation of measures and how to improve their effectiveness, especially where regional circumstances are similar and where there are differences in the measures implemented.

3. Analysis of variation and risk coverage of closed periods

The above finding is further corroborated by a scientific article[9] analysing the implementation of closed periods in the Member States. This article shows that there is very high variation, including at regional level, in the implementation of closed periods which may be linked to maximal use of flexibility to adapt to local climate, agronomic and environmental conditions, and that this flexibility may rather help to maximise the risk coverage of the closing periods, thus minimising nitrates leaching and run-off, and may further have benefits on reducing other nitrogen emissions such as ammonia and nitrous oxide.

This article confirms the high variability in the implementation of closed periods between NAPs, in terms of different closed periods for different fertilisers, crops, conditions, etc. The study identifies 1155 different closed periods across 69 NAPs, ranging from a single closed period for all fertilisers (e. g. Malta) to multiple closed period dates depending on, for example, fertiliser type and crop (e.g. 109 different closed periods in Nouvelle Aquitaine, France) and shows that land use/crop and fertiliser type are the most common parameters used to vary closed periods, followed by region, and then soil type; all of which will vary spatially.

The study analyses the coverage of leaching and run-off risks for nitrates across the Member States, and further whether there are benefits for other emissions like ammonia (NH3) or nitrous oxide (N2O). The study finds that

- Each Member State takes account of the regional circumstances to determine how measures, such as closed periods, are implemented.
- There are many areas within different Member States that have a relatively high coverage of risk periods. These areas tend to be where closed periods cover the highest risk periods and apply to crops that are widely grown.
- Further, those Member States and regions which have highly tailored closed periods appear to provide higher coverage of risk periods, where closed periods are resulting in risk reduction across all the impact categories.
- There are also a few Member States and regions where coverage of risk periods is relatively low across many of the impact categories. For example, some Member States only have closed periods for organic fertilisers. This results in a lower coverage of risk periods especially for NO3 leaching, NO3 run-off and N2O emissions, where closed periods for inorganic fertilisers (with high readily available N) are of more importance.

[9] J. Tzilivakis et al, A broad-scale spatial analysis of the environmental benefits of fertiliser closed periods implemented under the Nitrates Directive in Europe, 2021. https://doi.org/10.1016/j.jenvman.2021.113674

The study further finds that risk reduction is spatially variable across all the impact categories and the scope for synergy is also variable. For example, it cannot be assumed that high coverage of risk periods for nitrate loss will always correlate with high coverage N2O and NH3 risk periods. It will depend on the specific combination of climatic, soil and agronomic factors within each region. There may be scope to explore how closed periods can be better used to tackle N2O and NH3 emissions, by exploring where closed periods in similar zones have resulted in higher coverage of risk periods.

4. Temporal evolution of nitrogen fertiliser input across the EU and analysis of variation and risk coverage of the implementation of balanced fertilisation

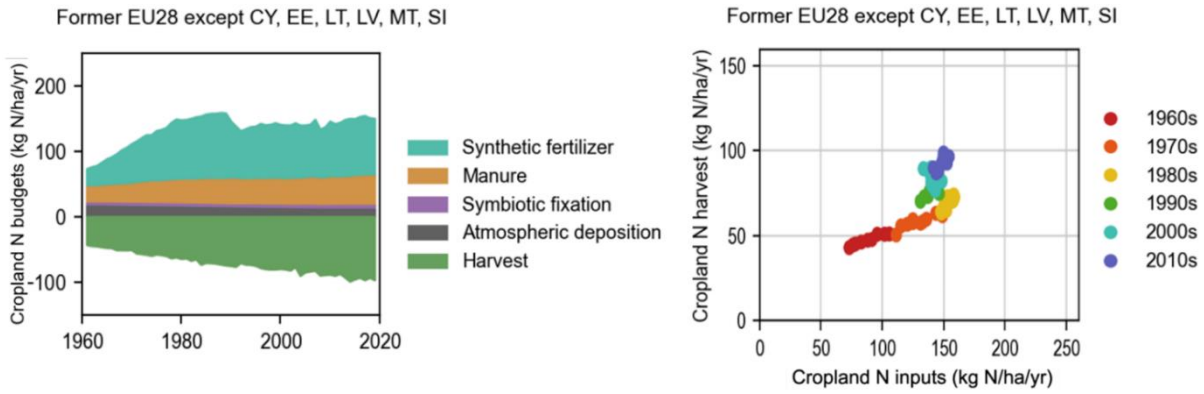
Growing plants requires relatively high concentrations of available N and P and that is why farmers add N and P to soil, via animal manure, fertilizers, composts, residues and wastes. However, the response of the crops decreases with increasing N and P availability, which is known as the law of diminishing returns (also called the law of diminishing marginal returns). Conversely, the risks of nitrate pollution of groundwater and surface waters and of eutrophication of surface waters increase with increasing N and P availability. Note, that the uptake efficiency by crops is always less than 100%, because of the heterogeneous distribution of available N in the soil and the heterogeneous distribution of the root system. Also, uptake of nutrients requires energy and at low nutrients concentrations the uptake of soil nutrients is less effective. Hence, some losses are inevitable, and therefore the purpose of balanced fertilisation is to ensure sufficient nutrients for plant growth while limiting those losses.

4.1 Temporal evolution of nitrogen fertiliser application in EU compared to other regions of the World

Over the past few decades, while global food production and fertilizer use in agriculture have increased, EU environmental legislation has limited the application of fertilizers in agricultural fields. Before the implementation of the Nitrates Directive, there was a significant increase in the application of synthetic fertilisers in the former EU28 with decreasing efficiency of N uptake by crops (between 1961 and the 1980s). This was followed by a break in the increase of nitrogen application in synthetic fertilisers around the 1990s and remains somewhat stable until 2010s. This is accompanied by increased efficiency of N uptake by crops, which resulted in higher harvest and thus minimises surplus N[10].

[10] Einarsson et al., 2021

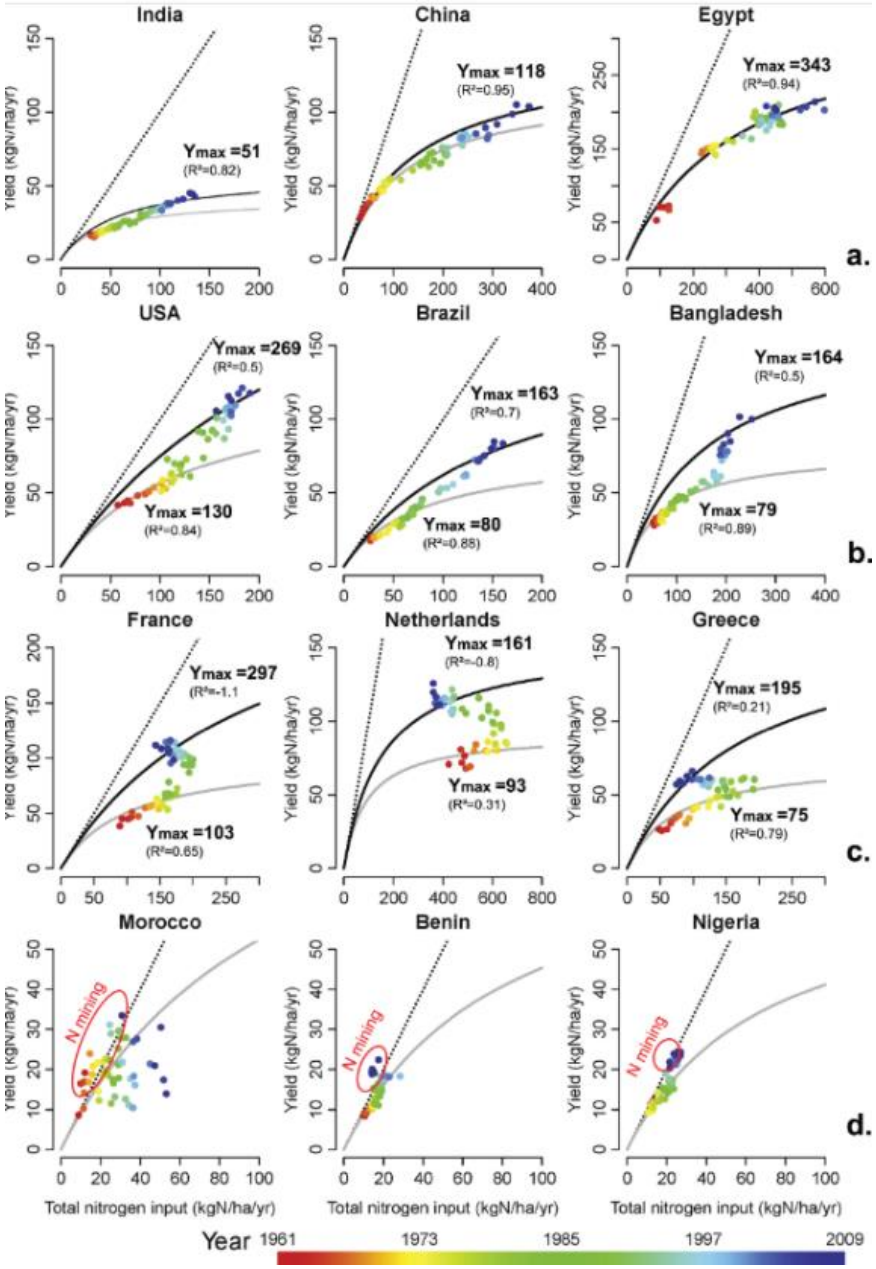
Figure 1 The left panel shows the cropland N budget in kg N/ha/year for the former EU28 countries, except Cyprus, Estonia, Lithuania, Latvia, Malta and Slovenia, between 1961 and 2019. The right panel shows the trajectory regarding total cropland N harvest and total N input rate to cropland (synthetic fertiliser, manure, symbiotic fixation, and atmospheric deposition) during the same period.



Lassaletta et al. (2014)[11] also analysed the long-term relationship (1961-2009) between crop yields and nitrogen input in cropland. In most European countries, they observed a trend towards increased yields without corresponding increases in fertilization, and in some cases, even decreases in fertilization rates. This shift can be attributed to the impact of EU environmental legislation, in particular the requirement of balanced fertilisation in the Nitrates Directive. In contrast, other regions of the world, such as the USA, China, India, and Brazil, have seen rising nitrogen fertilization rates. The graphs below show the relationship between the yields (y axis) and the nitrogen application rate (x axis), with dots representing years from 1961 to 2009. The graphs show a characteristic backwards curve in EU MS, indicating a reduction in fertiliser inputs but continued increase in yields.

[11] Lassaletta, L., Billen, G., Grizzetti, B., Anglade, J., Garnier, J., 2014. 50 year trends in nitrogen use efficiency of world cropping systems: The relationship between yield and nitrogen input to cropland. Environ. Res. Lett. 9. https://doi.org/10.1088/1748-9326/9/10/105011

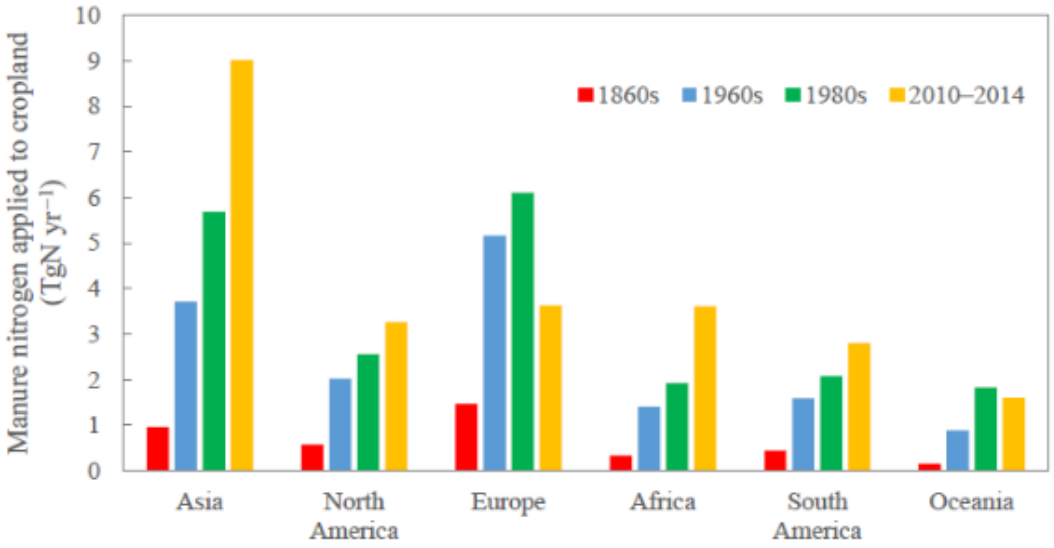
Figure 2 Temporal evolution of nitrogen fertiliser application in EU compared to other regions of the World



Moreover, Europe is the only region, apart from Oceania, where the application of manure nitrogen to cropland has decreased significantly between 2010-2014 compared to the 1980s, with Oceania experiencing a slight decline (Zhang et al., 2017). The graph below shows changes in manure nitrogen amount applied to cropland at the continental level (source Zhang et al. 2017)[12].

Figure 3 Evolution of manure nitrogen applied to cropland at the continental level

[12] Zhang, B., Tian, H., Lu, C., Dangal, S.R.S., Yang, J., Pan, S., 2017. Global manure nitrogen production and application in cropland during 1860–2014: a 5 arcmin gridded global dataset for Earth system modeling. Earth Syst. Sci. Data 9, 667–678. https://doi.org/10.5194/essd-9-667-2017



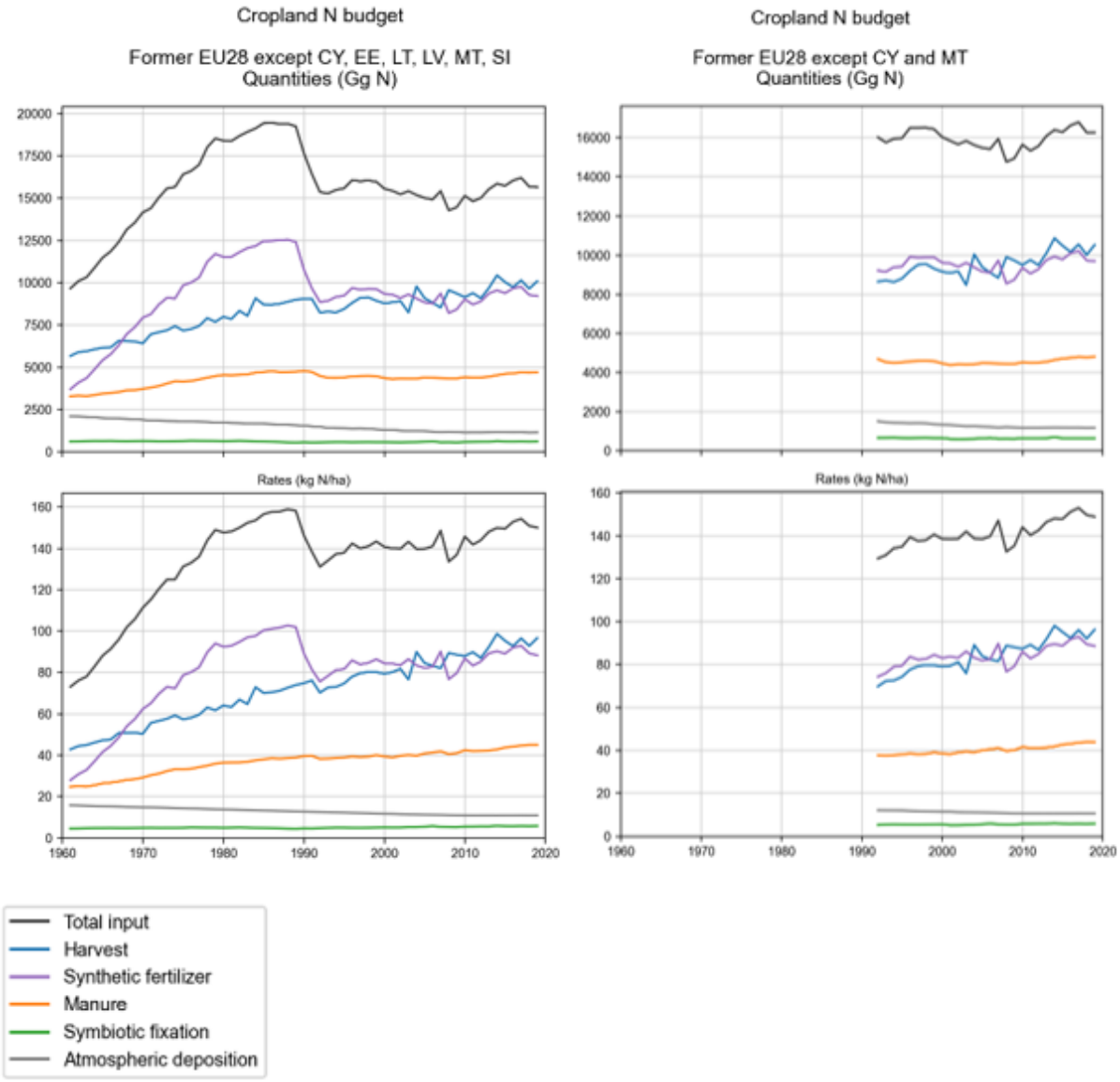
4.2 Temporal evolution of nitrogen input in EU considering political and economic changes (1961-2019)

Einarsson et al. (2021)[13] present a comprehensive overview of crop production and nitrogen use in European cropland and grassland, covering the period from 1961 to 2019, based on official statistical data.

Overall, in the EU28, the total production of manure (in terms of nitrogen content) increased from the 1960s to the 1990s, and then remained relatively stable, although a slight uptrend can be observed after 2010. However, the trend in nitrogen input from synthetic fertilizers and manure varied across countries and was influenced by a range of factors, including political and socio-economic conditions, as well as the development of the Common Agricultural Policy (CAP) and EU environmental legislation.

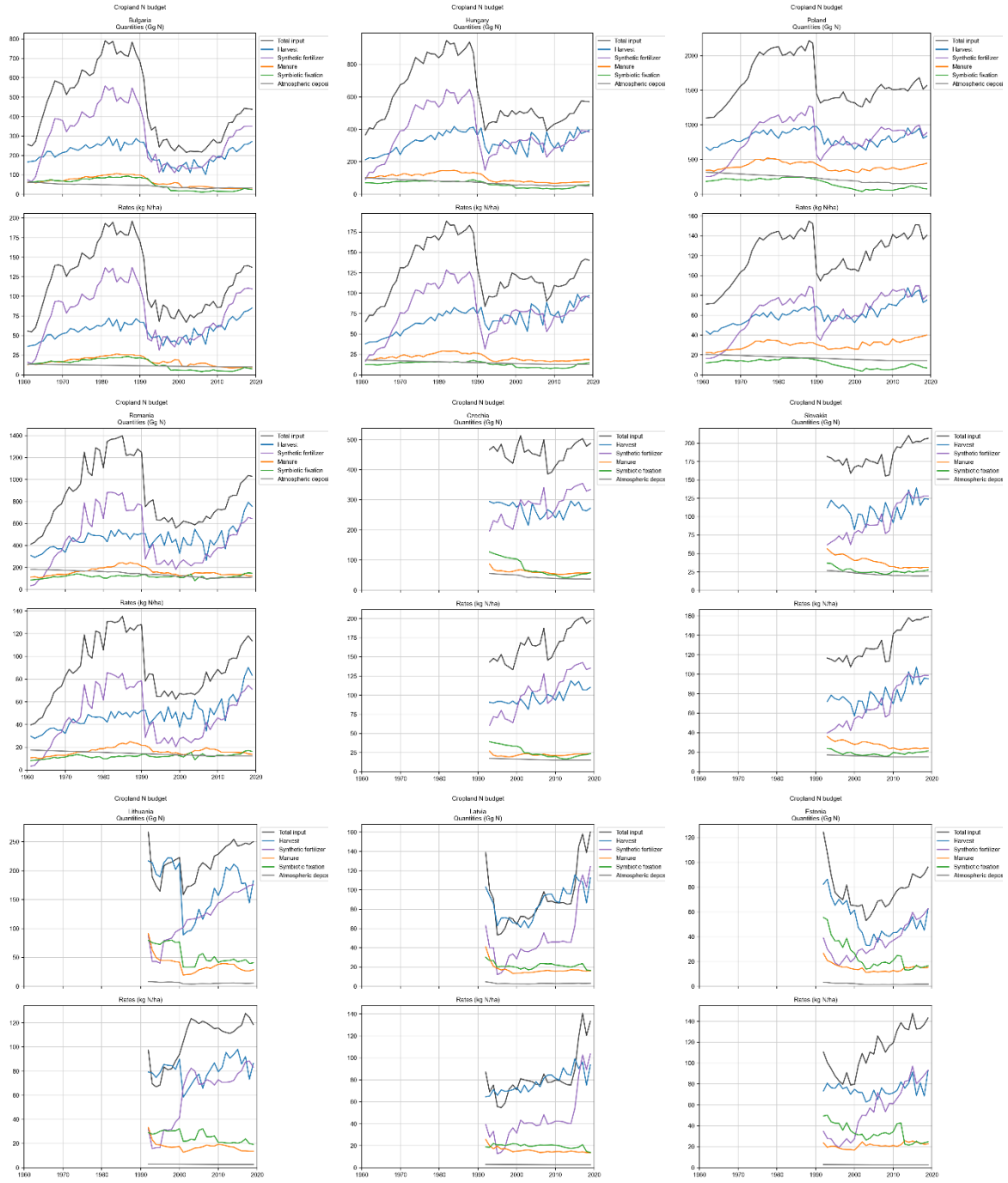
[13] Einarsson, R., Sanz-Cobena, A., Aguilera, E., Billen, G., Garnier, J., van Grinsven, H.J.M., Lassaletta, L., 2021. Crop production and nitrogen use in European cropland and grassland 1961–2019. Sci. Data 8, 288. https://doi.org/10.1038/s41597-021-01061-z

Figure 4 Cropland nitrogen budget (quantities (Gg N) and rates (kg N/ha)) in the former EU28



Countries that were formerly part of the Soviet bloc experienced a decline in manure production around 1990, coinciding with the Eastern European revolutions of 1989 and the collapse of the Soviet Union. Subsequently, manure production generally stabilized following the accession of these countries to the European Union, with the first wave of accession occurring in 2004 (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia) and a second wave in 2007 (Bulgaria and Romania). However, Poland and Estonia were exceptions to this trend, as they experienced a slight increase in manure production after 2010. The use of synthetic nitrogen fertilisers have increased in all countries since 1990s.

Figure 5 Cropland nitrogen budget (quantities (Gg N) and rates (kg N/ha)) in Member States, who joined the EU in 2004 and 2007 (Bulgaria, Hungary, Poland, Romania, Czechia, Slovakia, Lithuania, Latvia and Estonia)



In Western Europe, since the 1990s the use of nitrogen mineral fertilizers has been decreasing or remaining stable. The use of nitrogen from manure has remained relatively stable in Sweden, Finland, and Greece, while increasing in the Netherlands, Denmark, Austria, Spain, and Italy.

Figure 6 Cropland nitrogen budget (quantities (Gg N) and rates (kg N/ha)) in Western Europe (Sweden, Finland, Greece, Netherlands, Denmark, Austria, Spain and Italy)

In France, Belgium, and Luxembourg, mineral fertilization has been relatively stable, while manure application peaked in the 1990s. In Portugal, the total amount of manure has decreased since the 1990s, but the application rate per hectare has increased, indicating an intensification of agricultural practices. In Germany, mineral fertilization has decreased since 2010, while manure application has slightly increased. In Ireland, trends in nitrogen fertilisers have been influenced by the economic crisis of 2008. Additionally, several European countries have seen a decrease in the use of synthetic fertilizers in 2008 and 2022, largely due to peak fertilizer prices (Snapp et al. 2023)[14].

[14] Snapp, S., Sapkota, T.B., Chamberlin, J., Cox, C.M., Gameda, S., Jat, M.L., Marenya, P., Mottaleb, K.A., Negra, C., Senthilkumar, K., Sida, T.S., Singh, U., Stewart, Z.P., Tesfaye, K., Govaerts, B., 2023. Spatially differentiated nitrogen supply is key in a global food–fertilizer price crisis. Nat. Sustain. 6, 1268–1278. https://doi.org/10.1038/s41893-023-01166-w

The evolution of the Common Agricultural Policy (CAP) and the implementation of the EU environmental legislation (in particular the Nitrates Directive established in 1991 as well as the Water Framework Directive introduced in 2000) has also influenced the application of synthetic and manure nitrogen fertilisers.

Major reforms of the CAP:

- 1962 the CAP is established. Increase productivity, support the market price
- 1984 Milk Quota introduction
- 1992 MacSharry Reform, shift to producer support, direct income to farmers, set-aside
- 2003 Fischler Reform, income support, decoupling subsidies and production
- 2013 CAP reform, greening of the CAP, sustainable farming and innovation, rural development
- 2015 Milk Quota abolished
- 2018 New CAP legislation proposal, 2021-2022 transitional period
- 2023 CAP Reform, CAP 2023-2027 entered into force, CAP Strategic Plans
- 2025 First performance review of each CAP Strategic Plans

Figure 7 Cropland nitrogen budget (quantities (Gg N) and rates (kg N/ha)) in Western Europe (France, Belgium and Luxembourg, Portugal, Germany and Ireland)

4.3 Analysis of variation and risk coverage of the implementation of balanced fertilisation

The study of Tzilivakis et al. of 2020 showed that balanced fertilisation as a mandatory measure is implemented in all Member States, that there are large variations in the national implementation and that there seems to be overall an important potential for enhancement.

The large variation in implementation is further confirmed by an analysis done in 2022 comparing the ranges or maximum fertilisation rates for a set of crops across the NAPs in a number of Member States[15] in similar climatic zones, and comparing those to the recommendations for establishing action programmes from 2011[16].

The analysis found that N application levels included in the NAPs of the different Member States/Regions investigated in this study are following different methodologies. First, some MS/Regions do not regulate N application via fixed N-field limits, but have other methodologies, where farmers need to, for example, calculate fertilisation rates according to the N nutrient balance and some indicative average N requirements for a certain yield. This is the case for example in Germany, several Regions (and for differing crop groups) in France and in Poland for large farms. Second, in other regions, for example Wallonia in Belgium, no differentiation of field N limits for different crop groups is made, only field N limits for arable and grassland exist. Similarly, in Romania, field N limits differentiate for different crops for mineral fertilizer only, for animal manure a blanket threshold of 170 kg NT/ha exists. Third, in Ireland, field N limits per crop are differentiated based on the ability of soil to supply N, defined by a soil N index. Fourth, for example in the Denmark, Netherlands, Bulgaria and Belgium (Flanders) field N limits per crop are differentiated per soil type. In a few Member States field N limits per crop are further differentiated in function of water quality. Fifth and final, for example in Denmark, Luxembourg, Austria, Czech Republic, Slovakia and Hungary, field N limits are differing per crop and per estimated yield of the respective crop.

The difference in yield is either defined in categories (Austria, Czech Republic, Slovakia and Hungary) or with a yield adjustment factor per unit yield difference (Luxembourg, Denmark). Additionally, the yield differences are estimated according to soil type (Denmark), soil type and the ability of the soil to supply N (Hungary) and soil type and climate (Czech Republic).

The 2011 Recommendations for the measures of Annexes II and III of the Nitrates Directive[17] have been made specific for thirteen pedo-climatic (sub) zones in the European Union. Pedo-climatic zones have specific ranges for crop growth potential, surface runoff risk potential and leaching risk potentials. Pedo-climatic zones are based on climate, landform and soil type characteristics, as illustrated in the three figures below.

Figure 8 Environmental Stratification of Europe

[15] In Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Luxembourg, Netherlands, Romania, Slovakia.

[16] Recommendations for establishing Action Programmes under Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources, 2011, Contract number N° 07 0307/2010/580551/ETU/B1

[17] idem

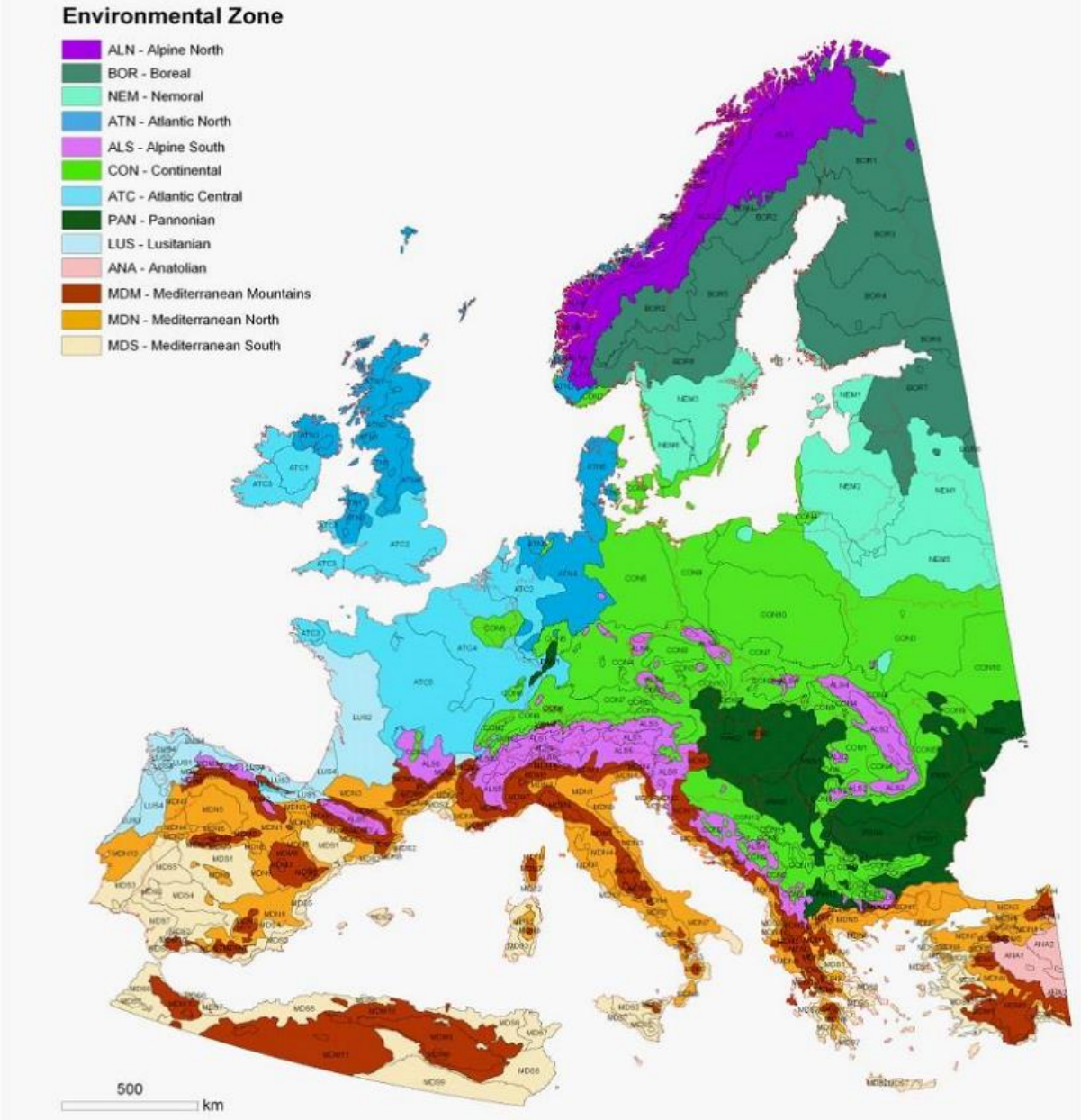
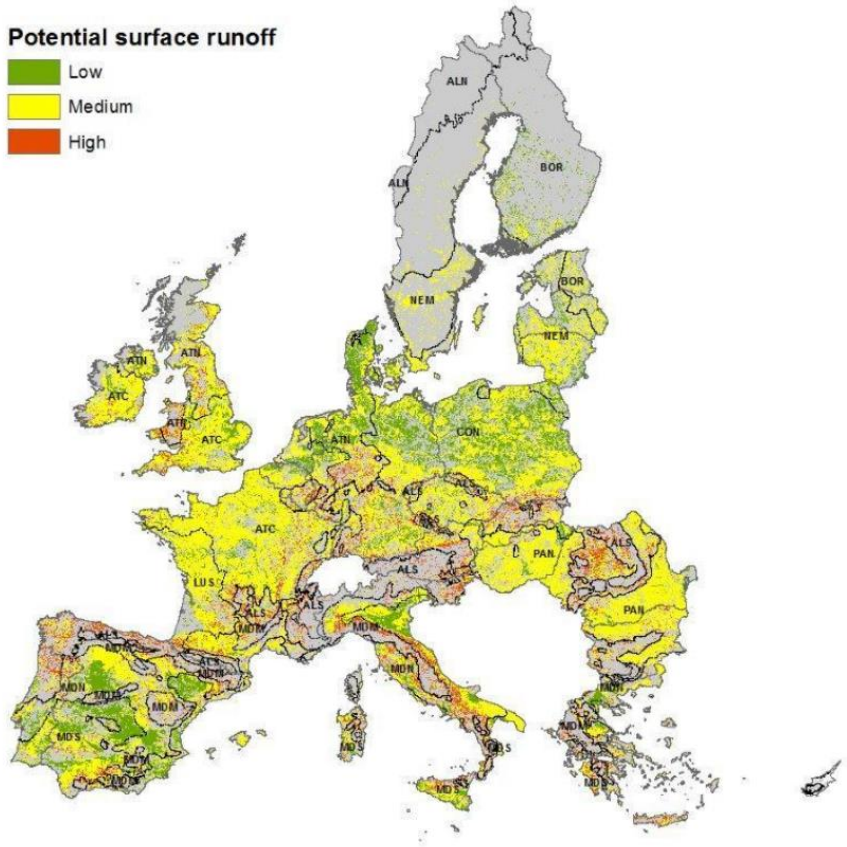
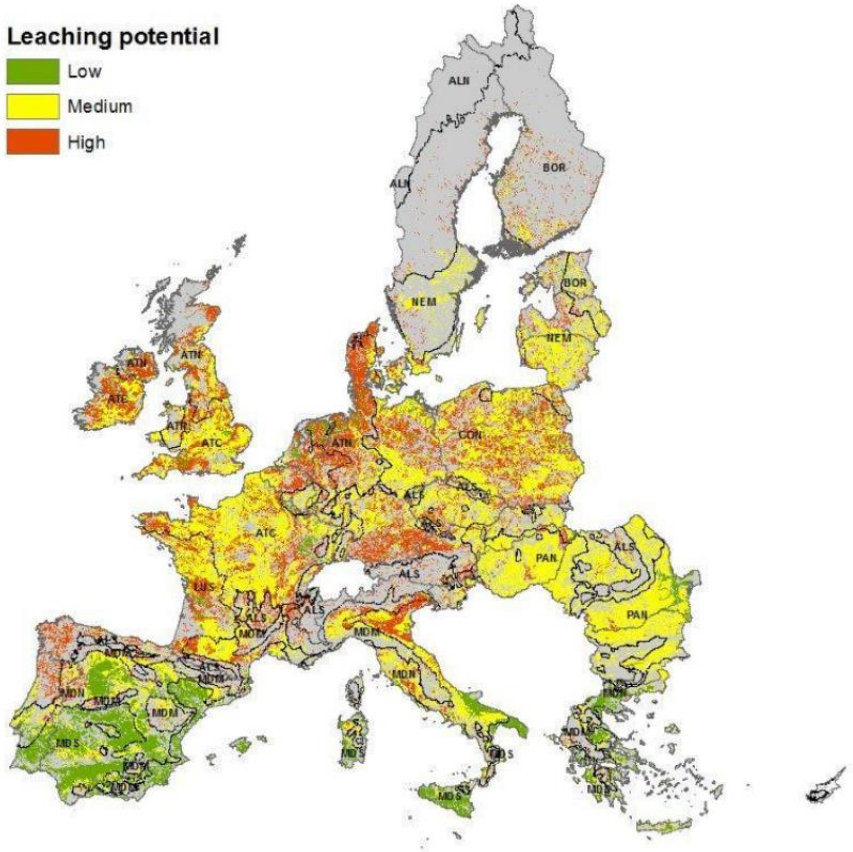


Figure 9 Map showing potential runoff risk for agricultural land within the Environmental Zones in the EU27



Note: grey areas indicate non-agricultural areas.

Figure 10 Map show leaching risk potential for agricultural land within the Environmental Zones in the EU27



The 2011 Recommendations have established recommendations for balanced fertilisation in relation to the risks of leaching and run-off and provided indicative N

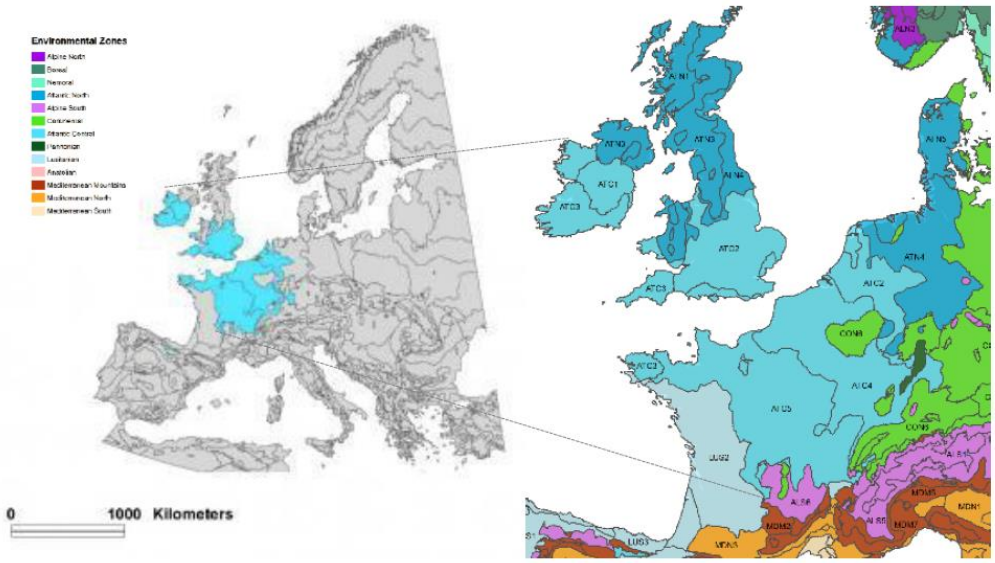
recommendations (kg N per ha per year) for major crop species per environmental zone. These recommendations are based on statistical records of crops yields. For each zone there are three ranges of N recommendations per crop in function of the risk of leaching and run-off (low/medium/high). The study notes that indicative N applications for the areas with medium and high risks for leaching and surface runoff may lead to a decrease in crop yield and quality, and that lower application rates may be needed in case receiving water bodies are very polluted.

For the purpose of the ND evaluation, we have selected two major EU agriculture production zones as examples to illustrate both the variation and the extent of risk coverage: the Atlantic Central Zone and the Continental Zone.

Atlantic Central Zone

The Atlantic Central Zone (ATC) includes the south west and south of the British Isles, Northern France and the Low countries. The ENZ-ATC covers 10% of Germany, 68% of the Netherlands, 89% of Ireland, 58% of Luxembourg, 66% of Belgium, and 49% of France.

Figure 11 Map of Atlantic Central Zone



Common crops are cereals, maize, potatoes, rapeseed, sugar beet, grasslands and vegetables. Potential crop yields and N demand by the crop are relatively high, due to the relatively long growing season, with on average sufficient rainfall. Indicative N application rates are presented below for the dominant crops as function of the leaching risk potential (in kg per ha per year). Note that the indicative N applications for the areas with medium and high risks for leaching and surface runoff may lead to a decrease in crop yield and quality. Lower application rates may be needed in case receiving water bodies are very polluted.

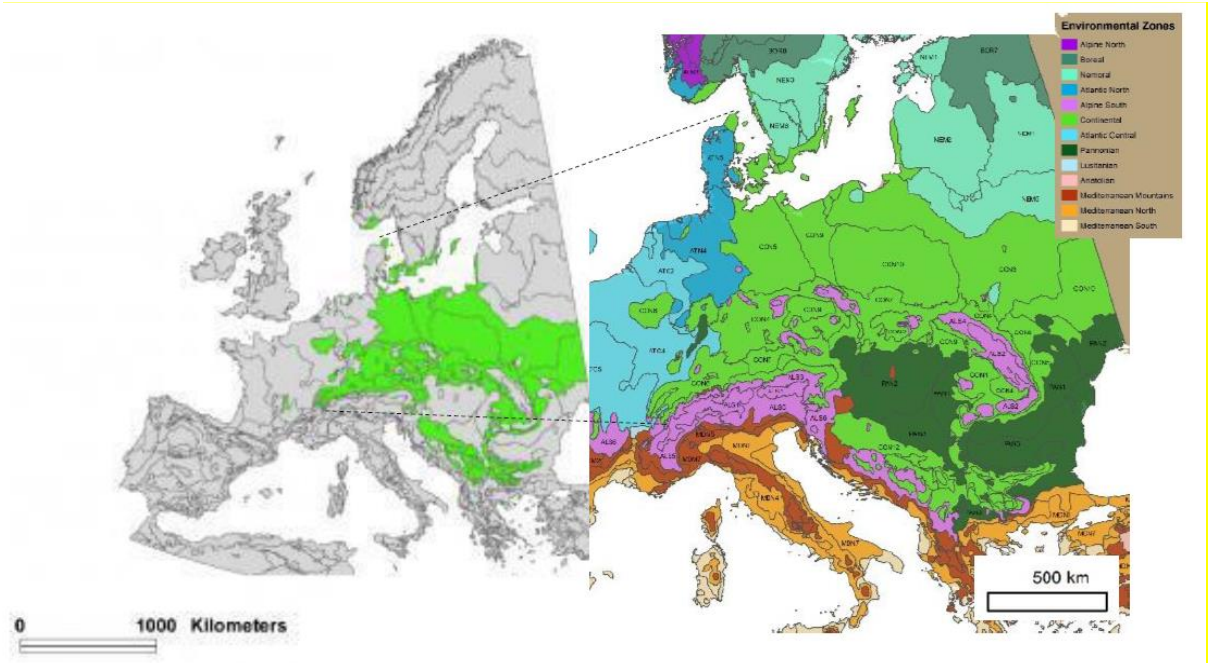
Risk	Wheat	Grain maize	Other cereals	Rapeseed	Potatoes	Sugar beets	Vegetables	*Grass land*	Silage maize
Low	130-220	140-230	100-170	100-160	200-250	130-200	130-210	*150-250*	150-250
Medium	80-130	80-130	50-90	50-90	120-200	130-200	70-110	*140-230*	90-150
High	50-80	50-80	30-50	30-50	80-130	90-150	40-70	*100-170*	60-90

Continental Environmental zone.

It covers vast areas in Central Europe: 82% of Czech Republic, 63% of Germany, 93% of Poland, 34% of Denmark, 70% of Slovakia, 42% of Austria, 8% of Hungary, 45% of Switzerland, 35 % of Romania, 31% of Bulgaria, 34% of Belgium, 42% of Luxembourg,

3% of France (Figure 12). The relevant European Member states/regions in this area are Austria, Belgium (Wallonia), Bulgaria, Czech Republic, Denmark, France (Grand Est, Auvergne - Rhône-Alpes and Bourgogne - Franche-Comté), Germany, Hungary, Luxembourg, Poland, Romania and Slovakia. Among those Member States, Austria, Bulgaria, Czech Republic, Denmark, Hungary, Luxembourg, Poland, Romania and Slovakia define clear field limits.

Figure 12 Map of Continental Environmental Zone



Common crops are cereals, maize, sunflowers, sugar beet, grasslands and vegetables. Potential crop yields and N demand by the crop are relatively high, due to the relatively long growing season, but with temporary droughts. Irrigation is therefore quite common, especially in high-value crops. Indicative N application rates are presented below for the dominant crops as function of the leaching risk potential (in kg per ha per year). Note that the indicative N applications for the areas with medium and high-risks for leaching and surface runoff may lead to a decrease in crop yield and quality. Lower application rates may be needed in case receiving water bodies are very polluted. Note that the recommended rates are usually lower in the Continental Zone compared to the Central Atlantic.

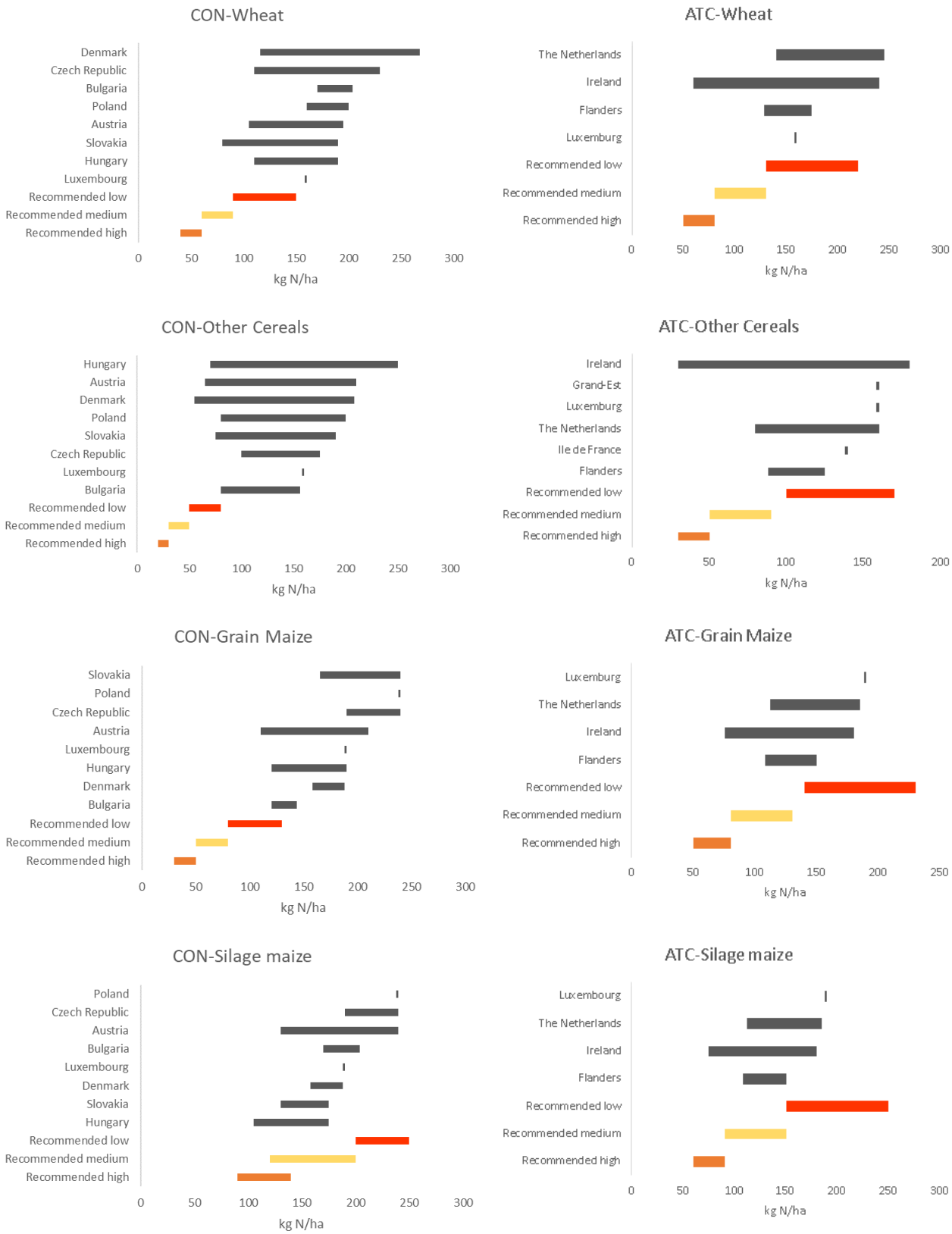
Risk	Wheat	Grain maize	Other cereals	Sun flower	Potatoes	Sugar beets	Vegetables	*Grassland*	Silage maize
Low	90-150	80-130	50-80	40-60	90-150	130-200	100-170	*80-140*	200-250
Medium	60-90	50-80	30-50	20-30	50-90	100-160	60-100	*50-80*	120-200
High	40-60	30-50	20-30	10-20	30-60	70-120	40-70	*30-60*	90-140

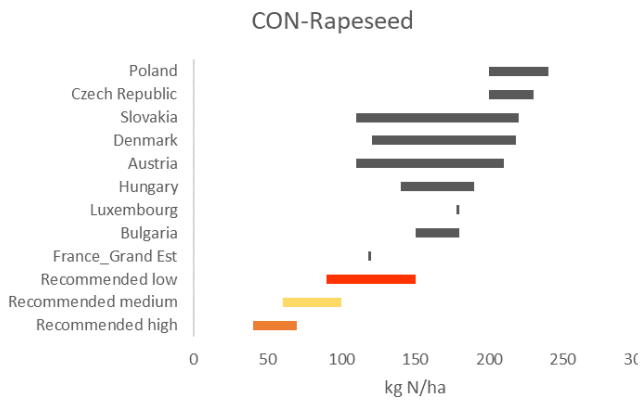
Comparisons

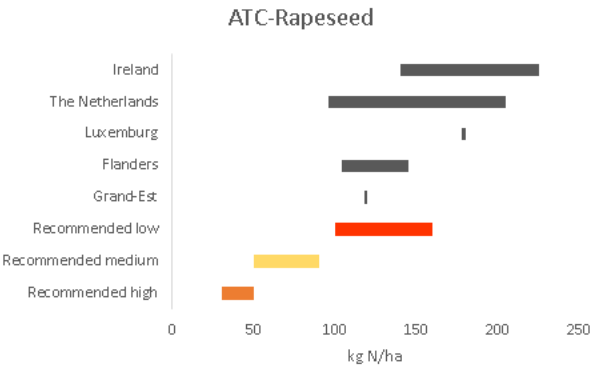
In 2022, a comparison was made of the main fertilisation rates for the main crops among Member States in the Continental and Atlantic central pedo-climatic zones and with the

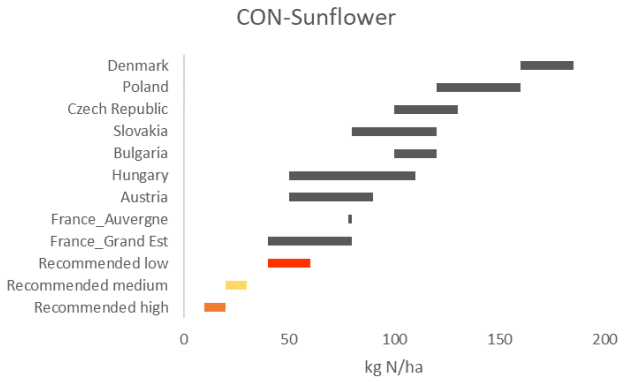
2011 recommendations. It is important to note that this is given as an illustration of the implementation in the Member States based on the available information in the national and regional action programmes but does not intend to be exhaustive or reflect all the specific situations and exceptions of the action programmes.

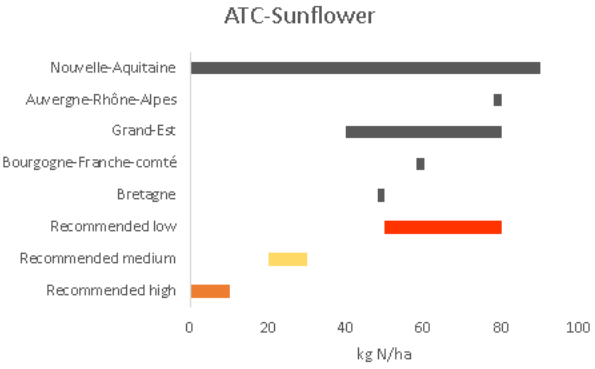
Figure 13 Schematic comparison of the Member states' of regional ranges of field limits together with the recommended limits for the Continental and the Atlantic central zone.

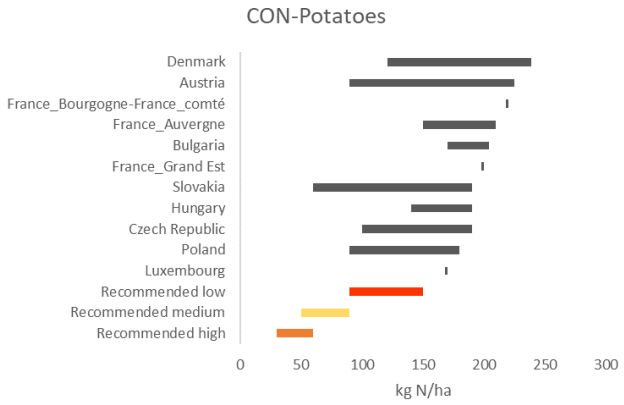


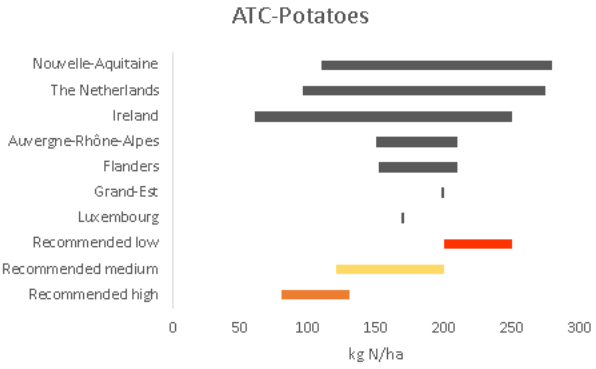

CON-Rapeseed
Poland
Czech Republic
Slovakia
Denmark
Austria
Hungary
Luxembourg
Bulgaria
France_Grand Est
Recommended low
Recommended medium
Recommended high
0
50
100
150
200
250
kg N/ha

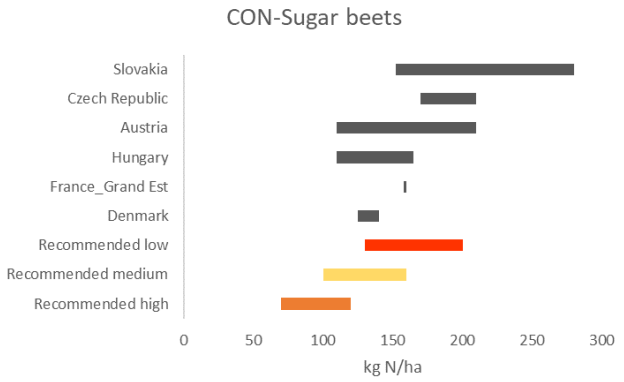

ATC-Rapeseed
Ireland
The Netherlands
Luxemburg
Flanders
Grand-Est
Recommended low
Recommended medium
Recommended high
0
50
100
150
200
250
kg N/ha

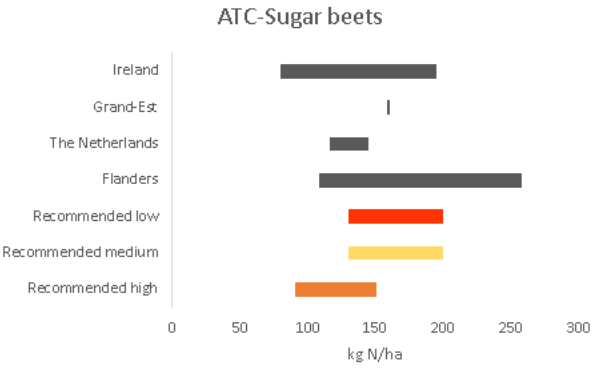

CON-Sunflower
Denmark
Poland
Czech Republic
Slovakia
Bulgaria
Hungary
Austria
France_Auvergne
France_Grand Est
Recommended low
Recommended medium
Recommended high
0
50
100
150
200
kg N/ha

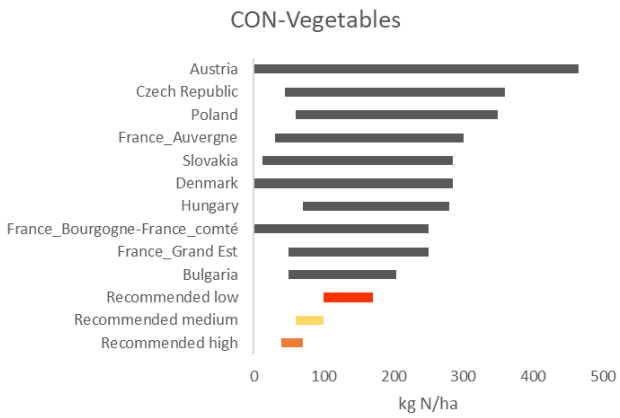

ATC-Sunflower
Nouvelle-Aquitaine
Auvergne-Rhône-Alpes
Grand-Est
Bourgogne-Franche-comté
Bretagne
Recommended low
Recommended medium
Recommended high
0
20
40
60
80
100
kg N/ha

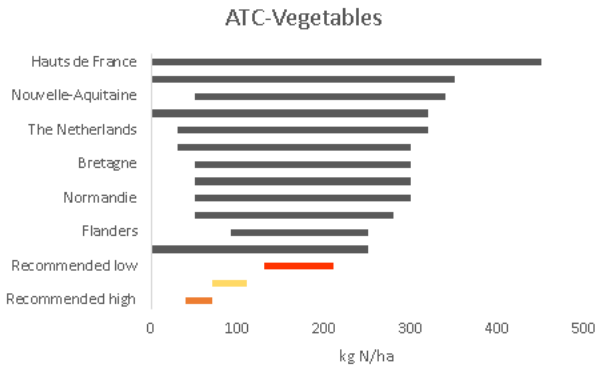

CON-Potatoes
Denmark
Austria
France_Bourgogne-France_comté
France_Auvergne
Bulgaria
France_Grand Est
Slovakia
Hungary
Czech Republic
Poland
Luxembourg
Recommended low
Recommended medium
Recommended high
0
50
100
150
200
250
300
kg N/ha

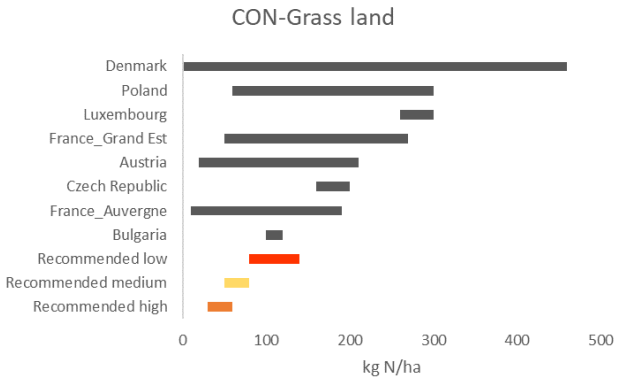

ATC-Potatoes
Nouvelle-Aquitaine
The Netherlands
Ireland
Auvergne-Rhône-Alpes
Flanders
Grand-Est
Luxembourg
Recommended low
Recommended medium
Recommended high
0
50
100
150
200
250
300
kg N/ha

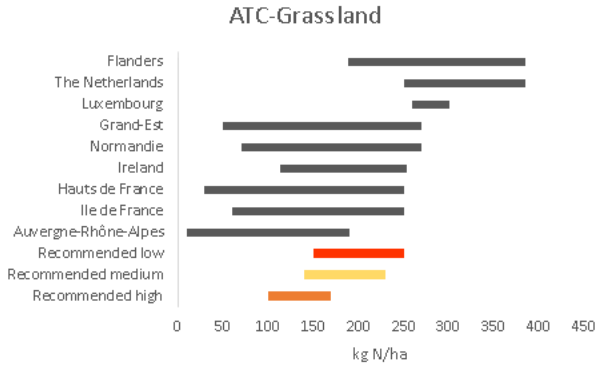

CON-Sugar beets
Slovakia
Czech Republic
Austria
Hungary
France_Grand Est
Denmark
Recommended low
Recommended medium
Recommended high
0
50
100
150
200
250
300
kg N/ha


ATC-Sugar beets
Ireland
Grand-Est
The Netherlands
Flanders
Recommended low
Recommended medium
Recommended high
0
50
100
150
200
250
300
kg N/ha









From this comparison, it appears that the

- fertilisation rates vary (sometimes significantly) between Member States, even in the same pedo-climatic zone.
- For many crops the fertilisation ranges in Member States would correspond to the *low risk* range recommendation, even when the Member State or part of it would be in a *high or medium risk* range
- In the continental zone, for many crops the fertilisation ranges in the Member States are significantly higher than the *low risk* range recommendation. It also needs to be noted that the 2011 recommendations are generally lower for the continental pedo-climatic zone, so that the ranges implemented in practice are not in effect always so different between the zones.

Analysis

These examples illustrate how MS are using the flexibility provided by the Directive in setting limits on the application of fertilisers in line with the balanced fertilisation as required in Annex III. Echoing the findings in the Tzilivakis et al. study, the examples illustrate that the fertilisation application limits set by the MS often overshoot the recommended limits for low risk areas, and that in many cases the ranges do not seem to encompass the higher risk of nitrogen losses in high and medium risk areas, which would according to the 2011 recommendations require a lowering of the fertilisation limits. In this case, it appears that the flexibility given by the directive is not only used as an adaptation to local conditions but that other factors are influencing. In particular, the

market pressure for high yields and production often overweigh the precautionary approach which would be required in areas with medium to high risks of leaching or run-off while MS do not sufficiently take into account the water quality objectives in areas with already very polluted waters. Consultations with the MS confirmed that in most cases the fertilisation rates were set so as to optimise yields based on economic calculations. This is also illustrated by the cost analysis which found that the cost of implementing the balanced fertilisation requirement is negligeable (see section 4).

Applying lower rates, which in some areas would be more effective for reducing water pollution or in line with the precautionary principle, entails the risk of lower yields or lower quality (e.g. lower protein content). The JRC study[18] has found that in some regions of the EU with high nutrient balances (mainly as a result of high livestock concentration and manure application) a reduction of up to 25% of mineral fertilisers would have a negligeable impact on yields for green and grain maize.

The choice of keeping high fertilisation rates in high-risk areas does not necessarily mean that the NAP will not be effective as a whole, but it has impacts on the design of the NAP if it needs to remain effective in reducing and preventing pollution. To avoid a reduced effectiveness of the NAP in the longer term, once the low hanging fruits have been picked, it can become necessary for Member States to strengthen other measures or adopt additional measures outside the NAP, in order to be able to maintain high fertilisation rates in high-risk areas. At the same time, reduced fertilisation rates have been implemented in a number of Member States with intensive agriculture, often targeting the most polluted areas (e.g. Germany and the Netherlands). Some of the measures have been imposed as a result of enforcement action by the Commission, and reduced fertilisation rates are unpopular with farmers.

5. Variation and risk coverage in the implementation of the manure application limit

The manure application limit is set at EU level and applies throughout the EU in all nitrate vulnerable zones. As shown in Tzilivakis et Al (2020), the measure is implemented in all Member States and the extent of implementation is considered overall strong. However, there remain important flexibilities linked to its implementation, which may impact its effectiveness.

It is for the Member States to specify the formulas for determining the **content of nitrogen and phosphorous in each type of manure**, at production, storage and application. The underestimation of nitrogen content of manure could lead to a systemic over fertilisation by manure and affect the effectiveness of the Directive. Such figures therefore need to be regularly updated based on empirical evidence. For example, livestock breeding aiming to increase productivity tends to increase excretion over time and changes in stable and storage technology may alter the level of ammonia emissions from farm buildings, leading to higher nitrogen content in the manure applied to fields.

[18] (Pacifico et al., 2024) as summarised in the JRC study Assessing the effectiveness of the Nitrates Directive: implications for agriculture and for water, soil and air quality (2025),

Another aspect is the assessment of the share of nitrogen in manure that is made available for the crop during the growing season. Such estimates will not affect the calculation in relation to the 170 kg/ha limit, but it will affect the calculation in relation to the overall amount of fertiliser that can be applied. If the fertiliser equivalence for the manure estimate is too low, there is a higher risk of leaching, as the overall the crop will be overfertilised.

As the limit applies at farm level, MS have the possibility to impose **limits at field level**. For example, some Member States impose a maximum percentage of exceedance per field, as they have found that the flexibility has sometimes led to large overapplication of manure on a limited number of fields of the farm, thereby increasing the risk of N and P losses.

MS are also free to impose lower limits for manure, for example in relation to the risk of eutrophication due to the imbalance of nitrogen vs **phosphorous in manure**. Long term high levels of manure application may result in phosphorous saturation of the soils, which is a major cause of eutrophication due to erosion or hydrology. The Nitrates Directive indirectly limits P application by manure, due to the limit of N application from manure, which is 170 kg ha^{-1} $year^{-1}$. However, using estimates of N-P ratios in different manure types, the nitrogen application rates may be higher than the required P inputs, especially in livestock dense regions where there tends to be a high accumulation of P. Limit values on manure application based on P requirements, would generally result in lower N application limits than what is currently allowed in the Nitrates Directive. (see below measures on P). Imposing limits on phosphorus in manure can be an effective way to implement the manure limit, addressing the risks of nitrogen and phosphorus pollution at the same time. Some Member States use this approach.

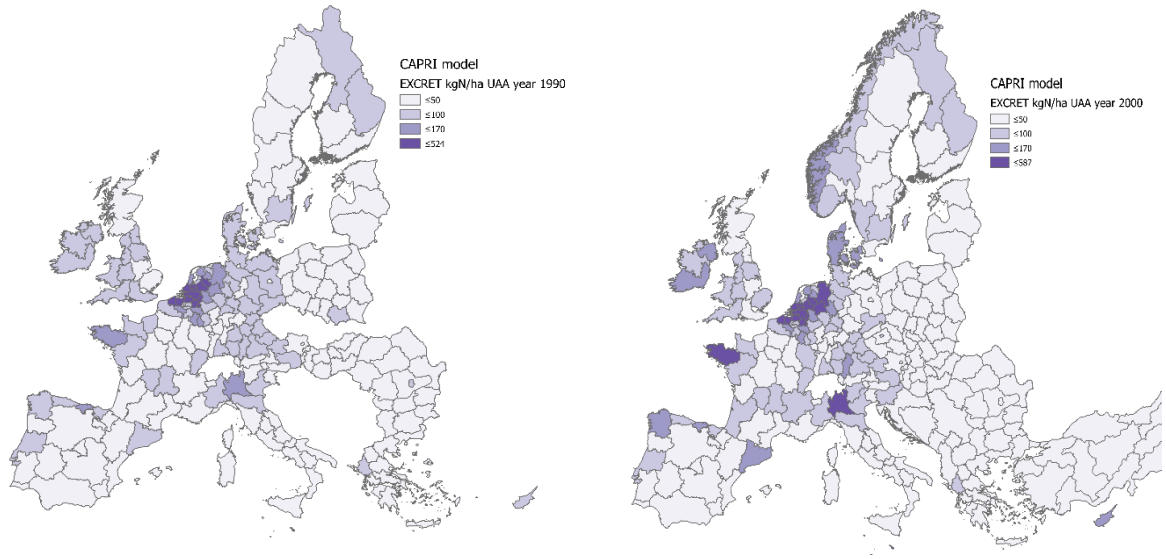
As the Nitrates Directive does not impose a limit on **manure production** per farm, there is also the flexibility for Member States to allow that farms produce more manure than they can apply on land. When a farm produces more manure than it can apply, the excess manure needs to be disposed of. The most economic way with least environmental impacts is when the excess manure can be used as fertiliser on crop fields from another farm nearby. Local biogas or manure processing plants can also serve as local hubs that allow redistribution of the processed manure among farms in the region. As long as the cumulative amount of manure produced on the farms in a given region remains well below the amount of manure that can be easily transported and applied on land in the same region in line with the manure application limit and balanced fertilisation limits, the flexibility profits all farms in the region (both those in need of disposing of excess manure and those receiving it) and the risks of nitrogen losses associated with this flexibility remain relatively low. However when the cumulative manure production on the farms in a given region exceeds the total amount of manure that can be easily transported and applied on land in the same region in line with the manure application limit and balanced fertilisation limits, both the costs for farmers to dispose of the manure and the risks of nitrogen losses (nitrates in water, ammonia in the air) increase, due to the high total concentration of nitrogen from manure in the same region. The mismatch between manure production and potential for manure application at regional level can have a negative impact on the effectiveness of the Nitrates Directive. In the long term,

nutrient pollution hotspots can develop with high nitrogen losses to the air, soil and water with cascading pollution impacts on all waters, on nature and human health[19].

The JRC study shows the evolution of manure production per NUTS 2 region in the EU in 1990, 2000, 2010 and 2018. While the maps clearly show that the majority of regions in the EU have maintained a manure production level far below the Nitrates Directive limit, there are a number of NUTS2 regions where the average manure production remains high between 100 and 170 kg N/ha UAA, and the maps also show the nutrient hotspots in the EU with average production at NUTS2 level above 170 kg N/ha of UAA. Even though most regions remain well below the established limit, the Nitrates Directive plays a crucial role in maintaining this status and in identifying nutrient hotspots where targeted measures should be implemented to prevent water pollution. The manure limit set by the directive has been effective in reducing nitrate pollution, eutrophication, and, to some extent, ammonia emissions. The manure limit aims to address high concentrations of livestock in certain regions as well as individual farms, which lead to excessive manure application and pose an additional risk of nitrogen losses.

The graphs below show the evolution of manure production over time for a selected number of countries and regions.

Figure 14 Nitrogen in manure production (EXCRET: Nitrogen in excretion of animals) per hectare of Utilised Agricultural Area (UAA) for NUTS2 regions in 1990, 2000, 2010 and 2018, as estimated by the CAPRI model.



[19] 2022 Medium-term EU Agricultural Outlook (EC, 2022, Chapter 7) explores scenarios limiting the livestock density to 2 LSU/ha UAA at NUTS2 level and at 10km x 10km grid level. In such scenarios nitrates leaching and run-off would be overall reduced between 4 % to 10%. However, in hotspots regions, the reductions could reach up to 50%. (Source JRC study 2025)

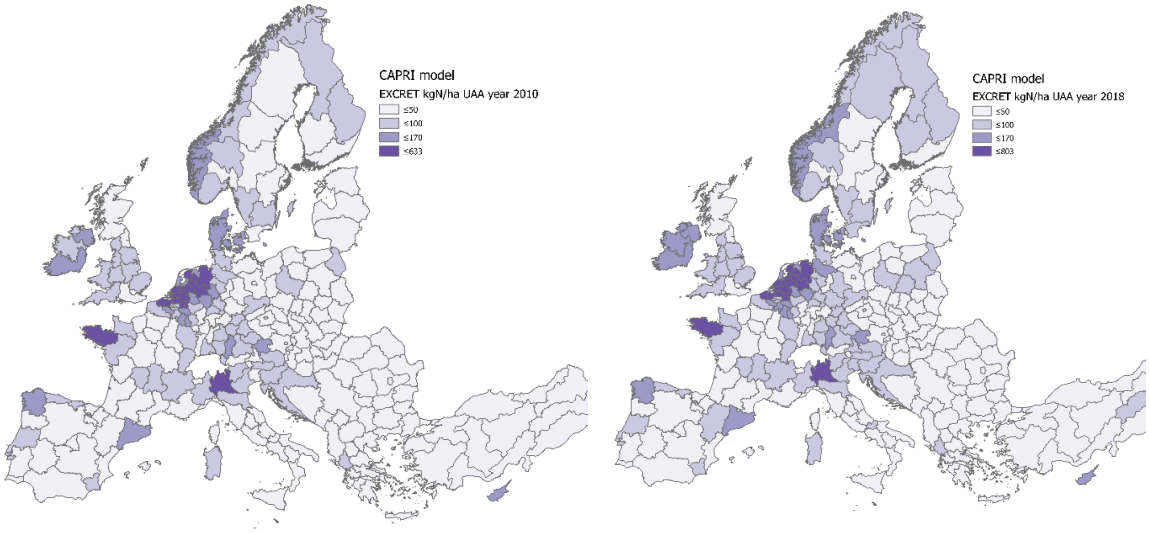
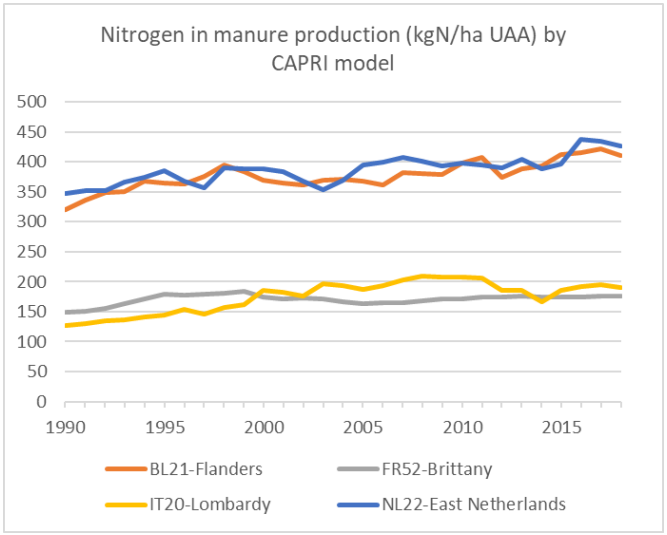
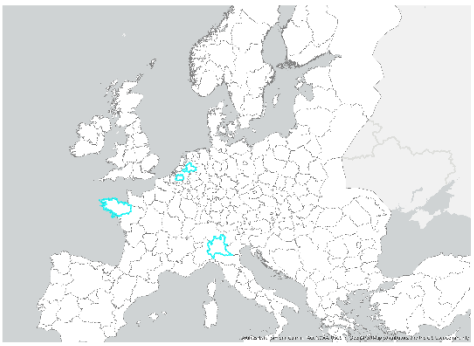
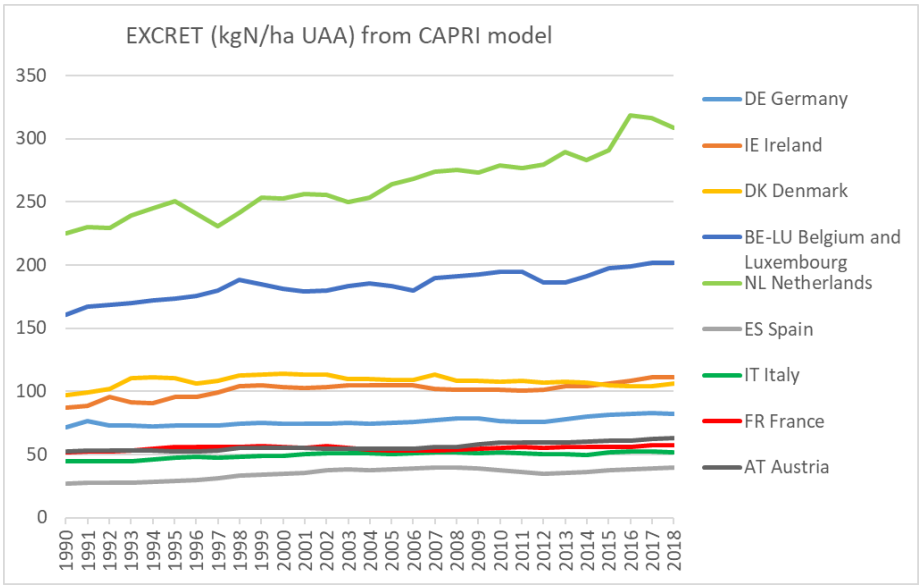


Figure 15 Nitrogen in manure production (EXCRET: Nitrogen in excretion of animals) per hectare of Utilised Agricultural Area (UAA) for selected NUTS2 regions and selected countries as estimated by the CAPRI model.



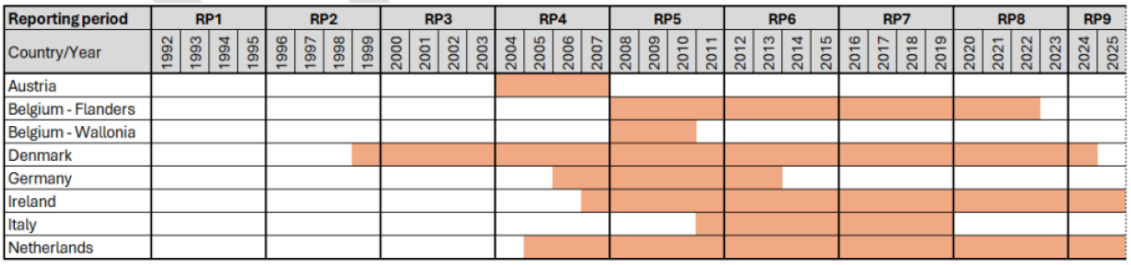




An additional flexibility to the manure application limit is that MS can also request **derogations to apply higher amounts of manure** in nitrate vulnerable zones if objective criteria show that the amount of nitrogen fixed and the other conditions will not lead to increased nitrate water pollution. Derogations to the manure limit are granted to Member States for 4 years by the Commission after obtaining the support of a qualified majority of Member States in the Nitrates Committee. The consultation and support of the other Member States on derogation decision is consistent with the requirement to protect the level playing field as minimum protection standard provided by the harmonized manure application limit. Seven Member States have requested derogations since the entry into force of the directive. The aim was to allow applying higher amounts of manure under different circumstances such as farms with long growing seasons and crops with high nitrogen uptake. In their requests for derogations, Member States have had to justify their requests based on their national conditions (soil type, climatic conditions etc.) and ensure that the use of higher amounts would not impact water quality. For each request, the Commission carefully considers scientific justifications, confirming that the higher amount of manure applied does not lead to additional pollution. The Commission also considers the status of water quality, the need to take reinforced measures in the Nitrate Action Programme and if needed the effectiveness of these reinforced measures and the revised action programme. The Figure 16 gives an overview of the derogations granted to the Member States over time. Some of the derogations were regional, such Belgium – Flanders and Wallonia, and for Italy - Lombardia, Piemonte, Emilia Romagna, Veneto. Comparing to the earlier maps and graphs on manure production, one can see that derogations have been granted in Member States and regions with high to very high manure production, which is natural as these are the regions that would require a derogation. However, as mentioned, the derogations are always based on objective criteria and strict conditions to ensure that they do not undermine the objectives of the directive.

While the Nitrates Directive provides considerable flexibility by enabling Member States to request and implement derogations, it should always be considered that such derogations risk having an influence on the directive's overall effectiveness. Livestock intensification in areas where derogations are in place has led the Commission to conduct closer assessments of how these derogations are applied. More importantly, it has prompted a stricter evaluation of the conditions that might justify the granting of such derogations.

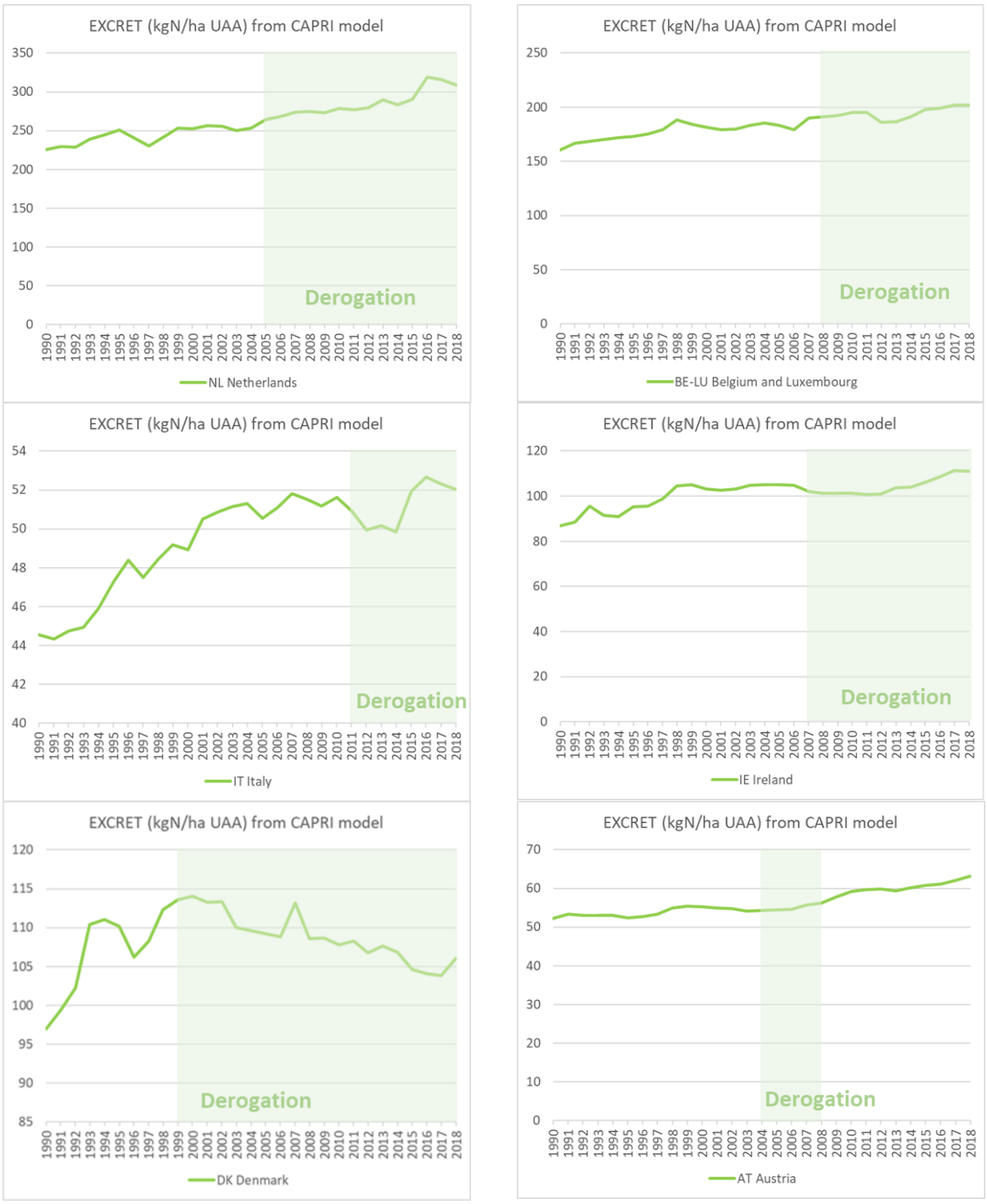
Figure 16 Overview of derogations granted to Member States[20]



[20] End of 2025, Ireland was granted a derogation for 2026-2028.

Except Denmark, Member States with long-term derogations have maintained or even increased the manure production over time, as shown in the graphs below.

Figure 17 Nitrogen in manure production (EXCRET: Nitrogen in excretion of animals) per hectare of Utilised Agricultural Area (UAA) for countries with derogation as estimated by the CAPRI model.



Derogation decisions granted to Member States have always included additional measures for farms with a derogation (e.g. percentage of grassland, buffer strips, chemical fertilisation, soil samplings, phosphorous measures) to mitigate the additional risk of leaching and run-offs from the farms with derogations. However it is not possible to affirm that the derogations have had no negative impact on the achievement of the objectives to reduce and prevent further water pollution. Derogations in Germany, Italy

and Belgium-Flanders have been discontinued following the start of infringement proceedings initiated by the Commission for failure to implement sufficiently effective measures under the directive. In 2024, Denmark decided not to request a new derogation following concerns about increasing eutrophication in coastal waters. A report from the European Court of Auditors in 2023[21] concluded that "As regards the application of the Nitrates Directive provisions relating to manure, we found that policy decisions such as the abolition of milk quotas led to an increase in the herd size in farms benefiting from a derogation from the nitrogen limits, which were constraining the application of manure. As a result, the derogation limited the achievement of the Directive's objective." The European Court of Auditors therefore recommended that when deciding whether to grant derogations, the Commission should ensure that they only apply to those areas already achieving the Nitrates Directive objective, and include in its assessment a review of potential conflicting objectives arising in other EU policy areas.

6. Measures to address phosphorus losses

Eutrophication can be caused both by nitrogen (N) and phosphorus (P), but the Nitrates Directive does not mention P explicitly. The evaluation therefore examined whether the fact that the Directive does not explicitly cover phosphorus has had an impact on the achievement of the objectives regarding eutrophication.

Section 3 and Annex XV on the interlinking between the Nitrates Directive and the WFD already examines more generally the absence of parameters or thresholds for N and P for defining eutrophication under the Nitrates Directive. This issue has led to delays in implementation, monitoring and reporting of eutrophication. The WFD however provides a legal context and a work strand for a scientifically validated methodology for setting ranges and thresholds for N & P in relation to eutrophication and good ecological status. Not all Member States have yet defined such thresholds for all waters, nor use the WFD approach to define the trophic status under the Nitrates Directive. This issue is also addressed further under coherence and simplification.

This section further examines whether the absence of *explicit measures to address P losses to water* in Annex II and III affected the achievement of the objectives.

Reducing P losses and eutrophication is regulated under several EU directives, including the Nitrates Directive, WFD, IED, UWWTD, MSFD and under international conventions (e.g. HELCOM, OSPAR) (see also table below with a list of relevant EU legislation). The Member States have implemented measures to address P losses under these various legal frameworks and there is no uniform approach across Member states. However, the WFD remains the overall coherent and encompassing framework to address eutrophication in fresh and coastal waters.

Nitrates Directive: measures to address P losses

When the Nitrates Directive (ND) and the UWWTD were adopted, P pollution was mostly caused by urban wastewater and this was considered as the main priority[22]. Nevertheless, the ND implicitly covers measures to reduce P losses to water.

[21] European Court of Auditors, Special report 19/2023, EU efforts for sustainable soil management.
[22] Wastewaters remain a very significant source for P and can also have local impacts as these are point source contributions.

The ND does not set limits to the application of P in fertilisers. The limit on livestock manure applying in all NVZ expressed in relation to nitrogen plays an important role in this respect, as livestock manure is a significant source of P. The phosphorus content varies depending on the animal type, but generally the 170 kg limit for nitrogen tends to result in an amount of P that exceeds crop needs in most cases, especially in regions with high legacy P content in agricultural soils. Manure generally has a N/P ratio between 2 and 8, in contrast to the N/P ratio of 7 – 11 required by crops. When the crop's N requirement is applied by using solely manure, this results in an excess of P[23]. Member States can impose lower limits under the ND where needed.

The good agricultural practices of Annex II and III to reduce nitrate leaching and run-off from fields are also effective measures in reducing P losses to water. P can be lost from the soil via erosion, surface runoff, subsurface runoff, leaching and tile drainage. In the consultations, Member States experts confirmed that the measures in Annex II and III are considered effective in addressing P losses and rated their effectiveness as follows from 1 (not effective) to 5 (very effective).

Table 4 Effectiveness of the measures to address P losses from agriculture based on Member States experts' consultations

How effective are the measures to address P losses from agriculture 1 (not effective) to 5 (very effective)	**Average score**
Requirements on capacity and construction of storage vessels	**4.3**
Restrictions on water-saturated, flooded, frozen and snow-covered ground	**4.2**
Restrictions near water courses	**4.1**
Requirements on land application methods and limits (balanced fertilisation)	**4.0**
Restrictions on steeply sloping ground	**3.9**
Requirements on fertiliser planning and record keeping	**3.6**
Closing periods for the application of fertilisers	**3.4**
Requirements on minimum land cover	**3.4**
Limit on manure application (170 kg N/ha) – without derogation	**3.4**
Requirements on land use management (crop rotation etc.)	**2.9**
Limit on manure application - with derogation and related conditions	**2.8**
Requirements related to irrigation	**2.8**

Moreover, in 2000, the CJEU highlighted with regard to Article 3(1) on the identification of polluted waters that 'restricting the scope of the ND to exclude certain categories of waters owing to the supposedly fundamental role of phosphorus in the pollution of those waters is incompatible with both the logic and the objective of the ND' (Case 258/00 Commission v France). Therefore, the CJEU clarified that Member States are required to identify waters as polluted also if P is the main controlling factor for eutrophication. This further means as a direct consequence once waters are identified as polluted that Member States should take measures to reduce and prevent such eutrophication and may imply the necessity to take action on addressing P losses from agriculture.

A study of 2014, after explicit requests to Member States on the measures to address P losses from agriculture found that the consulted Member States considered that the measures under the Nitrates Directive were addressing P losses from agriculture, and in addition at least 9 MS had explicit limits on application of P fertilisers depending on crop

[23] Study: Amery, F. and O.F. Schoumans, 2014. Agricultural phosphorus legislation in Europe. ILVO.

and/or soil conditions. (although the extent, form and the amounts of these limits vary a lot from one MS to another)[24].

A check on the NAP and ND reporting from MS in 2024 found that at least 14 MS implement explicit limitations on the application of P as fertiliser. The table below illustrates these findings[25].

Table 5 Limitations on the application of P as fertiliser

Member State	Region	Measure in the NAP	Measure outside the NAP *	Info
Austria		N	Y	For implementing SMR 1 obligation (as part of the conditionality of CAP Strategic Plan 2023-2027) in terms of controlling diffuse sources of phosphorus, an additional GAEC standard (GAEC 10) has been specified at the national level. Requirements include compliance with recommendations (guidelines) for proper fertilisation with regard to P fertilisation and the verification of P-requirement by soil test as well as the documentation of applications of additional mineral P-fertilisation exceeding a given threshold.
Belgium	Flanders	Y		Limitation on the application of phosphorus depending on the crop type, the soil phosphorus content (4 different classes) and the location in soil phosphorus saturated areas.
Belgium	Wallonia	N		
Bulgaria		N		
Croatia		N	Y	The Croatian Nitrates Action Programme does not include specific measures on phosphorus fertilisation as a standalone element. However, restrictions on the use of phosphorus are laid down in the Regulation on Conditionality and Social Conditionality, Official Gazette

[24] Study: Amery, F. and O.F. Schoumans, 2014. Agricultural phosphorus legislation in Europe. ILVO.
[25] The table is based on information provided by Member states authorities in December 2025.

Member State	Region	Measure in the NAP	Measure outside the NAP *	Info
				No. 71/2025. In particular, Annex IV of the Regulation defines maximum permissible application rates of phosphorus for different agricultural crops, expressed in kg/ha. These crop-specific limits constitute binding restrictions aimed at preventing excessive phosphorus inputs to soils. Furthermore, under SMR 1, phosphorus fertilisation must be carried out on the basis of soil chemical analysis, which must be performed at least once every four years per production parcel.
Cyprus		N		
Czech Republic		N	Y	The CZ AP does not include measures on phosphorus fertilisation. However, in 2025, the P (and N) balance on arable land has been incorporated into the conditions of the new eco-scheme supporting sustainable nutrient management (Government Regulation No. 83/2023 Coll.). The eco-payment is annual, so the balance result is evaluated each year, with a balance surplus limit for phosphorus on farm level of max. 10 kg P/ha. The need for phosphorus recovery to the soil depends on crop yields and on extractable phosphorus content in soils. Soil testing for available nutrient content (P, K, Mg, …) is provided nationwide in the Czech Republic as part of the Agrochemical Testing of Agricultural Soils.
Denmark		Y		Legislation limiting the application of phosphorus has entered into force in August 2017, although restrictions linked to P surplus from manure were

Member State	Region	Measure in the NAP	Measure outside the NAP *	Info
				already in place. Phosphorus ceilings are set for the different fertilisers. The phosphorus regulation covers both organic and chemical fertilizers. Stricter phosphorus ceilings apply in catchments for lakes in the river basin management plans where additional protection is needed.
Estonia		Y		Legislation provides a limit of P-application by manure. Manure may be applied up to 25 kilograms of phosphorus per hectare (on average over five years). The limit of 25 kilograms of phosphorus per hectare by manure does not apply if a valid soil analysis indicates that the need for phosphorus absorbed by plants in the soil is high or very high. A “total” P-limit, regarding both mineral and organic P-fertilisation is not present. The exemption from the 25 kg P/ha limit is subject to mandatory soil sampling and classification of soil phosphorus demand in accordance with national legislation. This is regulated by a ministerial regulation establishing soil phosphorus demand classes, which defines the soil phosphorus classes and the accredited analytical methods used for determining plant-available phosphorus in soil.
Finland		N	Y	The AP of Finland does not include measures on phosphorus fertilisation. However, this is set out in another regulation. The Government Decree on regulating the use of phosphorus in agriculture and horticulture and in green and environmental construction (64/2023) lays down provisions on restrictions on the

Member State	Region	Measure in the NAP	Measure outside the NAP *	Info
				use of phosphorus (e.g. fertilisation restrictions). It includes for example maximum rates of phosphorus fertilization in Annex I.
France		N		
Germany		Y	Y	Germany has a number of rules specifically regarding phosphorus fertilisation including a prohibition period, prohibition of fertilisation in certain circumstances, the need for a fertiliser requirement calculation, determination of soil phosphorus content, limitation of the P2O5-fertilisation, requirements for buffer distances to water bodies when applying phosphorus fertilisers and extended buffer distances on fields with a certain slope gradient. In addition, there are record-keeping obligations to document fertilisation measures carried out. Furthermore, the federal states are required to designate eutrophicated areas in which additional measures apply and must be complied with. Finally, outside the scope of the NAP, requirements under GAEC 5 of the Common Agricultural Policy apply with regard to soil cover, particularly in erosion-prone areas. These areas are designated under the erosion protection regulations.
Greece		N		
Hungary		N	Y	In the measures of Conditionality under the CAP in SMR1 P application with slurry is limited. Legislation for the application of sludge reducing eutrophication.
Italy	national	N		

Member State	Region	Measure in the NAP	Measure outside the NAP *	Info
	Emilia-Romagna	Y		Soil analyses must be carried out in areas with the highest density of livestock farms and/or with specific local conditions. A limit on soil P concentration is set (200 mg P/kg soil) and if this threshold is exceeded, it shall be prohibited to apply all fertilisers containing P.
	Lombardia	Y		Prohibition to use synthetic phosphate fertilisers when the phosphorus requirements of the crops are already met by the use of manure and/or agro-livestock digestate and agro-industrial digestate containing livestock P.
	other regions	N		
Latvia		N		
Lithuania		N		
Luxembourg		N		
Ireland		Y		Ireland requires farmers to comply with limits for both N and P application as part of the balanced fertilisation requirement. On arable land the maximum fertilisation rates depend on the P status of the soils as well as on the crop. On grassland the maximum P fertilisation rates depend on the stocking rate as well.
Malta		Y?		The Maltese Progress Report of January 2025 mentions attention for phosphorus in the fertiliser plan. The analyses include the amount of phosphorus which is also taken into consideration in the fertiliser plan. Where phosphorus surplus is identified, fertilisers with low phosphorus content will be applied. (Progress Report 5.2).
Poland		N		Currently, there are no legally

Member State	Region	Measure in the NAP	Measure outside the NAP *	Info
				binding measures limiting the amount of phosphorus fertilisers applied by farmers. However, assumptions for introducing such measures are included in planning documents developed under the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD), and recommendations and good practice guidelines are in place.
Portugal		Y	Y	The AP of mainland Portugal does not include rules on phosphorus fertilisation. However, the Code of Good Agricultural Practice (2018) is mandatory in the NVZ and includes some rules concerning the application of phosphorus fertilisation, while it is optional outside these zones. Additionally, Ordinance no. 79/2022, of February 3, which defines the regime applicable to the management of livestock effluents, also contains measures for the application of livestock effluents (manure and slurry) in fertilization according to the crop's needs for nitrogen and phosphorus for the expected production. The AP's of the vulnerable zones in the Autonomous Region of the Azores provide application limits for phosphorus depending on the P-content of the soil. Also in the Autonomous Regions of the Azores, certified laboratories will recommend the most appropriate fertilisation, including the amount and form of nitrogen and phosphorus. In the scope of WFD, threshold values have been set for

Member State	Region	Measure in the NAP	Measure outside the NAP *	Info
				phosphorus in groundwater and surface water. In addition, certain measures have been defined for cases where the status of water bodies is less than good due to agricultural practices, including livestock farming
Romania		N		
Slovakia		N		No rules on phosphorus fertilisation included. However, regarding phosphorus the Act provides the nutrient need of individual crops per unit of production is given (Annex 3 of the Act), and the proportion of phosphorus usable from applied agricultural fertilisers or organic fertilisers (Annexes No. 5 and 6 of the Act). A maximum dose to which the applied amount of phosphorus has to be limited is not provided.
Slovenia		N		
Spain		N		
	Aragón	N	N	The Fifth AP of Aragon sets out recommendations on phosphorus fertilisation.
	Madrid	Y	N	
	Murcia	Y	Y	
Sweden		Y		The fertilisation rate of organic fertilisers in the nitrate vulnerable zones is limited both by N and P. Regarding phosphorus, manure and other organic fertilisers must not be applied in greater amounts over a five-year period than the equivalent of 22 kg total phosphorus per hectare of application area per year. There is also a maximum amount of total phosphorus per hectare that may be added to arable land via

Member State	Region	Measure in the NAP	Measure outside the NAP *	Info
				sewage sludge. This amount is differentiated regarding the soil phosphorus class. The phosphorus regulations apply throughout the country and not just in the nitrate vulnerable zones.
Netherlands		Y		Phosphate usage standards are included in the regulations. These may vary depending on the phosphate status of the soil (based on combination of P-CaCl2- and P-AL values), type of fertilising product and whether it is applied on grassland and arable land. The standard limit is 75 kg of phosphate per hectare for grassland and 40 kg of phosphate per hectare for arable land. Extra P can be given from specific fertilising products with high effective organic matter content, in order to maintain soil organic matter content. Higher P-amounts are allowed (up to 120 kg P2O5/ha) for soils with poor P status (P-CaCl2 <3,4 and P-AL < 45).

Note: * WFD, CAP, etc.

Reporting on P concentrations or on P specific measures has not been part of the reporting guidelines under the Nitrates Directive. A number of Member States monitor and report P concentrations as part of their national reporting under the Nitrates Directive, but this is not systematic and the Commission has not integrated this aspect in its 4 yearly reporting to the European Parliament and the Council.

Water Framework Directive and P pollution

The WFD requires that Member States address eutrophication and pollution from N and P if these are a pressure responsible for deterioration of the status of a water body or if it is an obstacle in the water body achieving good ecological status. P and N are both supporting elements for assessing the ecological status. The WFD also provides an encompassing approach to P pollution as P is considered as a main pollutant and Member States have an obligation to control it as part of the basic measures in the programme of measures under the RBPM. Member States should address the different sources of the pollutant in a combined approach for point sources and diffuse sources. It is for Member States to determine the necessary load reduction from the different sources of P pollution,

being urban waste water, agriculture or industry and take effective measures for each sector to reduce the pollution so as to reach the water quality objectives. (see also Annex XV on links between ND and WFD).

Common Agriculture Policy and P pollution

The CAP Regulation[26] also plays a role in reducing P losses from agriculture through the cross compliance by reenforcing the obligation under the WFD:

SMR 1: Directive 2000/60/EC of 23 October 2000 of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (OJ L 327, 22.12.2000, p. 1): Article 11(3), point (e), and point (h), *as regards mandatory requirements to control diffuse sources of pollution by phosphates*

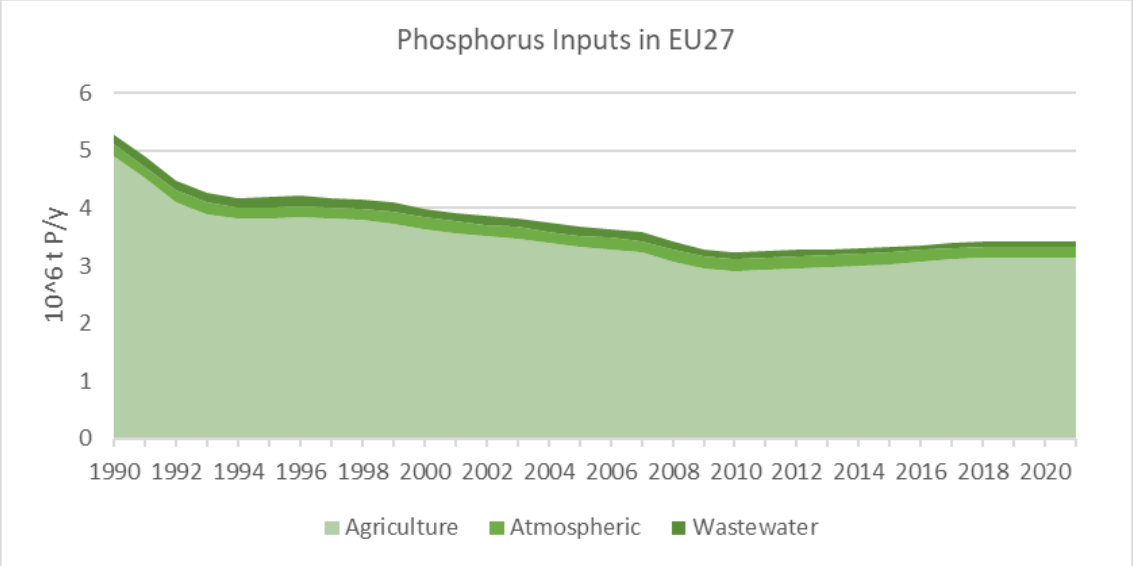
Moreover GAEC 4 (buffer strips), GAEC 5 (Tillage management, reducing the risk of soil degradation and erosion, including consideration of the slope gradient) and GAEC 6 (Minimum soil cover to avoid bare soil in periods that are most sensitive) further contribute to reducing P pollution. These obligations complement the Annex II measures under the Nitrates Directive, in particular outside NVZ.

Additional voluntary measures and financial incentives are also available in many Member States to address P pollution.

Evolution of P inputs from agriculture

The Figure 18 shows the evolution of P inputs from different sources: agriculture and wastewater discharges from domestic and industrial sources. The figure shows a clear reduction of P inputs from agriculture since 1990, with a renewed increase since 2010.

Figure 18 Development of the phosphorus inputs in the EU27 between 1990 and 2021

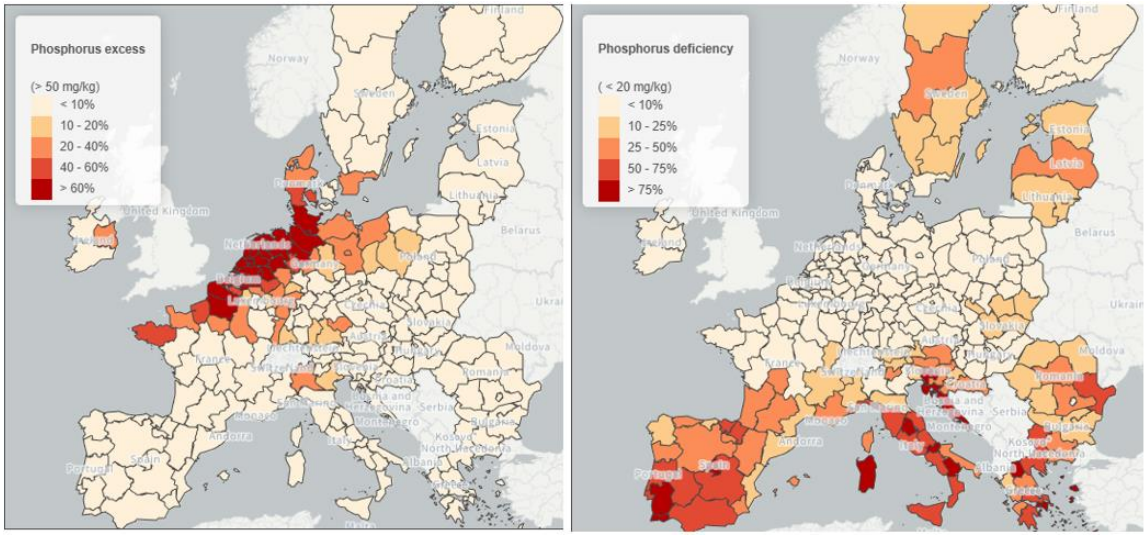


High P surpluses remain common in the EU, although they have reduced considerably since 1980. P inputs have peaked above 30 kg ha^{-1} around 1980, while P inputs are on average 16 kg ha^{-1} in the EU+UK (data available in 2022).

Due to the lower mobility and high retention of P in soils, the positive budgets of the past have resulted in a build-up of soil P pools representing a large soil P legacy in certain areas of EU. (source JRC study) On the other hand there are areas, mainly in the southern part of the EU, where there is a risk of phosphorus deficiency for crop production.

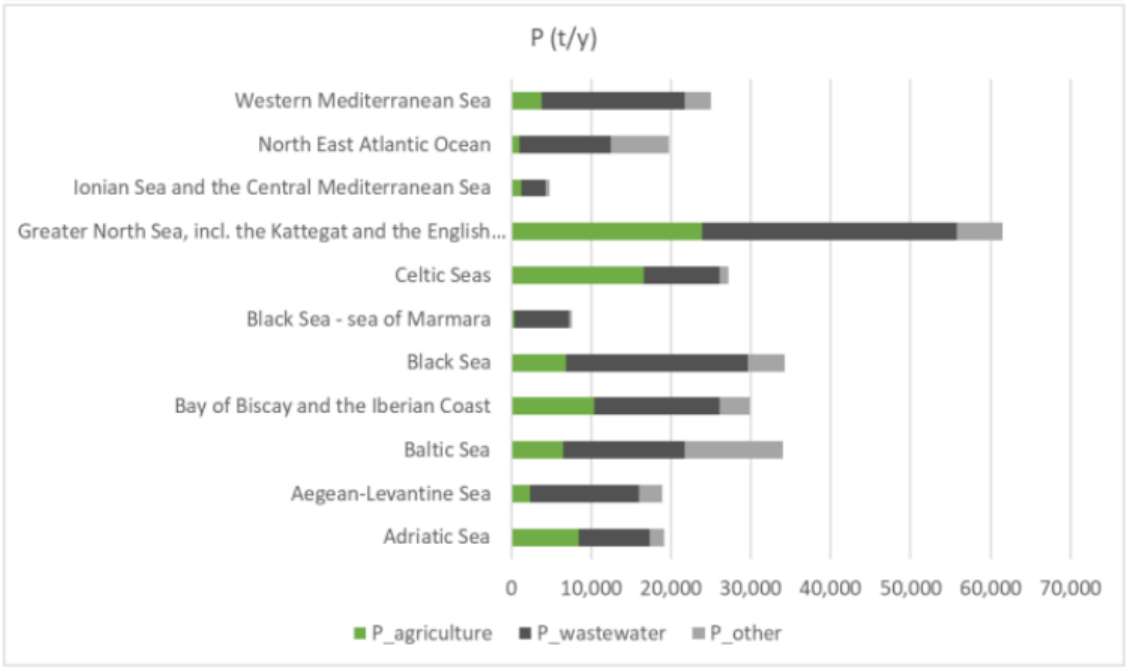
[26] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R2115

Figure 19 Phosphorus excess (left) and deficiency (right) in soils



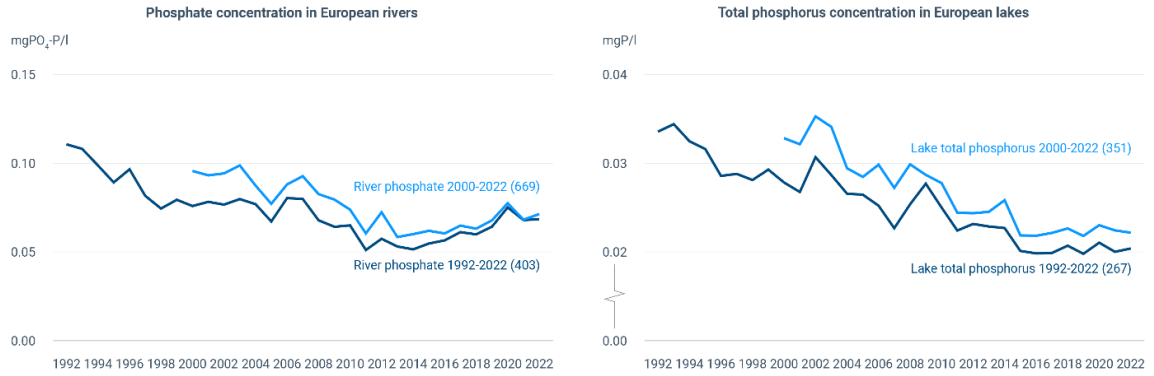
The Figure 20 shows the estimated P loads from different sources in European seas, which can be seen as the ultimate end point. Wastewaters remain the most important contributor at this level. The difference in the balance between agriculture and wastewater between this figure and Figure 18 above reflects the fact that most of the agricultural inputs are retained in agricultural soils and in sediments of small watercourses upstream, whereas discharges of wastewater tend to have a more direct route downstream towards the sea.

Figure 20 Estimated P loads from different sources in European seas



In terms of impacts to water, the following figure reproduced also in section 3 shows the evolution of P concentrations in rivers and lakes. The EEA explains that the bulk of the reduction is the result of UWW treatment and phosphate free detergents.

Figure 21 Evolution of concentrations of phosphates in rivers (left) and phosphorus in lakes (right).



Source: EEA, 2025, 'Nutrients in freshwater in Europe', European Environment Agency. (https://www.eea.europa.eu/en/analysis/indicators/nutrients-in-freshwater-in-europe) accessed 13 May 2025.

Conclusion

Requirements to address phosphorus pollution in water from agriculture are covered in several EU Directives. The Nitrates Directive does not mention phosphorus explicitly but the agricultural measures in Annex II and III also contribute to some extent to address phosphorus pollution. An CJEU ruling in 2000 clarified that Member States should identify polluted waters and thus take measures under the Nitrates Directive to reduce and prevent eutrophication, even where phosphorus is the main factor causing eutrophication.

The obligation under the WFD to address diffuse phosphorus pollution from agriculture in the programme of measures wherever phosphorus losses from agriculture has been identified as a pressure on a waterbody complements the obligation to take action under the Nitrates Directive, the measures taken under the latter constituting basic measures under the WFD. Therefore, when designing the programme of measures under the WFD, Member States can rely exclusively on the measures of the Nitrates Directive to address phosphorus pollution from agriculture but, if this proves insufficient to reach the overall objective of reducing phosphorus concentrations, they should add further measures. At least one third of the Member States have added measures to limit phosphorus fertiliser application in their national legislation. The obligation to address phosphorus pollution from agriculture is further reinforced through cross-compliance, GAEC requirements and voluntary measures under the CAP.

Consultations with Member States experts confirmed that national measures to address phosphorus pollution from agriculture are often a mix of mandatory and voluntary measures under different legal instruments. However, phosphorus concentrations and specific measures on phosphorus are not part of the reporting under the Nitrates Directive, creating a blind spot in terms of causes of the eutrophication, which is not filled by the WFD reporting.

While originally it was decided not to include requirements to limit phosphorus fertilisation in the Nitrates Directive, the question as to whether this should be done today remains valid. When consulted, Member States experts were divided on whether rules on addressing emissions of phosphorus were sufficiently well covered. Overall, measures taken under the Nitrates Directive in combination with the WFD have contributed to reducing phosphorus inputs from agriculture as well as run-off and erosion of phosphorus from soils and thus contributed to reduce phosphorus concentrations in water. Therefore the measures have allowed progressing towards the reduction and prevention of eutrophication, and achievement of water protection goals and the pertinence of including specific rules on phosphorus in the Nitrates Directive would need to be weighed against the risk of excessive regulation. Urban wastewater remains a

major source of phosphorus, even though the reduced concentrations in rivers and lakes that has taken place since the 1990s can mostly be attributed to progress in wastewater treatment.

Table 6 EU legislation that tackles phosphate pollution.

Legislation	Phosphate control
Urban Waste Water Treatment Directive (UWWTD)	• Requires more stringent removal of nutrients like phosphorus from urban wastewater, particularly in sensitive areas identified as eutrophic or at risk of becoming so.
Water Framework Directive (WFD)	• Sets the overarching objective for all water bodies to achieve "good status," which includes managing nutrient levels to prevent eutrophication. • Member States must take remedial action for waters that are eutrophic or have the potential to become so.
Marine Strategy Framework Directive (2008/56/EC)	• Aims to protect the marine environment across Europe and requires member states to develop strategies for their marine waters with the goal of achieving "Good Environmental Status" by addressing sources of pollution, including nutrients such as phosphates.
Industrial Emissions Directive (IED)	• Mandates the use of Best Available Techniques (BAT) for industries, which increasingly includes phosphorus recovery from waste streams. • Examples include recovering phosphorus as struvite from wastewater in the "Food, Drink and Milk" industry.
Common Agricultural Policy (CAP)	• the CAP includes measures and incentives for sustainable agricultural practices, which help reduce nutrient runoff (including phosphates) into water bodies
EU Action Plan: Towards Zero Pollution for Air, Water and Soil	• Includes a 2030 target to reduce nutrient losses by 50%. • Encourages pollution prevention across various policies and promotes synergies to reduce environmental damage from pollutants like phosphate.
EU fertilising products regulations	• Includes rules on the composition of fertilising products, allowing for the use of recycled materials like struvite, which contributes to a circular economy for phosphorus.
Detergents regulations	• This regulation controls the use of phosphates in detergents, contributing to the reduction of phosphate pollution in water bodies. Amendments have been made to restrict the use of phosphates in consumer laundry and dishwasher detergents

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